

Requirements of the Global Atmosphere Watch – GAW

Related CGMS Action/Recommendation: WG III A38.40
HLPP reference: 1.1

WMO in collaboration with the atmospheric composition community and satellite experts has initiated an update of the WMO observation requirements for atmospheric composition parameters, in support of the WMO Rolling Review of Requirements (RRR) process. The last update in the RRR framework in 2004 was based on the IGACO report, and identified only one “Atmospheric Chemistry” application area. Formulating internationally-agreed, technology-free observation requirements that related to chemistry and composition of the atmosphere is important information for CGMS agency mission planning, to inform the Vision for WIGOS surface/space components in 2040, and for a subsequent update of the CGMS baseline.

A WMO Global Atmosphere Watch (GAW) Task Team on Observational Requirements and Satellite Measurements as regards Atmospheric Composition and Related Physical Parameters was established and held its first meeting on 10-13 November 2014.

Three main application areas for observations of atmospheric composition were identified:

- Forecasting atmospheric composition
- Monitoring atmospheric composition, and
- Providing atmospheric composition information to support services in urban and populated areas

For each of the three applications, detailed and quantitative observation requirements for the necessary parameters will be established by autumn 2015, and entered into the WMO RRR database (which is part of OSCAR) by the end of 2015. The Task Team collaborates with the GAW Scientific Advisory Groups and other experts from CGMS, CEOS and WMO CBS on this task. A set of priority variables that cut across several application areas of atmospheric composition observations will also be identified. This process will inform the Vision for WIGOS component systems in 2040, and subsequent updates of the CGMS baseline.

The document contains the report of the Task Team report in November 2014, and related URLs.

Action/Recommendation proposed:

- WMO to provide a report on the observation requirements formulated for the three atmospheric composition-related WMO application areas to CGMS-44 (May 2016).

Requirements of the Global Atmosphere Watch – GAW



WMO GAW Task Team on Observational Requirements and Satellite Measurements
(TT-ObsReq) as regards Atmospheric Composition and Related Physical Parameters

Summary of Activities and Follow-up Plans from the First Meeting

Held: 10-13 NOV 2014; Geneva

Draft 1.0 DEC 4, 2014

The agenda and the list of attendees are given in Appendix A and B, respectively

1. Opening of the meeting

The meeting of the GAW Task Team on Observational Requirements and Satellite Needs was opened at the WMO Secretariat at 14:00 on 10 November by the Task Team Chair, Prof. Gregory Carmichael, who welcomed the participants to the meeting.

The list of participants to the session can be found in Annex B. A *Tour de Table* was carried out so that all the participants became acquainted. Apologies had been received from Ronald van der A who was not able to attend. Sander Houweling took part in the meeting via teleconferencing.

2. Adoption of the agenda

The agenda is given in Annex A. The agenda was adopted without changes.

3. Introduction and scene-setting

Greg Carmichael gave an introduction, explaining the background for the establishment of the Task Team and the expected outcome of the work to be carried out by the Task Team. The Powerpoint presentation can be found on the Task Team web page:

<http://www.wmo.int/pages/prog/arep/gaw/TaskTeamObsReq.html>

This presentation was followed by a presentation on the Rolling Review of Requirements and the OSCAR database, given by Lars Peter Riishøjgaard. Then followed a presentation by Paolo Ruti, who

discussed developments within WWRP and potential communities that can set up user requirements for observations.

4. Background

WMO continues to develop an over-arching *framework* for the *coordination and evolution* of WMO observing systems, and the contributions of WMO to co-sponsored observing systems, with the goal to enable more efficient and effective service delivery. The Global Atmosphere Watch (GAW) is a key component of this framework. The TT-ObsReq has several objectives: 1) to provide a contribution to GAW advisory groups on potential application areas; 2) make a first assessment of user requirements in these application areas; and 3) to help GAW develop a strategy for the integration of satellite observations of atmospheric composition and related physical parameters into the GAW program.

Towards this end the meeting focused on the following major activities:

1. Provide input into the identification of key application areas. A critical component in designing an observing system is the intended application. Currently in the WMO documents the application area that most closely links to GAW is “atmospheric chemistry.” Atmospheric chemistry is clearly too broad a topic for use in defining an observing system. The group discussed/identified key application areas (a few) that require atmospheric composition observations. These application areas should be sufficiently specific that observing requirements can be established (e.g., air quality forecasting of PM2.5 and ozone). Application areas usually describe the routine activities or services.
2. Discuss the role of atmospheric composition observations in support of the other WMO application areas. The complete list of WMO application areas (<http://www.wmo.int/pages/prog/www/OSY/GOS-RRR.html>) includes: Global numerical weather prediction (GNWP); High-resolution numerical weather prediction (HRNWP); Nowcasting and very short range forecasting (NVSRF); Seasonal and inter-annual forecasting (SIAF); Aeronautical meteorology; Atmospheric chemistry; Ocean applications; Agricultural meteorology; Hydrology; Climate monitoring (as undertaken through the Global Climate Observing System, GCOS); Climate applications; and Space weather. In addition, the observational requirements for WMO polar activities and the Global Framework for Climate Services (GFCS) are also to be considered under WIGOS.
3. Review the current and planned satellite missions and discuss their contribution to the application areas where atmospheric composition data are used.

Further background information can be found at:

<http://www.wmo.int/pages/prog/arep/gaw/TaskTeamObsReq.html>

5. Main Actions

A. The Task Team discussed what application areas should be used instead of the placeholder “Atmospheric Chemistry” application area currently identified used in WMO, taking into consideration the WMO strategic plan, CAS priorities, and the upcoming GAW implementation plan

(IP) for the period 2016-2023. Three recommended applications areas were identified that encompasses major elements of GAW research that is data driven and in-line with the theme “GAW – research enabling services”:

- **Forecasting Atmospheric Composition (F)** – Covers applications from global to regional scales (with horizontal resolutions similar to global NWP (~ 10 km and coarser) with stringent timeliness requirements (NRT) to support operations such as sand and dust storm and chemical weather forecasts.
- **Monitoring Atmospheric Composition (M)** - Covers applications related to evaluating and analysing changes (temporally and spatially) in atmospheric composition regionally and globally to support treaty monitoring, climatologies and re-analyses, assessing trends in composition and emissions/fluxes, and to better understand processes, using data of controlled quality (and with less stringent time requirements (not needed in NRT)), and used in products such as Ozone and Greenhouse Gas Bulletins, and State/Health of the Atmosphere reports.
- **Providing Atmospheric Composition information to support services in urban and populated areas (U)** - Covers applications that target limited areas (with horizontal resolution of a few km or smaller and stringent timeliness requirements to support services related to weather/climate/pollution, such as air quality forecasting. (The GURME SAG will review all related entries).

B. The committee identified key parameters needed for these applications.

Forecasting Atmospheric Composition (F)

1. All Global NWP variables (e.g., PBL + Tropopause height) and others we want to add and that will be determined through a dialogue between the Task Team and the SAGs.
2. Aerosols (aerosol mass, size distribution (or at least mass at 3 fraction sizes: 1, 2.5 and 10 micron), speciation and chemical composition, AOD at multiple wavelengths, AAOD, water content, ratio of mass to AOD, vertical distribution of extinction).
3. Total ozone, profile ozone, surface ozone, NO, NO₂ (surface, column, profile), PAN, HNO₃, NH₃, CO, VOC (isoprene, terpenes, alcohols, aldehydes, ketones, alkanes, alkenes, alkynes, aromatics), SO₂ (surface and column), CH₄, CO₂, N₂O, HCHO, HO_x, Cl_x, ClO, BrO, OCIO, ClONO₂, HDO, CFCs, HCFCs, HFCs, Rn, SF₆
4. Others: actinic flux, fire radiative power, land proxies, lightning, dry and wet deposition, pollen (key species), OCS

Monitoring Atmospheric Composition (M)

1. All Global NWP variables (e.g. PBL + tropopause height) and others we want to add: SST, deep ocean temperature, solar variability, albedo, land use, soil moisture, precipitation, sea ice cover, snow cover, PSC occurrence

2. Aerosols (aerosol mass, number, size/surface distribution (1, 2.5, 10 micron), speciation and chemical composition, AOD at multiple wavelengths, AAOD, water content, ratio of mass to AOD, vertical distribution of extinction), stratospheric aerosol backscatter coefficient, PSC composition, concentration of metals, chemical composition of PM (sulphate, nitrate, ammonium, BC, OC, OM, dust, sea salt, BS, SOA) aerosol index, refractive index, precipitation chemistry composition, Hg, POPs, primary biological particles
3. Total ozone, profile ozone, surface ozone, NO, NO₂ (surface, column, profile), PAN, HNO₃, NH₃, CO, VOC (isoprene, terpenes, alcohols, aldehydes, ketones, alkanes, alkenes, alkynes, aromatics), SO₂ (surface, column), CH₄, CO₂, N₂O, N₂O₅, NO₃, HCHO, HO_x, Cl_y, ClO, BrO, OCIO, ClONO₂, HDO, CFCs, HCFCs, HFCs, Halons, CH₃Br, CH₃Cl, BrONO₂, Rn, SF₆, glyoxal, methyl chloroform, H₂O, H₂O₂, H₂, O₂/N₂ ratio, DMS, MSA, OCS
4. Isotopes of CO₂, methane, N₂O, CO, (D, ¹³C, ¹⁴C, ¹⁷O, ¹⁸O, ¹⁵N) also in the aerosol phase
5. Actinic flux, fire radiative power, land proxies, lightning, dry and wet deposition, pollen (key species), ocean colour, chlorophyl-A, LAI, PAR, FPAR, fluorescence, vegetation maps, land use maps, burned areas, night light, fire counts, wet lands, ship routes, forest inventory, biomass density, crop lands

Providing Atmospheric Composition information to support services in urban and populated areas (U)

GURME in cooperation with DPFS Division of WMO will be asked to further develop list of variables and respective requirements.

C. The Task Team developed a strategy to begin the RRR process and to populate the OSCAR data base for the above applications. The process will engage the SAGs and the SSC. The committee started the process of identifying the atmospheric composition and related parameters needed to support the applications and began to fill out an Excel table with user requirements that will be used to populate the OSCAR data base after evaluation by the SAGs. The SAGs will be asked to discuss the application areas, including the sorts of specific applications that are important within the overarching application, and the parameters needed for the applications (making suggestions for adding and/or removing parameters) and continue filling out the tables of user requirements for the parameters that fall in their domain.

The outline of the process is:

1. An email with the Excel file and the meeting report should be sent out to the TT by 5 December.
2. An initial review of application areas will be done with a conference call with the SAGs/SSC before 19 December, with corrections and comments submitted to the chair before 15 January 2015);
3. The final meeting report and the Excel file will be sent to the SSC and the SAG Chairs before 22 January as background for the enlarged SSC meeting in February 2015.
4. Include the discussion on the Application Areas, the Observational Requirements and the RRR process as an agenda item for the enlarged SSC meeting in February);
5. Discuss the Applications Areas, the Observational Requirements and the RRR process at the enlarged SSC meeting (18-20 February)
6. Send the results of the discussion in 4) to the SAGs by the end of February and ask for feedback from the SAGs by 13 March.
7. Assemble the feedback from the SAG and send to the Task Team by 20 March.
8. Teleconference with the Task Team before Easter to review the progress so far.
9. Write a progress report before the end of April to be presented at Congress in May
10. RRR continues.

D. The committee reviewed the other WMO applications that have identified requirements for atmospheric composition variables. While GAW does not have overall responsibility of these applications, it has important contributions to make (for example in those related to climate, aeronautics and agriculture). Important aspects to ensure are addressed in these application areas include (but not limited to) SLCPs, aerosol-weather interactions and their impact on NWP, ecosystem services, biomass burning, UV/vis radiation to support renewable energy/agricultural meteorology applications. The TT-ObsReq, working with the secretariat, will develop a plan for collaborating with the application groups to provide input from GAW into the RRR and OSCAR data bases for these areas. As an example of the possible modes of carrying this out, there is a meeting being planned with agriculture meteorology (in the spring) where the atmospheric composition requirements will be discussed in detail.

E. Other:

The team reviewed the upcoming satellite missions with respect to their capability to help deliver the observations needed to support the application areas. The TT-ObsReq will continue to review the status and develop a statement that summarizes the status and articulates the need for future observing system to fill gaps.

The team recognized that the list of observations to support the applications is long. The RRR process needs to continue to identify/review the basic requirements. More expansive list can be included in supporting documents.

The team recognized the need to write/update the Statement of Guidance for the Atmospheric Chemistry- focused applications. Plans for this activity will be developed.

6. Next Steps

Secretariat should establish a connection with the owners of user requirements in the other application areas and bring them in contact with this Task Team and SAGs concerning atmospheric composition variables. Prior to joint SSC and SAG and ET Chair meeting in February 2015, TT-ObsREQ and SAGs should agree on 1) overarching application areas; and 2) variables required to support these applications. Overarching application areas should constitute an essential part of the GAW IP. First proposed user requirements tables due to be delivered to SAGs before June 2015. During June-September SAGs consider the proposed table and through joint telecons with TT-SAT finalize the requirements. End of September 2015 user requirements are placed in OSCAR database. During October-December the gaps in the current and planned observing system are analyzed and Statement of Guidance is developed for each applications. SSC becomes an owner of applications and assigns a focal point for each application as soon as the list is finalized. Focal point will be responsible for update of user requirements and SoGs through established link with SAGs on a regular basis.

GURME and others begin identification of observations needed for urban applications. This group should finalize user requirements and SoGs by the end of 2015.

SAGs will work with other application areas that need atmospheric composition data depending of variables to develop a plan to discuss atmospheric chemistry requirements. Key contacts and actions need to be identified through Secretariat.

7. Closure of the meeting

The meeting closed at 12:10 on Thursday 13 November.

Appendix A

AGENDA:

First meeting of the WMO Global Atmosphere Watch (GAW) Task Team on Observational Requirements and Satellite Measurements as regards Atmospheric Composition and Related Physical Parameters

*WMO Headquarters, Geneva
10-13 November 2014
Meeting room 8J (10-11 Nov.)
Meeting room 6L (12-13 Nov.)*

➔ **Monday 10 November**

1. 14:00 – 14:15 Welcome, logistics and *tour de table*

Welcome by TT Chair and the Secretariat

2. 14:15 – 15:00 Introduction and scene-setting

TT Chair

Background: Congress Recommendation from 2011

What do we expect as outcome from the Task Team's work?

IGACO Report of 2004 and the Statement of Guidance for Atmospheric Chemistry are now 10 years old

GAW Strategic Plan 2008-15 and GAW Implementation Plan 2016-2023

Relevant GCOS Reports.

Other strategy reports, such as those from EU and ESA, for example.

Work plan and the way forward (first meeting, telecons etc)

3. 15:00 – 15:30 Overview of RRR and the OSCAR database

Lars Peter Riishøigaard or Stephan Bojinski

4. 15:30 – 16:00 Examples from user communities

Paolo Ruti (WWRP) and Michel Rixen (WCRP)

5. 16:00 – 16:30 Coffee Break

6. 16:30 – 18:00 Discussion and definition of key Application Areas

All

7. 18:00 Adjourn

→ Tuesday 11 November

8. 09:00 – 10:00 Discussion on important variables

All

What are the important variables to measure?

Are there parameters missing in the GAW Programme?

9. 10:00 – 10:30 An overview of the GAW Observing System

Greg Carmichael

10. 10:30 – 11:00 Coffee break

11. 11:00 – 12:00 Mapping of GAW variables in the OSCAR data base

All

Variables measured by GAW appear not only under the “Atmospheric Chemistry” Application Area but also under other “Areas” such as Agricultural Meteorology and SPARC. We need to check the correctness and completeness of the requirements related to “Atmospheric Chemistry” and GAW.

12. 12:00 – 13:00 Lunch

13. 13:00 – 15:00 Mapping of GAW variables in the OSCAR data base cont.

All

14. 15:00 – 15:30 Coffee break

15. 15:30 – 18:00 Mapping of GAW variables in the OSCAR data base cont.

All

16. 18:00 Adjourn

➔ Wednesday 12 November

17. 09:00 – 12:00 Mapping of GAW variables in the OSCAR data base cont.

All

18. 12:00 – 13:30 Lunch

19. 13:30 – 14:30 Discussion on the role of atmospheric composition observations in support of other WIGOS application areas

All

20. 14:30 – 15:15 Overview of existing and planned satellite missions of relevance to atmospheric composition in all application areas

Rosemary Munro (EUMETSAT) and Ben Veihelmann (ESA)

21. 15:15 – 15:30 Overview of aircraft programmes

Oksana Tarasova

22. 15:30 – 16:00 Coffee Break

23. 16:00 – 17:30 Discussion on observational requirements, aircraft
and satellites

All

24. 17:30 Adjourn

25. 19:00 Group dinner

→ Thursday 13 November

26. 09:00 – 12:00 More on the RRR process

Discussion to be led by the TT Chair

How can the work of this group constitute the beginning
of a continually ongoing RRR process? Coffee at 10:30.

27. 12:00 – 12:30 The way forward

Next meeting (telecon). How can output from the TT
serve as input for other strategy documents?

28. 12:30 Close

Meeting of the GAW Task Team on Observational Requirements and Satellite Needs

10-13 November 2014, Geneva, Switzerland

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