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GAW Report

1. Highlights for JSC

- Research enabling service

  The Global Atmosphere Watch (GAW) Programme provides international leadership in research and capacity development in atmospheric composition observations and analysis through maintaining and applying long-term systematic observations of the chemical composition and related physical characteristics of the atmosphere, emphasizing quality assurance and quality control, and delivering integrated products and services related to atmospheric composition of relevance to users.

  The GAW Implementation Plan (IP) for the period 2016-2023 builds upon the growing importance of atmospheric composition observations and predictions, and focuses on research that enables a wide variety of Products and Services related to atmospheric composition.

  A critical strategy for the continued advancement of the GAW Programme is the broader use of GAW observations and research activities to underpin and support the development of services with high societal impact that rely on information on atmospheric composition and related parameters. Implementation of this strategy requires advances in both observing system and in modelling tools. The range of applications supported by the GAW products spans from the support of climate mitigation to ecosystem services and health impacts. Development of the tools to deliver required products relies on the enhanced collaboration with the communities that are outside of traditional GAW (atmospheric composition) community.

- An Enhanced Modelling Framework

  A new modelling framework was developed in GAW to promote and facilitate integration of GAW observational datasets throughout physical and chemical processes and to support specific applications. The Symposium on Coupled Chemistry-Meteorology/Climate Modelling in February 2015 organized by GAW, WWRP and WCRP was conducted to identify research needs to advance modelling of air pollution, weather and climate. Joint activities have been initiated by these groups and WGNE to further advance the earth system modelling approach needed to address these needs, to further develop capabilities to assess short-lived climate pollutants (SLCP), and to contribute to the Data-processing and Forecasting System (DPFS) and Global Framework for Climate Services (GFCS).

  Modelling and analysis efforts have been further promoted by the recently established Scientific Advisory Group on Applications. Several applications areas are being developed, including services to agriculture (International Workshop on Atmospheric Chemistry and Agricultural Meteorology, Pune, India, 2-4 November 2015), services to health sector (Forecasting Emissions from Vegetation Fires and their Impacts on Human Health and Security in South East Asia, Jakarta, Indonesia, 29 August – 1

September 2016) and ecosystem services (WMO GAW International workshop on Nitrogen Cycle, University of York, York United Kingdom, 13-14 April 2016 and a new project initiated at Workshop on Measurement-Model Fusion for Total Atmospheric Deposition, 28 Feb to 2 March 2017). Further collaborations with WCRP would be useful to improve long-term air quality forecasting in relation to biomass burning.

- Understanding long-term atmospheric composition and climate change

  GAW coordinates global observations and analysis of the greenhouse gases, stratospheric ozone, reactive gases and aerosols. GHG are the main drivers of climate change and GAW initiated a discussion with WCRP to collaborate on the better understanding of the relevant carbon climate feedbacks. Long-term datasets of aerosols and reactive gases allow determination of the trends in the radiative forcing. This collaboration can further benefit from the Integrated Global Greenhouse Gas Information System as articulated below. GAW coordinated observations and analysis of stratospheric ozone played an important role in the understanding of the ozone depletion and its effects on environment. Joint efforts with SPARC allowed to improve the quality of the available datasets (through the re-evaluation of the ozone cross sections) and analyse the long-term trend in the total ozone content. It is hope that this collaboration on stratospheric ozone continues in the future through the joint activities.

2. Issues and challenges

- GAW supports Global Framework for Climate Services in the delivery of relevant, timely and high-quality products related to greenhouse gas observations and bulletins.

  For mitigation, the Integrated Global Greenhouse Gas Information System (IG^{3}IS) is an essential component, being developed under GAW with significant support from stakeholders. This system will combine atmospheric observations and inverse modelling with socio-economic information to improve understanding of the GHG emissions and sinks and their spatial distribution. The IG^{3}IG implementation plan will be ready by EC-70 and a governance structure is in place including plans for an IG^{3}IG office. The IG^{3}IS analysis system must have in addition access to the best available (and improving over time) information about atmospheric transport, the horizontal and vertical movement of air masses. To achieve a group on inverse modelling cross-cutting activity is embodied in the IG3IS Science Team. Implementation of IG3IS will benefit from the better understanding of the global carbon cycle and carbon feedback in the climate system, which will help linking emission actions with the final climate impacts articulated in the Paris agreement.

- Short-lived Climate Pollutants

  Aerosols play diverse roles in the environment and activities in aerosol research are moving in directions required for specific applications. The activities highlighted below are related to: 1) aerosols and air quality/health and 2) Aerosols and climate and weather. Aerosols and more generally the short-lived climate pollutants are important foci of the GAW strategic plan. The need is to enhance our observing capabilities for aerosols and reactive gases and to improve our understanding of their sources, formations, removal and radiative forcing. Initiatives underway include sand and dust storm forecasting, biomass burning source estimation, and better constraining total deposition of key species. There are clear common interests in SLCPs in WCRP and GAW and these present an opportunity for enhanced collaborations with WCRP and others moving forward. A key element will be to identify some joint activities that are co-designed and executed.

- Enhancing the observing system

  There remain important gaps in observing systems and their capabilities to support the basic research and services related to climate science, weather and atmospheric composition. WCRP and related programs (e.g., GCOS) are major users of atmospheric composition data and have important roles to play in articulating observational requirements. GAW activities include both organizing atmospheric composition monitoring and using the data in various applications and services. Closer collaboration and co-design of strategies are needed to more effectively articulate and advocate for enhancements in the observing systems for atmospheric composition.

- Enhancing Cooperation

  An initial meeting was organized in March by the WMO Commission for Atmospheric Sciences gathering together Oystein Hov (President of the WMO Commission), Sarah Jones (Chair of WWRP steering committee), Greg Carmichael (Chair of GAW steering committee), Amanda Lynch (WCRP vice-chair) and Guy Brasseur (online from US). An initial discussion touched on GAW/WWRP Implementation Plans and WCRP strategy. In order to progress in this road-map, the following topics could guide further interactions:

  a. Research to define the future observing system considering needs for weather, climate, and the environment
  b. Development of common references on skill standards for chemical composition models and products for evaluation purposes and common verification methods
  c. Development of the methods for integration of model results and observations across thematic areas and integration of observations with model development, including model evaluation and source attribution.
  d. Translation of process understanding needs to be translated into predictive skill (e.g. better representation of aerosols)
  e. Enhance capabilities for assimilation of atmospheric composition (also including WGNE)
  f. Improve estimates/understanding of climate feedback/impacts and their dependencies on future atmospheric composition changes and on atmospheric composition/climate interactions
  g. Joint activities to support integrated urban services
  h. Joint activities on capacity development including support of the Early Career Scientists – YESS