



METEOROLOGY PANEL



**Summary Document of
Third Meeting
of the Working Group to the Meteorology Panel
Meteorological Operations Group (METP WG-MOG/3)
—
Matters Relating to World Area Forecast Systems (WAFS)**

Gatwick, London, United Kingdom, 15 and 16 June 2016

INTERNATIONAL CIVIL AVIATION ORGANIZATION

LIST OF WG-MOG/3 – WAFS ACTIONS

Action 3/1: Investigate discrepancies in WAFC performance indicators for BUFR data availability

Action 3/2: Review of current WAFS data deadline

Action 3/3: Addition of non-scheduled backup information to the reporting table in the management report

Action 3/4: Addition of a non-technical summary statement to the WAFS management report

Action 3/5: Sharing of the MOG Terms of Reference with the METP

Action 3/6: Updates to Job Card #10 for the WAFS

Action 3/7: Addition of new agenda item to WG-MOG WAFS meeting - WAFC Future Plans

Action 3/8: Provide a report to the next WG-MOG WAFS meeting - WAFS Forecasts consistency

Action 3/9: Requirements for aircraft-based observation (ABO) data

Action 3/10: Follow-up with authors of SP-ASWG/3 WP/11

Action 3/11: Updates to WG-MOG web pages

LIST OF WG-MOG/3 – WAFS DECISIONS

Decision 3/1 — Revised issuance times for scheduled WAFC backup operations

Decision 3/2 — Review of the Terms of Reference for MOG

Agenda Item 1: Opening of the meeting

1.1 The third meeting of the MET Operations Group (MOG/3) for matters pertaining to the World Area Forecast System (WAFS) took place in Gatwick, United Kingdom (U.K.), at the premises of the Civil Aviation Authority (CAA) from 15 to 16 June 2016.

1.2 Mr. Colin Hord, Principal, MET/AIM/Radio Licensing, CAA, as well as Rapporteur of WG-MOG, presided over the meeting, assisted by Mr. Raul Romero, Technical Officer, Airspace Management and Optimization Section, ICAO Headquarters.

1.3 Mr. Hord opened the meeting at 0900 British Summer Time. He thanked the WAFS Provider States with their continued investment in the WAFS which has been gratefully appreciated.

Agenda Item 2: Introduction

2.1 Participants to the meeting were introduced. The list of participants is contained in Appendix A.

Agenda Item 3, 4 and 5: Matters relating to SADIS (13 and 14 June)

3.1 Refer to a separate report.

Agenda Item 6: Matters relating to WAFS (15 and 16 June)

6.1. Review of Open Items from WAFSOPSG (i.e., WAFS actions and decisions from WG-MOG/1)¹

Actions	Status / Reference
Action 1/1: The WAFCs (Matt/Chris) prepare information on the SIGWX correction process and deliver to the Secretariat (by the end of October) for posting on the MOG web site.	Complete
Action 1/2: The WAFCs include key verification statistics in future WAFS Management Reports.	Complete (Management Report)
Action 1/3: The WAFCs prepare a working paper on the future provision of SIGWX in digital form at the MIE meeting (November) with an IP for MISD.	Complete
Action 1/4: That the WG-MOG WAFS Work Stream members review the MOG Terms of Reference and provide Colin comments by 25 September 2015.	In progress (SN 13)
Action 1/5 - In view of the expected developments of the WMO expert team on aircraft observations, the meeting agreed to review progress at the next MOG meeting. Note: WAFCs are part of the WMO expert team.	Complete (SN 11)
Decisions	
Decision 1/1 — Provision of additional levels for WAFS gridded forecasts.	Complete (SN 12)
Decision 1/2 — Provision of generic visualisations and source data for WAFS gridded forecasts of cumulonimbus cloud, icing and turbulence.	Complete
Decision 1/3 — WAFS Medium Level Strategy WAFS for ASBU Block 1 (2018- 2023).	In progress

¹ Note: MOG Meeting 2 was held in April 2016 in Buenos Aires and pertained to volcanic ash and not the WAFS.

Decision 1/4 - Updated Guidance on the Use of WAFS Grids for Cumulonimbus Cloud, Icing and Turbulence Forecast.	Complete (Management Report)
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6.2 Other Operational Matters

6.2.1 WAFS Management Report and Review of Key Performance Indicators (KPIs)

6.2.1.1 In response to the World Area Forecast System Operations Group (WAFSOPSG²) Conclusion 1/3, World Area Forecast Center (W AFC) Provider States are required to provide a joint WAFS management report at each WG-MOG (WAFS) meeting.

6.2.1.2 The WAFCs presented a Study Note (WAFS Management Report of the W AFC Operations) that provided a detailed summary of the W AFC's activities from the period of July 2015 through April 2016 inclusion. The report addressed recent developments related to the main operational functions of the WAFS, including: WAFS operational product changes, harmonization of WAFS data, W AFC quality management system, WAFS workshops and seminars, development of WAFS grid-point forecasts, WIFS and SADIS enhancements, WAFS performance indicators, W AFC backup tests, and service interruptions.

6.2.1.2.1 In response to WG-MOG/1 Decision 1/1, the WAFCs will begin providing data for FL080 (750hPa), FL210 (450hPa), and FL480 (125hPa) on 9 November, 2016.

6.2.1.2.2 The WAFCs updated the User's Guide for harmonized grids for icing, turbulence and cumulonimbus (CB) cloud. This material can be found on the WG-MOG webpages under WAFS.

6.2.1.2.3 W AFC London – as a function of the Met Office, is ISO 9001:2008 and ISO 14001:2004 compliant. W AFC Washington, as a function of the Aviation Weather Center in Kansas City, continues to maintain ISO9001:2008 QMS certification, and is working towards upgrading to the new ISO9001:2015 standard.

6.2.1.2.4 **WAFS Performance Indicators.** W AFC London performance indicators are online at <http://www.metoffice.gov.uk/public/weather/aviation-wafc/#?tab=wafcPerformance> W AFC Washington performance indicators are online at <http://www.emc.ncep.noaa.gov/gmb/icao/>.

6.2.1.2.4.1 Following the presentation of the management report the following four actions were formulated:

Action 3/1: Investigate discrepancies in W AFC performance indicators for BUFR data availability.

That the WAFCs (Matt as rapporteur) will investigate the apparent discrepancies between W AFC Washington and London performance indicators for availability of BUFR data, and report back to the next MOG WAFS meeting.

Action 3/2: Review of current WAFS data deadline.

That WAFCs review the current deadline of the WAFS data sets as described in Annex 3 to see if they can be revised (i.e., Annex 3 states no later than 6 hours), including availability of the hazard data and report back to the next MOG WAFS meeting.

² Although WAFSOPSG was disbanded in 2015, it is understood that WAFSOPSG Conclusions/Decisions remain extant unless superseded by the Meteorological Panel (METP) and/or its Working Groups as appropriate.

Action 3/3: Addition of non-scheduled backup information to the reporting table in the management report.

That the WAFCs add a column on non-scheduled backup statistics to their table regarding backup information for subsequent management reports.

Action 3/4: Addition of a non-technical summary statement to the WAFS management report.

That the WAFCs add an executive summary statement to future WAFS Management reports to provide a high-level, non-technical summary of the performance of the WAFS during the report's period of record.

6.2.1.3 The meeting thanked the WAFCs for the report and agreed that it meets the intent of the WAFSOPGS Conclusion 1/3.

6.2.2 Impacts in Relation to Amendment 77

6.2.2.1 **Additional Flight Levels.** SN/12, presented by the WAFC Provider States, updated the group with details relating to the additional levels of gridded upper air forecast data that will be provided by the WAFCs with applicability of Amendment 77 to ICAO Annex 3 – *Meteorological Service for International Air Navigation*.

6.2.2.2 The additional flight level data can be summarised as:

- U wind for FL080 (750hPa), FL210 (450hPa), and FL480 (125hPa)
- V wind for FL080 (750hPa), FL210 (450hPa), and FL480 (125hPa)
- Geopotential altitude for FL080 (750hPa), FL210 (450hPa), and FL480 (125hPa)
- Temperature for FL080 (750hPa), FL210 (450hPa), and FL480 (125hPa)
- Humidity for FL080 (750hPa) only.

6.2.2.3 The WAFCs will include the additional data in their respective datasets effective with data issued from the 1200 UTC 'data-time' on 9 November 2016. This is slightly in advance of the applicability of Amendment 77 to ICAO Annex 3 (10 November 2016).

6.2.2.4 The WAFCs are able to give access to test data. The test data is available on systems that are not fully operational. WAFC London is making test data available on Secure SADIS FTP via:

Server: ftp.metoffice.gov.uk
User: collect_wafc_additional
Password: nozowo2i

WAFC Washington is making test data available via:

Server: https://testbed.aviationweather.gov/wifs/data
User: WIFS username
Password: WIFS Password

Note: The above servers are a non-operational service provided for test and development purposes only, and will be removed by 30 November 2016 when the operational change has been fully implemented.

6.2.2.5 Appendix B to this report are the proposed WMO Abbreviated Header Line allocations.

6.2.3 **WAFS Backup Operations.** SN/9 proposed that WAFS backup tests be done under conditions as similar as possible to a real backup operations in order that users be prepared to face likely delays in delivery of the SIGWX, or other issues of the WAFS service. Following a discussion the meeting formulated the following decision:

Decision 3/1 — Revised issuance times for scheduled WAFS backup operations

That all WAFS significant weather (SIGWX) forecasts (in the BUFR code form and in the PNG chart form) for scheduled WAFS backup operations be issued by the WAFS Provider States:

- delay by 1-hour the normal issuance time during one of the WAFS backup operation (by each WAFS) per year;
- at 17 hours ahead of their validity time during all other backup tests

Note 1.— The change will be implemented with effect from the next scheduled backup events (January 2017).

Note 2.— The WAFSs will issue administrative messages as necessary, emphasizing the issuance time of each backup test.

Note 3.— The issuance time of unscheduled backup operations is not modified

6.3 Development of WAFS and Co-ordination with other METP Groups

6.3.1 **Review of MOG Terms of Reference in relation to WAFS**

6.3.1.1 SN/13 presented proposed Terms of Reference for the MOG, which are aimed at WAFS, SADIS/WIFS and IAVW. These Terms of Reference are shown in Appendix C to this report.

6.3.1.2 The meeting reviewed the draft changes proposed by the SADIS Work Stream and made additional edits. Following the discussion the meeting formulated the following decision and action:

Decision 3/2: Review of the Terms of Reference for MOG.

That, the revised Terms of Reference (Appendix C) be adopted by the Work Stream.

Action 3/5: Sharing of the MOG Terms of Reference with the METP.

That, the WG-MOG Rapporteur share the Terms of Reference (Appendix C) with the METP, as an information paper, at their next meeting.

6.3.2 Review of the WAFS Strategy Paper

6.3.2.1 Future WAFS plans will be discussed at the WG-MISD WAFS Work Stream meeting to immediately follow this meeting.

6.3.3 Work Required in Support of ASBU0 Job Cards #11, #2, #3

6.3.3.1 The meeting examined the job cards and focused their attention on Job Card #10, which pertains to the WAFS. Minor revisions were proposed to Job Card #10 to include the removal of reference to satellite distribution system and replace reference to WAFSOPSG with the WAFS

work streams of WG-MOG and WG-MISD. Following the discussion, the meeting formulated the following action:

Action 3/6: Updates to Job Card #10 for the WAFS.

W AFC London (Chris) provide a draft of minor edits (e.g., remove reference to satellite distribution system and WAFSOPSG) to Job Card #10 (WAFS) and deliver to WG-MOG Rapporteur in time for the Rapporteur to provide a working paper to the next METP meeting.

6.3.4 WAFS Matters Arising in Relation to Other METP Groups

6.3.4.1 WAFS and Meteorological Information Exchange – WG-MIE

6.3.4.1.1 The meeting was informed that, following the second meeting of the WG-MIE meeting (23-27 May 2016, Paris, France), a proposal will be submitted through channels to the Communications Panel that AHMS is not anticipated as a distribution mechanism for gridded data and therefore will not require testing in this regard.

6.3.4.2 WAFS and Meteorological Information and Service Development – WG-MISD

6.3.4.2.1 To be discussed at WG-MISD WAFS meeting that immediately follows this meeting.

6.3.4.3 WAFS and Meteorological Requirements and Integration – WG-MRI

6.3.4.3.1 The meeting was informed that work has begun on the new PANS-MET by an intern at ICAO Headquarters.

6.3.4.3.2 The meeting was also informed that the ATMRPP will propose a modification to their job card to allow contributions of MET.

6.3.4.4 Governance and Cost Recovery Group

6.3.4.4.1 The meeting was informed that a White Paper will soon be delivered that provides a vision for aviation MET by the year 2030, from the viewpoint of a looking backwards from 2030 to the present. The meeting was informed that this will be a living document.

6.3.4.4.2 The meeting was also informed that the group is looking to develop guidance material for cost recovery.

6.3.5 Long Term Planning of WAFS

6.3.5.1 **Developments of WAFS Gridded Global Forecasts of Cumulonimbus (CB) Clouds, Icing and Turbulence.** The W AFC Provider States presented SN/10 that discussed the progress made as well as the issues related to the increase in file size that will be seen as horizontal and vertical grid resolution increases.

6.3.5.1.1 The W AFCs have made significant progress towards providing icing and turbulence severity grids, which are due in 2018. As a proxy for an eventual WAFS product, W AFC Washington is currently making a global icing severity grid operationally available via its NOAA Operational Model Archive and Distribution System (NOMADS). The icing severity data is available at 0.25 degrees in the horizontal in one-hour time increments. The data is operationally supported and can be found at http://nomads.ncep.noaa.gov/cgi-bin/filter_gfs_0p25.pl.

6.3.5.1.2 It is notable that this increase in horizontal resolution to 0.25 degrees increases the file size up to 25 times the current 1.25 degree WAFS grid. This increase is before changing from three hour to one hour time steps, or adding additional flight levels. Fortunately, a system such as

NOMADS will allow users to select specific levels, times and even areas of the world, so that the entire global grid does not need to be downloaded.

6.3.5.1.3 The WAFCs are also working to deploy an advanced turbulence algorithm on the U.K.'s MOGREPS ensemble and the U.S.'s GEFS ensemble. This algorithm produces turbulence severity output in units of Eddy Dissipation Rate (EDR), and can differentiate between Clear Air Turbulence and Mountain Wave Turbulence. The use of the ensembles will enable probabilistic predictions.

6.3.5.1.4 The WAFCs have also developed an algorithm for probabilistic cumulonimbus cloud forecasts from a multi-center ensemble system. Initial experiments indicate improvements are made by including ensemble data from up to four global ensemble systems.

6.3.5.1.4.1 Following discussions, the meeting agreed to the following action:

Action 3/7: Addition of new agenda item to WG-MOG WAFS meeting - WAFS Future Plans.

That for subsequent WAFS-MOG meetings, a new agenda item, titled WAFS Future Plans, be added in order to, for example to inform the work stream of planned model improvements relating to the WAFS data suite.

6.3.6

6.3.6.1 WAFS Matters Relating to Amendment 78 of ICAO Annex 3

6.3.6.1.1 No amendments pertaining to WAFS were proposed.

6.3.6.2 WAFS Matters Relating to Amendment 79 of ICAO Annex 3

6.3.6.2.1 The meeting noted that perhaps SIGWX forecasts in XML format might be a candidate for Amendment 79, but no action was formulated.

6.3.6.3 Review of Job Cards Relating to WAFS

6.3.6.3.1 Job Card #10 was reviewed (see 6.3.3.1)

6.4 AoB Relating to WAFS

6.4.1 A PowerPoint presentation was given, from a user's perspective, on usage of select WAFS gridded forecasts and SIGWX forecasts in the tropical regions, with focus on CB clouds. After discussions the meeting agreed that the WAFCs investigate the possible inconsistency between WAFS gridded forecasts including SIGWX forecasts. The meeting agreed on the following action:

Action 3/8: Provide a report to the next WG-MOG WAFS meeting - WAFS Forecasts consistency.

That for next WAFS-MOG meetings, the WAFCs be invited to provide a report, titled WAFS Forecasts Consistency, in order to examine any inconsistencies between WAFS London and Washington WAFS forecasts, including the SIGWX forecasts and the gridded data for the hazardous fields.

6.4.2 The meeting noted SN/11 regarding the participation by the WAFCs (not related to the METP-MOG Work Plan) in virtual meetings with the WMO Expert Team on Aircraft-Based Observing Systems and in a Workshop on Future Requirements for Meteorological Aircraft

Observations, held at the WMO Headquarters in Geneva, Switzerland, 28-29 October 2015. SN/11 summarized the activities and issues being addressed by the ET-ABO. The meeting thanked the WAFCs for their participation with the WMO ET-ABO and agreed that it is a valuable relationship and provides an opportunity to share and learn from each other.

Action 3/9: Requirements for aircraft-based observation (ABO) data.

In regards to WAFS data needs, that the WG-MOG Rapporteur (Colin) identify an appropriate group to establish requirements for ABO via ADS-B, and report, via a working paper, to the next METP meeting.

-Note: The needs for aircraft data goes beyond the WAFS and will apply to TBO.

6.4.3 The meeting was informed of the recent ICAO Surveillance Panel's Third Meeting of the Aeronautical Surveillance Working Group (SP-ASWG/3), particularly Working Paper 11 titled *Status Update on Development of Meteorological Data Requirements*, prepared by Alex Rodriguez and presented by Tom Pagano, from USA's FAA. This working paper provides a status update on the development of meteorological data requirements being developed by RTCA SC-206. A copy of the working paper was also provided.

Action 3/10: Follow-up with authors of SP-ASWG/3 WP/11

That Pat make contact with the authors of SP-ASWG/3 WP/11 to inform them of the work being done by the MOG WAFS.

Agenda Item 7: Timetable and Future Meetings of WG-MOG WAFS

7.1 Since many participants of the MOG WAFS Work Stream are also participants of the MISD WAFS Work Stream the meeting agreed that it would continue to convene the next meeting of the MOG SADIS and WAFS Work Streams during the same week with a meeting of the MISD WAFS Work Stream, but reduce the length from 5-days to 4-days for the series of meetings. Tentative plans are to hold the next meeting of the MOG WAFS Work Stream during a 2-day period around late April 2017, to be preceded by MOG SADIS Work Stream (2 days) then followed by MISD WAFS Work Stream (1 day), at a location to be determined but likely in the United Kingdom.

Agenda Item 8: AoB Relating to WG-MOG

8.1 Regional SIGMET Guide Template. The meeting was informed that the template is currently outdated. WAFc London (Chris) with assistance from the Bureau of Meteorology (Sue) have made edits to the template. The meeting was informed that there currently is no formal ICAO MET body responsible for making changes to the guide and template. Raul informed the meeting that after endorsement by the METP ICAO Headquarters will send out the updated Regional SIGMET Guide Template to the regions for implementation.

8.2 WG-MOG web site. Content and information on the secure and non-secure METP WG-MOG web sites were briefly discussed by the meeting. The WG-MOG Rapporteur (Colin) agreed to provide "red-line" text changes to the web sites to ICAO Headquarters (Raul and Neil).

Action 3/11: Updates to WG-MOG web pages

That the WG-MOG Rapporteur provide necessary edits regarding the WG-MOG web pages to ICAO Headquarters (Raul and Neil).

8.3 No other business was raised by the meeting. Mr. Colin Hord thanked everyone for their attendance and contributions to a very productive meeting. Mr. Hord adjourned the meeting at 1000 hours on 16 June 2016.

APPENDIX A

Listing of meeting attendees:

Canada	Mario Ouellet	Mario.Ouellet@ec.gc.ca
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APPENDIX B

WMO Abbreviated Header Line Allocation for additional flight level data to be provided as part of WAFS gridded forecast data in GRIB2 code form

The T₁T₂A₁A₂ii allocation for additional flight level data to be provided as part of WAFS gridded forecast data in GRIB2 code form.

The CCCC allocation will be EGRR for WAFC London, KWBC for WAFC Washington.

	Geopotential Altitude			Temperature			U Component of Wind			V Component of Wind			Humidity
Unit	gpm	gpm	gpm	Kelvin	Kelvin	Kelvin	m/s	m/s	m/s	m/s	m/s	m/s	%
Pressure Level	750hPa	450hPa	125 hPa	750hPa	450hPa	125 hPa	750hPa	450hPa	125 hPa	750hPa	450hPa	125 hPa	750hPa
Nominal Flight Level	FL080	FL210	FL480	FL080	FL210	FL480	FL080	FL210	FL480	FL080	FL210	FL480	FL080
T+06 (C)	YHXC75	YHXC45	YHXC13	YTXC75	YTXC45	YTXC13	YUXC75	YUXC45	YUXC13	YVXC75	YVXC45	YVXC13	YRXC75
T+09 (D)	YHXD75	YHXD45	YHXD13	YTXD75	YTXD45	YTXD13	YUXD75	YUXD45	YUXD13	YVXD75	YVXD45	YVXD13	YRXD75
T+12 (E)	YHXE75	YHXE45	YHXE13	YTXE75	YTXE45	YTXE13	YUXE75	YUXE45	YUXE13	YVXE75	YVXE45	YVXE13	YRXE75
T+15 (F)	YHXF75	YHXF45	YHXF13	YTXF75	YTXF45	YTXF13	YUXF75	YUXF45	YUXF13	YVXF75	YVXF45	YVXF13	YRXF75
T+18 (G)	YHXG75	YHXG45	YHXG13	YTXG75	YTXG45	YTXG13	YUXG75	YUXG45	YUXG13	YVXG75	YVXG45	YVXG13	YRXG75
T+21 (H)	YHXH75	YHXH45	YHXH13	YTXH75	YTXH45	YTXH13	YUXH75	YUXH45	YUXH13	YVXH75	YVXH45	YVXH13	YRXH75
T+24 (I)	YHXI75	YHXI45	YHXI13	YTXI75	YTXI45	YTXI13	YUXI75	YUXI45	YUXI13	YVXI75	YVXI45	YVXI13	YRXI75
T+27 (J)	YHXJ75	YHXJ45	YHXJ13	YTXJ75	YTXJ45	YTXJ13	YUXJ75	YUXJ45	YUXJ13	YVXJ75	YVXJ45	YVXJ13	YRXJ75
T+30 (K)	YHXK75	YHXK45	YHXK13	YTXK75	YTXK45	YTXK13	YUXK75	YUXK45	YUXK13	YVXK75	YVXK45	YVXK13	YRXK75
T+33 (L)	YHXL75	YHXL45	YHXL13	YTXL75	YTXL45	YTXL13	YUXL75	YUXL45	YUXL13	YVXL75	YVXL45	YVXL13	YRXL75
T+36 (M)	YHXM75	YHXM45	YHXM13	YTXM75	YTXM45	YTXM13	YUXM75	YUXM45	YUXM13	YVXM75	YVXM45	YVXM13	YRXM75

The requirement will generate 143 additional bulletins per run. Following implementation there will be 858 (currently 715) WAFS GRIB2 bulletins for wind, temp, humidity, gph, and tropopause data. The number of CB, icing and turbulence bulletins, currently 407, will remain unchanged. As a consequence, the TOTAL number of bulletins issued per run by each WAFC will increase from 1122 to 1265.

APPENDIX C

METP MOG **Terms of Reference**

The aim of the MET Operations Group is to ensure that the following systems meet the agreed user requirements:

- WAFS
- SADIS / WIFS
- IAVW

In the longer term it is considered that Space Weather and Regional Hazardous Weather Centres will be added to the remit of the working group.

The MET Operations group should:

- a) Establish Key Performance Indicators for the provision of services based on the performance requirements in coordination with other METP WGs and final agreement by the METP
- b) Define the continuity / availability of services based on the performance requirements, in coordination with the other METP WGs and final agreement by the METP.
- c) Arrange for the reporting of KPIs from each provider State (e.g. verification and timeliness metrics)
- d) Receive reports from each provider State on the management of their system(s)
- e) Set out, review and maintain the back-up arrangements and include relevant details in management reports
- f) Ensure that coordination and harmonisation takes place between WAFCs, VAACs and SADIS / WIFS providers
- g) Monitor, assess and provide advice on potential scientific and technological developments to meet the current, future and evolving performance requirements to the METP in coordination with WMO.
- h) Assess the financial and technical implications of proposed developments to services and their implementation.
- i) Ensure that developments have measurable success criteria for implementation
- j) Establish the times scales, pre-operational tests and implementation of services
- k) Maintain and, when required, create guidance material on the implementation and provision of services.
- l) Identify any weaknesses in the current service provision and coordinate updates to the requirements with other Working Groups of the METP
- m) Ensure that the necessary remedial actions are in place when necessary to overcome identified deficiencies.
- n) Where necessary assist the Secretariat in the coordination of the arrangements between the various international organizations
- o) Maintain an up to date task list
- p) Following each meeting provide a report and make it available on the METP website