

SADIS WORKSTATION SOFTWARE EVALUATION GUIDE

Version number	Changes
1.0 (11 April 2019)	Initial Version
1.1 (April 2021)	Updated to include 0.25 degree horizontal resolution WAFS hazard data sets and IWXXM OPMET that were introduced to SADIS in November 2020. Figures B1-B6 replaced

This guide is intended to be used to facilitate the self-assessment of any systems or software that is designed to visualise the data sets that are available on the SADIS (Secure Aviation Data Information System) operated by WAFC London.

There are a number of scenarios that this guide could be used in:

- 1) When assessing the suitability of a new system during the procurement phase
- 2) To identify whether an existing system is fit for use
- 3) To identify if there are any issues/problems with functionality that may need to be raised with the software supplier.

Top level functionality

The system must be able to :

1. display OPMET (TAF, METAR, SPECI, SIGMET, AIRMET and GAMET) data in traditional alphanumeric code (TAC) format
2. display other bulletin types in TAC and graphical format (Tropical Cyclone Advisories and Graphics, Volcanic Ash Advisories and Graphics, Space Weather Advisories, Special AIREPs, ASHTAM and NOTAM.
3. display WAFC gridded data in GRIB2 format
4. display WAFC SIGWX data created from the BUFR data set
5. display the WAFC SIGWX png format charts
6. process and display administrative messages

It is also advised that the system is able to:

7. display OPMET (TAF, METAR, SPECI, SIGMET, AIRMET, Tropical Cyclone Advisory, Volcanic Ash Advisory and Space Weather Advisory) produced in IWXXM format
8. authenticate the downloaded data sets (process digital signatures)

The assessment of compliance should be based on the more detailed requirements that follow in the following sections of this document. Each main function is broken down into smaller objectives.

Appendix D contains a checklist that can be used to collate the results of the assessment.

1. Display of OPMET data in text format

The software must be able to receive and display OPMET data and other data types in traditional alphanumeric code (TAC) format (including TAFs, METARs, SPECIS, SIGMETs, EUR region AIRMETS and GAMETS).

<p>Objective 1a:</p> <p>a) A user must be able to retrieve a list of all available¹ METARs and SPECIS from each of the following regions: CARSAM, NAM, EUR/NAT, MID, and ASIAPAC. The SADIS data catalogue can be consulted to check what METARs are usually available on a given day.</p> <p>b) A user should be able to retrieve their own chosen selection of METARs.</p> <p>c) A user should be able to easily view a time-series of METAR observations from their chosen airports.</p>	<p><i>It must be possible to easily access a list which shows the available METARs. Ideally pre-set lists should be set up which allow easy access to the data from a particular country, FIR, region or continent. Users should be able to sort the METAR list either by the airport name, or by their ICAO identifier.</i></p>
<p>Objective 1b:</p> <p>a) A user must be able to retrieve a list of all available¹ TAFs from each of the following regions: CARSAM, NAM, EUR/NAT, MID, and ASIAPAC.</p> <p>b) A user should be able to retrieve their own chosen selection of TAFs.</p> <p>c) A user should be able to easily view a time-series of TAF observations from their chosen airports.</p>	<p><i>It should be possible to easily access a list which shows the available METARs. Ideally pre-set lists should be set up which allow easy access to the data from a particular country, FIR, region or continent. Users should be able to sort the METAR list either by the airport name, or by their ICAO identifier.</i></p>
<p>Objective 1c:</p> <p>A user must be able to retrieve the following types of SIGMET for a chosen region or aerodrome:</p> <p>a) General (WMO headers in the form WS**** CCCC)</p> <p>b) Volcanic Ash SIGMETs (WMO headers in the form WV**** CCCC)</p> <p>c) Tropical Cyclone SIGMETs (WMO headers in the form WC**** CCCC)</p>	<p><i>Users must be able to quickly access SIGMET information a particular FIR, or group of FIRs. The data can be displayed either in list format, or graphically on a map.</i></p>
<p>Objective 1d:</p> <p>A user should be able to retrieve AIRMETS and GAMETS.</p>	<p><i>Users should be able to quickly display any valid AIRMETS and GAMETS for a particular FIR or group of FIRs. The data could be displayed in list format, or graphically on a map</i></p>
<p>Objective 1e:</p> <p>The software/system should alert users when new SIGMETs (WMO headers in the form WS****, WV**** and WC****) are made available.</p>	<p><i>The software should be able to make an audible or visual alert of new SIGMET data becoming available in a particular area of interest.</i></p>
<p>Objective 1f:</p> <p>The software/system should alert users when SPECIS are received.</p>	<p><i>The software should be able to make an audible or visual alert of new SPECIS becoming available in a particular area of interest.</i></p>

¹ The SADIS data catalogue can be consulted to check what data is usually available. It can be accessed from the /DOCUMENTATION/ directory on SADIS.

2. OPMET Bulletin Viewer

The software must be able to receive and display other bulletin types currently available on SADIS: Tropical Cyclone Advisories and Graphics, Volcanic Ash Advisories and Graphics, Space Weather Advisories, Special AIREPs, and ASHTAMs and NOTAMs related to volcanic ash.

<p>Objective 2a: The software should have functionality which enables a user to display the contents of a single bulletin by typing in the WMO header of the bulletin (excluding GRIB and BUFR encoded bulletins)</p>	
<p>Objective 2b: The software must receive and display tropical cyclone (TCA) advisory statements.</p>	<p><i>Users should be able to access TCA statements with bulletin headers of FK**** CCCC.</i></p>
<p>Objective 2c: The software must receive and display tropical cyclone advisories in graphical format.</p>	<p><i>Currently, there is only one known TCAC issuing Tropical Cyclone Advisories in graphical form. La Reunion uses PZXD0(1-4) FMEE.</i></p>
<p>Objective 2d: The software must receive and display volcanic ash advisory (VAA) statements.</p>	<p><i>Users should be able to access VAA statements from: FVAK(20-25) PAWU; FVXX(01-03) EGRR; FVXX05 EGRR; FVXX(20-27) KNES; FVXX(01-05) LFPW; FVFE01 RJTD; FVCN(01-04) CWAO; FVAU(01-10) ADRM; FVAG(01-05) SABM; and FVPS(01-05) NZKL.</i></p>
<p>Objective 2e: The software must receive and display volcanic ash graphical forecasts (VAG).</p>	<p><i>Users should be able to access VAG from: PFXD(01-10) ADRM; PFXD(01-03) EGRR; PFXD05 EGRR; PFXD(20-27) KNES; PFXD(05-09) LFPW; PFXD01 RJTD; PFXD(01-05) NZKL; PFXD(01-04) SABM; PFXD(01-04) CWAO; PFXD(21-25) PAWU(21-25)</i></p>
<p>Objective 2f: The software must be able to receive and display Special AIREPS.</p>	<p><i>Users should be able to access: UA//60-69 CCCC; and UA//(70-79) CCCC</i></p>
<p>Objective 2g: The software should enable a user to retrieve and display valid ASHTAMs and NOTAMS relating to Volcanic Ash.</p>	<p><i>Users should be able to display NWXX01 bulletins</i></p>
<p>Objective 2h: The software should enable a user to retrieve and display space weather (SWx) forecasts</p>	<p><i>Users should be able to any advisories from FN**** CCCC</i></p>
<p>Objective 2i: The software should make an audible or visual alert for when a new bulletin (as listed in objectives 2b to 2g) becomes available in the area of interest.</p>	

3. WAFS gridded data display (GRIB2 format)

The software must enable a user to produce a charts/maps based on the GRIB2 data sets which are available on SADIS.

Note: Training material on cumulonimbus, icing and turbulence data can be found on the following pages: <https://www.icao.int/airnavigation/METP/Pages/Public-Documents.aspx>

On screen display	
<p>Objective 3a: A user must be able to produce a wind/temperature map/chart in the format that is shown in example chart A.</p> <ul style="list-style-type: none"> a) Wind data should be depicted by arrows with feathers and pennants b) Temperature data should be shown in Celsius and only be prefixed by a “+” or “PS” if the temperatures are positive. c) Wind data should be shown using the correct conventions for both the northern and southern hemispheres. d) Users should be able to display data from each of the following flight levels: FL050, FL080, FL100, FL140, FL180, FL210, FL240, FL270, FL300, FL320, FL340, FL360, FL390, FL410, FL450, FL480 and FL530 e) Latitude/longitude lines and the coastline should be shown. 	<p><i>It is acceptable for the map/chart to be produced in colour as long as it is clear, and can cover any part of the world.</i></p> <p><i>The data display should follow the guidance contained in ICAO Annex 3, Appendix 8-3, chapter 4.2</i></p> <p><i>Further information is provided in Appendix A of this document.</i></p>
<p>Objective 3b: A user should be able to create a map which shows the following:</p> <ul style="list-style-type: none"> a) Turbulence Severity values using the 0.25 degree horizontal resolution data sets b) data from each of the following flight levels: FL100, FL140, FL180, FL240, FL270, FL300, FL340, FL390, and FL450 	<p><i>There is no ICAO Annex 3 guideline on how best to visualise this data, so whatever colour scheme is used it should be appropriate to the data users, and contain a suitable colour scheme and legend. Appendix B gives some example turbulence visualisations.</i></p>
<p>Objective 3c: A user should be able to create a map which shows the following:</p> <ul style="list-style-type: none"> a) Icing severity values using the 0.25 degree horizontal resolution data sets b) data from each of the following flight levels: FL060, FL100, FL140, FL180, FL240, and FL300 	<p><i>There is no ICAO Annex 3 guideline on how best to visualise this data, so whatever colour scheme is used it should be appropriate to the data users, and contain a suitable colour scheme and legend. Appendix B gives some example icing visualisations.</i></p>
<p>Objective 3d: A user should be able to create a map which shows the following using the 0.25 degree horizontal resolution data sets:</p> <ul style="list-style-type: none"> a) cumulonimbus “horizontal extent” areas b) cumulonimbus base information c) cumulonimbus top information 	<p><i>There is no ICAO Annex 3 guideline on how best to visualise this data, so whatever colour scheme is used it should be appropriate to the data users, and contain a suitable colour scheme and legend. Appendix B gives some example cumulonimbus visualisations.</i></p>

<p>Objective 3e: In displaying all gridded data sets the software should: allow the user to:</p> <ul style="list-style-type: none"> a) easily switch between different vertical levels of data b) move between the different time-steps of data c) zoom into the area of interest d) pan the map to the area of interest 	<p><i>All gridded data is available from T+6 to T+36 at 3 hourly intervals</i></p>
<p>Objective 3f: In displaying all gridded data sets the software should allow the user to easily identify the following:</p> <ul style="list-style-type: none"> a) whether the data was sourced from WAFC London or WAFC Washington data b) the vertical level of data being shown c) the validity period or time-step of data being shown 	<p><i>This objective could be achieved through use of a legend on the map/chart, or the software itself making these elements clear.</i></p>
<p><i>Note: Some additional gridded data sets are available on SADIS and it would be prudent to check that they can be also be displayed. The data available is as follows:</i></p> <ul style="list-style-type: none"> a) <i>Relative humidity</i> b) <i>Geopotential Height</i> c) <i>Tropopause height and tropopause temperature</i> d) <i>Maximum wind and the height of the maximum wind.</i> 	
<p>Hard copy charts</p>	
<p>Objective 3g: Wind and temperature charts should:</p> <ul style="list-style-type: none"> a) be largely identical (as far as layout is concerned) to the wind and temperature chart contained in ICAO Annex 3, Appendix 1. b) have a legend c) be able to be created for each of the standard ICAO areas (A, B, B1, C, D, E, F, G, H, I, J, K, M, NAT, EUR, MID, SOUTH ASIA) d) be able to be created for a user defined map area, in both Mercator and polar stereographic projections. 	<p><i>Note: additional guidelines on chart characteristics can be found in ICAO Annex 3, Appendix 8, Chapter 4.2.</i></p> <p><i>The legend should contain each of the elements that are described in Appendix A of this document.</i></p>
<p>Objective 3h: Cumulonimbus, Clear Air Turbulence and Icing charts should:</p> <ul style="list-style-type: none"> a) use an appropriate colour scheme or contouring b) contain a key that explains any colour schemes used c) have a legend which matches the conventions used on the wind and temperature chart d) be able to be created for the chosen map in both Mercator and polar stereographic projections. 	<p><i>It should be possible to produce charts that match the ICAO standard areas as well as user defined areas.</i></p>

4. WAFS SIGWX data display using the BUFR data set

The software must provide functionality that enables a user to display and create charts using the WAFS SIGWX data sets (in BUFR format).

On screen display	
<p>Objective 4a:</p> <p>a) A user must be able to display the following SWH (high level) data parameters, as illustrated in example chart B:</p> <ul style="list-style-type: none"> i) Jet stream (core position, speed, height of the jet core, and jet depth (where the jet speed exceeds 120kt)) ii) Clear Air Turbulence areas iii) Cumulonimbus areas iv) Tropopause height information v) Active volcanic eruptions vi) Active tropical cyclones vii) Radioactive releases viii) Sand and dust storms <p>b) Each parameter listed above should be depicted using the standard conventions</p> <p>c) Each parameter should be largely identical (spatially) to the WAFS produced SIGWX charts</p>	<p><i>The standard conventions for the depiction of SIGWX elements are included in ICAO Annex 3, Appendix 1 and the Example D chart. Colour may be used</i></p> <p><i>Further information is provided in Appendix C of this document.</i></p> <p><i>Checks should be made to ensure that jet streams are depicted correctly either side of the equator.</i></p>
<p>Objective 4b:</p> <p>a) A user must be able to display the following SWM (mid level) data parameters as illustrated in example chart C:</p> <ul style="list-style-type: none"> i) Jet stream (core position, speed, height of the jet core, and jet depth (where the jet speed exceeds 120kt)) ii) Clear Air Turbulence areas iii) Cumulonimbus areas iv) Areas of in cloud turbulence and icing v) Active volcanic eruptions vi) Active tropical cyclones vii) Radioactive releases viii) Sand and dust storms <p>b) Each parameter listed above should be depicted using the standard conventions</p> <p>c) Each parameter should be largely identical (spatially) to the WAFS produced SIGWX charts</p>	
<p>Objective 4c:</p> <p>SIGWX feature labels (text boxes) for the SWM and SWH data sets should:</p> <ul style="list-style-type: none"> a) have identical content to those on the WAFS produced SIGWX charts b) be positioned so as to be clearly readable and not obscuring the SIGWX features themselves 	<p><i>Note: the position of feature labels does have to match those on the WAFS produced charts. A check should be made to ensure that the arrows and arrow head placement is unambiguous and clear, and that the features do no overlap or obscure other SIGWX chart elements.</i></p>

<p>Objective 4d: The display of SIGWX data should:</p> <ul style="list-style-type: none"> a) maintain their integrity and clarity when panning or zooming b) maintain their integrity and clarity when switching between map projections. c) make it clear when SIGWX data is not available 	<p><i>SWM SIGWX data for in-cloud icing and turbulence is not produced for the whole globe, so the software should make it clear where no data is available so that users do not mistakenly believe that no in-cloud icing or turbulence has been forecast.</i></p>
<p>Objective 4e: The software must:</p> <ul style="list-style-type: none"> a) clearly indicate whether WAFC London or WAFC Washington data is being used b) clearly show the validity date/time of the data set 	<p><i>Note: If the software allows the user to modify any of the plotted meteorological parameters, reference to either WAFC must be automatically removed if such modification is carried out by the end user.</i></p>
<p>Objective 4f: The software must:</p> <ul style="list-style-type: none"> a) be able to handle BUFR bulletins that contain no data – i.e. bulletins that are empty apart from message header information². b) be able to process SIGWX BUFR data during a WAFC Backup Test c) be able to display corrected SIGWX BUFR data sets 	<p><i>Back up test dates are published here: https://www.icao.int/airnavigation/METP/Pages/Public-Documents.aspx (in the MOG-WAFS Reference Document section)</i></p> <p><i>The issuance of corrected SIGWX data sets is rare, but tests should be manually made to ensure that files with CCA, CCB and CCC on the end of the normal file names can be handled correctly.</i></p>
Hard copy charts	
<p>Objective 4g: A user should be able to create hard copy SIGWX charts that:</p> <ul style="list-style-type: none"> a) meet objectives 4a, 4b, and 4c. b) For SWH (high level SIGWX) covering ICAO map areas: A, B, B1, C, D, E, F, G, H, I, J, K and M c) For SWM (medium level SIGWX) covering ICAO map areas: ASIA_SOUTH, EURO, MID and NAT d) cover a user defined/customisable area 	<p><i>ICAO Annex 3, Appendix 8, figure A8-1, A8-2 and A8-3 provides information on the coverage areas and map projections for all ICAO map areas</i></p>
<p>Objective 4h: The hard copy chart should:</p> <ul style="list-style-type: none"> a) identify whether the chart is derived from WAFC London or WAFC Washington data b) identify the provider of the data c) show the validity date/time for the chart d) identify the flight level the chart applies to e) if the chart is for an ICAO area, the chart area should be listed. f) contain the following statement: “CB IMPLIES TS, GR, MOD OR SEV TURB AND ICE. UNITS USED: HEIGHTS IN FLIGHT LEVELS. CHECK SIGMET, ADVISORIES FOR TC AND VA, AND ASHTAM AND NOTAM FOR VA” 	<p><i>Note: If the software allows the user to modify any of the plotted meteorological parameters, reference to either WAFC must be automatically removed if such modification is carried out by the end user.</i></p>

². This applies to the BUFR bulletins formerly used for surface front information.

5. Display of WAFS SIGWX charts in the PNG (portable network graphics) chart format.

The WAFCs produce .png (standard portable network graphics format) charts to accompany the digital SIGWX data sets.

<p>Objective 5a: Users must be able to display SIGWX png format charts for</p> <ul style="list-style-type: none"> a) the following SWH (high level) areas: A, B, B1, C, D, E, F, G, H, I, J, K, M, b) the following SWM (medium level) areas: NAT, EUR, MID, SOUTH ASIA c) the 00UTC, 06UTC, 12UTC and 18UTC validity periods 	<p><i>The requirements applicable to objective 4 all still apply to the .png format charts.</i></p> <p><i>Further information is provided in Appendix C of this document.</i></p>
<p>Objective 5b: Users must be able to:</p> <ul style="list-style-type: none"> a) process and display all SIGWX png format charts listed in 5a during a WAFc Backup Event. b) display SIGWX charts that have been corrected by WAFc London or WAFc Washington. 	

6. Process and display administrative messages and SIGWX correction messages

The software must be able to notify users when WAFS SIGWX corrections are issued. These corrections are text messages issued with the following WMO header: FXUK65 EGRR or FXUS65 KKCI

<p>Objective 6a: The software should clearly alert users when administrative messages are received. Administrative messages have the following WMO headers:</p> <ul style="list-style-type: none"> a) NOUK10 EGRR, NOUK11 EGRR, NOUK12 EGRR, NOUK13 EGRR b) NOUK31 EGGY, NOBX99 EBBR 	
<p>Objective 6b: The software should clearly alert users when a WAFS SIGWX correction message is received. These messages have the following WMO headers:</p> <ul style="list-style-type: none"> a) FXUK65 EGRR b) FXUS65 KKCI 	
<p>Objective 6c: The software should clearly alert users when a Space Weather advisory message is received. These messages have the following WMO headers</p> <ul style="list-style-type: none"> a) NOXX39 	

7. Display OPMET (TAF, METAR, SPECI, SIGMET, AIRMET, Volcanic Ash Advisory, Tropical Cyclone Advisory and Space Weather Advisories) in IWXXM format

In ICAO Annex 3 Amendment 79 (November 2020), the production of OPMET data sets in ICAO Meteorological Information Exchange Model (IWXXM) format became mandatory for all States. TAC format data will be retired (possibly in November 2026) so it is important that the visualisation software can download and display this new data type.

<p>Objective 7a:</p> <p>a) A user must be able to retrieve a list of all available IWXXM format METARs and SPECIS and view them in an appropriate readable format.</p> <p>b) A user should be able to retrieve their own chosen selection of IWXXM format METARs (WMO headers in the form <i>LA**** CCCC</i> and <i>LP**** CCCC</i>).</p> <p>c) A user should be able to view a time-series of IWXXM format METAR observations from their chosen airports.</p>	<p><i>The visualisation software needs to present the IWXXM format SPECI/METARs in user readable format. This could be similar to TAC, or could be in graphical or tabular format.</i></p> <p><i>Users should be able to sort the IWXXM format METAR data either by the airport name, or by their ICAO identifier, and set up preset (favourite) lists.</i></p>
<p>Objective 7b:</p> <p>a) A user must be able to retrieve a list of all available IWXXM format TAFs and view them in an appropriate readable format. (WMO headers in the form <i>LC**** CCCC</i> and <i>LT**** CCCC</i>).</p> <p>b) A user should be able to retrieve their own chosen selection of IWXXM format TAFs.</p> <p>c) A user should be able to easily view a time-series of IWXXM format TAF observations from their chosen airports.</p>	<p><i>The visualisation software needs to present the IWXXM format TAFs in user readable format. This could be similar to TAC, or could be in graphical or tabular format.</i></p> <p><i>Users should be able to sort the IWXXM format TAF data either by the airport name, or by their ICAO identifier, and set up preset (favourite) lists.</i></p>
<p>Objective 7c:</p> <p>A user must be able to retrieve the following types of IWXXM format SIGMET and view them in an appropriate readable format:</p> <p>a) General (WMO headers in the form <i>LS**** CCCC</i>)</p> <p>b) Volcanic Ash SIGMETs (WMO headers in the form <i>LV**** CCCC</i>)</p> <p>c) Tropical Cyclone SIGMETs (WMO headers in the form <i>LY**** CCCC</i>)</p>	<p><i>Users must be able to quickly access SIGMET information for a particular FIR, or group of FIRs.</i></p> <p><i>The visualisation software needs to present the IWXXM format SIGMETs in user readable format. This could be similar to TAC, a tabular format, or graphically on a map.</i></p>
<p>Objective 7d:</p> <p>a) A user should be able to retrieve IWXXM format AIRMETs and view them in an appropriate readable format. (WMO headers in the form <i>LW**** CCCC</i>).</p>	<p><i>Users must be able to quickly access AIRMET information for a particular FIR, or group of FIRs.</i></p> <p><i>The visualisation software needs to present the IWXXM format AIRMETs in user readable format. This could be similar to TAC or in a tabular format.</i></p>
<p>Objective 7e:</p> <p>a) A user should be able to retrieve IWXXM format Volcanic Ash Advisories and view them in an appropriate readable format. (WMO headers in the form <i>LU**** CCCC</i>).</p>	<p><i>Users must be able to quickly access Volcanic Ash information for a particular FIR, or group of FIRs.</i></p> <p><i>The visualisation software needs to present the IWXXM format VAAs in user readable format. This could be similar to TAC, a tabular format, or graphically on a map.</i></p>

<p>Objective 7f:</p> <p>a) A user should be able to retrieve IWXXM format Tropical Cyclone Advisories and view them in an appropriate readable format. (WMO headers in the form <i>LK**** CCCC</i>).</p>	<p><i>Users must be able to quickly access Tropical Cyclone information a particular FIR, or group of FIRs.</i></p> <p><i>The visualisation software needs to present the IWXXM format TCAs in user readable format. This could be similar to TAC, a tabular format, or graphically on a map.</i></p>
<p>Objective 7g:</p> <p>a) A user should be able to retrieve IWXXM format Space Weather Advisories and view them in an appropriate readable format. (WMO headers in the form <i>LN**** CCCC</i>).</p>	<p><i>Users must be able to quickly access Space Weather information a particular FIR, or group of FIRs.</i></p> <p><i>The visualisation software needs to present the IWXXM format SWAs in user readable format. This could be similar to TAC or in a tabular format.</i></p>

Note: Even though the production of IWXXM format OPMET data is now mandatory, it will take some time before the complete data set is available on SADIS. This is due to delays in State level production of IWXXM format data and transmission of data between the regional OPMET Centres.

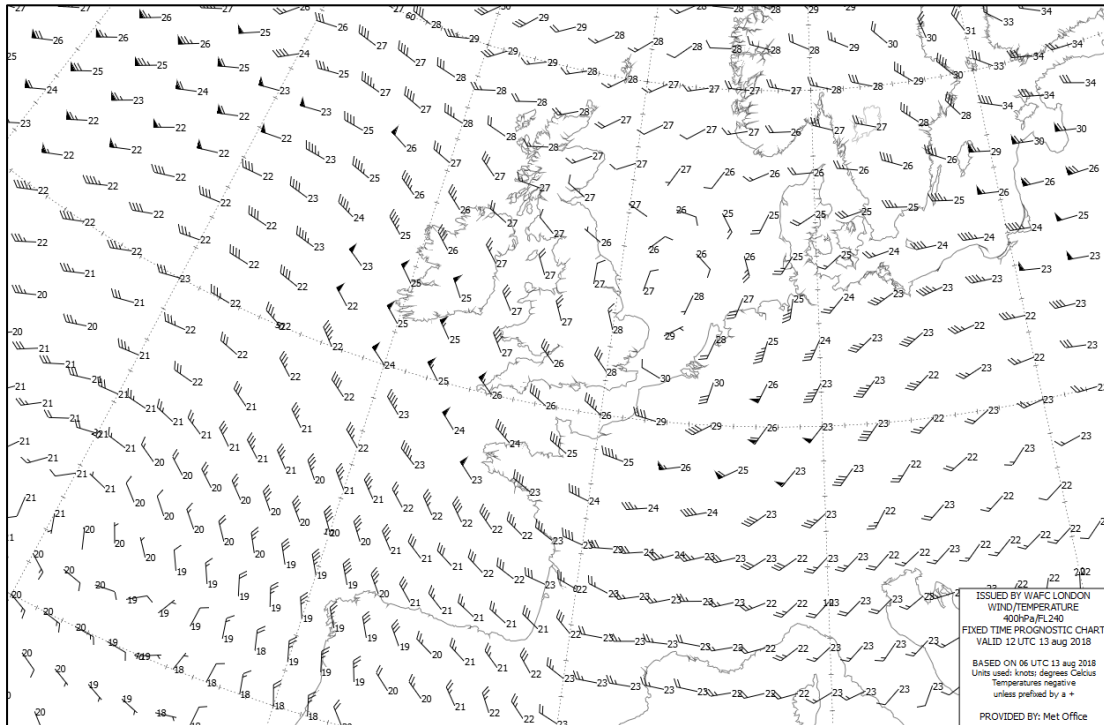
8. Digital Signatures

SADIS provides Digital Signatures (which may also be called a Digital Certificate) so that the authenticity and integrity of data downloaded from Secure SADIS FTP can be checked. It may be difficult for software users to check this functionality by themselves, so instead users may wish to ask their software provider to demonstrate it to them.

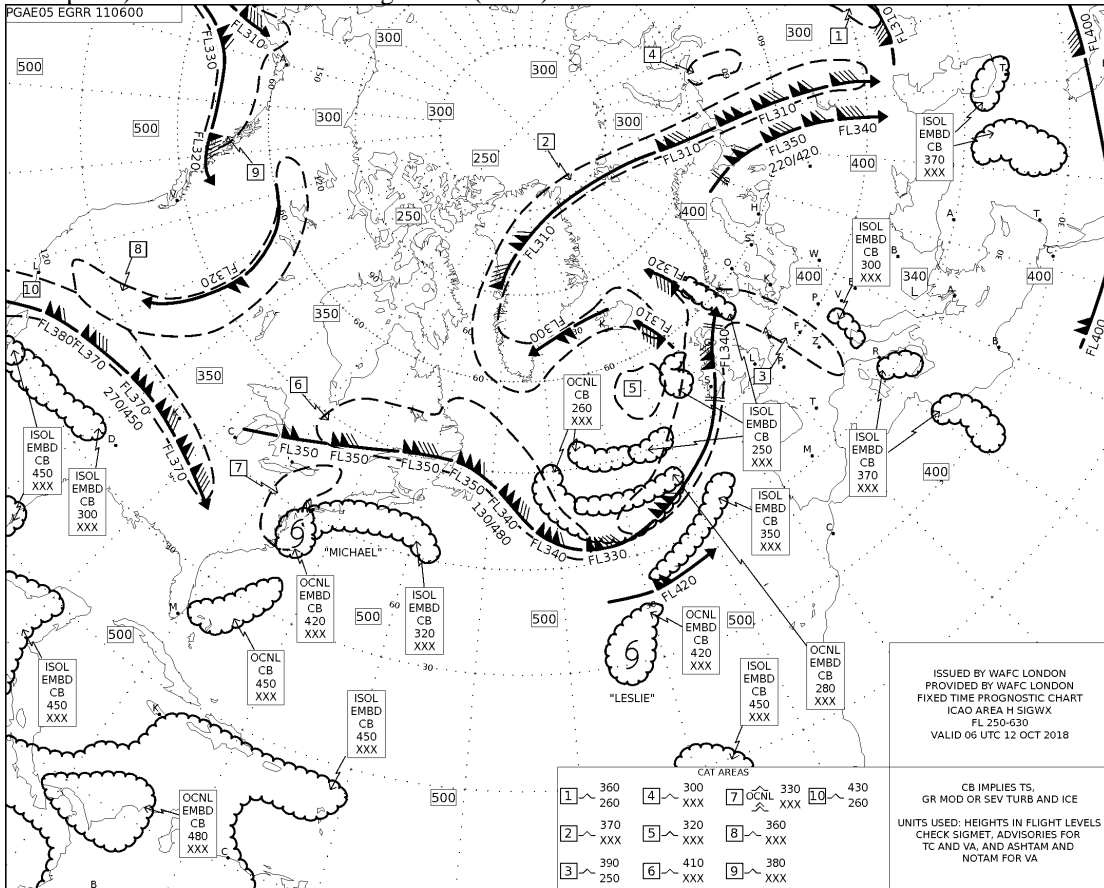
<p>Objective 8a:</p> <p>a) The software should check the Digital Signature and use the information contained in the .sig files for authenticity checks</p> <p>b) alert users when unable to confirm that a file has not been corrupted or tampered with and;</p> <p>i) provide information on the options available to the user with regard to continuing to accept data</p> <p>ii) Log and store responses</p>	<p><i>Each file on SADIS has an accompanying Digital Signature file (which has an identical name to the original, but has .SIG appended to it).</i></p> <p><i>More detailed guidance on Digital Signatures can be found in the SADIS User Guide part 2.</i></p>
<p>Objective 8b:</p> <p>The software should be able to:</p> <p>a) deal with a change Digital Signature.</p> <p>b) Re-try or re-poll for a new Digital Signature if the initial attempt at loading it fails.</p>	<p><i>This is required to deal with rare occasions where there may be a small delay in the availability of the Digital Signatures after the relevant and equivalent data file has been delivered.</i></p>
<p>Objective 8c:</p> <p>a) Users should be alerted if the processing of a Digital Signature fails.</p> <p>b) if providing the user with an option to continue to accept data a warning message should alert the user of these risks</p> <p>c) the software should log and store the users response in the event of a Digital Signature failure.</p>	

Example Charts

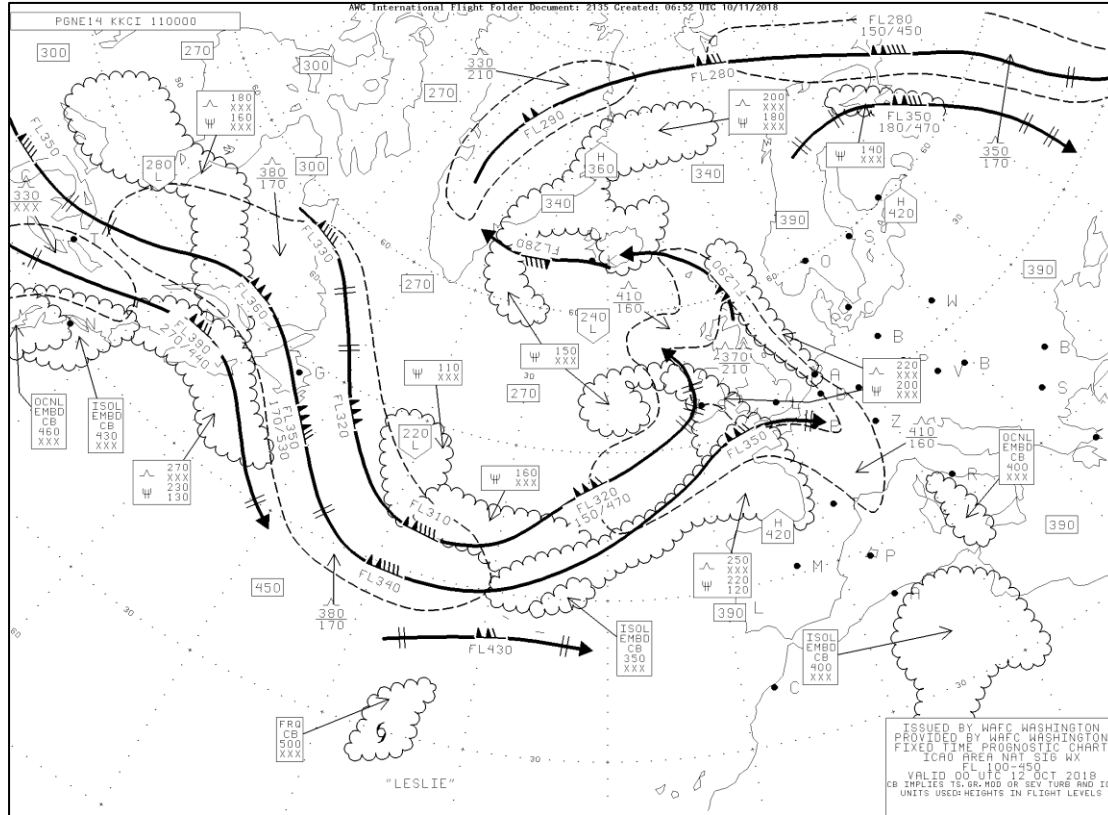
Example A) Wind and Temperature Chart



Example B) – An ICAO Area H High level (SWH) SIGWX Chart



Example C) – An ICAO Area NAT Medium level (SWM) SIGWX Chart



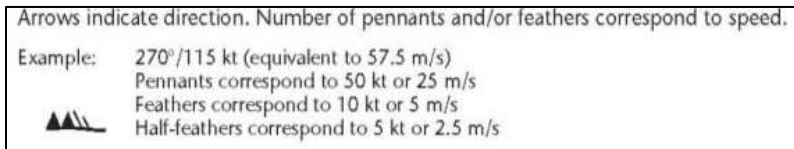
Appendix A

Additional guidance on Objective 3a - WAFC Wind and Temperature Charts

The key objective when producing a wind and temperature chart from the WAFC GRIB 2 data sets is for the chart to be clear, unambiguous, and meteorologically correct.

What to look out for:

- a) are the correct conventions used for the wind pennant/feathers?



- b) are the wind pennant/features depicted correctly on either side of the equator?
For winds in the northern hemisphere the pennants and/or feathers should be plotted on the clockwise side whilst in the southern hemisphere they should be on the anticlockwise side.
- c) temperature values should generally not be obscured by, or be obscuring the wind fletches
- d) positive temperature values should be prefixed with a + or PS
- e) latitude/longitude lines should be used
- f) the chart legend should be clear and contain the following information:
- The name of the WAFC who has issued the wind/temperature data set
 - Clear information on the flight level that the chart is for
 - Information that states which model run the chart is based on, and the validity time/date for the chart
 - A statement that says “Units used: knots, degrees Celsius” and “Temperatures negative unless prefixed by ‘+’
 - The name of the company/organisation that has generated/provided the chart

Appendix B

Additional guidance on Objective 3b, 3c, and 3d - WAFC Hazard data

The presentation of WAFC hazard data is not pre-defined, so the choice of how to display it is up to the user.

- The data should be in a colour scheme that is clear to the users (note: it may be necessary to consider whether the colour scheme used is suitable for users who suffer from colour blindness). A selection of charts has been included below to give some examples.
- Data could be thresholded (as in figure B2 and B3) in line with operating requirements.
- A key should be used
- On any printed hazard charts, a key and legend that clearly defines the source, type, level, validity date, and provider should be included.

Figure B1 –Turbulence Severity shown using a blue to red colour scheme.

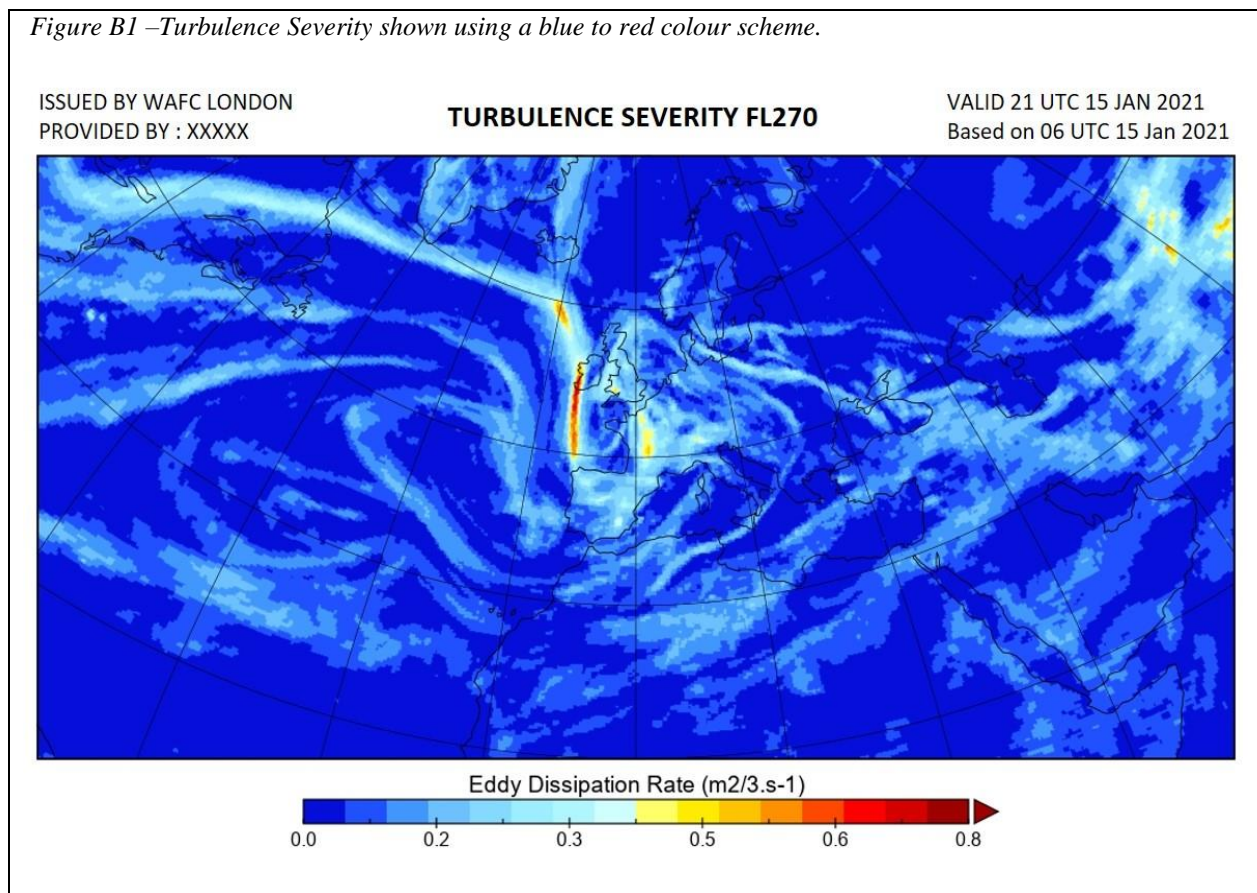


Figure B2 –Turbulence Severity depiction – with thresholding applied so that only values with an EDR above 0.2 are shown.

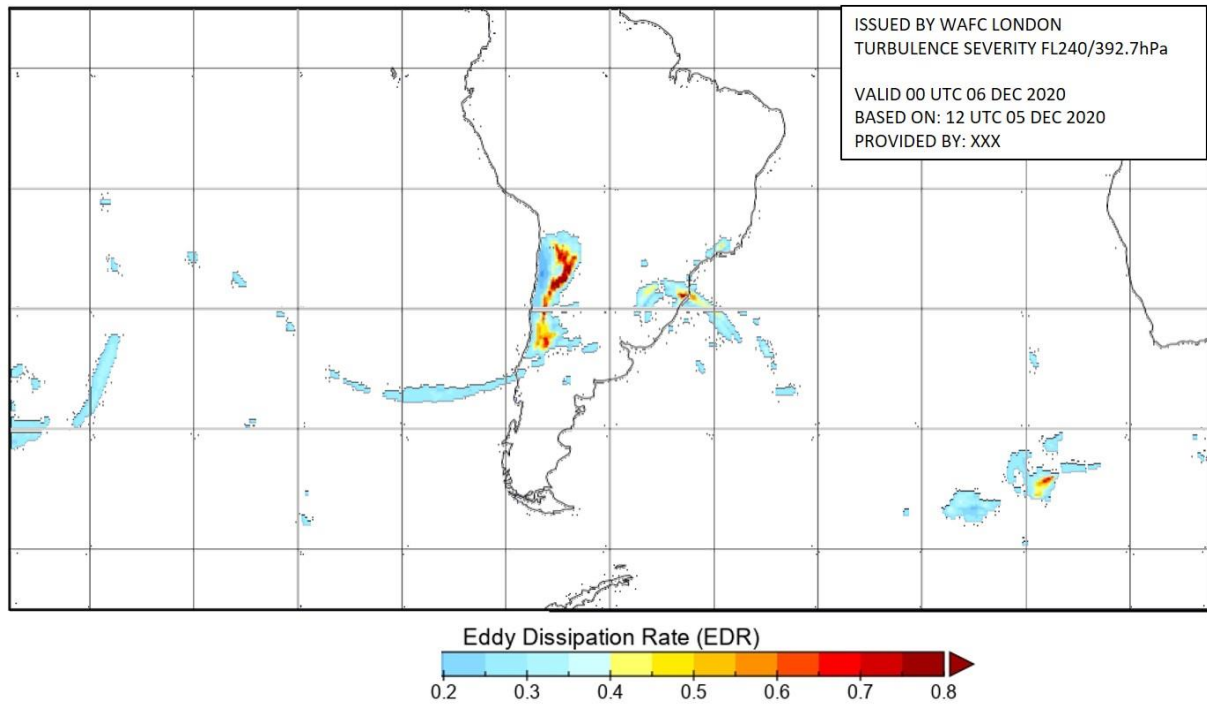


Figure B3 –Icing Severity – using graduated blue colour scheme

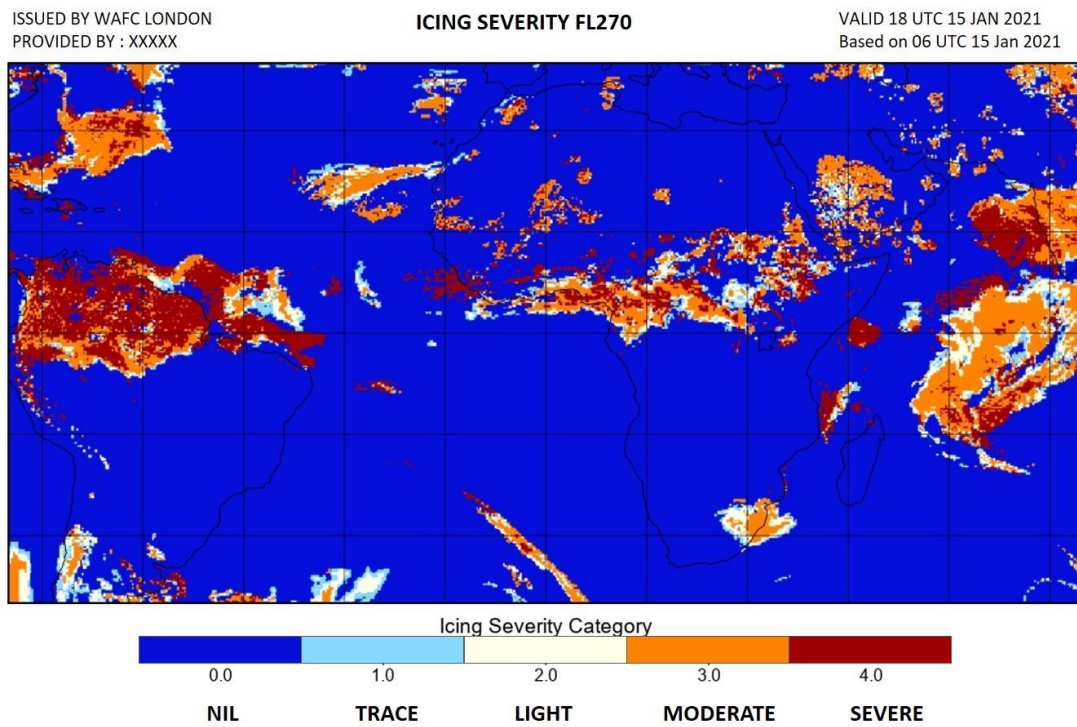


Figure B4 – Icing Severity at FL140, using with only moderate and severe icing categories shown..

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PROVIDED BY : XXXXX

ICING SEVERITY FL140

VALID 18 UTC 15 JAN 2021
Based on 06 UTC 15 Jan 2021

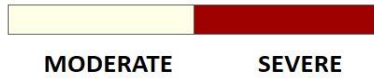
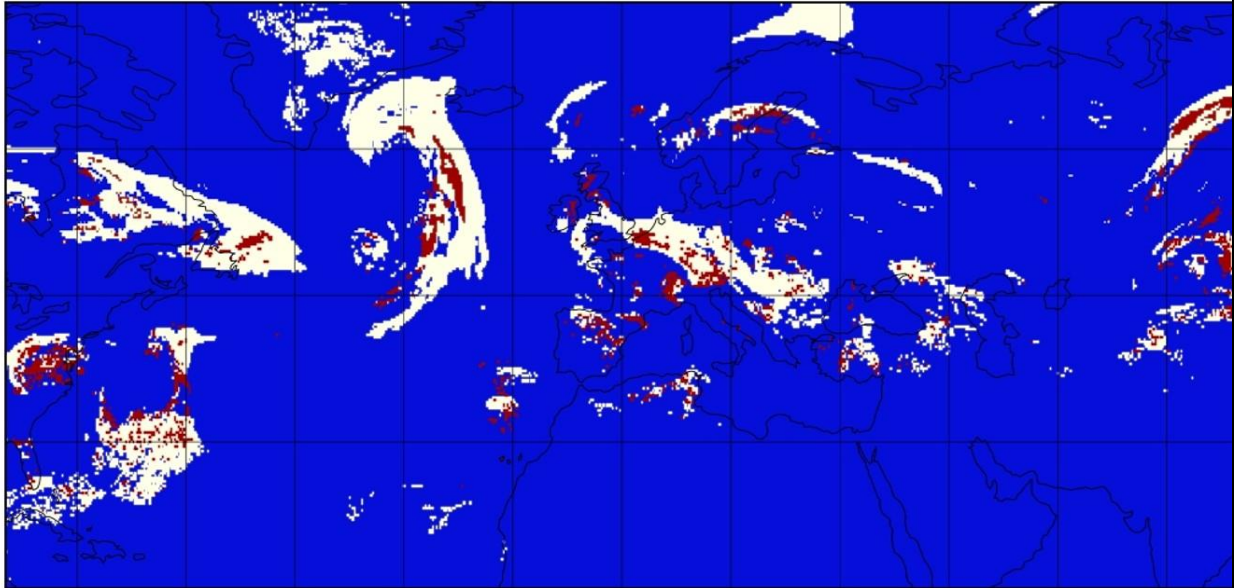


Figure B5 – Cumulonimbus extent – greyscale colour scheme.

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PROVIDED BY : XXXXX

HORIZONTAL EXTENT OF CUMULONIMBUS

VALID 18 UTC 15 JAN 2021
Based on 06 UTC 15 Jan 2021

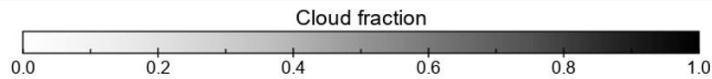
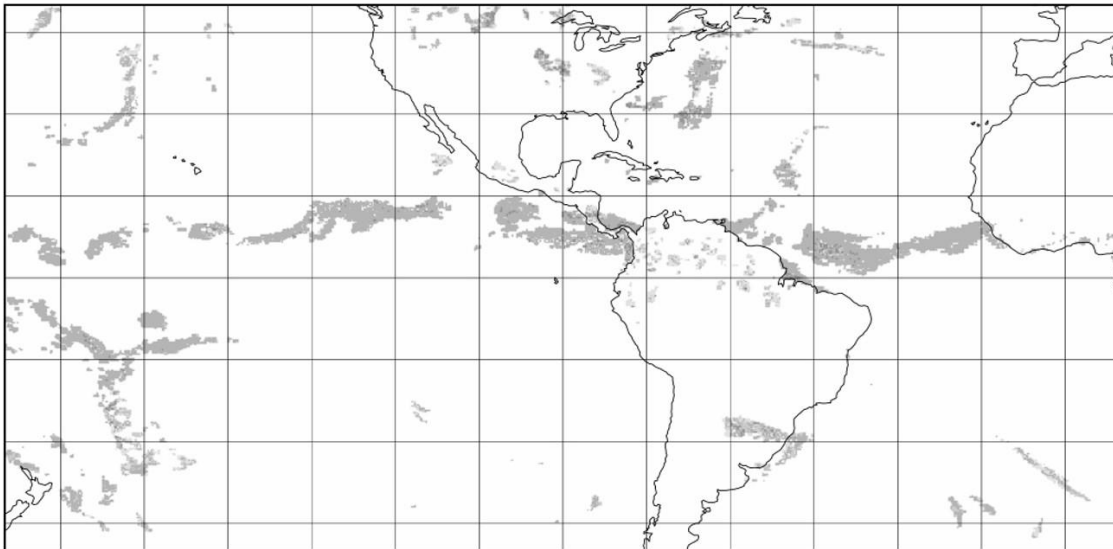
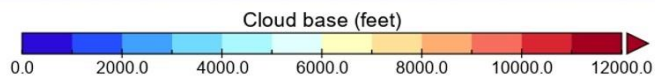
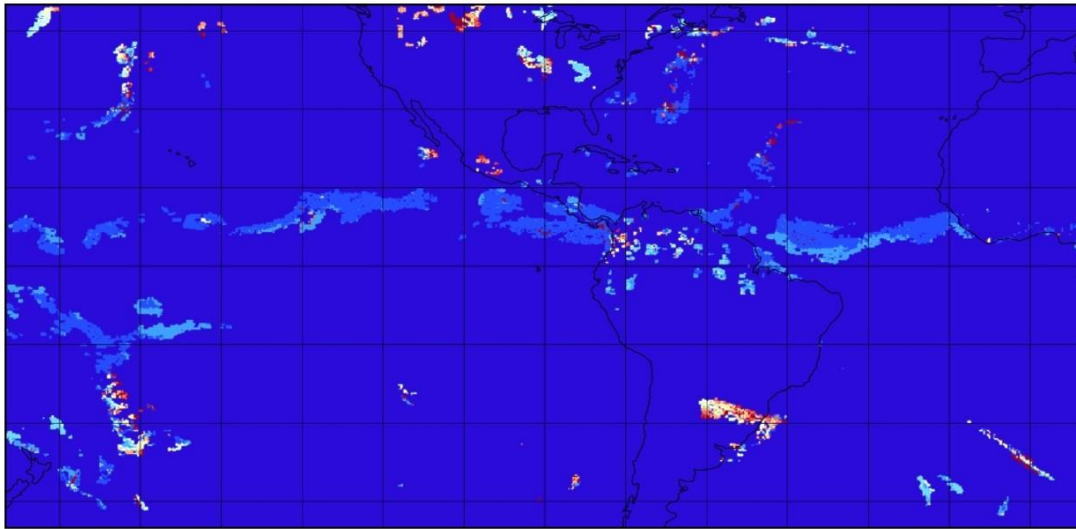


Figure B6 – Cumulonimbus base in feet

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PROVIDED BY : XXXXX

VALID 18 UTC 15 JAN 2021
Based on 06 UTC 15 Jan 2021

HEIGHT OF CUMULONIMBUS BASE



Appendix C

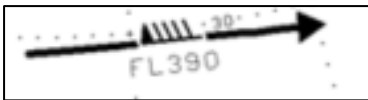
Additional guidance for objective 4a, b, and c - WAFC SIGWX charts

The key objective when producing a WAFC SIGWX chart from the BUFR data set is that it should be clear, unambiguous, and meteorologically correct. The relevant WAFC produced SIGWX chart (in .png format) should be closely consulted and compared to the version produced on your software.

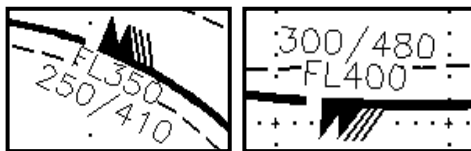
SIGWX Features should closely match the geographical positions and shapes that are depicted on the WAFC produced SIGWX charts, and be depicted using the correct conventions as described below (these follow the ICAO Annex 3, Appendix 1 specification). Colour may be used.

1. Jet streams

- a) correctly show the direction of the wind, with the arrow pointing where the wind is going to. Jet streams must not cross.



- b) For a jet stream that starts in the northern hemisphere the speed symbols should be plotted to the left of the jet core, whilst a jet that starts in the southern hemisphere should have the speed symbols on the right.



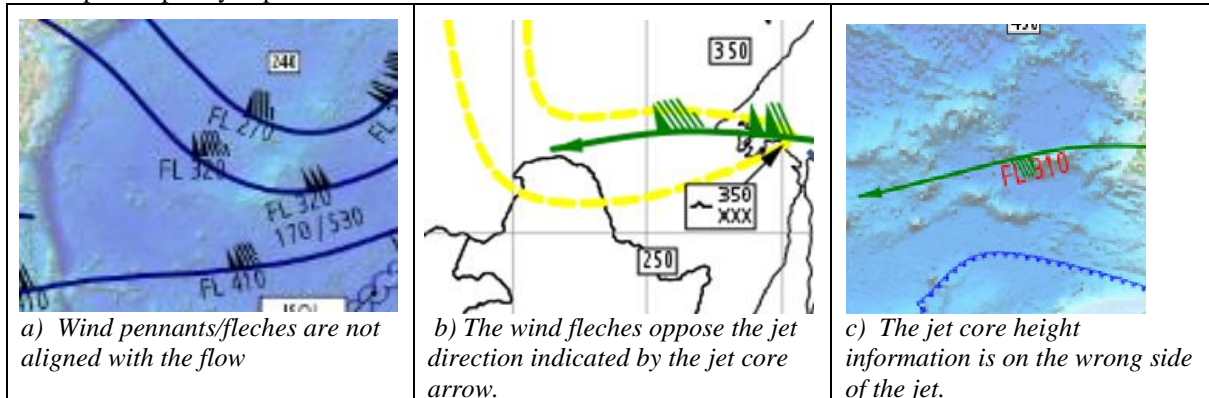
Left: northern hemisphere example
Right: southern hemisphere example

- c) Have jet core height information (in FL) plotted along the length of the jet, on the opposite side to the speed symbols.
d) Use a “change bar” (two short lines perpendicular to the jet stream) where there is a change of speed of 20 knots but insufficient speed to plot the full wind symbol.



- e) Contain vertical jet depth information where the jet stream has a speed of 120kt or more.

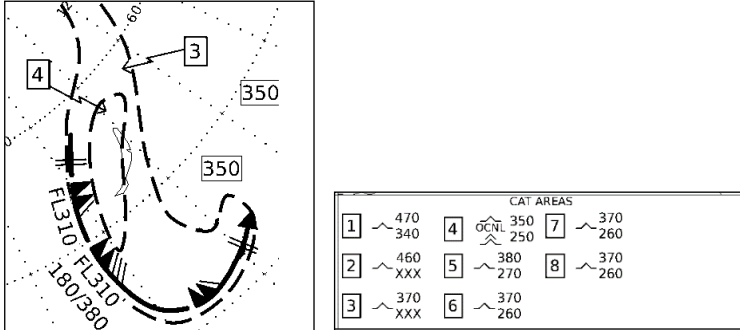
Some examples of poorly depicted Jetstreams are shown below



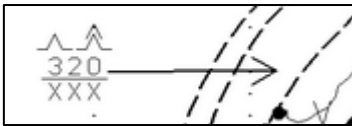
2. Clear Air Turbulence

a) Areas of clear air turbulence are generally represented by a dashed and/or shaded area and a feature label. This feature label can take two forms:

i) a reference number, which relates to a legend shown elsewhere on the chart.



ii) a pictorial/numerical representation of with the turbulence severity and base/top information

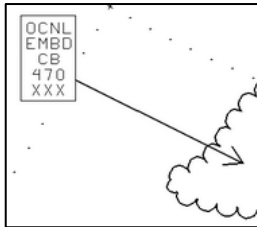


3. Cumulonimbus Cloud

a) CB cloud is generally depicted as a scalloped area, with an associated label which provides information on the CB amount/type and base and top information.

b) CB bases that fall below the lower vertical boundary of the chart, or CB tops that extend above the top of the chart should be marked as XXX

c) Labels can be displayed wholly within the marked CB area, or be linked with a call out arrow.



4. Tropopause Height

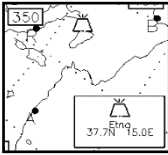
Tropopause height is indicated with three different types of symbol:



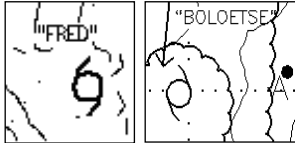
Left to right: a tropopause high; a tropopause low, and a "spot" value.

5. Volcanoes, sandstorms, tropical cyclones and radiation

- a) Tropical cyclones and volcanoes should be accompanied by a label which gives their name.



- b) The tropical cyclone symbol changes between the northern and southern hemisphere to indicate the different directions of rotation.



*Left;- Northern hemisphere tropical cyclone (Fred),
Right;- Southern hemisphere tropical cyclone (Boloetse)*

- c) Sandstorms are only forecast if the hazard is expected to extend above the lower limit of the chart.



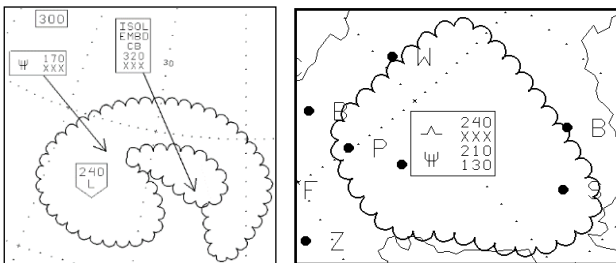
- d) Release of radioactive material should be represented by the radiation symbol



6. In cloud (non-convective) icing and turbulence

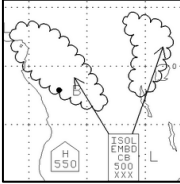
SIGWX forecasts for this parameter only apply to the limited areas covered by the SWM (medium level SIGWX) charts.

- a) The in-cloud icing and turbulence should be encompassed by a scalloped line, and have an associated label which provides information on the forecast intensity and base/top information.
b) Bases that fall below the lower vertical boundary of the chart, or tops that extend above the top of the chart should be marked as XXX



7. General Guidelines - Feature labels

- a) should not overlap
- b) should not be underneath, or over the top of other SIGWX features
- c) can be used for more than one feature if each feature shares the same attributes.



- d) Should follow the correct format, using the correct abbreviations
- e) It should be clear what a feature label corresponds to:
 - i) The arrow should point either to the boundary of the cloud/CAT/icing area or end within the area of the feature
 - ii) Ideally the arrow should not cross feature label boxes as it may make them difficult to read

The examples below give examples of poor feature labelling:

<p>a) overlapping text boxes</p>	<p>b) the wrong abbreviation for embedded has been used</p>	<p>c) this CB label is overlapping the jet stream information</p>
<p>d) there are two different labels attached to a single CB area making it impossible to know which one is correct</p>	<p>e) this arrow terminates outside of a cloud area</p>	<p>f) a label inside of a feature suggests that it applies to that feature. However in this example there is another label which indicates alternative attributes.</p>

8. General Guidelines – Legends

There should be a clear legend containing the elements shown below:

- a) The name of the WAFC who has issued the data set
- b) Clear information on the flight level(s) that the chart is for
- c) The ICAO area the chart is applicable for (if a standard area is used)
- d) Information that states which model run the chart is based on, and the validity time/date for the chart
- e) For SIGWX charts: A statement that says “CB IMPLIES TS, GR, MOD or SEV TURB AND ICE” and “Units used: heights in Flight Levels. Check SIGMET, advisories for TC and VA, and ASHTAM and NOTAM for VA”
- f) For wind and temperature charts: A statement that says “Units used: knots, degrees Celsius” and “Temperatures negative unless prefixed by ‘+’
- g) The name of the company/organisation that has generated/provided the chart

<p>ISSUED BY WAFC LONDON PROVIDED BY WXCHARTS.COM FIXED TIME PROGNOSTIC CHART ICAO AREA D SIGWX FL 250-630 VALID 12 UTC 19 NOV 2009</p> <hr/> <p>CB IMPLIES TS, GR, MOD OR SEV TURB AND ICE UNITS USED: HEIGHTS IN FLIGHT LEVELS CHECK SIGMET, ADVISORIES FOR TC AND VA, AND ASHTAM AND NOTAM FOR VA</p>
--

APPENDIX D– SOFTWARE EVALUATION FORM

	Compliant ✓/✗	Comments/notes
1. Display of OPMET data in traditional alphanumeric code (TAC) format		
Objective 1a:		
a) A list of all available METARs and SPECIS from the following CARSAM, NAM, EUR/NAT, MID, and ASIAPAC regions can be displayed.		
b) A user defined/bespoke list of METARS can be displayed.		
c) A time series of METAR observations can be viewed for a selection of airports.		
Objective 1b:		
a) A list of all available TAFS from each of the following regions: CARSAM, NAM, EUR/NAT, MID, and ASIAPAC can be displayed.		
b) A user defined (bespoke) list of TAFs can be displayed.		
c) A time series of TAF observations can be viewed for a selection of airports.		
Objective 1c:		
a) General (WS****) SIGMETs can be displayed.		
b) Volcanic Ash (WV****) SIGMETs can be displayed		
c) Tropical Cyclone SIGMETs (WC****)		
Objective 1d:		
AIRMETS can be displayed GAMETS can be displayed		
Objective 1e:		
An alert is given (audible or visual) when new SIGMET becomes available		
Objective 1f:		
An alert is given when a SPECI for an aerodrome becomes available		

OPMET Bulletin Viewer		
Objective 2a:		
The contents of a single bulletin can be displayed by typing in the WMO header of the bulletin (excluding GRIB and BUFR encoded bulletins)		
Objective 2b:		
Tropical cyclone advisories can be displayed		
Objective 2c:		
The graphical tropical cyclone advisory from La Reunion - <i>PZXD01 (1-4) FMEE</i> can be displayed		
Objective 2d:		
Volcanic ash advisory statements can be displayed		
Objective 2e:		
Volcanic ash graphical forecasts can be displayed		
Objective 2f:		
Special AIREPS can be displayed		
Objective 2g:		
ASHTAMS and NOTAMS relating to volcanic ash can be displayed		
Objective 2h:		
Space Weather advisories (FN**** CCCC) can be displayed		
Objective 2i:		
An audible or visual alert should be given when each of the data types listed in objectives 2b to 2g becomes available in the area of interest.		

WAFS gridded data (GRIB2 format)		
On screen display		
Objective 3a:		
a) Wind data is correctly displayed using arrows with feathers and pennants		
b) Temperature data is correctly displayed in Celsius, and is only prefixed by a “+” or “PS” when the temperatures are positive.		
c) Wind data should be displayed using the correct conventions in both the northern and southern hemispheres		
d) Data from the following flight levels can be displayed: FL050, FL080, FL100, FL140, FL180, FL210, FL240, FL270, FL300, FL320, FL340, FL360, FL390, FL410, FL450, FL480 and FL530		
e) Latitude/longitude lines and the coastline can be shown.		
Objective 3b:		
a) A map can be created which shows Turbulence Severity values at 0.25 degree horizontal resolution		
b) Data from the following flight levels can be displayed: FL100, FL140, FL180, FL240, FL270, FL300, FL340, FL390, and FL450		
Objective 3c:		
a) A map can be created which shows Icing Severity categories at 0.25 degree horizontal resolution		
d) Data from each of the following flight levels can be displayed: FL060, FL100, FL140, FL180, FL240, and FL300		

Objective 3d:		
a) A map can be created which shows cumulonimbus <u>horizontal extent</u> areas at 0.25 degree horizontal resolution		
b) A map can be created which shows cumulonimbus <u>base</u> information at 0.25 degree horizontal resolution		
c) A map can be created which shows cumulonimbus <u>top</u> information at 0.25 degree horizontal resolution		
Objective 3e:		
a) It is possible to easily switch between the different vertical levels of data		
b) It is possible to move between the different time-steps of data		
c) It is possible zoom into the area of interest		
d) it is possible to pan the map into the area of interest		
Objective 3f:		
a) The source of the gridded data (WAFC London or WAFC Washington) can easily be identified		
b) the vertical level of data being shown can clearly be identified		
c) the validity period or time-step of data being shown can clearly be identified		
Optional objectives:		
a) A map showing relative humidity can be displayed		
b) A map showing geopotential height can be displayed		
c) A map showing tropopause height and tropopause temperature can be displayed		
d) A map/chart showing the maximum wind and the height of the maximum wind can be displayed		

Hard Copy Charts		
Objective 3g:		
a) A wind and temperature chart can be produced that is largely identical to that contained in ICAO Annex 3, Appendix I		
b) The wind and temperature chart has a legend which contains the following elements: <ul style="list-style-type: none"> - The name of the WAFC who has issued the data set - Clear information on the flight level the chart is for - The ICAO area the chart is applicable for (if appropriate) - Information on the model run and the validity time/date - A statement that says “Units used: knots, degrees Celsius” and “Temperatures negative unless prefixed by ‘+’” - The name of the company/organisation that has generated/provided the chart 		
c) A wind and temperature chart can be produced for each of the standard ICAO areas (A, B, B1, C, D, E, F, G, H, I, J, K, M, NAT, EUR, MID, SOUTH ASIA)		
d) A wind and temperature chart can be created for a user defined map area, in both mercator and polar stereographic projections.		
Objective 3h:		
a) Cumulonimbus, Turbulence and Icing charts are displayed using an appropriate and clear colour scheme or contouring		
b) Cumulonimbus, Turbulence and Icing charts contain a key that explains the colour scheme being used		
c) Cumulonimbus, Turbulence and Icing charts contain a legend which contains the following information: <ul style="list-style-type: none"> - The name of the WAFC who has issued the data set - Clear information on the flight level that the chart is for - The ICAO area the chart is applicable for (if appropriate) - Information on the model run and the validity time/date - The name of the company/organisation that has generated/provided the chart 		
d) Cumulonimbus, Turbulence and Icing charts can be created for a user defined map area, in both Mercator and polar stereographic projection		

WAFS SIGWX forecasts - using the BUFR data set		
On Screen Display		
Objective 4a:		
d) The following SWH (high level) data parameters can be displayed:		
i) Jet stream (core position, speed, height of the jet core, and jet depth (where the jet speed exceeds 120kt))		
ii) Clear Air Turbulence areas		
iii) Cumulonimbus areas		
iv) Tropopause height information		
v) Active volcanic eruptions		
vi) Active tropical cyclones		
vii) Radioactive releases		
viii) Sand and dust storms		
b) Each SWH parameter is depicted using the standard conventions (<i>as per ICAO Annex 3, Appendix 1</i>)		
c) Each SWH parameter should be largely identical (spatially) to the WAFS produced SIGWX charts		
Objective 4b:		
d) The following SWM (mid level) data parameters can be displayed:		
i) Jet stream (core position, speed, height of the jet core, and jet depth (where the jet speed exceeds 120kt))		
ii) Clear Air Turbulence areas		
iii) Cumulonimbus areas		
iv) Areas of in cloud turbulence and icing		
v) Active volcanic eruptions		
vi) Active tropical cyclones		
vii) Radioactive releases		
viii) Sand and dust storms		
b) Each SWM parameter is depicted using the standard conventions		
c) Each SWM parameter is largely identical (spatially) to the WAFS produced SIGWX charts		

Objective 4c:		
a) SIGWX feature labels (text boxes) for the SWM and SWH data sets have identical content to those on the WAFC produced SIGWX charts		
b) SIGWX feature labels (text boxes) for the SWM and SWH data sets are positioned so that they are clearly readable and are not obscuring the SIGWX features		
Objective 4d:		
a) the display of SIGWX data maintains its integrity and clarity when panning or zooming on the map		
b) the display of SIGWX data maintains its integrity and clarity when switching between map projections		
c) the display clearly shows when a SIGWX map layer is not available, or when SWM data is not available for a particular area		
Objective 4e:		
a) the display must show whether WAFC London or WAFC Washington data is being used		
b) the software must clearly show the validity date/time of the data set		
Objective 4e:		
a) The software must be able to handle BUFR bulletins that contain no data – i.e. bulletins that are empty apart from message header information.		
b) SIGWX BUFR data can be displayed during a WAFC Backup test.		
c) Corrected SIGWX BUFR data sets can be displayed.		

Hard Copy Charts		
Objective 4g:		
a) Hard copy SIGWX charts can be created that meet objectives 4a, 4b, and 4c.		
b) SWH (high level SIGWX) charts can be created for ICAO map areas: A, B, B1, C, D, E, F, G, H, I, J, K and M		
c) SWM (medium level SIGWX) charts can be created for ICAO map areas: ASIA_SOUTH, EURO, MID and NAT		
d) SIGWX charts can be created that cover a user defined/customisable area		
Objective 4h:		
a) The hard copy charts show whether the WAFC London or WAFC Washington data set was used.		
b) The hard copy charts show the company/organisation name		
c) The hard copy charts show the validity date/time for the chart.		
d) The hard copy charts identify the flight level the chart applies to		
e) if the chart is for an ICAO area, the chart area should is listed		
f) the hard copy chart contains following statement: “CB IMPLIES TS, GR, MOD OR SEV TURB AND ICE. UNITS USED: HEIGHTS IN FLIGHT LEVELS. CHECK SIGMET, ADVISORIES FOR TC AND VA, AND ASHTAM AND NOTAM FOR VA”		

Display of WAFS SIGWX charts in the PNG (portable network graphics) chart format.		
Objective 5a:		
a) High level (SWH) SIGWX charts for areas A, B, B1, C, D, E, F, G, H, I, J, K and M can be displayed		
b) Medium level (SWM) SIGWX charts for NAT, EUR, MID, and SOUTH ASIA can be displayed		
c) Charts for 00UTC, 06UTC, 12UTC and 18UTC can be displayed		
Objective 5b:		
a) All SIGWX png format charts listed in 5a can be displayed during a WAFC Backup Event		
b) SIGWX charts that have been corrected by WAFC London or WAFC Washington can be displayed.		
Display of WAFS SIGWX charts in the PNG (portable network graphics) chart format.		
Objective 6a:		
a) An alert is given when NOUK10, NOUK11, NOUK12, and NOUK13 administrative messages are received, and these messages can be displayed.		
b) An alert is given when NOUK31 and NOBX99 administrative messages are received, and these messages can be displayed		
Objective 6b:		
a) An alert is given when FXUK65 SIGWX correction messages are received, and these messages can be displayed		
b) An alert is given when FXUS65 SIGWX correction messages are received, and these messages can be displayed		
Objective 6c:		
a) An alert is given when NOXX39 Space Weather Advisory administrative messages are received, and these messages can be displayed		

Display OPMET in IWXXM format		
Objective 7a:		
a) A list of METARs and SPECIS can be created from the IWXXM format LA**** CCCC and LP **** CCCC data and displayed in a useful format (e.g. in a form similar to a TAC format METAR, in a table, or as a graphic on a map)		
b) A time series of METARs can be viewed for a selection of airports		
Objective 7b:		
a) A list of TAFs can be created from the IWXXM format LC**** CCCC and LT **** CCCC data and displayed in a useful format (e.g. in a form similar to a TAC format TAF, in a table, or as a graphic on a map)		
b) A time series of TAFs can be viewed for a selection of airports		
Objective 7c:		
a) A list of SIGMETS can be created from the IWXXM format LS**** CCCC data and displayed in a useful format (e.g. similar to a TAC format SIGMET in a table, or as a graphic on a map)		
b) A list of SIGMETS can be created from the IWXXM format LV**** CCCC data and displayed in a useful format (e.g. similar to a TAC format SIGMET, in a table, or as a graphic on a map)		
c) A list of SIGMETS can be created from the IWXXM format LY**** CCCC data and displayed in a useful format (e.g. similar to a TAC format SIGMET, in a table, or as a graphic on a map)		
Objective 7d:		
a) A display showing IWXXM format AIRMETS can be created from the LW**** CCCC data and displayed in a useful format (e.g. similar to a TAC format AIRMET or in a table)		
Objective 7e:		
a) IWXXM format Volcanic Ash Advisory statements (LU**** CCCC) can be displayed in a useful format (e.g. similar to a TAC format VAA, in a table, or as a graphic on a map)		
Objective 7f:		
a) IWXXM format Tropical Cyclone Advisory statements (LU**** CCCC) can be displayed in a useful format (e.g. similar to a TAC format TCA, in a table, or as a graphic on a map)		
Objective 7g:		
a) IWXXM format Space Weather Advisory statements (LN**** CCCC) can be displayed in a useful format (e.g. similar to a TAC format Space Weather Advisory, in a table, or as a graphic on a map)		

Digital Signatures		
Objective 8a:		
a) The software uses the Digital Signature and uses it for authenticity checks		
a) Users are alerted when the software has been unable to confirm that a file has not been corrupted or tampered with and; i) provides information on the options available to the user with regard to continuing to accept data ii) Logs and stores the responses		
Objective 8b:		
a) The software can deal with a change in digital signature		
b) The software will re-try or re-poll for a new digital signature if the initial attempt at loading it fails		
Objective 8c:		
a) Users should be alerted if the processing of a Digital Signature fails		
b) if providing the user with an option to continue to accept data a warning message should alert the user of these risks		
c) the software should log and store the users response in the event of a Digital Signature failure.		