EUROCONTROL, the European Organisation for the Safety of Air Navigation

DEMETER USER MANUAL VERSION 2.4

DEMETER MAINTENANCE

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2.4	18/03/2016	254	Final review for release 2.4 Minor improvements and general revision

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1. INTRODUCTION

1.1. PURPOSE

This manual is the DEMETER user manual. It provides instructions to the end user to use all functionalities and tools provided in DEMETER and describes all the features available on DEMETER and explains to the user how to use them.

Throughout this document, several images are used that might refer to distinct versions of DEMETER. That has to do with the iterative evolution of this document and doesn't affect the functionality/feature being explained. These functionalities/features should work the same way, independently of the version of DEMETER used to obtain the images.

1.2. ACRONYMS

Acronyms used in this document and needing a definition are included in the following table:

Table 1: Acronyms

Acronym	Definition
AIP	Aeronautical Information Publication
ANSP	Air Navigation Service Providers
B-RNAV	Basic Area Navigation
CPU	Central Processing Unit
DEMETER	DistancE Measuring Equipment TracER
DME	Distance Measuring Equipment
DLL	Dynamic-Link Library
DOC	Designated Operational Coverage
EAD	European Aeronautical Information System Database
ECAC	European Civil Aviation Conference
ECTL	EUROCONTROL
EIRP	Equivalent Isotropic Radiated Power
ICAO	International Civil Aviation Organization
FIR	Flight Information Region
GB	Gigabyte
GHz	Gigahertz
ILS	Instrument Landing System
MB	Megabyte
MSL	Mean Sea Level
NavAid	Navigational Aid
NDB	Non directional beacon
NM	Nautical miles
P-RNAV	Precision Area Navigation
PC	Personal Computer
PM	Project Management
RAM	Random Access Memory
RNAV	Area navigation

Acronym	Definition
SID	Standard Instrument Departure
STAR	Standard Instrument Arrival
SVGA	Super Video Graphics Array
TACAN	Tactical Air Navigation
TBC	To be confirmed
TBD	To be determined
TMA	Terminal Maneuvering Area
UIR	Upper Information Region
VOR	VHF (Very High Frequency) Omni-directional Radio Range
VORTAC	VHF (Very High Frequency) Omni-directional Radio Range Tactical Air Navigation
RCS	Reference Coordinate System

2. REFERENCES

2.1. APPLICABLE DOCUMENTS

The following documents, of the exact issue shown, form part of this document to the extent specified herein. Applicable documents are those referenced in the Contract or approved by the Approval Authority. They are referenced in this document in the form [AD.X]:

Table 2: Applicable documents

Ref.	Title	Code	Version	Date
[AD.1]	Contract nº. 08-111673	08-111673	N/A	27-11-2008
[AD.2]	DEMETER Technology Assessment document	EUR.2.029.08-EVA.001	1.3	03-06-2009
[AD.3]	DEMETER "Technical Proposal" Amendment document	EUR.2.029.08-PRP.003	1.0	16-11-2009

2.2. REFERENCE DOCUMENTS

The following documents, although not part of this document, amplify or clarify its contents. Reference documents are those not applicable and referenced within this document. They are referenced in this document in the form [RD.X]:

Table 3: Reference documents

Ref.	Title	Code	Version	Date
[RD.1]	EUROCONTROL's "DEMETER 2000 High-Level Technical Description" document	N/A	Draft D	12-05-2005
[RD.2]	EUROCONTROL's "DEMETER Migration Requirements (MRD)" document	N/A	1.3	04-04-2007
[RD.3]	EUROCONTROL's "DEMETER Additional Requirements" document	N/A	1.0	N/A
[RD.4]	"EUROCONTROL Guidelines for P-RNAV Infrastructure Assessment" - P-RNAV Infrastructure Assessment document	EUROCONTROL-GUID-0114	1.2	16-04-2008
[RD.5]	EUROCONTROL's "Using DEMETER 2000 NT" document	N/A	1.0	N/A
[RD.6]	DEMETER Requirements Baseline	EUR.2.029.08-REQ.001	1.6	01-12-2009
[RD.7]	RFC 2119 - Key words for use in RFCs to Indicate Requirement Levels	RFC2119	N/A	03-1997

3. INSTALLATION PROCESS

3.1. DEMETER DVD CONTENTS

When inserted, DEMETER DVD will automatically open the following document:

Figure 1: DEMETER Automatic menu

On the left, you can find several options available:

- **Setup Package** – contains the setup package executable. Can be used to setup this product in your computer;
- **User Manual** – contains the DEMETER user manual;
- **Portable minimal version** – contains the product package portable executable that can be copied to your computer without installing any component. Just copy and run from any folder;
- **DEMETER terrain and datasets package** – contains the terrain and dataset packages that can be used by DEMETER. This package includes GTOPO 30 and DTED 0 datasets. Also includes a local data cache that can be copied to your local disk to be used by NASA World Wind.

On the main page you can access the included DEMETER read-me file.

3.2. THE SETUP PROCESS

The setup package can be accessed directly from the option "**Setup Package**" located on the menu on the left.

This option runs the executable "**DEMETER-X.Y.n-setup.exe**", where "n" is the minor version of X.Y release. The aforementioned executable will automatically identify the current DEMETER installation (if there is any) on the computer, and either **Install** or **Upgrade** the current identified DEMETER version.

Note that this identification is made recurring to the Windows operative system's registry keys, which means that if you are certain that there is currently a version of DEMETER installed in your computer, verify that all your registry keys are present and have not been corrupted.

Note: Images shown below may change, depending on the version of DEMETER being installed.

3.2.1. INSTALLING DEMETER

If the setup process identifies no version of DEMETER installed, it triggers the install process in a few minutes. When started, the following screen will appear:

Figure 2: DEMETER installation page

By clicking "Next", you will be redirected to the "License Agreement" screen of DEMETER product:

Figure 3: DEMETER installation license agreement

In order to proceed with the installation process, it is required to check "I accept the terms of the License Agreement" option and then click "Next". The following screen will ask if you prefer to install DEMETER either for all the users of your computer (**"Install for anyone using this computer"**), or only to the current user (**"Install just for me"**):

Figure 4: DEMETER installation user options

It is important to consider that choosing the option "**Install for anyone using this computer**" will install DEMETER for all users in your computer, that is, typically this option will install DEMETER in "**C:\Program Files**" folder of your Windows environment. **In order to run this option you will require administrative privileges on your computer. This option will be available only if the current user is an administrator (or power user).**

Choosing this option will grant every user that can log in onto on your computer, access to DEMETER product. In the presented case, all users will use the same configuration settings in DEMETER. Please be aware that this option will not work if the current user doesn't have read and write permissions to that folder.

On the other hand, the option "**Install just for me**" will install DEMETER in your computer for your account only. **To run this option you do not require administrative privileges in your computer.** Typically, this option will install DEMETER in a local folder associated with your profile.

Clicking "Next" in this screen will result in the installation of the DEMETER product into your computer.

Figure 5: DEMETER installation feature options

This screen allows you to choose the type of installation of DEMETER. Currently there are two possible types:

- **DEMETER complete package**
  - This option will install DEMETER application files and all terrain files (GTOPO30 for World and DTED0 for EUROPE);
- **DEMETER minimum package**
  - This option will install DEMETER only application files plus GTOPO 30 for EUROPE region.

Please note that you cannot choose the check boxes of components list. You just need to select the type of install above.

Click "Next" in order to proceed with the installation. In following screen, setup will try to automatically detect your proxy configurations. You can also modify these settings by checking the "**Set proxy options**" checkbox.

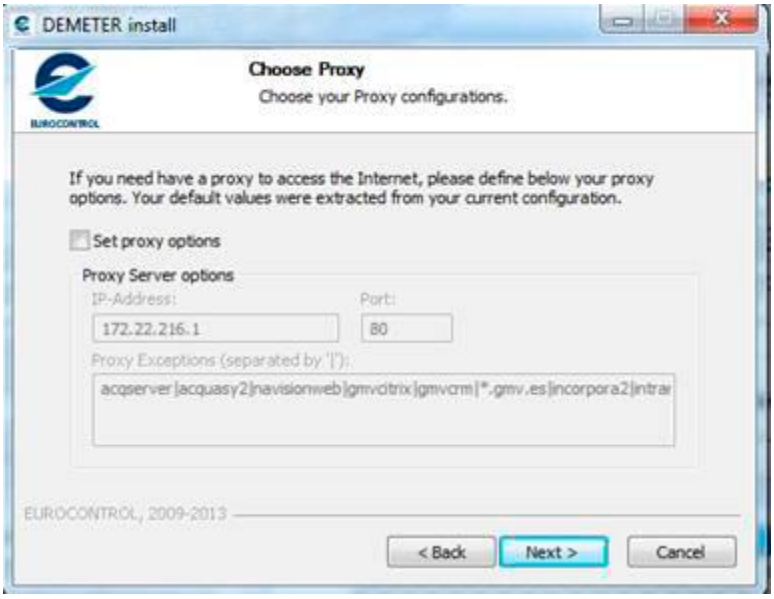


Figure 6: DEMETER installation proxy options

Please note that if you insert incorrect values into the proxy options, the following message will appear:

Figure 7: DEMETER installation proxy options warning

Click "Next" in order to proceed with the installation process and choose the folder in which you want to install the DEMETER product:

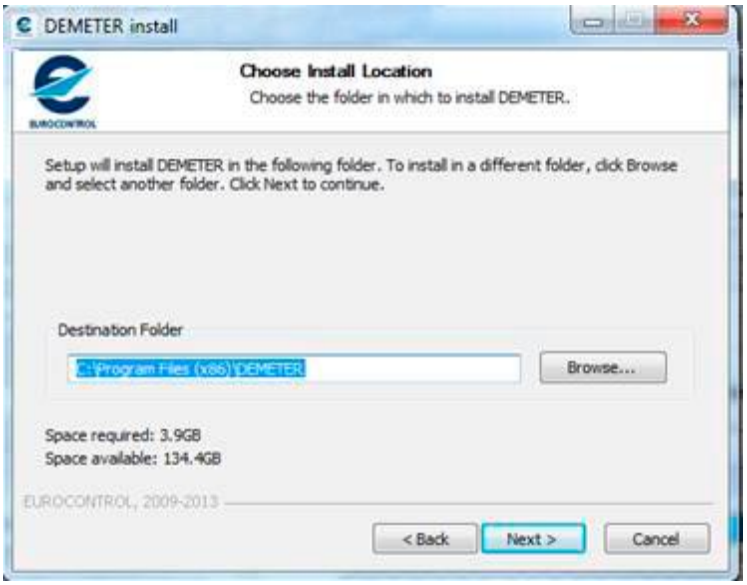


Figure 8: DEMETER installation location options

Please note that it is required that you have **write privileges** on the selected folder. The default installation folder will end with "DEMETER", but nonetheless you can name the install folder as you desire. If there is not enough space on the selected path's disk, you will not be able to continue with the installation process. The space required for each type of installation is presented at the bottom of this screen.

On the next screen you will be able to select the "Start Menu Folder" option, that is, the group folder created in "Start Menu" where all shortcuts will be created. By default, this folder is assumed to be: "**EUROCONTROL – DEMETER**".

Figure 9: DEMETER installation start menu options

Click "Install" in order to proceed to the installation screen. After completing installation with success, you should have a screen like this:

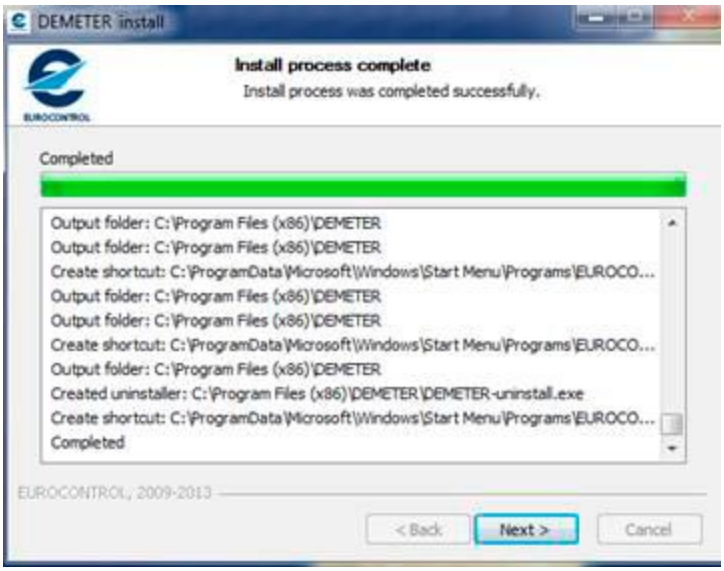


Figure 10: DEMETER installation progress

Click "Next" in order to proceed to the last screen, which will allow you to access the "**read-me**" file of DEMETER, and/or run DEMETER for the first time. Select your option(s) and press "**Finish**" to end setup process.

Figure 11: DEMETER installation finished screen

After the completion of the installation with success, if you consult your **Start Menu Folder**, you should have something like presented below:

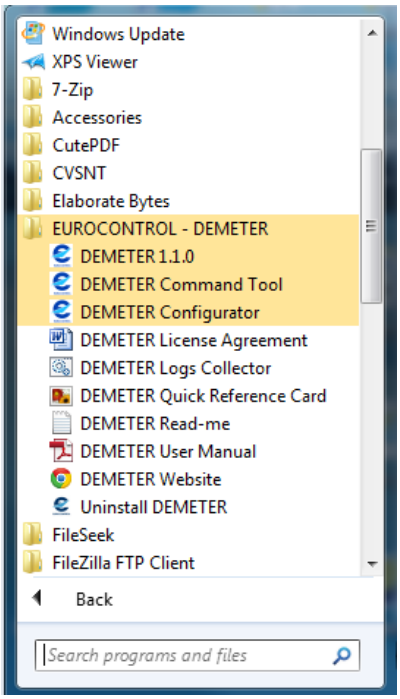


Figure 12: DEMETER installation start menu folder

Once here, (on bottom left of your Windows installation) you can access all DEMETER shortcuts, including this manual and **DEMETER quick reference card**. The latter provides a brief description of the tools that are available on DEMETER's toolbar. This file can also be found on DEMETER installation DVD:

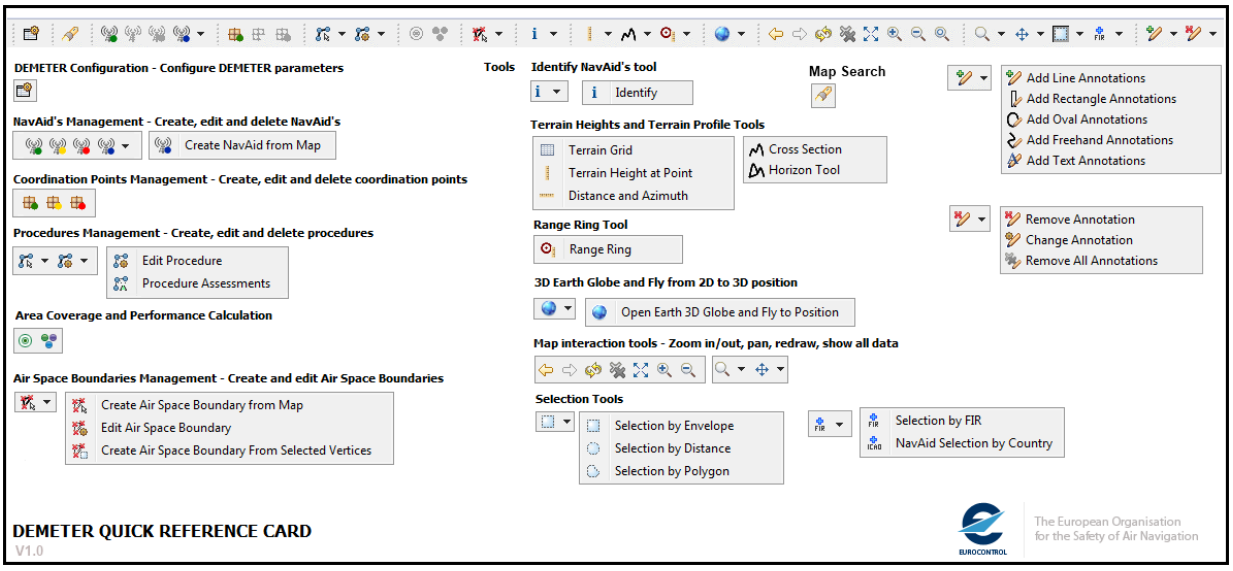


Figure 13: DEMETER reference card

3.2.2. UPDATING DEMETER

The updating process takes turn when the setup detects if there is already a DEMETER installation on the computer. Note that if there is not a previous DEMETER X.Y.n installation, the setup will automatically detect the issue and run the full installation (see **section 3.2.1**). The process is similar to the installation process described in previous section, and will maintain all user data that has been saved during the application usage, including all user files, DEMETER database, configurations, results, terrain files and other important files (consult **chapter 3.3** for further details).

The setup process tries to detect if there is a lower version of DEMETER installed, and if a previous version is encountered the following warning will be shown:

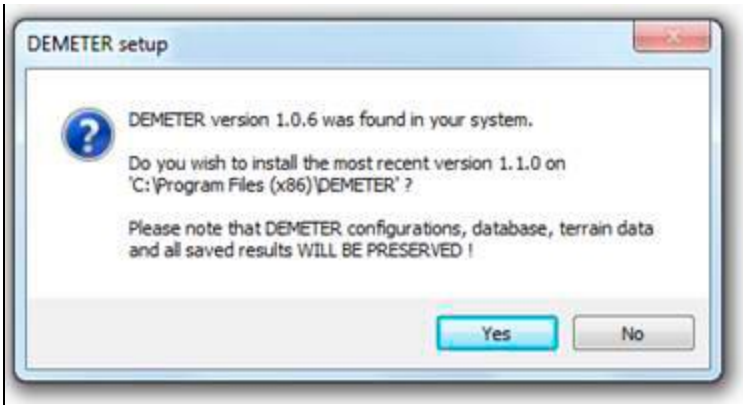


Figure 14: DEMETER upgrade warning

Note that you cannot perform an installation of DEMETER 1.1.0 over an existing latest version. If the setup identifies that the latest version of DEMETER is already installed in your computer, an error will be presented and the setup will close:

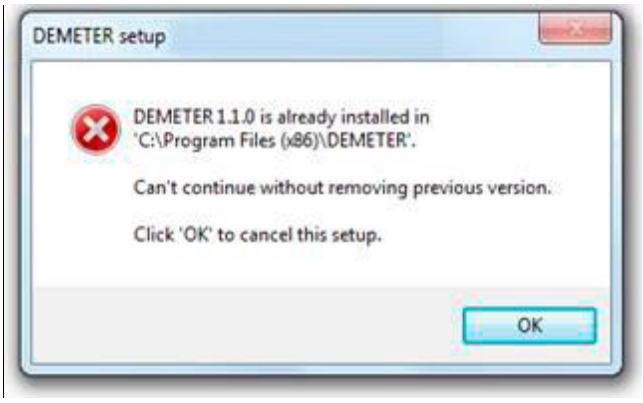


Figure 15: DEMETER upgrade version already exists' error

3.2.3. 'CALCRES' FOLDER AND NAVAID DATABASE

During the update process, you will be asked if you want to preserve the files that were stored in your 'calcRes' folder, which were previously used by the older version(s) of DEMETER to perform the calculations:

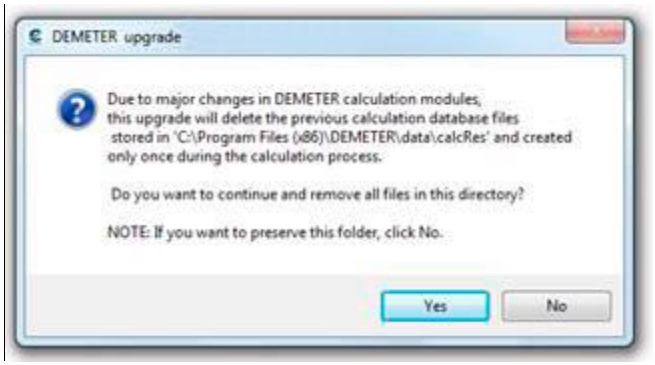


Figure 16: Preserve the DEMETER "calcRes" folder

If you desire to keep the folder intact, you should then press "Yes", otherwise press "No" in order to delete those files. The following update steps will be similar to the process described on previous chapter with the particularity of not allowing the user to change the installation location, since the process will update the application and has to update DEMETER files and general configuration of the previous version.

Moreover, due to structural and modular changes on DEMETER, the NavAid database will require an update:

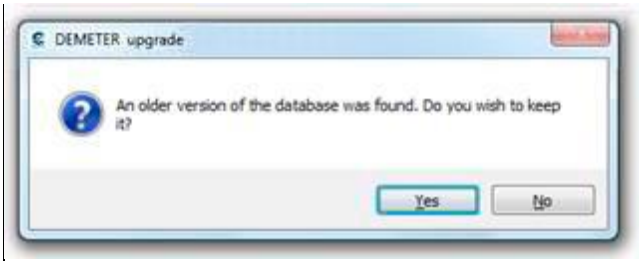


Figure 17: Upgrade DEMETER NavAid database

Thus, during the update process, the setup will automatically identify your NavAid database version, and if sorts to be older than the current version, it will ask if you wish to keep that database and just perform the update on its structure (**"Yes"**), or completely remove it from the file system and install the newest version (**"No"**).

Note: The "calcRes" folder can typically be located at " <DEMETER-installation-path>\DEMETER\data\projects\default\configurations\Default\calcRes"

3.3. DEMETER-LOGS-COLLECTOR

Since version 1.0.4, there was built a new tool on DEMETER, which is essentially used to gather and back up all user files. As was already mentioned, such files are backed up to an external folder. In order to run the tool, select the option "DEMETER Logs Collector", which is located on your "Start Menu" → "EUROCONTROL – DEMETER", as shown below:

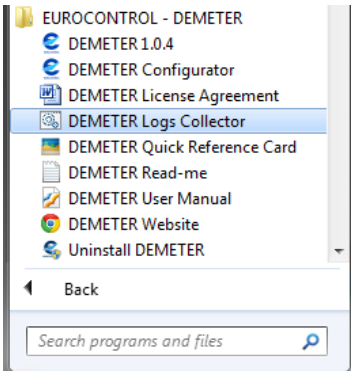


Figure 18: Logs collector start menu location

This tool will back up all user files, including DEMETER database, configurations, results, terrain files, logs and other important files to several zip files in an external folder inside "<DEMETER-installation-path>\backups".

After running the tool, you will be provided the opportunity to customize the archives that are to be generated. Thus, this utility will show the following configuration window in which you can choose the files you desire to backup:

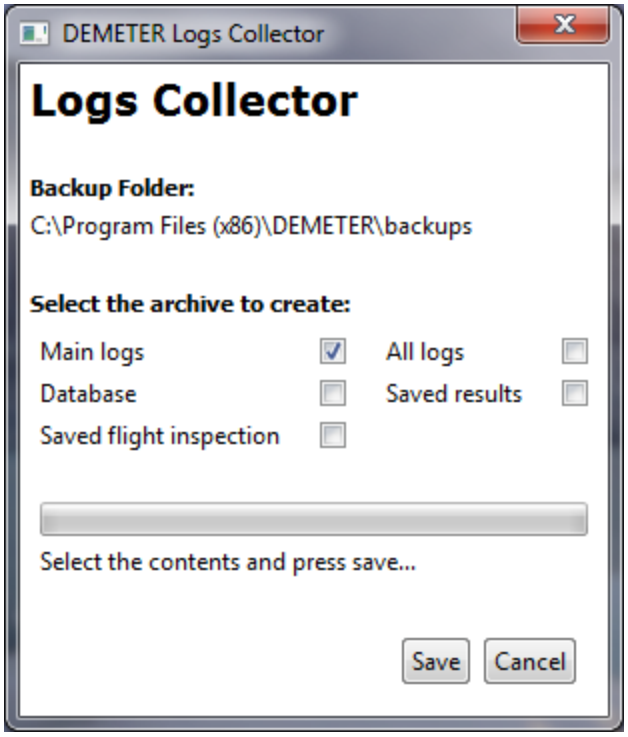


Figure 19: Logs collector configuration window

This tool will make use of the checkbox selection that was shown previously in order to:

- gather local computer information associated with the DEMETER environment;
- gather DEMETER (1.03 or higher) main logs to a zip file;
- gather all DEMETER (1.03 or higher) logs to a zip file;
- backup local DEMETER database to a zip file;
- backup DEMETER saved results to a zip file;
- backup DEMETER saved flight inspections to a zip file;

As was already mentioned, the files will be placed in "<DEMETER-INSTALLATION-FOLDER>"\backups". The list of files is listed below:

- file for computer information: LocalMachineInformation.txt
- file for DEMETER logs: DEMETER-LOGS-YYYY-MM-DD_HH-MM-SS
- file for DEMETER main logs: DEMETER-LOGS-MAIN-YYY-MM-DD_HH-MM-SS
- file for DEMETER database: DEMETER-DATABASE-YYYY-MM-DD_HH-MM-SS
- file for DEMETER saved results: DEMETER-SAVEDRESULTS-YYYY-MM-DD_HH-MM-SS
- file for DEMETER saved inspections: DEMETER-SAVEDINSPECTIONS-YYYY-MM-DD_HH-MM-SS

Note: that YYYY-MM-DD_HH-MM-SS represents the date/time the tool creates the files.

The user will then be able to save these zip files to an external location in order to prevent losing this information. These files can also be used to get support from DEMETER support team. Please report any problems to EUROCONTROL support team ('mailto:DEMETER@eurocontrol.int').

3.4. DEMETER CONFIGURATOR

Since 1.04, there is also a new tool called "DEMETER Configurator".

This tool is used to configure DEMETER files without having the need to open the DEMETER application itself. It is particularly useful if some changes occur on DEMETER installation folders.
In order to run the tool, select the option "DEMETER Configurator", located in your "Start Menu" → "EUROCONTROL – DEMETER", as shown below:

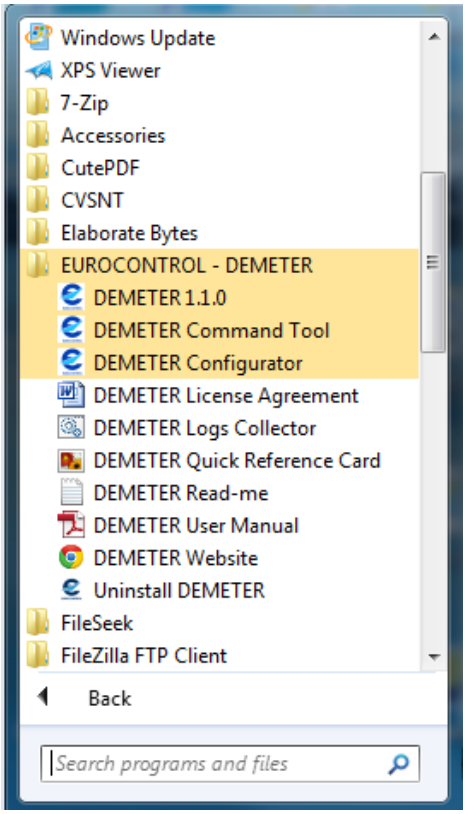


Figure 20: DEMETER Configurator start menu location

After running the tool, you will then be presented with the following screen:

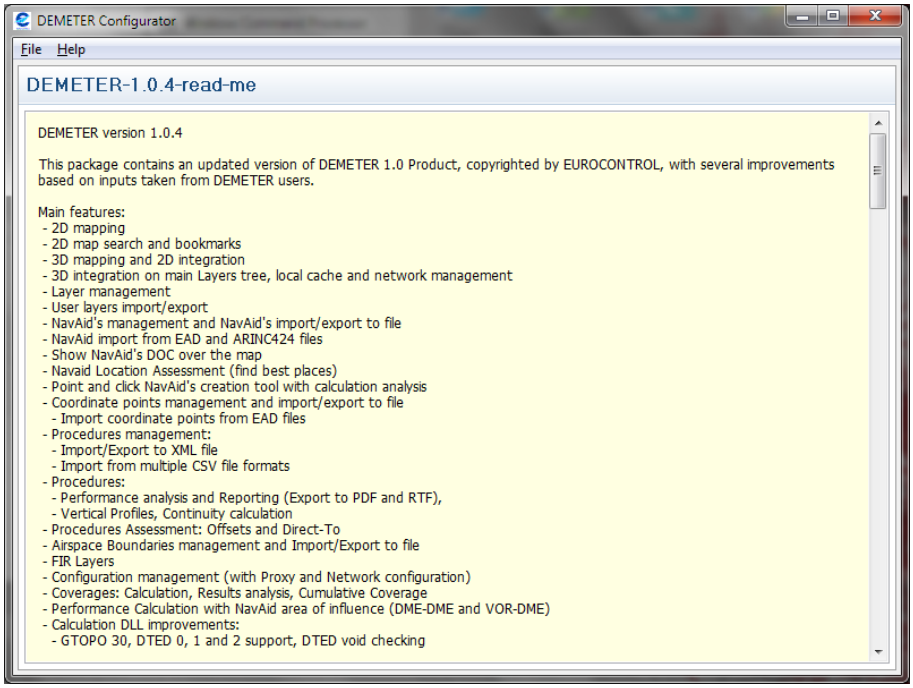


Figure 21: DEMETER Configurator

Inside this tool you will find two options in File menu:

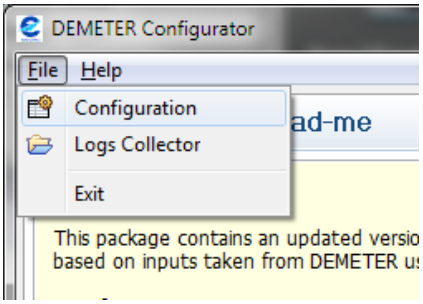


Figure 22: DEMETER Configurator File menu

- **Configuration** – will open the same dialogs and configuration options as described in **chapter** 5. **Note:** Please note that you should exit DEMETER before changing the configurations using this tool.

- **Logs Collector** – this option will run DEMETER logs collector described in previous chapter.

4. GENERAL OVERVIEW

4.1. APPLICATION LAYOUT

In this chapter it is made a general introduction to the DEMETER tool. When running DEMETER, there are essentially 4 main areas that deserve important focus. Such areas will be introduced in this chapter and explained with further detail in the next chapters.

The initial main areas of DEMETER are:

- Menus
- Icons toolbar
- Layer tree
- 2D Map

Here are listed the characteristics related with each of these areas:

- On the top of the application window there are the menus and the icons toolbar;
- The menus and the icons are each divided by functional areas. Besides the "File" menu, there is a menu regarding each type of operation that is currently supported by DEMETER application.
- Additionally, the following menus represent the tools ("Tools" menu) that DEMETER can use in order to manage its calculations ("Calculation" menu).
- The last menu is the "Help" menu, in which can be found several information about DEMETER application and support;
- The same order is used on the icons toolbar. First the configurations, then the items management followed by the tools and calculations;
- On the left the user can find the layer tree and area of interest list;
- This tree allows the user to hide or show information on the map. In the tree user can select or deselect any layer displayed on the map;
- The area of interest list allows user to manage the Area of Interest that will be explained further in this document
- The rest of the application area is used to display the 2D map.

The figure below illustrates how DEMETER's main screens are organized when the application first starts. Notice that the map initially starts with all the NavAids displayed on the map:

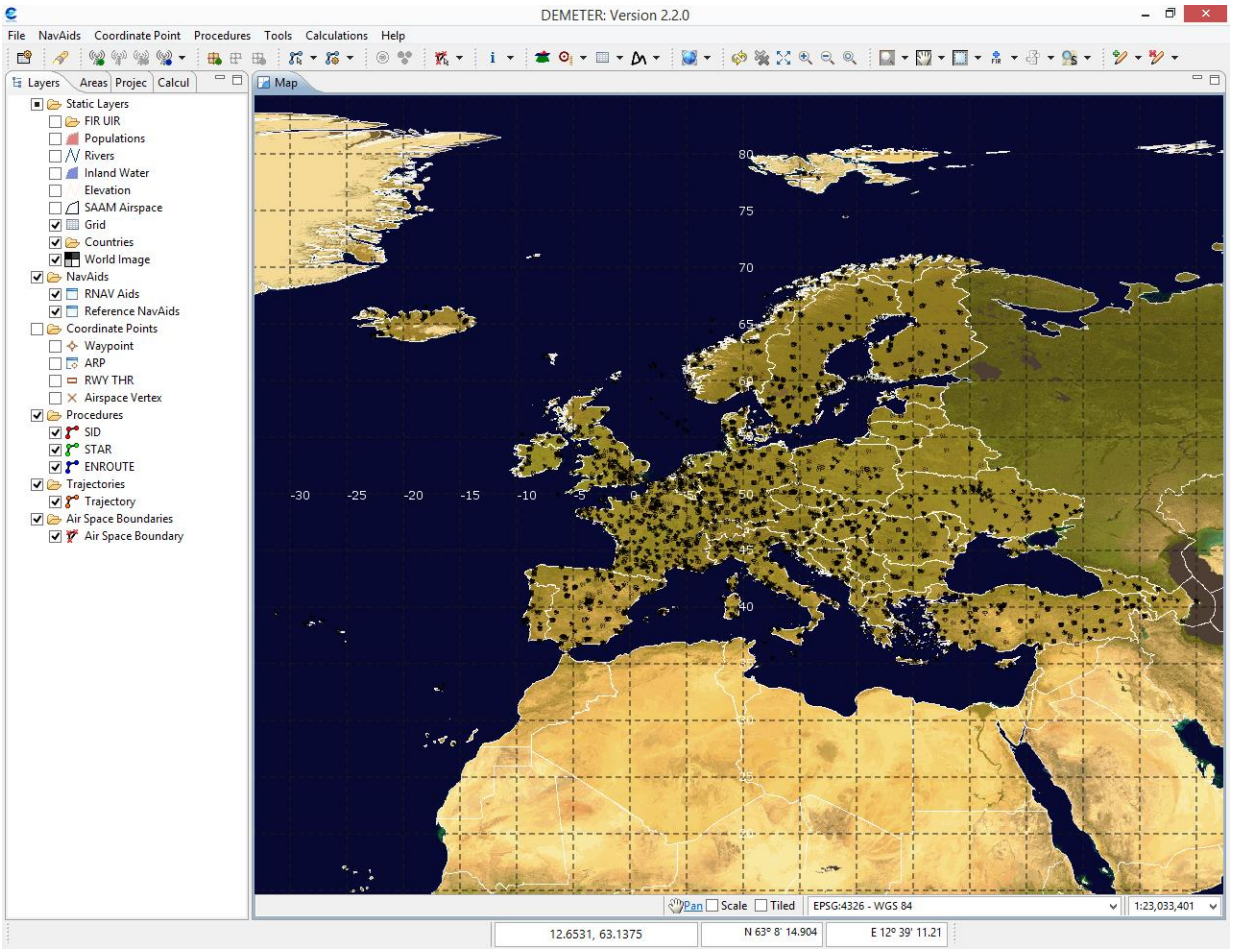


Figure 23: DEMETER startup window

During the DEMETER usage, 3 more areas are considered.

- Below the Layer tree there is an area that is used by any tool that interacts with the map. On this category the user can find for example the "Results Analysis" tools or the "Draw Range Rings" tool.
- Below the map there is an area that is reserved to edit information, which can be related to any calculation, layer, or item that is considered within the DEMETER scope – For example, creation or edition of NavAids or Procedures.
- The last considered area is displayed on the right of the 2D map and is used by the Earth 3D Globe view.

These 3 areas are showed on next figure.

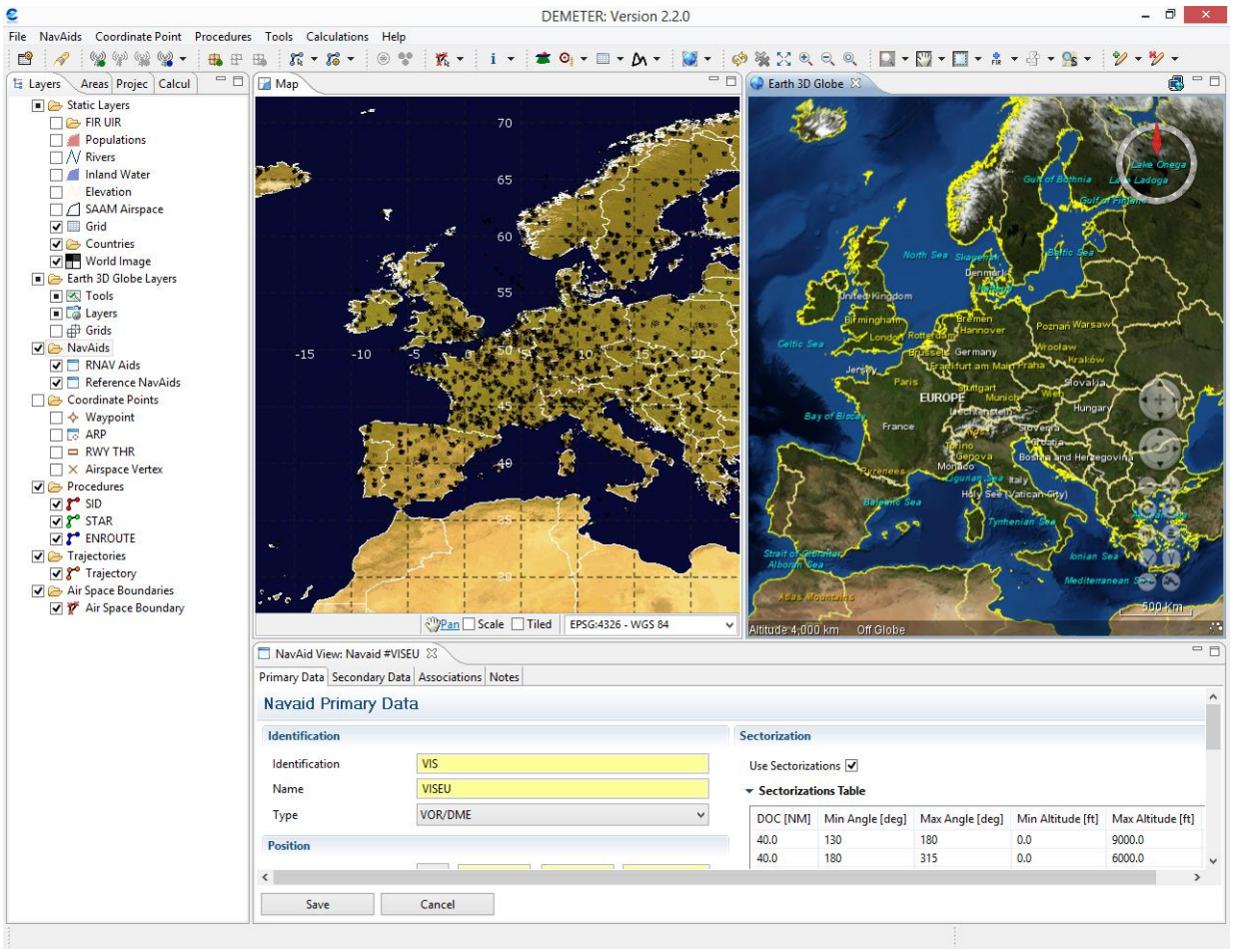


Figure 24: DEMETER working areas

Any of these views can be **resized** or **moved**. In order to **move** a view, the user clicks on the view's name and drags it with the mouse to the new desired location, dragging it afterwards. In order to **resize** a view, the user clicks on the view's margin and drags it with the mouse, adjusting it to define the new desired size.

Note that the application layout can always be reset. In order to do so, the user must select the "File" → "Reset Layout" menu option.

On the **default layout**, only the 5 views will stay opened, which are the Layers, Areas, Projects, Calculation Manager and 2D Map (Figure 23), meaning that all the other views are automatically closed. If the user clicks on the view header with the right mouse button, a configuration window will be displayed, allowing him to change the view:

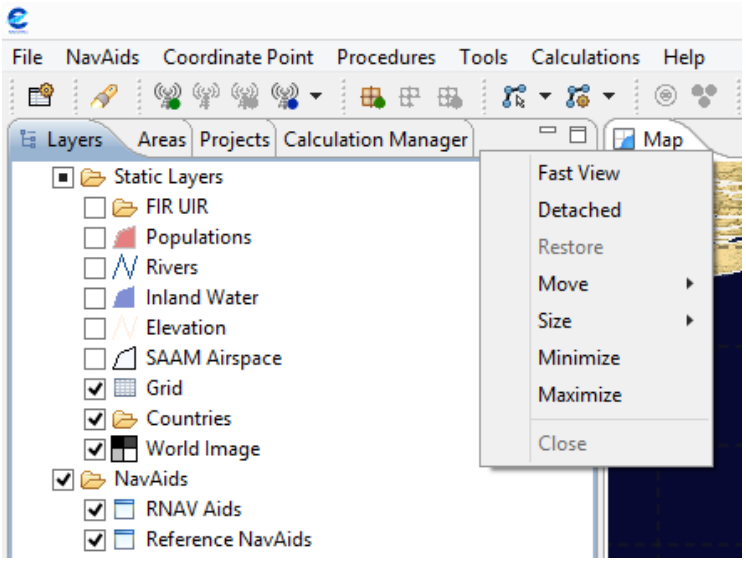


Figure 25: View management

Fast View – The view is minimized and turned into a toolbar. The user can access to the view by clicking on the respective icon;

Detached – The view is detached from the DEMETER application and can be used as a separate window;

Restore – Restores the view to a previous position and size;

Move – Allows to move the view to the intended position;

Size – Allows to change the size of the selected window. This options shows on the screen a line between two views. The user drags the line to a desired position;

Minimize – This button allows to minimize the view, but keeps this view within the main window;

Maximize – It allows the user to expand the view to occupy the entire area of the main window.

4.2. TOP MENU

Top Menu contains main tools and features available on DEMETER. Based on its context, the tools can be used to interact with the map, perform calculations or simply manipulate the information available in DEMETER's database. Within DEMETER you will find the following menus:

File:

Configuration
Update from EAD XML
Update all

- Update Aerodromes
- Update Vertex
- Update Procedures
- Update Route Segments
- Update Coordinate Points
- Update NavAids

Update from ARINC424
Registration
Reset Layout
 Import Layer
 Export Map to Image
 Print Map
Exit

NavAids:

 Create NavAid
 Edit NavAid
 Delete NavAid
ARINC FOM Check
Show Critical NavAids
DOC and Sectorization Display
Co-Channel Check
XML Import/Export
- Full Data
  - Import
  - Export Selected NavAids
  - Export All NavAids
- Secondary Data
  - Import
  - Export Selected NavAids
  - Export All NavAids

CSV Import/Export
- Full Data
  - Import
  - Export Selected NavAids
  - Export All NavAids
- Secondary Data
  - Import
  - Export Selected NavAids
  - Export All NavAids

Coordinate Point:

 Create Coordinate Point
 Edit Coordinate Point
 Delete Coordinate Point
Import Vertex from CSV

Create Coordinate Point from NavAid
Create Coordinate Point with Azimuth and Distance
XML Import/Export
- Import
- Export Selected
- Export All

Procedures:

 Manage Procedures on Map

 Procedure – NavAid Association

 Manage Trajectories on Map

Import from RVT/KMZ
- Import Trajectory

 Import Route Segments from CSV

Create Procedure from Route Segments

 Import procedure from CSV

XML Import/Export
- Import
- Export Selected
- Export All

Tools:

- Import Flight Inspection
- Pre-Processing Tool
- Air Space Boundaries
  - Manage Air Space Boundaries on Map
  - XML Import/Export
    - Import
    - Export Selected
    - Export All
- Import Obstacle Data
- Barometric Calculation Tool
- Multipath Tool
- Map Search
- Open Log Viewer

Calculations:

- Area
  - Coverage
  - Cumulative Coverage
  - Performance
  - NavAid Siting Tool
    - Define area by Envelope
    - Define area by Circle
    - Define area by Multi Point Line
- Procedures
  - Performance Report
  - Performance Analysis
  - Vertical Profile
- Build Calculation Database
- Delete Calculation Database
- Manage Saved Results
- Manage Pre-Processing Results

Help:

- Help Contents
- Search
- Dynamic Help
- User Manual
- License Agreement
- Read me
- About DEMETER

4.3. TOOLBAR

The toolbar contains the main DEMETER tools that can be easily executed by clicking or by selecting each of the available icons. Each tool has its own description and this is accessible through its tooltip. Different shortcuts that can be used in order to manage map views, calculations, or even to manipulate DEMETER information. Below are listed – by order of appearance – the tools that the DEMETER toolbar offers:

- DEMETER Configuration
- Map Search
- Create NavAid
- Edit NavAid
- Delete NavAid
- Create NavAid from Map
- Create Coordinate Point
- Edit Coordinate Point
- Delete Coordinate Point
- Procedure Creation
  - Create Procedure from Map
  - Create Procedure from Selected Zone
  - Create Procedure from File
- Procedure Edition
  - Edit Procedure
  - Procedure Assessments
- Calculate Area Coverage
- Calculate Area Performance
- Air Space Boundary Management
  - Create Air Space Boundary from Map
  - Create Air Space Boundary from Selected Vertices
  - Edit Air Space Boundary
- Identify Tool Multi Layer
  - Identify Multi Layer
  - Identify
- Terrain Altitude Cut
- Range Ring
  - Range Ring
  - Angles Tool
- Terrain Tools
  - Terrain Grid
  - Terrain Height at Point

- Distance and Azimuth
- Terrain GIS Tools
  - Horizon Tool
  - Cross Section
- Open Earth 3D Globe and Fly to Position
- Back
- Forward
- Redraw Map
- Stop Drawing
- Show All Data
- Zoom In
- Zoom Out
- Zoom Out fast
- Adjust Current Zoom
- Pan Map View
- Selection Type
  - Selection by Envelope
  - Selection by Distance
  - Selection by Polygon
- NavAid Selection Type
  - Selection by FIR
  - NavAid Selection by Country
- Altitude Filter
- Web Browser Map
  - Web Browser Map – Type: Satellite
  - Web Browser Map – Type: Roadmap
- Annotation Creation
  - Add line Annotation
  - Add Rectangle Annotation
  - Add Oval Annotation
  - Add Freehand Annotation
  - Add Text Annotation
- Annotation Deletion/Edition
  - Remove Annotation
  - Change Annotation
  - Move Points From Annotation
  - Remove All Annotations

4.4. LAYERS

The Layer Tree contains the list of all the items that are shown on map. For simplification and organization purposes, the layers are grouped and organized in folders. Each end node of the tree is directly linked with a layer on the map.

4.4.1. LAYER TREE MANAGEMENT

Each layer has a checkbox on its left, which changes the visibility of the layer:

- If the checkbox is checked, it means that the layer is visible
- If the checkbox is unchecked, it means that the layer is hidden

Checking/Unchecking a checkbox of a node that contains other nodes will modify the latter nodes' visibility recursively, according to its implicit hierarchy. This will result in the showing/hiding of all the layers that are inside the parent node's branch, respectively.

Moreover, the layers tree has another important roll on DEMETER. Every calculation or data modification that is made has its effects on the map's items. **Selection** has 2 main requirements within the DEMETER application:

The layer has to be **checked** on layer tree (thus, visible in the map's context)

The layer has to be **selected** on layer tree (highlighted with a blue colour). For further information about selection please consult section 0 in this manual.

4.4.2. LAYER TREE'S STRUCTURE

The layer tree is divided into 4 major types: **User layers**, **Static layers**, **Dynamic layers** and **Results layers**.

- The **User Layers** represent the layers that have been imported by the user to the application, over which the user has all control to reorder, delete, add and also change the layer style.

- The **Static Layer** node contains all the DEMETER's default layers, such as the countries that are loaded at the beginning. Please note that these layers cannot be changed by the user.

- The **Dynamic Layers** are represented on the map and contain all the elements stored on the database – for example NavAids or Coordinate Points. These layers are updated as elements are added or removed from the database and represent the basis of several functionalities inside DEMETER

- The **Results' Layers** are not displayed at the start-up of the application and are mainly used to display the results that appear after the calculations have been performed. For this type of layers there are 4 different sub folders:

  - **Flight Inspection Folder**
    Anytime a flight inspection is imported, a new layer is created, added to this folder and added to the map.

  - **Results Folder**
    Anytime a calculation is performed, a new layer is created, added to this folder and added to the map.

  - **Saved Layers Folder**
    If the user saves a Flight Inspection or a calculation result, the layer is moved from the respective folder to this folder, meaning that the layer(s) has/have been saved. Also, there is an option on the "Calculation->Manage Saved Results" menu available to close and open saved results.

4.4.3. LAYER TREE VIEW

The following scheme serves the purpose of describing the Layer Tree, providing insight into the latter's layer organization:

- **User Layers** – This layer appears whenever the user loads an external shape file
- **Static Layers**
  - (Range Ring)
  - (Angles Tool)
  - (Terrain Grid)
  - Annotations (appears when a note is added)
    - Annotation#1
    - Annotation#N
  - FIR UIR
    - ECAC Lower Airspace
    - ECAC Upper Airspace
    - ENP Lower Airspace
    - ENP Upper Airspace
    - World Lower Airspace
    - World Upper Airspace
  - Populations
  - Rivers
  - Inland Water
  - Elevation
  - SAAM Airspace
  - Grid


Countries

Europe

World


World Image

- **NavAids**
  - RNAV Aids
    - DME
      - Published
      - User defined
    - VOR/DME
      - Published
      - User defined
    - TACAN
      - Published
      - User defined
    - VORTAC
      - Published
      - User defined
  - Reference NavAids
    - DME (ILS)
      - Published
      - User defined
    - VOR
      - Published
      - User defined
    - NDB
      - Published
      - User defined
- **Coordinate Points**
  - Waypoint
    - Published
    - User defined
  - ARP
    - Military
      - Published
      - User defined
    - Civil
      - Published
      - User defined
    - Mixed
      - Published
      - User defined
  - RWY THR
    - Published
    - User defined
  - Airspace Vertex
    - Published

User defined

Procedures
- ENROUTE
- STAR
- SID
- (Routes)

Trajectories
- Trajectory

Air Space Boundaries
- Air Space Boundary

(Flight Inspections)

(Results)

(Saved Results)

Note: All of the existing static layers have the option of being personalized. In order to do so, right click in nearly all of the layers (the only exceptions are the Country Grid layer and the Annotations layer) and choose to "Edit Style". There you will find many colors and shades, with which you will be able to personalize those layers.

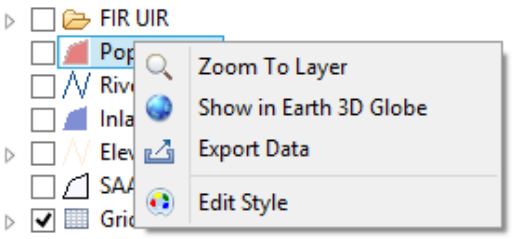


Figure 26: Zoom to Layer

4.4.4. USER LAYERS

User can import external shape files in order to have more information on the map, and thus giving DEMETER the capability of providing a personal context. Hence, this context can prove to be useful in data analysis and presentation.

To **import layers** the user must use the "Import Layer" menu, which is located on the "File" menu, spotted at the upper left of DEMETER's screen.

Then, a window will pop up, asking the user to choose a file that has a **Shapefile** (".shp" extension) format. After that another popup window will ask for the name that the user desires to give to the new imported layer. The chosen name will be applied as the layer is placed under the "User Layers" layer tree node.

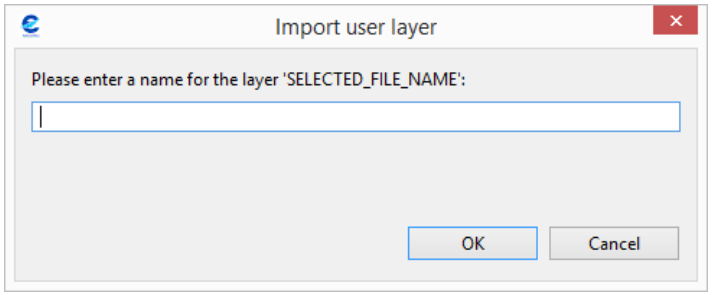


Figure 27: Import user layer window

After giving a name to the imported layer, the layer tree item correspondent to this layer will be included on the "User Layers" tree node, with the chosen name (Figure 28).

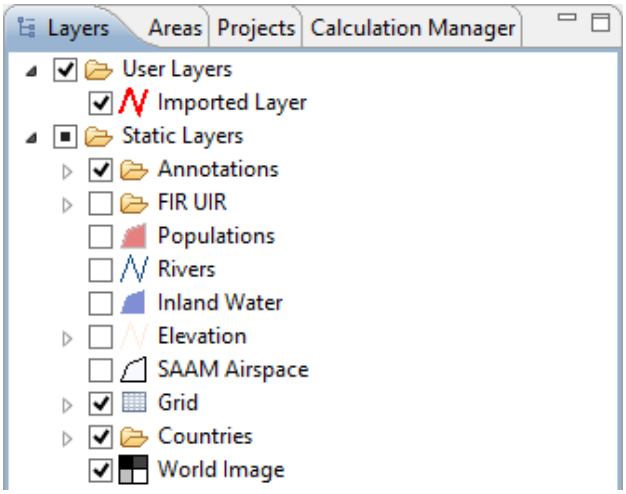


Figure 28: Import layer tree node

As in the Static Layers node, it is possible for the user to control the subsequent layers with a set of provided actions, which can be applied to them. In order to access these actions the user needs to right click over an imported layer, triggering the following menu to appear:

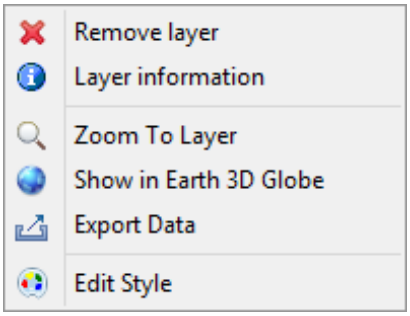


Figure 29: Remove imported layer menu

Below is a list of the possible actions that can be performed over an imported layer, as shown on Figure 29:

- **Remove layer**
  - This action will completely remove the layer from the tree and from the map. Note that the layer will not be deleted from the user computer.

- **Layer Information**
  - This action will pop up a window which will show the layer information (Figure 30). By clicking on the layer file's location on the disk, the system will automatically open the real location of the layer inside the user's computer.

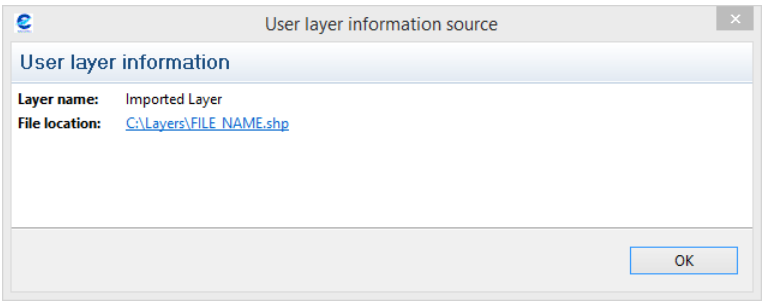


Figure 30: User imported layer information

- **Zoom To Layer**
  - This action zooms to the imported layer's envelope on the map.

- **Show in Earth 3D Globe**
  - Shows the layer in the 3D map.

- **Export Data**
  - This action allows exporting the layer to shapefile or KML file.

- **Edit Style**
  - This action pops up the "Edit style" window, which will be shown in order to allow the user to create the desired layer style in an analogous way as it can be done to the static layers.

4.5. AREAS

Next to "Layers" tab you will find "Areas" tab, which represents the **areas of interest** that can be shown on DEMETER's map. The main purpose of this tab is to allow the user to define areas that will act as bookmarks on the map. The user can choose to define as many areas as necessary.

The user can quickly switch between areas by just double-clicking in the name of the Area:

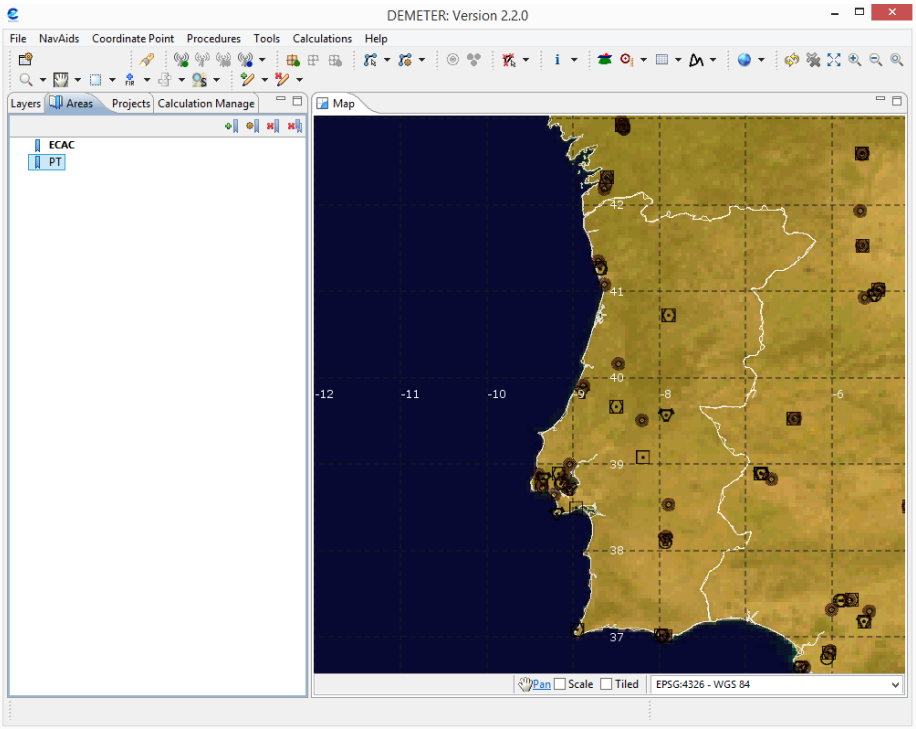


Figure 31: Selecting Areas

In order to manage the areas of interest, there available 4 icons at the top of the tab:

(Add Area of Interest): To create an Area of interest, first select the region on the map to the extent that you desire. Next, click on "Add Area of Interest" icon to set the current view as a new Area of Interest. You can set a Name, a Description, and you can set it as Default view checking Default Area checkbox.

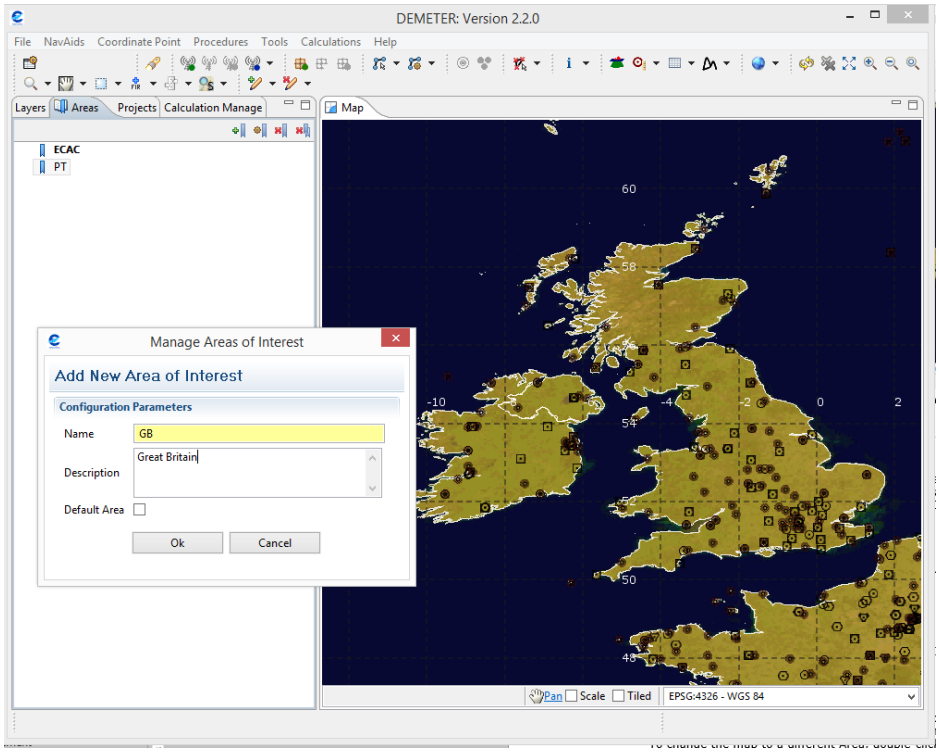


Figure 32: Add Area of Interest

(Edit Area of Interest): Select any area and click on this icon to modify Name or Description. If you want to modify the view to the current one, check the "Update Bounds" checkbox.

(Remove Area of Interest): Select any Area of Interest and click on this icon to delete it from the list.

(Remove All Areas of Interest): Click on this icon to remove the complete list of Areas of Interest. To see the description of an area move the mouse over the Area of Interest name. To change the map to a different Area, double-click on the Area of Interest name.

4.6. PROJECTS

A Project in DEMETER allows an user to logically organize its work. A project consists on a set of elements (NavAids, Coordinate Points, Procedures and Air Space Boundaries) that relate to a specific scenario built by the user.

By using projects, an user can work on distinct scenarios, built for different purposes (for instance, to make simulations in different areas or to make simulations in the same area but with different configurations), without having to mix information, offering an easy way to organize work and information in DEMETER.

A project can, for instance, be saved and loaded at any time so that the user can work on it whenever it is more convenient.

The "Projects" tab is placed at the right of the "Areas" tab. It provides a Multi-Project view where it is possible to aggregate NavAids, Coordinate Points, Procedures and Air Space Boundaries. To activate a Project, double-click on the Project's Name.

It is also possible to create, edit, remove, import, export and reload Projects.

(Add Project): Adds a new Project. The user must specify the Name of the project, provide a description and choose a configuration.

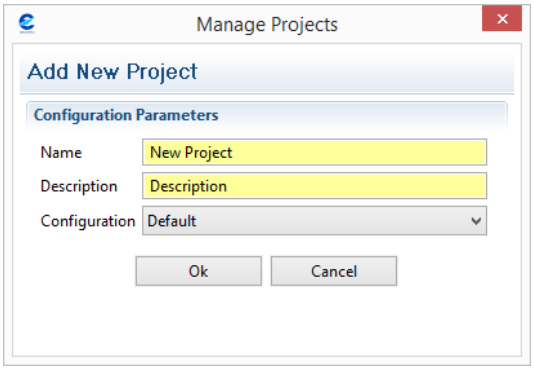


Figure 33: Create a new Project

(Edit Project): Edit the active Project. Allows changing the description of the project.

(Delete Project): Delete the selected Project.

(Save Project): Save the active Project, with the current configuration and elements. Whenever the user changes the active project, the state of the current project is saved automatically.

(Import Project): Import a Project. The user must select the project to import on the local file system.

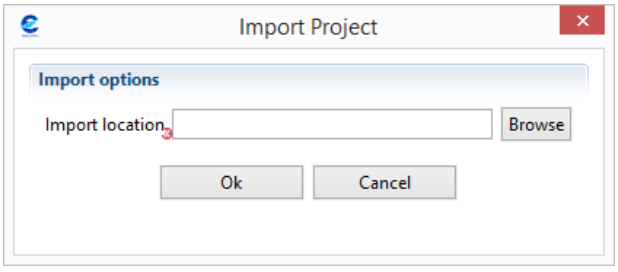


Figure 34: Import Project.

(Export Project): Exports the Active Project. The user must provide the location to where the project will be exported

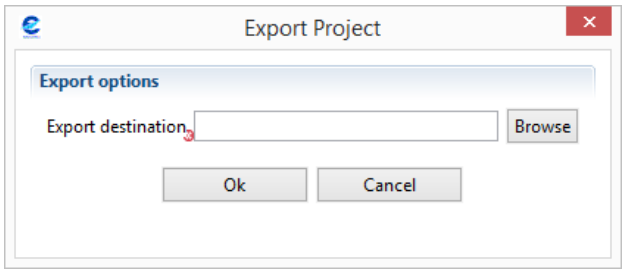


Figure 35: Export a Project.

Project Explorer: The project explorer window shows the tree with the existing projects. Here, projects can be selected and activated, by simply double-clicking over the desired project.

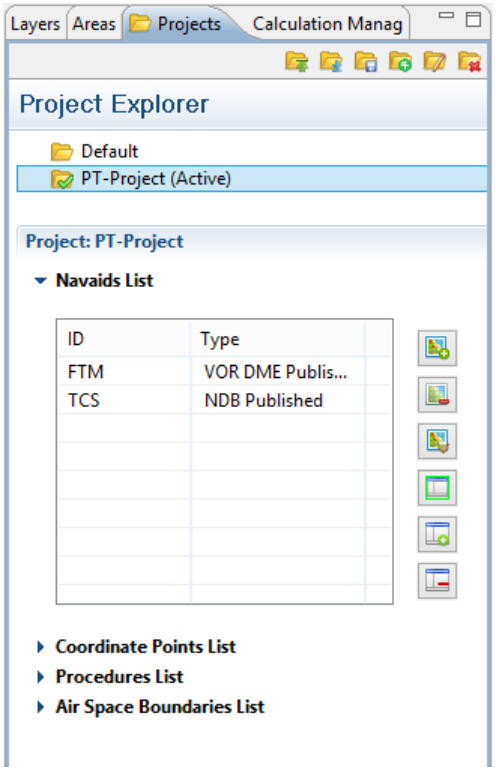


Figure 36 - Project Explorer

Project Content: The project content window has four lists (feature sets) with the elements that belong to the project:

- NavAids;
- Coordinate Points;
- Procedures;
- Air Space Boundaries;

Features List: For each list mentioned above, it is possible to manipulate the objects that the list contains through the use of the following options:

(Add to List): Add the selected features on the Map to the List

(Select all): Select all features on the List

(Remove from List): Remove the selected features from the List

(Add to Map): Add the selected features to the Map

(Remove from Map): Remove the selected features from Map

(Clear Map): Clears all features from the Map

4.7. ANNOTATIONS

The DEMETER user has the option to add graphical annotations to the map. An annotation represents pure graphical information that can be used by the user to add extra information to the map. On DEMETER the user can add **drawings** and **text annotations**.

Annotations are stored on a specific layer. The layer is presented on the Static Layer folder and the user can show or hide the complete layer or a set of annotations, changing the visibility in the respective checkbox.

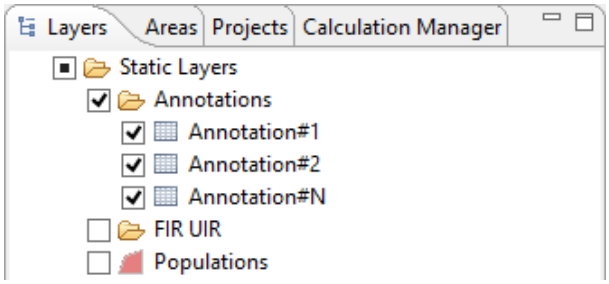


Figure 37: Annotation to Layer

4.7.1. CREATE ANNOTATIONS

To create a new Annotation, you must select the type of annotation and then draw it on the map. To select the type the user must click on the icon on the Icons Toolbar as presented in the figure below.

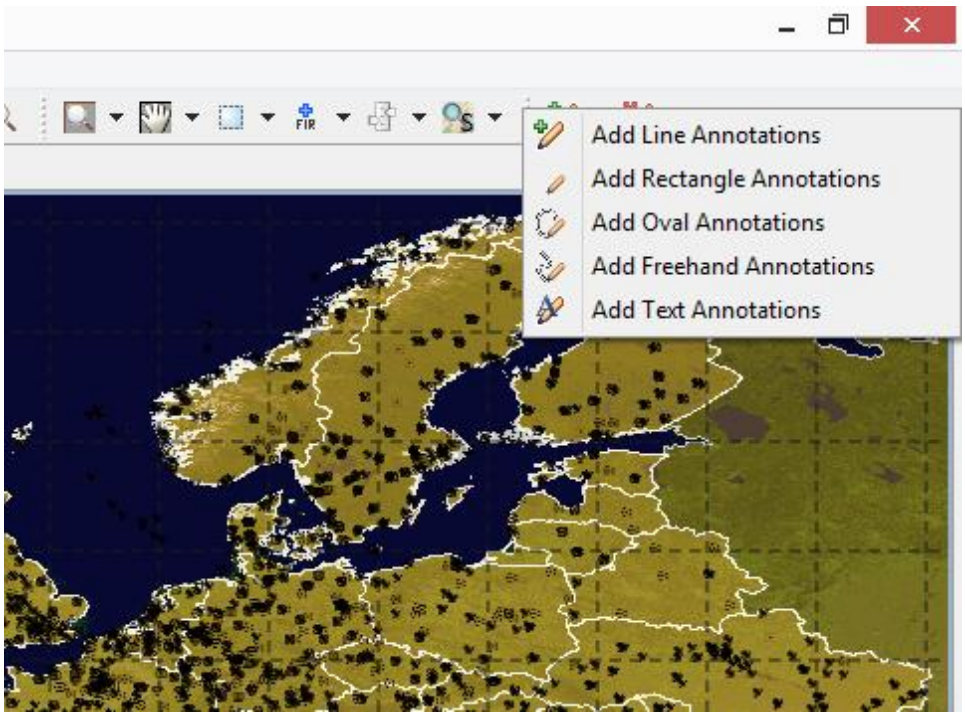


Figure 38: Select Create Annotation

There are five types of annotations available. For each one of them, after selecting the icon, the user is allowed to draw on the map, in order to create the annotation. Note that depending on the Annotation's type, the creation mode can vary and be slightly different.

4.7.1.1. Drawable Annotations

Add line Segments Annotation

To add points Click with the Left mouse button on the required map position;

To remove the last point Right Click on the map;

To finish the line Double Click on the last required point position.

Add Rectangle Annotation

To add the first rectangle point Click with the Left mouse button on the map. Drag the mouse with the Left mouse button pressed. To establish the final rectangle shape release the Left mouse button.

Add Oval Annotation

The same as the Rectangle Annotation but in this case it will be drawn an oval shape.

Add Freehand Annotation

To start the Freehand Annotation hold down the Left mouse button. Then move the Mouse over the map till the Annotation has the required form. To finish the Annotation release the left mouse button.

When the Annotation is finished, a window will pop up, as illustrated in Figure 39. In this window the user can change the Name, Color and Line Width of the annotation.

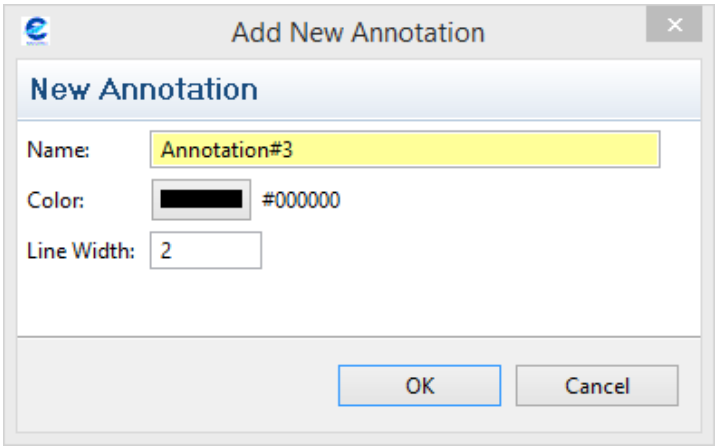


Figure 39: Create Drawing Annotation style

4.7.1.2. Text Annotations

Add Text Annotation

To create the text Annotation, double-click on the required position on the map. After that, a window like the one below is displayed. Here the user can define the Annotation Name, Text, Color and Font and Font Size.

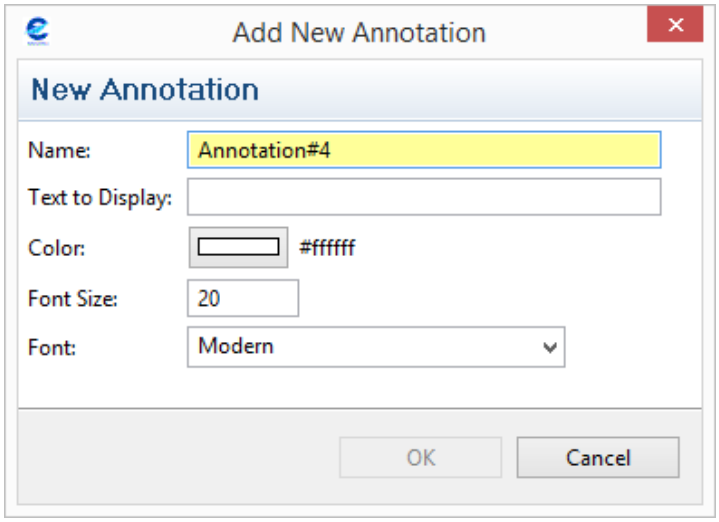


Figure 40: Create Text Annotation style

4.7.2. MANAGE ANNOTATIONS

After the Annotation is created, the user can choose either to edit it or to delete it (Figure 41).

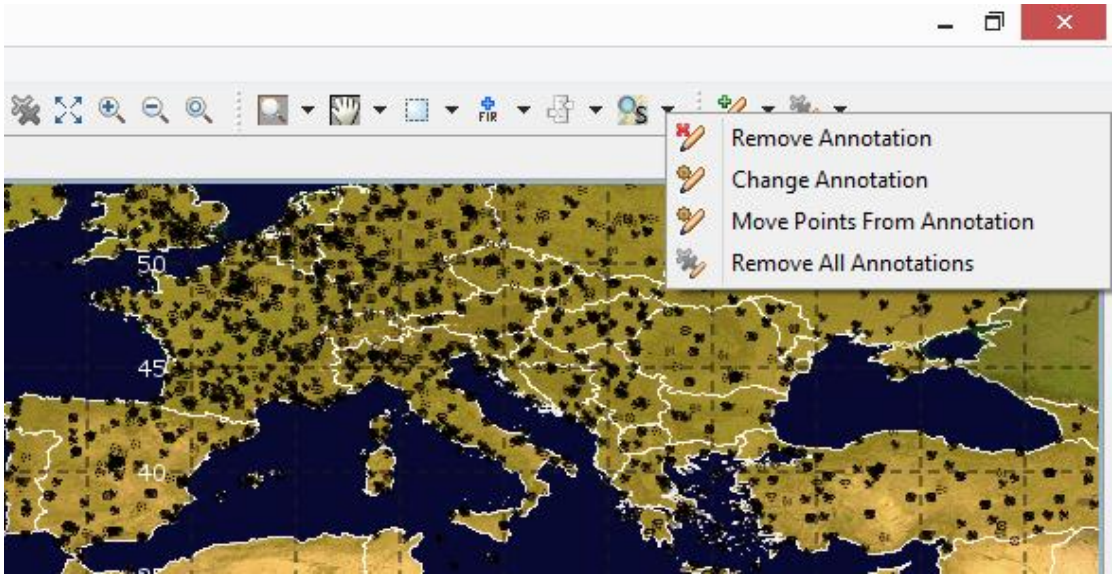


Figure 41: Manage Annotations

Delete Annotation

This action deletes an annotation after it has been selected. To select an annotation, left click with mouse on any annotation on the map.

Change Annotation

This action allows the user to change an annotation by clicking with the Left mouse button over the required Annotation. A window to change the parameters is then displayed, allowing the edition of the annotation.

Move Points from Annotation

This action allows the user to move, add or remove points to the existent Annotation. Click on a point and drag it to a new location to reposition a point. Click with the right mouse button on an existent point to delete it. Double-click over an existent line to divide an existent segment in two.

Remove All Annotations

This action deletes all the Annotations present on the map and created by the user.

4.7.2.1. Annotations' Information

After Annotations are created the user may want to see the details of an Annotation. This information can be accessed with the **Identify Tool**.

First select the Annotations layer on the Layer tree. Then select the "Identify tool" on the Icons toolbar and move the mouse over the required Annotation until an information window appears.

4.8. MAP

4.8.1. SELECTION TOOLS

DEMETER has five ways to select items from the map. Selecting any item allows you to work with it, for edition, deletion or calculations.

The five ways DEMETER has to select items are:

 **(Selection by envelope):** This tool allows the user to select any item included in a rectangle over the map.

 **(Selection by distance):** This tool allows the user to select all items within a pre-defined distance from a clicked point.

 **(Selection by polygon):** This tool allows the user to select items on the map using the most flexible way. The user only has to draw over the map a polygon that includes the desired items on the map.

(Selection by FIR): This tool allows the user to select any item included in a FIR (Flight Information Region).

(NavAid Selection by Country): This tool allows the user to select all NavAids included in a country.

In order to **select items** (three first types) on the map, it is required that the following three steps are followed:

1- Select the kind of selection tool you want to use (Envelope, Distance or Polygon).
2- Select on the Layers Tree, the layer or layers that contains the items you want to select. For selection of two or more items on the layer tree use the CTRL key and click on the additional tree items.
3- Make sure that items you want to select are checked on Layers Tree (visible on the map).
4- Move the mouse cursor to the map and use the chosen selection tool.
    - For the Selection by envelope press the left mouse button to define the location of the first corner of the selection. Holding down the left mouse button then move the mouse to specify the area. When the mouse button is released the selection area is defined.
    - For the Selection by Polygon the process is similar. The difference is that when moving the mouse the selection area is being defined.
    - For the Selection by Distance when the user holds down the left mouse button the selection area is showed with the center point on the mouse position and the size you define one the "Selection Buffer Configuration" window. If the user moves the mouse the center and the selection area are modified. The selection area is defined when the user releases the mouse button.
5- After the items have been selected on the map the user can add more items to the selection by pressing the SHIFT key and using the Selection tool again on the map.
6- If the user wants to remove any item from the selection, just need to press the CTRL key and use the Selection tool on any selected item.

7- The user can also select elements one by one using the Envelope or Polygon Selection tool by clicking over an element on the map that belongs to a layer selected on layers tree (visible on the map)..

The process to select any item using the **selection by FIR** (fourth type) is similar to previously ones. The difference is that the selection areas are already defined in the FIR layers. The process to select any item using the selection by FIR tool requires the following steps:

1- Check the FIR layer on the Layer Tree (make it visible on the map).
2- Select the selection by FIR tool.
3- Select on the Layers Tree, the layer or layers that contains the items you want to select. For selection of two or more items on the layer tree use the CTRL key and click on the additional tree items.
4- Make sure that items you want to select are checked on Layers Tree (visible on the map).
5- With the mouse cursor click inside the FIR area that you want to use to make the selection.
6- Once more, to add or remove element to the selection the user can repeat the process described on point 5 using the SHIFT or the CONTROL key together with click on the map.

The last selection tool is the **selection of NavAid by Country** (fifth type). In fact the selection is made by the ICAO Country code. The user selects the country and the NavAids with the same ICAO Country Code field are selected. The process to select NavAids using the NavAid selection by Country tool, requires the following steps:

1- Check the Country layer on the Layer Tree (make it visible on the map).
2- Select the NavAid selection by Country tool.
3- Check on the Layers Tree (visible on the map), the NavAid layer or layers that contain the items you want to select. For selection of two or more items on the layer tree use the CTRL key and click on the additional tree items.
4- With the mouse cursor click inside the Country area that you want to use to make the selection.

Once more, to add or remove element to the selection the user can repeat the process described on point 4 using the SHIFT or the CONTROL key together with click on the map.

4.8.2. MAP PROJECTION TOOL

DEMETER allows the re-projection on-the-fly of the map taking into account the **Coordinate Reference Systems** (RCS) that are suitable for the world representation of the DEMETER spatial data. A combo box is available at the bottom of the DEMETER map allowing the selection of the RCS (Figure 42 and Figure 43).

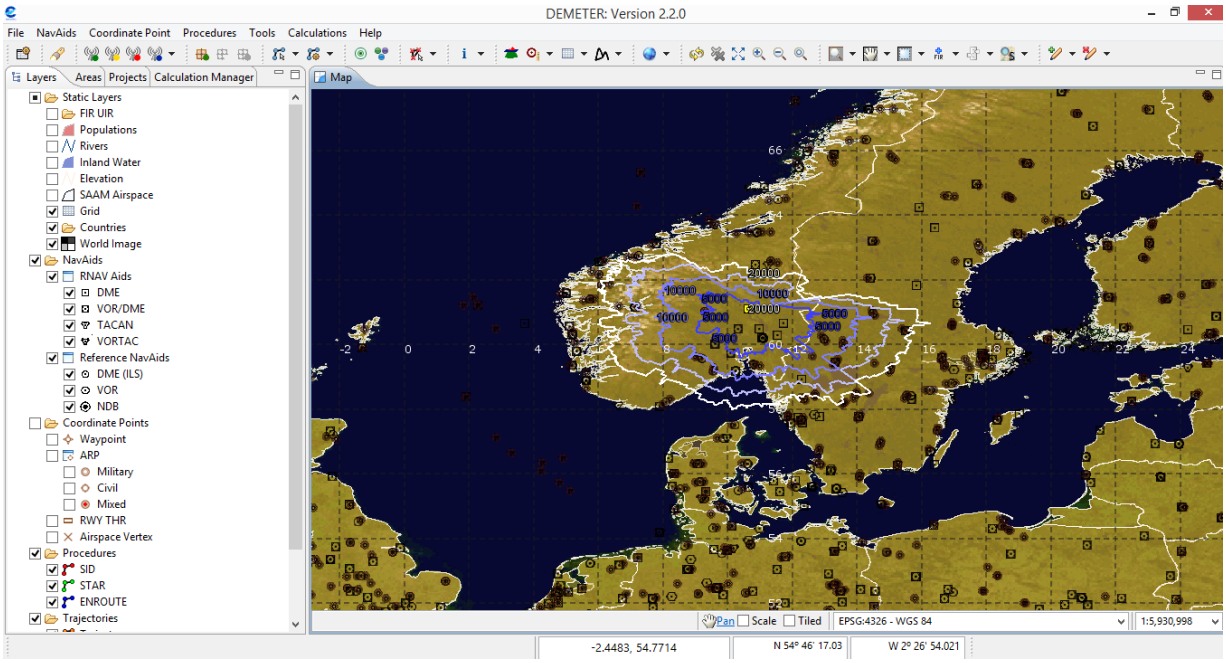


Figure 42: Calculation result (coverage) projected using EPSG:4326 - WGS 84(DD)

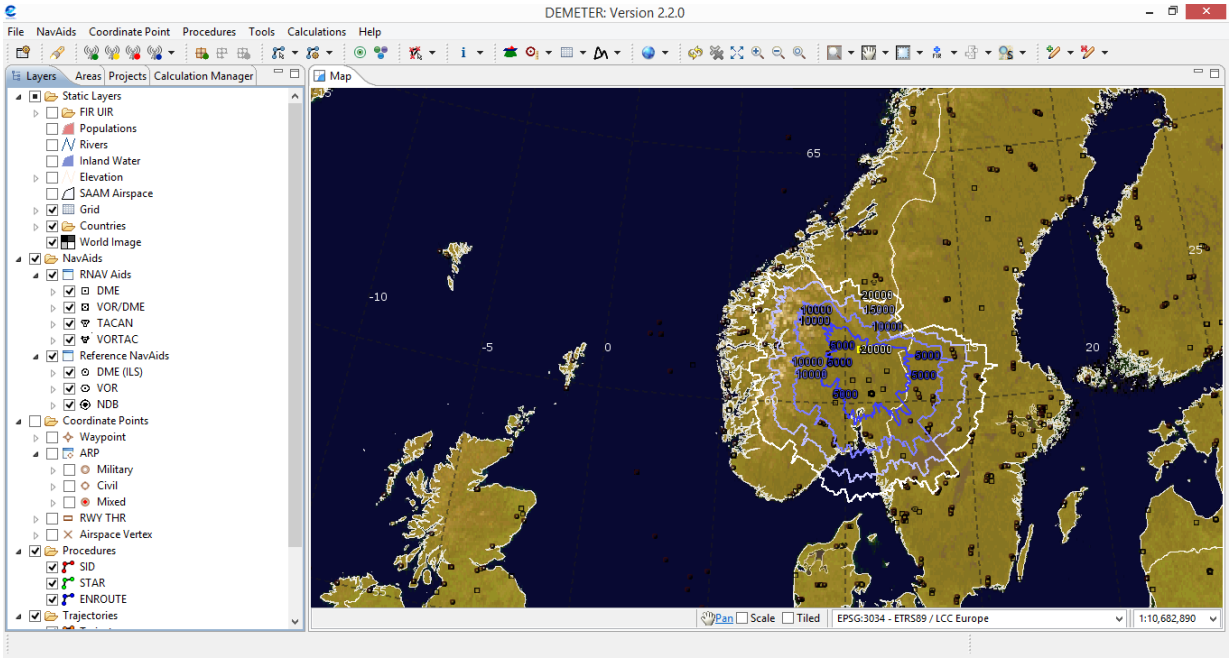


Figure 43: Same calculation result (coverage) projected using EPSG:3034 – ETRS / LCC Europe

In order to change the map projection, access the right bottom combo box with the pre-defined list of RCS, and choose the one that best applies to the user data. After the choosing the RCS the map is re projected on the fly. At least a "country specific" RCS is provided for each member state country, plus a number of "generic" ones (i.e. WGS 84).

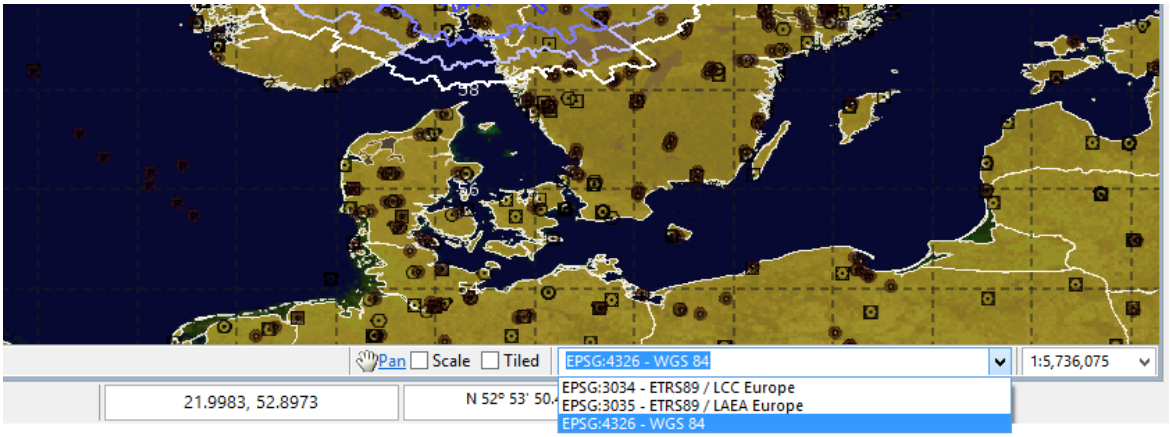


Figure 44: List of coordinate reference systems

The sub-set of RCS to be presented on the map combo box can be configured on the RCS Menu inside the "Configurations Manager", as shown in the figure below:

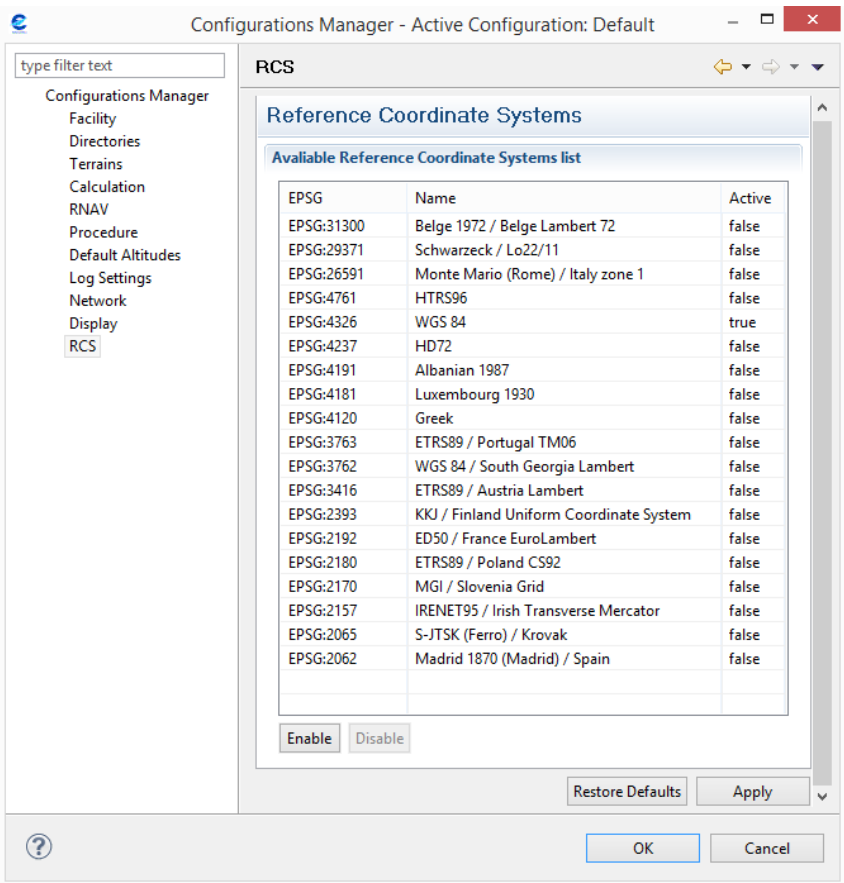


Figure 45: List of all available RCS

4.9. DATA FIELDS

During the usage of DEMETER you will find many fields that are available in two different units (for example, meters and feet's). You only have to type one of them and the other one will be converted automatically.

Most data fields have an error verification mechanism that allows the user to see the invalid data inserted while editing the fields. When an error is detected a warning message is display on the header of the corresponding form like the example in the next figures:

4.9.1. ERROR MESSAGES

In some fields, DEMETER has internally defined a maximum and a minimum constraint values. Whenever the user oversteps these limits, an error alert (⊗) appears, unavailing the save of any change. The user can view the top panel message and click on it to know the limits on that field. Look for the fields with this icon ⊗ and change the parameters between the limits. A short example follows:

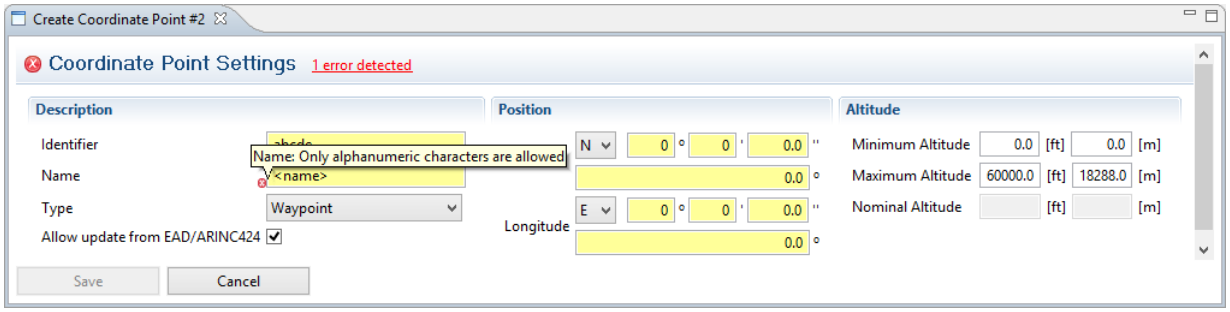


Figure 46: Error message example, creating a Coordinate Point

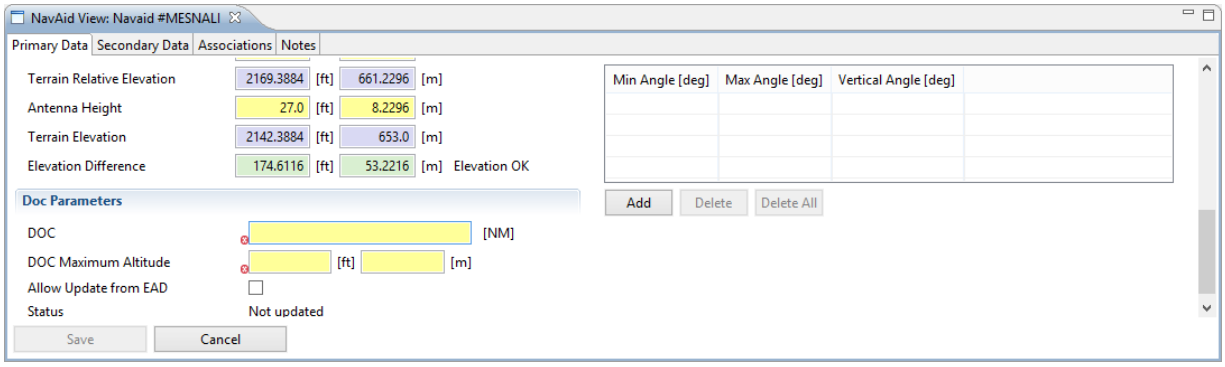


Figure 47: Error message example, editing NavAid data

4.10. REGISTRATION PROCESS

A registration manager software is implemented to manage the distribution of DEMETER releases.

This software generates registration key hashes based on the requesting user email, the MAC address of the computer network interface and the request date.

At the first time the user runs DEMETER, the application generates a registration request email to be sent to DEMETER@eurocontrol.int (the user must introduce an email to receive the registration key) or, in alternative the email text message to be copy-paste on a manual email request (offline registration), to EUROCONTROL DEMETER administrators.

Each new version of DEMETER will work without registration for a limited period of three weeks. After this period the application asks for the registration key in order to validate if the software is in conformity with the registration. After the key validation the installation application will send an email to EUROCONTROL in order to keep the track of software activations.

In order to avoid the use of old versions of DEMETER the registration validity shall be limited to 1 year. After this period the application shall warn the user to update to the latest version and request a new registration key.

An upgrade to a new release of DEMETER shall reset the 1 year validity counter and repeat the process of 3 weeks notification.

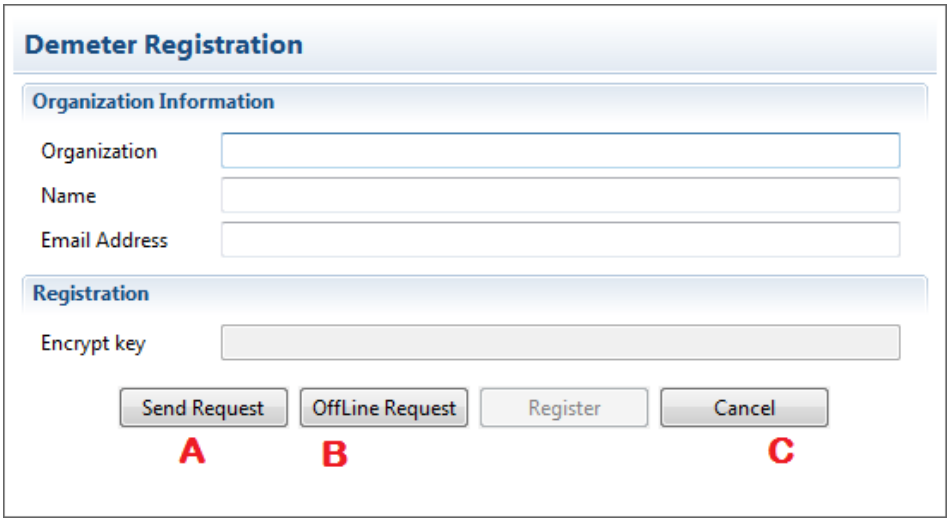


Figure 48: DEMETER registration window

A) This option sends an email a registration request to DEMETER@eurocontrol.int
B) This option is used to manually send a registration request to EUROCONTROL; this option will generate the email body with the registration key to be send to DEMETER administrators.
C) This option let you work with DEMETER for 21 days without registering the product.

After the key is received, the user must insert the key in the Encrypt Key input from the registration window and select the Register button.

At any time, within the 21 days period, a registration request can be done by accessing the option Registration from File menu, as shown in the figure below:

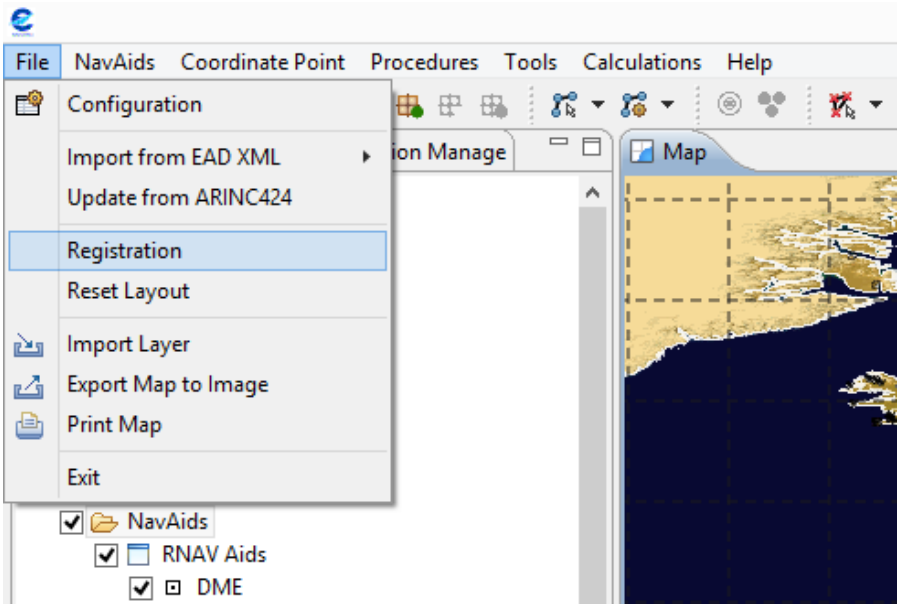


Figure 49: DEMETER registration menu entry

5. CONFIGURATIONS

DEMETER has configuration parameters that are used during the program execution. On these parameters there are definitions for minimum, maximum and default values that can be used on DEMETER operations and calculations.

In order to change these parameters, there is an option located on the "File" menu and an icon on the toolbar. Both of them are identified with this icon .

5.1. CONFIGURATION MANAGEMENT

In DEMETER 2.2.0 is possible to have multiple configurations, meaning that each one of them has its own Calculation database and can have its own NavAid database. Additionally, it is possible to **Clone**, **Activate** or **Delete** Configurations.

The Configuration Management process is directly related with the Project Management process and it is only possible to create more than one Configuration in the Default Project. On the other hand, in a custom Project it is only possible to have one Configuration.

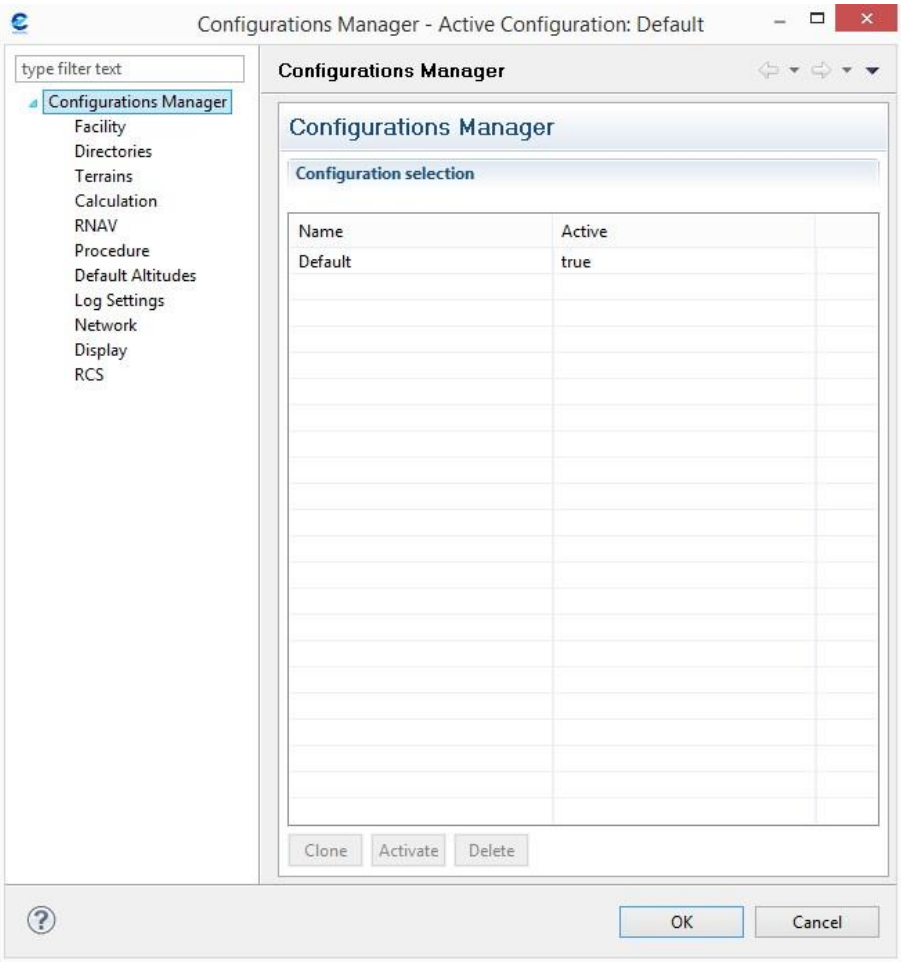


Figure 50: Configuration Manager window

5.2. CONFIGURATION ITEMS

DEMETER parameters can be modified in a Configuration panel that is displayed when the user clicks on the configuration.

The Configuration panel has a tree on left-hand, which divide the Configuration in:

- **Facility Settings**
- **Directories Settings**
- **Terrain Settings**
- **Calculation Settings**
- **RNAV Settings**
- **Procedure Semi-widths**
- **Default Altitudes**
- **Log Settings**
- **Network Configuration**
- **Display Settings**
- **RCS Settings**

Further information about all of these configurations will be detailed in the following chapters.

5.3. FACILITY SETTINGS

The "Facility Settings" page contains the main DEMETER parameters, which are mainly related to the NavAids' characteristics.

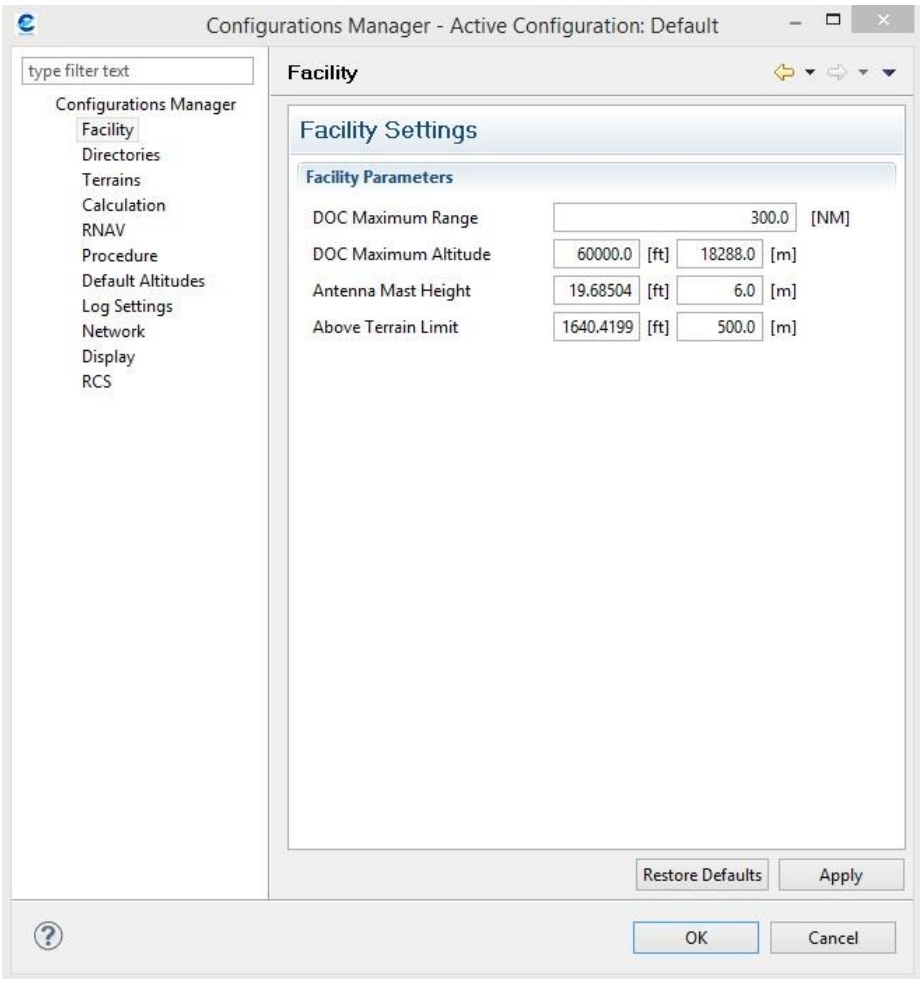


Figure 51: Facility Settings

5.3.1. FACILITY PARAMETERS

DOC Range

This value represents the Designated Operation Coverage (DOC) in nautical miles. The range of values you are able to use is:

Table 4: DOC Range Parameters

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	1	500

DOC Maximum Altitude

This value represents the highest altitude in feet or meters. The range of values you are able to use is in this value are:

Table 5: DOC Maximum Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Antenna Mast Height

This parameter defines the altitude of the antenna from the ground. It will be used when creating a new NavAid. This value will be added to the terrain height getting then the Facility elevation. The range of values you are able to use is:

Table 6: Antenna Mast Height Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	1641
Meters [m]	0	500

Above Terrain Limit

This parameter defines the maximum distance between the terrain and the NavAid facility Elevation. If the difference is bigger than the value specified here a warning is given to the user for example when performing a calculation. The range of values you are able to use is:

Table 7: Above Terrain Limit Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	1641
Meters [m]	0	500

5.4. DIRECTORY PARAMETERS

In this configuration page, the user can define the directory paths used by the DEMETER application.

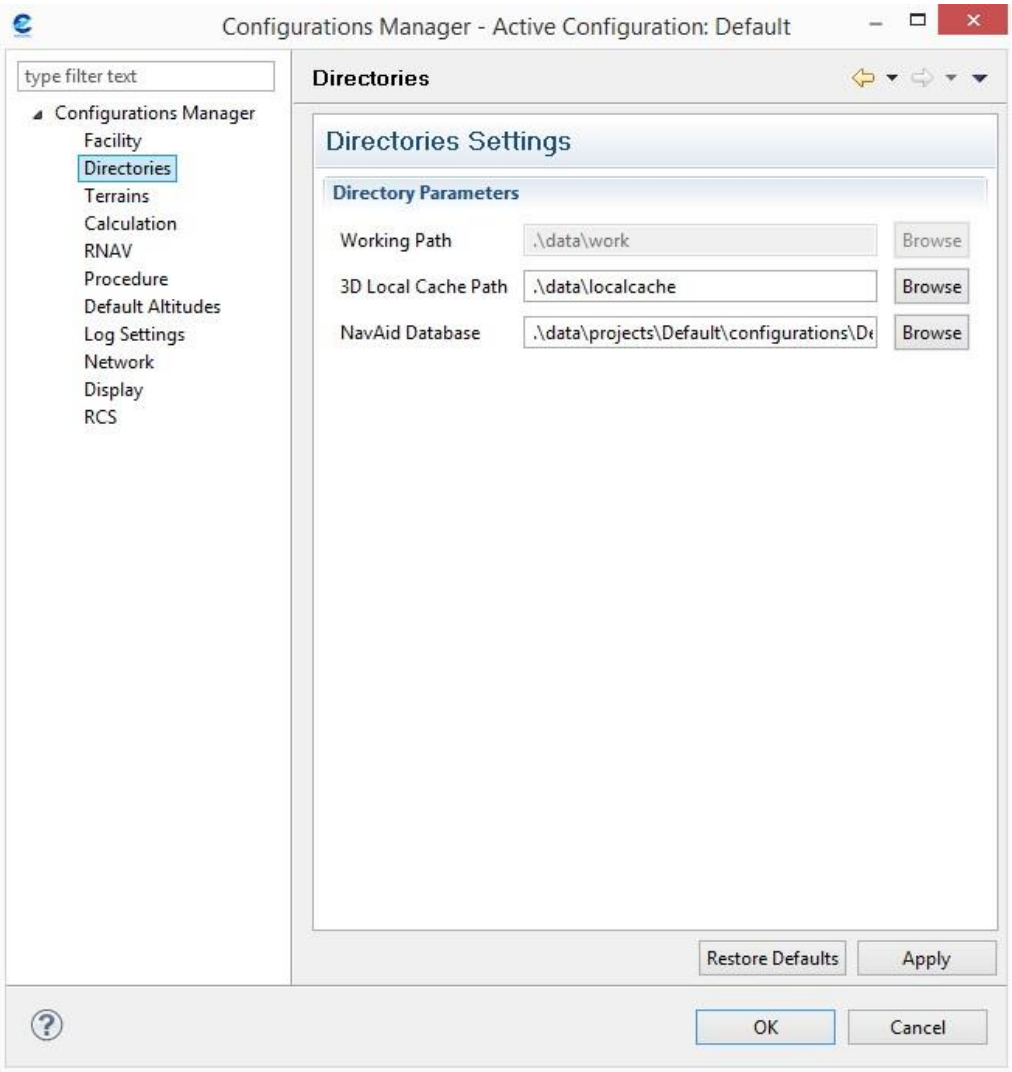


Figure 52: Directories Settings

The aforementioned directories are typically divided into **four** major **groups**:

Working Path

This is the default folder where DEMETER saves its data. For example, whenever the user saves a result, or exports the map as an image.

Local Cache Path

This is the path where the 3D Map (Nasa WorldWind) cache files are typically stored.

NavAid Database: This is the path to the folder where the DEMETER NavAid database is stored.

After the installation, each field is filled automatically using the installation folder. Moreover, every time DEMETER is started, the following verifications are made:

- If any of the other directory field is empty, the software tries to fill automatically that field using the installation folder.

5.5. TERRAIN SETTINGS

In this "Terrain Settings" page the user is able to define the terrain paths that are used by DEMETER (Figure 53). In DEMETER 1.1 is now possible to configure more than one terrain at the same level, which is intended to be used in a predefined order – that can be defined by the user. It is also possible to Create, Edit, Delete, Move Up and Down each terrain. This menu is defined for each Terrain Level.

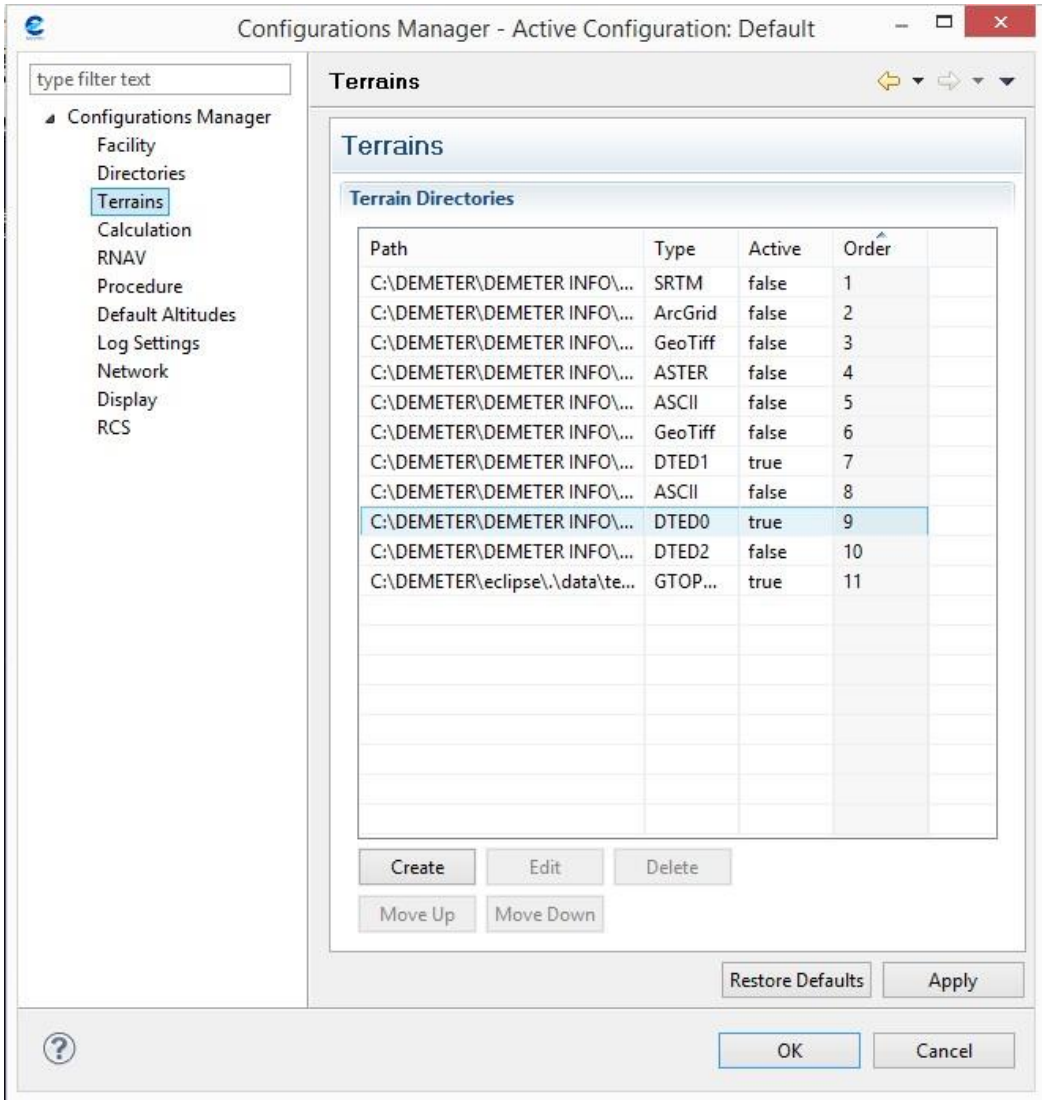


Figure 53: DEMETER Terrain Settings window

5.6. CALCULATION SETTINGS

On the "Calculation Settings" page the user is able to find the parameters that are used by DEMETER on its performed calculations. All these parameters have direct impact on each calculation, by the time it will be performed.

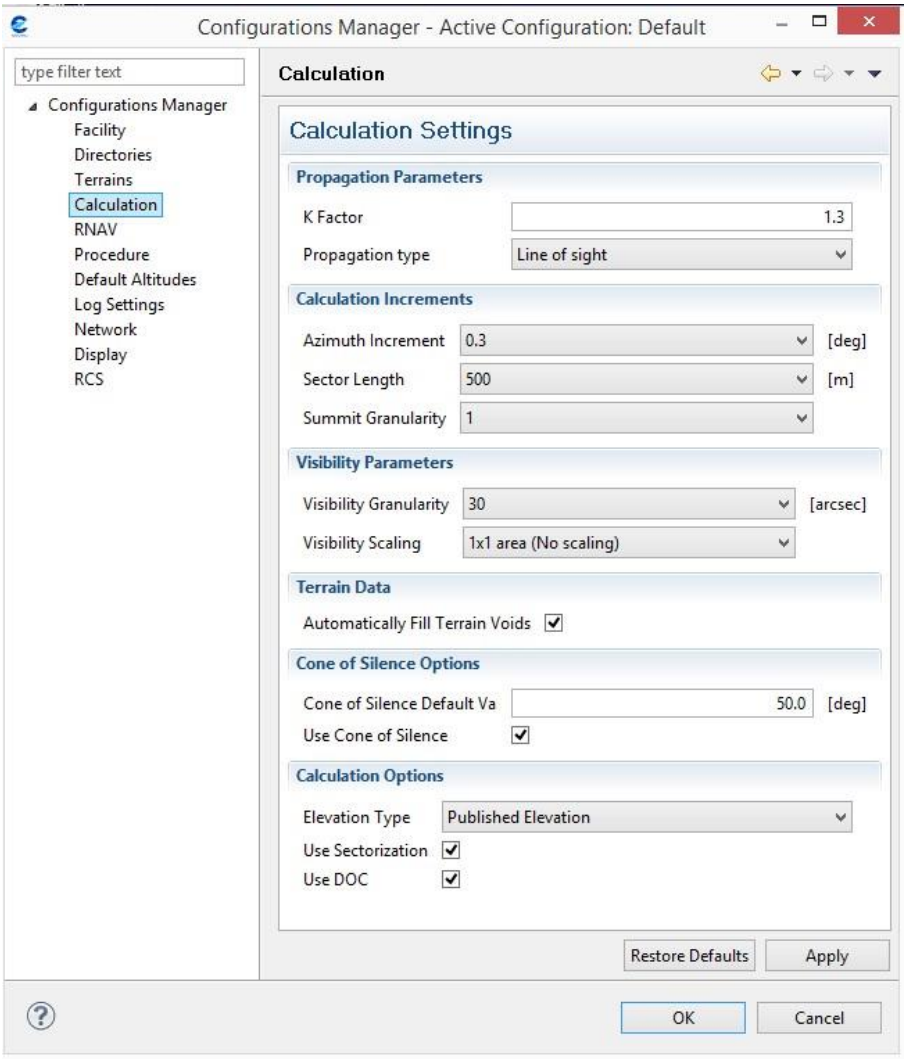


Figure 54: Calculation Settings window

5.6.1. PROPAGATION PARAMETERS

In this section you will find one parameter to modify:

K-Factor

This value represents the ratio of the effective Earth radius to the actual Earth radius. This parameter is used on the calculation model. The default k-factor is approximately 4/3. The range of values you are able to use is:

Table 8: K-Factor Parameters

Unit	Minimum Value	Maximum Value
N/A	1	1.5

Propagation Type

This option enables the user to select which propagation algorithm wants to use. The following options are available:

Propagation Type	Description
Line of sight	With the line of sight propagation DEMETER will calculate the visibility based on the line of sight algorithm.
Diffraction	With the Diffraction algorithm DEMETER will calculate the visibility based on the diffraction model, using the Deygout method. In this model DEMETER will calculate the total attenuation and subtract this value from the Ground Station power. It´s considered that the minimum power available that the station has visibility is -89 DbW.
Diffraction (60% simplification)	With the Diffraction algorithm DEMETER will calculate the visibility based on the diffraction model, using the Deygout method. In this option it´s considered that the Ground station has visibility at a certain point if the line between this point and station doesn´t intersects the 60% of the first Fresnel zone.

5.6.2. CALCULATION INCREMENTS

In this section there are scroll-down menus, where calculation parameters can be defined:

Azimuth Increment

This value represents the increment angle – in degrees – that determines the number of screening directions (or rays) for each NavAid summits calculation. Below is the range of values you are able to choose:

Table 9: Azimuth Increment Parameters

Unit	Values		
Degrees [deg]	0.3	0.5	1

Sector Length

This value represents the sampling length, in meters, for the rays in a NavAid summits calculation. The values you are able to choose are:

Table 10: Sector Length Parameters

Unit	Values	
Meters [m]	500	1000

Summit Granularity

After sampling a ray, in summits calculation for a NavAid, calculation will only store summits with summit granularity distance from each other. This distance is measured as Sector-Lenght*SummitGranularity. The values you are able to choose are:

Table 11: Summit Granularity Parameters

Unit	Values									
N/A	1	2	3	4	5	6	7	8	9	10

5.6.3. VISIBILITY PARAMETERS

In this section there are scroll-down menus that allow the user to select the calculation parameters according to increments.

Visibility Granularity

This value determines the resolution that the visibility 1X1 degrees files will have. The values you are able to choose are:

Table 12: Visibility Granularity Parameters

Unit	Values		
Arc second [aRCSec]	30	60	120

Visibility Scaling

This is the sampling factor, used on calculations that depend on visibility files (Coverage with minimum constraints, Cumulative Coverage and Performance). The visibility information is aggregated and the number of used samples depends on the selected value. This parameter is used for fastening and memory economy purposes. The possible values are:

Default – 3x2 area
One – 1X1 area (No scaling)
Two – 2x2 area
Three – 3x3 area
Four – 4x4 area

Thus, the values you are able to choose are:

Table 13: Visibility Scaling Parameters

Unit	Values				
N/A	Default	One	Two	Three	Four

5.6.4. TERRAIN DATA

Automatically fill terrain Voids

Checking this value will make DEMETER use lower resolution terrain data, if voids are found on DTED files.

5.6.5. CONE OF SILENCE OPTIONS

Cone of Silence Default Value

This test area allows the user to enter the vertical angle value, which is used to parameterize the cone of silence, applicable to all Ground Stations.

Use Cone of Silence

In order to perform calculations using cone of silence, this checkbox must be checked, otherwise it will be ignored.

5.6.6. CALCULATION OPTIONS

In this section you will find 4 options:

Facility Elevation

This combobox allows the user to choose if the calculations are to be performed considering one of two types of elevation:

Published Elevation

Choosing this option will make the calculations consider the facility elevation, that is, the elevation that the facility itself has, despite the terrain elevation. Please note that some values might be considered below the current terrain elevation and therefore, the NavAid being used in the calculation is considered invalid. The latter is also true if the NavAid published elevation is too far above terrain. Nonetheless, the correction of these values is identified by DEMETER and their correction is possible, applying a relative elevation.

Relative Elevation

Choosing this option will make the calculations consider the aforementioned relative elevation, that is, the corrected elevation. The corrected elevation considers both the terrain elevation at the NavAid's position plus its antenna height.

Use Geometry Constraints

Checking this checkbox will make DEMETER use the maximum and minimum DME Facility Range and Max Elevation Angle that was defined before. Setting this checkbox also allows the user to change the constraints values.

Use Sectorization

Checking this checkbox you allow DEMETER to use the Sectorizations that have been defined for each NavAid, as the calculations are performed.

Use DOC

Checking this checkbox DEMETER will use the DOC defined for each NavAid. If the checkbox is unchecked, a DOC of 500 NM will be used.

5.7. RNAV SETTINGS

On the "RNAV Settings" menu, the user can define the NavAid restrictions that are to be used during the calculations (Figure 55).

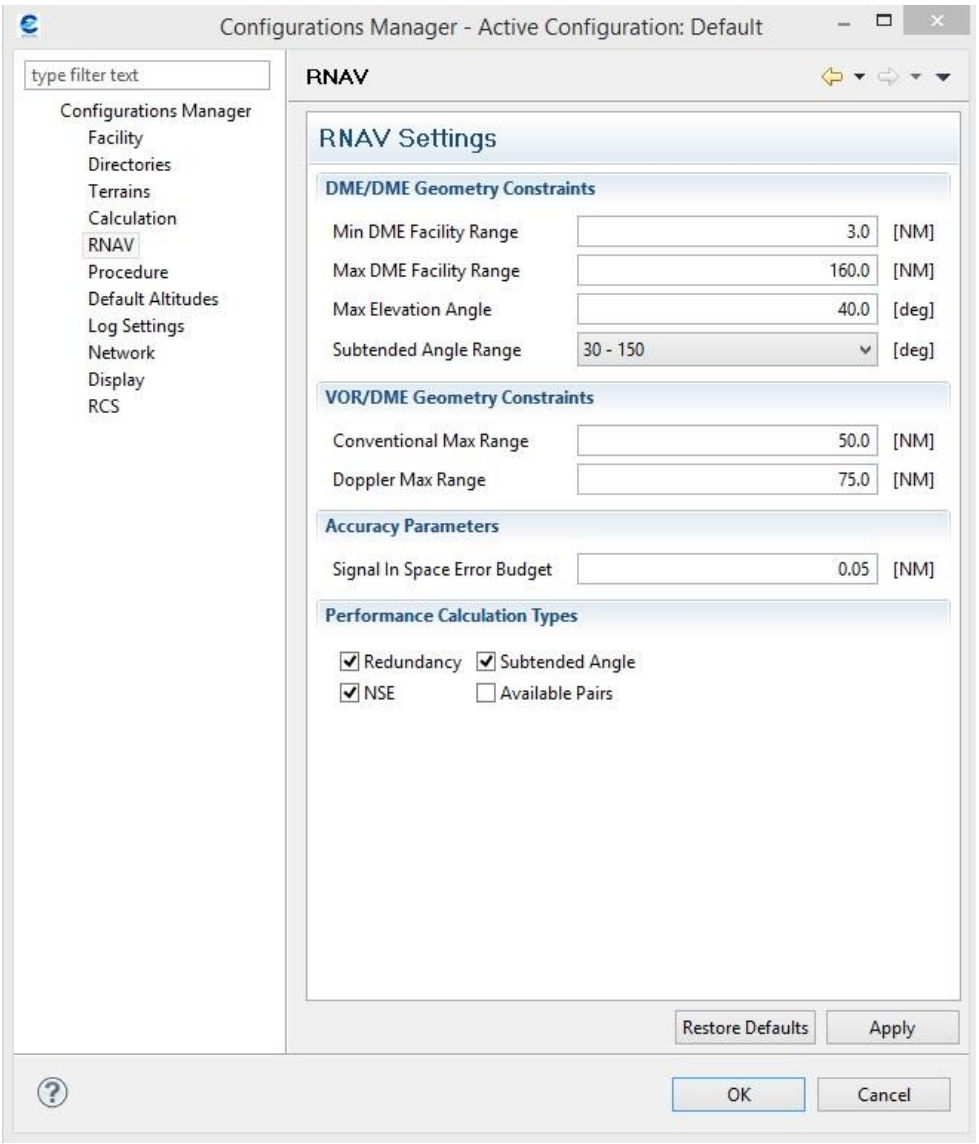


Figure 55: RNAV Settings

5.7.1. DME PARAMETERS

In this section you will find four parameters to modify:

Min DME Facility Range

This value essentially constrains the minimum distance NavAid signal that can be used for the RNAV. Make sure the "Use Geometry Constraints" checkbox is checked before trying to change this parameter. The range of values you are able to use is:

Table 14: Min DME Facility Range Parameters

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	3	160

Max DME Facility Range

This value constrains the maximum distance NavAid signal that can be used for the RNAV.

Make sure "Use Geometry Constraints" checkbox is checked before trying to change this parameter. The range of values you are able to use is:

Table 15: Max DME Facility Range Parameters

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	3	160

Max Elevation Angle

This value constrains a maximum angle on the vertical plane to be used for the RNAV.

Make sure 'Use Geometry Constraints' checkbox is checked before trying to change this parameter. The range of values you are able to use is:

Table 16: Max Elevation Angle Parameters

Unit	Minimum Value	Maximum Value
Degrees [deg]	0	90

Subtended Angle Range

Default value suggested to be used on Performance Calculations. The value can be changed each time a Performance calculation is executed. The values you are able to choose are:

Table 17: Subtended Angle Range Parameters

Unit	Values	
Degrees [deg]	40-140	30-150

5.7.2. VOR/DME GEOMETRY CONSTRAINTS

In this section there are two parameters that can be modified:

Conventional Maximum range

This value represents the maximum DOC value that can be used on the VOR/DME performance calculations, which are used for the CVOR NavAid type. Please note that this value will not be used if a different value is defined on the NavAid secondary data:

Table 18: Conventional Maximum range

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	3	160

Doppler Maximum range

This value represents the maximum DOC value that will be used on the VOR/DME performance calculations for the DVOR NavAid type. Please note that this value will not be used if a different value is defined on the NavAid secondary data:

Table 19: Doppler Maximum range

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	3	160

5.7.3. ACCURACY PARAMETERS

On this section there is one parameter to modify:

Signal In Space Error Budget

This is the constant value that is used on the NSE calculations. The default value is 0.05 NM.
The range of values you are able to use is:

Table 20: Signal In Space Error Budget Parameters

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	0	5

5.7.4. PERFORMANCE CALCULATION TYPES

These set of options control which performance calculations will be automatically set for calculation:

Redundancy

Checking/unchecking this checkbox sets/unsets the performance analysis of redundancy;

Subtended Angle

Checking/unchecking this checkbox sets/unsets the performance analysis on Subtended Angle;

NSE

Checking/unchecking this checkbox sets/unsets the performance analysis on NSE;

Available Pairs

Checking/unchecking this checkbox sets/unsets the performance analysis of available pairs.

5.8. PROCEDURE SETTINGS

In the "Procedure Semi-Widths" page, you are able to see the specified semi-widths that are associated with and used in procedure calculations. The following chapters will bring insight into the details about each of the aforementioned fields.

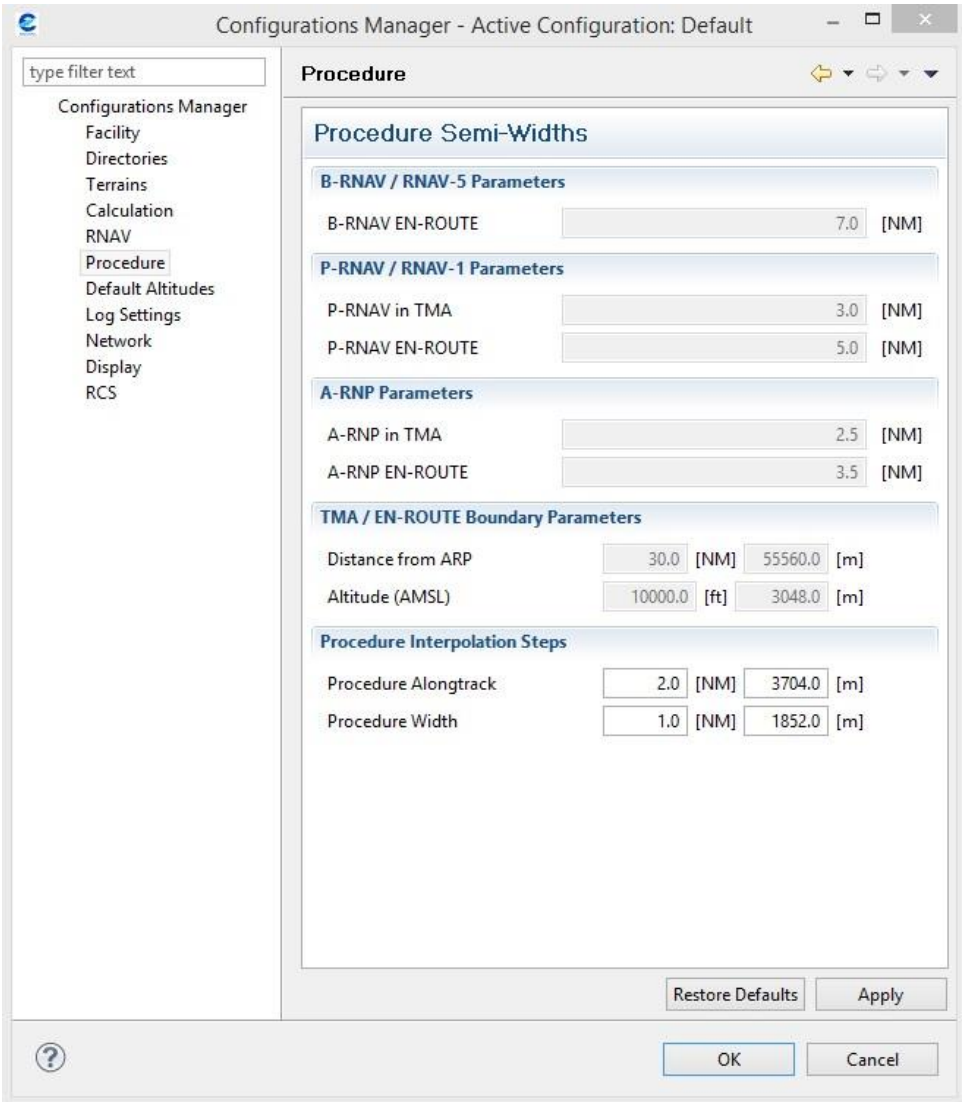


Figure 56: Procedure Settings

5.8.1. B-RNAV / RNAV-5 PARAMETERS

In this section there is one parameter that cannot be changed (view mode):

B-RNAV EN-ROUTE

This value represents the semi-width value that is to be used on procedure calculations, with performance type B-RNAV / RNAV-5. The standard value for this parameter is set as:

Table 21: B-RNAV EN-ROUTE Parameter

Unit	Value
Nautical Miles [NM]	7

5.8.2. P-RNAV / RNAV-1 PARAMETERS

In this section there are two parameters that cannot be changed (view mode):

P-RNAV in TMA

This value represents the semi-width value that is to be used on procedures with performance type P-RNAV / RNAV-1 when the aircraft is near (TMA specified on next section) to the ARP. The standard value for this parameter is set as:

Table 22: P-RNAV in TMA Parameter

Unit	Value
Nautical Miles [NM]	3

P-RNAV EN-ROUTE

This value represents the semi-width value that is to be used on procedures with performance type P-RNAV / RNAV-1 when the aircraft is far (EN-ROUTE specified on next section) from the ARP. The standard value for this parameter is set as:

Table 23: P-RNAV EN-ROUTE Parameter

Unit	Value
Nautical Miles [NM]	5

5.8.3. A-RNP PARAMETERS

In this section there are two parameters that cannot be changed (view mode):

A-RNP in TMA

This value represents the semi-width value that is to be used on procedures with performance type A-RNP when the aircraft is near (TMA specified on the next section) to the ARP. The standard value for this parameter is set as:

Table 24: A-RNP in TMA Parameter

Unit	Value
Nautical Miles [NM]	2.5

A-RNP EN-ROUTE

This value represents the semi-width value that is to be used on procedures with performance type A-RNP when the aircraft is far (EN-ROUTE specified on next section) from the ARP. The standard value for this parameter is set as:

Table 25: A-RNP EN-ROUTE Parameter

Unit	Value
Nautical Miles [NM]	3.5

5.8.4. TMA / EN-ROUTE BOUNDARY PARAMETERS

These parameters are used by DEMETER in order to swap between semi-widths (TMA\EN-ROUTE) on procedure calculations. This swap happens when at least one of these values is reached on a procedure calculation:

Distance from ARP

This value represents the distance – in nautical miles or meters – from the airport reference point. The standard values for this parameter are set as:

Table 26: Distance from ARP Parameters

Unit	Value
Nautical Miles [NM]	30
Meters [m]	55560

Altitude (AMSL)

This value represents the altitude above mean sea level. The standard values for this parameter are set as:

Table 27: Altitude (AMSL) Parameters

Unit	Value
Feet [ft]	10000
Meters [m]	3048

5.8.5. PROCEDURE INTERPOLATION STEPS

In this section there are two parameters to modify:

Procedure Alongtrack

This field allows the user to set the step size used on the procedure interpolation along the track in nautical miles or meters. The range of values you are able to use is:

Table 28: Procedure Alongtrack Parameters

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	0.5	5
Meters [m]	185.2	9260

Procedure Width

This value sets the step's size that is used on the procedure width interpolation – in nautical miles or meters. The range of values you are able to use is:

Table 29: Procedure Width Parameters

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	0.5	5
Meters [m]	185.2	9260

5.9. DEFAULT ALTITUDES

In the "Default Altitudes" page, you can defined the altitudes used on each calculation (Figure 57).

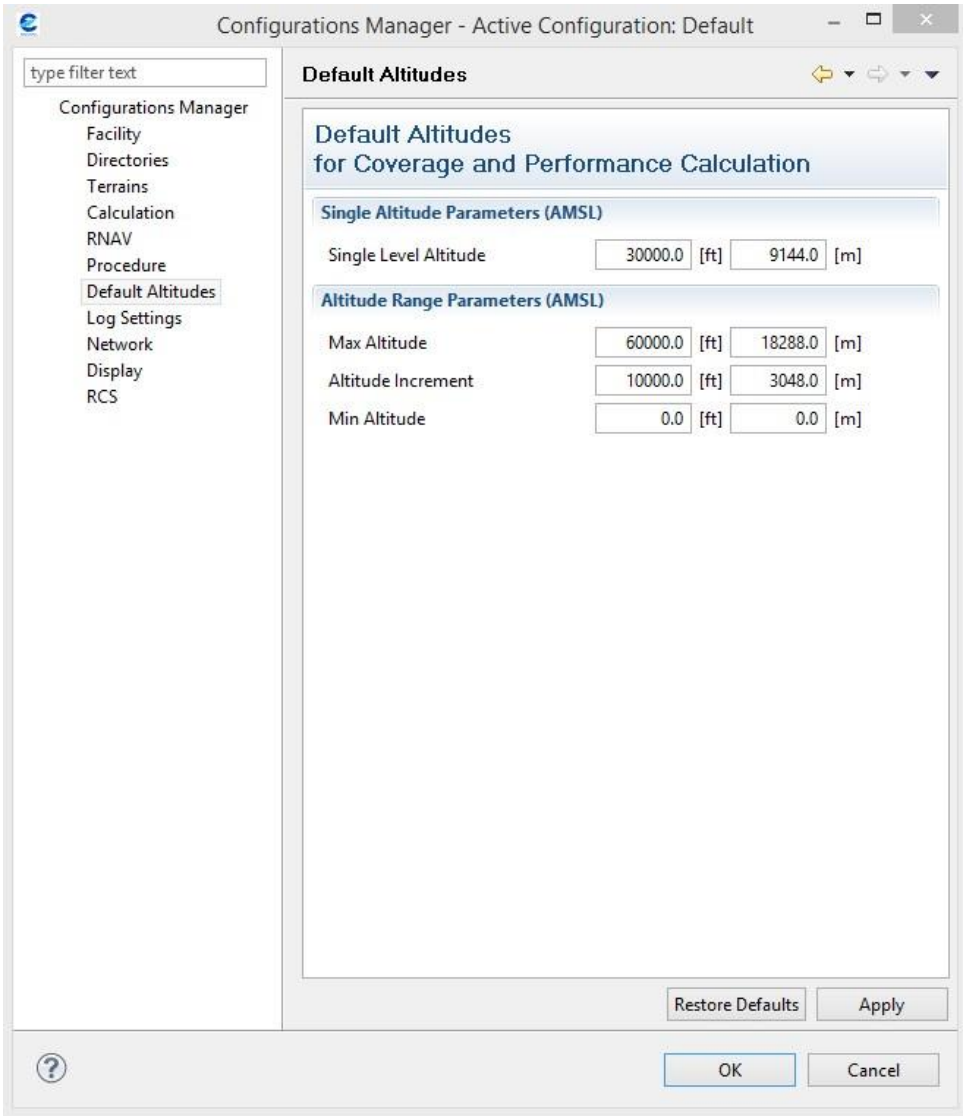


Figure 57: Default Altitudes

5.9.1. SINGLE ALTITUDE PARAMETERS (AMSL)

In this section there is one parameter to modify:

Single Level Altitude

This value represents the default parameter value for a single level altitude calculation.
The range of values you are able to use is:

Table 30: Single Level Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

5.9.2. ALTITUDE RANGE PARAMETERS (AMSL)

In this section there are three parameters to modify:

Max Altitude

This value represents the default maximum value for calculations – in feet or meters. The range of values you are able to use is:

Table 31: Max Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Altitude Increment

This value represents the gap of altitude between interpolations in feet or meters. The range of values you are able to use is:

Table 32: Altitude Increment Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	100	3.4028235e38
Meters [m]	30.48	1.0371806e38

Min Altitude

This value represents the default minimum altitude value for calculations – in feet or meters. The range of values you are able to use is:

Table 33: Min Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

5.10. LOG SETTINGS

In the "Log Settings" page, the user is able to configure the desired log settings (Figure 58)

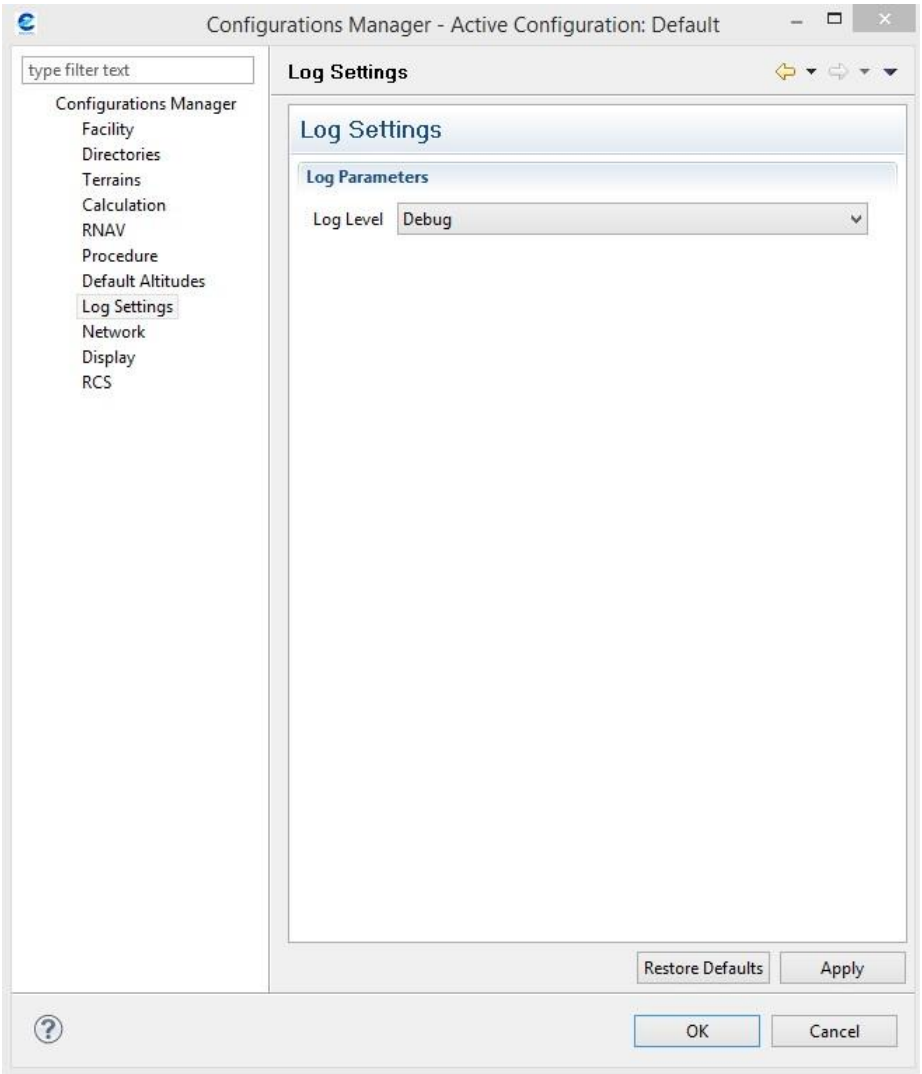


Figure 58: Log Settings

There are two different types of Log Level:

Information:

Using this option grants that the only informative log message is saved, providing a low depth analysis to the DEMETER application processes.

Debug:

Using this option, grants that the log has a higher detail over the program processes and action and this way it is possible to analyze deeply the descriptions and errors of what occurred during the application runtime.

5.11. NETWORK CONFIGURATION

In the "Network Configuration" page, the user is able to modify the settings that are related to the network connection (Figure 59).

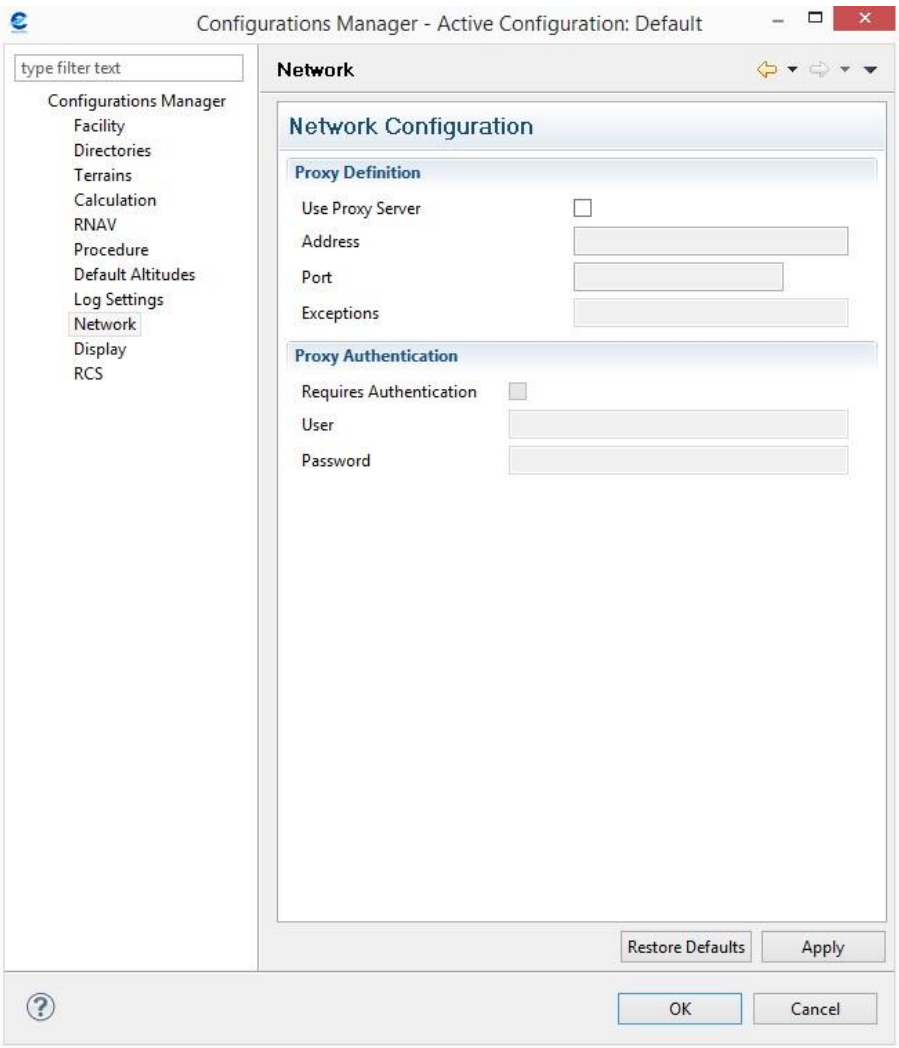


Figure 59: Network Settings

5.11.1. PROXY DEFINITION

Checking the "Use Proxy Server" checkbox enables the usage of a Proxy Server check. When Proxy usage is enabled, the user is able to change the following parameters:

Address

This value represents the IP address of the Proxy Server.

Port

This value represents the port to be used by the Proxy Server.

Exceptions

These values represent the addresses for which the proxy is not used.

5.11.2. PROXY AUTHENTICATION

Checking the "Requires Authentication" checkbox grants that the user's proxy needs authentication. After checking 'Requires Authentication' you will have to specify both **username** and **password**:

5.12. DISPLAY CONFIGURATION

In the "Display Settings" page, the user is able to modify settings that are related to the display (Figure 60).

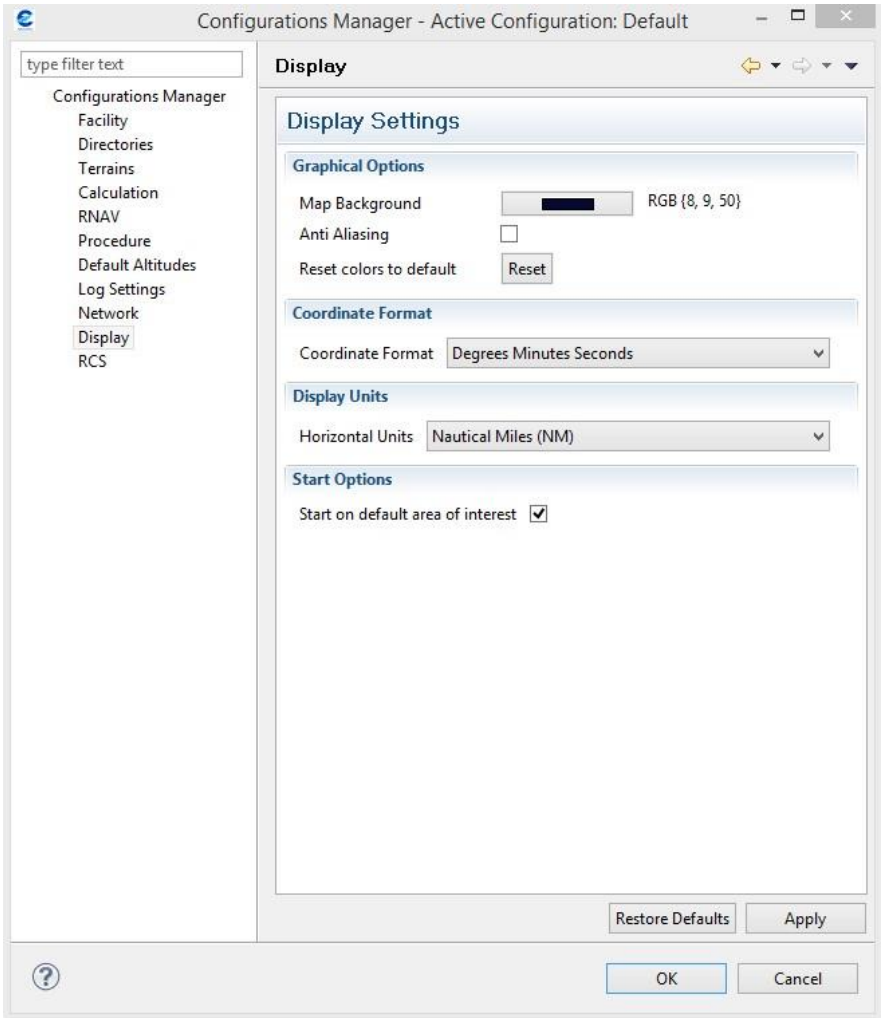


Figure 60: Display Settings

5.12.1. GRAPHICAL OPTIONS

In this section there are two parameters that can be configured:

Map Background

This parameter defines the color that is to be used for the ocean, when the World Image is not displayed (that is, unchecked on the layer tree)

Anti Aliasing

This value specifies the usage of anti-aliasing graphical techniques in order to improve the graphical quality of the map.

5.12.2. COORDINATE FORMAT

In this section, the user is able to specify the format to be used to display the mouse coordinates. The following options are available:

Degrees, Minutes and Seconds [DMS]
Decimal Degrees [DD]

5.12.3. DISPLAY UNITS

In this section the user is able to specify the units used to display all the horizontal distances:
The following options are available:

Nautical Miles [NM]
Meters [m]

5.12.4. START OPTIONS

In this section the user is able to specify if DEMETER starts on the Default Area of Interest (if defined) or on the last location where the user was working before closing DEMETER.

5.13. RCS CONFIGURATION

Since DEMETER 1.1 is available a multi-projection feature, that allows the user to choose the Reference Coordinate System to be used. In this menu the user should define the set of RCS that will appear in the Projections drop down box on the Map.

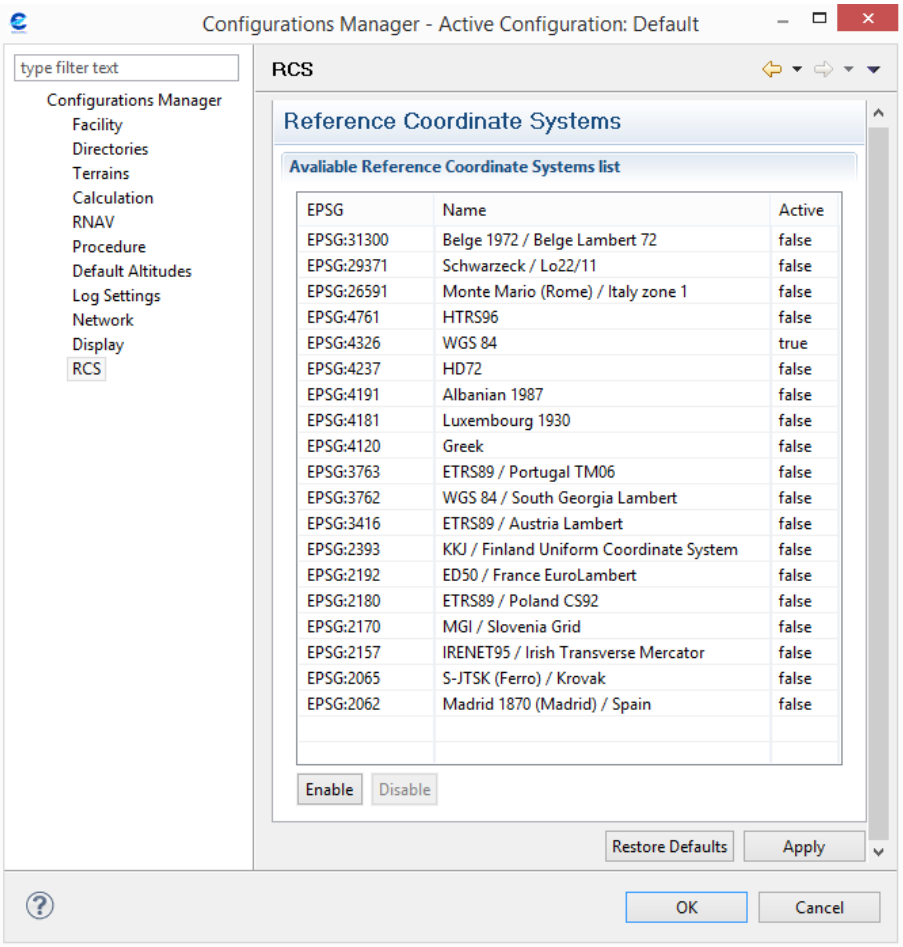


Figure 61: RCS settings

6. NAVAIDS

In this chapter there are described all the options available on the NavAids DEMETER menu and toolbar icons.

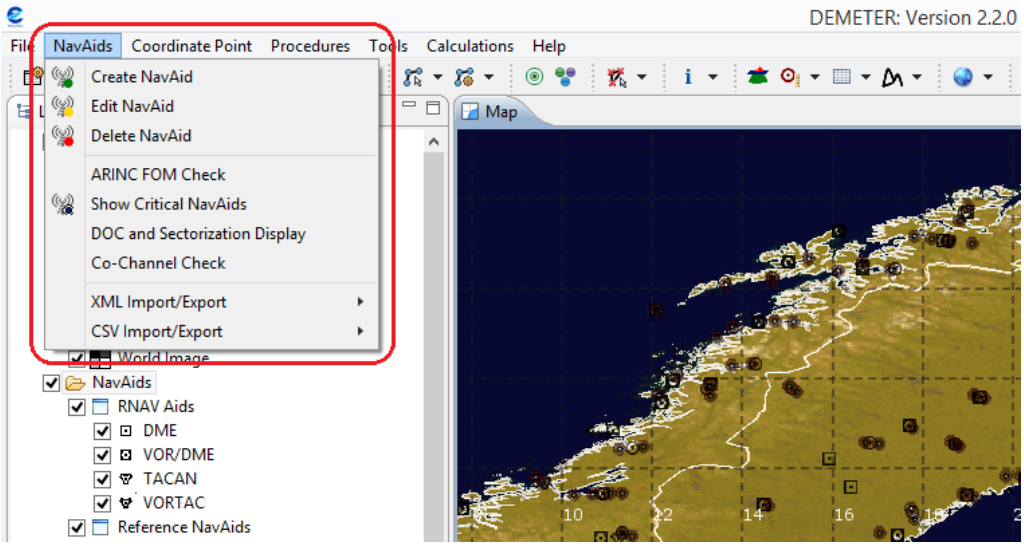


Figure 62: NavAids' menu options

In this menu, the user is able to manage the NavAids on the map. It is also possible to use some tools that provide extra information from existing NavAids. On the following subchapters, we will describe in detail the necessary steps in order to make use of each option. Note that the user can easily manage NavAids either by the "NavAids" menu (Figure 62), or by the DEMETER toolbar (Figure 63).

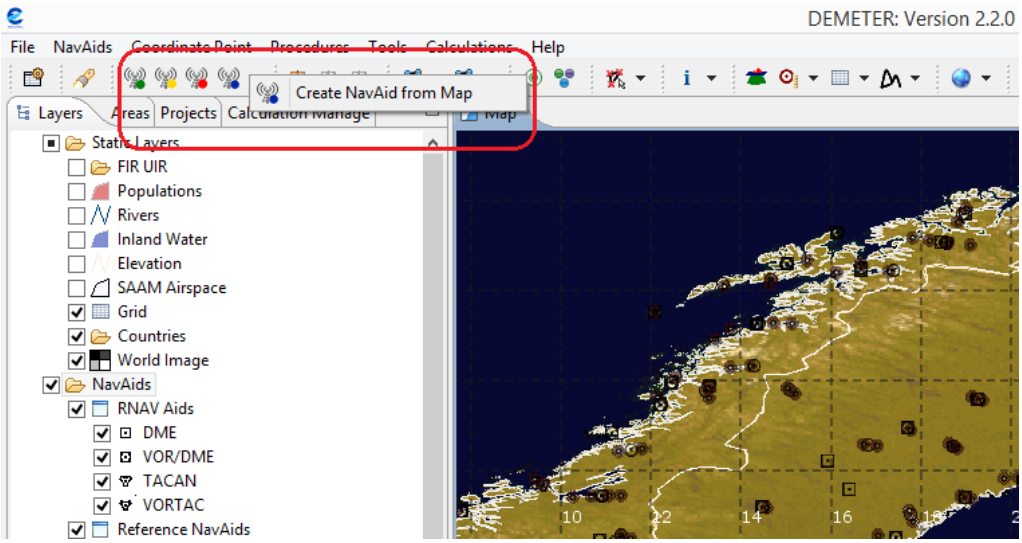


Figure 63: NavAid management through DEMETER toolbar

6.1. NAVAIDS' MANAGEMENT

The NavAid data is basically divided into three essential parts: **Primary Data**, **Secondary Data** and **Notes**.

6.1.1.1. Primary Data

In the "Primary Data" page, it can be found all the mandatory fields (marked in yellow) that are necessary to describe a NavAid. In addition to these fields, there are two more sections that are not mandatory: **Sectorization** and **Minimum Screening Angle**.

Sectorization information

This value is used to configure the limitation to the DOC of the NavAid on a specific angle and altitude range.

Minimum Screening Angle

This value is used to model the fact that in some cases there is an obstacle cutting the visibility of a NavAid on a specific direction, for example a tree. On that case the user can specify an horizontal angle range and minimum vertical angle with visibility.

6.1.1.2. Secondary Data

In the "Secondary Data" page, there can be found complementary data that is associated with the NavAid. The number and type of fields that can be found in this page, are dependent on the NavAid type.

6.1.1.3. Associations

In the "Associations" page, shows the Procedures and Airspace Boundaries which use the selected NavAid

6.1.1.4. Notes

In the "Notes" page, the user is able to enter free text that will be stored and associated with the NavAid.

6.1.2. CREATE NAVAIDS FROM SCRATCH

This tool allows the user to create a new NavAid by specifying the position (latitude and longitude) and type of NavAid. The following steps are required in order to create a new NavAid from scratch:

1. Select the "NavAids -> Create NavAid" menu, or click on icon, located on DEMETER's Toolbar.

2. The following menu will appear:

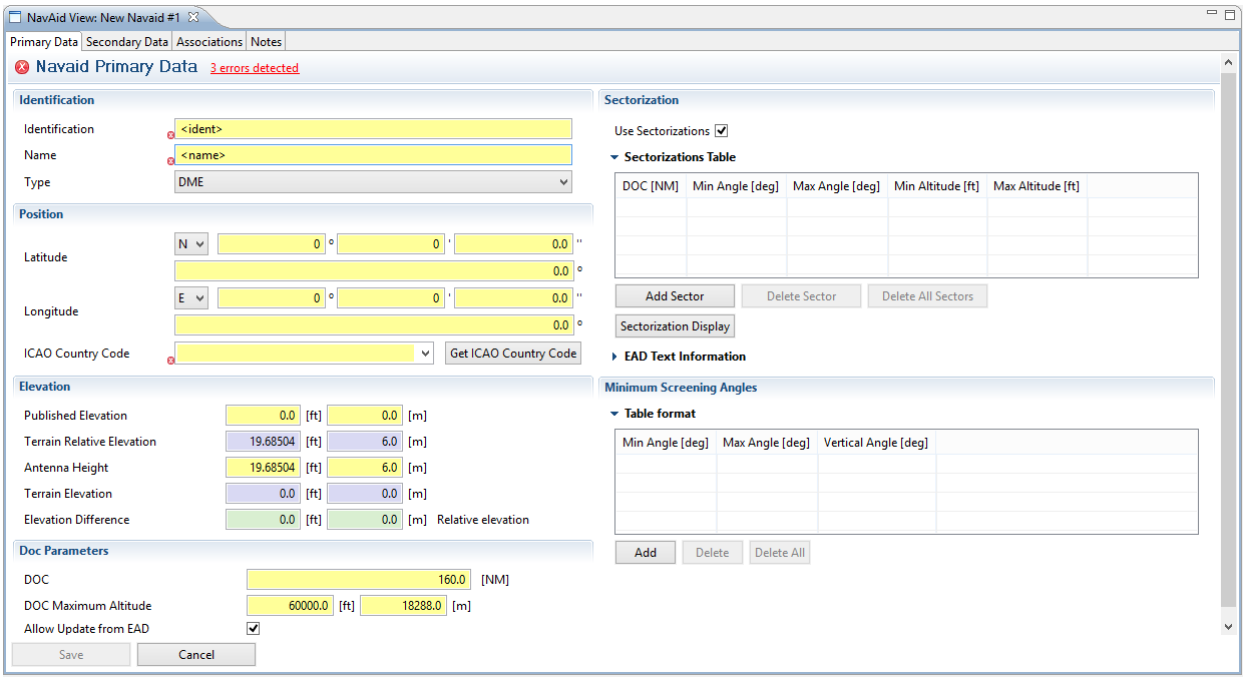


Figure 64: NavAid Primary Data

3. The first tab displayed is the "**NavAid Primary Data**" page (see section 6.1.1.1)

4. In the "**Identification**" section, the user should:
   1. Type the **Identification** for the new NavAid (the limit is 8 characters).

   2. Type the **Name** for the new NavAid.

   3. Choose from the scroll-down menu the NavAid type to create (one of the following):
      i. DME
      ii. VOR/DME
      iii. TACAN
      iv. VORTAC
      v. DME (ILS)
      vi. VOR
      vii. NDB

In the "**Position"** section, the user should:

4. Choose from the scroll-down menu between North (N) and South (S), as values for latitude.

5. Type the degrees, minutes and seconds or degrees in decimal format. The user should make sure that the values are comprehended between the limits of Table 34**.**

Table 34: Degree limits for Latitude fields

Unit	Minimum Value	Maximum Value
Decimal Degrees [deg]	-90	90

6. Choose from the scroll-down menu between East (E) and West (W), as values for longitude.

7. Type the degrees, minutes and seconds or degrees in decimal format, make sure you are between the limits of Table 35.

Table 35: Degree limits for Longitude fields

Unit	Minimum Value	Maximum Value
Decimal Degrees [deg]	-180	180

8. Click on "Get ICAO Country Code" button and select any of the scroll down menu options. You also can type a code.

5. In the "**Elevation"** section, the user should:

1. Type the **Published Elevation** field on Edit NavAid menu.

2. Type the **Antenna Height** field on Edit NavAid menu.

6. In the "**Doc Parameters"** section, the user should:

    1. Type the DOC value for the new NavAid with any number between Table 36 limits.

Table 36: DOC limits in NavAid fields

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	1	500 (Table 4: DOC Range Parameters)

    2. Type the DOC Maximum Altitude in feet with any number between Table 37 limits.

Table 37: DOC Maximum Altitude limits in NavAid fields

Unit	Minimum Value	Maximum Value
Feet [ft]	0 (Table 5: DOC Maximum Altitude Parameters)	60000 (Table 5: DOC Maximum Altitude Parameters)
Meters [m]	0 (Table 5: DOC Maximum Altitude Parameters)	18288 (Table 5: DOC Maximum Altitude Parameters)

7. Define the NavAid Sectorization (Note that this step is not mandatory)

8. In the "**Sectorization"** section, the user should:

    1. Click on Add Sector button.

    2. Type DOC value for the sector you are creating.

    3. Press Tab or double click on the next field.

    4. Type the Minimum angle value for the sector you are creating.

    5. Press Tab or double click on the next field.

    6. Type the Maximum angle value for the sector you are creating. Note: In order to create a sector, the user should make sure that the angles are complementary (for example, from 300 degrees to 40 degrees you must create 2 sectors: 300-360 Range and 0-40 range).

    7. Either press "Tab" or double click on the next field.

    8. Type the Minimum altitude value in feet for the sector you are creating.

    9. Press Tab or double click on the next field.

    10. Type the Maximum altitude value in feet for the sector you are creating (it cannot be bigger than NavAids maximum operational altitude).

    11. Press Enter or click anywhere to finish sectorization.

12. You can add more sectors starting again from step b.

13. If the user does not want to use the defined sectorization on the calculations the checkbox "Use Sectorizations" should be unchecked.

In order to display a graphical representation of the DOC and Sectorizations, the user can click on the "Sectorization Display" button. On the "**NavAid Sectorization**" window, the user is able to move the "Altitude Range" scrollbar so that the different Altitude Ranges and their correspondent sectorizations are visible.

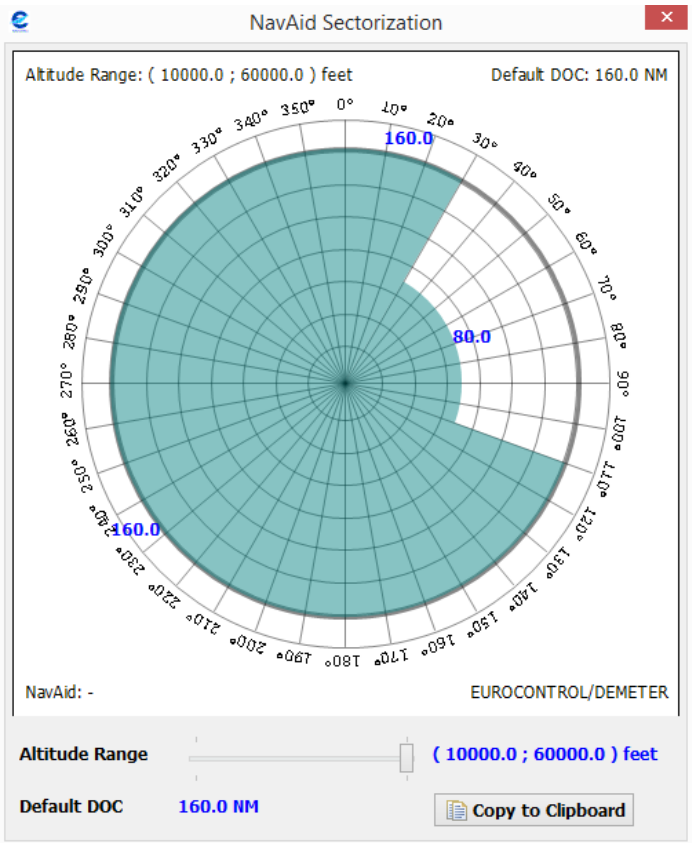


Figure 65: Sectorization display

9. In the "**Minimum Screening Angles**" section, the user is able to define the NavAid Minimum Screening Angle (Note that this is not mandatory). In order to do so, the user should:

   1. Double click on Add button on Minimum Screening Angles area.
   2. Type the values for Min Angle between values given on table 37.
   3. Type the values for Max Angle between values given on table 37.
   4. Type the values for Vertical Angle between values given on table 38.

Table 38: Vertical Elevation limits for Minimum Screening Angle

Unit	Minimum Value	Maximum Value
Degrees [deg]	-90	90

10. Click on the "Secondary Data" page. Depending on the selected NavAid's type (which was defined on the "Primary Data" page), a different set of parameters will be available on this page. **Please note that none of the parameters present on this page is mandatory**. Below is displayed the page for the NavAids with type **DME**, **TACAN** or **ILS**:

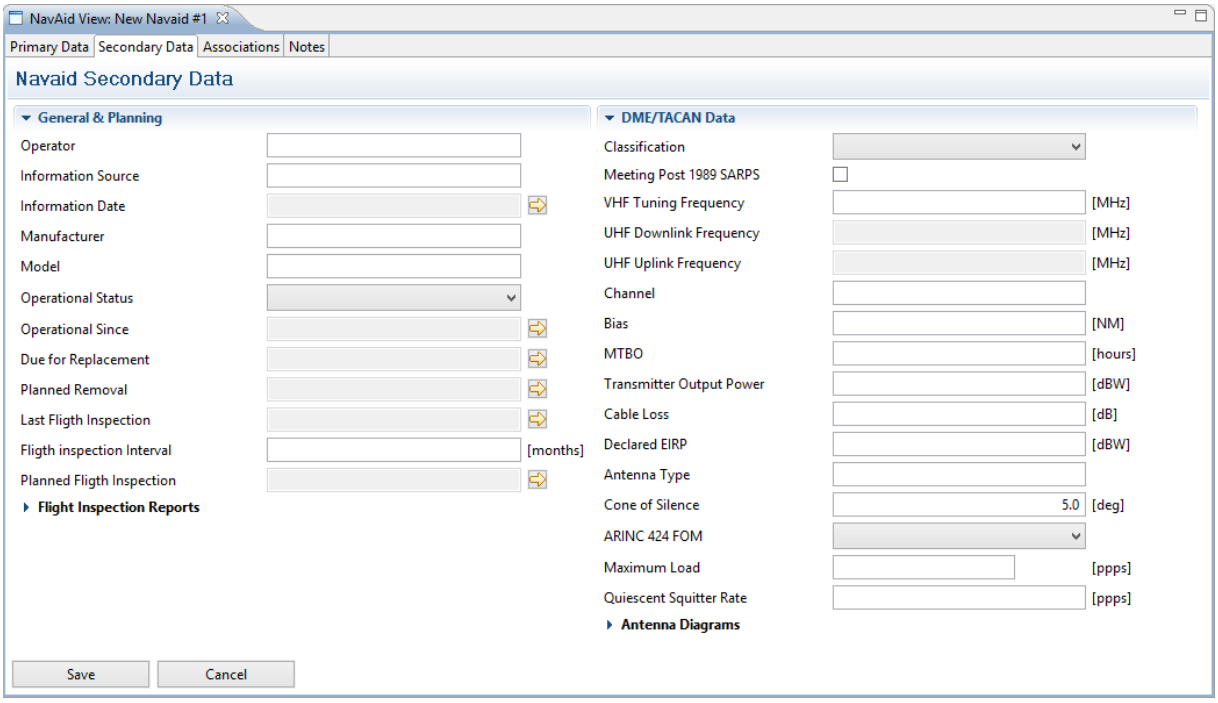


Figure 66: NavAid Secondary Data (DME, TACAN or ILS)

Below is displayed the page for the NavAids with type **VOR/DME** and **VORTAC**:

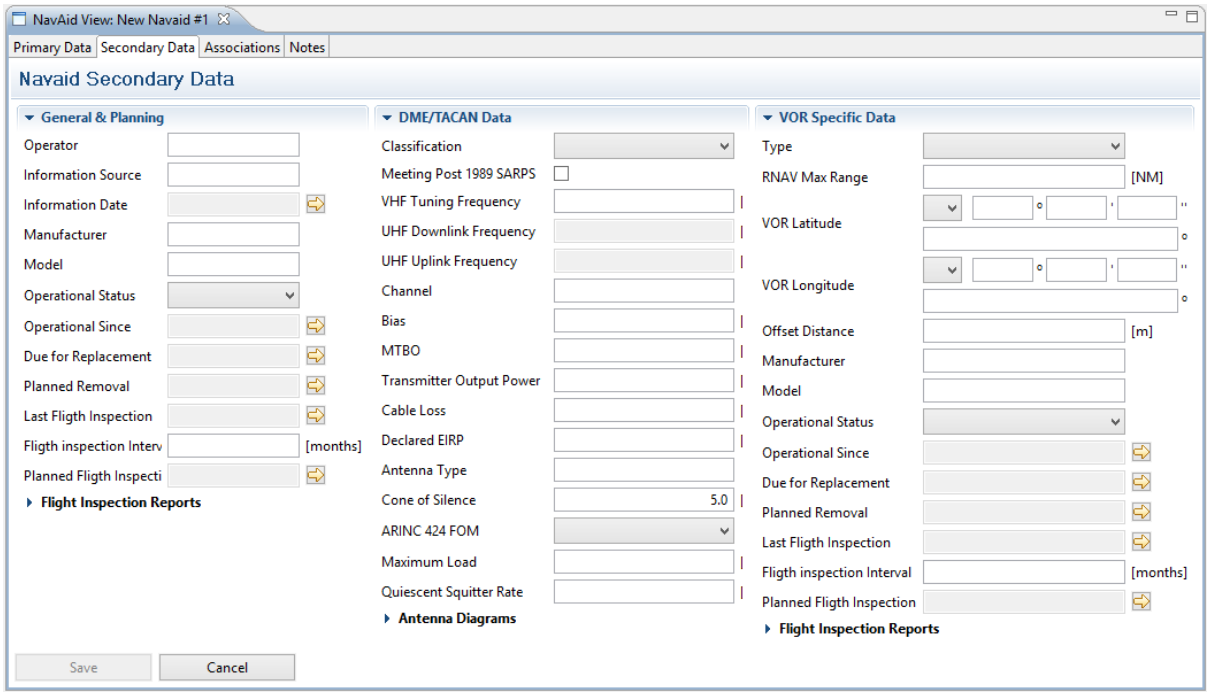


Figure 67: NavAid Secondary Data (VOR/DME or VORTAC)

Below is displayed the page for the NavAids with type **VOR**:

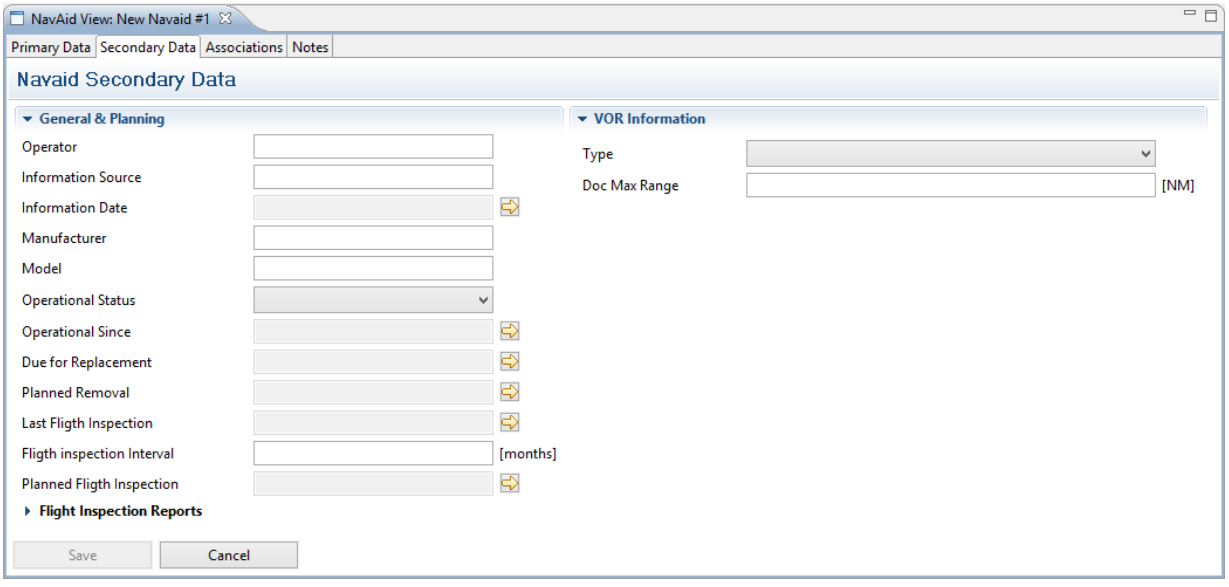


Figure 68: NavAid Secondary Data (VOR)

Finally, below is displayed the page for the NavAids with type **NDB**:

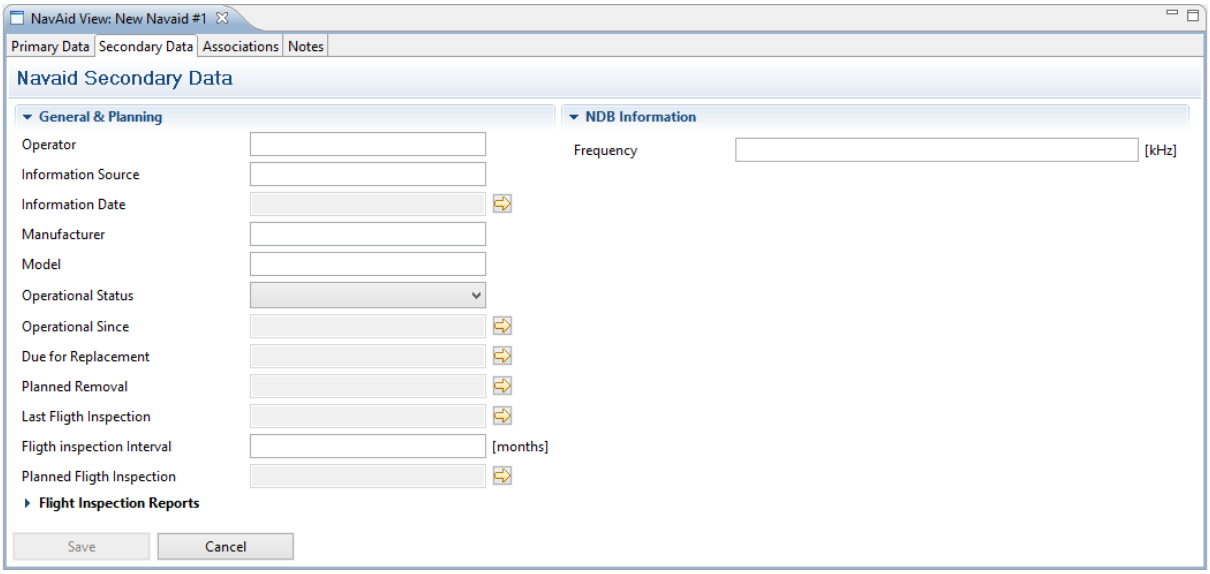


Figure 69: NavAid Secondary Data (NDB)

It is important to refer that although none of these parameters are mandatory, some of them are used on calculations (for example **Cone of Silence** and **Frequency**).

11. Click on the "Associations" page. This page shows the Procedures and Airspace Boundaries which use the selected NavAid

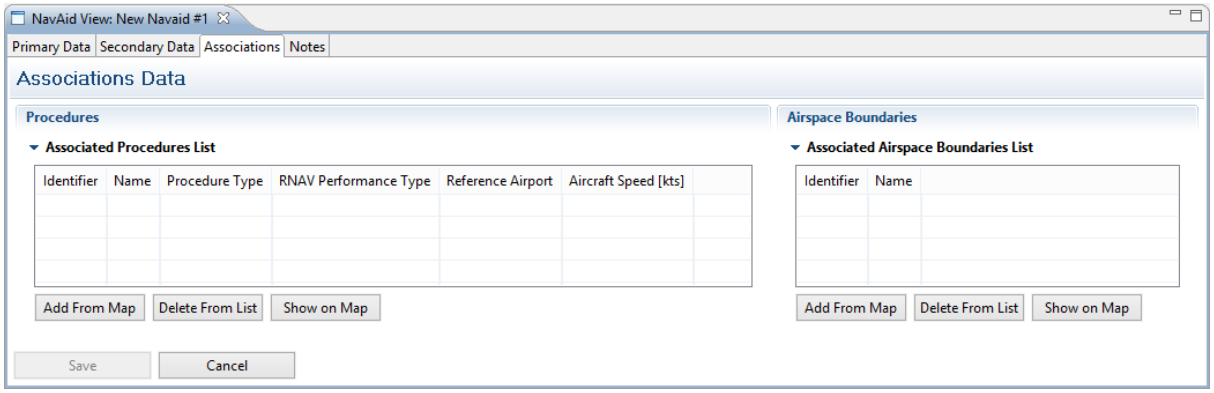


Figure 70: NavAid "Associations" page

12. Click on the "Notes" page. This is a free text area which can be used by the user in order to fill with some additional information.

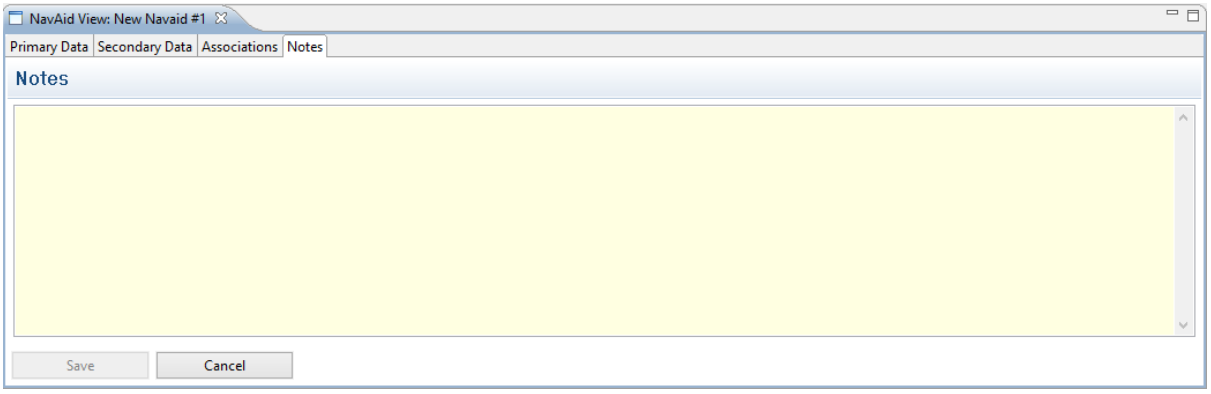


Figure 71: NavAid "Notes" page

13. Click the "Save" button in order to save the NavAid data. Please note that before saving the NavAid on the database, DEMETER will verify if the newly created NavAid is somehow close to another existing NavAid. In such cases, the user is alerted with the possibility of information duplication, and given the decision of whether to continue or cancel the NavAid creation.

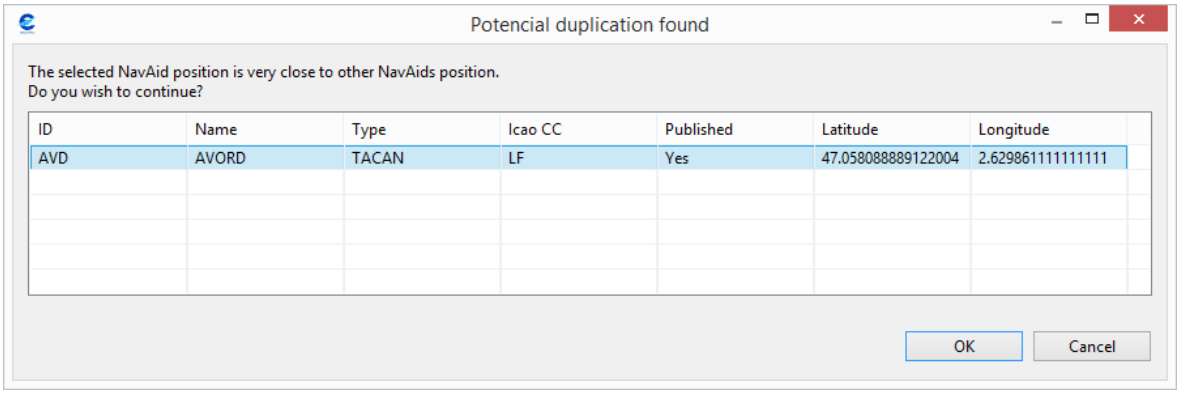


Figure 72: NavAid Duplication

6.1.3. CREATE NAVAID FROM MAP

This tool helps the user finding a place for a new NavAids to cover areas on the map. This creation method will perform both coverage and performance calculations with other selected NavAids. For such reason, it is required to have selected at least one NavAid in order to calculate the performance together with the newly created one, using this method. This process has 4 different levels of usage:

1. Use only the clicked position, which will grant that the Coverage calculation is made using an imaginary NavAid that is placed on the clicked position.

2. Calculate Coverage for the selected NavAids with the imaginary NavAid placed on the clicked position

3. Calculate Performance using the selected NavAids and the imaginary NavAid placed on the clicked position

4. Calculate both Coverage and Performance using the selected NavAids and the imaginary NavAid placed on the clicked position

The process to use this tool requires the following steps:

1. Select one or more NavAids around the area in order to improve the coverage.

2. Click on  icon on the DEMETER toolbar. Note that this option is not available on the "NavAids" menu.

3. Below the Layer Tree, a new view will appear allowing the creation of the NavAid:

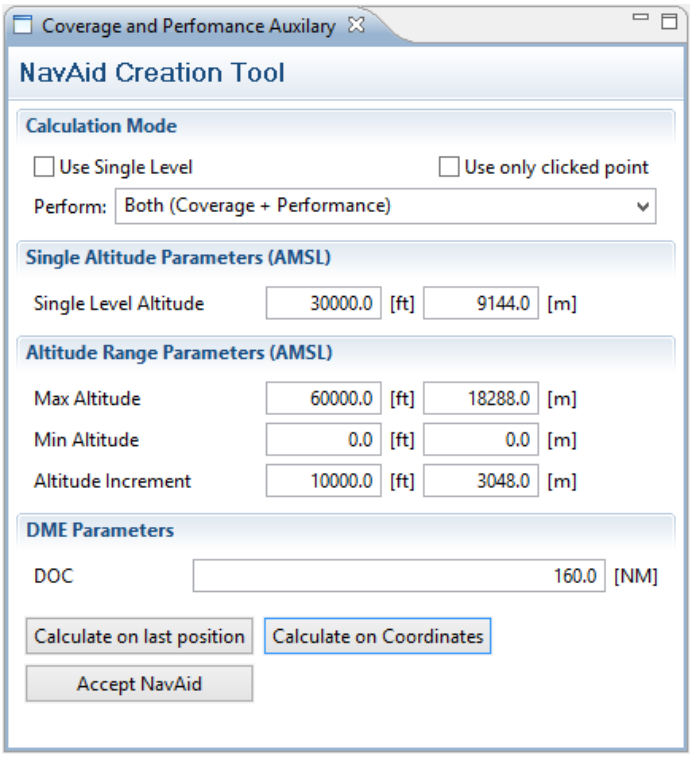


Figure 73: NavAid Creation Tool

4. In the view presented on Figure 73, configure the appropriate calculation and NavAid parameters, such as:

   - Use Single level
   - Use only clicked point
   - Single Level Altitude
   - Max, Min and altitude increment
   - DOC

5. Double click on the desired location to create the new NavAid.

6. Confirm and check the presented results.

7. If the Coverage and/or Performance results are valid, then click on the "Accept NavAid" button and continue as described on **section 6.1.2**. Note that the Latitude and Longitude are automatically fielded with the clicked position location.

If the result is not the expected, please go back to **step 5** in order to define a new location or 4 in order to readjust the calculation and NavAid parameters, in this process. If the user wants to try the same location but with different calculation configurations or New NavAid options repeat step 4 and click the 'Calculate on last position' button. If the user wants to manually specify the latitude and longitude for the New NavAid click on the 'Calculate on Coordinates' button, enter the coordinates and press OK.

6.1.4. EDIT NAVAIDS

On DEMETER 1.1, the user is able to edit any NavAid from Database. In order to do so, it is required that the following steps are executed:

1. Select one or more NavAids, using the **selection tool**.
2. Select the "NavAids -> Edit NavAid" menu, or click on icon, located on DEMETER toolbar.
3. If the user's selection contains multiple NavAids, a list containing all the selected NavAids will appear, allowing the user to choose the NavAid to be edited.
4. Select the NavAid and click on "Ok". The following window will then appear:

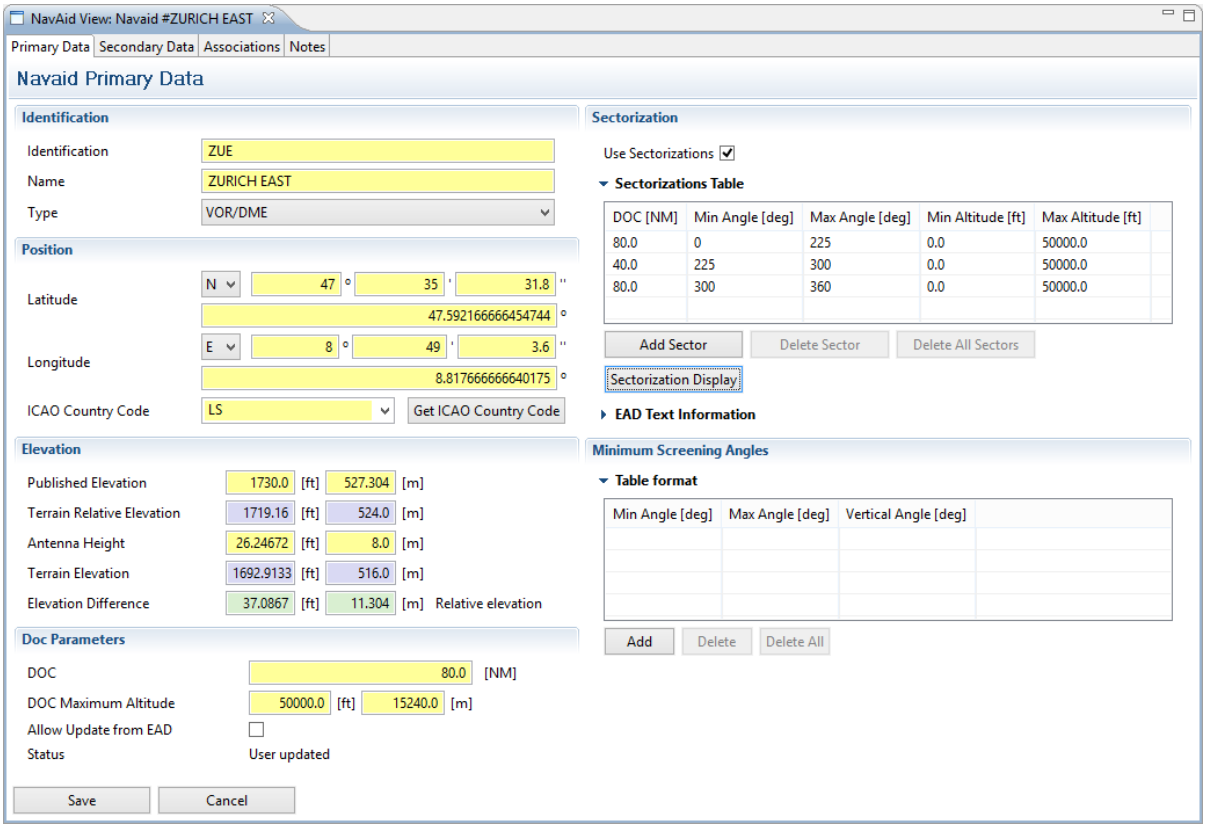


Figure 74: Edit NavAid View

1. Continue as described on "**Navaids' Management**
2. " (see **section 6.1**), and execute the necessary steps for the parameters to be changed.
3. Note: DEMETER can import information from official sources, such like the European AIS Database (EAD) (further details on **section 0**). If the user manages to update a **published NavAid**, but do not want that information to be overwritten, the checkbox "**Allow Update from EAD**" must be unchecked, in order to prevent the overwrite of information whenever the import process takes place.

4. If the user edits a published NavAid, status information is displayed at the bottom of the view. The "**Status**" information is changed from "**Not Updated**" to "**User Updated**" whether the user changes and saves any value.

5. If the user chooses to edit a published NavAid, before the saving process occurs, the following confirmation window will be shown:

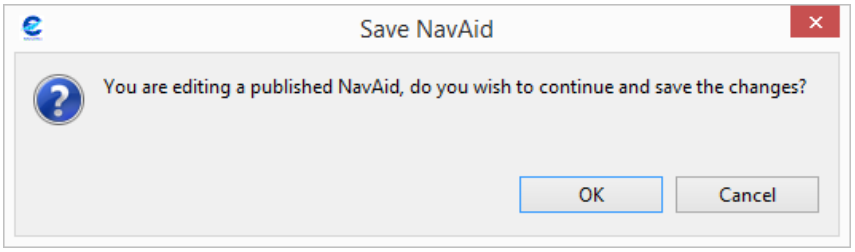


Figure 75: Confirm edit action on a published NavAid

At this point, the user either confirms the edited changes by clicking "Ok" button, or prevents the changes from being saved by clicking the "Cancel" button.

6.1.5. DELETE NAVAIDS

The user can delete NavAids from the Database (except critical NavAids) executing the following steps:

1. Select one or more NavAids.
2. Select the NavAids\Delete NavAid menu or click on icon on Toolbar.
3. If the user has selected multiple NavAids a list will appear, where it is necessary to choose one or more NavAids to delete.
   To select/Unselect only a few NavAids use the CTRL key and click on them.
   If the user wants to delete all the selected NavAids click on "Select All" button.
4. Click on OK.
5. If it is a critical NavAid, appears the following window and the NavAid will not be deleted:

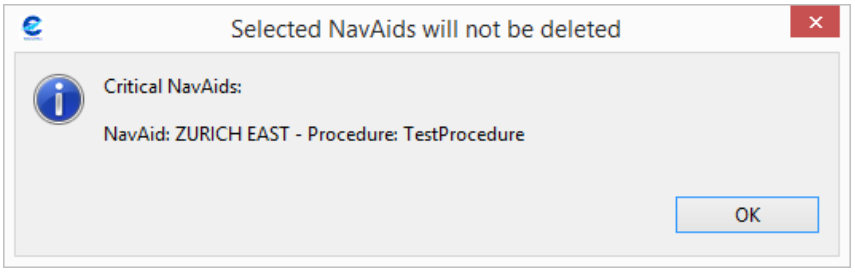


Figure 76: Information about critical NavAids that will not be deleted

6. If it is not a critical NavAid, it is necessary confirm or cancel the deletion on the following confirmation window:

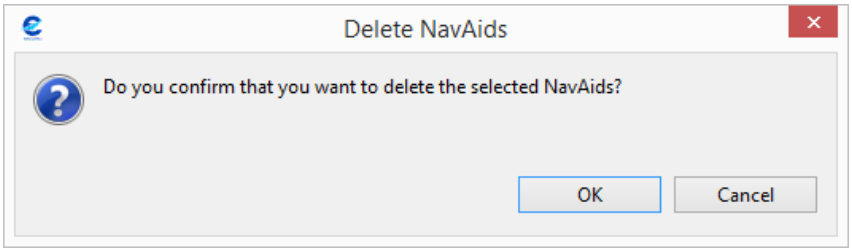


Figure 77: Confirm delete action of a NavAid

6.2. FACILITY ELEVATION AND TERRAIN ELEVATION

As stated on **section 5.6.6**, DEMETER uses the **Facility Elevation** for calculations. In some cases, this parameter may not be saved correctly. One of the reasons could be the usage of different **Terrain Data** files, either on the moment of saving data, or the moment of using it.

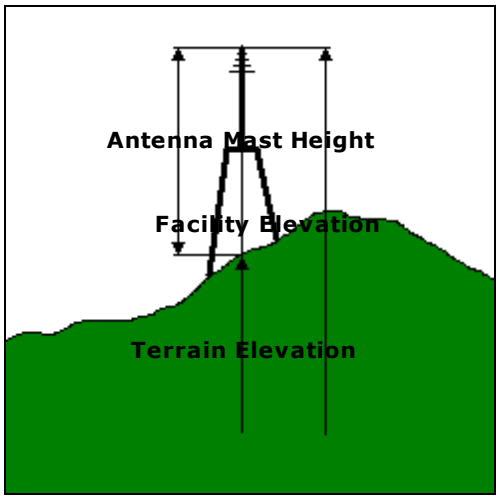


Figure 78: Facility Elevation

Thus, in order to help the user understand the data management that DEMETER applies to the terrain elevations, the NavAid edition page has been altered, showing either the theoretically incorrect or correct elevation, depending on the **elevation configuration** that the user has set, on the **"**Calculation Settings**"** page (see **section 5.6.6**). If the user has selected the "Published Elevation" on the "Calculation Configuration" page, DEMETER will not apply any correction to the elevation value (Figure 79**,** on the left). On the other hand, if the user has selected "Relative Elevation" on the aforementioned page, the elevation presented will consider both the terrain elevation at the NavAid's position, plus the antenna height (Figure 79, on the right).

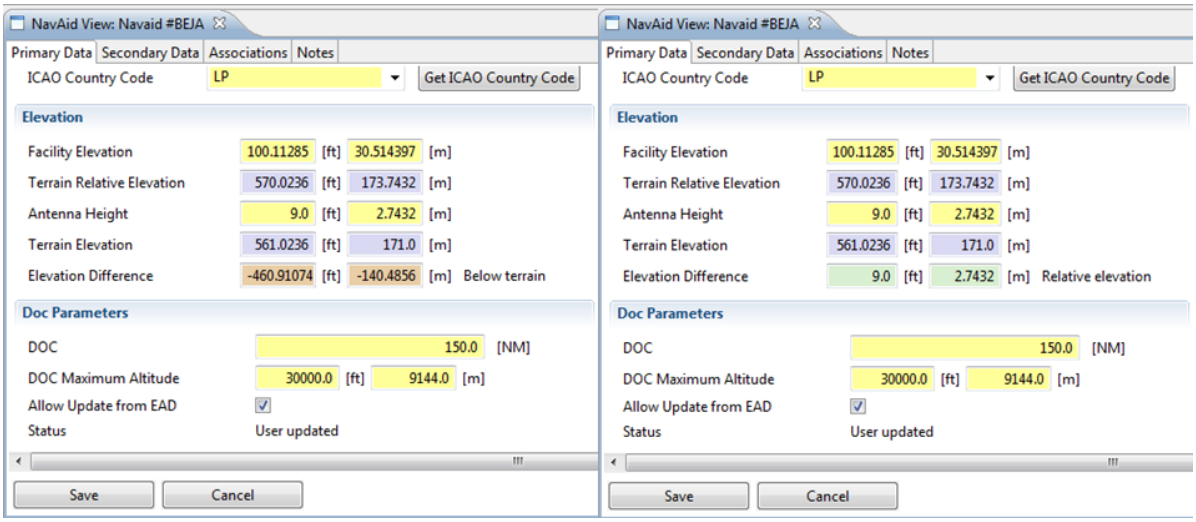


Figure 79: NavAid edit page with "Published Elevation" configuration selected (left), and with "Relative Elevation" selected (right)

Note that DEMETER automatically gets the **Terrain Elevation** from the NavAid location (Latitude and Longitude). The **Elevation Difference** calculates the difference between the **Terrain** and the **Facility Elevation**.

The "Elevation Difference" field will always show a number, a color code and a text message:

Below Terrain

If the NavAid's facility elevation is less than the terrain elevation, a negative value is displayed and the field color is changed to brown, alerting the user for the fact that the NavAid is considered below terrain.

Above Terrain

If the NavAid's elevation difference is greater than the "Above Terrain Limit" configuration (see **section 5.3.1)** that the user has specified on the "Facility Settings", DEMETER will consider the NavAid's elevation as being too far above the terrain, and the field's color is changed to blue.

Elevation Ok

If none of the above cases apply, DEMETER will consider that the NavAid's elevation is correct, and the field's color is changed to green.

Relative Elevation

If the user has set the elevation configuration to "Relative Elevation", DEMETER will automatically correct any "Below Terrain" or "Above Terrain" incorrect values, setting the correct ones and changing the field's color to green.

6.3. ARINC FOM CHECK

The purpose of this tool is to validate if the Figure of Merit (FOM) field of each NavAid stored on the database has a value according to the defined DOC. By default the FOM field is empty and only after the user imports data from an ARINC 424 file this information is added to the NavAid.

To use this tool the user selects the option on the NavAids menu. The results (inconsistent values are displayed on a separate window.

6.4. IMPORT NAVAIDS FROM EAD SDO REPORTS

DEMETER 1.1 offers the user the possibility of importing NavAid data (AIXM 4.5 format. See http://www.aixm.aero/public/subsite_homepage/homepage.html, for further details) from a specific type of data source – EAD XML. In order to use this functionality, the user should click on the "File -> Import From EAD XML -> Import NavAids", as shown on Figure 80.

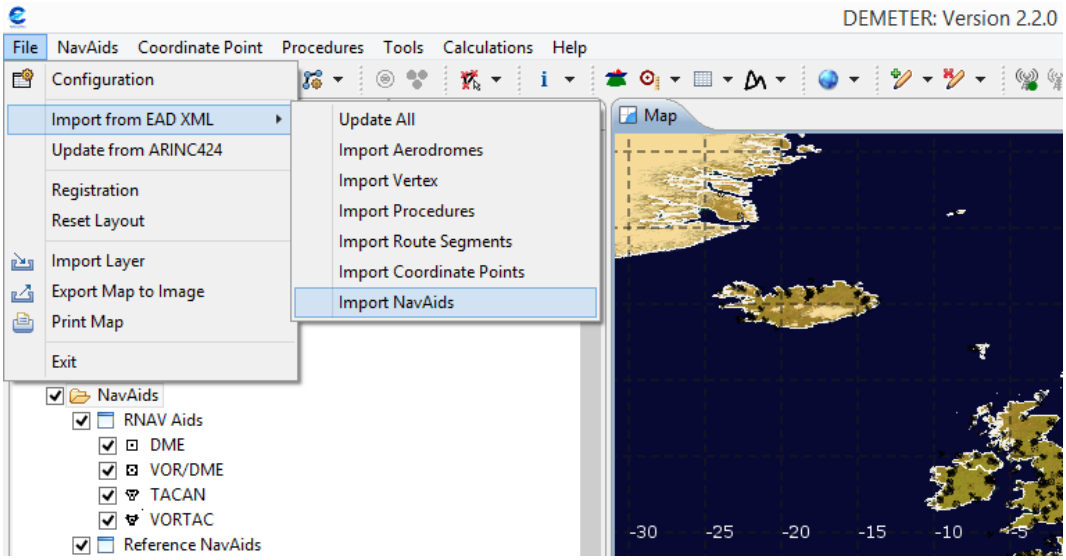


Figure 80: Importing NavAids from EAD XML format

The user will then be asked to browse for the desired file, which contains the NavAid data that will be imported. Before initiating the import process, DEMETER will alert the user for the fact that the database information will be overwritten, but if some fields are missing on the chosen file (but present on DEMETER), they will be preserved (Figure 81). Note: if the user clicks "OK", the process will continue, otherwise the import process fails.

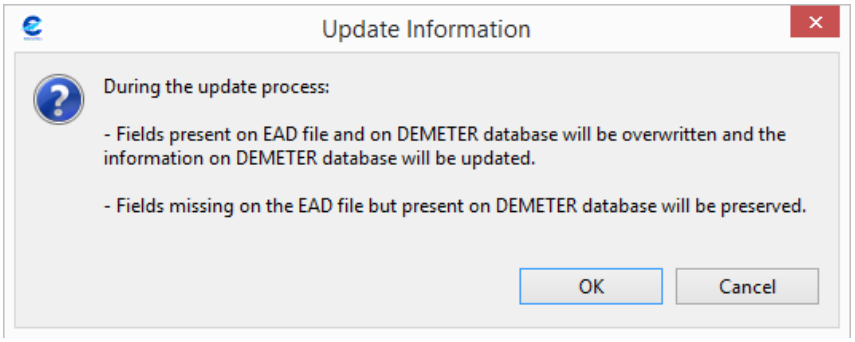


Figure 81: Field data overwrite alert, when importing NavAids from EAD XML file

If DEMETER detects a match (or several) in the imported file's data, it will consider them as duplications and will alert the user for that fact, as shown in the figure below:

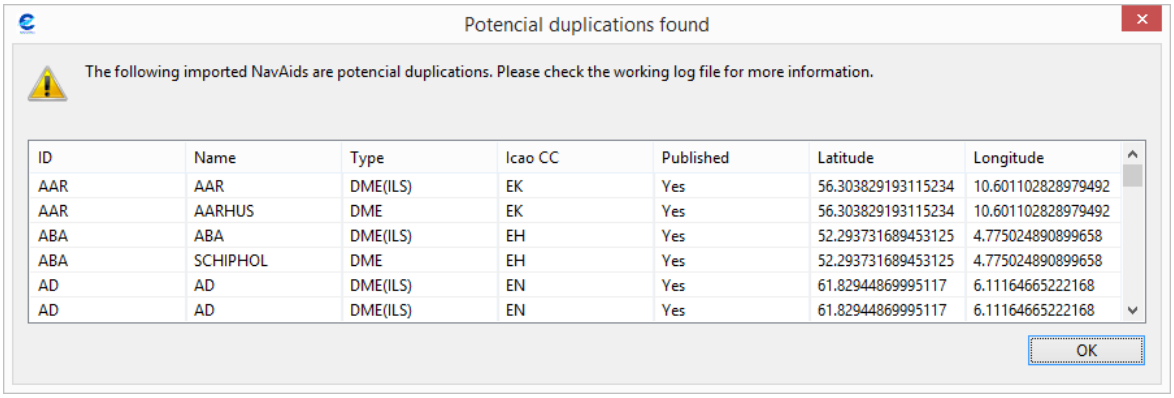


Figure 82: Data duplication when importing NavAid's data from EAD XML

Note that considering there is no problem with data duplication, DEMETER will not ask the user if he or she wants the process to perform a rollback. Pressing "OK" will finish the import process in a while, finally showing the user a success message:

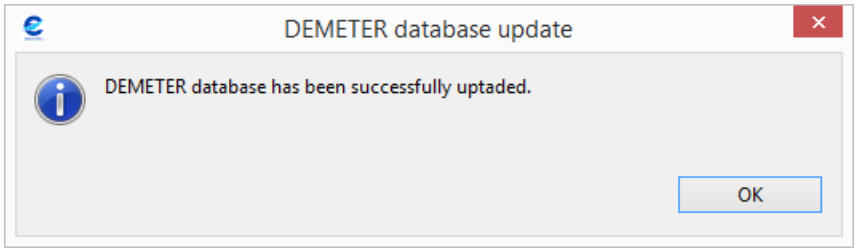


Figure 83: Import Successful

Thus, the user can notice immediately that the NavAids' data has been imported successfully, by searching for any previously non-existent NavAids on DEMETER database, that have been imported from the EAD XML file.

6.5. DOC AND SECTORIZATION DISPLAY

In order identify a NavAid's natural coverage (excluding constraints that are considered with screening), DEMETER offers a tool that has the main purpose of displaying the DOC and Sectorizations a set of selected NavAids. The "DOC and Sectorizations Display" tool, provides the user with an insight of the NavAid's natural coverage, given its predefined sectorizations, which are set by default for a range of altitudes. In order to use this tool, it is required that the user:

1. Selects one or more NavAids from the map.

2. Select the "NavAids -> DOC and Sectorization Display" menu (Figure 84).

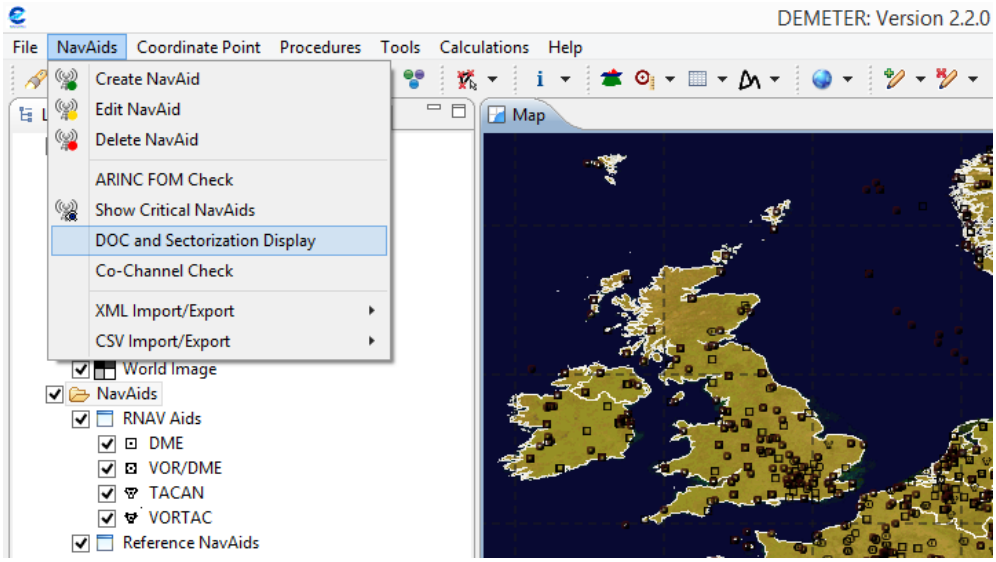


Figure 84: DOC and Sectorization Display menu

After a short while, a new result layer (similar to the one presented on the figure below) will appear on the map:

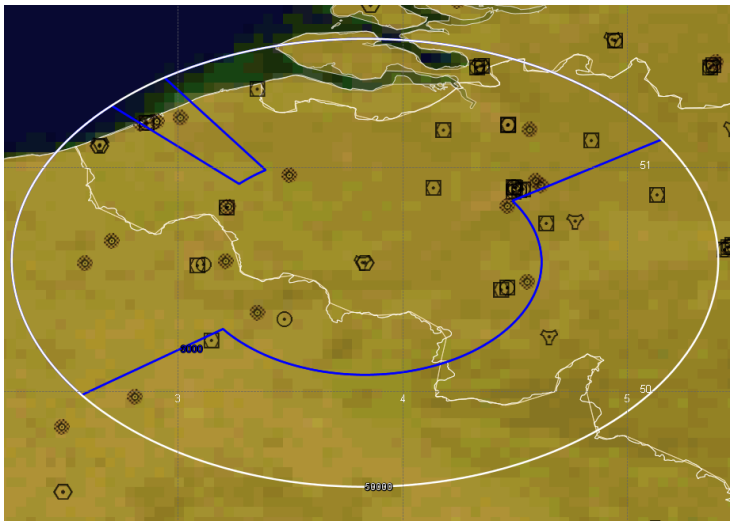


Figure 85: DOC and Sectorization Display calculation on the map

Notice how the **maximum altitude** (50000 feet) has been colored **white**, whereas the **other altitudes** (0 and 3000 feet) where colored **blue**.

Notice the "Results" layer and its organization, in order to better understand the number of calculations that have been performed (Figure 86). In this case, DEMETER has performed three calculations, as the selected NavAid only has three different altitudes for which it has been defined sectorizations.

Note: For coherence and resilience purposes, DEMETER always considers the **0 feet altitude**, as well as the **maximum altitude** of the NavAid, regardless of the fact that sectorizations have been defined for such altitudes, or not.

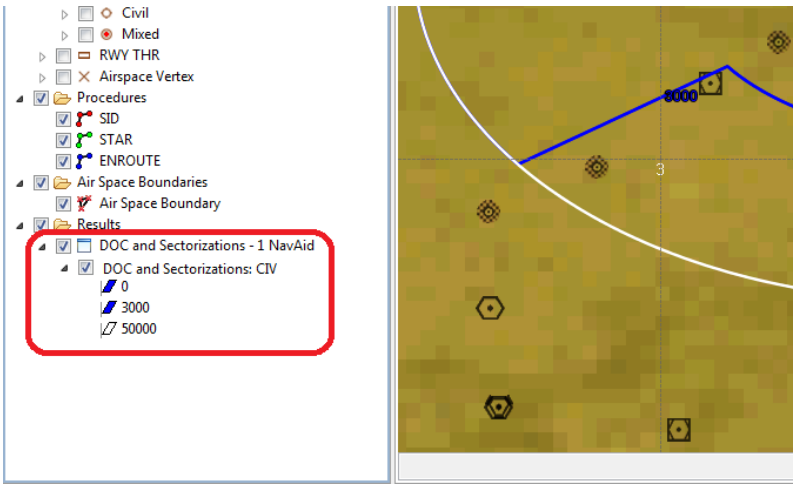


Figure 86: DOC and Sectorizations layer for three altitudes

If the user right clicks on "DOC and Sectorizations" layer (on the Layer Tree), which has been created after the calculation, the "Analysis Tool" option appears, giving the user the possibility to easily investigate the previously obtained result (Figure 87).

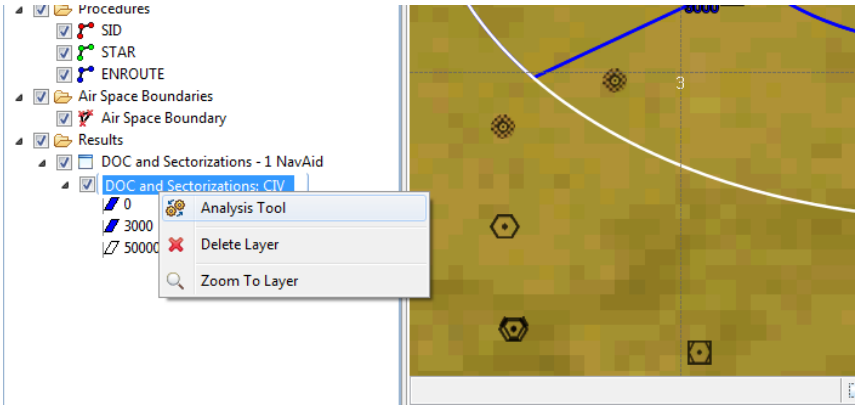


Figure 87: Analysis Tool for DOC and Sectorization result

Selecting this tool will open another view under the Layer Tree, allowing the user to understand the NavAid's Sectorizations , filtered by its altitudes (Figure 88). A **NavAid Combobox** (1) will be presented, allowing the selection of the NavAid (or NavAids, if the selection contains multiple NavAids), giving the possibility to either investigate each selected NavAid, or all of them. Also, an **Altitude Slider** (2) will be present, giving the user the possibility to change between a range of altitudes (which, as explained before, are defined by the NavAid's Sectorizations).

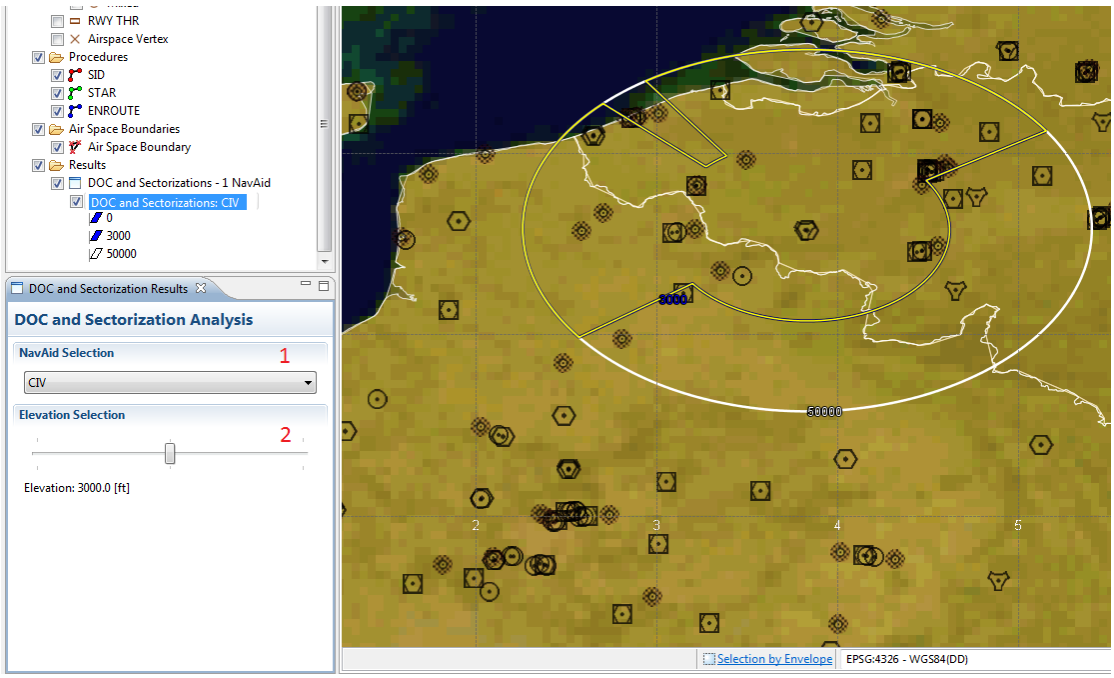


Figure 88: DOC and Sectorization Analysis

Given this perspective, the user is able to easily understand how the NavAid's DOC limitations can affect the coverage that this has. Furthermore, the user can identify which is the DOC for the each of the altitudes of the NavAid.

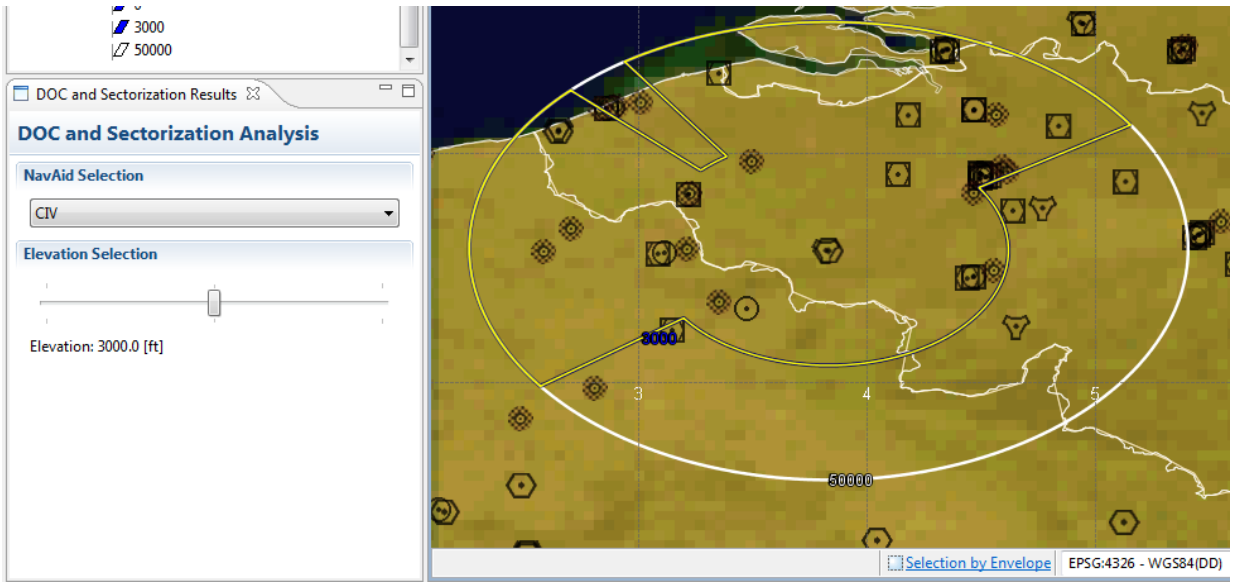


Figure 89: DOC and Sectorizations Analysis for altitude 3000 feet

Notice how changing the altitude slider affects the layer that is highlighted on the map. This is notable as the user changes the altitude slider from value 3000 feet (Figure 89), to value 50000 feet (Figure 90).

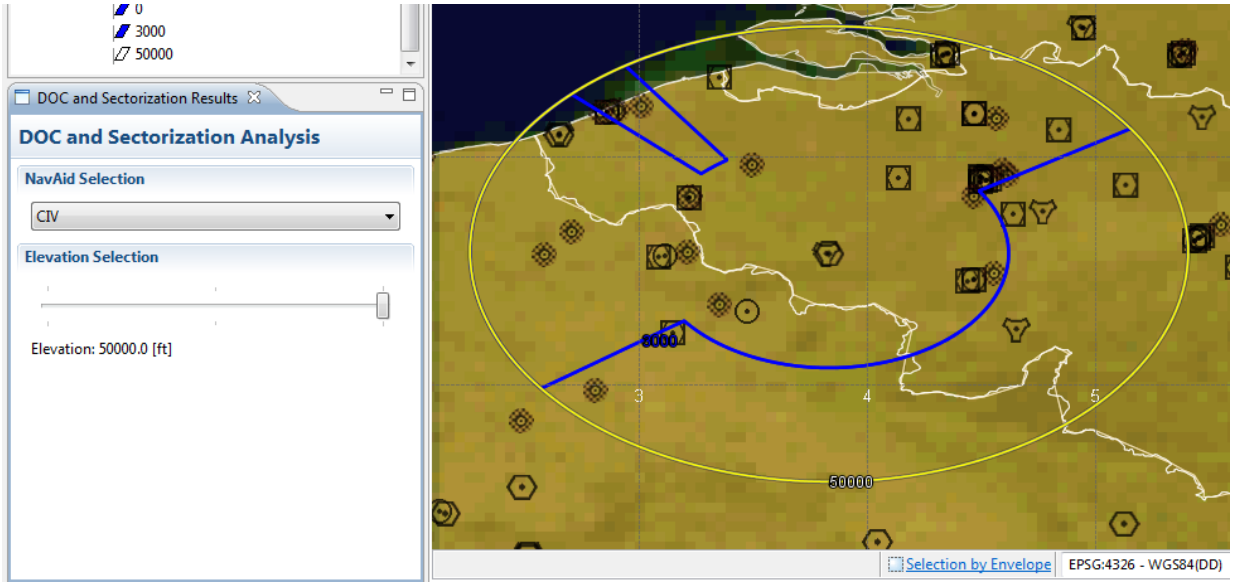


Figure 90: DOC and Sectorizations Analysis for altitude 5000 feet

6.6. CO-CHANNEL CHECK

This tool allows the user to see which NavAids are using the same frequency as the ones selected by the user. In order to use this tool, the following set of steps is required:

1. Select one or more NavAids from the map.
2. Select the "NavAids -> Co-Channel Check" menu, from the DEMETER toolbar.

A new view will appear, which contains all the selected NavAids and their respective frequencies:

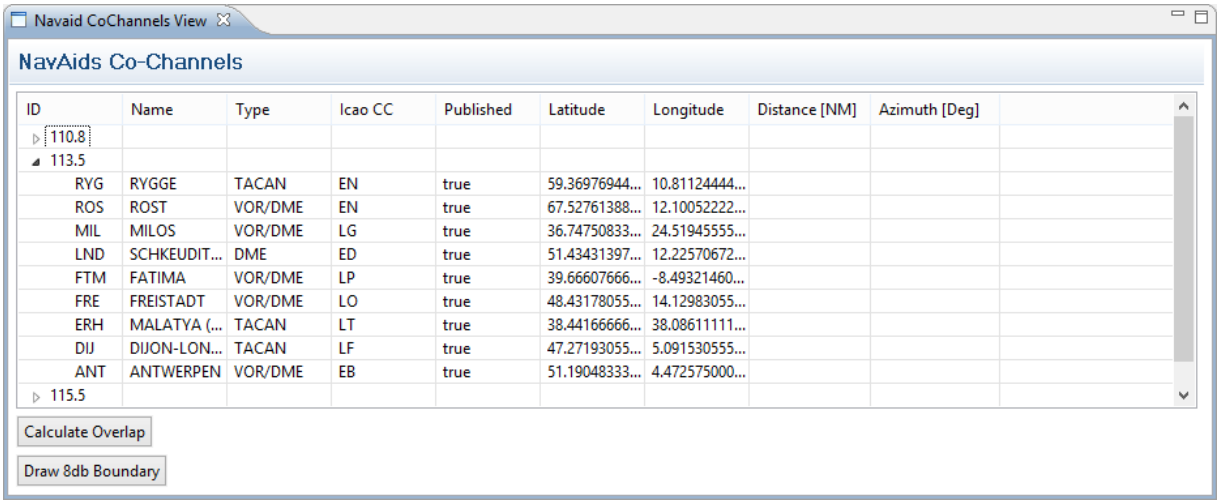


Figure 91: Co-Channel Check view

In this new view, the user is able to investigate for each frequency of selected NavAids, if there is/are any other NavAid(s) stored on DEMETER's database that has/have the same frequency. Such information is organized by **frequency values** within a tree. Each tree node (representative of the NavAid frequency) can be expanded or collapsed as displayed on **Figure 91**.

Additionally, the user can see on map the overlap and the boundary. For this, clicks on "Calculate Overlap" and "Draw 8 db Boundary" button, after selecting at least two NavAids of the list.

6.6.1. CALCULATE OVERLAP

In order to use this tool, the following set of steps is required:

1. Select at least two NavAids from the view.
2. Click on "Calculate Overlap" button.
3. The following view will appear:

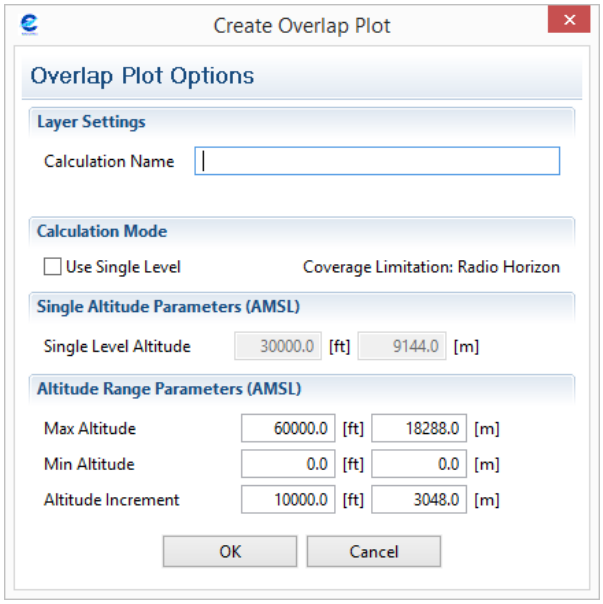


Figure 92: Create Overlap Plot

4. Type the optional calculation **Name**. If this field is left blank, it will be defaulted.

5. Check or uncheck the "Use Single Level" checkbox:

Checked

DEMETER will calculate only at the specified level defined by Single Altitude Parameters.

Unchecked

DEMETER will calculate according to Altitude Range parameters:

- **Max Altitude:** Highest calculation altitude.
- **Min Altitude:** Minimum calculation altitude.
- **Altitude Increment:** DEMETER will calculate the area coverage starting with min altitude and then adding this Increment until the altitude reach the maximum value.

6.6.2. DRAW 8 DB BOUNDARY

In order to use this tool, the following set of steps is required:

1. Select at least two NavAids from the view.
2. Click on "Draw 8db Boundary" button.

3. The following view will appear:

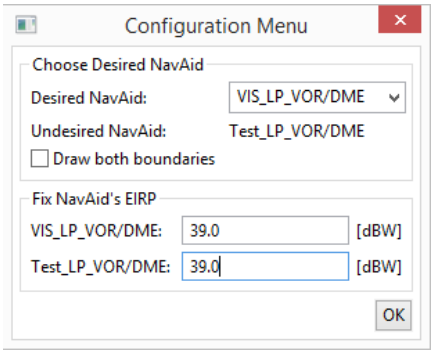


Figure 93: Draw 8db Boundary

4. Choose the desired NavAid to draw the boundary. If the user wishes to draw the two boundaries, then check "Draw both boundaries" check box.

5. Change NavAids EIRP if it is wrong.

6. Click on "OK" button.

7. COORDINATE POINTS

In this chapter, there are described all the options available on the "Coordinate Point" menu, located on DEMETER toolbar.

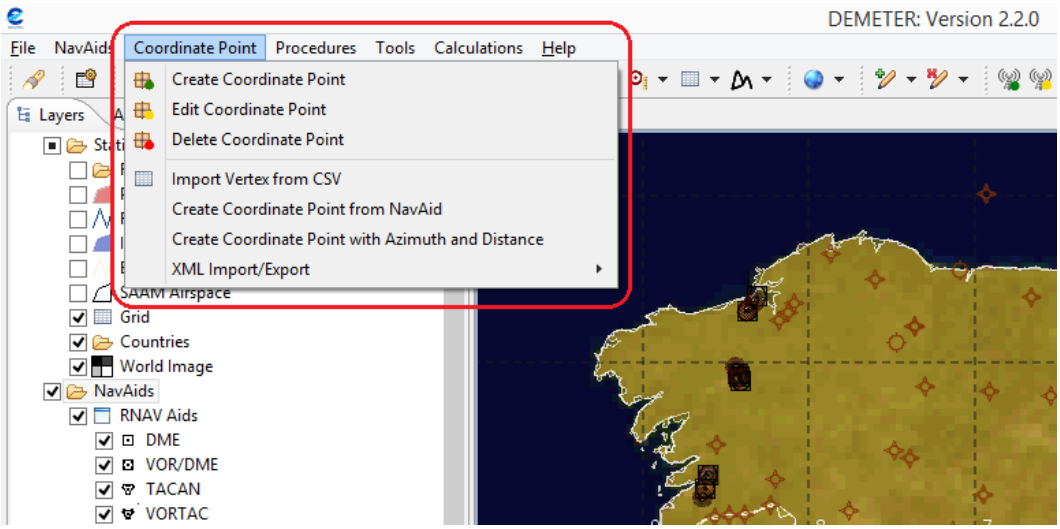


Figure 94: "Coordinate Point" menu

In this menu, the user is able to manage the **Coordinate Points** on the map. It is also possible to use some tools that provide extra information from existing coordinate points. On the following sub-chapters, we will describe in detail the necessary steps in order to make use of each option. Note that user can easily manage coordinate points either by the "Coordinate Point" menu (**Figure 94**), or by the DEMETER toolbar (**Figure 95**).

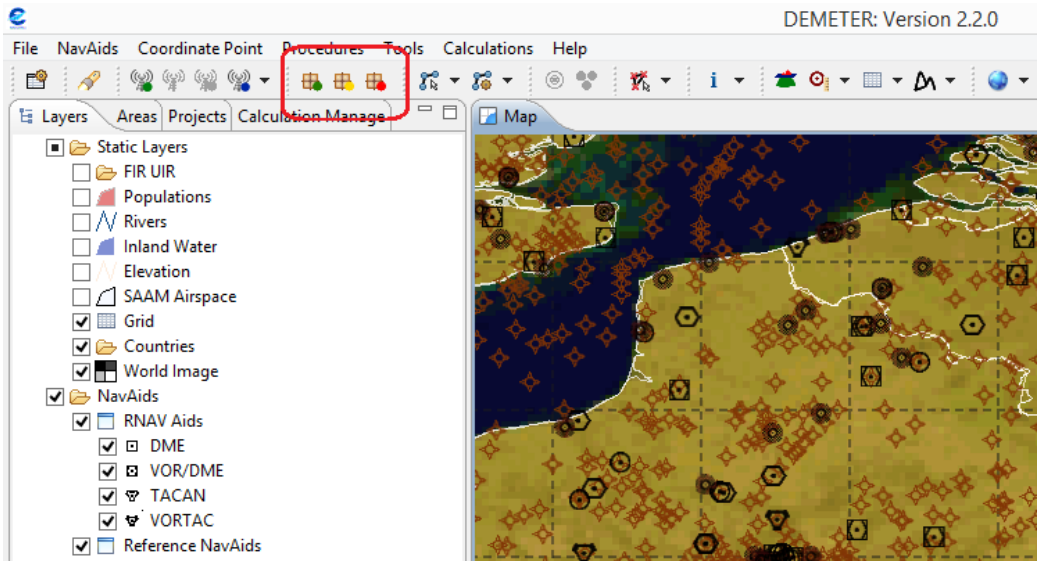


Figure 95: Coordinate Point management through DEMETER toolbar

7.1. COORDINATE POINTS' MANAGEMENT

7.1.1. CREATE COORDINATE POINT

Within DEMETER, the user can store locations on the map, which are named **Coordinate Points**. These points will be used to create **Procedures** (see **chapter 8** for further details) on. DEMETER allows the user to store some extra information about these, such as the **Name**, the Coordinate Point **Type** or the **Altitude**. A coordinate point can have one of the following types:

- **Waypoint**
- **Civil Airport Reference Point (ARP Civil)**
- **Military Airport Reference Point (ARP Military)**
- **Runway threshold (RWY THR)**
- **Airspace boundary vertex**
- **Mixed Airport Reference Point (Mixed ARP)**

In order to create a new Coordinate Point, the following steps are required:

1. Select the "Coordinate Point -> Create Coordinate Point" menu, or click on  icon, located on the toolbar.

2. The following view will appear, allowing the user to create the coordinate point data:

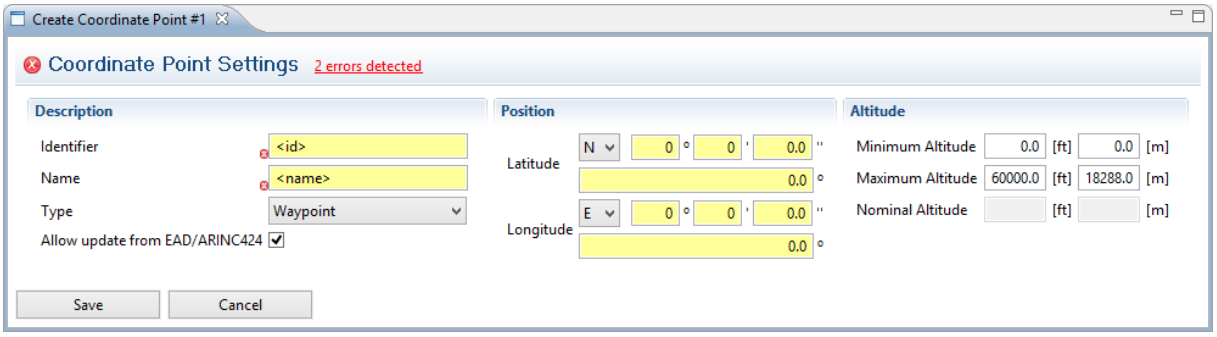


Figure 96: Create Coordinate Point

3. In the "**Description**" area, the user must:

   a. Type the **Identifier** for the new Coordinate Point (limited to 5 characters).

   b. Type the **Name** for the new Coordinate Point.

c. Choose from the **Type** scroll-down menu the Coordinate Point type to be created:

Waypoint

ARP Civil

ARP Military

RWY THR

d. The user is able to select/deselect the "**Allow Update From EAD**" checkbox in order to allow/disallow automatic updates from EAD, respectivelly.

4. In the "**Position**" area, the user must:

a. Choose from the scroll-down menu between North (N) or South (S) as for Latitude values.

b. Type the degrees, minutes and seconds or degrees in decimal format. The user should verify that the value is between the limits of Table 34.

c. Choose from the scroll-down menu between East (E) or West (W) as for longitude values.

d. Type the degrees, minutes and seconds or degrees in decimal format. The user should verify that the value is between the limits of Table 35.

5. In the "**Altitude**" area – depending on the **Type of Coordinate Point** created – the user should fill the following fields (see more details on **chapter 7.2**):

Waypoint

Minimum and Maximum altitude values between the

Table 39 limits.

ARP Civil

Nominal altitude value between the Table 40 limits.

ARP Military

Nominal altitude value between the Table 40 limits.

RWY THR

Nominal altitude value between the Table 40 limits.

Airspace Boundary Vertex

Minimum and Maximum altitude values between the

Table 39 limits.

Table 39: Minimum and Maximum Altitude limits in Coordinate Points fields

Unit	Minimum Value	Maximum Value
Feet [ft]	0 (Table 5: DOC Maximum Altitude Parameters)	60000 (Table 5: DOC Maximum Altitude Parameters)
Meters [m]	0 (Table 5: DOC Maximum Altitude Parameters)	18288 (Table 5: DOC Maximum Altitude Parameters)

Table 40: Nominal Altitude limits in Coordinate Points fields

Unit	Minimum Value	Maximum Value
Feet [ft]	0 (Table 5: DOC Maximum Altitude Parameters)	60000 (Table 5: DOC Maximum Altitude Parameters)
Meters [m]	0 (Table 5: DOC Maximum Altitude Parameters)	18288 (Table 5: DOC Maximum Altitude Parameters)

6. Click on "Save" button in order to store all information. Before saving the Coordinate Point on the database, DEMETER analyzes if the new coordinate point is close to another. In such cases, the user is alerted with the possibility of information duplication. The user is then able to decide whether to continue or cancel the coordinate point creation process (Figure 97).

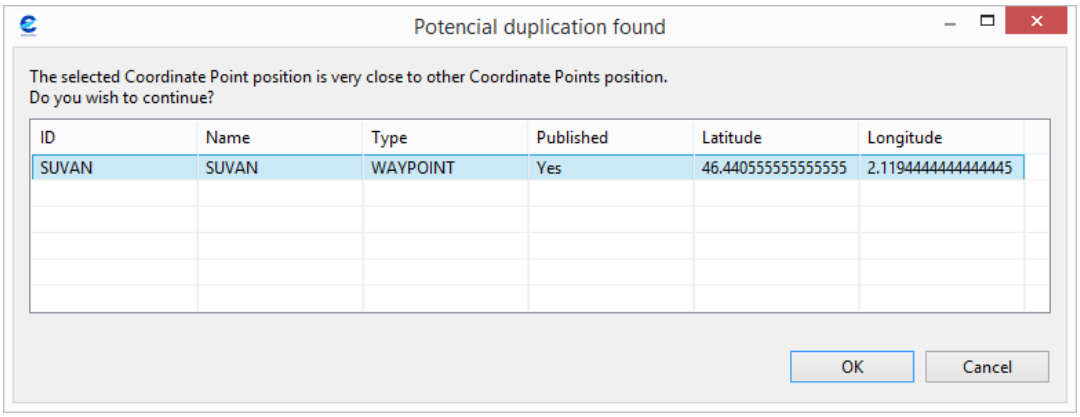


Figure 97: Coordinate point Duplication

7.1.2. CREATE COORDINATE POINT ON NAVAID LOCATION

Note: the user is also able to create a Coordinate Point using the coordinates of a selected NavAid. In order to create the new coordinate point, the user should:

1. Select the NavAid that is placed on the desired location.

2. Then, the user selects the "Coordinate Point -> Create Coordinate Point From NavAid" menu.

3. The last step is to enter fill all the fields as explained on "Create Coordinate Point" (**section 7.1.1**). Notice that in this case the Latitude and Longitude are already filled with the NavAid location information (Figure 98).

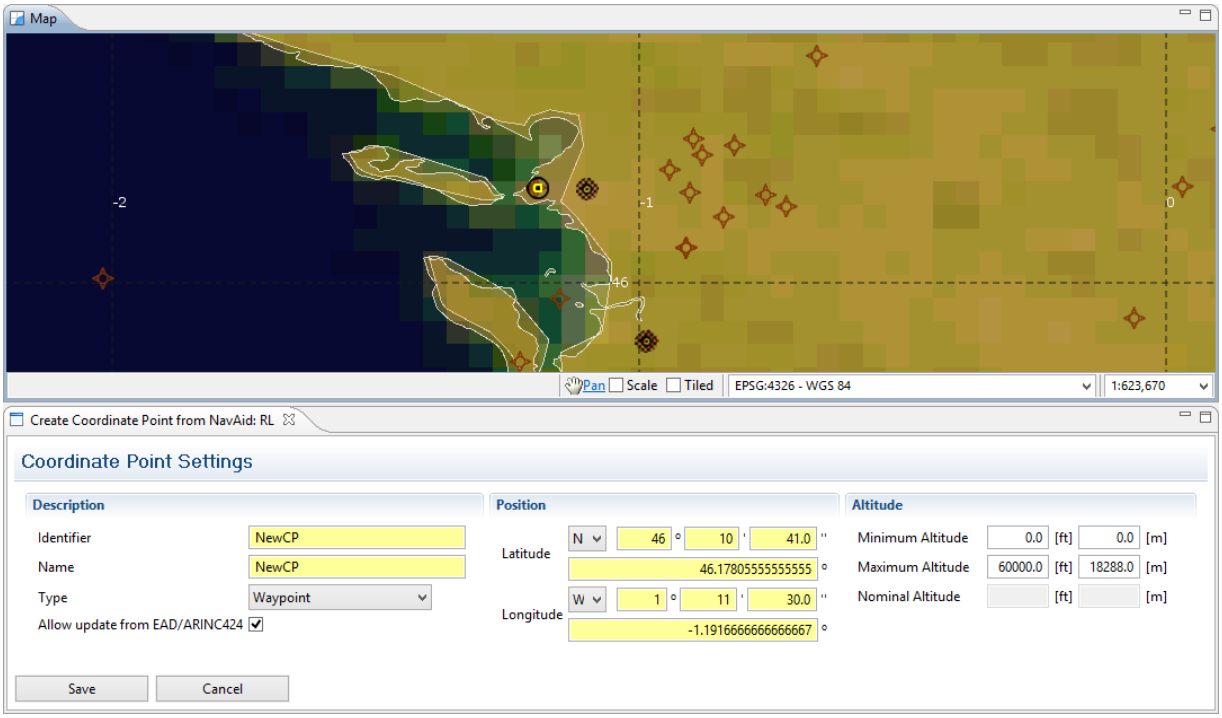


Figure 98: Create Coordinate Point from NavAid

7.1.3. CREATE COORDINATE POINT WITH AZIMUTH AND DISTANCE

With this feature it is possible to create a coordinate point using a NavAid location as a starting point. The position of this new coordinated point is calculated using additional information like azimuth and distance from the starting point NavAid

1. Select the NavAid that is the starting point.

2. Then, the user selects the "Coordinate Point -> Create Coordinate Point With Azimuth and Distance" menu.

3. The following view will appear, allowing the user to create the coordinate point data:

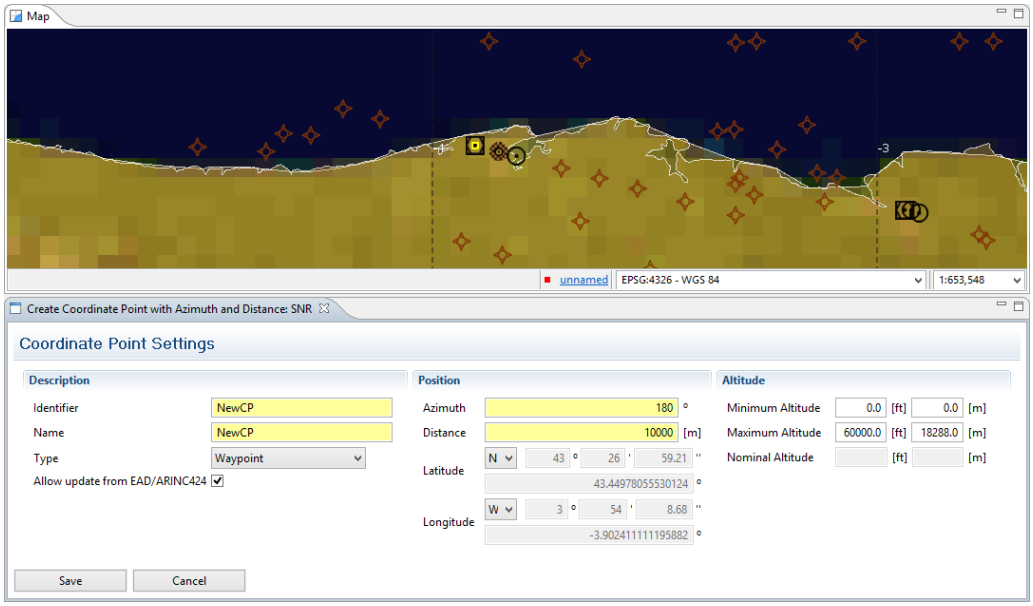


Figure 99: Create Coordinate Point With Azimuth and Distance

4. The last step is to fill all the fields as explained on "Create Coordinate Point" (**Section 7.1.1**). The Latitude and Longitude are already filled with the NavAid location information. Additionally is necessary to enter the azimuth and distance of the coordinate point from the selected NavAid.

7.1.4. EDIT COORDINATE POINT

The user is also able to edit any Coordinate Point from the Database. In order to do so, the user should execute the following steps:

1. Select one or more Coordinate Points (make sure that the "Coordinate Points"' layer is selected and the respective visibility checkbox is checked).

2. Select the "Coordinate Point -> Edit Coordinate Point" menu, or click on icon, located on the toolbar.

3. If multiple coordinate points have been selected a list will appear, allowing the user to choose which coordinate point to edit.

4. Select the desired coordinate point and click on "OK".

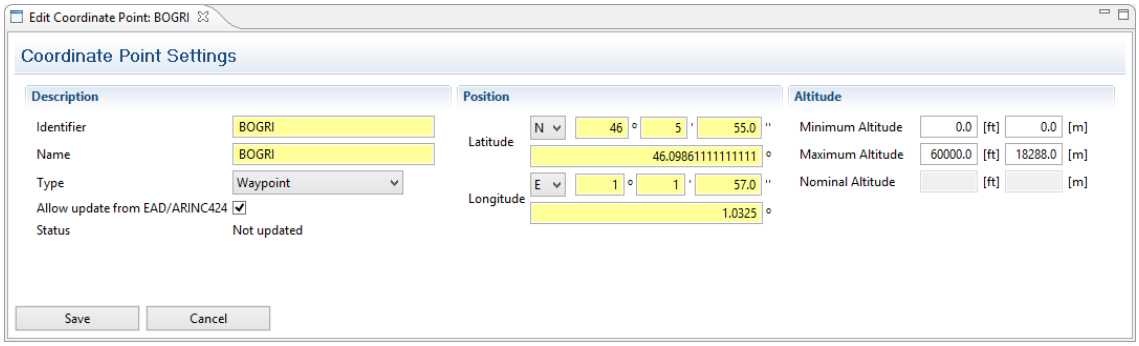


Figure 100: Edit Coordinate Point view

5. The following steps are the same as the ones described on "Create Coordinate Point" (see **section 7.1.1**), starting on step 2. Execute the necessary steps to change the required parameters.

6. As it is described on **chapter 0**, DEMETER can import information from official sources like the EAD. If the user makes an update to a Published Coordinate Point and do not want that information to be overwritten when importing information from the EAD the checkbox "Allow Update from EAD" must be unchecked.

7. If the user edits a published Coordinate Point, status information is displayed at the bottom of the view. The Status information is changed from Not Updated to User Updated if the user changes and saves any value.

7.1.5. DELETE COORDINATE POINT

The user is able to delete any Coordinate Point from Database. In order to do so, the user should execute the following steps:

1. Select one or more Coordinate Points (make sure that the "Coordinate Points"' layer is selected and the respective visibility checkbox is checked).

2. Select the "Coordinate Point -> Delete Coordinate Point" menu, or click on  icon, located on the toolbar.

3. If multiple Coordinate Points have been selected a list will appear, allowing the user to choose which Coordinate Point to delete. Note that in order to select/unselect only a few Coordinate Points, the user can make use of the "CTRL" key and then click in each one of them. If the user wants to delete all Coordinate Points, click on the "Select All" button.

4. Click on the "OK" button. The selected Coordinate points will be deleted.

7.2. ALTITUDES

When the user creates a Coordinate Point, there are 3 different altitude fields that can be specified: **Minimum**, **Maximum** and **Nominal altitude**. Depending on the Coordinate Point type, only some altitude fields will be available. These values will be used later when the coordinate point is used to create a procedure:

For coordinate points with type **Waypoints** or **Airspace Boundaries**, the following rules apply:

- Maximum and/or Minimum Altitude can be specified;
- If these values are specified they are used on procedure definition (Minimum as a suggestion, Maximum as a limitation);

For coordinate points with type **ARP** and **RWY THR**, the following rules apply:

- Only Nominal Altitude can be specified;
- When used on a procedure an altitude must be specified.

7.3. IMPORT VERTEX FROM CSV FILE

In order to import **Airspace Vertexes** from a CSV file, the user should select the "Coordinate Point -> Import Vertex from CSV File" menu. As a result of this process, the following window will appear:

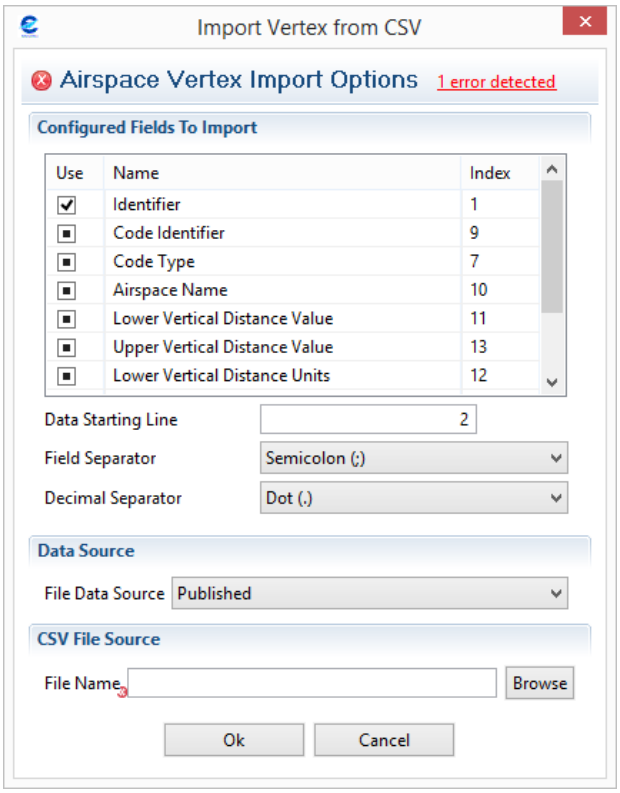


Figure 101: Airspace Vertex Import Options

On the "**Configure Fields to Import**" section, on the "**Index**" column it is possible to edit the index of the column related to each data field on the csv file that the user wants to import.

The first field "**Identifier**" is an option field on the csv, so the first row of the table can be edited so that the user can represent if the field is present on the file. The user can do this by clicking on the checkbox on the column "**Use**" on the first row of the table establishing if he wants to use or not this field.

On the "**Data Starting Line**" the user sets the line from which the import process starts to read the csv file. This allows the csv file to have a number of non-data lines, e.g. field description header.

"**Field Separator**" and "**Decimal Separator**" refer to the character on the file that corresponds to the separator between columns and numerical decimal separator, respectively. This two values must not be the same so that the application can be able to separate columns and determinate the decimal part of numerical values.

"**File Data Source**" in "**Data Source**" sector related to the origin of the file. If the file is made constructed from EAD data the user has the possibility to indicate that by choosing "**Published**" on this option. By choosing "**Published**" all imported vertex will belong to the "**Published**" layer on the layer tree. If the user constructed the file, he or she can choose "**User Defined**" option and indicate that the fill is not form official data and therefore the data will be imported to "**User Defined**" layer on the layer tree.

Finally on the "**File Name**" field the user can input the csv file in question containing the EAD vertex data on the format he or she had just specify. Pressing "Ok" will start the import process. Note that before the import process starts, the following warning is shown, alerting for the possible changes of data that might occur after the import process:

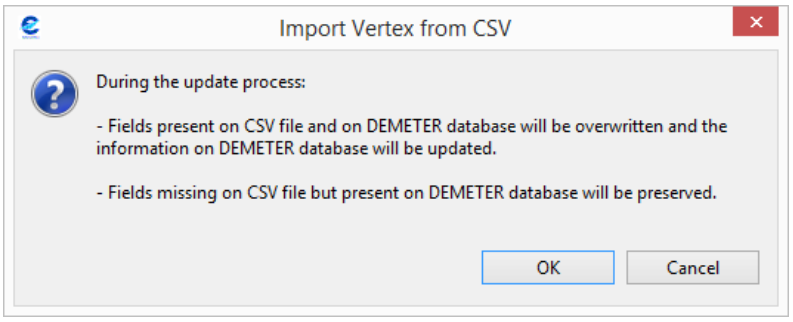


Figure 102: Import vertex from EAD warning

Note that the coordinate identifier data cannot be null for any airspace vertex coordinate point. If the imported data contains any **incorrect values** (Figure 103), the application will show the following window, so that the user can see the problematic data:

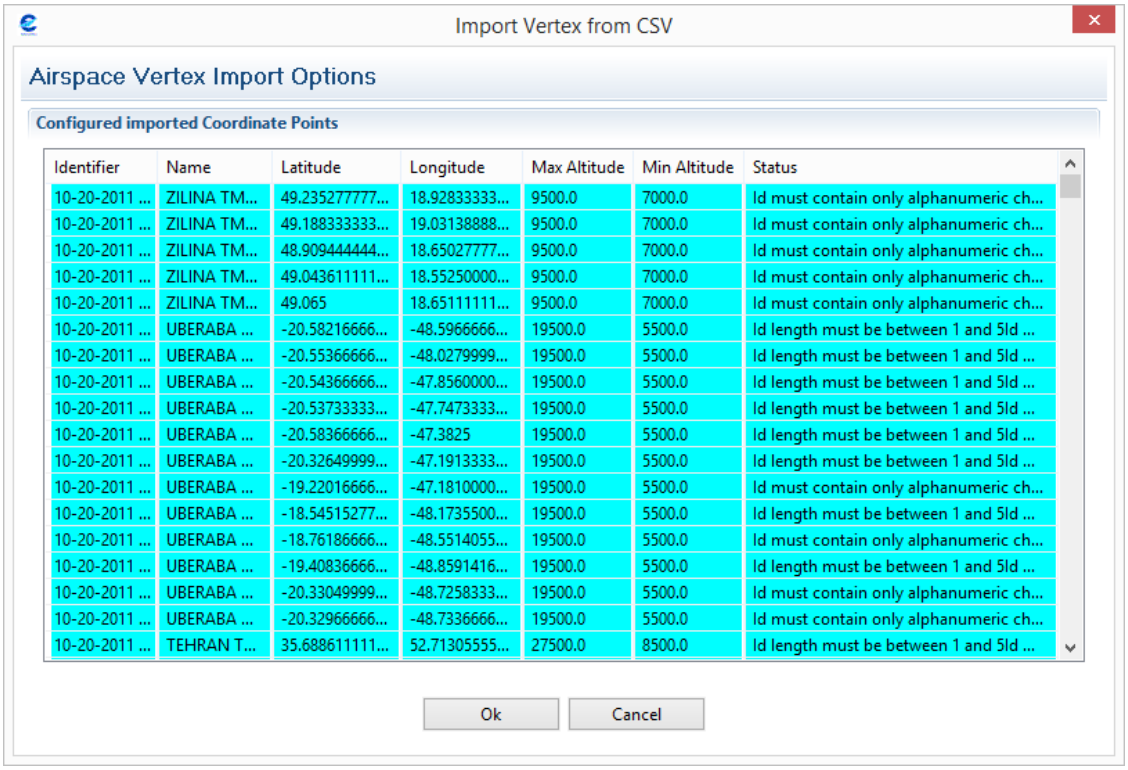


Figure 103: Airspace Vertex Problematic Data

If the user decides that the identifier for each field is not present on the imported file, the user is then allowed to insert manually every identifier for each point. After the insertion and data checking, the user must click on the "Ok" or "Cancel" button, whether he or she wants the process to continue or quit, respectively.

Nevertheless, if the user chooses to continue the operation, the application will load data into the database and map the data that was shown as corrected on the previous window. The next steps of this process are similar to the "Import NavAids from EAD" (see **chapter 6.4**), regarding its functionality in the duplication management and data confirmation.

7.4. IMPORT COORDINATE POINTS FROM EAD SDO REPORTS

7.4.1. IMPORT GENERAL CORDINATE POINTS

In order to import the **general** type of coordinate points from an EAD XML file, the user should select the "File -> Import from EAD XML -> Import Coordinate Points" menu:

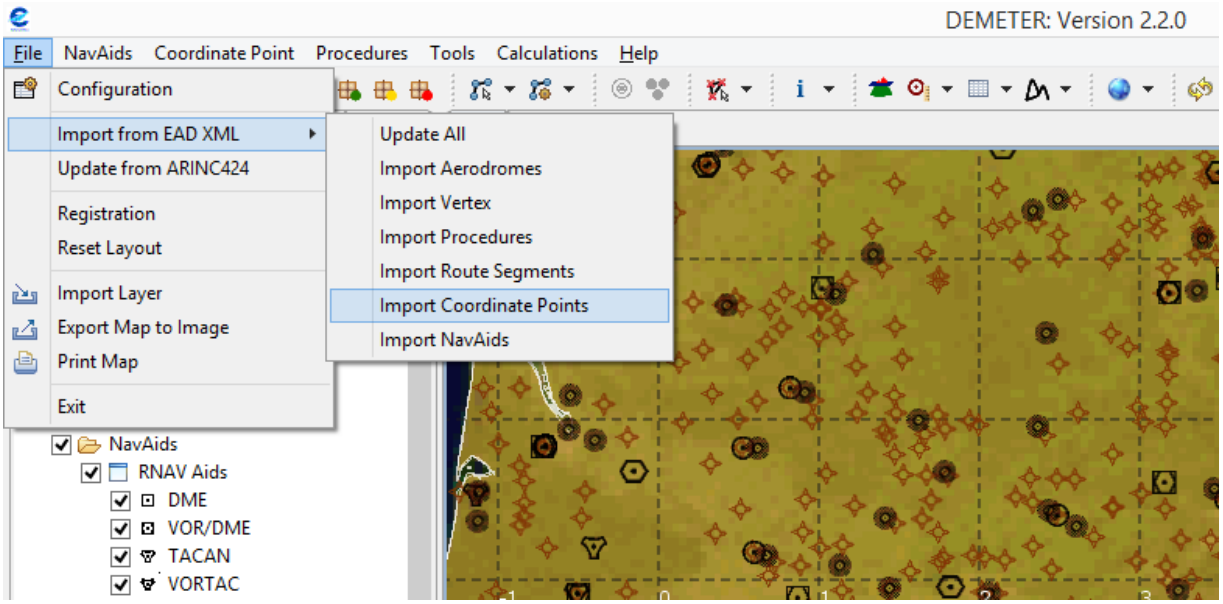


Figure 104: Import Coordinate Points from EAD XML

The user will then be asked to browse for the desired file, which contains the Coordinate Points' data that will be imported. Before initiating the import process, DEMETER will alert the user for the fact that the database information will be overwritten, but if some fields are missing on the chosen file (but present on DEMETER), they will be preserved (Figure 105). Note: if the user clicks "OK", the process will continue, otherwise the import process fails.

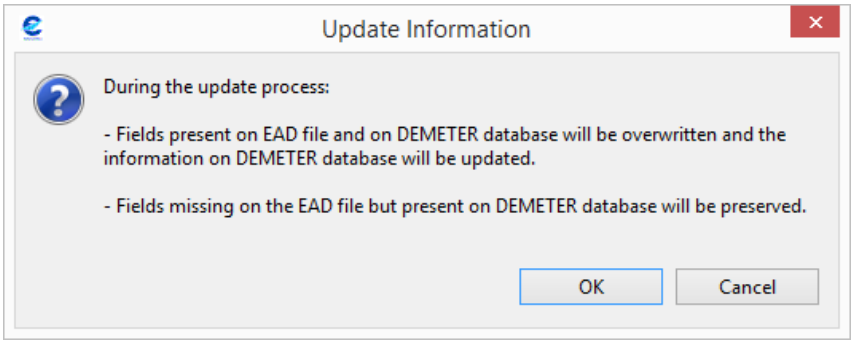


Figure 105: Field data overwrite alert, when importing coordinate points from EAD XML

If DEMETER detects a match (or several) in the imported file's data, it will consider them as duplications and will alert the user for that fact, as shown in the figure below:

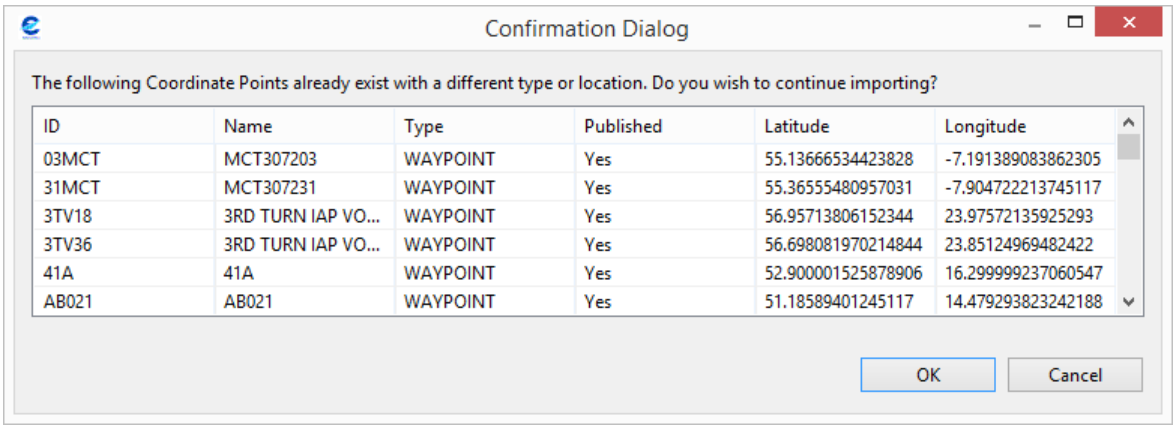


Figure 106: Data duplication when importing Coordinate Points' data from EAD XML

Note that considering there is no problem with data duplication, DEMETER will not ask the user if he or she wants the process to perform a rollback. Pressing "OK" will finish the import process in a while, finally showing the user a success message:

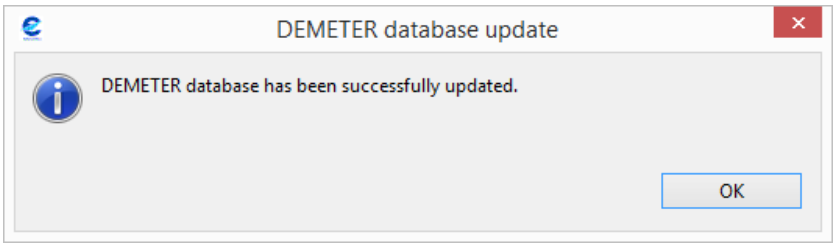


Figure 107: Import successful

7.4.2. IMPORT AERODROMES

In order to import the **aerodrome** type of coordinate points from an EAD XML file, the user should select the "File -> Import from EAD XML -> Import Aerodromes" menu:

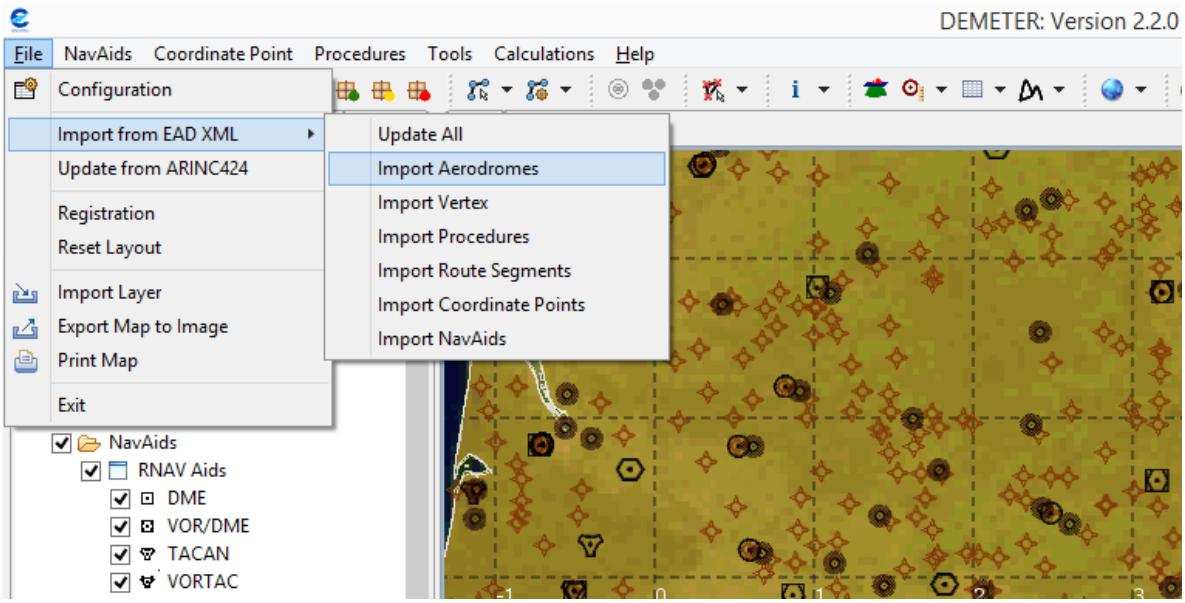


Figure 108: Import Aerodromes from EAD XML

The rest of the import process follows analogously as the process of importing general Coordinate Points from EAD XML, detailed in the previous section (**7.4.1**).

7.4.3. IMPORT VERTEXES

In order to import the **vertex** type of coordinate points from an EAD XML file, the user should select the "File -> Import from EAD XML -> Import Vertex" menu:

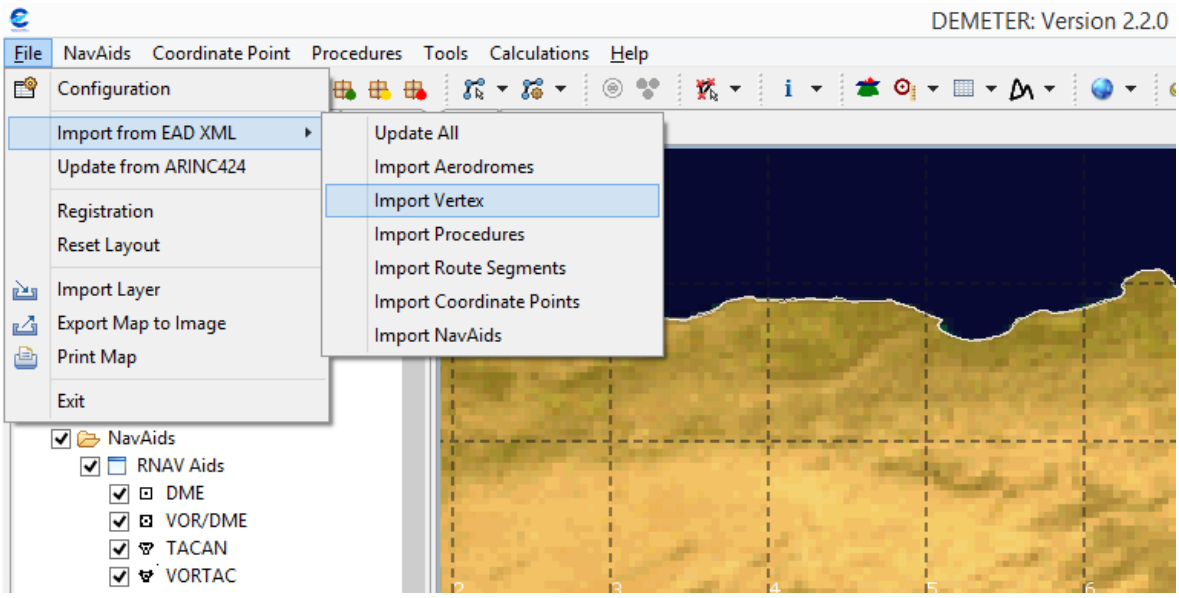


Figure 109: Import Vertexes from EAD XML

After selecting the EAD file that contains the Vertex information, a window like the one shown in Figure 110 will appear, allowing the user to select the file's inherent data source – either **Published** or **User Defined** – as well as the list of coordinate points to be imported.

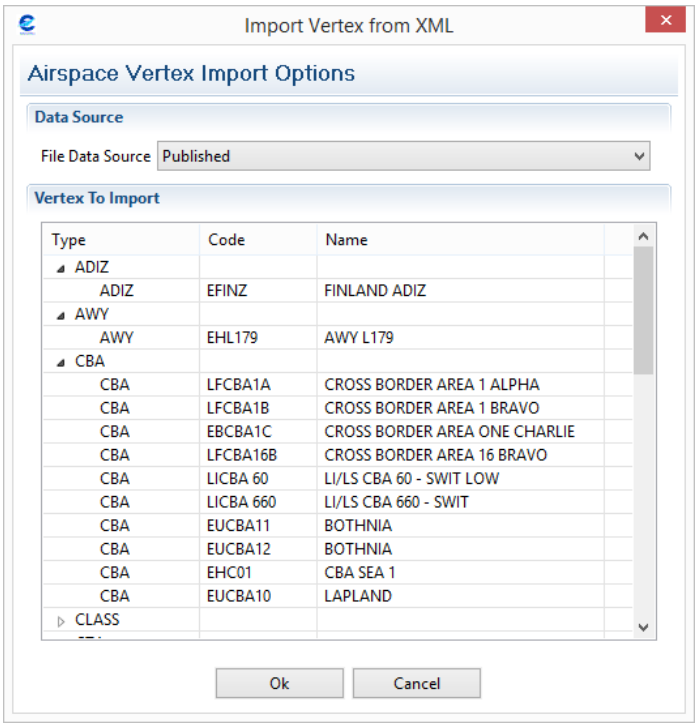
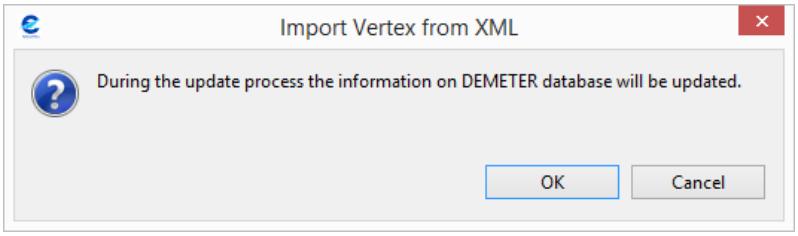


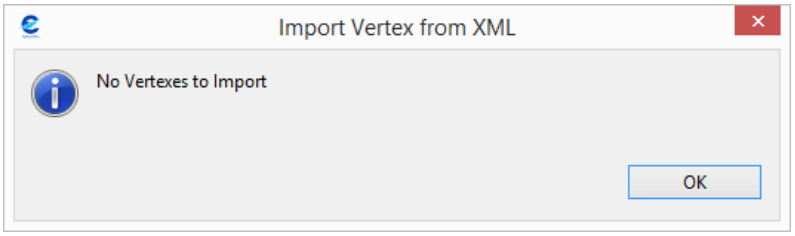
Figure 110: Import Vertex options

After selecting the file's data source and the list of coordinate points to be imported, the user should click either "Ok" or "Cancel", whether he or she wants to proceed with the import process, or cancel it, respectively. Nevertheless, after pressing "Ok", the user will be informed that during the import process there will be updates to the DEMETER database:



At this point, pressing "OK" will allow DEMETER to continue with the import process, whereas pressing "Cancel" will terminate the same process.

After pressing "OK", if DEMETER identifies that the given file does not have any Vertex coordinate points, the following message will be shown, informing the user that there were not any Vertex coordinate points to be imported:



Otherwise, if DEMETER identifies Vertex coordinate points on the given file, the import process will continue until it is finished.

8. PROCEDURES

In this chapter will be a description of all the options that are available on the "Procedures" menu. Such options are essentially related with the creation and management of procedures on the map. Procedures are essentially a set of coordinate points that form a structured route, with a reference Airport. These concepts will be better understood and discussed on the following sections.

8.1. PROCEDURES' MANAGEMENT

DEMETER allows the user to manage the Procedures (create, edit, add/remove from the map and delete). There are three ways of creating procedures on DEMETER:

- Create procedure from map
- Create procedure from selected zone
- Create procedure from file

On the following sections there will be a description with detail of the necessary steps in order to use each of the procedure options.

8.1.1. CREATE PROCEDURE FROM MAP

In this procedure creation method, the user interacts with the map in order to create procedures. Instead of a pre-defined list of Coordinate Points, this method is based on clicking over the map, in order to **create new coordinate points** or **select existing ones**, to define the Procedure.
These are the required steps to create a new procedure:

1. Click on (Create Procedure from Map) icon, located on the toolbar.
2. The following window will appear:

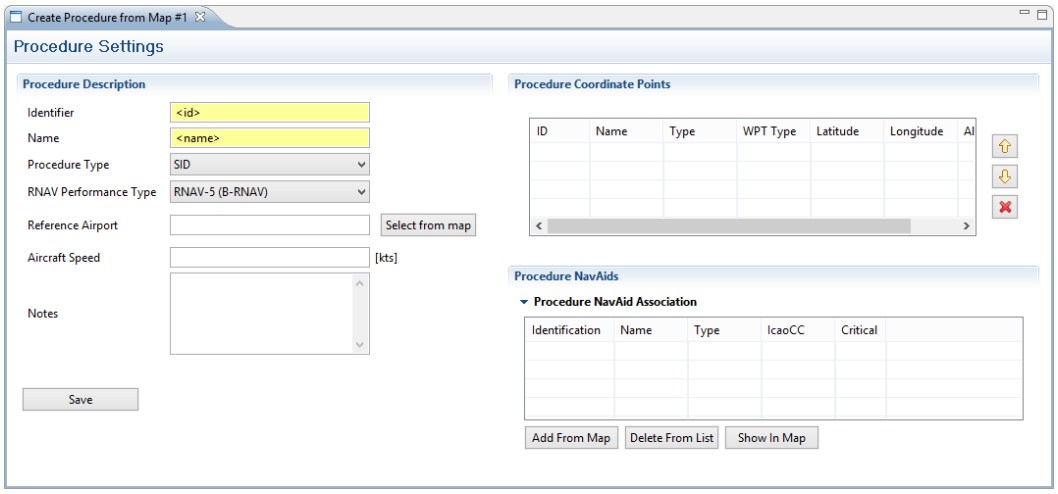


Figure 111: Create Procedure from Map

3. In the "**Procedure Description"** area, the user must:

   a. Type the **Identifier** for the new Procedure (No restriction on size or characters to be used).

   b. Type the **Name** for the new Procedure.

   c. Choose from the scroll-down menu the Procedure type to create:

      - **SID**
      - **STAR**
      - **EN-ROUTE**

   d. Choose from the scroll-down menu the required **RNAV Performance Type**:

      - **RNAV-5 (B-RNAV)**
      - **RNAV-1 (P-RNAV)**
      - **A-RNP**

   e. Optionally the user can add a **Reference Airport**:

      In order to do so, the user should click on the "Select" button (located next to the "Reference Airport" field. Then the user clicks next to the required Airport (on the map). Finally, the user should fill the optional "Aircraft Speed" field with any value between the limits presented on Table 41.

Table 41: Aircraft Speed limits in Procedure fields

Unit	Minimum Value	Maximum Value
Knots [kts]	0	1000

The last step of adding a Reference Airport is to select "OK" on the window with the list of selected Airports. Note that if the user clicks on a zone with multiple airports, the aforementioned list will contain more than one Airport.

4. Type any **Note** to store attached to this Procedure.

5. Now double click anywhere on the map in order to set the **first Coordinate Point**. Notice that its respective Latitude and Longitude (for the Clicked position) appears on the list.

6. Anytime the user double clicks on the map to add a Procedure's Coordinate Point, one of the following cases can happen:

New Coordinate Point

If the user clicks on a location on the map where there are no Coordinate Points, DEMETER will create a new one for this purpose.

Existing Coordinate Point

If the user clicks next to any Coordinate Point on the map, a message window like the following will appear:

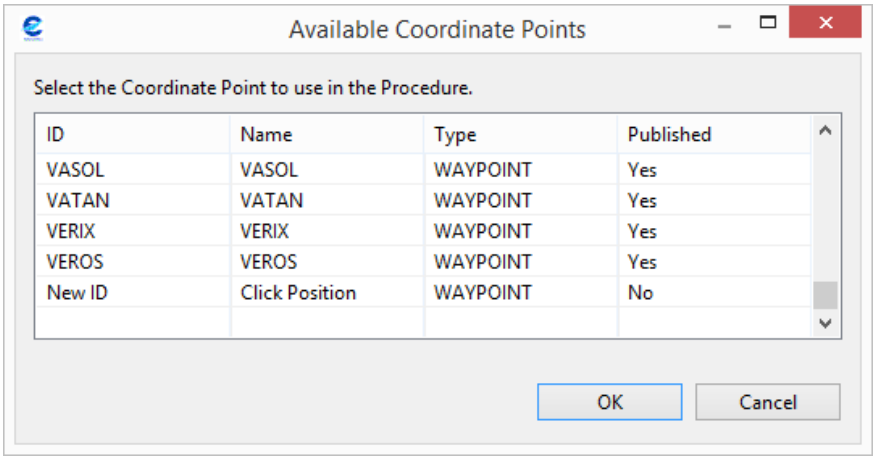


Figure 112: Available Coordinate Points

Then, if the user picks any of the available coordinate points and clicks "OK", the procedure will include that point(s) on the list. Note that the user always has the option of selecting the "**NewID**", which means that selecting that option will create a new coordinate point in the exact clicked position.

7. Enter the **ID** for each new Coordinate Point. New coordinate points are highlighted in blue.

8. Enter the **Name** for each new Coordinate Point. New coordinate points are highlighted in blue.

Table 42: Altitude limits for Procedure's Coordinate Points fields

Unit	Minimum Value	Maximum Value
Feet [ft]	0 (Table 5: DOC Maximum Altitude Parameters)	60000 (Table 5: DOC Maximum Altitude Parameters)
Meters [m]	0 (Table 5: DOC Maximum Altitude Parameters)	18288 (Table 5: DOC Maximum Altitude Parameters)

9. Set the **Altitude** for the Procedure at each point, clicking on Altitude field, with any value between the limits on Table 42.

10. The user can also edit the **Waypoint Type** by double clicking on the respective column on the table. The possible values for this field are:

    - **Fly-Over - F/O**
    - **Fly-By - F/B**
    - **Departure – DEP**
    - **En-Route – ENR**
    - **Initial Approach Waypoint – IAWP**
    - **Initial Approach Fix – IAF**
    - **Intermediate Waypoint – IWP**
    - **Intermediate Fix – IF**
    - **Final Approach Waypoint – FAWP**
    - **Final Approach Fix – FAF**
    - **Landing Threshold Point – LTP**
    - **Missed Approach Waypoint - MAWP (includes turning and holding points)**
    - **Missed Approach Point – MAPt**

11. Now the user can reorder the coordinate points by selecting them on the list and clicking on ⇧ to move up or ⇩ to move down the list. The order of the list will define the order and the sequence of the coordinate points present into the procedure. Note that the procedure representation on the map is also updated as the coordinate point is changed.

12. The user can also delete any selected coordinate point(s) from the list by clicking on it/them and then clicking on the ✖ icon.

13. The last step is associate NavAids to the procedure. First, the user selects the NavAid on the map and next, clicks on "Add From Map" button.

14. The user can mark the NavAid as critical. This operation is performed, double clicking over it on list. A critical NavAid cannot be deleted from database.

15. Additionally, the user can delete or see on the map any selected NavAid, clicking on "Delete From List" or "Show In Map" button respectively.

16. When all finished, the user should click on the "**Save**" button in order to store the Procedure.

8.1.2. CREATE PROCEDURE FROM SELECTED ZONE

One of the ways to create procedures is by selecting some existing Coordinate Points from an area. The following steps are required in order to create new procedures with this method:

1. Using any of the selection tools, select some coordinate points (Note that the "Coordinate Points"' layer must be selected and visible on the layer tree).

2. Click on the on (Create Procedure from Selected Zone) icon, located on the toolbar.

3. The following window will then appear:

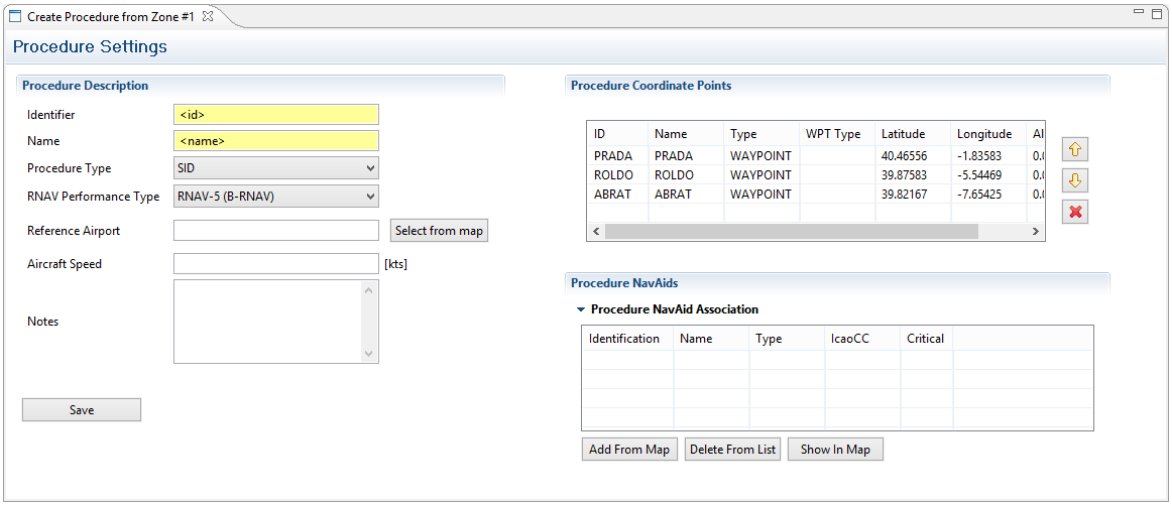


Figure 113: Create Procedure from List

4. The steps in order to fill the information on the window are similar to the ones described in **section 8.1.1**, except that the coordinate points have been added before.

8.1.3. CREATE PROCEDURE FROM COORDINATE POINTS FILE

This method to create a new procedure is very similar to Create Procedure from Selected Zone (**section 8.1.2**), but in this case the area (list of Coordinate Points) have been previously selected and exported to a Coordinate Points file.

This is the process to create new procedure from a Coordinate Points file:

1. Click on (Create Procedure from file) icon, located on the toolbar.

2. Browse your PC to find a valid xml Coordinate Points file. To create a valid file, see the instructions on **chapter 10** on how to import/export XML valid data. Afterwards open the selected file.

3. Next steps are the same as described on **section 0,** starting on step 3. The only exclusive difference is that the coordinate points that are available on the scroll-down menu on step 13, are the ones that were imported from the provided XML file (last step).

8.1.4. EDIT PROCEDURES

DEMETER also allows the user to edit previously, created and/or imported procedures. In order to do so, the user should follow these steps:

1. Using one of the selection tools, select one Procedure from the map (make sure that the "Procedures"' layer is selected and that the visibility checkbox is checked).
2. Click on (edit procedure) icon, located on the toolbar.
3. The following window will appear, allowing the user to change the procedure's fields:

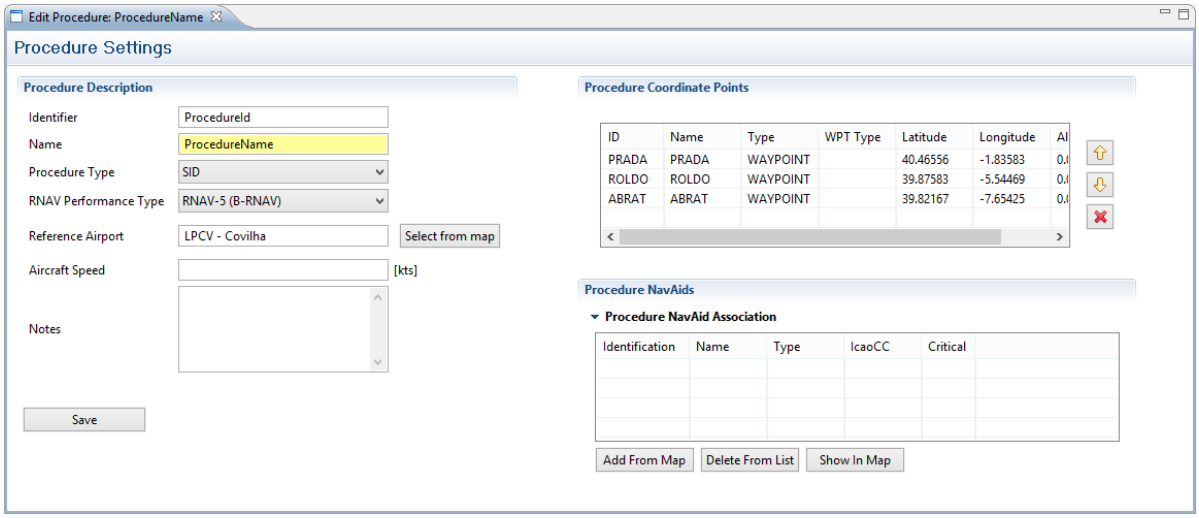


Figure 114: Edit Procedure

Note that the coordinate points can also be changed. In order to do so, the user should these steps:

4. Add a new coordinate point to the coordinate points' list (the user is able to do this action by clicking on the map. See **section 8.1.1** for further details).

5. Modify the "**Altitude**" field for the procedure at each point, by clicking on Altitude field, with any value between the limits on Table 42 (See **section 8.1.1** for further details).

6. Modify the Waypoint Type at each point clicking on "**WPT Type**" field and changing as desired (See **section 8.1.1** for further details).

7. The user can also reorder Coordinate Points by selecting them on the list and clicking on ⇧ to move up or ⇩ to move down the list. The order of the list will define the order and the sequence of the coordinate points into the procedure. Procedure representation on the map is also updated (See **section 8.1.1** for further details).

8. The user is able to delete any coordinate point(s) from the coordinate points' list, by clicking on it and then on ✖ (See **section 8.1.1** for further details).

9. When the list is finished click on the "Save" button in order to store the newly created procedure.

8.1.5. ADD/DELETE FROM MAP OR DATABASE

DEMETER allows the user to manage its procedures' visibility with a simple tool. This tool allows the user to either **show** or **hide** any procedure from the map that is stored on the DEMETER Database. It is also possible to **delete** procedures from the database. In order to perform such actions, the user should follow these steps:

1. Select the "Procedures -> Manage Procedures on Map" menu.

2. The following window will appears, allowing the user to manage the procedures:

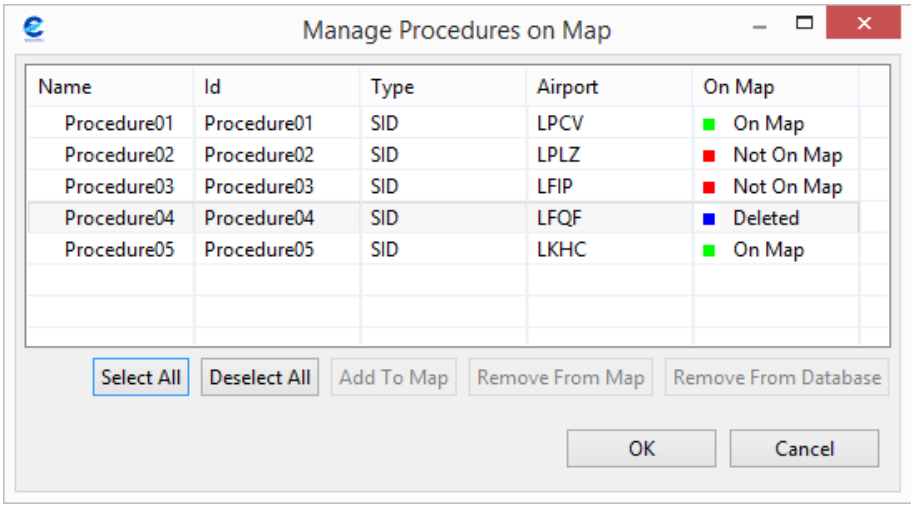


Figure 115: Manage Procedures on the map

3. In order to show any **hidden** procedure on the map, the user should select that procedure (from the procedures' list) and click on the "Add to Map" button.

4. In order to hide any **shown** procedure on the map, the user should select that procedure (from the procedures' list) and click on the "Remove From Map" button.

5. In order to **delete** from Database select any Procedure and click on "Remove From Database" button (Note that the deleted information will be lost!).

Notice the colors on the "On Map" column of Figure 115, as they identify the procedures' status:

Green Light

This color means that the procedure is **currently shown** on the map.

Red Light

This color means that the procedure is **not currently shown** on the map.

Blue Light

This color means that the procedure will be deleted as the user clicks on the "OK" button.

6. Click on "OK" in order to apply changes.

8.2. IMPORT PROCEDURES FROM EAD SDO REPORTS

On DEMETER it is also possible to import Procedures from EAD XML files. In order to do so, select the "File -> Import from EAD XML -> Import Procedures" menu:

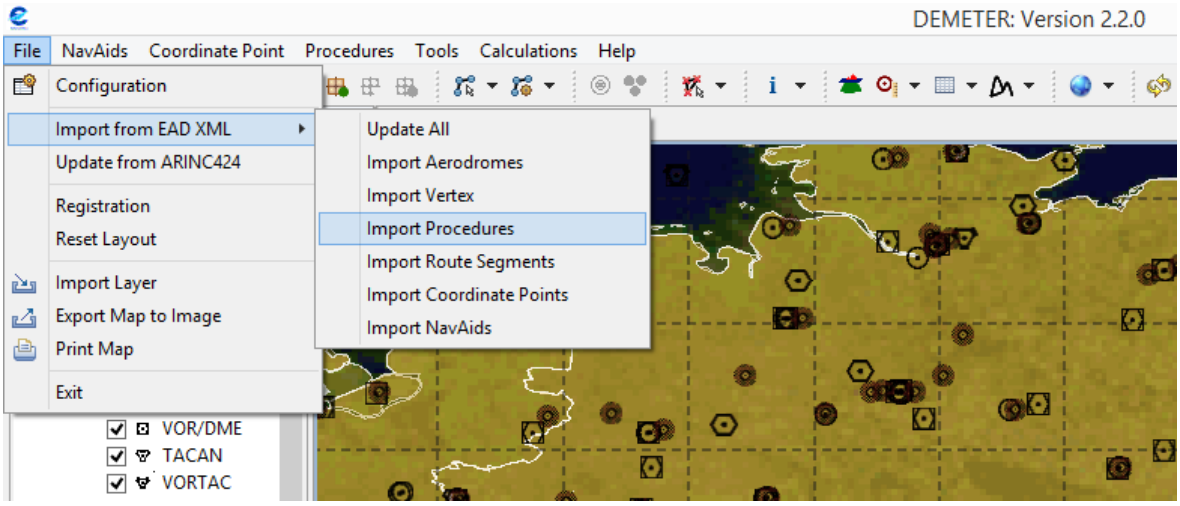


Figure 116: Import Procedures from EAD XML file

After selecting the aforementioned menu, the user is then able to select the Procedure EAD file. After selecting the desired file, the user should click "Ok", triggering the following window to appear:

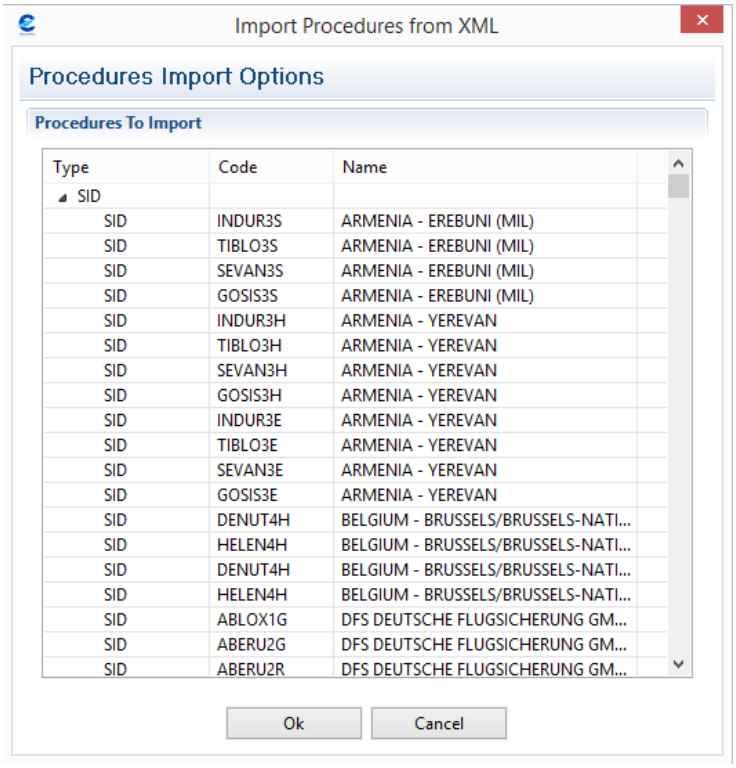


Figure 117: Procedures Import Options

In this window the user is able to select the set of Procedures that he or she desires to import. For the user's commodity, the window already presents the **Type**, **Code** and **Name** of the Procedure(s)

to be imported. Note that procedures can have two essential types, that being **Standard Instrument Departure** (SID), or **Standard Terminal Arrival Route** (STAR).

After selecting the desired procedure to import, the user is then able to manage which procedures are to be shown on the map (Figure 118). Note that the user can also make a procedure **visible/invisible** on the map, **without necessarily deleting it**.

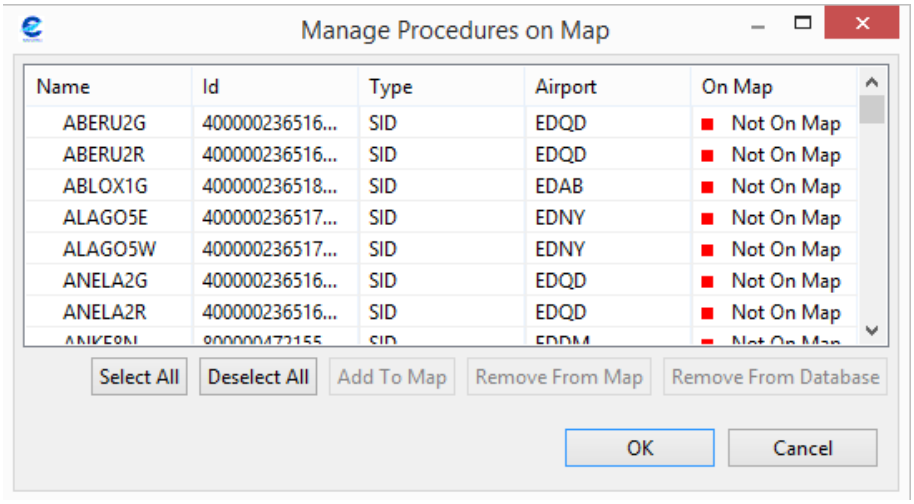


Figure 118: Manage Procedures on Map

8.3. PROCEDURE – NAVAID ASSOCIATION

The purpose of this tool is to allow the user to create associations between Procedures and NavAids, allowing the user to lately be able to evaluate which procedures are affected if a NavAid (or a set of NavAids) fails. This tool is used following two steps:

1. First, the user should create the associations (see **section 8.3.1**). After using DEMETER and its calculation tools, the user is able to decide whether a NavAid is important for specific procedure or not.

2. Second, the user should manually create the association (see **section 8.3.1**). Please note that DEMETER will not create automatically any association, as this is a manual task that should be performed by the user. This second step is required in order to evaluate how a NavAid failure affects the procedures.

8.3.1. CREATE ASSOCIATIONS

In order to create Procedure-NavAid associations, the user should follow the next steps:

1. Select at least one **NavAid** or **Procedure** from the map

2. Select the "Procedures -> Procedure – NavAid Association" menu:

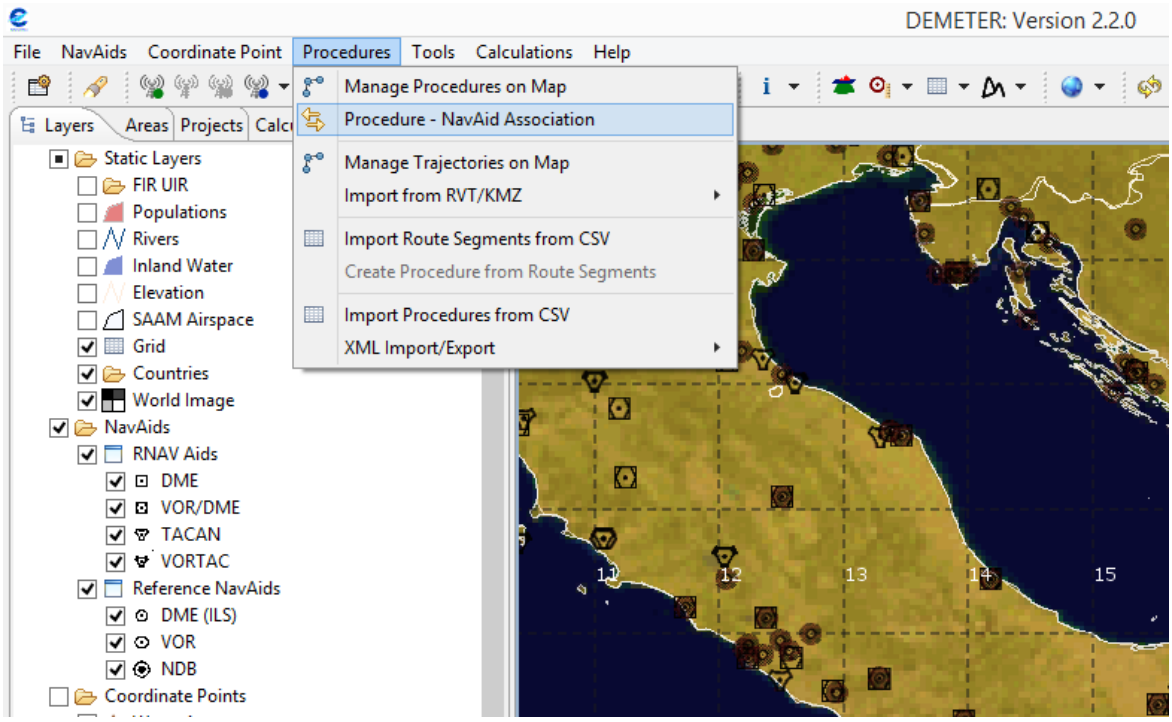


Figure 119: Procedure – NavAid Association menu

The following window will appear, allowing the user to perceive which NavAid(s) are associated with each Procedure(s):

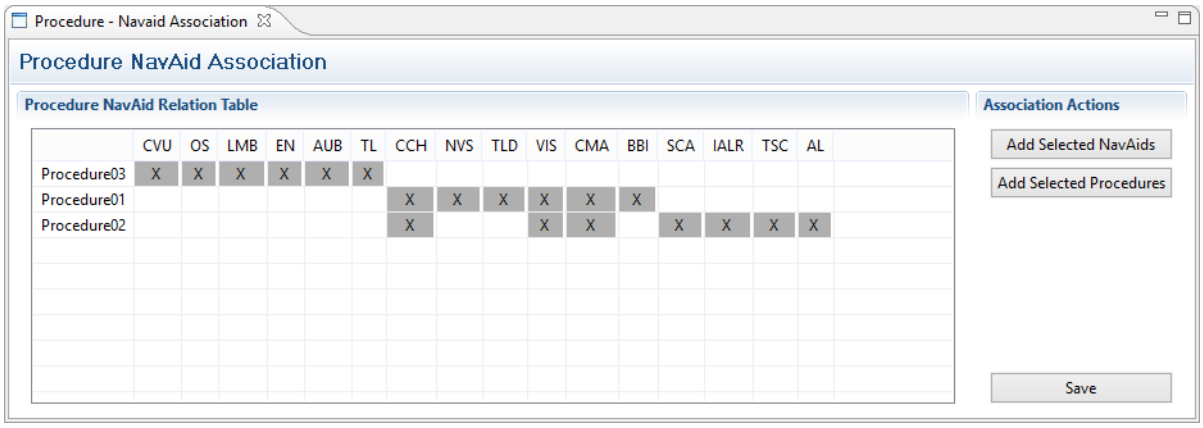


Figure 120: Procedure – NavAid Association window

3. The user is now able to add more NavAids or Procedures to the list. In order to do that the user should select a NavAid or Procedure on the map, and click either "Add Selected NavAid" or "Add Selected Procedure" on the right of the window, as he or she desires to add a NavAid or Procedure, respectively.

4. To create the Procedure – NavAid association the user should double-click on the line / column that correspond to the pair to be associated, until it is marked with an "X" (Figure 120). If the user double-clicks again, the association is removed. A grey square with a cross will be displayed for the existing associations.

8.3.2. EVALUATE NAVAID FAILURES

In order to evaluate the impact of a NavAid failure, the user should select a set of NavAids or Procedures and select the "Procedures -> Procedure – NavAid Association" menu.
If the user selects **Procedures** on the map, the table will include

1. The set of procedures placed on the left.

2. All the associated NavAids placed on top.

If the user selects **NavAids** on the map, the table will include:

1. All the procedures (associated with the selected NavAids) placed on the left.

2. All the NavAids (associated with the procedures. Note that there could be more than one selected NavAids) placed on top.

To evaluate the impact of a NavAid failure, click over the NavAid Id. The affected procedures will be highlighted in **red**.

9. ROUTE SEGMENTS

9.1. IMPORT ROUTE SEGMENTS FROM CSV

On DEMETER, EAD Route information allows the users to create en-route procedures with the official waypoints that are provided by this source, and to visualize the routes spatially as continuous segments.

In order to import EAD Route information into the application, an EAD data file must be defined as "Comma-separated values" file, commonly known as a "CSV" file (with '.csv' extension).

The user should supply this file and input the column format in which this file contains the data in it. The user will have to describe the columns and respective indexes in relation to the data inside the file.

In order to import routes into DEMETER the user should select the "Procedures -> Import Route Segments from CSV" menu. After clicking this menu, the following window will be shown in order for the user to complete the files columns structure, indexes and line color:

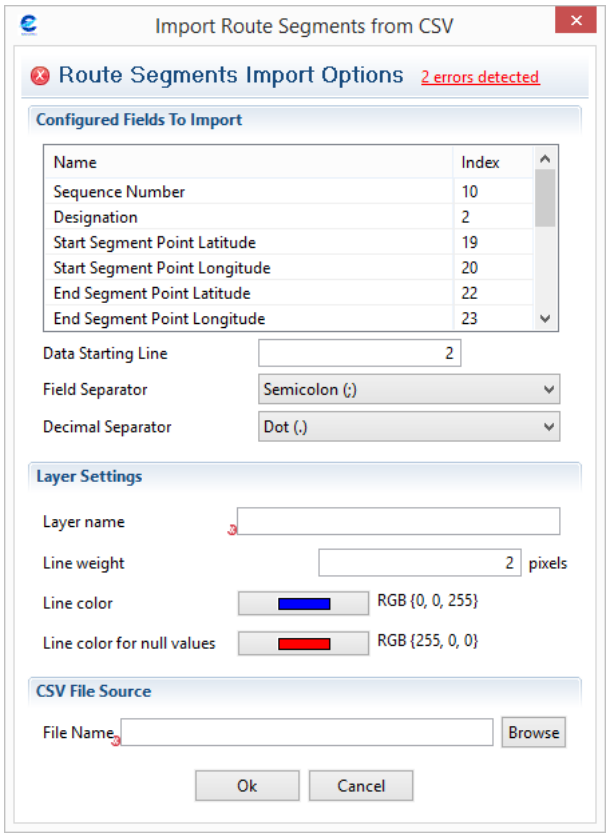


Figure 121: Route Segments import options

Configured Fields to Import

The table inside the "Configured Fields to Import" section specifies where the user should edit the "Index" column in order to specify in which column the CSV file has the respective data. As has been shown on the other import processes described earlier, the user can input the line number on "Route Starting Line" field, from which the process must start to read the file. This allows the CSV file to contain previous data lines, e.g., a data description header.

The "Field Separator" and "Decimal Separator" fields refer to the character on the file that corresponds to the separator between columns and numerical decimal separator, respectively. This two values must not be the same so that the application can be able to separate columns and determinate the decimal part of numerical values.

Layer Settings

Under "Layer Settings" section the "Name" field is where the user inputs the name for the layer that will be created and displayed on the layer tree.

On the remaining fields, the user can configure the layer elements appearance in terms of line weight and line color. Whereas the file can contain null values on the elevation field the user must choose a color for the elements that contain elevation in "Line color" and other color for the elements that have null values (upper or lower values) in "Line color for null values".

CSV file Source

Finally on the "File Name" field the user can input the csv file in question containing the route data on the format he or she had just specified.

Afterwards, the layer will be created and added to the map and to the layer tree, inside the "Procedure" node. The map representation will be the same as in the one the user configured on the import window, i.e. the layer will contain the segment lines with elements of the colors the user specified for elements with and without null values, as showed below:

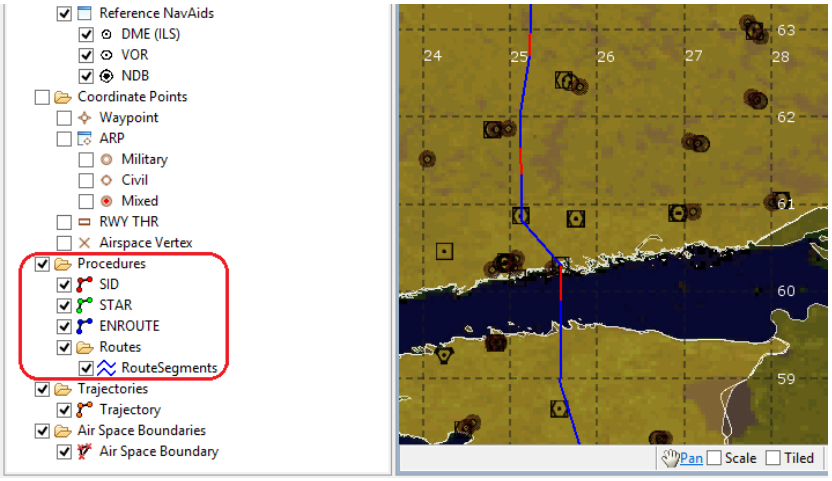


Figure 122: Imported Route Segments Sample Map

On the layer tree, a node for the imported route layers will be created and all the layers that will be imported through this process will be added on this node, like is shown below:

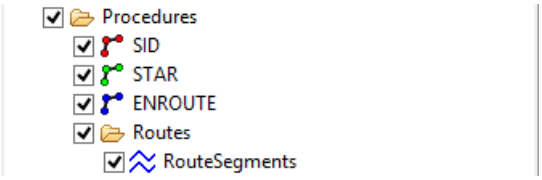


Figure 123: Imported Route Segments Sample Tree

There are several actions that the user is allowed to perform over an imported route layer. Such actions are displayed after right-clicking over an imported route layer (Figure 124).

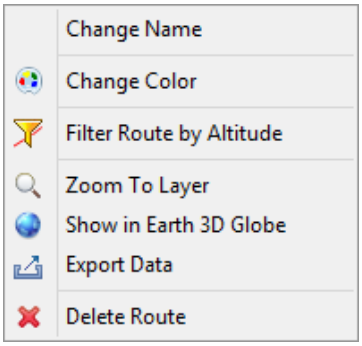


Figure 124: Route Segments Layers Options

This menu allows the following actions:

Change Name

Allows to change the current name of the layer by a new one.

Change Color

A simple color palette window will be shown in order to allow the user to choose a color to paint the elements on the layer, which contain elevation data. Note that elements with NULL elevation will not be affected and thus, cannot be changed. In order to be able to perform such action, the user must re-import the route segments file.

Show in Earth 3D Globe

Shows the layer in the 3D map.

Zoom to Layer

This action will force the map to zoom on the envelope of the respective selected route layer.

Export Data

This action allows exporting the layer to shapefile or KML file.

Delete Route

This action will delete the selected route layer.

Filter Route by Altitude

This action will show an integrated window below the layer tree, in which the user can filter the route. This filter will make the layer show on the map only the routes segments in which the range between the minimum elevation and the maximum elevation contain the given filter elevation value. The described window is shown below with a description of the functionality:

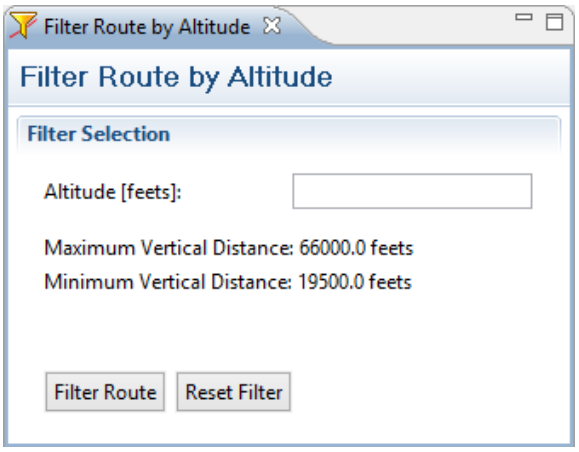


Figure 125: Filter Route Segments Layers View

Considering this view, under "Filter Selection" section, the "Altitude" field allows the user to set the altitude value with which the layer will be filtered. In this field, the user must enter a value that is considered inside the range represented by "Maximum Vertical Distance" and "Minimum Vertical Distance", otherwise a warning will be shown.

Clicking the "Filter Route" button will trigger the filter to the value on the "Altitude" field. Clicking the "Reset Filter" button will turn the changes that have been made to the layer, reverting them to its initial state, hence, without filtering.

9.2. IMPORT ROUTE SEGMENTS FROM XML

It is also possible to import **Route Segments** from a XML file (**Figure 126**).

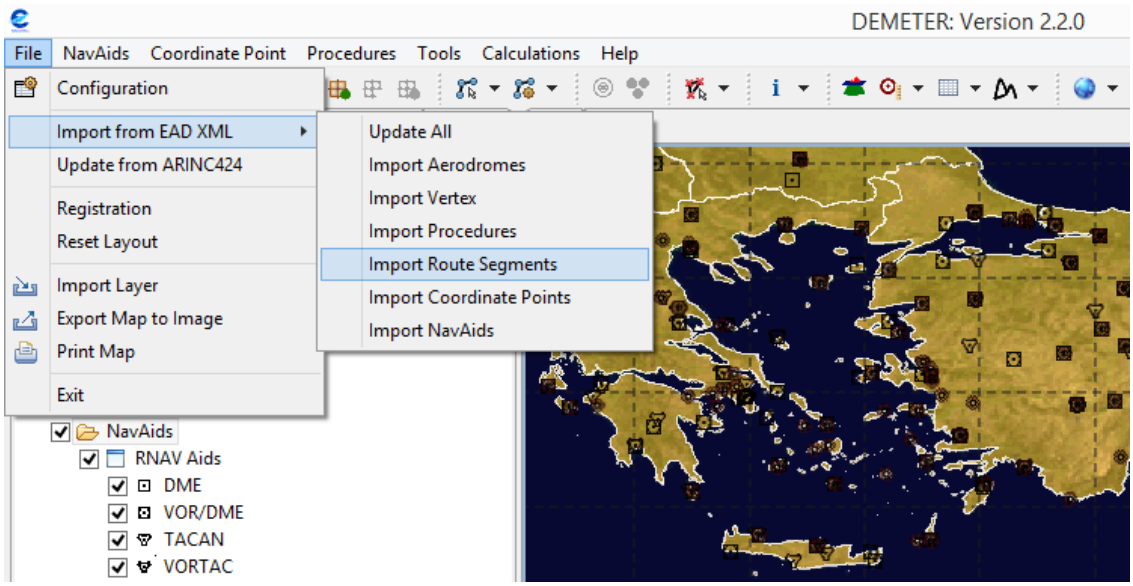


Figure 126: Import Route Segments from EAD XML menu

Route segments represent parts of a procedure and can be managed as such. In order to import route segments, the user should select the "File -> Import From EAD XML -> Import Route Segments" menu, which will show the following window:

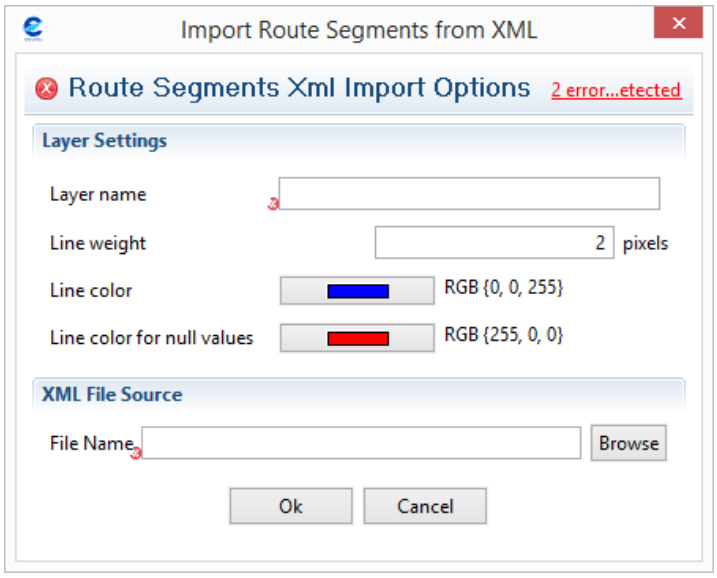


Figure 127: Route Segments Layer Options

In the window that is presented in **Figure 127**, the user is able to select the file he desires to import, as well as edit the layer settings (layer name, line weight, line color for valid values and null values). Clicking "Ok" will allow the user to select the set of routes to import (**Figure 128**).

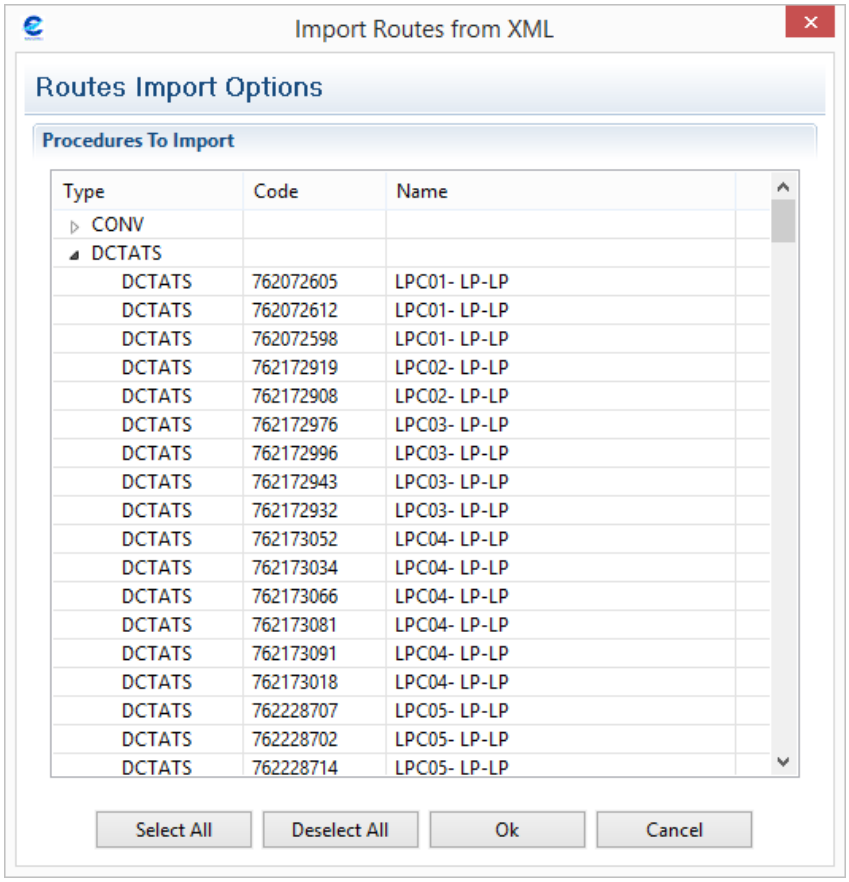


Figure 128: Route segments Import Options

Note that the user either is able to select a single segment from a route, or several segments (using CTRL/SHIFT while clicking the routes on the list). Additionally, clicking a route type (expandable) will import all the routes under that type.

9.3. CREATE EN-ROUTE PROCEDURE FROM ROUTE SEGMENTS

Continuous route segments can be used in order to create en-route procedures based on the elevation values and segment position that are present on each segment. In order to do this, the user should first select a set of **continuous** route segments (Figure 129).

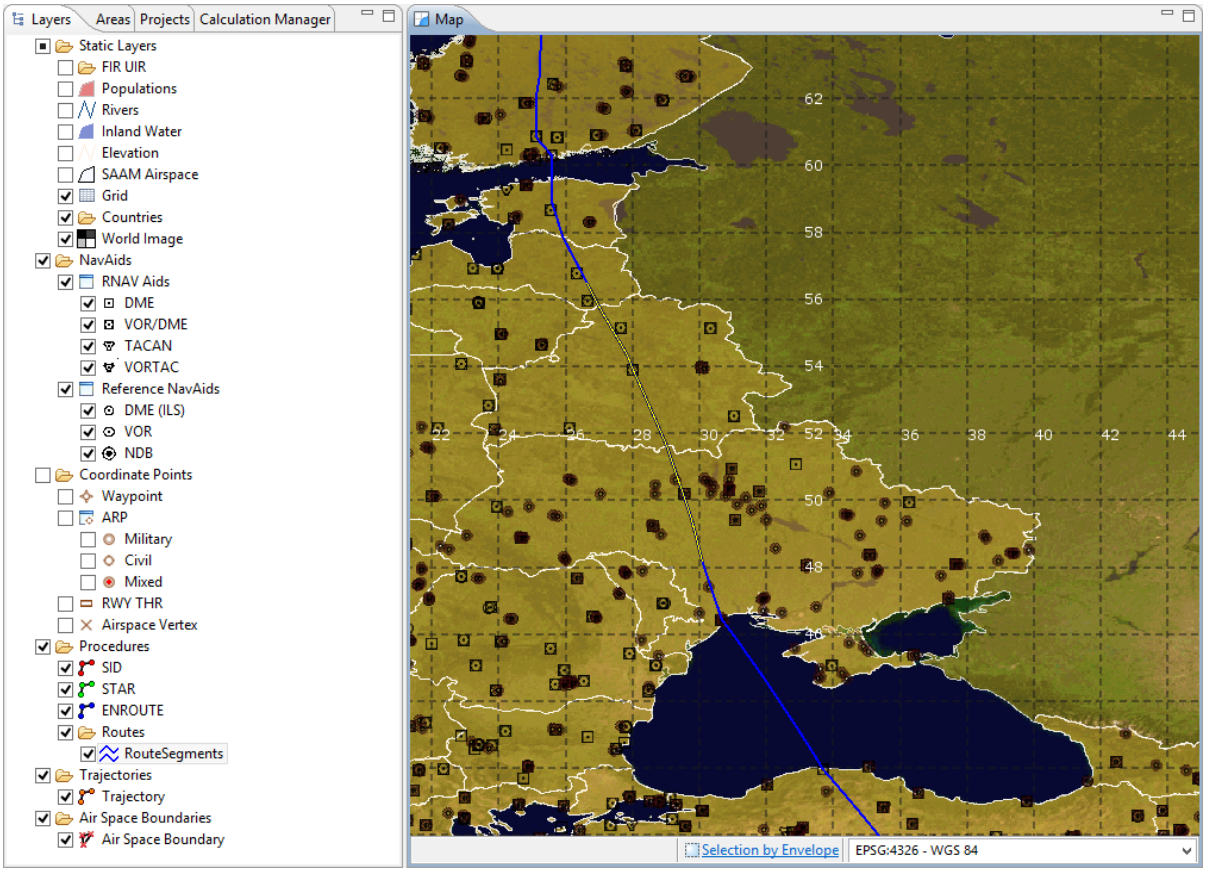


Figure 129: Route Segments selection

Then, the user should click the on the "Procedures -> Create Procedure from Route Segment" menu:

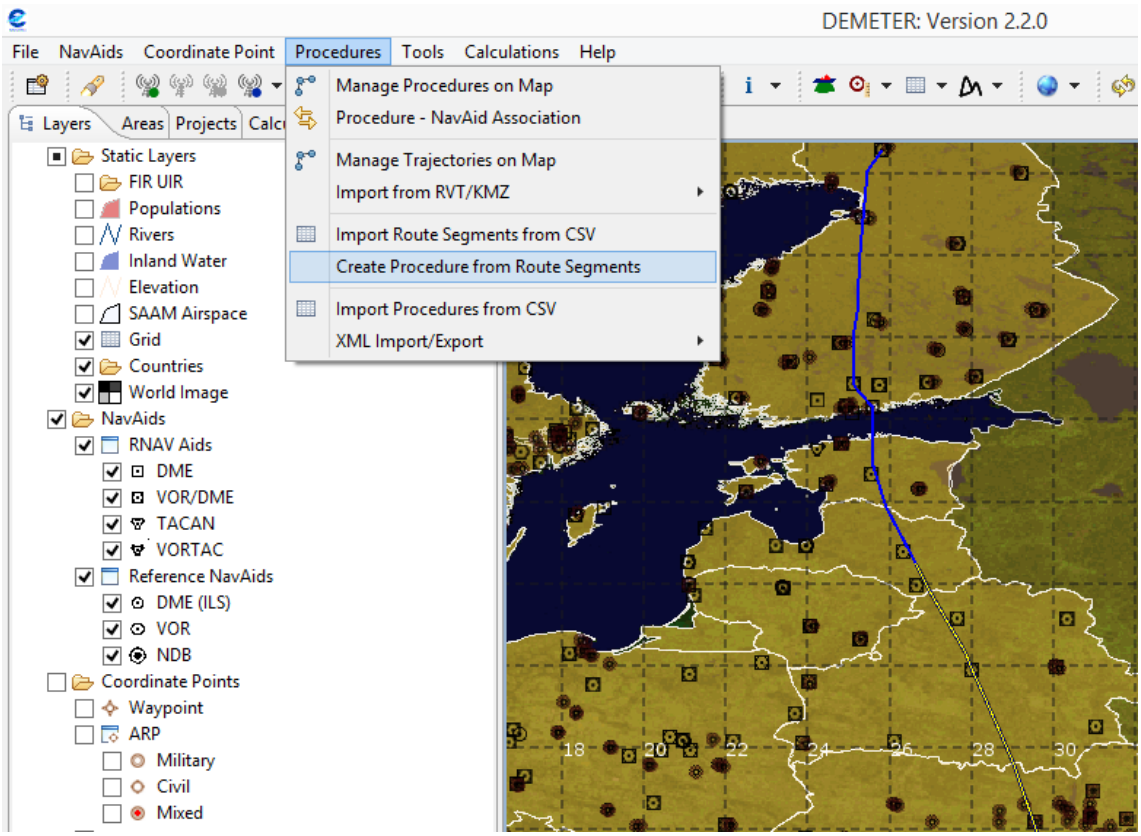


Figure 130: Create Procedure from Route Segments menu

The route imported layers can be selected on the layer tree in order to perform a map selection with the selection tools available. Once the user selects a number of segments the "Create Procedure from Route Segments" the application will analyze the continuity of the selected segments. Note that if the selected segments are part of only one route and they are not continuous the following message will be displayed:

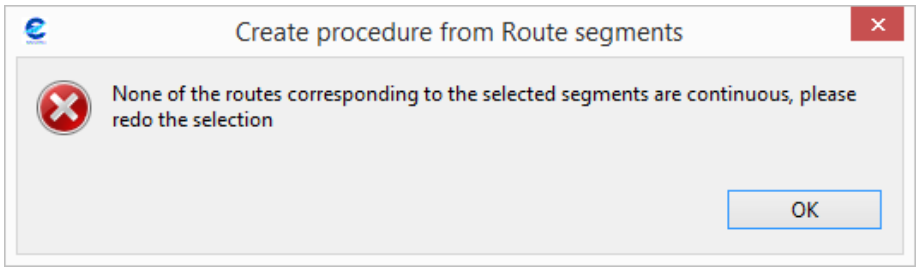


Figure 131: Warning creating procedures from route segments

If the selected segments refer to different routes, a window will be shown so that the user can choose which route he desires to select for the creation of the procedure:

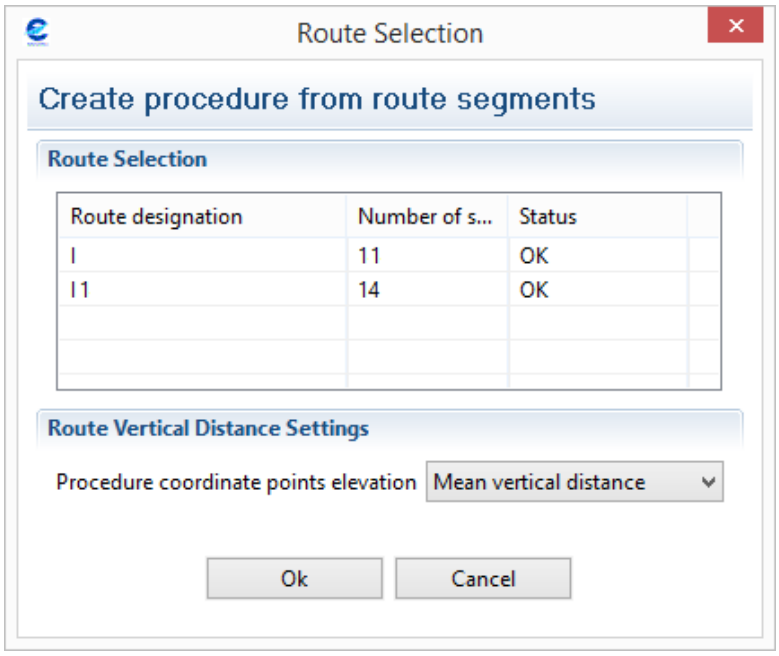


Figure 132: Creating procedures from route segments – Route Selection

In this last window, the user must choose one route from the routes present on the "Route Selection" table. Note that in this case, the first route is displayed with a different color - this represents that the route is **invalid** and the invalidation reason is explained on the "Status" column.

Under the "Route Vertical Distance Settings" section, the user can choose between "Mean vertical distance", "Maximum vertical distance" and "Minimum vertical distance" in order to use the mean, maximum or minimum elevation value (respectively) for each waypoint of the procedure the user is about to create.

This mean, maximum and minimum elevation value refers to the mean, maximum and minimum value of the range composed by the maximum vertical distance and the minimum vertical distance of each route segment.

After this selection, the "Create Procedure from Route" window will be displayed under the map with a display and functionality equal to the view created on the selection of "Create Procedure from Map" tool (see **section 8.1.1** for further details).

10.IMPORT/EXPORT INFORMATION

On DEMETER there are several methods that allow the import and export of data. Such data can be used to exchange information between DEMETER users. All the entities managed by DEMETER (**NavAids**, **Coordinate Points**, **Procedures** and **Airspace Boundaries**) can be imported and exported in XML format. This format was chosen due to the fact that it is an open standard format. In addition, it is a format very easy to view and edit on any text editor.

Additionally to the **XML format**, DEMETER also supports to import data from **CSV formats** for Procedures, Flight Inspections and Obstacle data.

10.1.XML FILES

The user can find in some DEMETER menus an XML Import/Export submenu. This feature is used to load or save information in xml files. For each menu there are different options depending on the data type:

10.1.1.NAVAIDS

XML Import/Export

Full Data

Import: this function loads the primary and the secondary data from a NavAid file.

Export Selected NavAids: this function saves in a file the primary and the secondary data of selected NavAids.

Export All NavAids: this function saves in a file the primary and the secondary data of all the NavAids stored on the Database.

Secondary Data

Import: this function loads the secondary data from a NavAid file. Note that the NavAids must exist already on the database.

Export Selected NavAids: this function saves in a file the secondary data of selected NavAids.

Export All NavAids: this function saves in a file the secondary data of all the NavAids stored on the Database.

10.1.2. COORDINATE POINTS

XML Import/Export

Import: this function loads a Coordinate Point file.

Export Selected: this function saves a Coordinate Point file with the selected Coordinate Points.

Export All: this function saves a Coordinate Point file with all the Coordinate Points stored on the Database.

10.1.3. PROCEDURES

XML Import/Export

Import: this function loads a file with Procedures and stores them in the Database.

Export Selected: this function creates a file with selected Procedures.

Export All: this function creates a file with all the Procedures stored on the Database.

10.1.4. AIRSPACE BOUNDARIES

XML Import/Export

Import: this function loads a file with Airspace Boundaries data and stores them in the Database.

Export Selected: this function creates a file with selected Airspace Boundaries.

Export All: this function creates a file with all the Airspace Boundaries stored on the Database.

10.2.CSV FILES

As stated before, DEMETER supports the import of data on a CSV formats for **Procedures**, **Flight Inspections** and **Obstacle data**. On this chapter it is explained only the method to import Procedures. The explanation on how to import the other two types is presented on the respective chapters. In order to import a procedure, the user should follow these steps:

1. Select the "Procedure -> Import Procedure from CSV" menu. The following window will be presented:

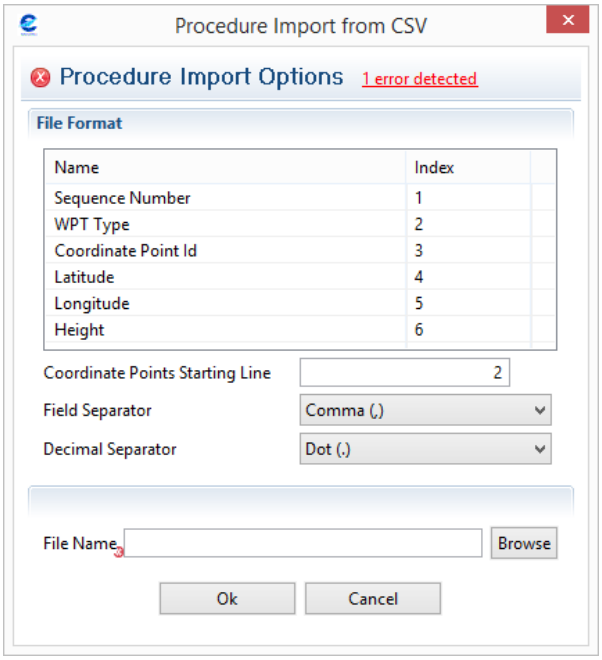


Figure 133: Procedure Import from CSV

2. DEMETER supports different formats for the CSV file. Before using the tool, the user needs to define the CSV file format, namely the column number where each parameter is stored. On the CSV, a list of coordinate points is expected. The following parameters to define a waypoint must be present on the CSV file:

   - **Sequence Number**
   - **WPT Type**
   - **Coordinate Point Id**
   - **Coordinate Point Latitude**
   - **Coordinate Point Longitude**
   - **Coordinate Point Altitude**

3. With a double click on the values on the "Index" column, the user is able to configure each field according to the required CSV file columns.

4. Enter the line number on the CSV file where the first Coordinate Point is defined on the field "Coordinate Points Starting Line"

5. Select the Field Separator and Decimal Separators used on the CSV file

6. Select the file name clicking on the "Browse" button

7. After clicking "Ok", the configurations of the import process are applied

The CSV file format does not support all the DEMETER necessary fields to define a procedure. Before the procedure can be stored on the database the user must fill the remaining fields. For that purpose, a new window is displayed equal to the one used on the create Procedure option (see chapter 8.1.1). The data imported from the CSV will be already filled, but even so, the user must fill the following fields that are missing, such as:

- **Identifier**
- **Name**
- **Procedure Type**
- **RNAV Performance Type**
- **Reference Airport** (Optional)
- **Aircraft Speed** (Optional)

If a coordinate point that is present on the file does not match with an existing point on DEMETER, the user must also enter the Coordinate Point's Name. The last step is to save the procedure on the database, by clicking on the "Save" button.

10.3. AERONAUTIC FORMATS: AIXM 4.5, AIXM 5.1 AND ARINC424

DEMETER allows the user to import information (**NavAids** and **Coordinate Points**) from official Aeronautic databases. The user is able to import information in two different formats: **AIXM 4.5** and **AIXM 5.1** exported from the EAD database and **ARINC424** format. Currently the procedure import from **AIXM 5.1** is not yet supported.

In order to import this data the user must select the respective option on the "File Menu" and select the source file. Usually these files are big so the import process could take some time to finish.

During the update process, DEMETER reads and parses each entry at a time. Because not all the parameters stored on the DEMETER database are mandatory on the EAD or ARINC 424 files, during the update process 2 different scenarios could happen:

- If the field being processed is present on EAD or ARINC 424 file (e.g. NavAids DOC) and also on the DEMETER database the new information overwrites the information on the DEMETER database (which is lost). The exception is if the user has marked the NavAid or Coordinate Point as "Not to be updated".
- If a field is missing on the EAD or ARINC 424 file (e.g. DOC maximum altitude) but it is present on the DEMETER database the value is not deleted.

At the end, the DEMETER update process has made a simple merge process where EAD and ARINC 424 files have more priority than the DEMETER database.

Before DEMETER starts the update process a warning window is displayed to the user to alert for this process.

When the import process is finished, DEMETER identifies the potential duplication NavAids or Coordinate Points and lists them on a separate window. The information is also stored on the working log file (see **chapter 15** for further details about the working log).

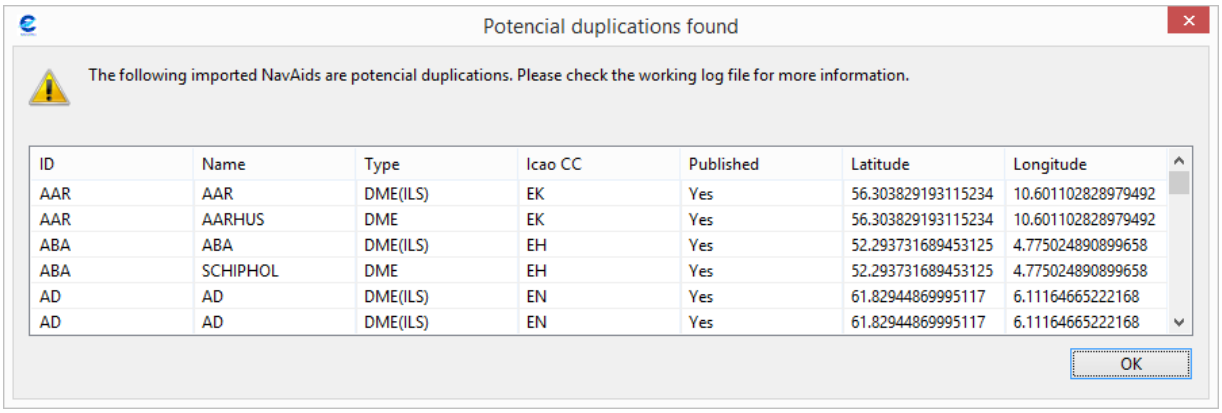


Figure 134: Duplication Analysis Result

10.4. RVT TRAJECTORIES

The RNAV Validation Tool – RVT – is a desktop application, developed by DWI for EUROCONTROL, to help procedure designers in the ground validation of new or modified RNAV SIDs and STARs. Ground validation is a key step between the design and the implementation of RNAV procedures. The RNAV Validation Tool provides a user-friendly, cost-effective method of ground validation with the capacity to input and update procedures, together with their supporting waypoints and NavAids.

DEMETER allows the import of trajectories exported by RVT. The following figure shows the option that should be selected.

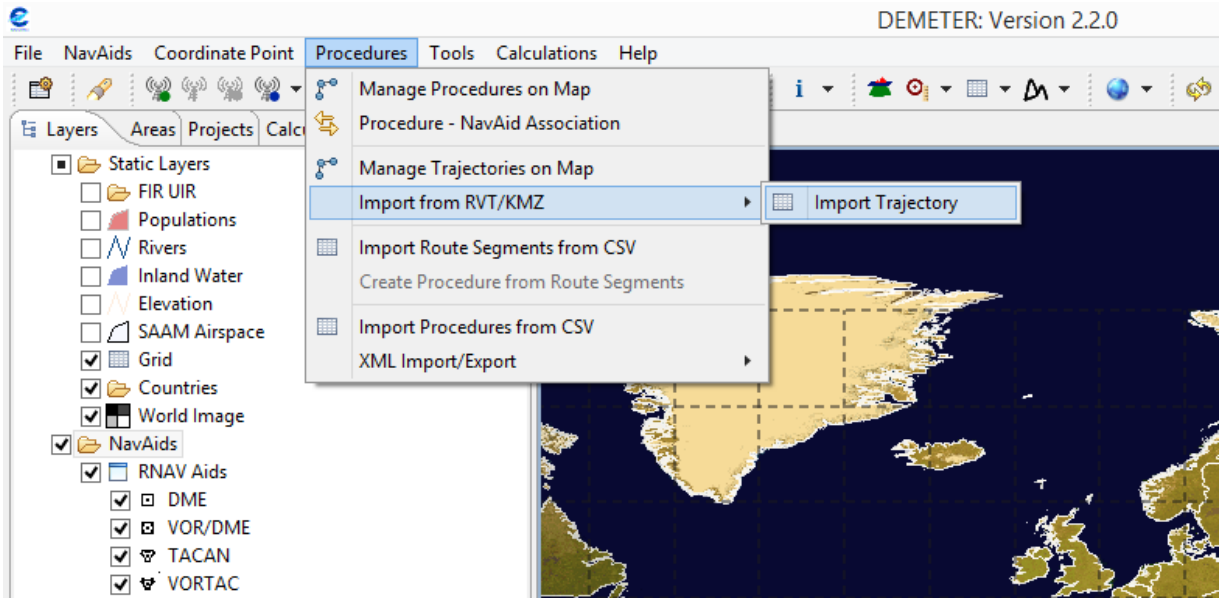


Figure 135 - Import trajectories from RVT option

When selected, it will appear a window where is possible to configure the trajectory to import. It can be by selecting an existing procedure or creating a new procedure without waypoints. The procedure will not be shown on the map.

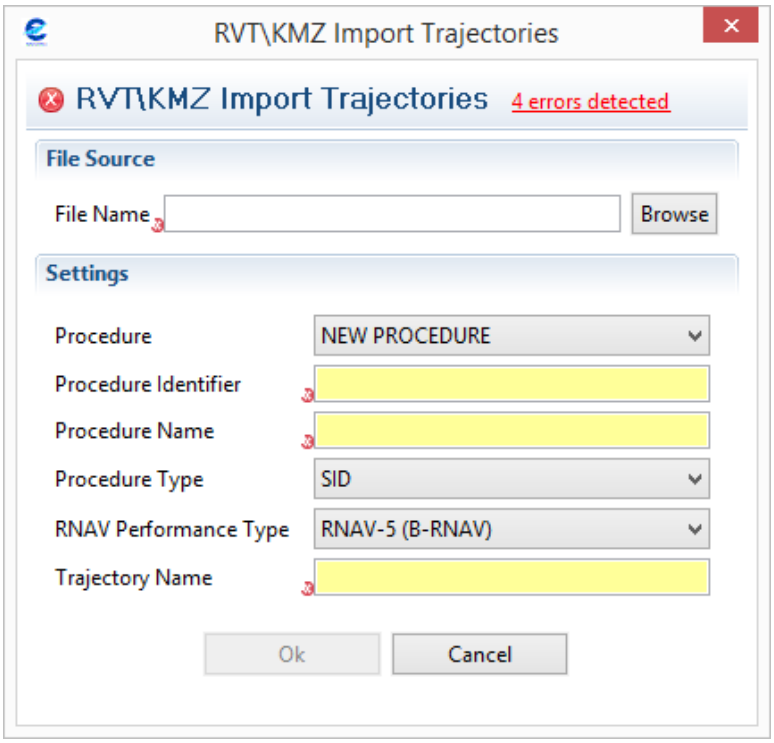


Figure 136 - RVT\KMZ import trajectories configuration

After the import, the imported trajectory will be shown on map and will look like the following figure.

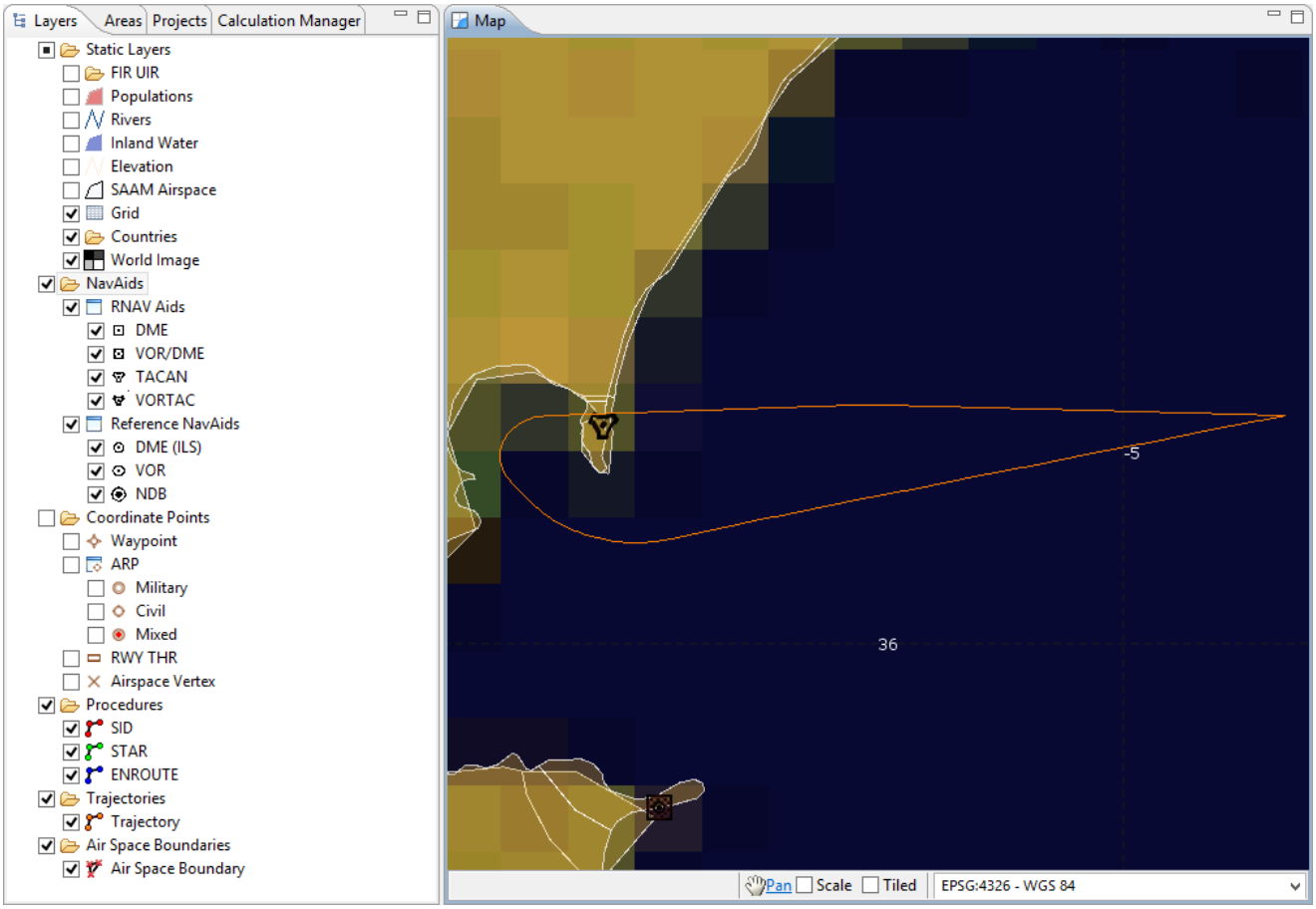


Figure 137 - Imported trajectory in DEMETER

11.AIR SPACE BOUNDARIES

DEMETER also allows the user to create **Air Space boundaries**. These entities are geometric figures that can be created over the map and are merely informative. The Air Space Boundaries are areas defined by the **Airspace Boundary Vertexes** (one type of Coordinate Points).

On this menu and toolbar the user has the possibility to manage the Air Space Boundaries (create, edit, add/remove from the map and delete). On next subchapters it is described in detail the necessary steps to use each option.

11.1.CREATE AIR SPACE BOUNDARY FROM SELECTED VERTICES

One of the ways to create Air Space Boundaries is by selecting some existing Vertex from an area. This is the process to create new Air Space Boundaries:

1. Select some Vertex by clicking on Airspace Vertex layer and using any selection method.
2. Click on  (Create Air Space Boundary from Selected Vertices) icon on the Toolbar.
3. A new window like this appears:

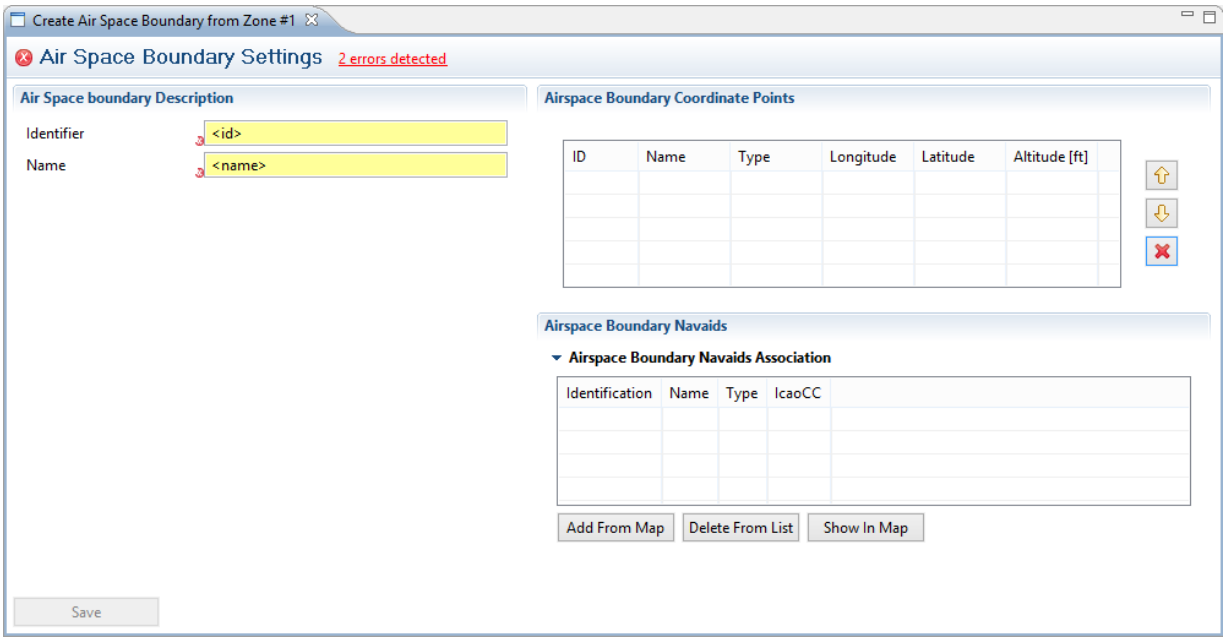


Figure 138: Create Air Space Boundary from Zone

4. In the "**Air Space Boundary Description"** area in Create Air Space Boundary from zone window the user must:

   a. Type the **Identifier** for the new Air Space Boundary.

   b. Type the **Name** for the new Air Space Boundary.

5. In the "**Air Space Boundary Coordinate Points"** area in Create Air Space Boundary from Zone:

   a. Below the list you will find a scroll-down menu with all selected Coordinate Points. Pick one of them.

   b. Set the Altitude for the Procedure at that point with any value between the limits defined on Table 43.

Table 43: Altitude limits for Air Space Boundaries' Coordinate Points fields

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

   c. Picked point will go to the top of the list.

   d. Repeat from **step "c"** till here until the list has all the required Coordinate Points.

   e. Now you can reorder Coordinate Points by selecting them on the list and clicking on  to move up or  to move down the list. The order of the list will define the order and the sequence of the points into the Airspace Boundary. The Airspace Boundary representation on the map is also updated.

   f. You can delete any selected Coordinate Point from the list by clicking on it and then on  .

6. The user can add NavAids to the Air Space Boundary. Just select the NavAids on the map and click "Add From Map" button. It is also possible to remove NavAids or change their order in the list.
7. When all is done click on the "Save" button to store the Air Space Boundary.

11.2. CREATE AIR SPACE BOUNDARY FROM MAP

This creation method allows the user to interact with the map in order to create Air Space Boundaries. The process is based on clicking over the map – to create points or select them – in order to define the **Air Space Boundaries**. This is the process to create new Air Space Boundaries:

1. Click on icon on Toolbar.

2. A new view like this appears:

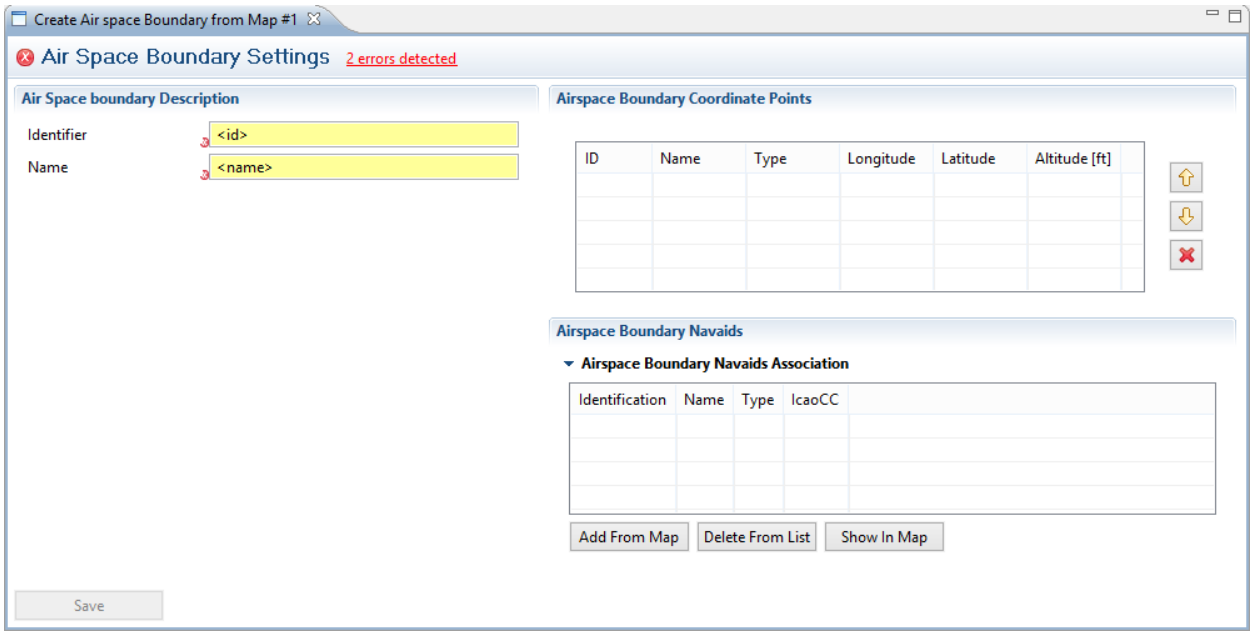


Figure 139: Create Air Space Boundary from Map

3. In the **Air Space Boundary Description** area in Create Air Space Boundary from Map window the user must:

   a. Type the **Identifier** for the new Air Space Boundary.

   b. Type the **Name** for the new Air Space Boundary.

   c. Double click anywhere on the map to set first Vertex. Notice how the clicked position location (Latitude and Longitude) will appear on the list.

4. Anytime the user double clicks on the map to add an Airspace Boundary Vertex, one of two cases can happen:

New Vertex

If you select any position on the map where there is no Air Space Vertex, DEMETER will create a new one for this purpose.

Existing Vertex

If you click next to any Air Space Vertex on the map a new windows will appear:

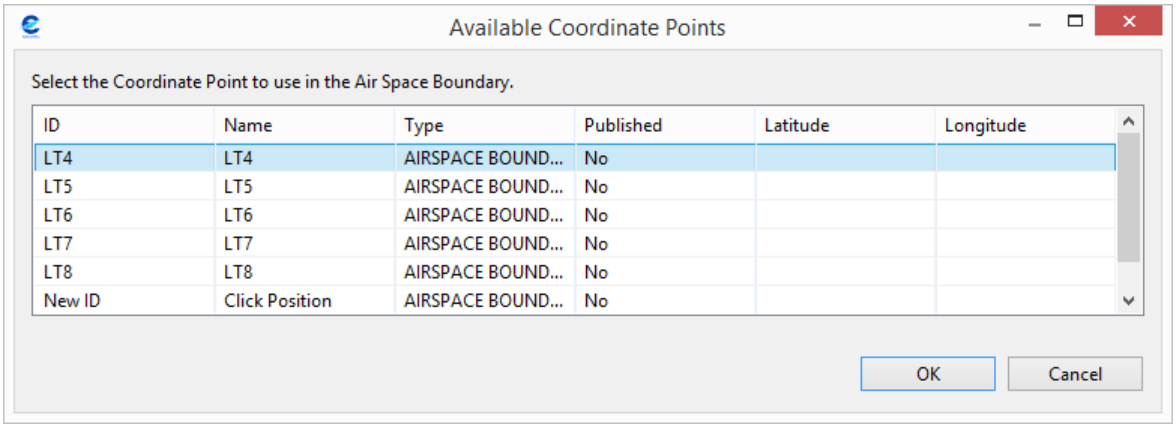


Figure 140: Available Airspace Vertex

Pick any of the available Coordinate Points or the new one added to the list and click on OK. The Air Space Boundary will include that point on the list. If you click on Cancel DEMETER will cancel choosing or creating any Coordinate Point on clicked position.

5. The new Coordinate Points are highlighted in blue on the Air Spec Boundary Coordinate Points list. For these points, the user must enter a value for the ID and Name.

6. Set the Altitude for the Air Space Boundary at each point, clicking on Altitude field, with any value between the limits defined on Table 43.

7. Now you can reorder Coordinate Points by selecting them on the list and clicking on to move up or to move down the list. The order of the list will define the order and the sequence of the points into the Airspace Boundary. The Airspace Boundary representation on the map is also updated.

8. You can delete any selected Coordinate Point from the list by clicking on it and then on .

9. The user can add NavAids to the Air Space Boundary. Just select the NavAids on the map and click "Add From Map" button. It is also possible to remove NavAids or change their order in the list.

10. Click on the "Save" button to store the Air Space Boundary.

11.3. EDIT AIR SPACE BOUNDARIES

You can edit any Air Space Boundary by following these steps:

1. Using one of the selection tools, select one Air Space Boundary from the map (make sure Air Space Boundaries layer is selected and visibility checkbox is checked).

2. Click on  icon on the Toolbar.

3. A window similar to this will appear:

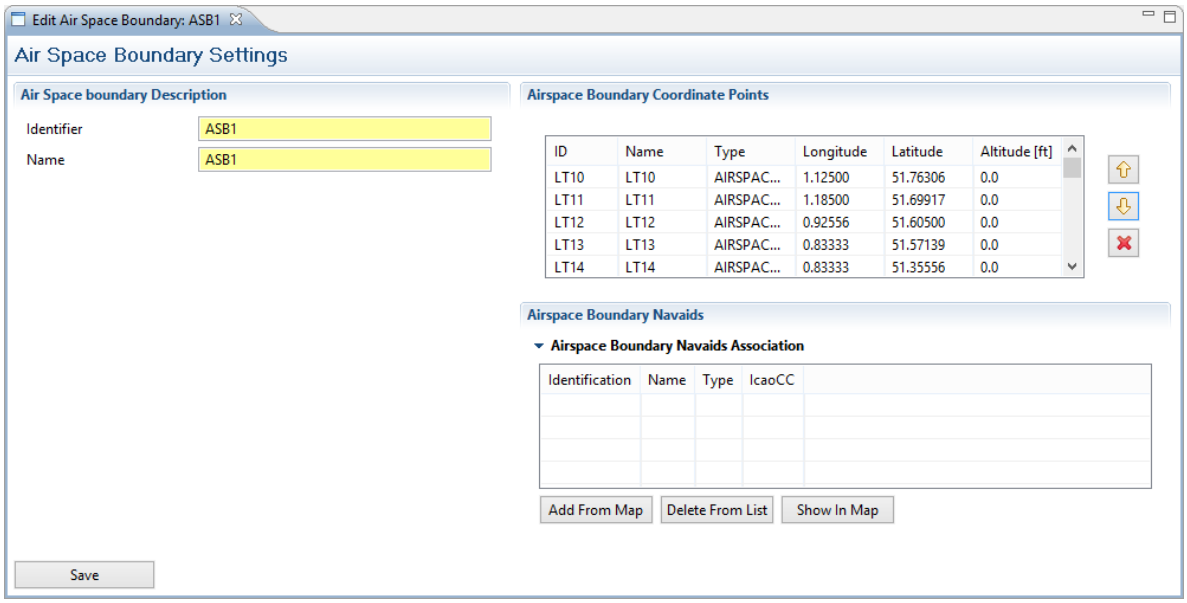


Figure 141: Edit Air Space Boundary

4. In the "Air Space Boundary Description" area in the "Edit Air Space Boundary" view, the user can:

   a. Change the **Identifier** for the new Air Space Boundary.

   b. Change the **Name** for the new Air Space Boundary.

   c. Modify the **Altitude** for the Air Space Boundary at each point, clicking on "Altitude" field, with any value between the limits defined on Table 43.

5. Now you can reorder Coordinate Points by selecting them on the list and clicking on  to move up or  to move down the list. The order of the list will define the order and the sequence of the points into the Airspace Boundary. The Airspace Boundary representation on the map is also updated.

6. You can add new Coordinate Point with a double click on the map.

7. You can delete any Coordinate Point from the list by clicking on it and then on the icon.

8. The user can add NavAids to the Air Space Boundary. Just select the NavAids on the map and click "Add From Map" button. It is also possible to remove NavAids or change their order in the list.

9. When all the changes to the Air Space Boundary are finished click on the "Save" button to store the Air Space Boundary.

11.4. ADD/DELETE FROM MAP OR DATABASE

On DEMETER you can manage Airspace Boundaries with a simple tool. This tool lets you **show** or **hide** any Air Space Boundary from the map, or **delete** them from the database. In order to do so, follow the next steps:

1. Select the "Tools -> Manage Air Space Boundaries on Map" menu.

2. The following window will appear:

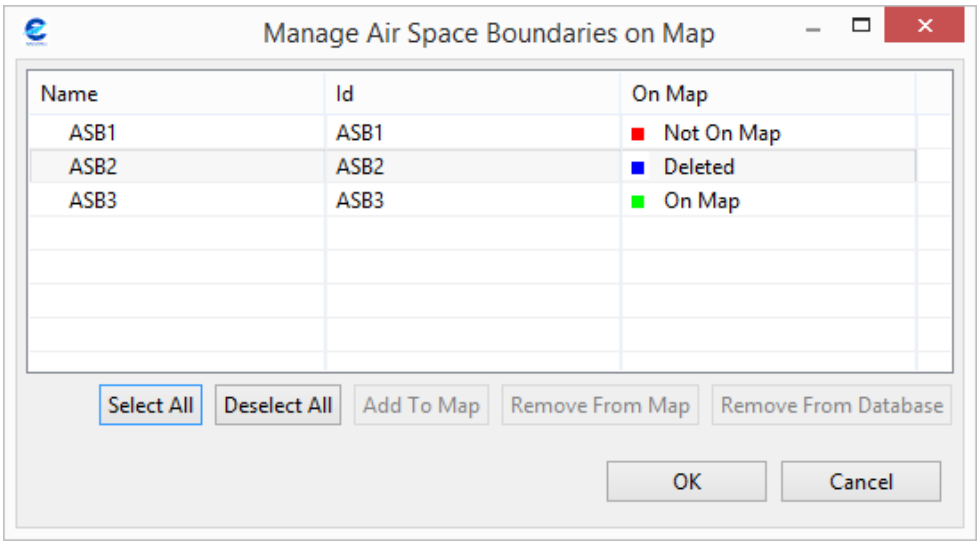


Figure 142: Manage Air Space Boundaries

3. All the Air Space Boundaries stored on the database are shown on this window.

4. Note how the "On Map" field presents the Air Space Boundaries that are being considered:

Green Color

This color means that the Air Space Boundary is currently **shown** On Map.

Red Color

This color means that the Air Space Boundary is currently **not shown** On Map.

Blue Color

This color means that the Air Space Boundary will be deleted as the user clicks on the "OK" button.

5. To show any hidden Air Space Boundaries select it and click on the "Add to Map" button.

6. To hide any shown Air Space Boundaries select it and click on the "Remove From Map" button.

7. To delete from Database select any Air Space Boundary and click on the "Remove From Database" button (Note that the information will be lost!).

8. Click on "OK" in order to apply changes.

12.CALCULATIONS

In this chapter there are described all the calculation tools available on DEMETER. This chapter is divided in four parts:

First Part

Introduction to the internal calculation database

Second Part

How to use and manage area calculations

Third Part

How to use and manage procedure calculations

Fourth Part

Terrain files and formats supported by DEMETER

12.1.CALCULATION DATABASE

One of the most important features on DEMETER is the ability to execute calculations taking into account the NavAids and terrain around them. All the calculations performed by DEMETER are executed in 3 steps.

First Step

The terrain is evaluated to calculate the terrain summits for each selected NavAid. A **Summit** is the point on the terrain where it is made the transition between visible and invisible terrain area. For example the top of a mountain hides some terrain behind the summit point.

Second Step

The visibility of the selected NavAids is calculated. For the area inside the NavAid coverage a sampling is made to divide the terrain in cells. The sampling size is defined with the configuration parameters described on **sections 0** and **5.6.3**. For each cell a minimum and maximum visibility Altitude is calculated.

Third Step

An independent calculation is made, using the parameters that have been acquired from the first two steps.

Note that all the calculations executed by DEMETER will be based on the information calculated on previous steps. Every time the user executes a calculation with a new NavAid, DEMETER will execute these three steps before presenting the result. The **summits** and **visibility** data is stored internally in files. The next time a NavAid is used on a calculation, the summits and visibility information is reused and not calculated again, which greatly optimizes the calculations' performance.

Despite this fact, the user has the possibility to force DEMETER to execute the Summit and Visibility calculation for a set of selected NavAids. In order to do so, the user should select at least one NavAid and click on the "Calculation -> Build Calculation Database" menu (Figure 143).

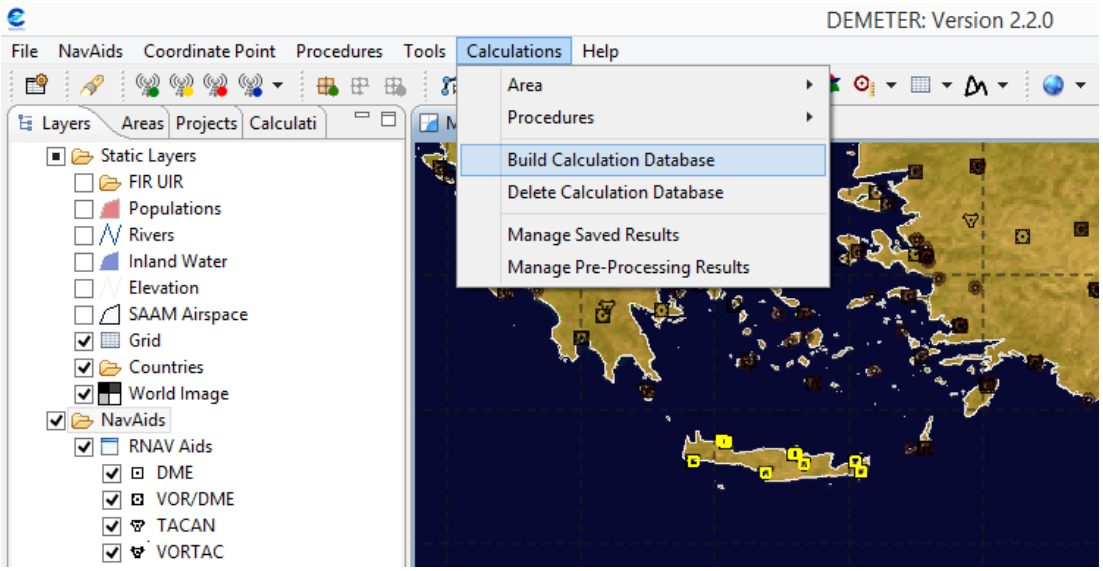


Figure 143: Build Calculation Database menu

If for some reason the user wants to delete the previously stored values, there is also an option on the "Calculation -> Delete Calculation Database" menu. Note: If you delete this information next calculation will be slower because DEMETER will need to calculate the Summits and the Visibility again (Figure 144).

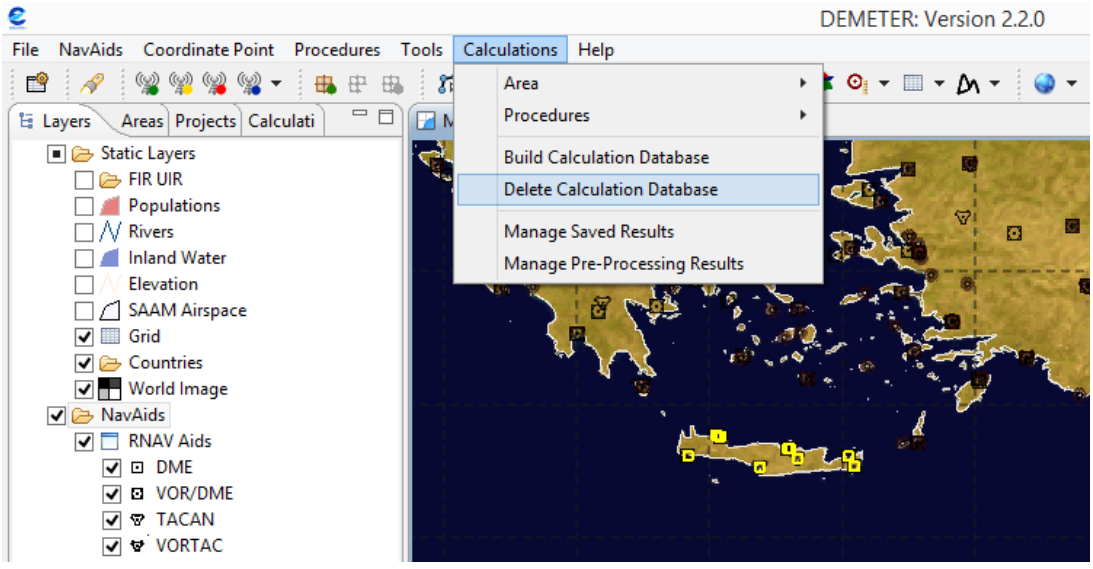


Figure 144: Delete Calculation Database menu

Note that the "Delete Calculation Database" command is automatically executed if the user changes the terrain files on the configuration page. This is mandatory in order to prevent data inconsistencies between the internal calculation database and the terrain information.

12.2. AREA CALCULATIONS

On this chapter it is described the Area calculation tools. All of them are available together on a menu on the DEMETER. Under Calculation there is a submenu for Area calculations. In addition there are 2 icons on the icons toolbar for a quick access to the Coverage and Performance calculations (Figure 145).

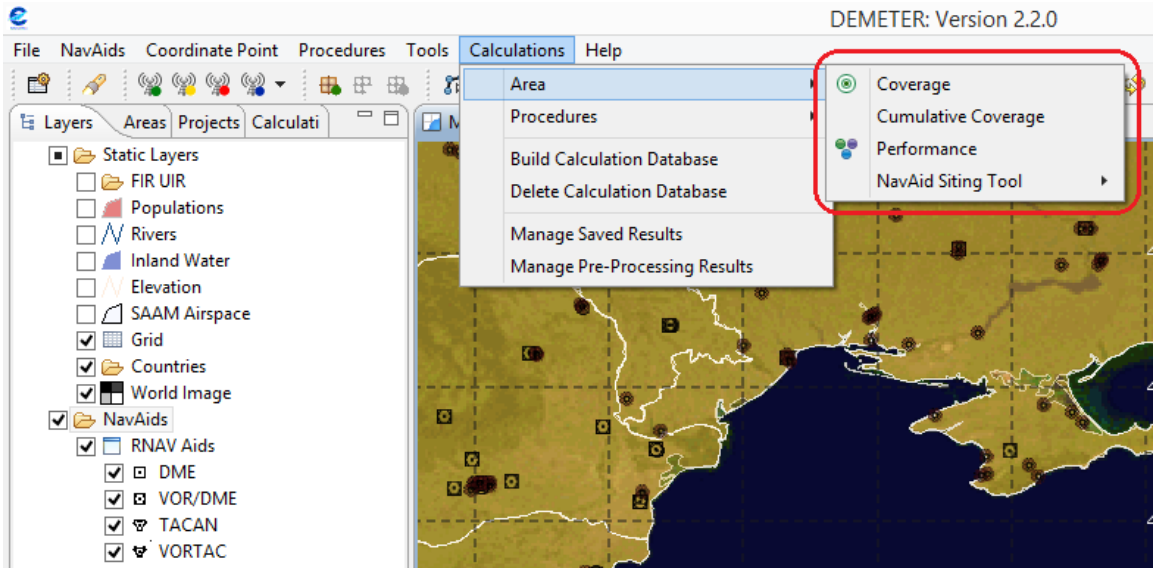


Figure 145: Area Calculations menu

On the area calculations it is included the **Coverage**, the **Cumulative Coverage**, the **Performance** and the **Siting Tool**.

12.2.1. COVERAGE

The purpose of the Coverage tool is to calculate the line-of-sight from a NavAid, considering the imaginary sphere surface floating on a specified altitude value. The limits for the coverage are imposed by the following factors:

Terrain Elevations

NavAid Characteristics

- DOC
- Sectorizations
- Minimum Screening Angle
- Cone of Silence

Earth Curvature (specified by the K-Factor on the configuration)

RNAV Constrains (specified on the configurations - Min and Max DME Range, Max Elevation Angle)

DEMETER is able to calculate the coverage for a range of selected NavAids and for a specified range of altitudes. The result is displayed over the 2D map with a color code in order to distinguish the different altitudes. After the coverage calculation is finished the user can use an **Analysis Tool** to analyze the results with more detail. To calculate Area Coverage please follow next steps:

6. Select one or more NavAids from the map.

7. Select the "Calculations -> Area -> Coverage" menu or click on the icon, located on the toolbar. The following menu will be displayed:

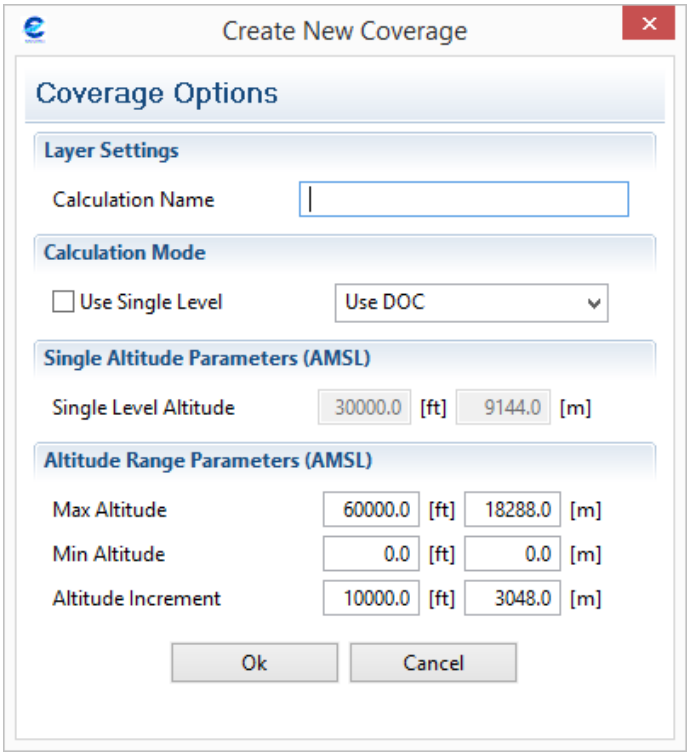


Figure 146: Calculate Coverage configuration parameters

8. Type the optional calculation **Name**. If this field is left blank, it will be defaulted.

9. Check or uncheck the "Use Single Level" checkbox:

Checked

DEMETER will calculate only at the specified level defined by Single Altitude Parameters. Type the Altitude making sure the value is between the limits defined on Table 44.

Table 44: Single Level Altitude limits for Area Coverage Calculation

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Unchecked

DEMETER will calculate according to the Altitude Range parameters:

- **Max Altitude:** Highest calculation altitude.
- **Min Altitude:** Minimum calculation altitude.
- **Altitude Increment:** DEMETER will calculate the area coverage starting with min altitude and then adding this Increment until the altitude reach the maximum value.

Note that all values have to be between the limits of the following tables:

Table 45: Max Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Table 46: Min Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Table 47: Altitude Increment Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	100	3.4028235e38
Meters [m]	30.48	1.0371806e38

10. Select "Use DOC" or "Use Free Space Path Loss" in the drop down.

Use DOC

The DOC value obtained from database will be used to perform the coverage calculation.

Use Free Space Path Loss

The EIRP value obtained from the database will be used to perform the coverage calculation.

11. Click on the "OK" button and wait for the calculation results. Before the calculation starts, the NavAids data is verified. If there is any problem, an alert window is displayed. See section 0 for further details on the different issues that can occur on calculations.

12. When the results are displayed on the map, also a "Results" folder will appear on the Layers tree. You can see the layer legend if the tree nodes are expanded (Figure 147).

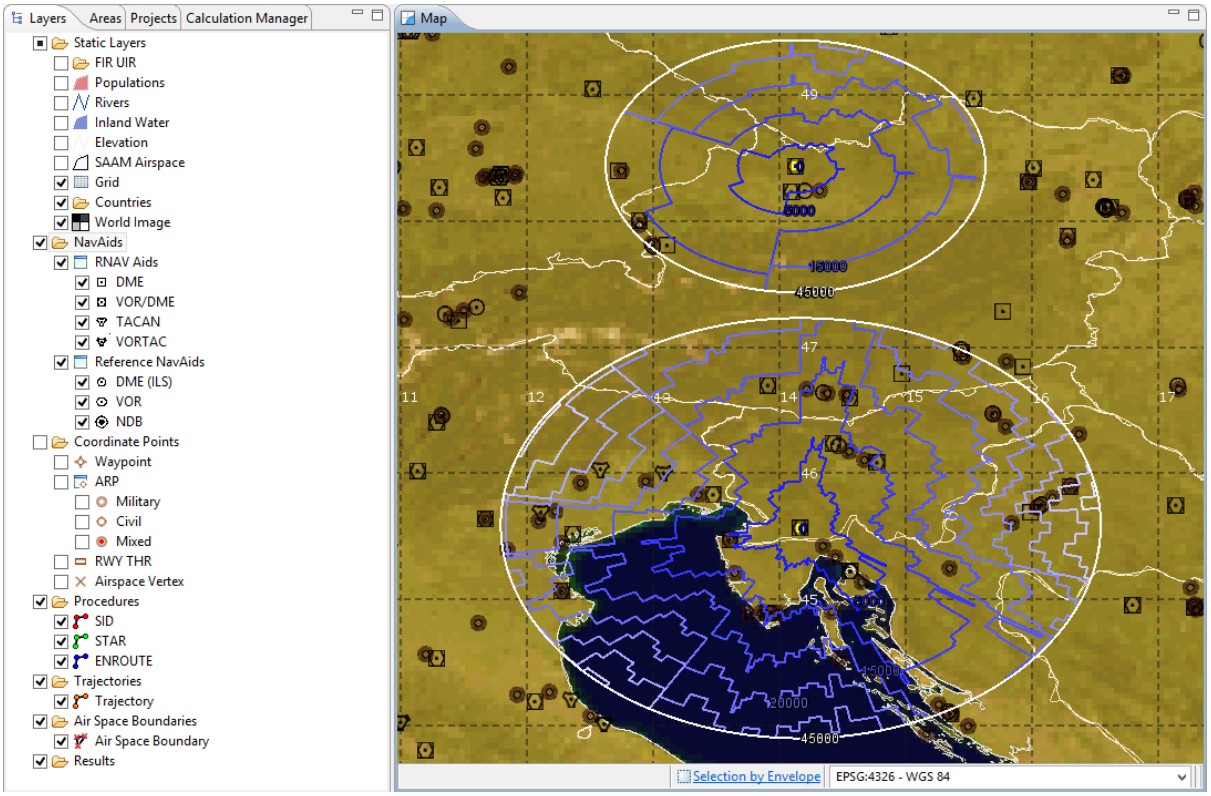


Figure 147: Coverage Calculation results

The presented result shows the line of sight defined by the NavAid parameters and terrain around that NavAid. Each blue line represents the line defined by the intersection of NavAid line of sight (LOS) and the imaginary sphere at the specified altitude.

12.2.1.1. Analyze Coverage Results

In order to analyze the coverage result, the user can utilize the "Analysis Tool". This tool allows the user to filter the results per NavAid, or per Altitude, or even both. In order to use this tool, the user should execute the following steps:

1. After a calculation is performed, on the "Results" folder, right-click on the "Coverage" layer.

2. Click on the "Analysis Tool" option.

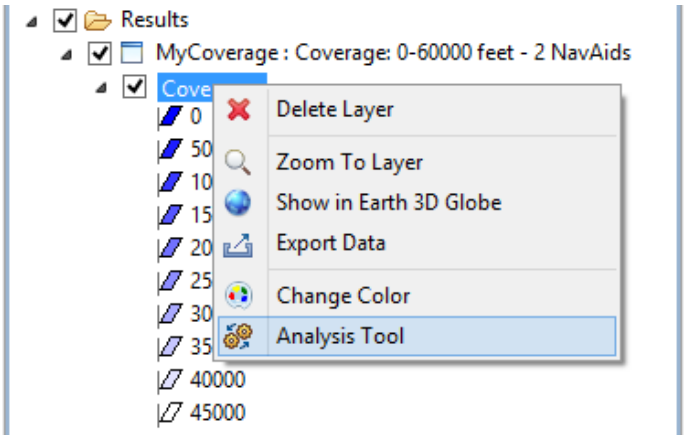


Figure 148: Coverage Analysis Tool

3. Below the Layer Tree, the following menu will appear:

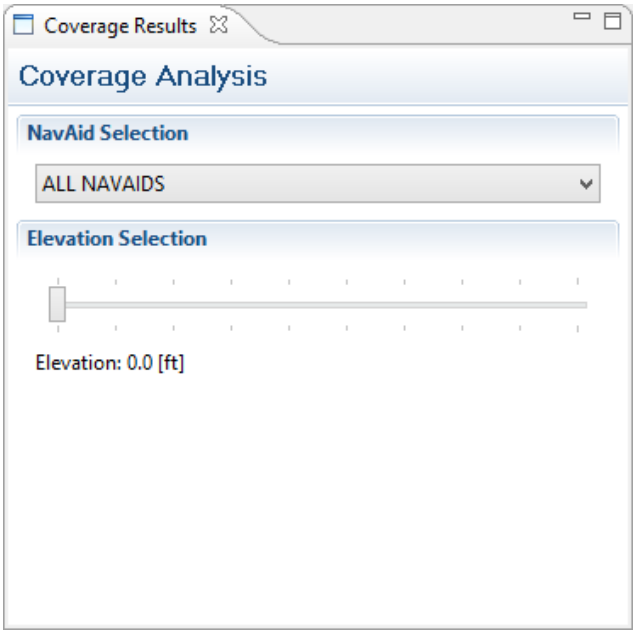


Figure 149: Analysis Tool

4. Click on the scroll-down menu on the "NavAid Selection" section in order to select the NavAid to be analyzed or leave it on "ALL NAVAIDS" in order to filter only by **Elevation** (Figure 150).

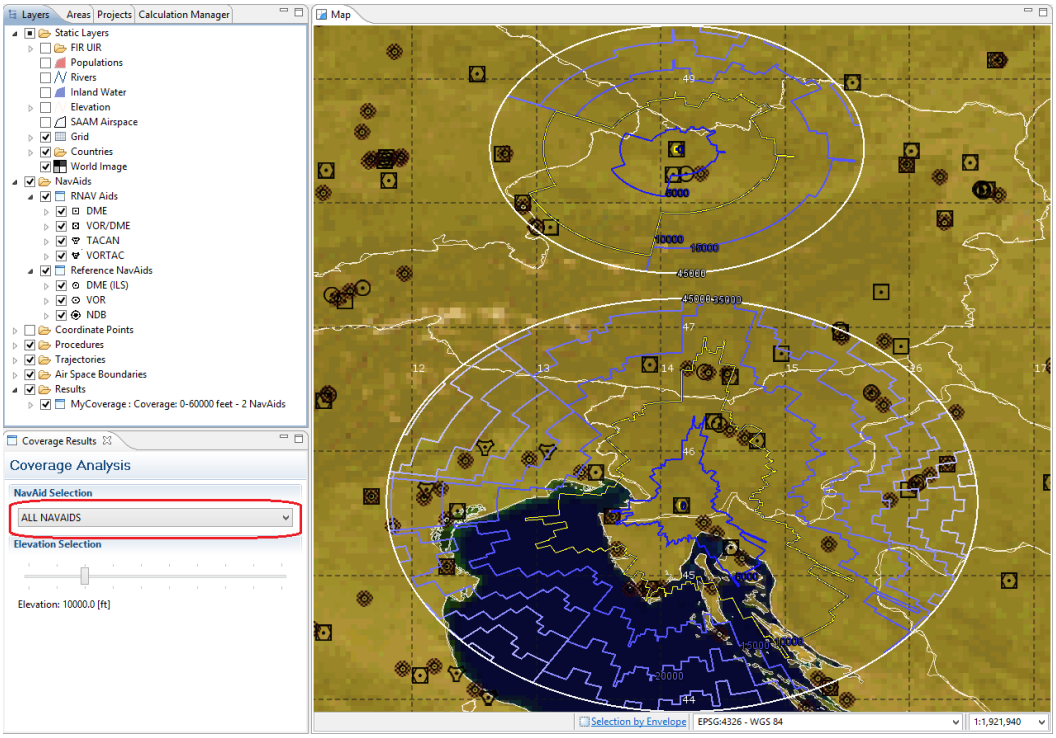


Figure 150: Coverage Analysis Tool for all the selected NavAids

5. In order to investigate the NavAids' elevation, the user is able to move the Elevation Selection bar to the required elevation. The result for that elevation will be **yellow highlighted** on the map (Figure 150 and Figure 151**)**.

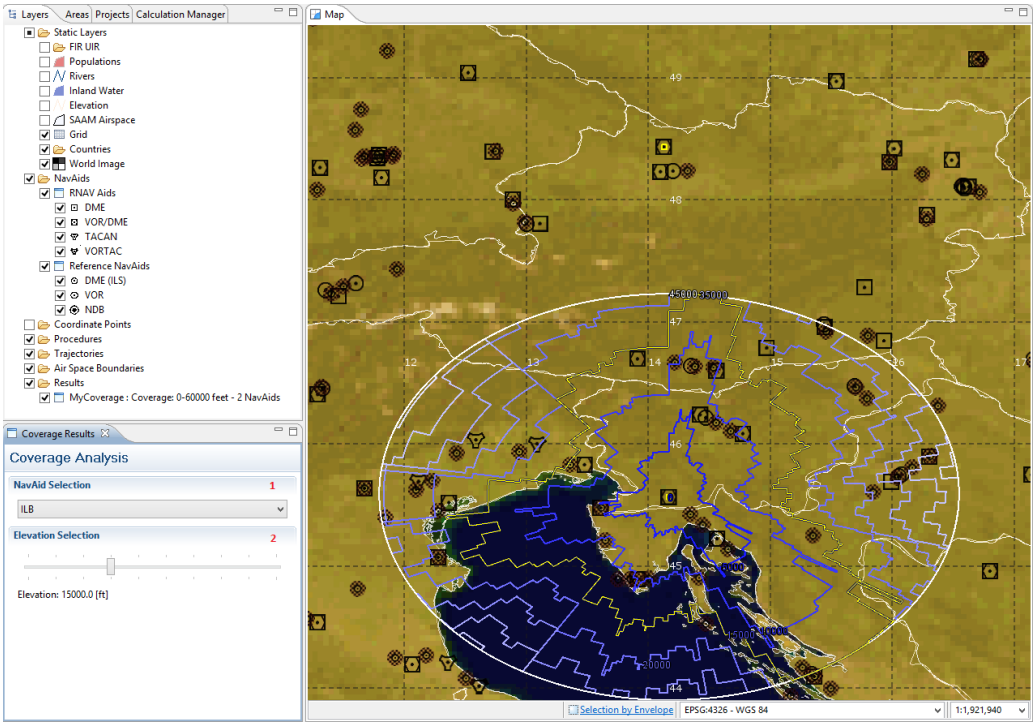


Figure 151: Coverage Analysis Tool for one of the selected NavAids

Please notice how changing the **NavAids selection** (**1**) affects the layers that are presented on the map, and how changing the **Altitude selection** (**2**) affects the feature that is highlighted on the map (Figure 151).

12.2.2. CUMULATIVE COVERAGE

The objective of this tool is to allow the user to know the number of NavAids that cover each area on the map. In order to use this tool, the user should follow this steps:

1. Select at least two NavAids.

2. Select the "Calculations -> Area -> Cumulative Coverage" menu and the following window will appear:

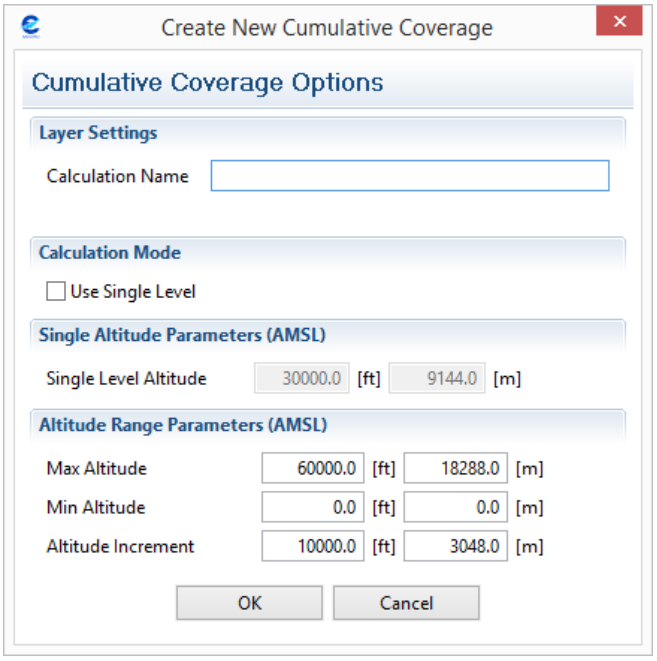


Figure 152: Cumulative Coverage Menu

--

4. Type the optional calculation **Name**. If this field is left blank, it will be defaulted.

5. Check or uncheck the "Use Single Level" checkbox:

Checked

DEMETER will calculate only at the specified level defined by Single Altitude Parameters. Type the Altitude making sure the value is between the limits defined on Table 48.

Table 48: Single Level Altitude limits for Area Coverage Calculation

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Unchecked

DEMETER will calculate according to the Altitude Range parameters:

- **Max Altitude:** Highest calculation altitude.
- **Min Altitude:** Minimum calculation altitude.
- **Altitude Increment:** DEMETER will calculate the area coverage starting at min altitude and then adding this Increment until the altitude reach the maximum value.

Note that all values have to be between the limits of the following tables:

Table 49: Max Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Table 50: Min Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Table 51: Altitude Increment Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	100	3.4028235e38
Meters [m]	30.48	1.0371806e38

6. Click on the "OK" button and wait for the result calculations. Before the calculation starts, the NavAid(s) data is verified. If there is any problem an alert window is displayed. See **section 0** for further details on the different issues that might occur.

7. When the results are displayed on the map also a Results folder will appear on Layers tree:

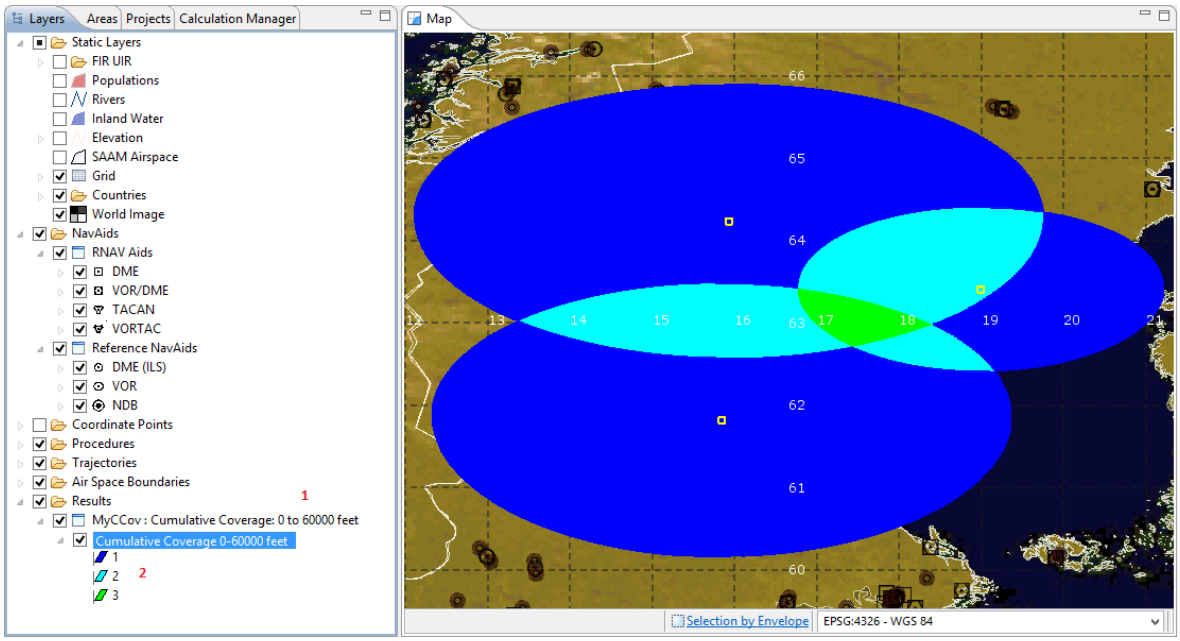


Figure 153: Cumulative Coverage Results Folder and map layer

Please notice that in the legend of the layer (**1**), a different color is used in order to distinguish **the number of NavAids covering it** (**2**). Thus, if the selected NavAids' area coverage does not overlap in any point, the result will be only multiple zones with value 1 that corresponds to each NavAid's individual coverage (Figure 154).

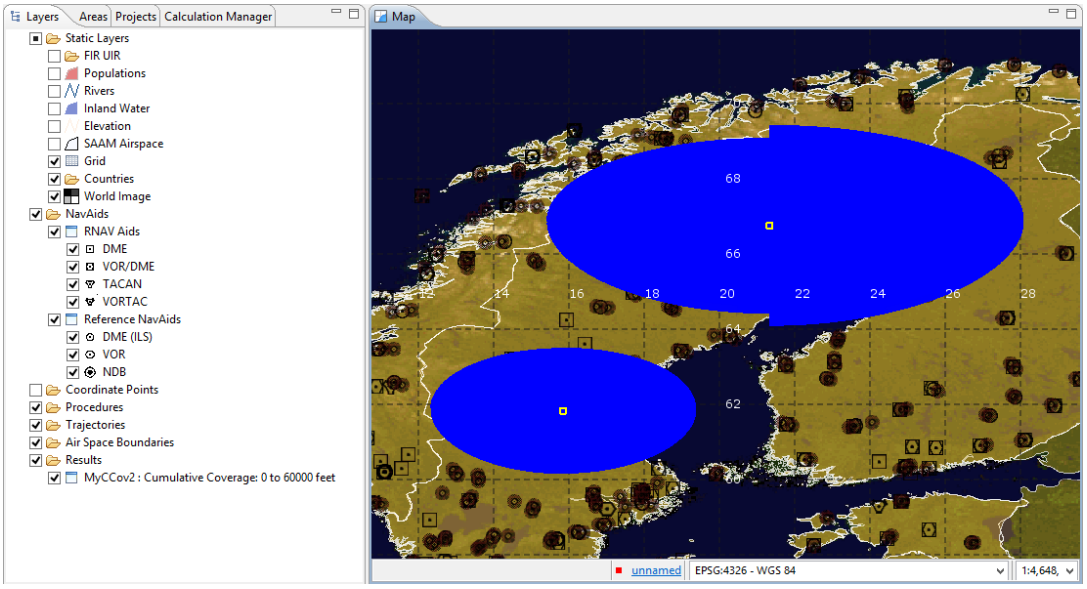


Figure 154: Cumulative Coverage for NavAids with non-intersecting coverage

12.2.3. PERFORMANCE

The purpose of the performance calculation is to evaluate multiple performance parameters based on the available NavAid on each point. DEMETER executes the performance calculation for an altitude specified by the user. The user is able to select 2 types of Performance calculations (DME-DME or VOR-DME). Depending on the performance type some calculations are performed:

- **Redundancy**
- **Available Pairs**
- **Subtended Angle**
- **Navigation System Error (NSE)**

12.2.3.1. VOR-DME Performance Calculation

For the **VOR-DME performance** calculation, only the NavAid redundancy is calculated for the VOR/DME or VORTAC selected NavAids. To perform this calculation the VOR/DME Max range values are used as Maximum DOC limitation as follows:

- If available use the Max DOC Range from the VOR Specific data (NavAids Secondary Data)
- Depending on the VOR type (CVOR or DVOR defined on the NavAids Secondary Data) use one of the VOR/DME Parameters defined on the configuration RNAV page.

Note that using this DOC the coverage area intersections are calculated to determine the NavAid Redundancy.

12.2.3.2. DME-DME Performance Calculation

For the **DME-DME performance** calculation, all the calculations are executed. NavAid redundancy and Available NavAid pairs are calculated using the coverage area for each of the selected NavAids.

For the Subtended Angle and NSE calculations, the user specifies the minimum subtended angle allowed for the results (30º or 40º). DEMETER evaluates each point around the NavAids calculating the subtended angle for each available NavAid pair. If the best (highest) Subtended Angle value is smaller than the specified value the point is not considered for the calculations.

In order to calculate Area Performance, the following steps are required:

1. Select at least two NavAids from the map.

2. Select the menu "Calculations -> Area -> Performance" or click on the icon, located on the toolbar. The following menu will appear:

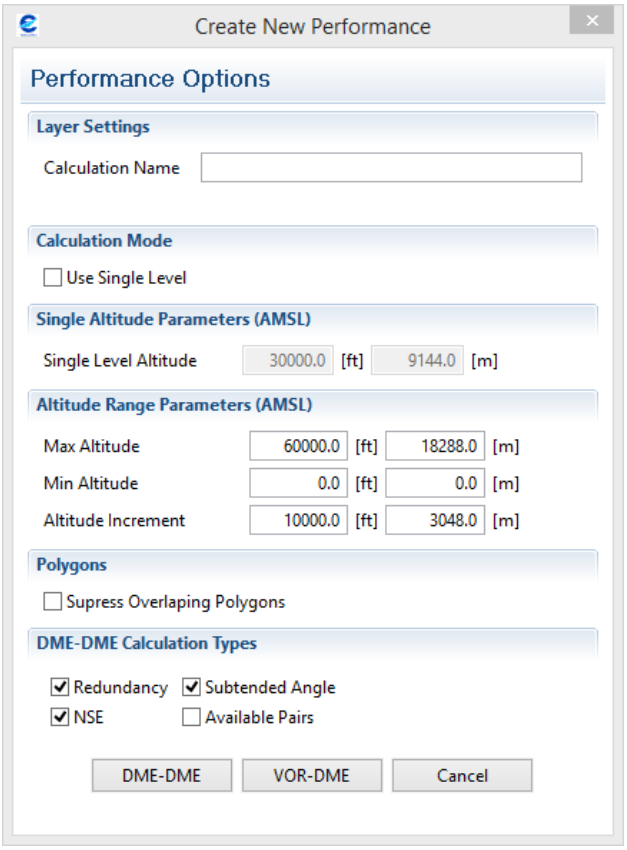


Figure 155: Calculate Performance

3. It is possible to name the results. If the "**Calculation Name"** field is left blank, name is defaulted.

4. Check or uncheck the "Use Single Level" checkbox:

Checked

DEMETER will calculate only at the specified level defined by the Single Altitude Parameters. Type the Altitude making sure the value is between the limits defined on Table 48.

Table 52: Single Level Altitude limits for Area Coverage Calculation

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Unchecked

DEMETER will calculate according to the Altitude Range parameters:

- **Max Altitude:** Highest calculation altitude.
- **Min Altitude:** Minimum calculation altitude.
- **Altitude Increment:** DEMETER will calculate the area coverage starting at the min altitude and then adding this Increment until the altitude reaches the maximum value.

Note that all values have to be between the limits of the following tables:

Table 53: Max Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Table 54: Min Altitude Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	0	60000
Meters [m]	0	18288

Table 55: Altitude Increment Parameters

Unit	Minimum Value	Maximum Value
Feet [ft]	100	3.4028235e38
Meters [m]	30.48	1.0371806e38

5. Check or uncheck the "Supress Overlaping Polygons" checkbox to remove the overlapping polygons. This operation takes some time.

6. Select the desired calculation types, from the ***Calculation Types*** section.

7. Click on the "DME-DME" or "VOR-DME" buttons, and wait for the calculation results. Before the calculation starts, the NavAids data is verified. If there is any problem an alert window is displayed. See **section 15** for further details on the different issues that might occur.

8. As the results are displayed on the map, also a "Results" folder will appear on the Layer tree. Notice the four layers in it: **Available Pairs**, **NSE**, **Redundancy** and **Subtended Angle**.

12.2.3.3. Performance Layers

12.2.3.3.1. Navigation System Error (NSE)

NSE or Navigation System Error represents the results given by this formula:

$$2\sigma_{DME1/DME2} \le 2\frac{\sqrt{\left(\sigma^2_{DME1,air}+\sigma^2_{DME1,SIS}\right)+\left(\sigma^2_{DME2,air}+\sigma^2_{DME2,SIS}\right)}}{\sin(\alpha)}$$

There is a threshold on the maximum acceptable NSE value of 0,866. This threshold is displayed with green and red zones for the values below and above this value.
Next figure shows an sample of a performance calculation with only the NSE layer displayed:

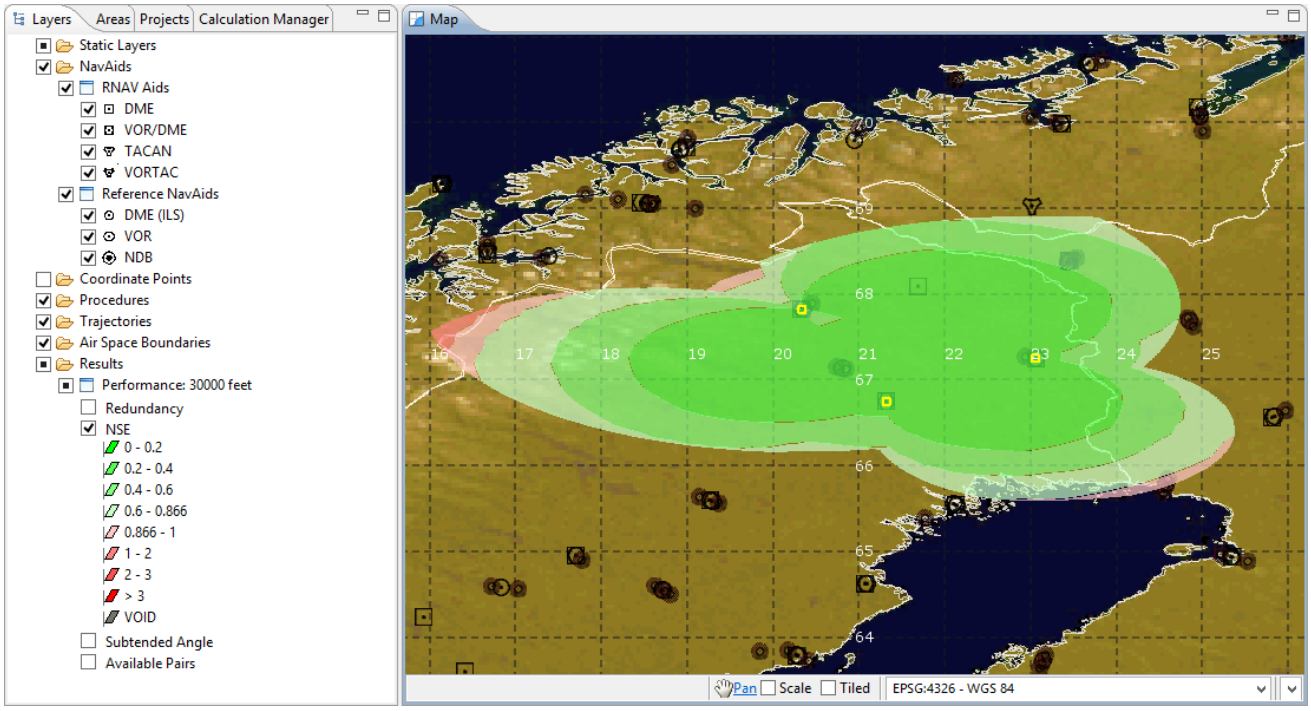


Figure 156: Performance Sample; Navigation System Error

12.2.3.3.2. Redundancy

Redundancy represents the number of NavAid pairs that cover the performance area (Figure 157). Several types of redundancy can be considered within the performance calculation:

No coverage

This layer represents that there are no NavAid pairs covering the given area.

No Redundancy

This layer represents that there is only one NavAid pair covering the given area.

Limited Redundancy

This layer represents that there are two NavAid pairs covering the given area, but that they have a NavAid in common. Thus, there is one critical NavAid, meaning that if it fails, the number of available pairs changes to zero.

Full Redundancy

This layer represents that there are two independent NavAid pairs covering the given area. If one of the NavAid fails (one at a time) the numbers of available pairs changes to one.

Excessive Redundancy

This layer represents that there are more than two independent NavAid pairs covering that area. If one of the NavAid fails (one at a time) the numbers of available pairs is at least two.

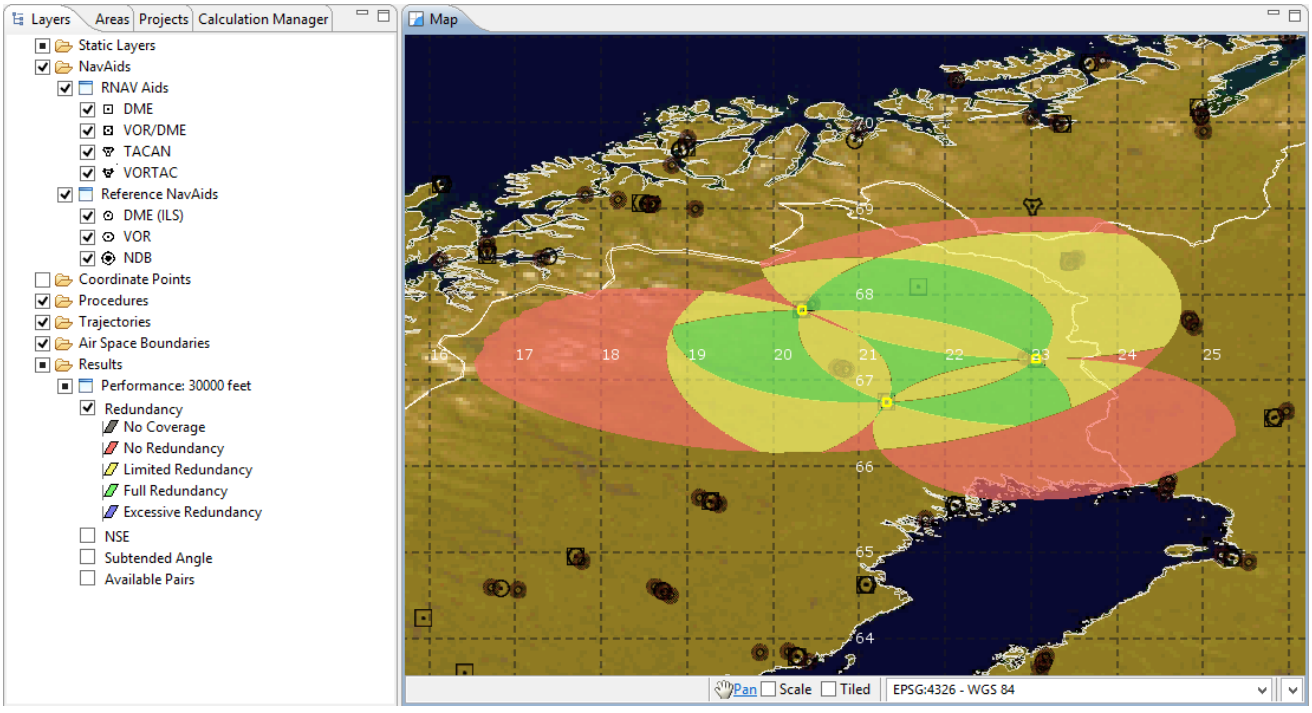


Figure 157: Performance Sample; Redundancy

12.2.3.3.3. Available Pairs

To calculate the Available Pairs the user must select the "Available Pairs" options in the "Create Performance Window" as shown below:

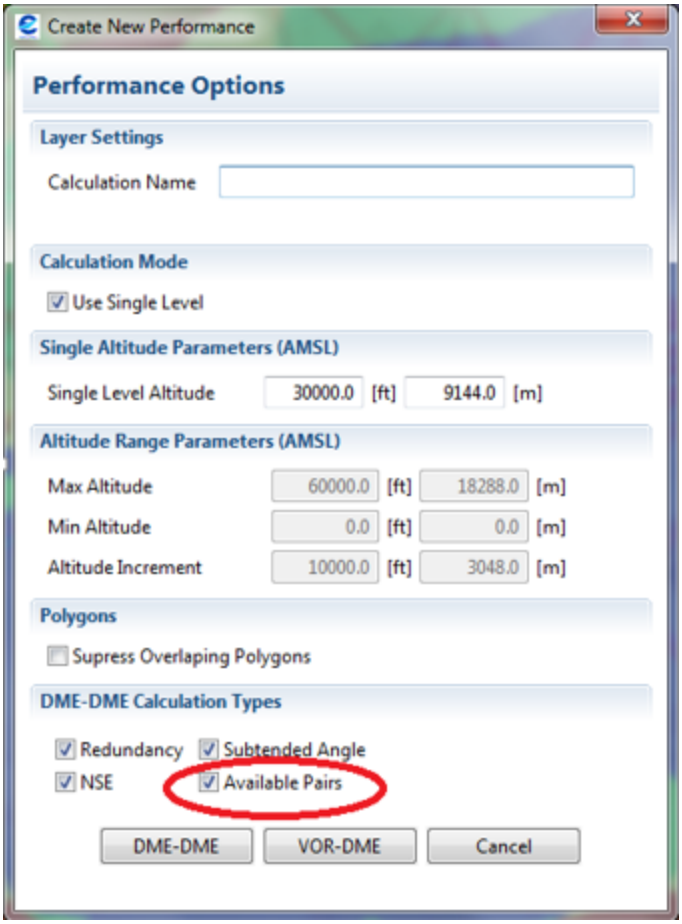


Figure 158: Available pairs

The Available Pairs result layer gives extra information about which pairs are available on each area. In order to explore this information the user is able to use two different methods.

1. Use the **Identify Tool** (click on the icon), located on the toolbar, and move the mouse over any area (Figure 159).

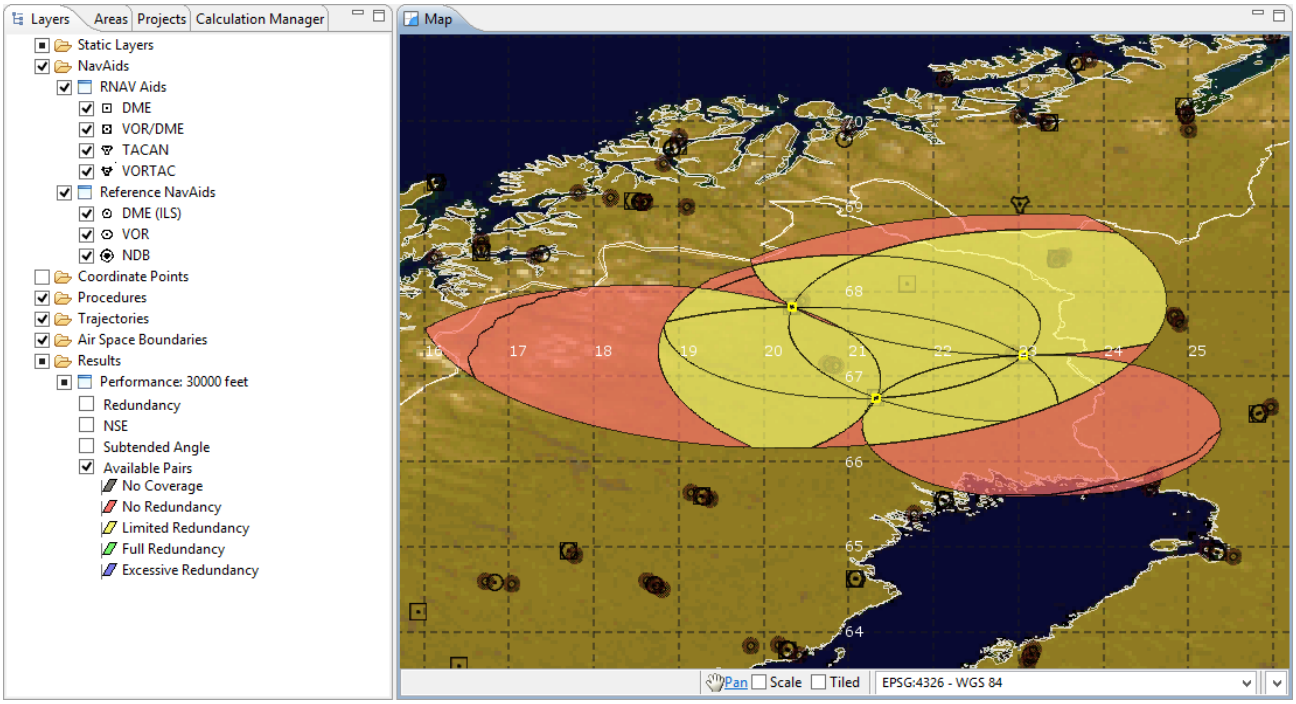


Figure 159: Performance Sample; Available Pairs

On this layer, the user is also able to use the **Analysis Tool**, in order to help on the analysis of each area in which the NavAid pairs are available. In order to do so, the user should right click on Available Pairs layer (Figure 160).

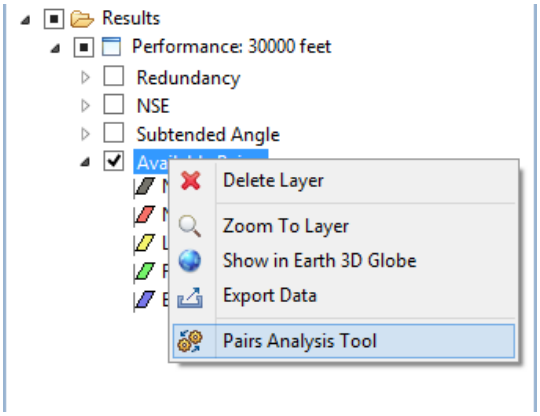


Figure 160: Performance Sample; Available Pairs

The following window will appear below the layer tree:

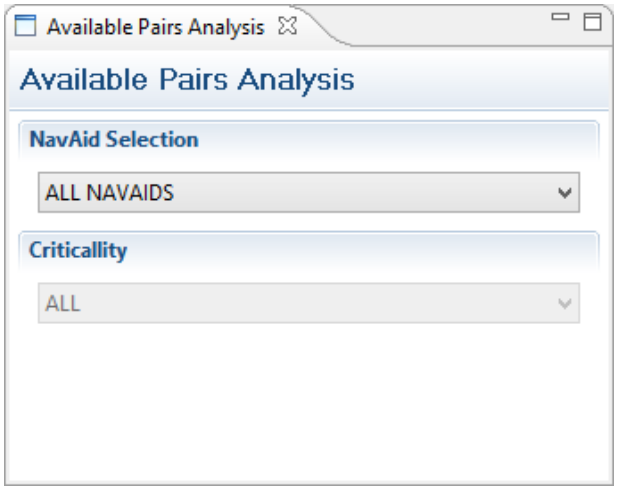


Figure 161: Available Pairs Analysis Tool menu

On the "NavAid Selection" area, select one NavAid from the list, in order to see the areas in which that NavAid is used on a pair. On the "Criticality" area, the user is able to select the criticality that he or she desires to investigate (Figure 161). The available levels of criticality are:

All

The areas in which the NavAid is used in order to create a valid pair.

Critical

The areas in which the selected NavAid is critical. On the result, two areas will be highlighted: The area in which if the NavAid fails the number of available pairs drops to 1 (Limited Redundancy) and the areas where the NavAid pairs drop to zero (No Redundancy).

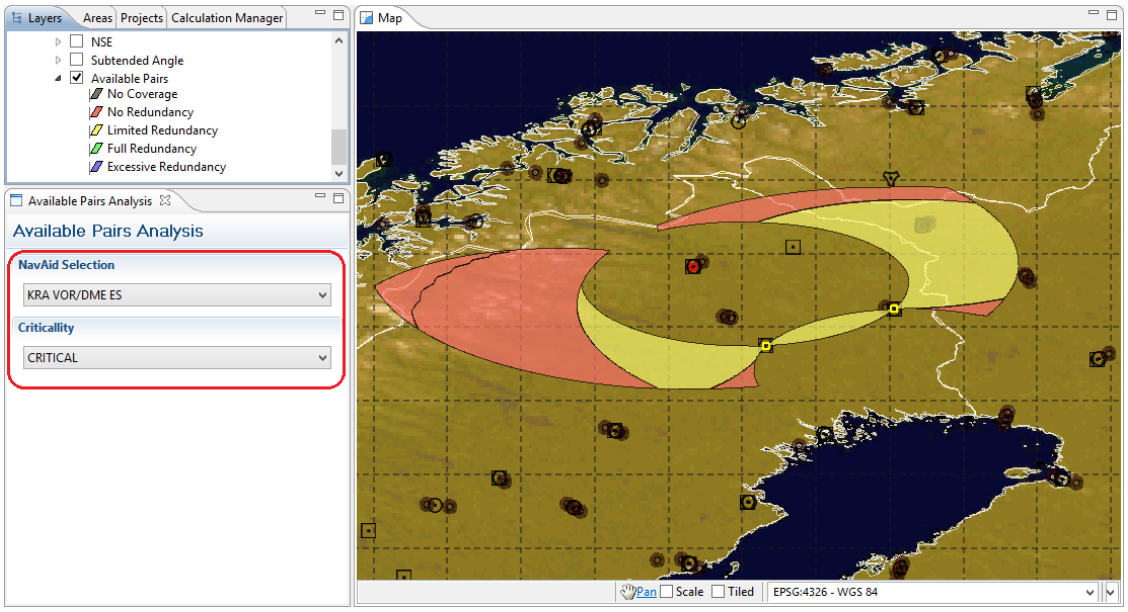


Figure 162: Criticality selection for a given NavAid

12.2.3.3.4. Subtended Angle

The Subtended angle results show the best subtended angle value that can exist for each point on the map. This is done by analyzing the best NavAid pair from the list of the selected NavAids. The result is divided into intervals of 10 degrees (Figure 163).

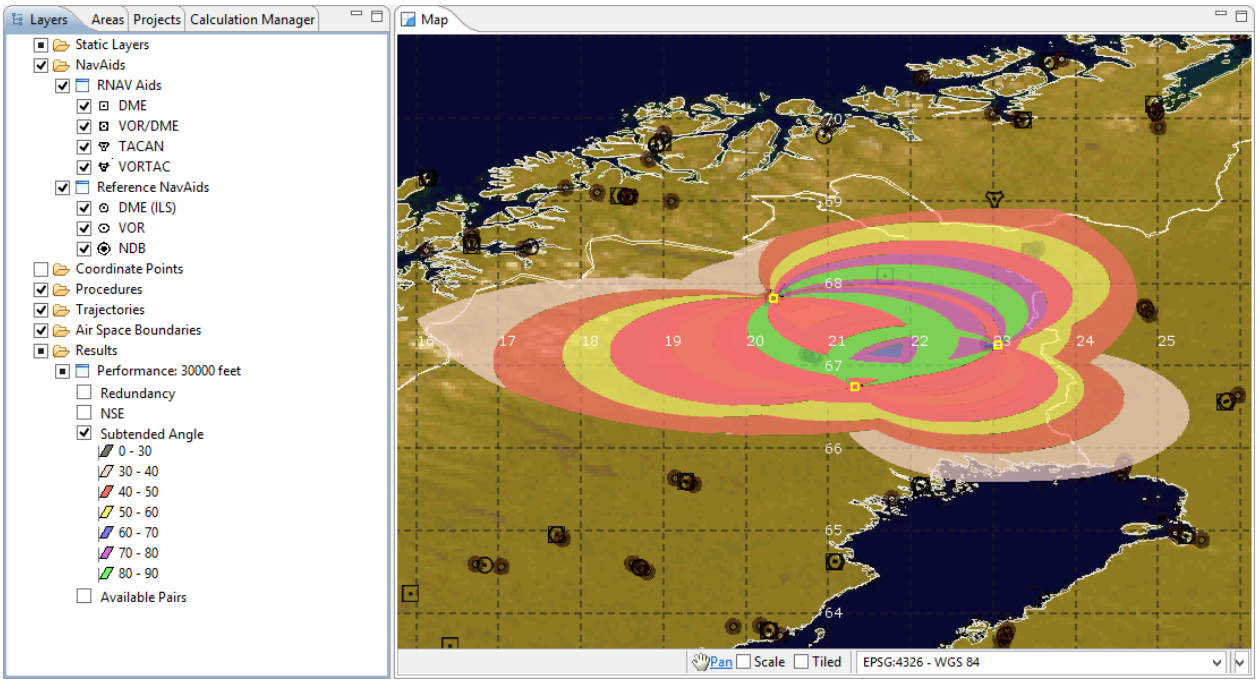


Figure 163: Performance Sample; Subtended Angle

12.2.4. SITING TOOL

This tool is very useful as it represents the first step in order to find the best place to install a new DME facility. The input parameters are:

- At least 1 NavAid (a pair containing the selected and the new NavAid will be evaluated)
- The area of interest (area that will be covered with DME/DME signal)
- The minimum allowed subtended angle.
- The future NavAid DOC.

By using these input parameters, the tool is going to calculate and display over the map the areas that fulfil the input parameters for each selected NavAid (using a different color for each NavAid).

Looking to the result with a color for each NavAid the user can visualize the intersections. On the intersection areas the previous criteria apply to all the NavAids.

Attention: After using the Siting tool the user must use other tools to select the best place for the new NavAid; for example the "Create NavAid from Map". The Siting tool just minimizes the zone where the user must look for.

In order to use the tool, the user should follow the next steps:

1. Select at least 1 NavAid

2. Select the "Calculations -> Area -> NavAid Siting Tool" and appears three different ways to choose the area of interest (Figure 164). Then choose one to proceed.

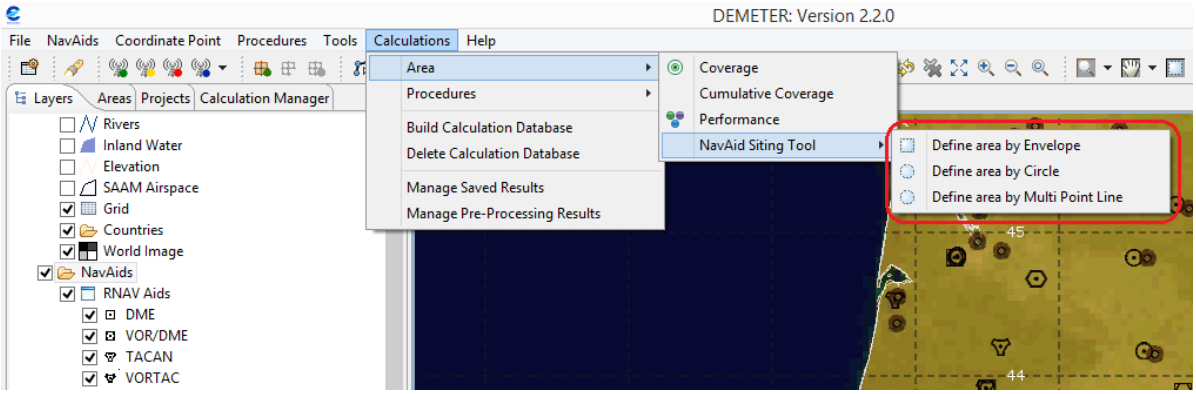


Figure 164: Siting tool, type of area selection

3. The user selects the area where the subtended angle value needs to be improved:

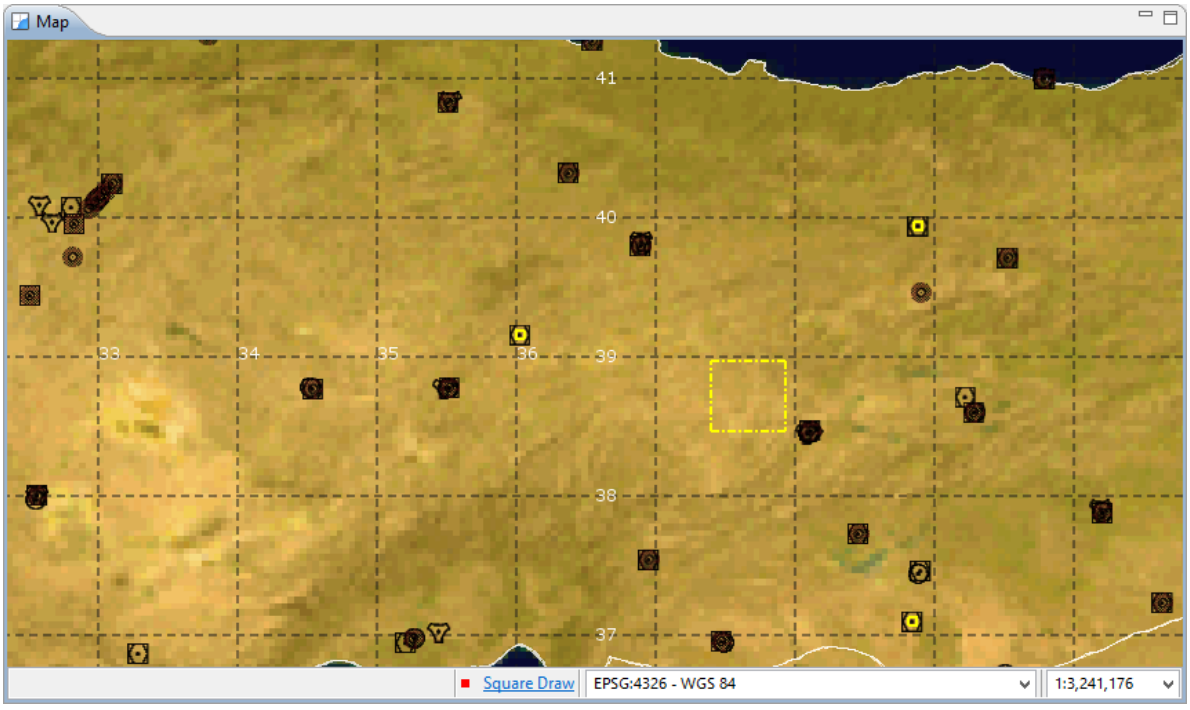


Figure 165: Siting tool area selection

4. Note that if area selection is made containing any of the selected NavAids, the following warning will be shown:

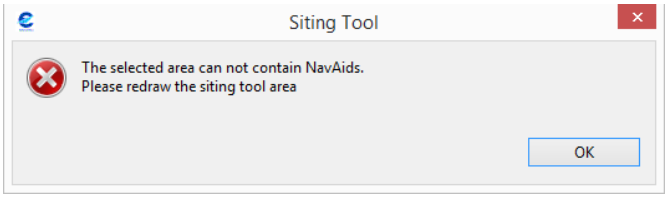


Figure 166: Siting tool area warning

5. After the area selection is made successfully, the following window will appear:

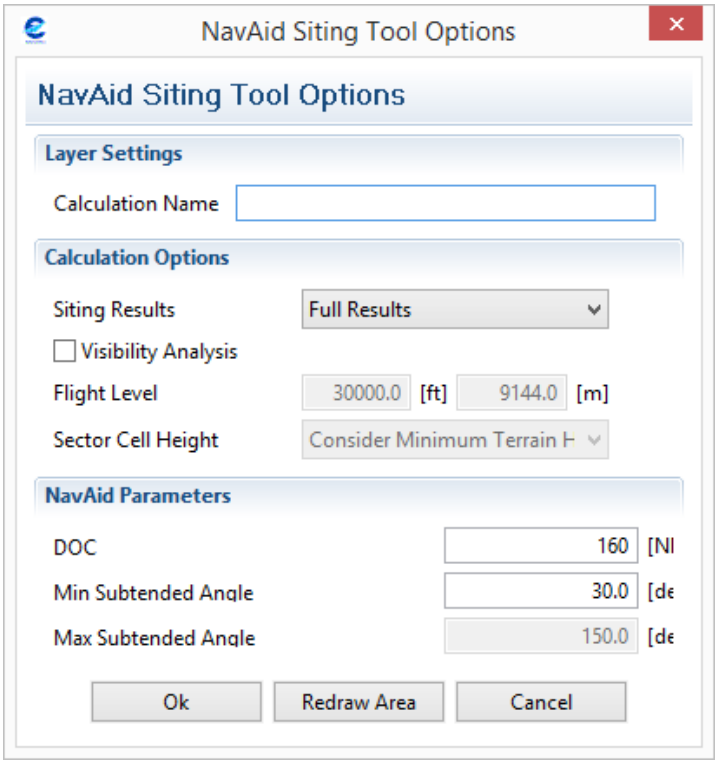


Figure 167: Siting tool parameter specification

Then, the user specifies the parameters that will be used on the calculation:

- **Calculation Name:** Note that if this field is not filled, it will be defaulted
- **Siting Results:**
  - **Full Results:** Show all the calculated results on map
  - **Exclude Water:** Show the calculated results on the map without areas that are on the water
- **Visibility Analysis:** calculates the results considering the terrain data
  - **Flight Level:** required value for calculate obstacles
  - **Sector Cell Height:**

- **Consider Minimum Terrain Height:** In case of sectors in the terrain with different values of height. It is considered the lowest value
- **Consider Maximum Terrain Height:** In case of sectors in the terrain with different values of height. It is considered the highest value

- **DOC:** required value for the DOC of the new NavAid
- **Min / Max Subtended Angle:** Minimum Subtended Angle value allowed inside the selected area

6. The calculation will then be executed and the result displayed over the map as presented below (Figure 168). Note that the selected zone is displayed in yellow color, with the name "Area of Interest". The result for each selected NavAid is displayed with different colors.

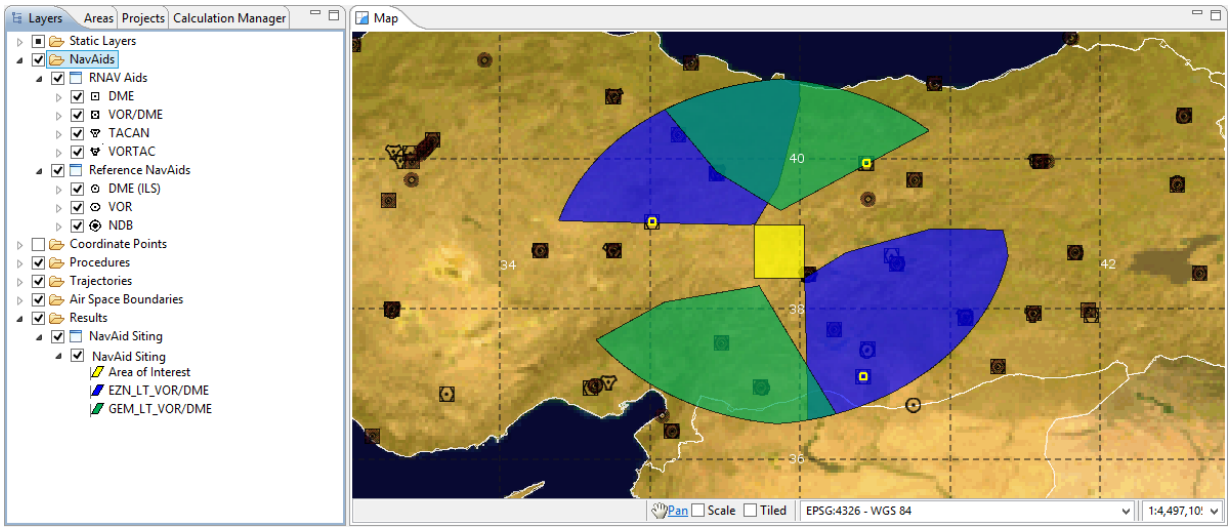


Figure 168: Siting tool result and layer legend

7. If the area of interest was defined too close to the selected DME Navaids, or if the inputted DOC is too small to cover all the area of interest, the calculation may return no results, in that case the following warning will be shown:

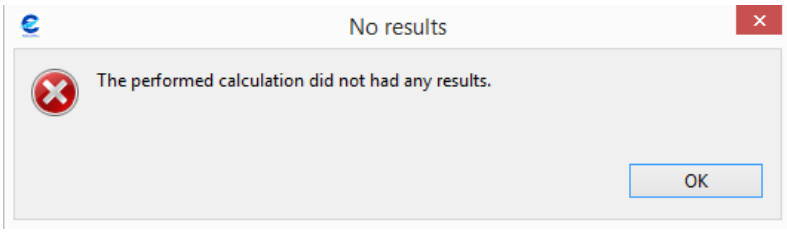


Figure 169: Siting tool, no results warning

12.3. PROCEDURE CALCULATIONS

In this chapter there are described the calculation tools that involve a Procedure. Using these tools, the calculation is always made along the procedure's track, and taking into account the procedure width.

There are three types of calculations available for procedures: **Procedure Performance Report**, **Procedure Performance Analysis** and **Procedure Vertical Profile**.

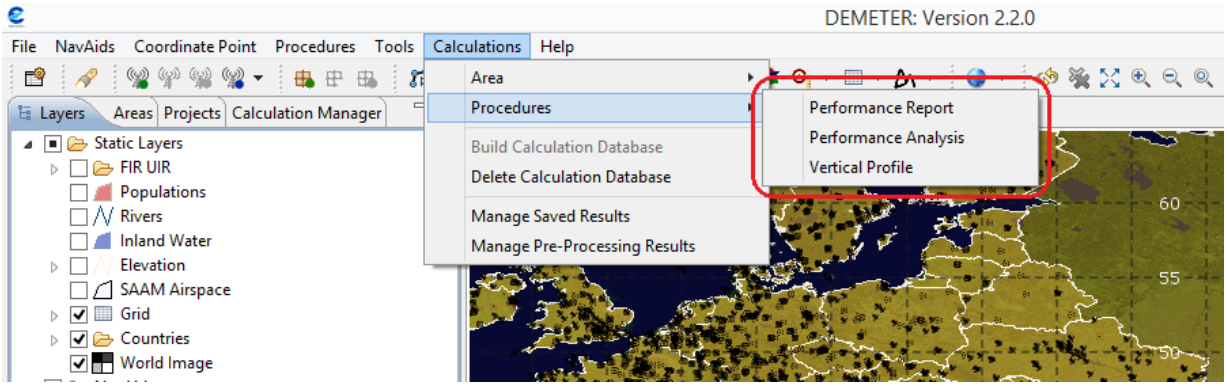


Figure 170: Procedure Calculations menu

12.3.1. PROCEDURES PERFORMANCE REPORTS

The purpose of this functionality is to provide a tool that allows the DEMETER user to collect all the necessary information to plan a flight inspection to validate de DEMETER results. On the report the user will have all the information associated with the selected procedure. In addition there is a planning tool where the user can plan the necessary runs to make a procedure flight inspection.

Note: On the report, the Latitude, Longitude and Distance fields are displayed according to the respective configuration fields "Display / Coordinate Format" and "Display / Horizontal Units".

In order to create this report, the user should follow the next steps:

1. Select one procedure and the NavAids with which the user desires to make the inspection (at least two). Note that you can select both at a time, by having both their layers selected. In order to do so, click on any of the layers, and then hold CTRL while clicking on the other:

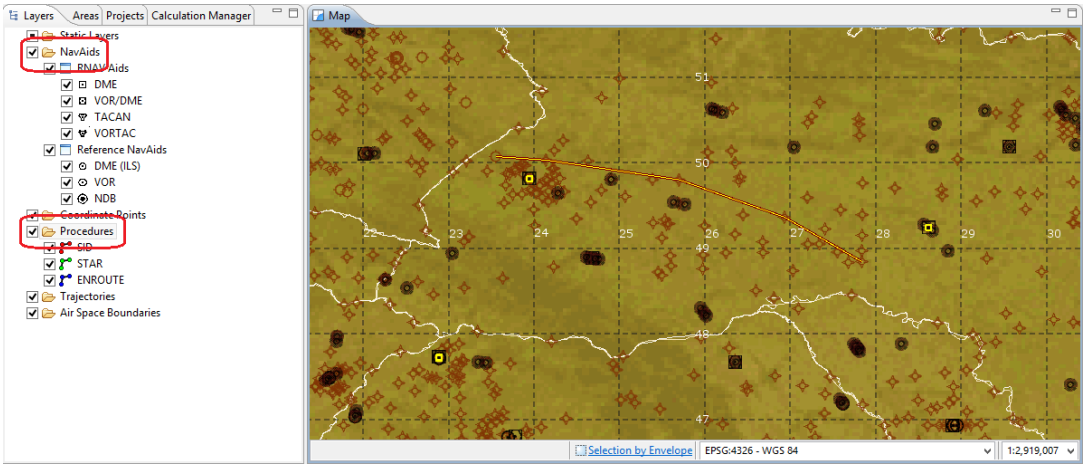


Figure 171: Procedure and NavAid selection

2. Select the "Calculations -> Procedures -> Performance Report" menu and the following view will appear under the map view:

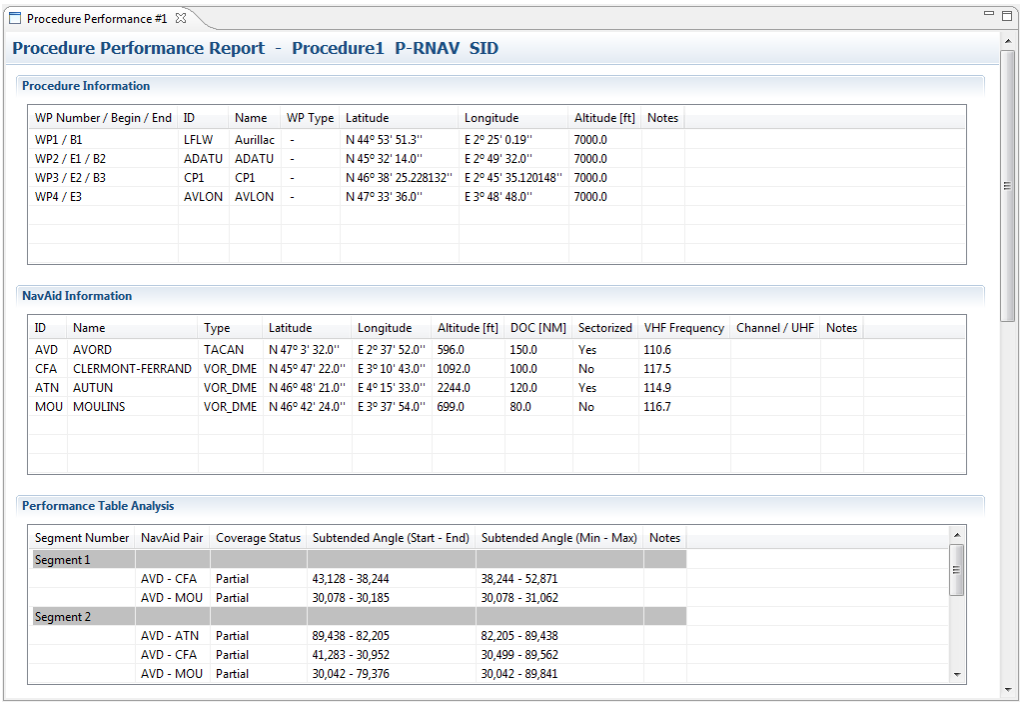


Figure 172: Procedure Performance Report (I)

The aforementioned view will contain all the relevant information about the procedure. Such information is classified as:

Procedure Information

In this section it is presented basic information about coordinate points used to define the procedure. That information contains: Latitude, Longitude and Altitude. The user can type additional information on the Notes field by double clicking on the last row for each line.

NavAid Information

In this section you will find all the information about the selected NavAids used for calculations.

Performance Table Analysis

In this section it is presented the segment coverage status and subtended angle - divided in segments - for each of the available NavAid pairs.

Note that on the "Coverage Status" column, there are only two possible results: "Partial" that means in that segment, the referred NavAid Pair covers only part of the procedure corridor, and "Total" means that the referred NavAid Pair covers all procedure corridor in that segment.

Also, note that on the "Subtended Angle" column, the user is able to find four values: Subtended Angle at the beginning, at the end, the maximum and the minimum value across the segment.

Performance Graphic Analysis

In this section it is presented a more detailed and graphic information about Procedure coverage for each NavAid pair. Each vertical line represents coordinate points that defines the procedure. The green and red colour represent if the NavAid pair covers all the procedure width on that point (green) or only partially (red).

Run Planning

This area is exclusively used by the user in order to plan the necessary runs to make the Flight Inspection to the selected NavAids. In this section the user can **create**, **delete** and **reorder** the runs, by using the buttons that are located on the right. After creating a run the user can specify the path, the NavAids to inspect and add any additional note. The options for the path specification are:

Full Forward

Considers the flight in the whole procedure in forward direction

Full Backward

Considers the flight in the whole procedure in backward direction

Partial

Considers the flight only in a part of the procedure; the "Notes" field is used for further details

Off-centerline

Considers the flight not on the procedure center line; the "Notes" field is used for further details

Altitude deviation

Considers the flight in the procedure for a different Altitude; the "Notes" field is used for further details

Figure 173: Procedure Performance Report (II)

Waypoint Distance and Azimuth Information (Figure 174)

This last section shows Distance and Azimuth from each procedure waypoints to each NavAid.

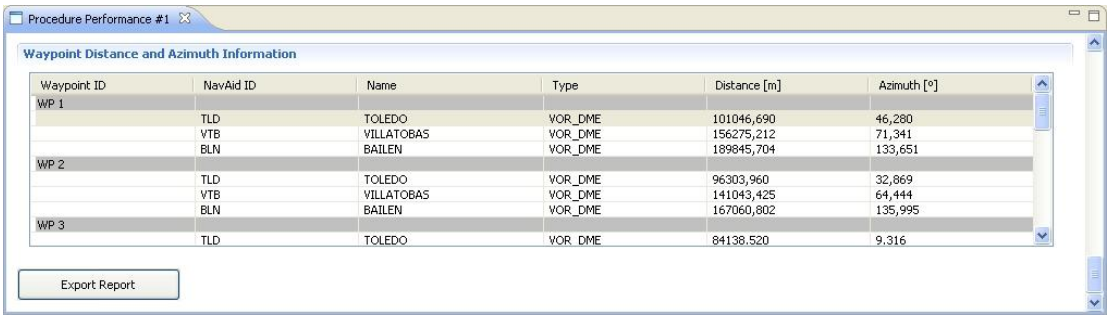


Figure 174: Procedure Performance Report (III)

Once the planning is finished the user can click on the "Export Report" button in order to export a document with all the information needed for the Flight Inspection. Note that in order to export the document, the user must specify the file format (PDF or RTF), and the destination file name. Optionally the user can also include the Report Author's name (Figure 175).

The RNAV Pair Coverage image is also exported on an image format to the same directory with the same selected name with the file extension png.

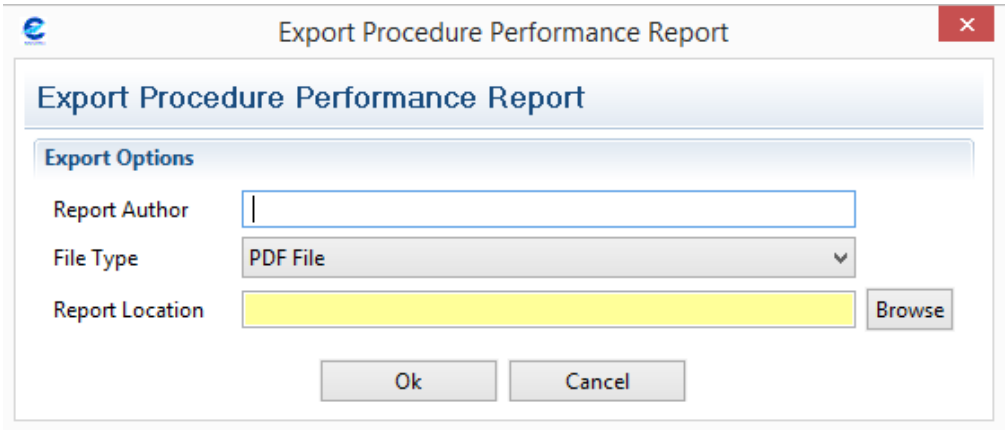


Figure 175: Export Procedure Performance Report

12.3.2. PROCEDURES PERFORMANCE ANALYSIS

This option allows the user to make a Performance analysis calculation along the procedure path. The calculation takes into account:

Procedure Interpolation Steps

This value is defined on the **configuration calculation settings page**. The interpolation is made along the procedure track and on the procedure width. The results will be displayed for each point of the interpolation

Procedure Width Values

Displayed on the **configuration procedure page**. The used values depend on the procedure performance type, the distance from the reference airport and the procedure altitude.

When using the Procedure Performance Analysis, the user must select the required processing type. Depending on the selection, different calculations will be performed:

Subtended Angle

On this option, the best Subtended Angle is calculated, taking into account all the NavAids that cover the point. The result is displayed using the same color code used on the Area Calculation.

Redundancy

On this option, two calculations are executed and displayed to the user. First is calculated the NavAid redundancy on each point as it is performed on the Area Calculation.

Using the information about the available NavAids on each point a second step is performed to calculate the 30 Seconds Signal Delay.

The 30 Seconds Signal Delay is calculated evaluating the Redundancy level. Every time the redundancy level increases (e.g. Limited -> Full) a 30 seconds delay is calculated using the Aircraft speed. Only after 30 Seconds equivalent distance is passed the new redundancy level is assumed. This information is displayed over the procedure central line.

Navigation System Error (NSE)

On this option, the Navigation System Error is calculated for each point. This calculation uses the best NavAid pair that covers the point. The result is displayed using the same colour code used on the Area Calculation (See **section 12.2.3.3.1** for more details).

After the calculation is performed, the result is displayed in two formats:

Result over the Map

For each interpolation point (along procedure track and on the procedure width a point is created using the same colour code as it is used on the Area Calculation.

Graphic information

Below the map a window is displayed with a graphic representation of the result where the X-Axis represents the distance from procedure begin and the Y-Axis is used to present the analysed parameter. For each calculation, Worst case and Central line values are displayed.

Together with these calculations the Procedure Continuity Information is also calculated.

The Procedure Continuity Information is calculated dividing the procedure in segments (space between two consecutive Coordinate Points).

For each segment, the MTBO of the available NavAids on each segment is used to calculate the continuity value.

The following results are displayed:

- Minimum and Average continuity achieve

- Continuity value on each segment.

In order to use this tool, the user should follow the next steps:

1. Select one procedure and the NavAids with which the user desires to make the inspection (at least two). Note that you can select both at a time, by having both their layers selected. In order to do so, click on any of the layers, and then hold CTRL while clicking on the other:

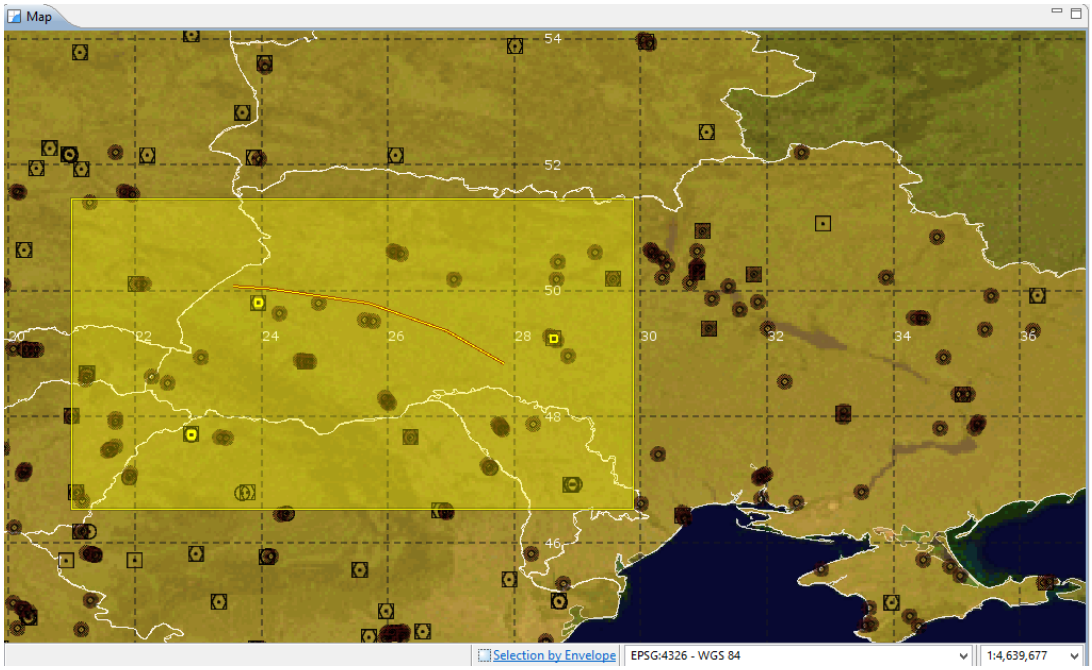


Figure 176: Procedure and NavAid selection

2. Select the "Calculations -> Procedures -> Performance Analysis" menu. The following window will appear:

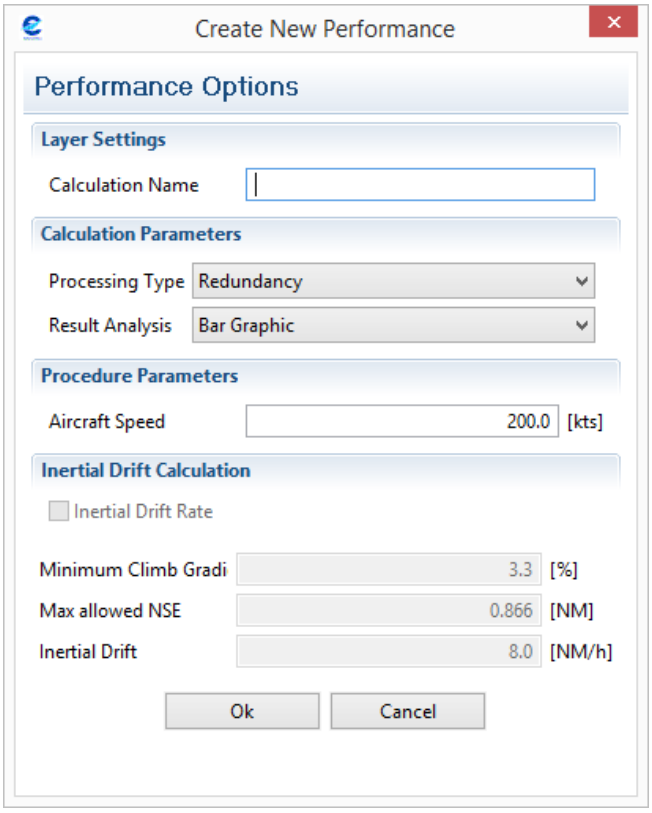


Figure 177: Procedure Performance Analysis menu

3. The user should then configure the Calculation Parameters, the Aircraft Speed and the Inertial Drift:

Processing Type

Subtended Angle

Redundancy (Signal Receiver Delay is also calculated)

Navigation System Error (NSE)

Graphic Type

Bar: A bar graphic is displayed

Plot: A line graphic is displayed

Aircraft Speed

This parameter is used when the processing type Redundancy is selected. The value is used to calculate the 30 seconds signal delay.

Inertial Drift

Check this option to show on the map the positions of the aircraft where it is valid in relation to the runway. If you want you can specify Minimum Climb Gradi, Max allowed NSE and Inertial Drift.

4. Click on the "OK" button and wait for the result calculations. Before the calculation starts, the NavAids data is verified. If there is any problem an alert window is displayed. On **section 0** it is described the different issues that might occur.

5. If the selected processing type is **Redundancy**, then two "Results" layers are created:

Signal Delay

This layer shows the signal receiver delay for the procedure. In Figure 178, notice the legend (**1**) with signal delay selected and the different types of coverage. Please note that for usability purposes, on the "Graphic Information" section, the redundancy bar (**3**) matches the part of the procedure that is displayed on the map (**2**).

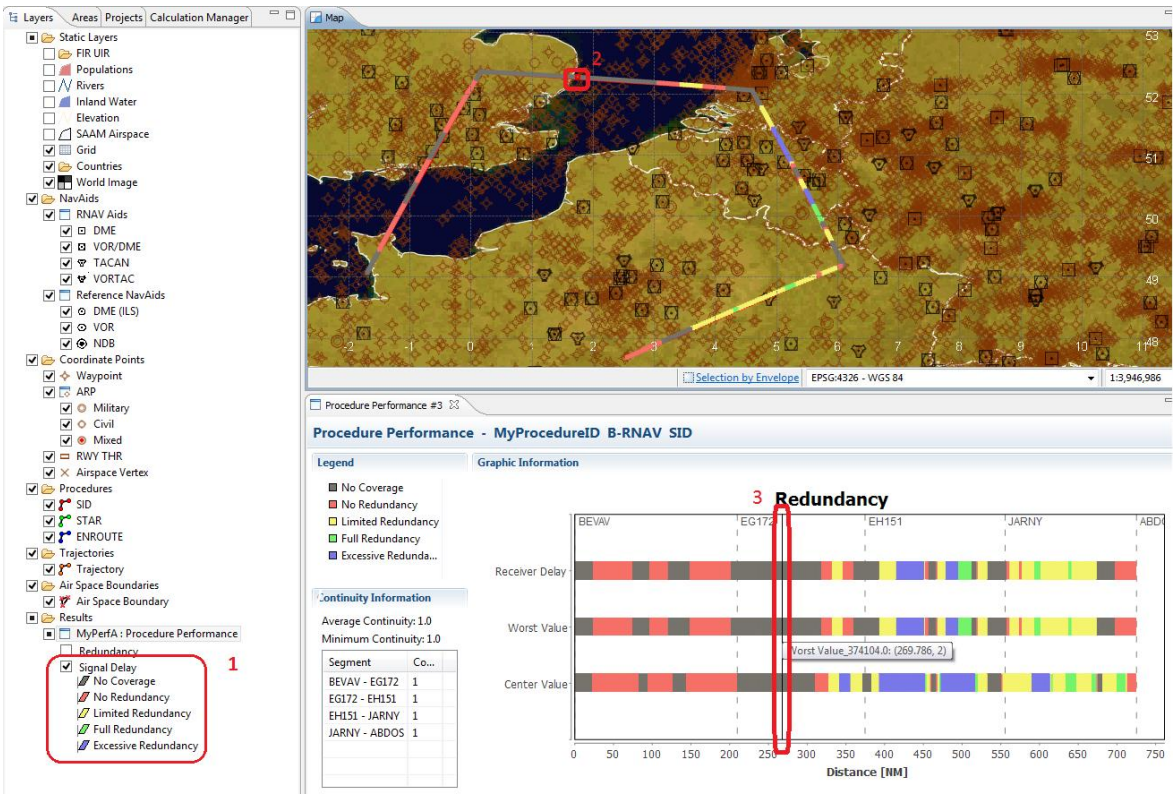


Figure 178: Signal Delay sample

Redundancy

This layer is essentially the result of crossing the procedure corridor limits (Figure 179). In Figure 179, notice the legend (**1**) with signal delay selected and the different types of coverage. Please note that for usability purposes, on the "Graphic Information" section, the redundancy bar (**2**) matches the part of the procedure that is displayed on the map (**3**).

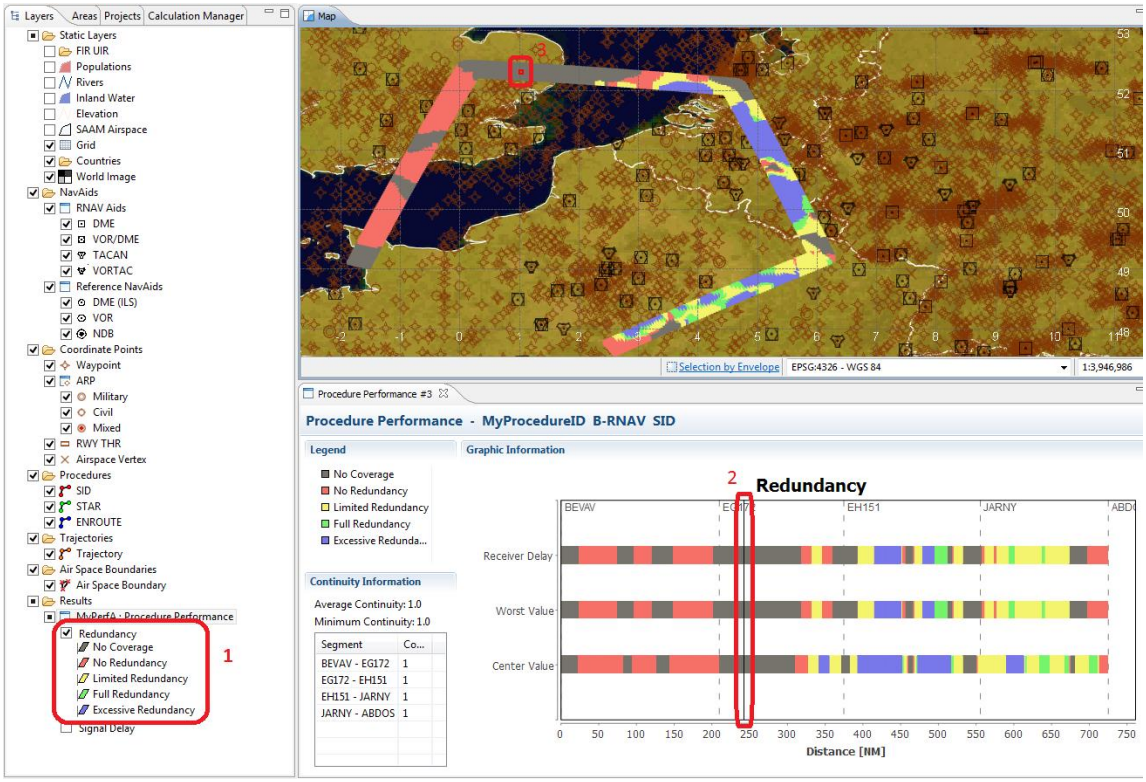


Figure 179: Redundancy sample

6. The same information can also be displayed in a graphical format below the map. The representation depends on the "Graphic type" that was initially selected (Plot or Bar)

Plot Result

Using the checkboxes on the left the user can hide/display each result:

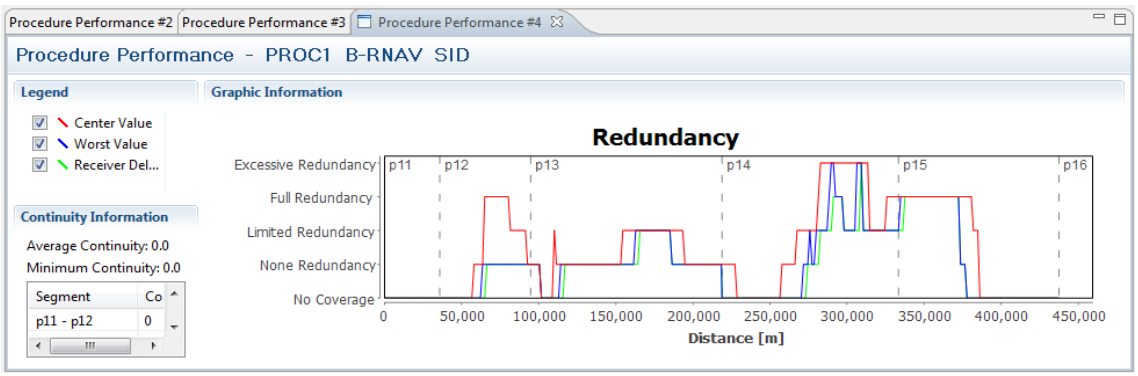


Figure 180: Graphic plot results

Bar Result

Represents the same result, but using bars:

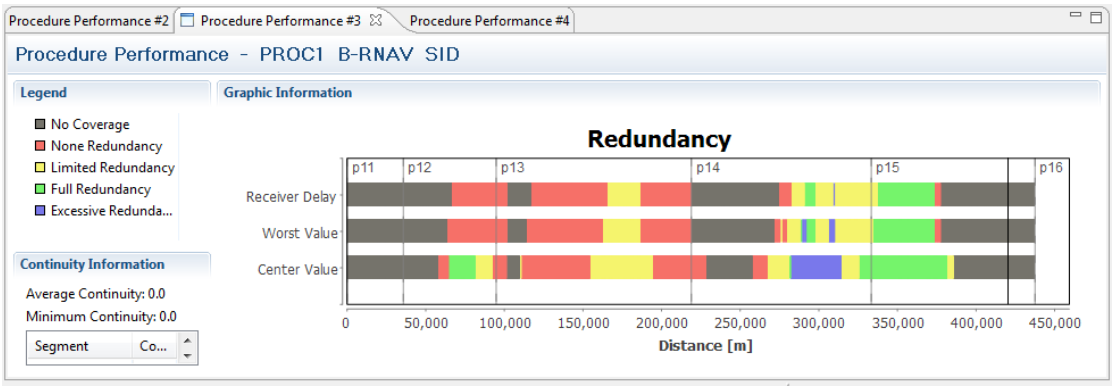


Figure 181: Graphic bar results

7. If the selected processing type is **Subtended Angle**, the respective "Results" layer is created and below the map a graphical representation is also displayed for the central line and the worst case.

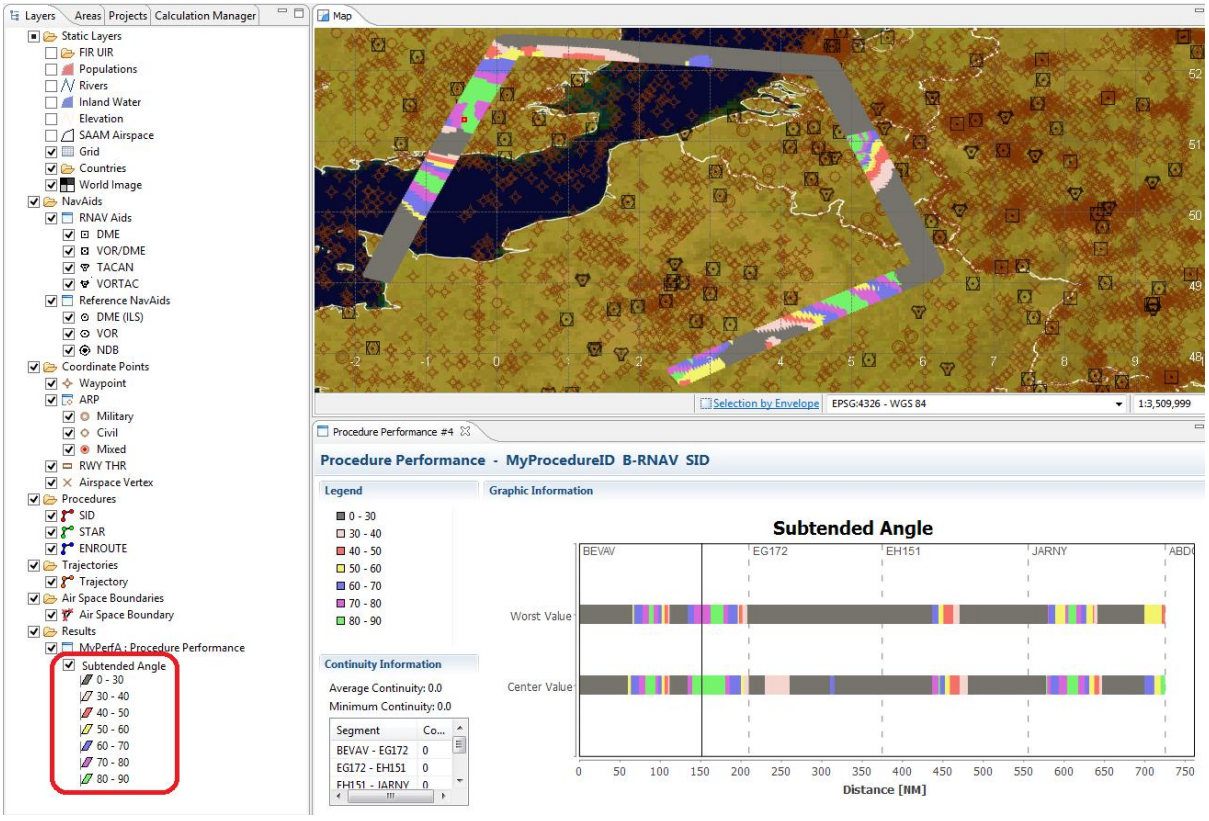


Figure 182: Subtended Angle results

8. If the selected processing type is **Navigation System Error**, the corresponding result layers are created. Below the map, a graphical representation is also displayed for the central line and for the worst case.

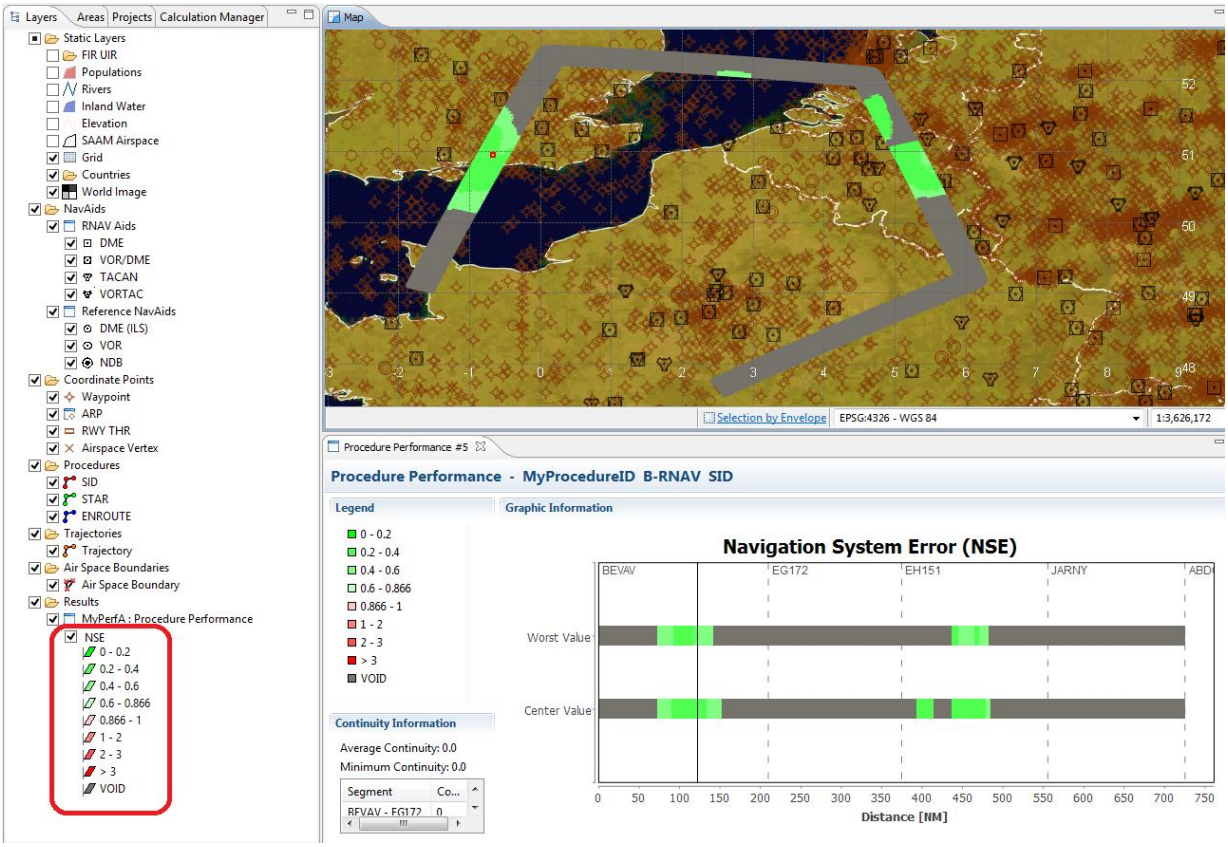


Figure 183: Navigation System Error results

9. If "Inertial Drift Rate" is checked, the graph will appear on the bottom of the view (Figure 184). The blue zone of the graph is the positions of the aircraft where it is valid in relation to the runway.

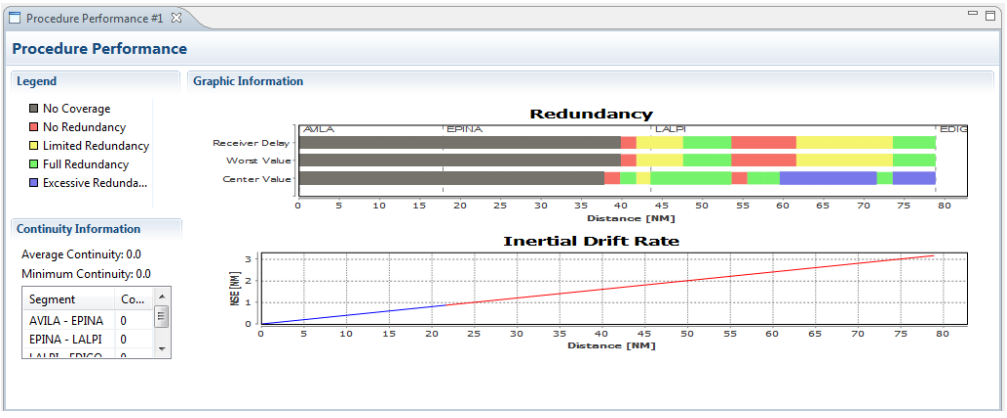


Figure 184: Inertial Drift Rate

12.3.3. PROCEDURES VERTICAL PROFILES

Vertical Profiles provides the user with information regarding the visibility of NavAids along the procedures. In order to use this tool, the user should follow the next steps:

1. Select one procedure and the NavAids with which the user desires to make the inspection (at least two). Note that you can select both at a time, by having both their layers selected. In order to do so, click on any of the layers, and then hold CTRL while clicking on the other:

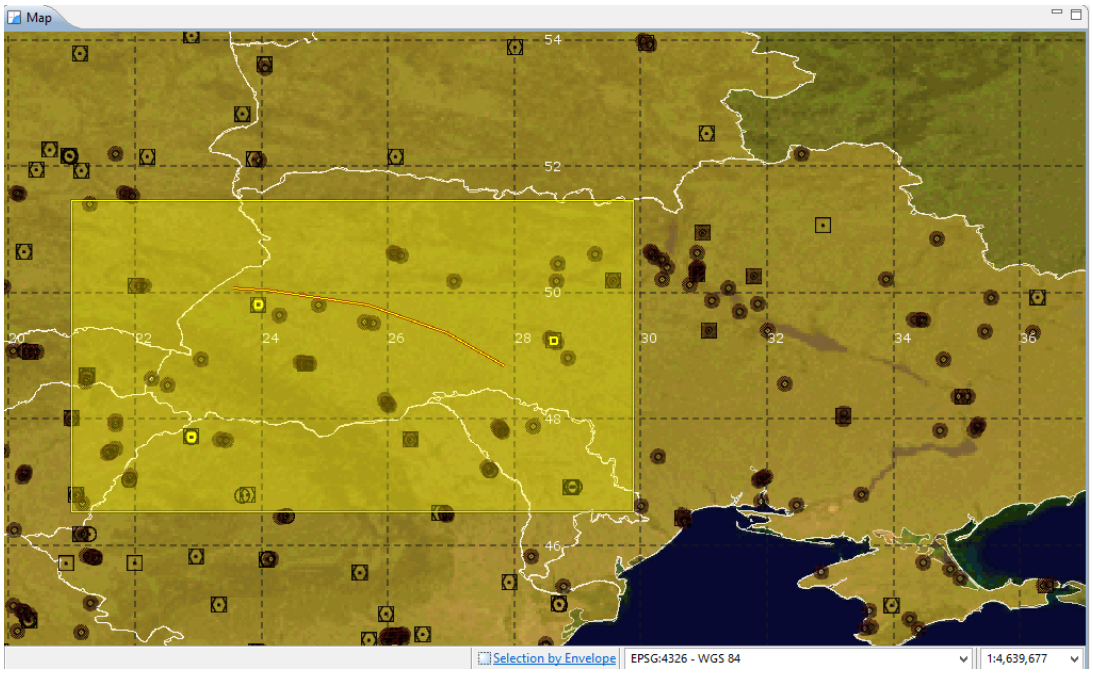


Figure 185: Procedure and NavAid selection

2. Select the "Calculations -> Procedures -> Vertical Profile" menu. The following window will appear:

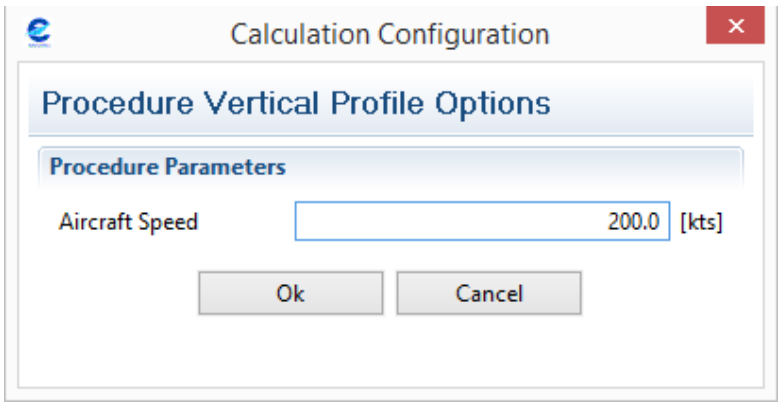


Figure 186: Aircraft Speed for Vertical Profile Calculation

After specifying the "Aircraft Speed" value, the user should click on the "OK" button. A new plot view with the results will appear below the map view:

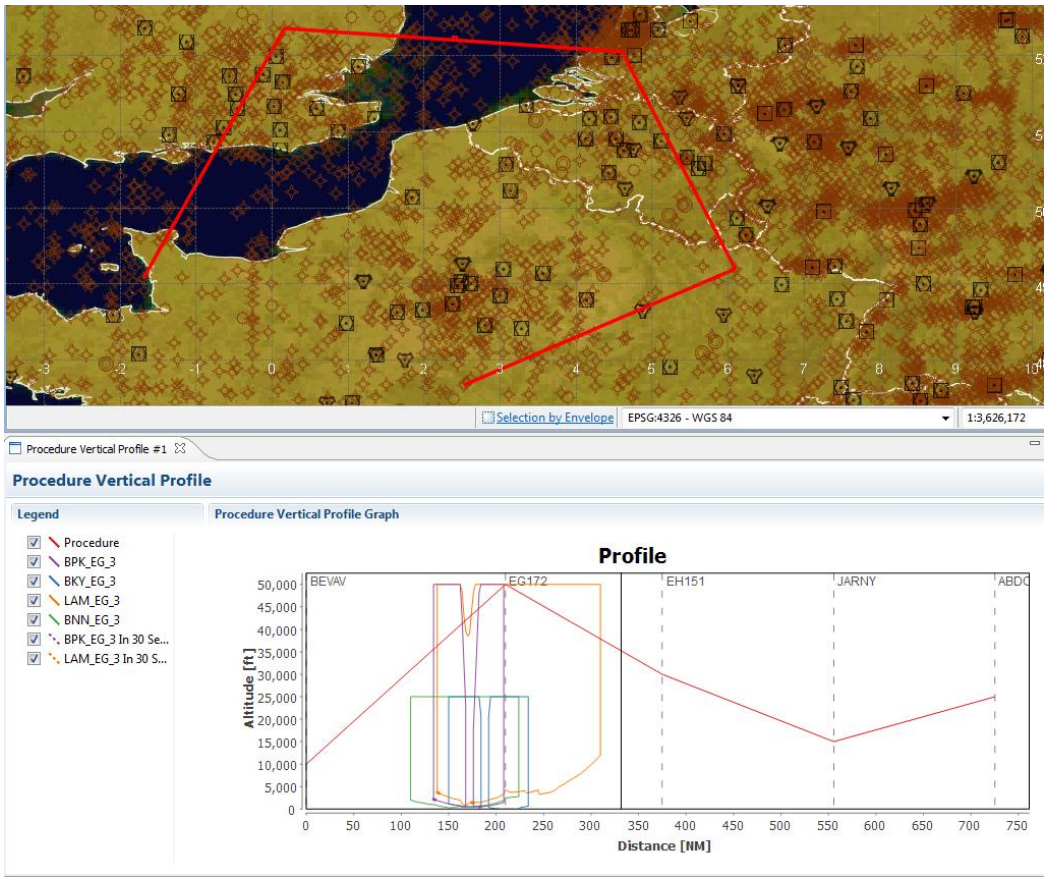


Figure 187: Vertical Profile

This plot represents the procedure's elevation along its track (painted with a **red line** on Figure 187) and the other lines represent the visibility of each of the selected NavAids.

Note that there is a representation of the point where the procedure enters one of the NavAid visibility zone. Using dots it is represented the distance that the aircraft will flight during **30 seconds with the specified velocity** (Figure 188)

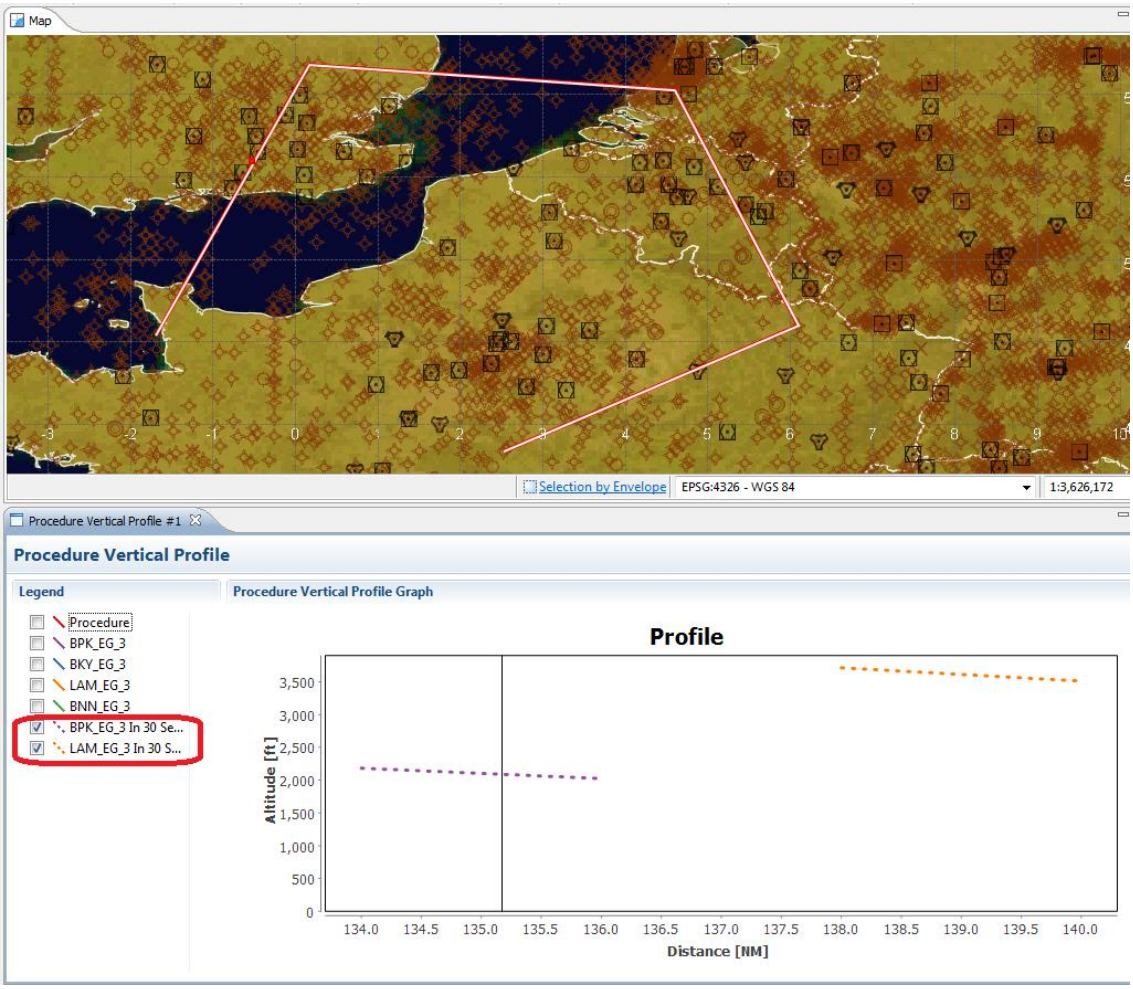


Figure 188: Procedure 30 seconds impact with specified velocity

12.3.4. PROCEDURE ASSESSMENT

The Procedure Assessment tool helps the user evaluating how changes affect an existing procedure. This tool also allows the user to move any coordinate point or to simulate a "direct to" or an "offset" on a procedure, and then calculate the performance and vertical profile results to the new configuration.

In order to use the procedure assessment tool, the user should:

1. Select one procedure and click on the icon, located on the toolbar. The following view will appear:

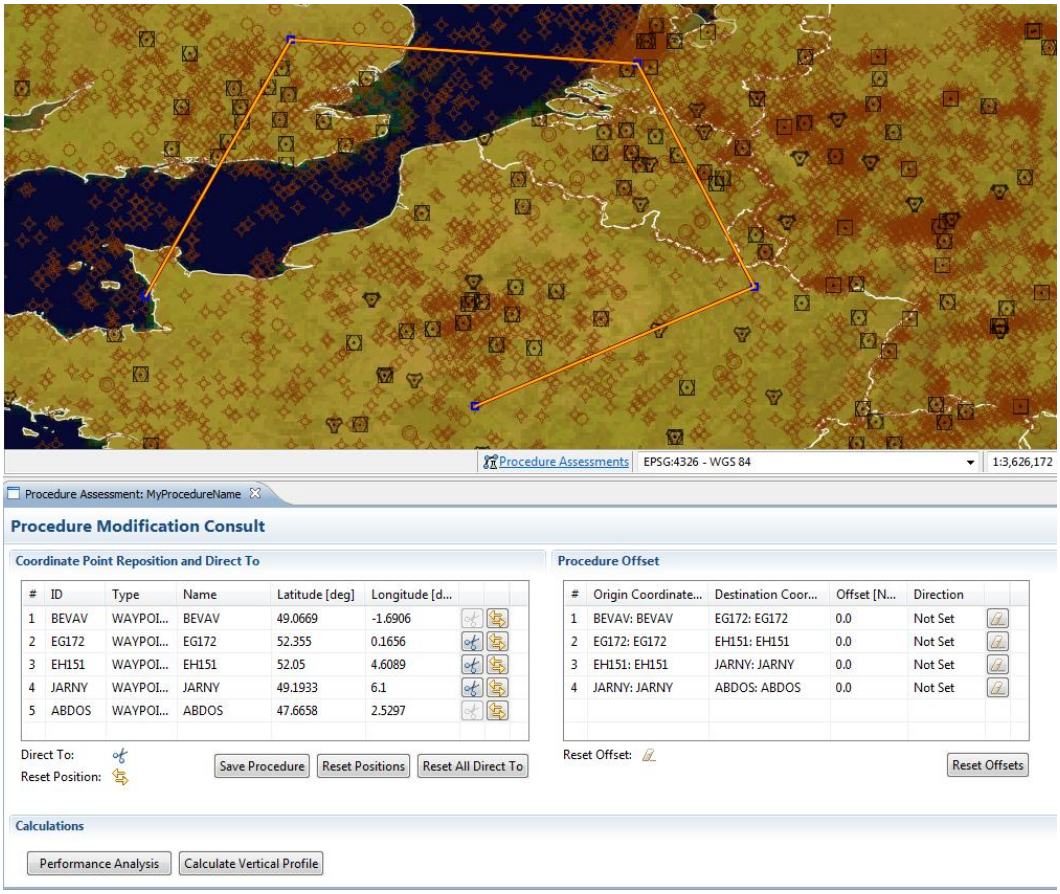


Figure 189: Procedure Assessment window

The left part of the window contains the list of the Coordinate Points that define the procedure, whereas the right part of the window shows the segments between two consecutive Coordinate Points.

This tool allows the user to perform three types of changes to the procedure:

Modify coordinate points' position

The user is able to change position of any Procedure's Coordinate Points (Figure 190). Click any procedure's coordinate point (**1**) and drag it a new position on the map (**2**). This will change the previously selected procedure. Note that the coordinate point that has been selected on the map, is automatically highlighted on the "Coordinate Point Reposition and Direct To" list (**3**):

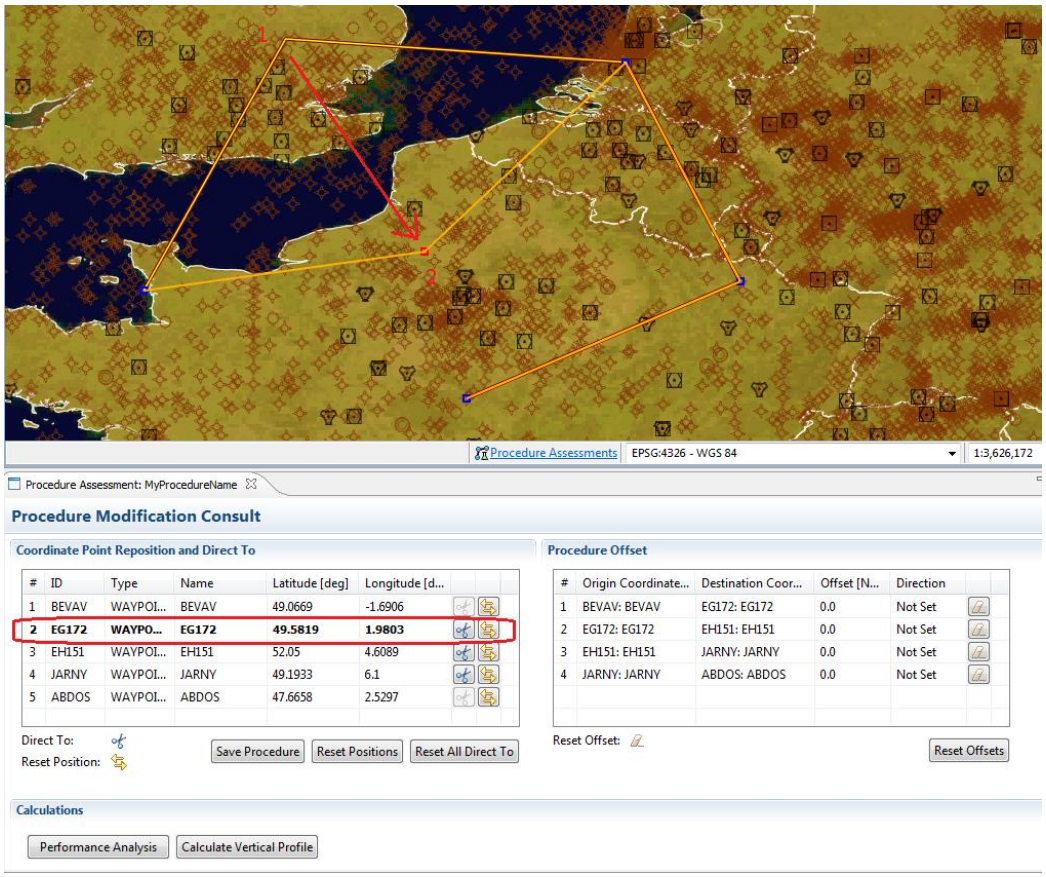


Figure 190: Procedure Assessment (Coordinate Points Reposition)

After making any changes, the user is then able to:

Save Procedure

Clicking on the "Save Procedure" button will update the database, regarding all the changes that have been made to the selected procedure. The user has the possibility to move the existing points or to create new ones.

Reset Positions

If the user desires to reset to the original procedure, he or she should click on the "Reset Positions" button. If the user wants to perform that action only for one Coordinate Point, then he must click on the icon, located in front of the respective coordinate point.

Use "Direct To" tool

Using this tool will consider the selected coordinate point "ignored" or "jumped", on the current procedure. In Figure 191, the third coordinate point (**1**) is selected and highlighted on the "Coordinate Point Reposition and Direct To" list (**2**).

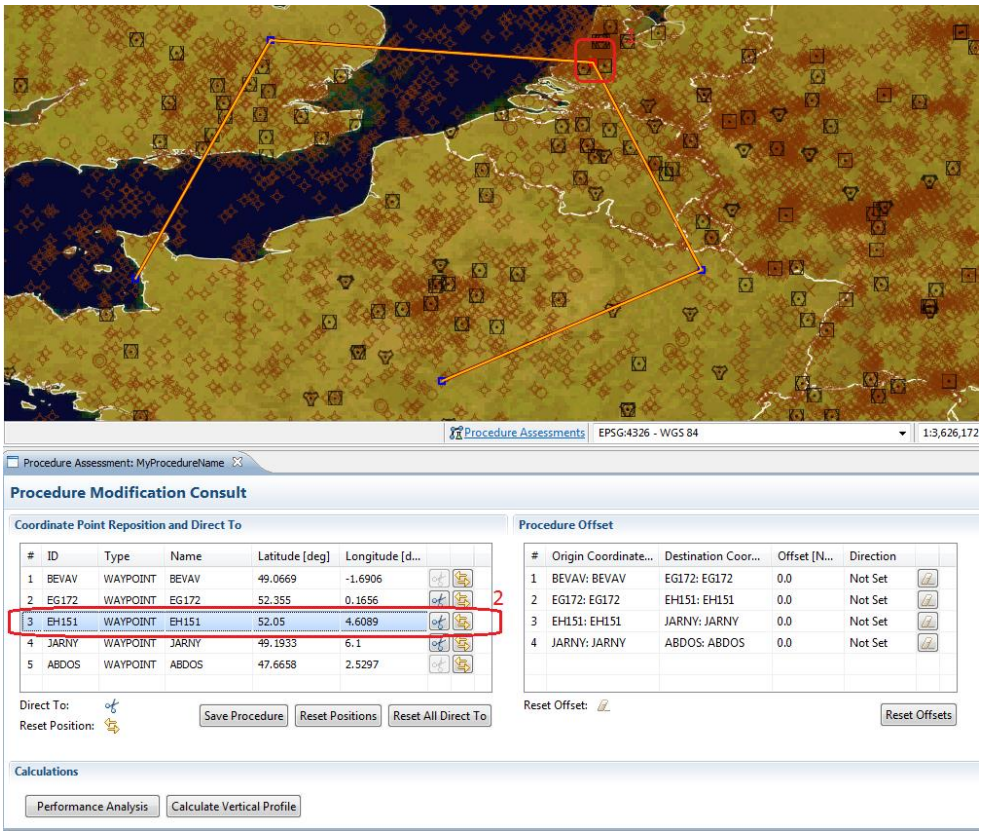


Figure 191: Procedure Assessment (Direct To tool)

Once the user clicks on the icon (Figure 192), the currently selected coordinate point's row becomes highlighted in **red** (**1**). Also, the two segments that became unavailable on the new procedure definition are now highlighted in **blue** (**2**).

Please notice that once the user makes any "Direct To" operations, it is always possible to perform a "Reset Direct To", in order to reset those changes to the default positions. Additionally, the user is able to perform such action for each "directed" coordinate point, by clicking again on the same icon that was clicked in order to direct the coordinate point in the first instance.

Finally, if the user desires to reset all the directed coordinate point changes, he or she can click on the "Reset All Direct To" button.

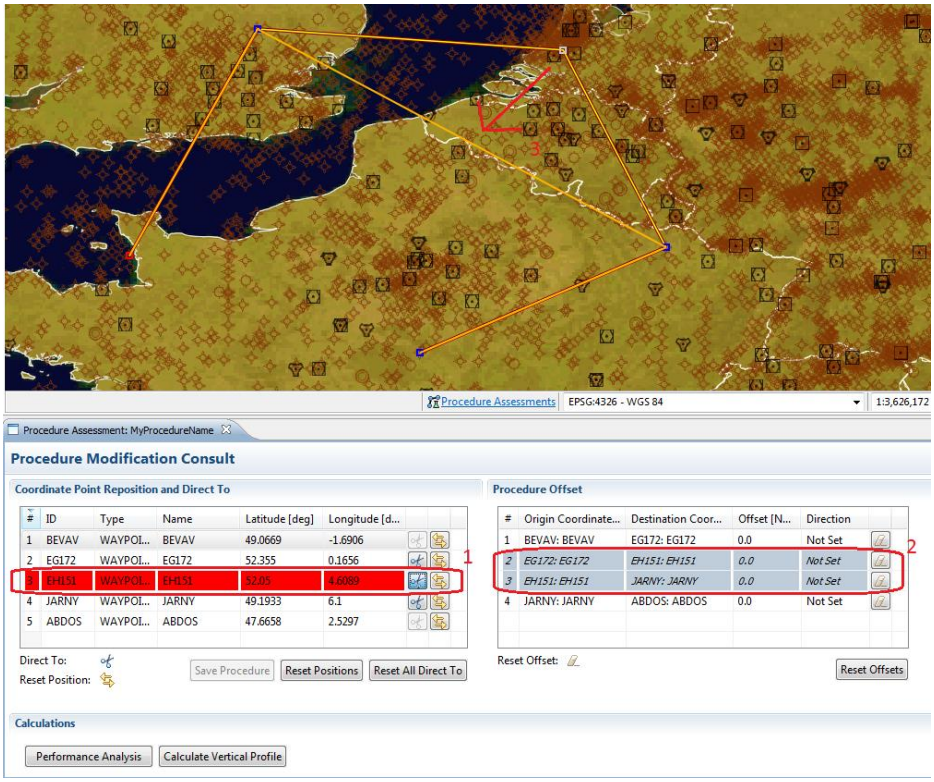


Figure 192: Direct To operation on a coordinate point

Make Offsets

The procedure offsets add two extra coordinate points to the procedure:

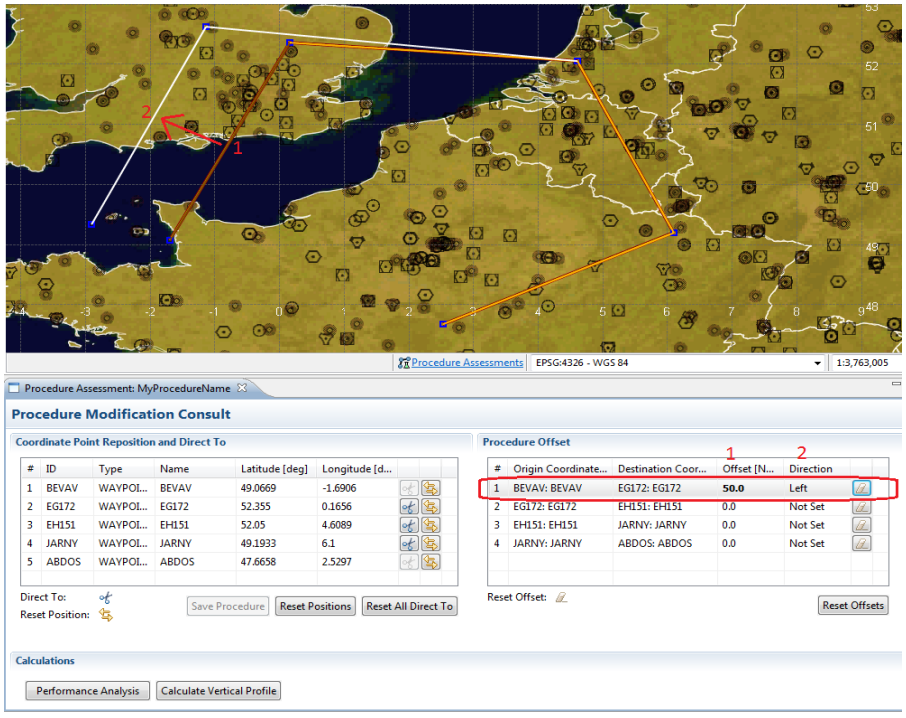


Figure 193: Procedure Assessment (Offset)

This tool allows the user to modify the procedure's segments by selecting the desired segment to be modified, on the "Procedure Offset" list (Figure 193). In order to perform these changes, the user should set first the "Offset" distance (in Nautical Miles) (**1**), by double clicking on the field in order to alter the value. On the "Direction" field (**2**), double click and a scroll-down menu with two options will appear: **Right** or **Left**, according to the direction that the procedure takes. After changing these values, press the "Enter" key and notice how the selected segment (**3**) was changed according to the inserted values (**4**).
Note that once the user changes any procedure segment offset, he or she can click the "Reset Offset" button in order to reset all the changes that were made. Also, the user is able to perform this action individually, by clicking on the icon, located on the segments list, in front of each segment.
After each modification, the user has the possibility to execute **Calculations** with the new procedure definition:

- **Performance Analysis** (see **section 12.3.2** for further details about this tool).
- **Vertical Profile** (see **section 12.3.3** for further details about this tool).

Note: any of these tools can be used at the same time, allowing the user to easily see results for multiple variations.

12.4. TERRAIN FILES

12.4.1. GTOPO30, DTED0, DTED1 AND DTED2 SUPPORT

DTED (or Digital Terrain Elevation Data) is a standard of digital datasets which consists of a matrix of terrain elevation values. This standard was originally developed in the 1970s to support aircraft radar simulation and prediction.

DTED supports many applications, including line-of-sight analyses, terrain profiling, 3-D terrain visualization, mission planning/rehearsal, and modelling and simulation. DTED is a standard National Geospatial-Intelligence Agency (NGA) product that provides medium resolution, quantitative data in a digital format for military system applications that require terrain elevation.

The DTED format for level 0, 1 and 2 is described in U.S. Military Specification Digital Terrain Elevation Data (DTED) MIL-PRF-89020B, and amongst other parameters describes the resolution for each level:

- **Level 0** has a post spacing of 30 arc seconds in latitude direction (ca. 900 meters).
- **Level 1** has a post spacing of 3 arc seconds (ca. 90 meters) which results in the following table:

Zone	latitude	range latitude (arc sec)	range longitude (arc sec)
I	0°–50° (North–South)	3	3
II	50°–70° (North–South)	3	6
III	70°–75° (North–South)	3	9
IV	75°–80° (North–South)	3	12
V	80°–90° (North–South)	3	18

- **Level 2** has a post spacing of 1 arc second (ca. 30 meters).

In addition three more levels (3, 4 and 5) at increasing resolution have been proposed, but not yet standardized.

DTED data is stored in a big endian format where negative numbers are signed magnitude.

GTOPO30 is a global digital elevation model (DEM) with a horizontal grid spacing of 30 arc seconds (approximately 1 kilometre). GTOPO30 was derived from several raster and vector sources of topographic information. For easier distribution, GTOPO30 has been divided into tiles which can be selected from the map shown above. Detailed information on the characteristics of GTOPO30 including the data distribution format, the data sources, production methods, accuracy, and hints for users, is found in the GTOPO30 README file.

GTOPO30, completed in late 1996, was developed over a three year period through a collaborative effort led by staff at the U.S. Geological Survey's Center for Earth Resources Observation and Science (EROS). The following organizations participated by contributing funding or source data: the National Aeronautics and Space Administration (NASA), the United Nations Environment Programme/Global Resource Information Database (UNEP/GRID), the U.S. Agency for International Development (USAID), the Instituto Nacional de Estadistica Geografica e Informatica (INEGI) of Mexico, the Geographical Survey Institute (GSI) of Japan, Manaaki Whenua Landcare Research of New Zealand, and the Scientific Committee on Antarctic Research (SCAR).

DEMETER can use both types of terrain data: DTED and GTOPO30 and will use the best resolution data for each point on the terrain. In addition, if voids are detected on DTED files an option is available on the configurations to allow DEMETER to use lower quality data for those points.

12.4.2. SRTM

The Shuttle Radar Topography Mission (SRTM) is an international research effort that obtained digital elevation models on a near-global scale from 56° S to 60° N,[2]to generate the most complete high-resolution digital topographic database of Earth prior to the release of the ASTER GDEM in 2009.

SRTM has a 3 arcsec resolution for all over the world and a 1 arcsec for USA.

12.4.3. ASTER

ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) is a Japanese sensor which is one of five remote sensory devices on board the Terra satellite launched into Earth orbit by NASA in 1999.

The first version of the ASTER GDEM was generated using stereo-pair images collected by the ASTER instrument onboard Terra. ASTER GDEM coverage spans from 83 degrees north latitude to 83 degrees south, encompassing 99 percent of Earth's landmass.

The improved GDEM V2 adds 260,000 additional stereo-pairs, improving coverage and reducing the occurrence of artifacts. The refined production algorithm provides improved spatial resolution, increased horizontal and vertical accuracy, and superior water body coverage and detection. The ASTER GDEM V2 maintains the GeoTIFF format and the same gridding and tile structure as V1, with 30-meter postings and 1 x 1 degree tiles.

12.4.4. GEOTIFF

GeoTIFF is a public domain metadata standard which allows georeferencing information to be embedded within a TIFF file. The potential additional information includes map projection, coordinate systems,ellipsoids, datums, and everything else necessary to establish the exact spatial reference for the file. The GeoTIFF format is fully compliant with TIFF 6.0, so software incapable of reading and interpreting the specialized metadata will still be able to open a GeoTIFF format file.

12.4.5. ASCII AND ARCGRID

An Esri grid is a raster GIS file format developed by Esri, which has two formats:

1. A proprietary binary format, also known as an ARC/INFO GRID**, ARC GRID** and many other variations
2. A non-proprietary **ASCII** format, also known as an ARC/INFO ASCII GRID

The formats were introduced for ARC/INFO. The binary format is widely used within Esri programs, such as ArcGIS, while the ASCII format is used as an exchange, or export format, due to the simple and portable ASCII file structure.

The grid defines geographic space as an array of equally sized square grid points arranged in rows and columns. Each grid point stores a numeric value that represents a geographic attribute (such as elevation or surface slope) for that unit of space. Each grid cell is referenced by its x,y coordinate location.

12.4.6. OBSTACLE INFORMATION

Sometimes the user verifies that a natural or an artificial obstacle is cutting the NavAid visibility. There is a way on DEMETER to simulate this obstacle on the calculation results. To configure the obstacle data the user must edit the NavAid and fill the Minimum Screening Angle table highlighted in red on next figure.

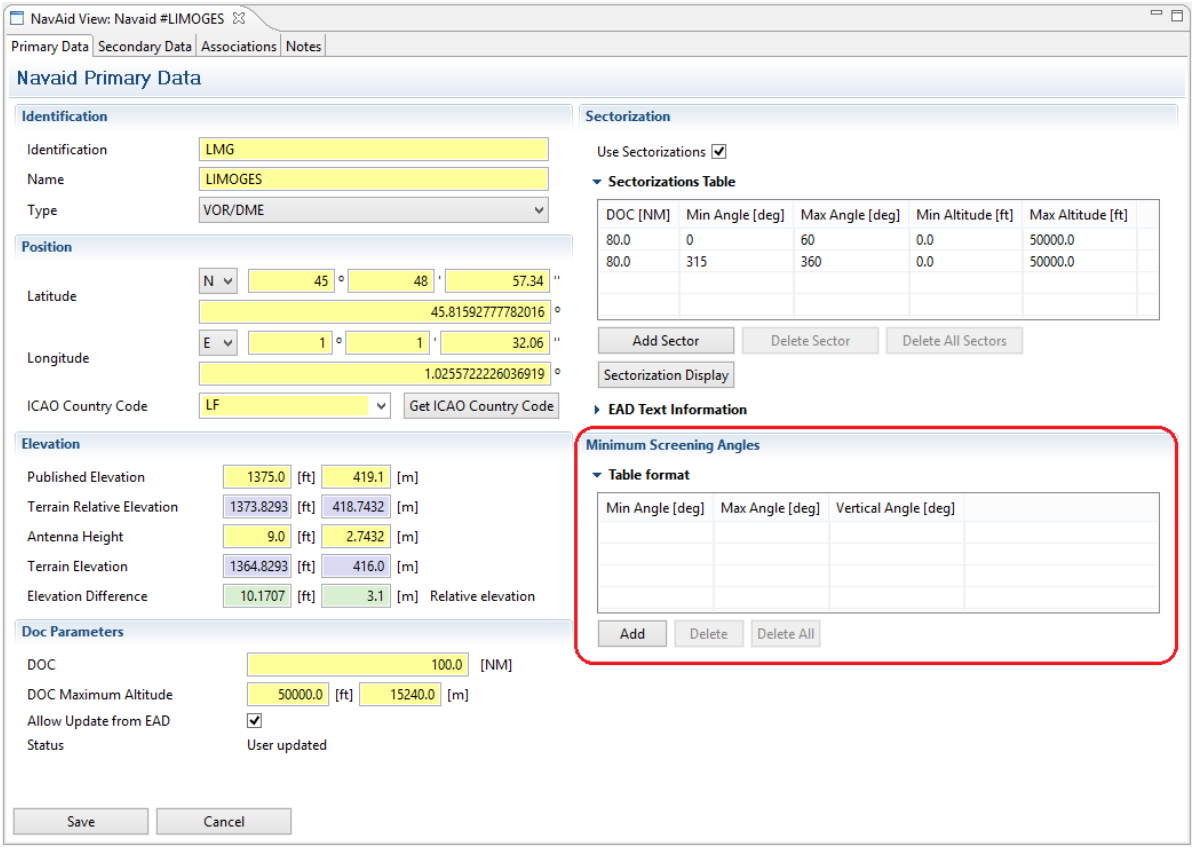


Figure 194: Minimum Screening angle

In order to add a new Entry to the table, the user should click on the "Add" button. Then, the user should fill the horizontal Angle range (Min and Max Angle fields).

The last step is to fill the Vertical Angle. This value represents the minimum vertical visibility angle from the NavAid point of view. Below this angle there is no visibility representing on this mode a "virtual obstacle" on the specified direction.

12.5. MANAGE RESULTS

After a calculation is performed, the new layer is stored on the layer tree inside a folder named Results. This folder is temporary and all its content will be deleted if you close DEMETER and open it again.

For each layer inside the Results folder the user can execute the following actions:

- Delete one layer or multiple layers
- Save de results layer
- See the configuration and input parameters used to create the result

Delete a result layer

To delete any result right click on the layer you want to remove and select Delete Layers. The user can select multiple layers and delete all at the same time (Figure 195).

Note: After this action is performed, the information is lost and cannot be recovered!

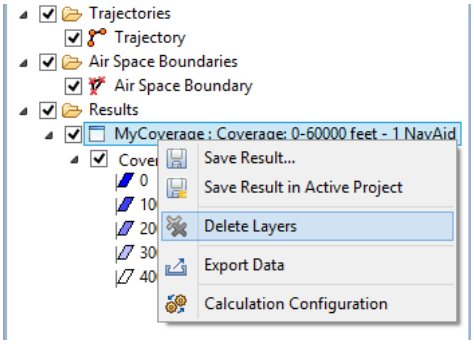


Figure 195: Delete Result Layer

Save Result

If the user wants to store a result to be available after DEMETER is closed it is necessary to save it. To save a result right click on the required layer and select "Save Result" (Figure 196).

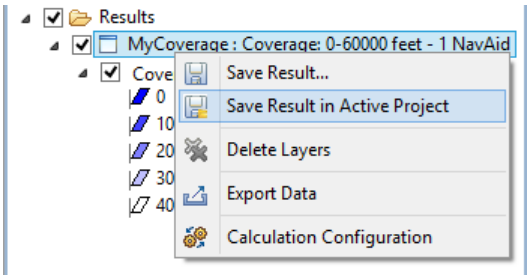


Figure 196: Save Result Menu

After selecting the option to save the result, the following window is displayed:

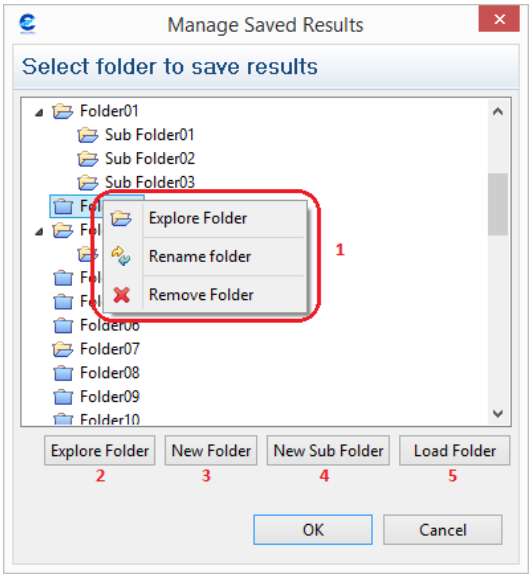


Figure 197: Save Results Window

On this window (Figure 197) the user is able to:

By right clicking on an existing folder (**1**), the user is able to:

Explore the folder
Rename an existing folder
Delete an existing folder

Explore the folder (**2**)

By clicking on the "Explore Folder" button.

Create a new folder (**3**)

By clicking on the "New Folder" button.

Create a new sub folder (**4**)

By clicking on the "New Sub Folder" button.

Select the folder to store the result

By selecting the folder, clicking on the "Load/Unload" button (**5**), and then clicking on the "OK" (**5**) button.

Save Result in Active Project

To save a result on the Active Project, right click on the required layer and select "Save Result in Active Project" (Figure 197).

12.6. ALTITUDE FILTER

After a calculation with altitude range parameters has been performed, it is possible to filter the information shown on the map by altitude. To filter this information, click on the "Altitude Filter" button shown in Figure 198.

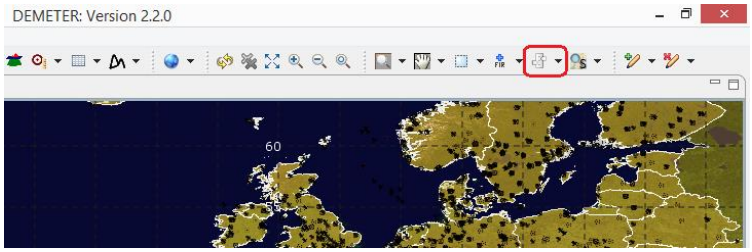


Figure 198: Altitude Filter Button

The Altitude Filter tab is shown on the right side of the DEMETER main window (Figure 199).

In this tab, the user sets the range of elevation that is intended to be seen at the end result, and selects the calculations that will have the filter applied to. Finally, the user must click on the "Apply Filter" button.

The "Disable Filters" checkbox allows disabling the filter temporarily without resetting the minimum and maximum elevation. With this feature it is possible to re-apply the same filter without inserting this values again.

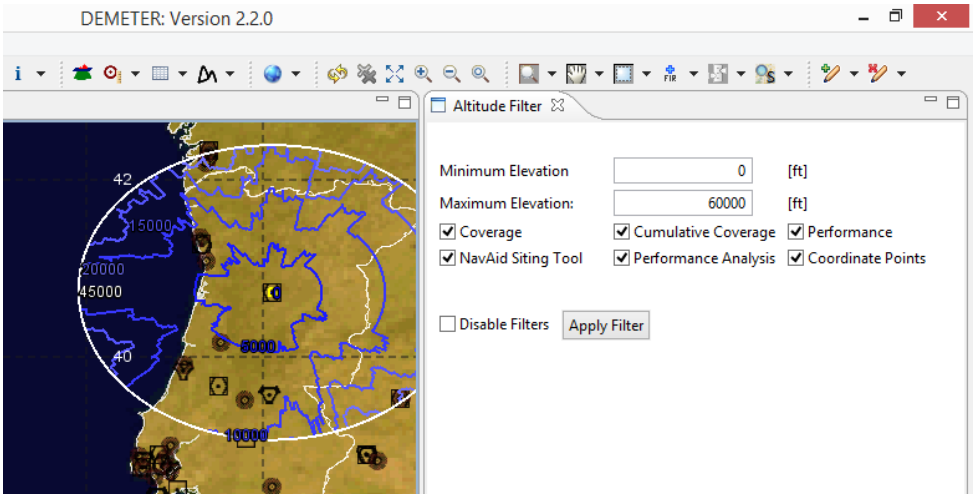


Figure 199: Altitude Filter Tab

12.7. CALCULATION OUTPUT

Starting in DEMETER 1.1 the calculation output is essentially in the form of shapefiles.

12.8. CALCULATION CONFIGURATIONS

After a calculation is executed the user can consult which were the inputs in order to obtain that result. To access such information, the user should right click on the layer and select the "Calculation Configuration" option (Figure 200).

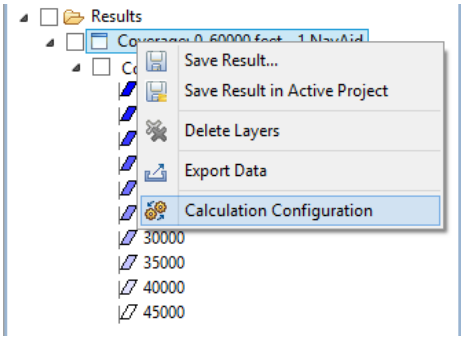


Figure 200: Calculation Configuration

The result is displayed below the map on a separate view. in this window the user is able to check which configuration parameters have been used and which items on the map were selected.

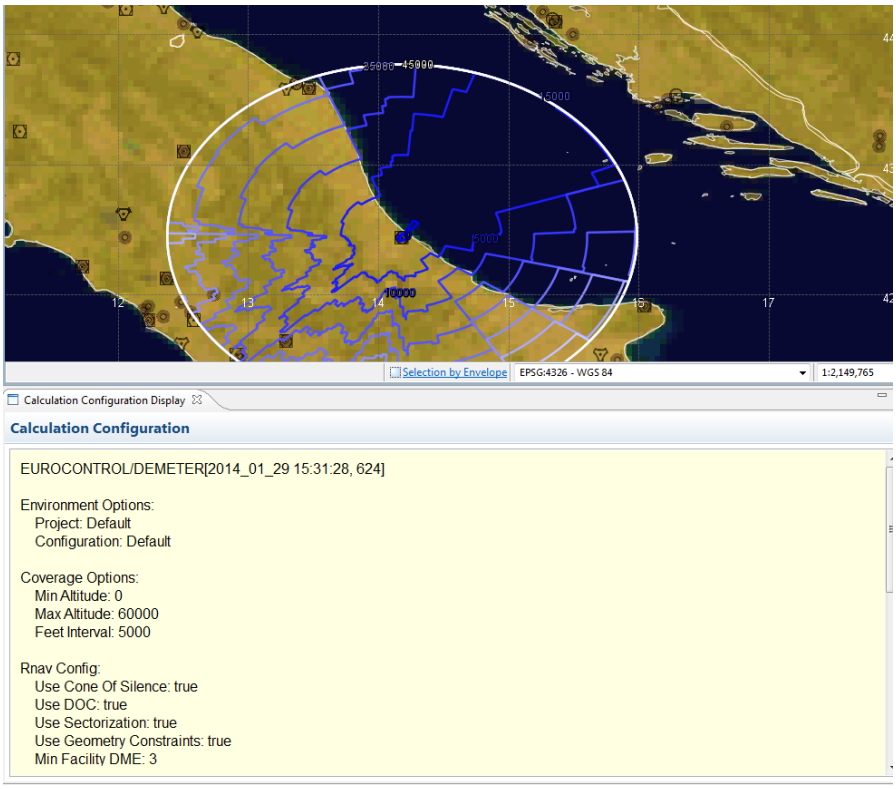


Figure 201: Calculation Configuration Display

12.9. ERROR INFORMATION

Three kinds of issues can occur before a calculation is started. For each one of them, a different window is displayed to alert the user:

NavAids Issues

A window is displayed if there is any problem with the NavAid data used on the calculation. Missing data applies to the following fields: **missing DOC**, **missing Maximum Operational Altitude** and **missing or wrong Elevation** (Figure 202). Putting the mouse cursor over the problematic cell, highlighted with a color, will show a tooltip with the problem.

The user must correct these values before the calculation starts.

For the DOC the user can select all the NavAids and apply to all the same value, using "Fix DOCs", or must specify a valid value for each one.

For the Maximum Operational Altitude the default value is suggested and the cell is marked in orange. If the user does not change it the default value will be used.

For the Elevation there is a "Fix Elevation" button that the user can use. This button will change the NavAid elevation to be equal to the terrain elevation plus the antenna height.

The user can save all the changes permanently on the database by clicking on the "Save" button.

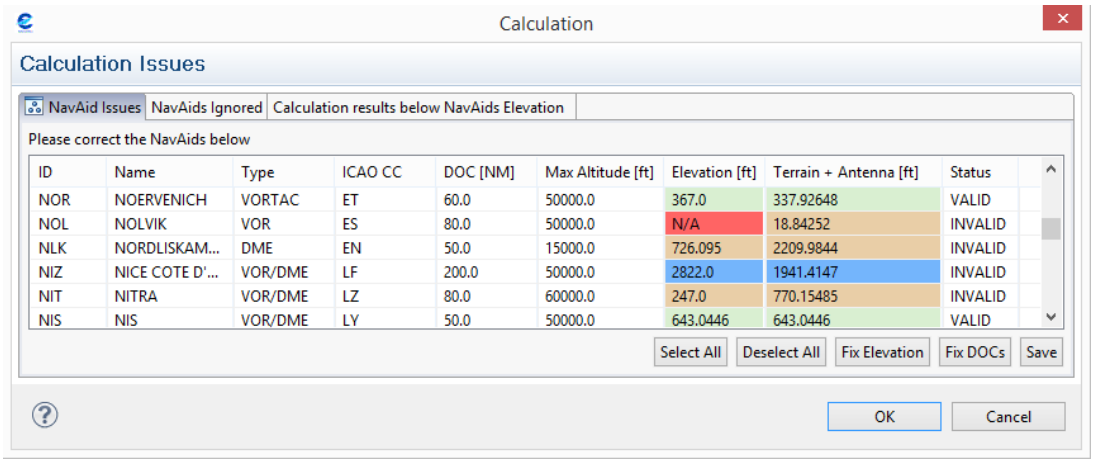


Figure 202: NavAid Issues

NavAids Ignored

DEMETER only makes calculations for RNAV NavAids (Figure 203). If other kind of NavAids is selected, an alert is displayed alerting the user that those NavAids are not going to be used in the calculations. No action is required from the user. After clicking the OK button the calculation will proceed.

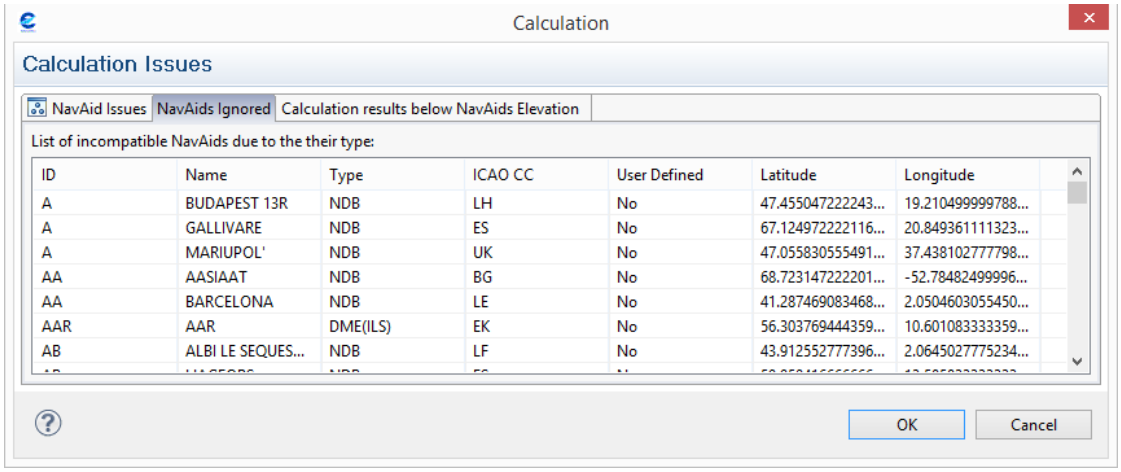


Figure 203: Ignored NavAids

Calculation Altitude is lower than the Altitude of the NavAid

If the user starts a calculation on an altitude that is lower than the altitude of the NavAid there is a warning to the user (Figure 204). No action is required from the user. After clicking the OK button the calculation will proceed.

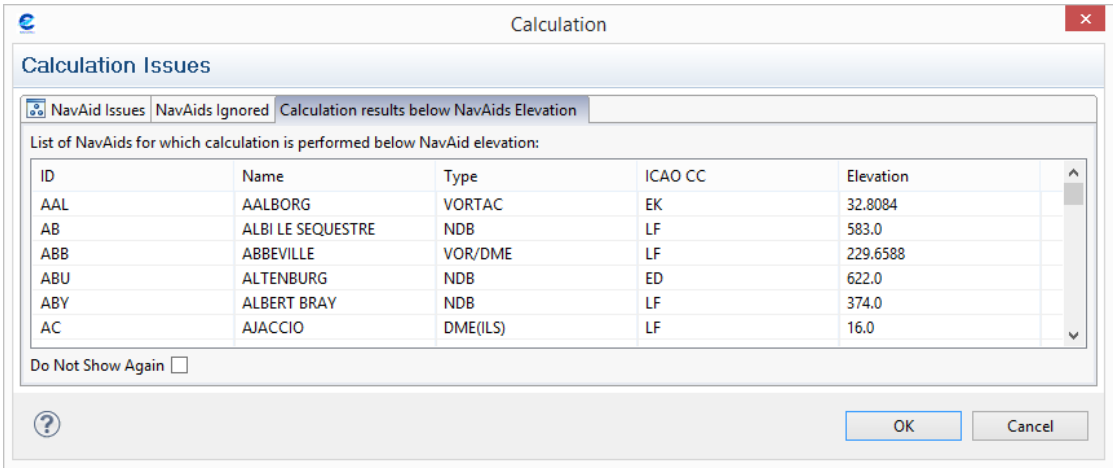


Figure 204: Calculation Altitude lower than the NavAid Altitude

13.EARTH 3D GLOBE

DEMETER has the option to see the Earth in a 3D perspective. This will help the user for example to inspect the terrain around a NavAid on a 3D view.

To view the 3D globe click on the icon, located on the toolbar, and a new view will appear:

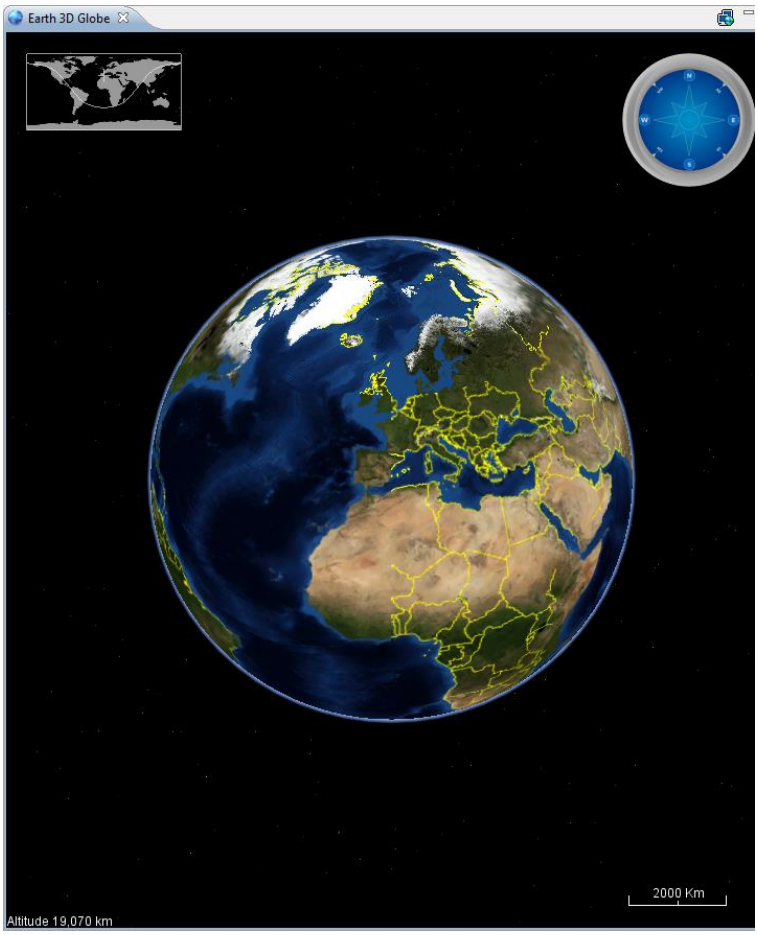


Figure 205: Earth 3D Globe Main View

When the window is shown, please note that also a new set of layers appear on the Layer tree. The user is able to **show** or **hide** any of those layers:

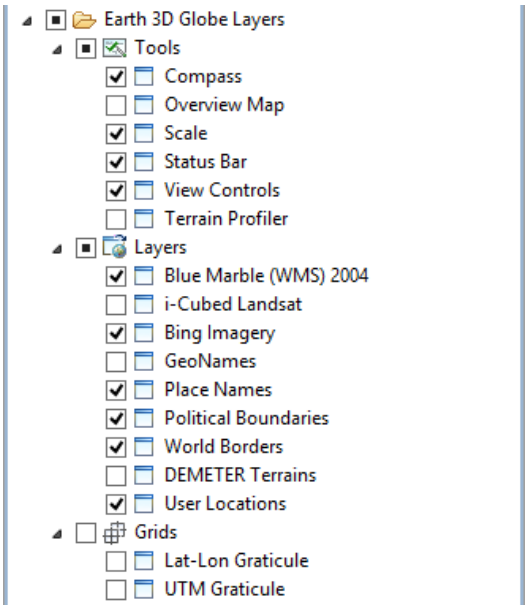


Figure 206: 3D Map Layer

In order to move the Globe, the user can use the following options:

- Click (right button) over the globe and drag anywhere on the window. Then release whenever desired.
- Click (left button) over the globe and drag anywhere on the window. Then release whenever desired.
- Simple click anywhere on the map and automatically will be positioned at that point.
- Move upper right compass to rotate.

- Click on the 2D map, located on the upper left, anywhere in order to perform a zoom to the clicked position on the 3D Globe.

- Use the **View Controls**. Check the "View Controls" layer on the Layer tree in order to see the following panel:

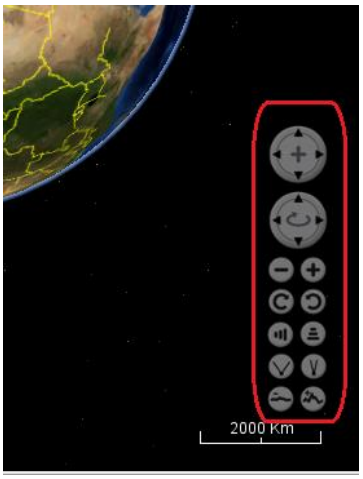


Figure 207: View Controls

In this panel, from the top to the bottom, you can see the following buttons (Figure 207):

 (**Pan Tool**)
Click and move over the pad to make smooth pan movements.

 (**Rotate Tool**)
Click and move over the pad to make smooth rotations.

 (**Zoom**)
Zoom in or out of the current position.

 (**Rotate by vertical axis**)
Rotate in both ways by a vertical axis.

 (**Slope Angle**)
Modify up or down slope view angle.

 (**Vision angle**)
Open or close the current view angle.

 (**Terrain Exaggeration**)
Modify height differences between points to better see terrain level.

The user is also able to see NavAids on the 3D map by making them visible on the NavAids Layer tree.

Click on any NavAid on the Earth 3D Globe view to see some details. Click again to hide the information.

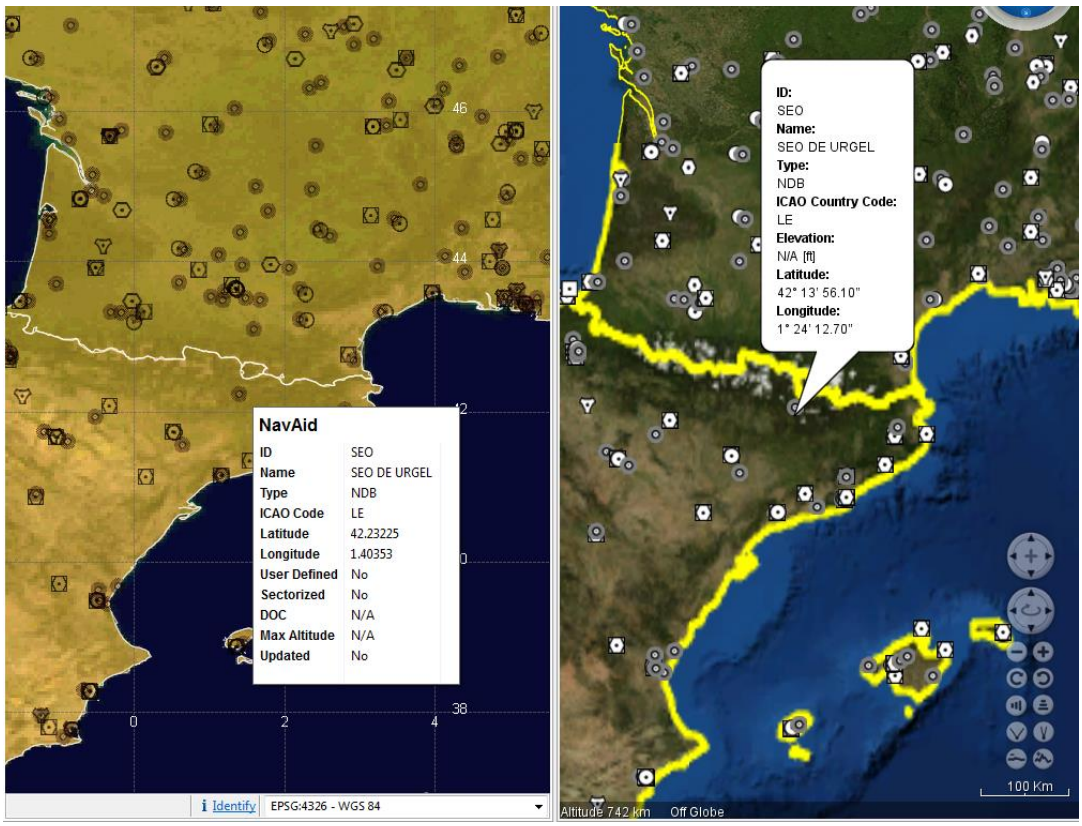


Figure 208: NavAid Information on 3D map

13.1. DEMETER TERRAIN VIEW IN 3D

It´s possible to show the configured terrains in DEMETER in the 3D globe. Only DTEDs formats are currently supported

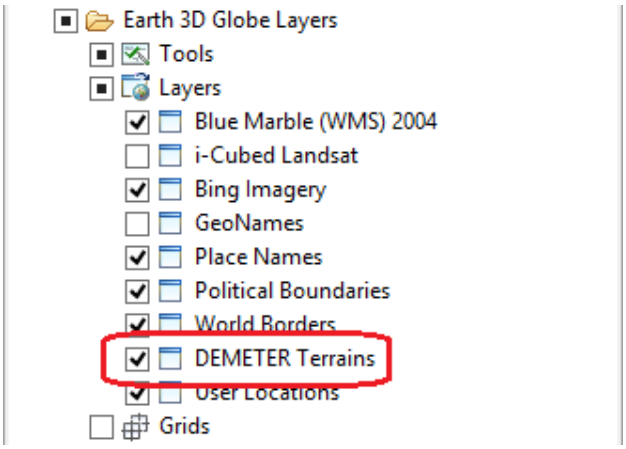


Figure 209 - Terrain selection on 3D

13.2. CALCULATIONS SUPPORT ON 3D

In DEMETER 2.2 it was introduced the support for multiple calculations results and procedures on the 3D window. The following figure represents how it´s possible to show a calculation result on the 3D window.

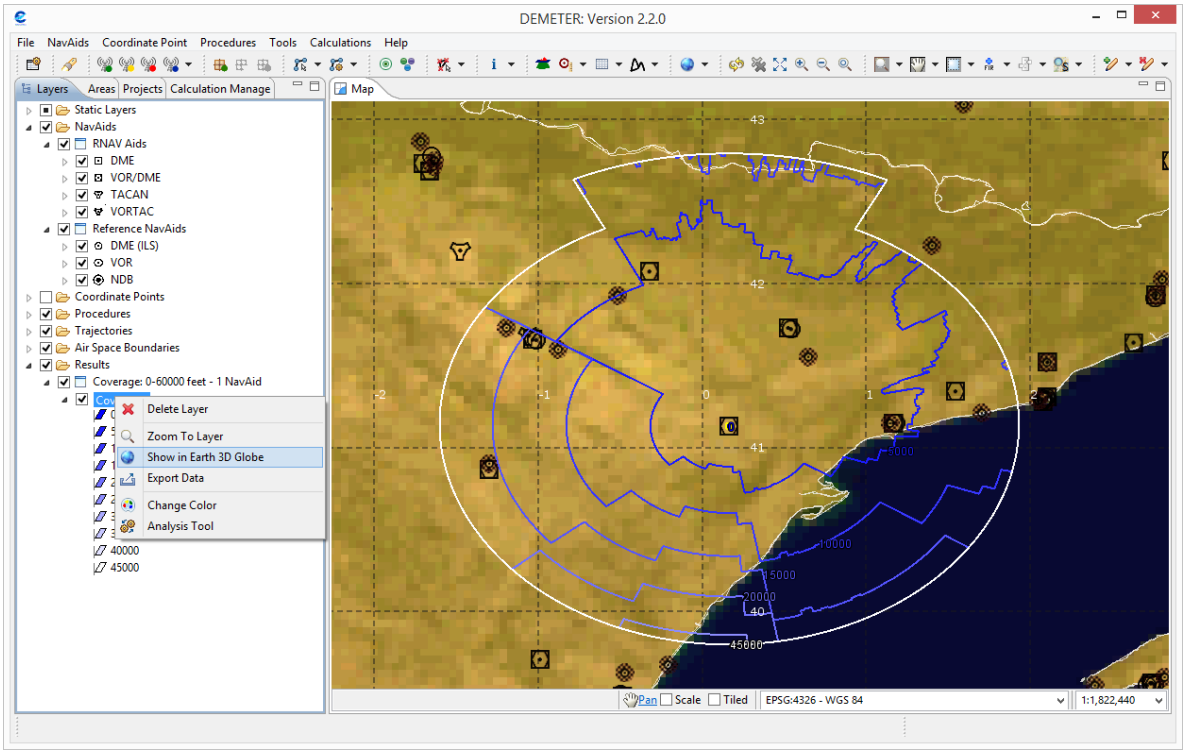


Figure 210 - Show on 3D option

The following calculation results are possible to show on 3D:

- Coverage;
- Area Performance;

- Cumulative Coverage;
- Procedure Analysis;
- Flight Inspections and Pre-Processing results that have altitude;

13.3. FLY TO POSITION TOOL

This is a tool that allows the user to see a specified place on the Earth 3D Globe view by clicking on the 2D map. In order to use this tool the user must click on the icon, located on the icons' toolbar.

Then double click anywhere on the 2D map and automatically the 3D globe will move to the selected position and a mark over the position appears.

Click on the mark to know the Latitude and Longitude of selected point. Click again to hide the information.

Figure 211: Fly to Position tool

14.OTHER TOOLS

14.1.TERRAIN ALTITUDE CUT

The terrain altitude cut tool shows on the map the terrain above the user-defined altitude. In order to use this tool, the following steps are required:

1. Click on the icon, located on the toolbar.
2. Select area on the map.
3. The following window will appear:

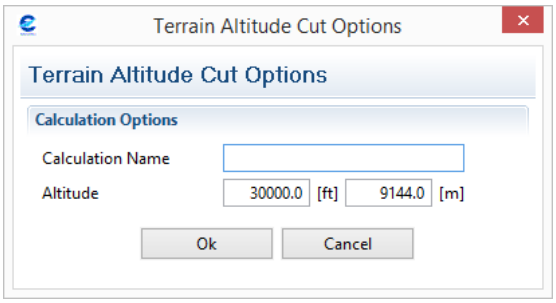


Figure 212: Terrain Altitude Cut Options

4. Then, the user specifies the parameters that will be used on the calculation:
   - Calculation **Name:** Note that if this field is not filled, it will be defaulted
   - **Altitude:** Required values for the calculatio
5. The result appears on the map (Figure 213).

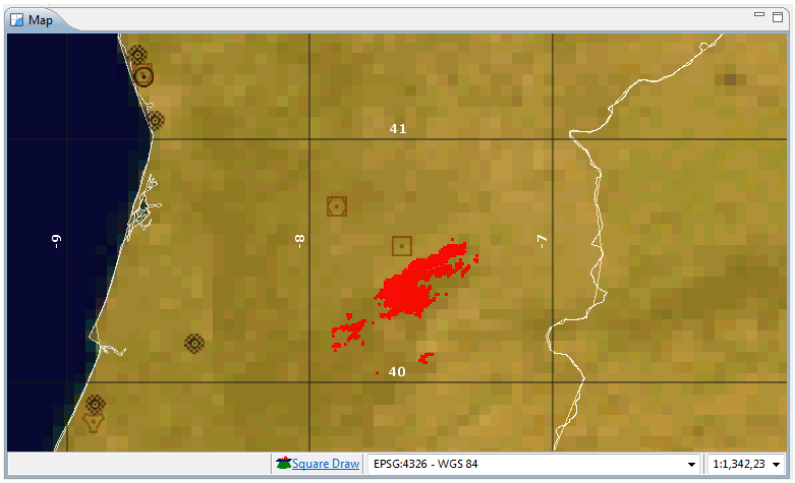


Figure 213: Terrain Altitude Cut Sample

14.2. CROSS SECTIONS

The Cross sections tool shows terrain profiles defined by a line on the 2D map (Figure 214). In order to use this tool, click on the icon, located on the toolbar. A new window with an empty graphic zone appears on DEMETER. To create a new cross section terrain profile, the user should follow the next steps:

4. Double click anywhere to start the cross section (**1**).

5. To finish the current section double click on another location on the map (**2**).

6. If the user desires to add a new section, he should press and hold the "CTRL" key and double click anywhere on the map (**3**).

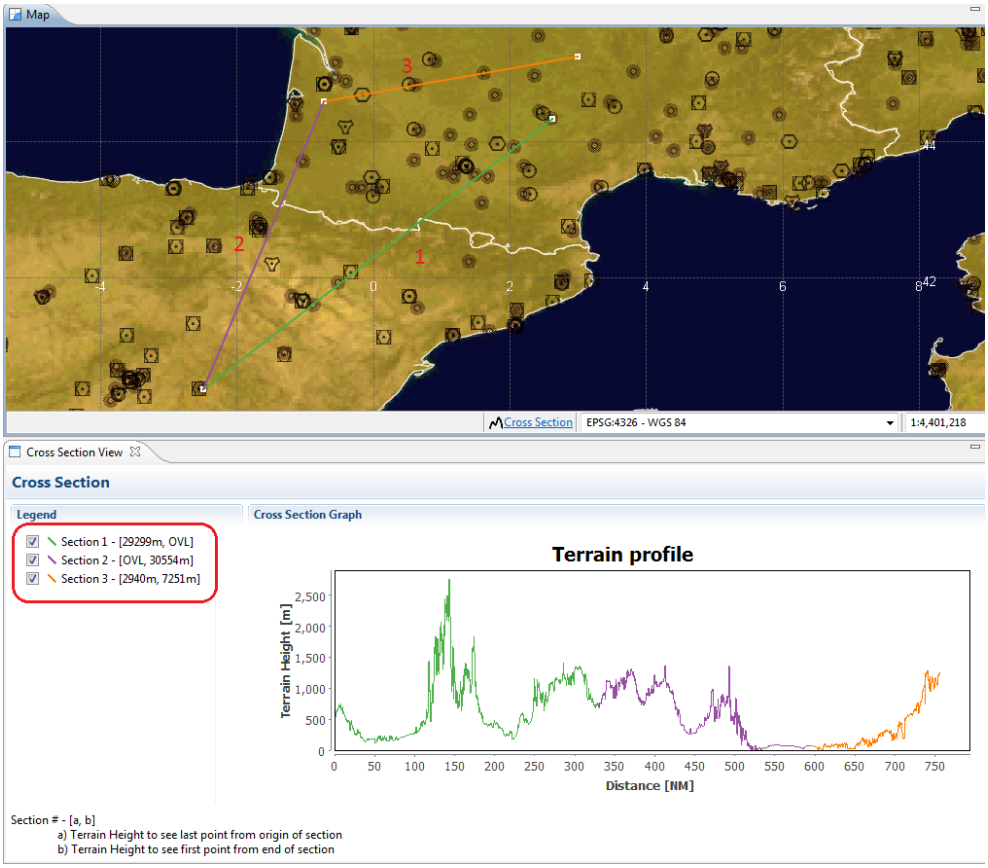
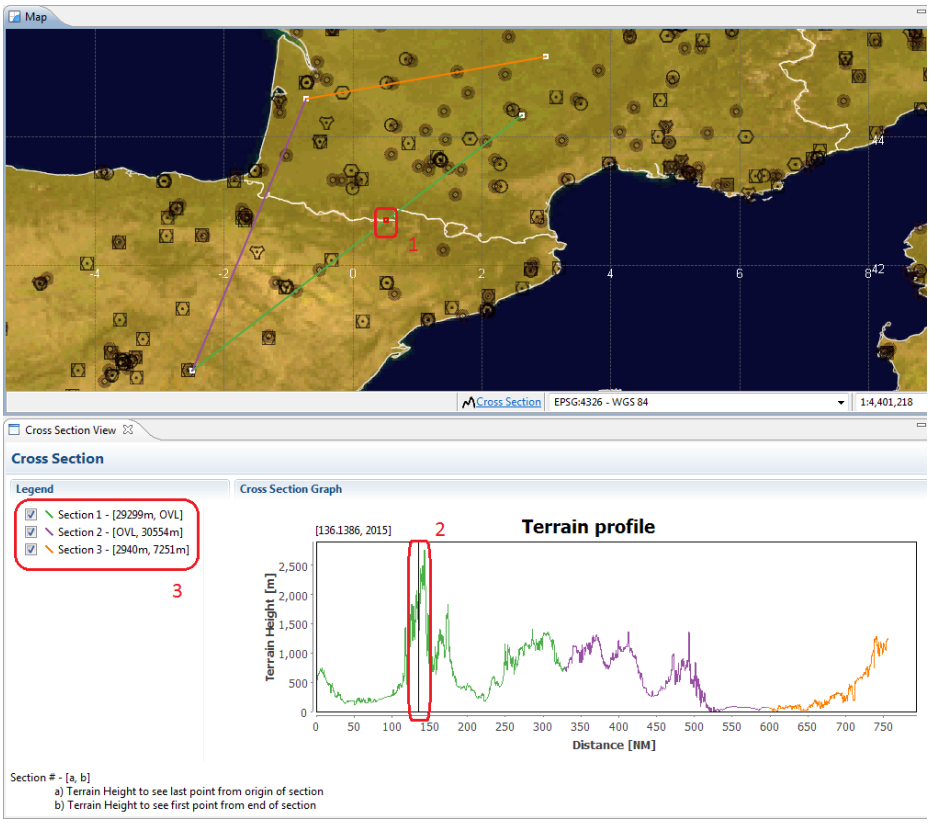


Figure 214: Cross Section sample

On the Terrain Profile view, the user is able to use the terrain **features**:

- To know the position on the map from a point on the Terrain Profile window just move the mouse over the graphic (**2**). A small red square will be displayed on the map over the segments (**1**).



- Use the Check Boxes on the legend in order to show/hide any profile segment.

- On the legend (**3**), in front of section name there are 2 numbers that give some extra information:

First Value

The altitude value that an observer at the beginning of a cross section segment needs to rise to be able to see the last point of the segment

Second Value

Has the same meaning as the first value but now for an observer at the end of a cross section segment to see the first point.

Note that if any of the values is too big (bigger than 32 Km) the value is not displayed, showing an overload indication (OVL).

14.3. ANGLES TOOL

The Angles tool allows the user to draw over the map, concentric lines centered on a specified point. This tool can be used – for example – to evaluate the coverage angles from a NavAid. Click on the Angles Tool icon in order to use this tool. A new view will appear:

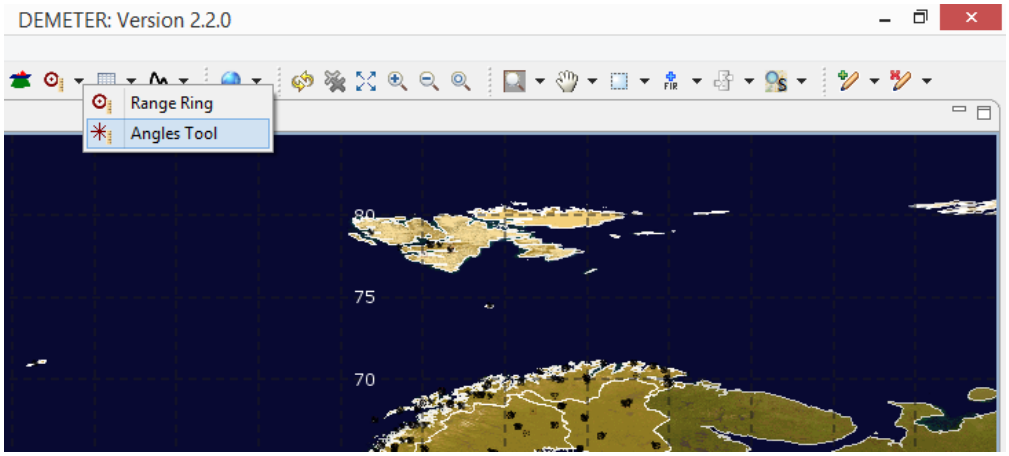


Figure 215 - Angles tool selection

In the window that will appear, the user is able to configure:

Line Length (NM)

Distance from the point at the center to the end of the line, for each azimuth.

Angle Increment (º)

Value that defines the increment between each azimuth.

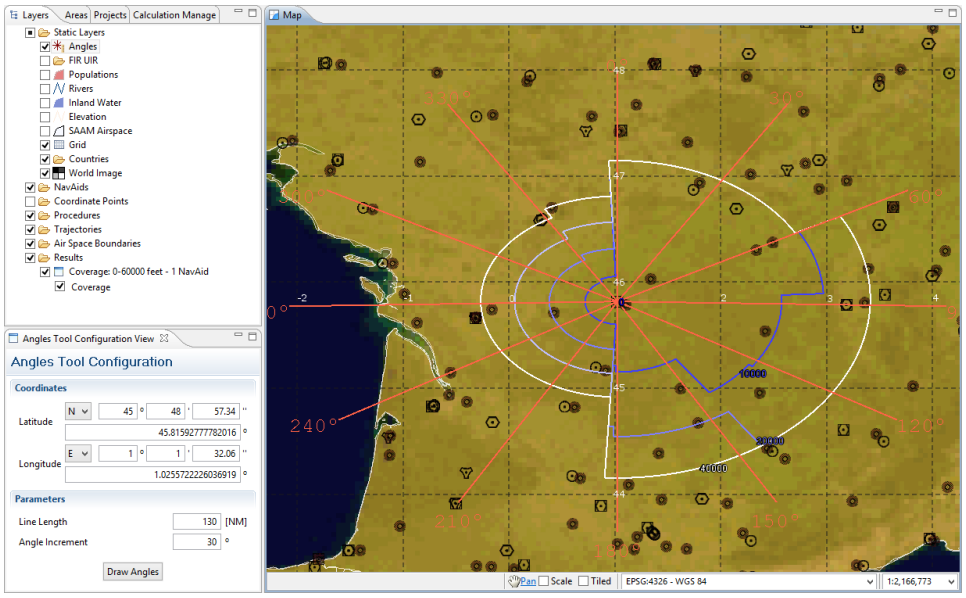


Figure 216 - Angles tool usage

14.4. RANGE RING TOOL

The Range Ring tool allows the user to draw over the map, concentric circles centered on a specified point. This tool can be used – for example – to evaluate distances from a NavAid. Click on the icon in order to use this tool. A new view will appear:

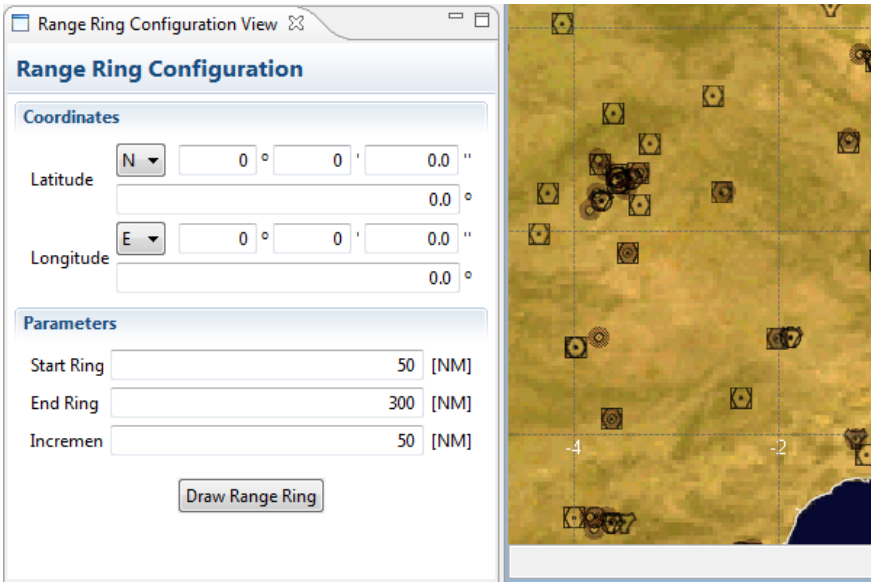


Figure 217: Range Ring Configuration

In this view, the user is able to configure:

Start Ring (NM)

Distance from the point at the center, to the first range ring

End Ring (NM)

Distance from the point at the center, to the last range ring

Increment (NM)

Distance between the range rings

Make sure all values are between the limits given on next tables:

Table 56: Start Ring value limits

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	0	300

Table 57: End Ring value limits

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	50	500

Table 58: Increment value limits

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	1	500

In addition, the value for the End Ring must always be higher than the Start Ring.

After all the parameters are configured, click on the position you want to be the center of the Range Rings and some rings like these will appear over the map:

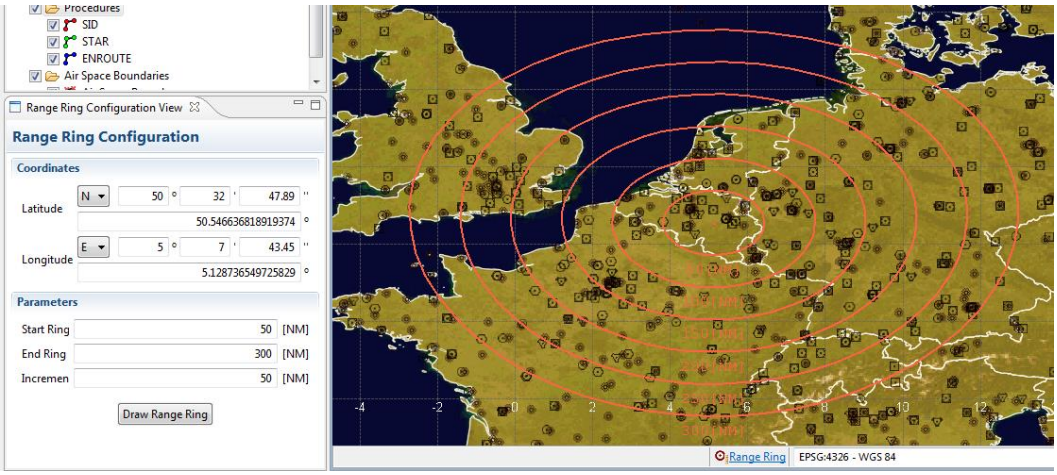


Figure 218: Range Ring tool

To modify the rings and show them on the same place, just modify any parameter and click on "Draw Range Ring" button.

If the user clicks next to an existing NavAid, DEMETER will ask if the user wants to center the Range Ring on that NavAid or not.

Range Rings are stored on a graphical layer that is present on the static layers folder.

The user can either show or hide the range rings on the respective visibility checkbox. Note that if the user closes the Range Ring view, the Range Rings on the map are deleted.

14.5. TERRAIN GRID TOOL

DEMETER Terrain Grid tool will help you to know the different terrain heights near a certain point. This could be helpful for NavAid creation or positioning.

In order to use the terrain grid tool, click on the icon (Terrain Tools), and then click anywhere on the map. If the user clicks near a NavAid a window will appear asking if it is required to center the grid on any NavAid from the list:

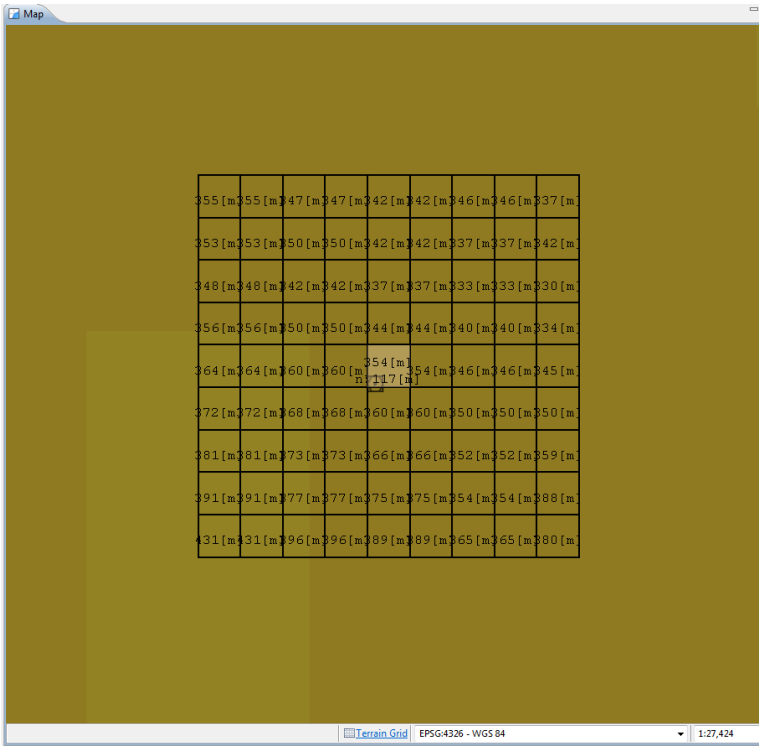


Figure 219: Terrain Grid tool

If the grid is centered on a NavAid, center field will be colored as follows:

Blue

The NavAid is too much above the terrain level. Value defined on the configurations (See chapter 5.3.1).

Brown

The NavAid is below the terrain level.

Green

None of the previous conditions is met.

There is also a menu on the left hand side of the window, below the layers tree, that allows the user to configure the location and the number of squares of the grid.

Terrain Grid is stored on a graphical layer that is present on the static layers folder.

The user can show / hide the Terrain Grid on the respective visibility checkbox. If the user closes the Terrain Grid view the Terrain Grid on the map is deleted.

14.6. HORIZON TOOL

Using this tool the user has two functionalities. After clicking on the map, the user will have:

- Using a color code, the summits around the selected point displayed over the map.
- A graphical representation of the horizon that an observer placed on the clicked point would have.

Before the user clicks on the map, the following parameters can be configured:

Min Depth
The first ring, in nautical miles, DEMETER used to calculate the summits.

Max Depth
The last ring, in nautical miles, DEMETER used to calculate the summits.

Interval
The minimum distance between two rings represented on Horizon graph.

Height
The height (distance to the ground) of the observer.

Make sure all values are between the limits defined on next tables:

Table 59: Degree limits in Coordinate Points fields

Unit	Minimum Value	Maximum Value
Decimal Degrees [deg]	-90	90

Table 60: Minimum Depth limits on Horizon tool

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	0	50

Table 61: Maximum Depth limits on Horizon tool

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	0	500

Table 62: Interval value limits on Horizon tool

Unit	Minimum Value	Maximum Value
Nautical Miles [NM]	0	500

Table 63: Height value limits on Horizon tool

Unit	Minimum Value	Maximum Value
Height [m]	0	5000

In order to use this tool, the user should follow the next steps:

- Click on the icon, located on the toolbar.
- A new window like the one presented on Figure 220 will appear.
- On the left part of the window, the user is able to configure the parameters presented before. The limits defined on the previous tables will be applied.
- The user can now double click anywhere on the map to set the center position or type the value in Latitude and Longitude on Coordinates fields and then click on Draw Horizon.
- If the user clicks next to a NavAid a list with the nearest ones will appear, asking the user if the calculation should be centered on it.

If a NavAid is selected to be the center, the user has, in addition the possibility to use the NavAid Height as Observer Height on the Horizon tool (on these conditions the Horizon calculation will represent the horizon point of view of the selected NavAid).

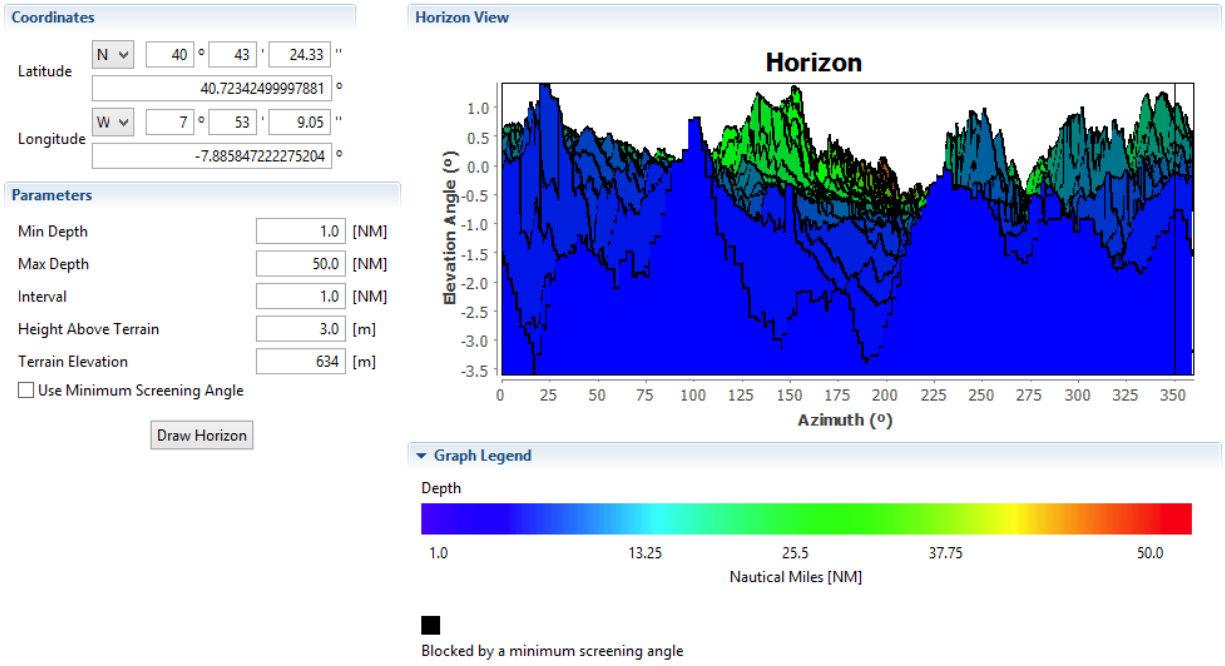


Figure 220: Horizon tool

This tool also shows the summits that exist on the map as it is presented on the next image:

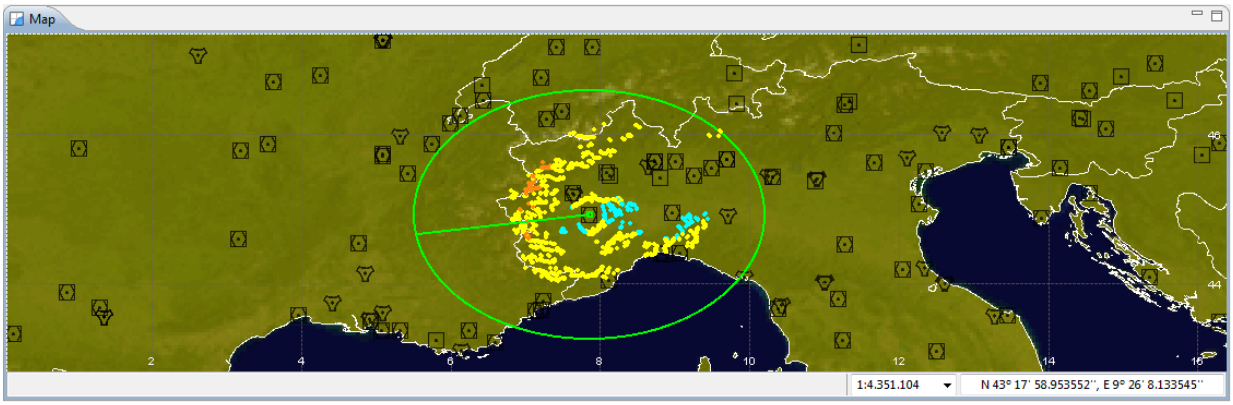


Figure 221: Summits on Horizon tool

A legend for the Horizon tool results is available on the map. This legend displays the meaning of each color (the legend is hidden the first time the tool is used).

If the user moves the mouse over the Horizon graph a line of sight is displayed over the map representing the corresponding direction.

After using this tool, the user can, for example, find which summits are affecting the NavAid coverage on a specific direction.

14.7. DISTANCE AND AZIMUTH

With this tool, the user can measure the distance and the azimuth between two points.

Select the icon, located on the toolbar and then double click anywhere on the map to set the first point (**1**).

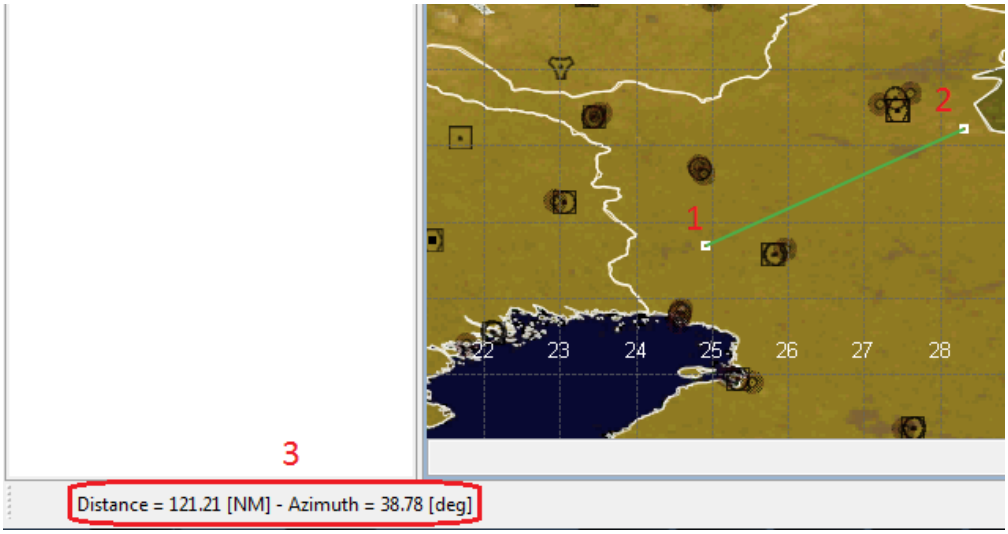


Figure 222: Distance and Azimuth tool

On the image highlighted in **red**, the result of distance and azimuth appears on the bottom left hand side of the map window while the user moves the mouse over the map (**3**).

To define the second point double click anywhere on the map and a segment will be displayed over the map (**2**).

To calculate another distance and azimuth, follow the previous instructions and another segment will appear (the one on the map will be deleted).

If the user wants to continue measuring using the last segment, hold <Ctrl> key and double click anywhere on the map again. In this case, the distance result is the sum of all distances and the azimuth result represents the azimuth of the last segment.

14.8. INFO TOOL

This tool provides all the information stored on NavAids, Coordinate Points, Procedures and Airspace boundaries. It also provides information about the Annotations and the Available Pairs result, on Performance calculation. In order to use this tool, the user should:

1. Select the layer to be analyzed.

2. In order to use this tool, select the icon, locate in the toolbar, and then move the mouse over any item on the map.

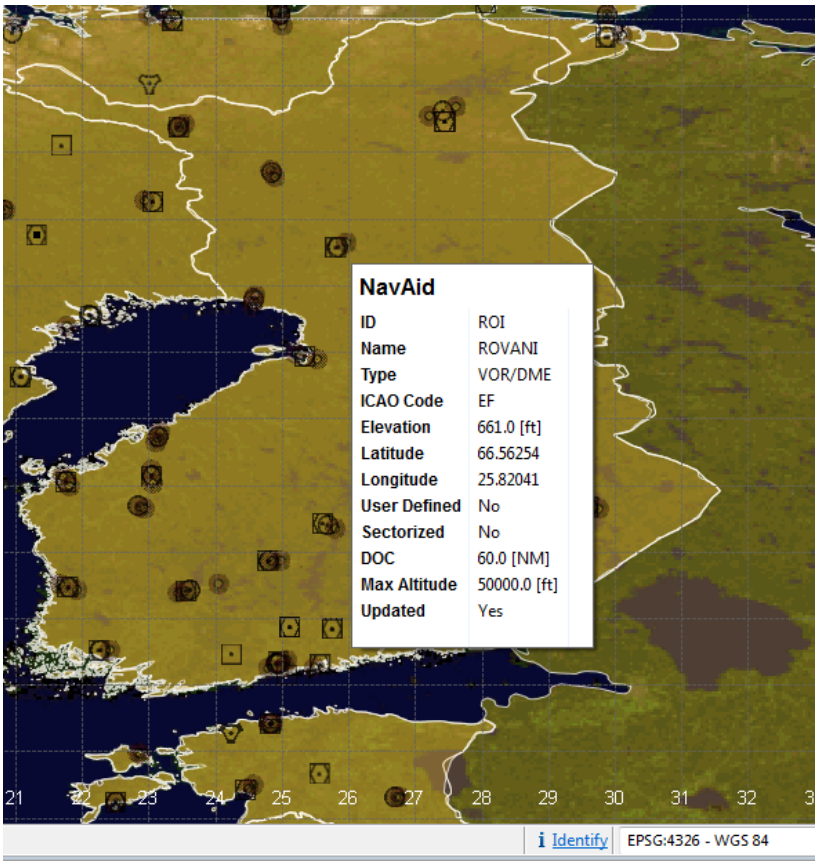


Figure 223: Info tool sample

A small window will appear (Figure 223) near the info arrow giving you the most important information about that item.

14.9. FLIGHT INSPECTION

DEMETER allows you to load Flight Inspection files and see the details over the map.
To use this tool select the "Tools -> Import Flight Inspection" menu and the following window will appear:

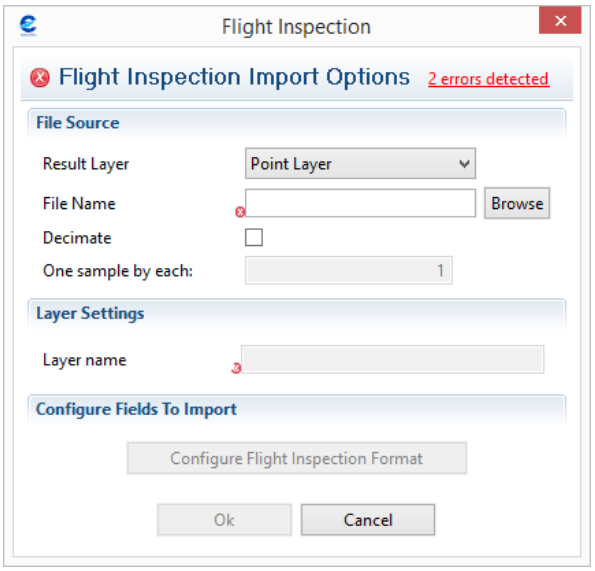


Figure 224: Flight Inspection Report Options

Result Layer

In this text field you can choose between Point Layer and Line Layer that will define the way of plotting results over the map.

File Name

Browses the user's PC in order to load any CSV file.

Layer Name

This is the name of the layer that will be created from the imported data.

Configure Flight Inspection Format

This button launches the configuration window for the file format, relating data sequence in the file with data fields in the new layer (as explained below). You must click on this button and confirm the previous/default configuration or changing it to make the "OK" button available.

When you click on the "Configure Flight Inspection Format" button, the following window appears:

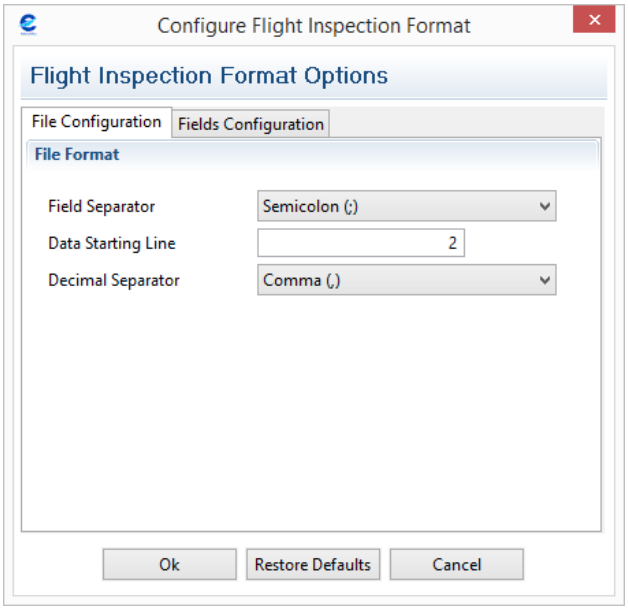


Figure 225: Flight Inspection Format Options, File Configuration Tab

Note: When the user chooses the file on local disk, he can choose between "Comma Separated Values Files", "Flexible text format" and "R&S EDS 300" file types. According to the chosen type, there will be more configuration tabs with the same visual appearance and extra options.

Field Separator

In this field, you can choose what is the separator element used on the "*.CSV" file.

Data Starting Line

For choose where the import operation begins.

Decimal Separator

In this field, you can choose what is the decimal separator used on the "*.CSV" file. This Field must be different of the Field Separator.

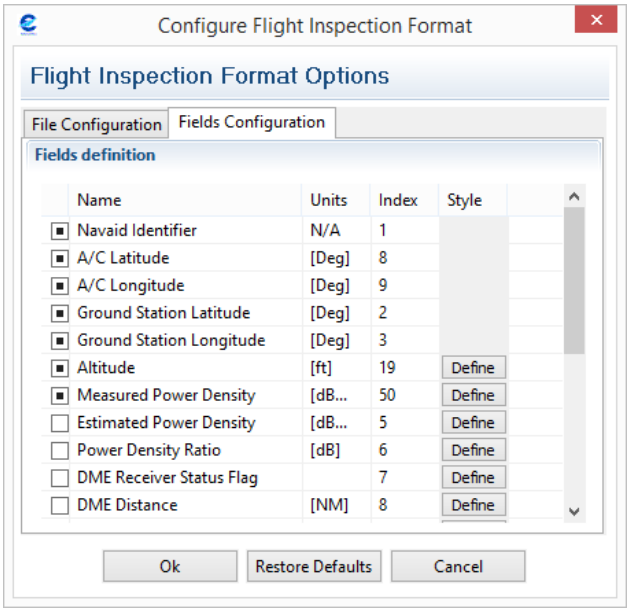


Figure 226: Flight Inspection Format Options, Fields Configuration

Checkboxes

Check the ones that the user desires to import from the file. Latitude, Longitude and Altitude are mandatory.

Name

Represents the name that will appear on the legend for each data field.

Index

Fill the column where the data is located when importing the CSV file. To know this information open the *.csv file on a text editor or on Microsoft Excel, count the columns and enter on this window the column number for each field that is going to be imported.

Style

Clicking on each "Define" button will pop up the following window:

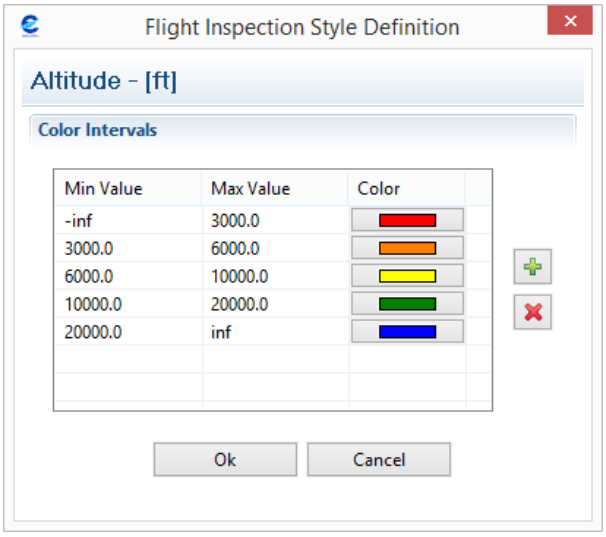


Figure 227: Flight Inspection Style Definition

By default, some intervals and colors are already configured for each parameter. By clicking on the icon, a new configuration line will be created (Min. Value= -inf, Max. Value= inf). The user is able to set the Minimum and Maximum values and the respective color used for the range. In order to delete any range, select it and click on the icon.

When every range is created, the user should click on the "Ok" button.

To configure the "Field Separator" and "Decimal Separator" open the CSV file in order to check what fields are used, and select them on the scroll down menus.

When everything is configured, click on the "OK" button and a result will appear on the map, and a layer for the result will be created:

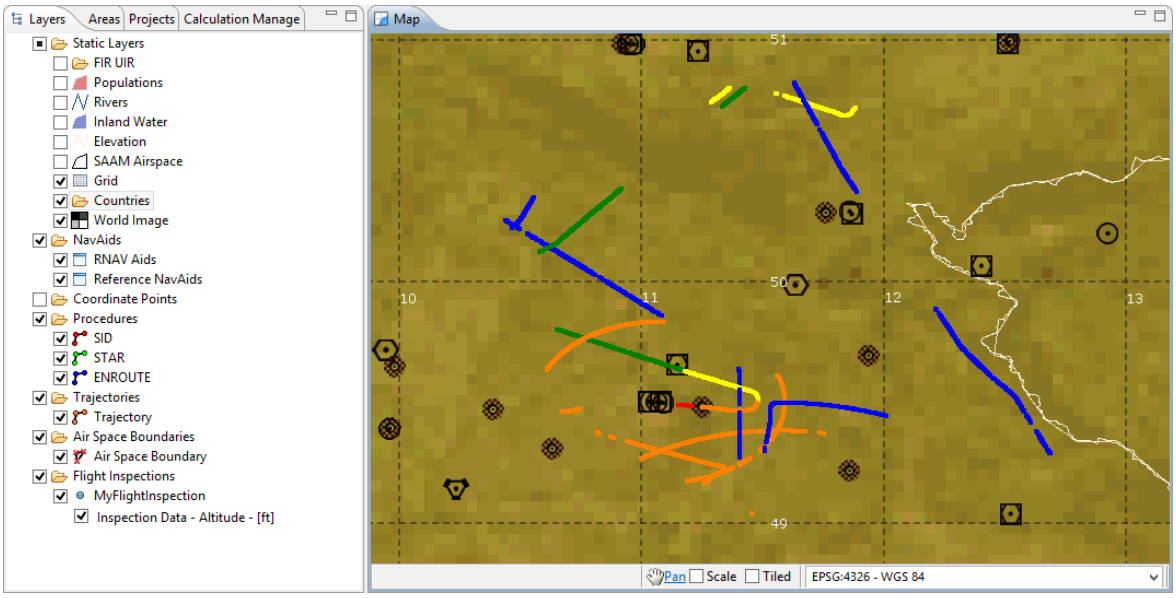


Figure 228: Flight Inspection Report sample

Flight inspections information could include several parameters. After importing the Flight inspection data, the user is able to define which parameter must be showed on the map. In order to select the parameter to be presented, the user should right click on the layer and select the "Attribute Representation" option menu:

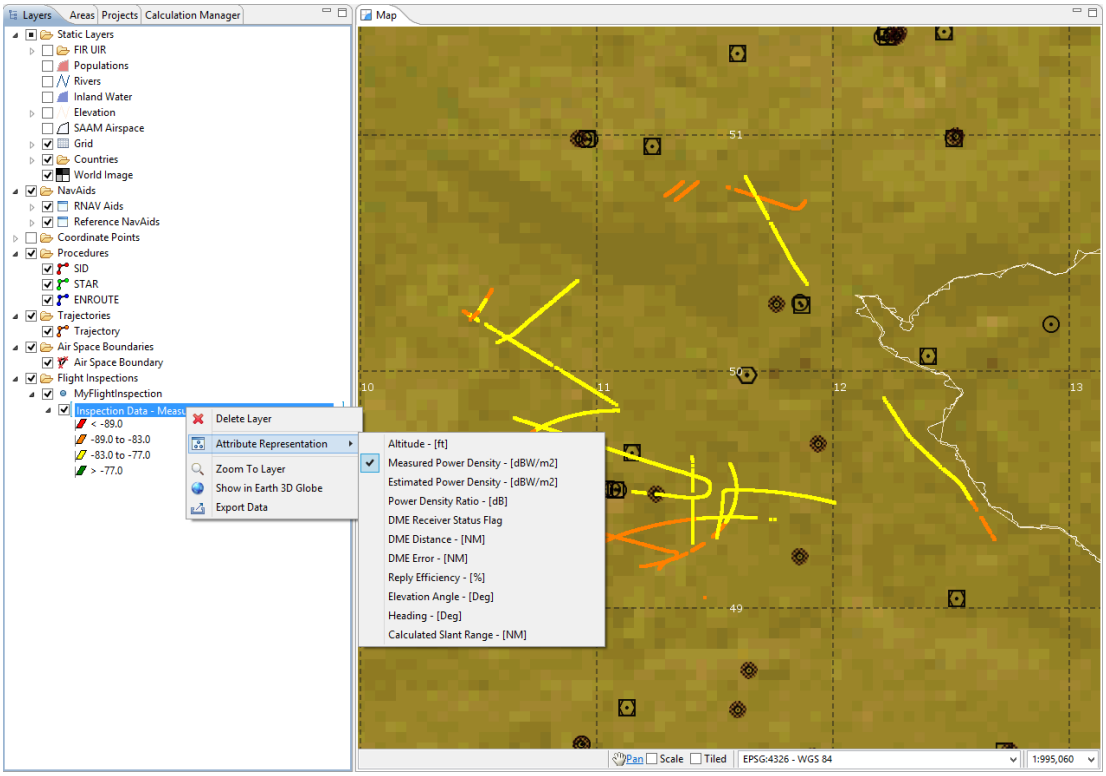


Figure 229: Attribute representation menu

The results are presented using a color code that depends on the selected parameter. The ranges and colors are configured while importing the file using the "Configure Flight Inspection Format" button, or later on the "Tools -> Configure Flight Inspection Format" menu.

14.10. PRE-PROCESSING TOOL

This tool is identical to the Flight Inspection presented in the previous section. The main difference is the options shown on "Configure Flight Inspection Format", which have an additional tab named "Pre-Processing Tool Fields" (Figure 230). On this tab you can configure the parameters of the calculations to be shown on map.

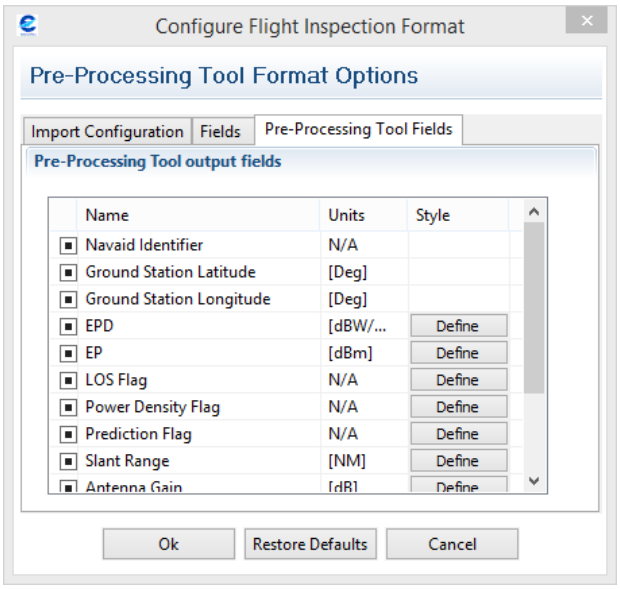


Figure 230: Pre-Processing Tool Fields

Subsequently, Demeter requests additional information to make the calculations, as shown in Figure 226.

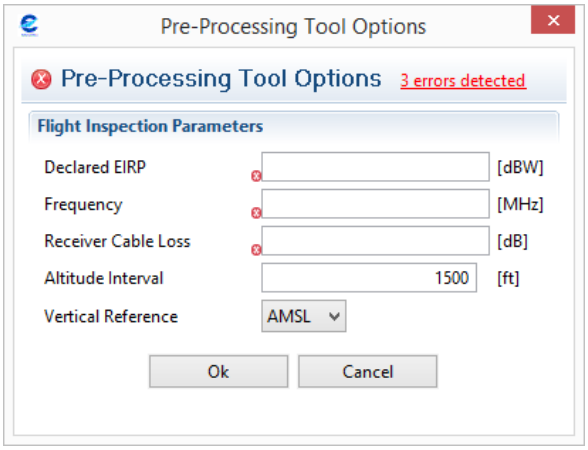


Figure 231: Pre-Processing Options

After all calculations are finished, the user is able to define which parameter must be showed on the map. In order to select the parameter to be presented, the user should right click on the layer and select the "Attribute Representation" option menu:

Figure 232: Attribute representation menu

The information calculated by the Pre-processing Tool can be exported to a CSV file. To perform this operation, the user should right click on the layer and select the "Attribute Representation" option menu:

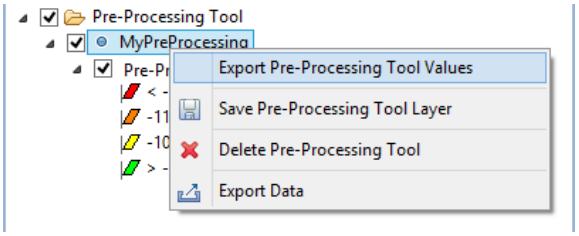


Figure 233: Export Pre-Processing Tool Values

Finally, you must choose the data to be exported and the location and file name where the information will be exported (Figure 234).

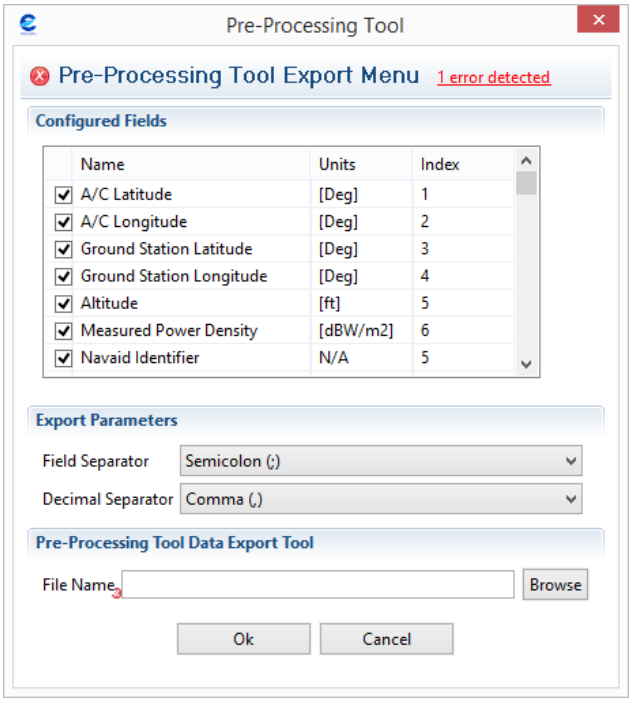


Figure 234: Pre-Processing Export Menu

14.11. MAP SEARCH

This tool will help the user to find NavAids or Coordinate Points on the map. In order to use this tool, click on the icon located on the toolbar. The following window will appear (Note that the "Results" area is clean for the first usage):

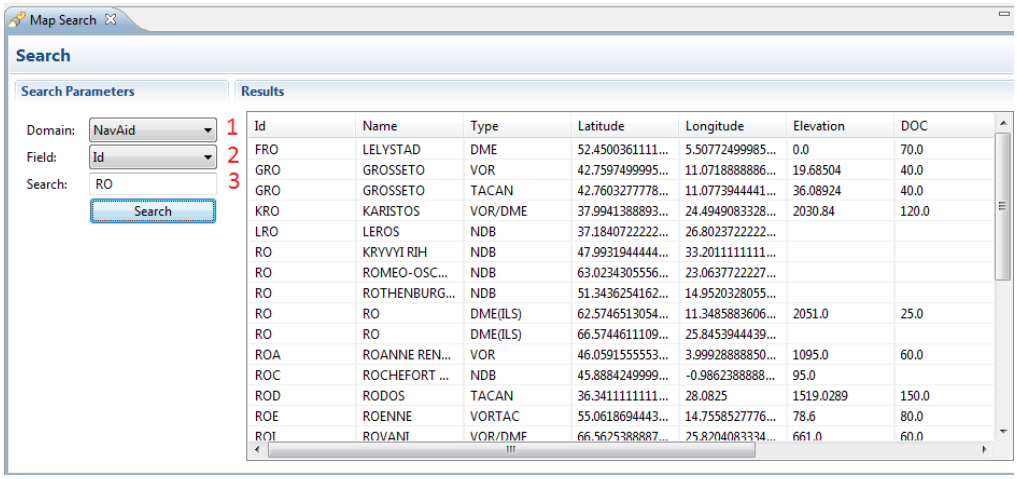


Figure 235: Feature Localizer

On the "Domain" scroll down menu (**1**), the user is able to select either **NavAid** or **Coordinate Points**. On the "Field"'s scroll down menu (**2**), the user is able to input the field to filter the search. The available fields are: **Id**, **Name**, **Type**, **Latitude**, **Longitude**, **Elevation**, **DOC**, **Max Altitude**, **User defined** or **ICAO Country Code**. Finally on the "Search" field (**3**), the user is able to apply a word filter. At last, the user should click on the "Search" button to apply the search and obtain the results.

After the results appear on the list, if the user clicks on any line, that item gets highlighted in red on the map. If the user double clicks on any line, the map view will be centered on the respective feature.

14.12. OBSTACLE DATA

DEMETER allows the user to load CSV files that contain **Obstacle Data**. Note that this information is purely graphic and it is not used by any calculation algorithm. In order to import the obstacle data, the user should click on the "Tools -> Import Obstacle Data" menu. The following window will appear:

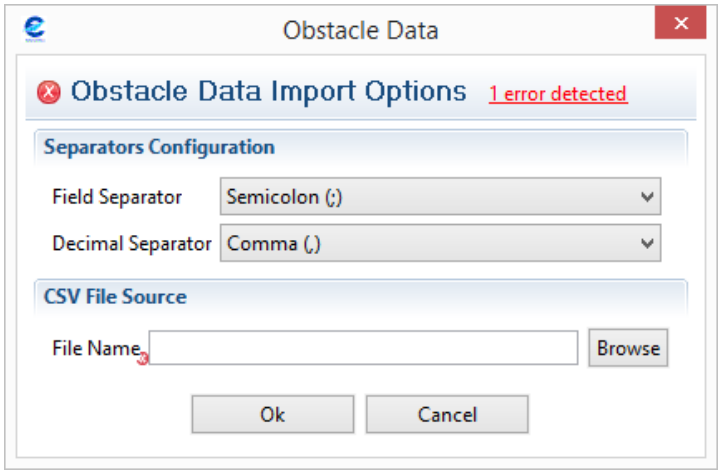


Figure 236: Obstacle Data Import Options

In order to set the "Field Separator" and "Decimal Separator", the user should open the CSV file on a text editor and check which format is used. Then the user should select the respective option from the scroll down menus (Figure 236). Click on the "Browse" button in order to select a valid file from your file system.

Click on the "Ok" button and the obstacles that were defined on the file, will be displayed on the map. The columns on the CSV file are the following:

Latitude

Longitude

Height

0 or 1 for Human or Natural Obstacle, respectively

Optional text area

14.13. BAROMETRIC CALCULATION TOOL

The Barometric tool is an independent tool that is integrated on the DEMETER interface.

The purpose of the tool is to have corrected altitudes depending on Temperature and Atmospheric Pressure changes.

The user must insert an Altitude, a Temperature and a Pressure value. For each of these fields two different units are available as showed on the figure and an automatic conversion is made.

The outputs of the tool are the corrected Altitude (in Meters and Feet) taking into account only the Temperature, only the Pressure and both parameters combined.

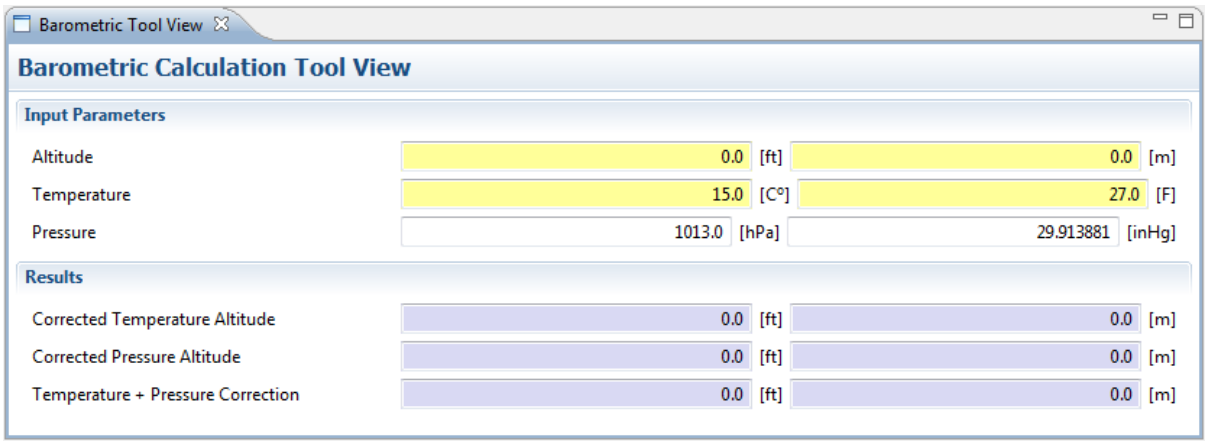


Figure 237: Barometric Calculation tool

14.14. MULTIPATH TOOL

The purpose of this tool is to evaluate the possibility of having multipath problems on the NavAid signal received by an Aircraft. In order to use this tool, the user must select at least one NavAid to be analyzed. After selecting the NavAid, click on the "Tools -> Multipath Tool" menu. The following window will be displayed.

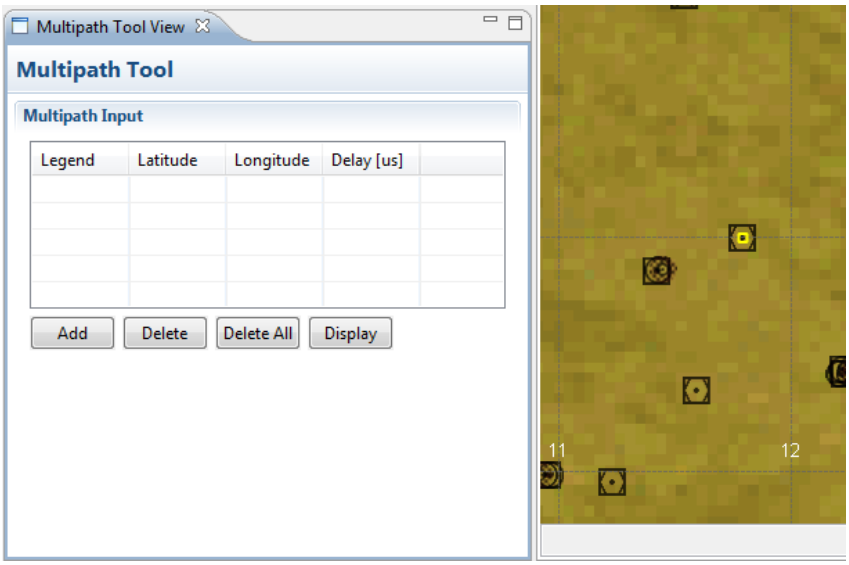


Figure 238: Multipath tool

The next step is to specify the Aircraft Position. The user can add multiple aircraft positions by clicking on the "Add" button and enter the value for the fields on the new line: Latitude, Longitude and the Pulse Delay time. The process can be repeated to define more positions. The tool will automatically display multiple results over the map.

In order to delete an Aircraft position, the user should select the respective row, and then click on the "Delete" button. If the user desires to delete all the entries, he or she should click on the "Delete All" button. In order to see the result of the calculation the user should click on the "Display" button.

14.15. EXPORT MAP TO IMAGE

The user is able to export any map view as an image file, with some information about the image around.

1. Move the map view (zoom level and boundaries) to the zone to export. Do not forget to Enable or Disable the layers as desired.

2. To export the map as an, the user should click on the "File -> Export Map to Image" menu. The following window will appear:

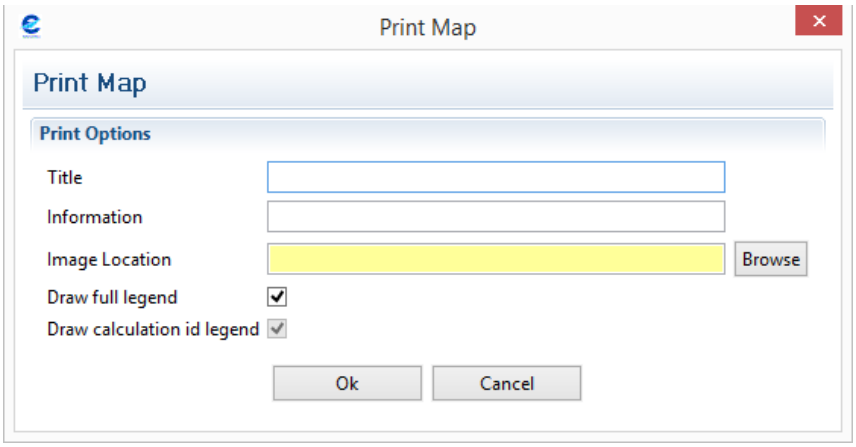


Figure 239: Export Map to Image options

The user should now enter the data to include in the exported image:

Title

Will be displayed above the map on the exported file, as the title.

Information

A free text field that will be added below the map.

Draw full legend

Checkbox to control whether the Map Legend is exported together with the map or not.

Draw calculation legend

Checkbox to control if the Unique Id associated with each calculation is printed together with the map or not. The Unique Id can be accessed on the Calculation Configuration as described on **section 12.8**. This information is also stored on the Working Log (see **chapter 15** for further details).

Click the "Browse" button to select the directory and file name to store the image. The following formats can be used: .jpg, .bmp, .gif, .png, .emf and .svg. After these steps, click on the "Ok" button in order to export the map to a file and an image such as the following will be created:

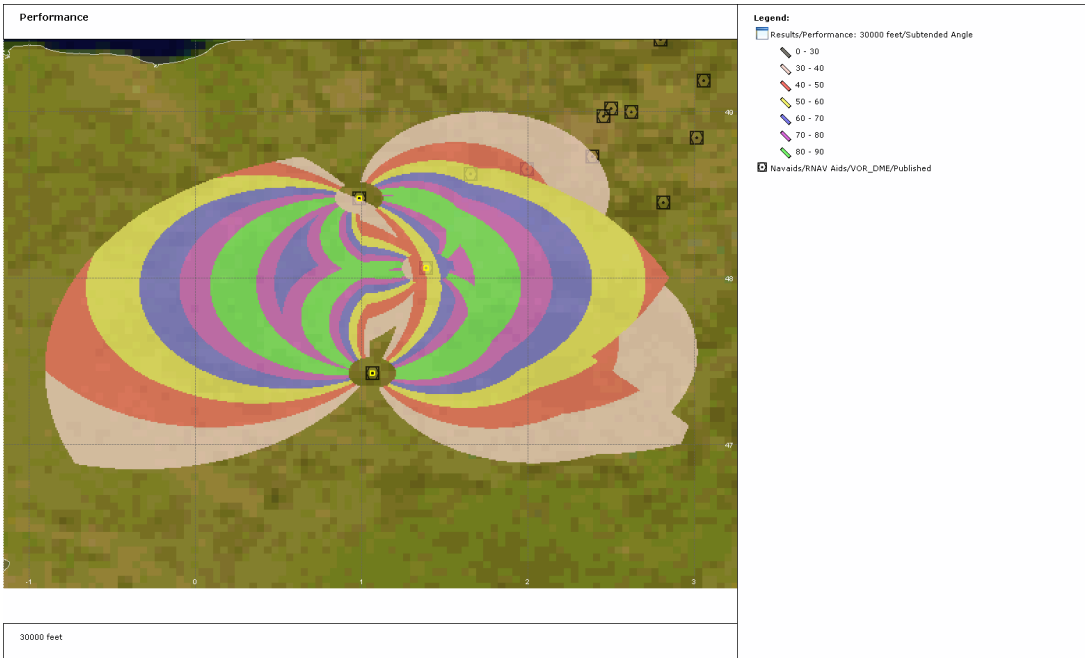


Figure 240: Export Map to Image sample

Notice that located on the left, the user is able to see the legend, which contains additional information about all the layers that have been exported.

14.16. PRINT MAP

The user is also able to directly print the map. In order to do so, the user must click on the "File -> Print Map" menu. The following window will appear:

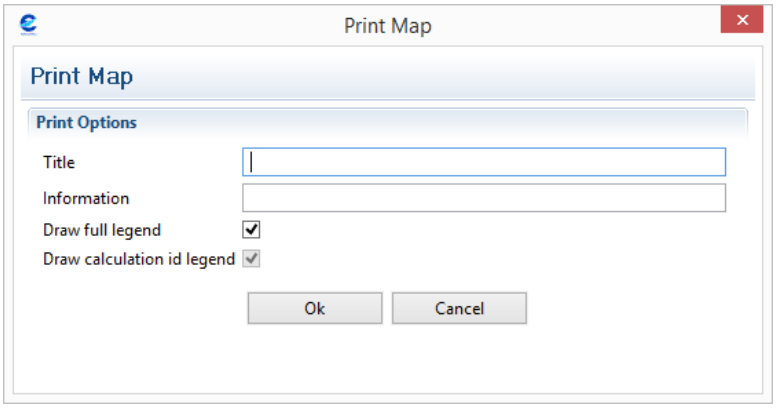


Figure 241: Print Map

The user should now enter the data to include in the exported image:

Title

Will be displayed above the map on the exported file, as the title.

Information

A free text field that will be added below the map.

Draw full legend

Checkbox to control whether the Map Legend is exported together with the map or not.

Draw calculation legend

Checkbox to control if the Unique Id associated with each calculation is printed together with the map or not. The Unique Id can be accessed on the Calculation Configuration as described on **section 12.8**. This information is also stored on the Working Log (see **chapter 15** for further details).

14.17. WEB BROWSER MAP

The purpose of this tool is providing the visualization of a website map in a desired position by the user. This map is shown on a web browser and supported by a well-known company. In order to use this tool, the following steps are required:

1. Click on "Web Browser Map" button (Figure 242).

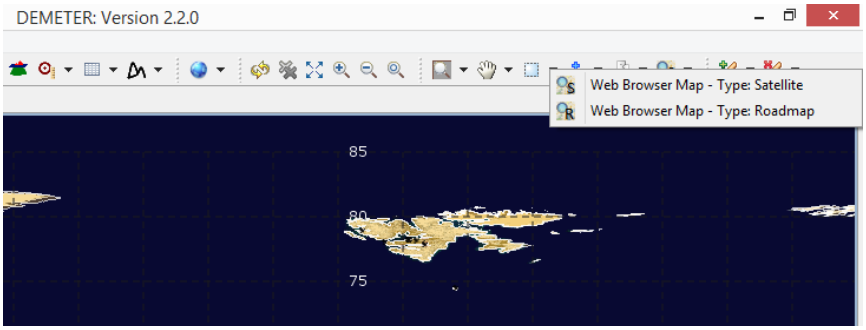


Figure 242: Web Browser Map

Web Browser Map has four different types of maps, described below:

(Type: Satellite): Shows satellite images.

(Type: Roadmap): Shows a map where is illustrated the roads.

2. Adjust the map zoom in DEMETER with Zoom buttons in toolbar or use the mouse scroll. Depending on the map zoom in DEMETER, will affect the map zoom shown in the browser.

3. Double click on map in a desired position.

14.18. EXPORT DATA

DEMETER allows the user to export layers to a well-known file format like shapefile or KML file. If the user clicks with the right mouse button over a tree view, appears the menu with "Export Data" option (Figure 243).

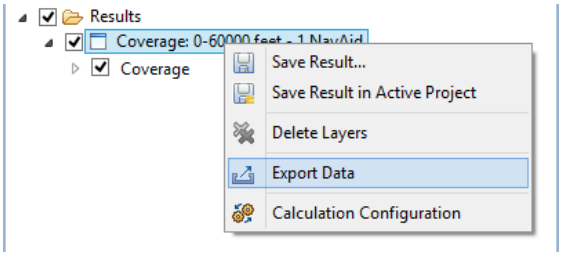


Figure 243: Export Data

After the user clicks over "Export Data" button, appears the window in Figure 244. Then the user can select the type of file to be exported, changing the extension between "*.shp" and "*.kml".

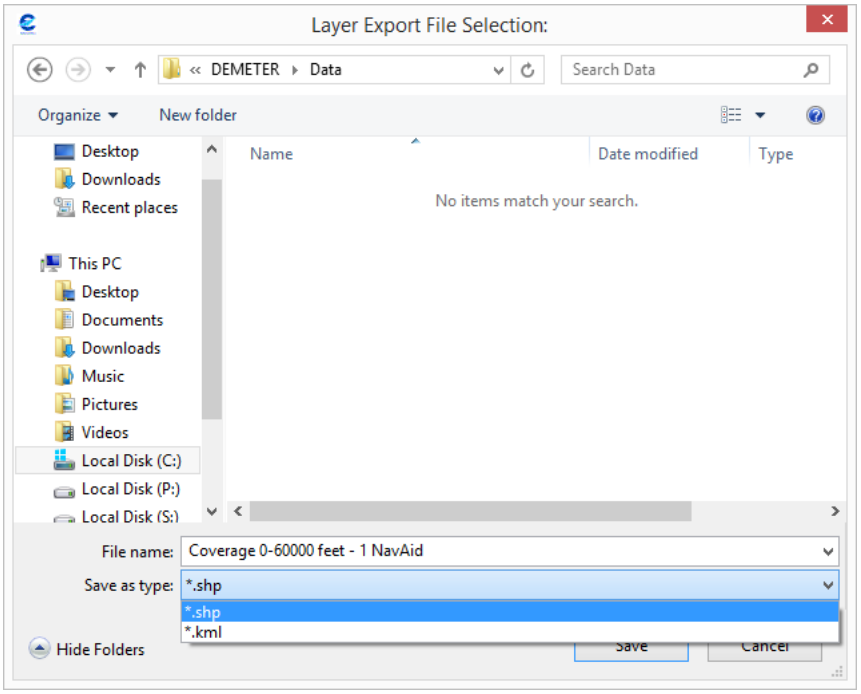


Figure 244: Export Data File Selection

15.LOG AND DEBUG

DEMETER logs all actions and internal errors. These logs are always available in:
DEBUG Log - "<DEMETER installation folder>\data\log\ DEMETER.log.x"
Working Log - "<DEMETER installation folder>\data\work\workLog.log".

The Working Log is stored in a text format and can be accessed by any text editor. On the file all the calculation actions are registered namely the configurations, NavAids and Procedures used on each calculation. Each action is identified with a Unique Id that is used later when exporting or printing a result (see **sections 14.15** and **14.16** for further details). The user is also able to open a view, by clicking on the "Tools -> Open Log Viewer" menu, in order to access the debug information (Figure 245).

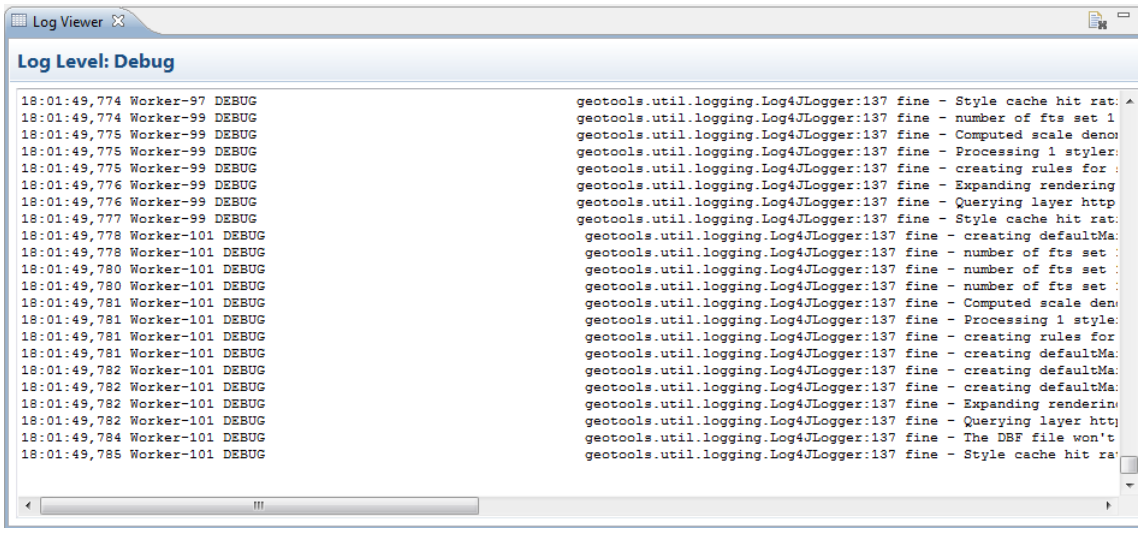


Figure 245: DEMETER Log Viewer

Note that the user is also able to change the details of the debug information, by changing the applied configuration options on the DEMETER configurations. Please consult **section 5.10** for more details on how to change Log Settings.

16.HARDWARE REQUIREMENTS

DEMETER application has two modes of installation: **Complete Package** and **Minimum package**.
The difference between them is the space needed to store all the files. The Complete Package has GTOPO30 files for the entire World and the Minimum version has files only for Europe.

On the table below is described the minimum hardware requirements to run DEMETER application. The information for the Data Disk Space is estimated for an average usage of DEMETER.

The necessary disk space for the data depends on the:

- Number of calculations
- Number of saved results
- Number of saved Flight inspections
- Nasa World Wind cache information

Table 64: Hardware Requirements

	Recommended Minimum Requirements
Display	17”
Resolution	1366 x 768
CPU Speed	1.6 GHz
Memory	4 GB
Installation Disk Space	5GB
Data Disk Space	10 GB
Video Graphics	3D graphics card

END OF DOCUMENT

