



GESAMP

Joint Group of Experts on the
Scientific Aspects of Marine
Environmental Protection

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REPORT OF THE ADMINISTRATIVE SECRETARY OF GESAMP

Activities and achievements of the Sponsoring Organizations of GESAMP

This document provides a summary of WMO's achievements since GESAMP 41 (1 to 4 September 2014).

World Meteorological Organization (WMO)

2 The activities of WMO dealing with ocean issues are of a multidisciplinary nature and are largely carried out through scientific and technical programmes in cooperation with other specialized agencies of the United Nations.

WMO/IOC/ICSU World Climate Research Programme (WCRP)

3 Research on physical oceanography and ocean ecosystems and biogeochemistry, which is of prime priority for GESAMP, are continuously becoming more integrated and interlinked within the World Climate Research Programme (WCRP), particularly through its CLIVAR (Climate and Ocean – variability, Predictability and Change) core project.

4 By consolidating global and regional efforts to understand the dynamics, the interaction and the predictability of the coupled ocean-atmosphere system, significant improvement has been made in understanding climate variability and change, as well as the associated benefit to society and the environment in which we live. For example through predictive experiments on the future state of climate system and how it will evolve under different emission scenarios. As the follow-up to the discussion made at the Open Science Conference (OSC) entitled “Climate Research in Service to Society” (<http://conference2011.wcrp-climate.org>), Denver, Colorado, USA, October 2011, the WCRP has been implementing Grand Science Challenges on the following subjects (<http://www.wcrp-climate.org/index.php/grand-challenges>):

- .1 Cloud, Circulation and Climate Sensitivity;
- .2 Melting Ice and Global Consequences;
- .3 Understanding and Predicting Weather and Climate Extremes;
- .4 Regional Sea-level Change and Coastal Impacts; and
- .5 Changes in water availability.

5 These research topics are seen by WCRP as scientific challenges of particularly high societal importance and as areas of research in which it is possible to expect significant progress within five to ten years. The Grand Challenges serve as unifying themes across the four WCRP core projects, i.e. CLIVAR, CliC, GEWEX and SPARC, and the various working groups that develop implementation plans for the Grand Challenges. They are designed to be continuously evolving, with new Grand Challenges being discussed as others conclude.

6 **CLIVAR** (<http://www.clivar.org/>) is the main WCRP core project dealing with ocean-related climate research matters and aims at understanding the dynamics, the interaction, and the predictability of the coupled ocean-atmosphere system, in particular:

- Intraseasonal, seasonal and interannual variability and predictability of monsoon systems
- Decadal variability and predictability of ocean and climate variability
- Marine biophysical interactions and dynamics of upwelling systems
- Sea Level Rise and Regional Impacts
- Trends, nonlinearities and extreme events
- ENSO in a changing climate
- Consistency between planetary heat balance and ocean heat storage

7 Three of the Research Foci have been endorsed for implementation in 2015 by the CLIVAR Scientific Steering Group (SSG), namely Decadal Climate Variability and Predictability, Consistency Between Planetary Energy Balance and Ocean Heat Storage and ENSO in a Changing Climate. The Research Foci on Monsoons and on Marine Biophysical Interactions and Dynamics of Upwelling Systems (in collaboration with the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project) will further develop their plans, to be reviewed by the SSG by the end of 2015 with a view towards implementation in 2016. The CLIVAR Research Focus

areas on Sea Level Rise and Extremes are being implemented as WCRP Grand Challenges previously mentioned.

8 CLIVAR will be holding a major Open Science Conference on September 16-23, 2016 in Qingdao, China entitled "Charting the course for future climate and ocean research" as well as an associated Early Career Scientists Symposium on the 15-18, September (<http://www.clivar2016.org>).

WMO Marine Meteorology and Oceanography Programme (MMOP)

9 MMOP plays a vital role in supporting human activities on and adjacent to the world's oceans and in contributing to the sustainable use of ocean resources. MMOP coordinates, regulates, and facilitates the sustained provision of global and regional coverage observational data, products and services to address the continued and expanding requirements of the maritime user community for met-ocean services and information, focusing on safety of life and property at sea, integrated coastal management and societal impacts. The overall technical guidance and governance for MMOP is provided by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), jointly sponsored by WMO and IOC of UNESCO (<http://www.jcomm.info/>).

WMO World Weather Research Programme (WWRP)

Sub-seasonal to Seasonal Prediction Project

10 Ocean-sea-ice-atmosphere interaction is one of the key challenges of weather and climate prediction from days to seasons. The WMO World Weather and World Climate Research Programme's Sub-seasonal to Seasonal Prediction Project aims to provide predictions from two weeks to two months ahead. The sub-seasonal to seasonal timescale is a very important one as many management decisions in agriculture and food security, water disaster risk reduction and health fall into this range. Improved weather-to-climate forecasts tailored to key social needs promise to be of significant socio-economic value. The representation of atmospheric phenomena – such as the Madden Julian Oscillation (MJO) and improved coupling with, and initialization of, the land-ocean-cryosphere and stratosphere – has been proved to extend predictability beyond 20 days. A sub-seasonal to seasonal database gathering most of the global prediction systems has been organized under this WMO initiative and is has been hosted by the European Center for Medium-Range Weather Forecast and the China Meteorological Administration since May 2015.

WMO Global Atmosphere Watch Programme (GAW)

11 The Global Atmosphere Watch Programme (GAW) is the only existing long-term international global programme that coordinates observations and analysis of changes in the chemical composition of the atmosphere. GAW also helps improve understanding of interactions between the atmosphere, the oceans and the biosphere.

12 GAW is in the process of developing a new Implementation Plan for the period 2016-2023. Programme development is aimed at delivery of enhanced products and services through cross-cutting application areas including the assessment of human health and ecosystem impacts from atmospheric pollution, atmospheric composition forecasting at regional and global scales, urban services, numerical weather prediction and climate applications.

13 Several groups within the GAW Programme perform research relevant to the ocean, including research on atmospheric aerosols that can help to estimate the transport of nutrient materials to the ocean, research on precipitation chemistry and atmospheric deposition of major ions, research on the global nitrogen and sulphur cycle through several expert groups, and research on greenhouse gases that address the global carbon cycle.

Event on aerosol related impacts and applications

14 During the 17th World Meteorological Congress held in Geneva from 25 May to 12 June 2015, a one-hour side event on aerosol related impacts and applications was held. The event highlighted the role of aerosols on weather, climate, ocean productivity, and adverse human health effects. Alex Baker (University of East Anglia, UK and member of GESAMP) delivered a presentation about the impacts of aerosol deposition on terrestrial and marine ecosystems. Key messages were that aerosol nutrient deposition is important on land and in the ocean, that the significance of their impact varies depending on the receiving ecosystem, and that the indirect effects of aerosol chemistry (e.g. acidification of dust surfaces) can increase solubility and hence nutrient supply.

Extension of scope of GAW Precipitation Chemistry observations and analysis to Total Atmospheric Deposition

15 A major recent product of GAW's Scientific Advisory Group for Precipitation Chemistry is the publication of "A global assessment of precipitation chemistry and deposition of sulfur, nitrogen, sea salt, base cations, organic acids, acidity and pH, and phosphorus" (Vet et al., 2014, *Atmospheric Environment* Vol. 93, available online at <http://dx.doi.org/10.1016/j.atmosenv.2013.10.060>). The assessment concludes that although some inorganic ions (namely sulfate, nitrate and ammonia) are reasonably well characterized globally, major regions of the world remain insufficiently monitored for important ions in precipitation (including South America, parts of North America, much of Asia, Africa, Oceania, the polar regions, and the oceans). Recommendations from the assessment confirm that a strategic approach to long-term observations is required for future improvements in global concentration and deposition estimates. This will require increased spatial coverage of long term wet and dry deposition measurements of acidifying species, mineral base cations, sea salt, organic acids and nutrients such as phosphorus in regions of the world that are data sparse, highly sensitive, or affected by changing regional emissions. The database of quality-assured ion concentration and wet deposition data gathered from regional and national monitoring networks that formed the basis for the assessment is available for download from the World Data Centre for Precipitation Chemistry (<http://wdcpc.org/>).

16 The assessment also clearly establishes that total (wet plus dry) atmospheric deposition characterizes the exchange process between the atmosphere and the underlying surface, while precipitation chemistry and wet deposition capture only part of this exchange. In order to be able to better address environmental relevant issues, an expansion of the scope of the SAG from precipitation chemistry and wet deposition to include dry and total atmospheric deposition as well as a renaming to SAG for Total Atmospheric Deposition was approved at the 17th World Meteorological Congress (25 May to 12 June 2015). This expansion in scope will necessitate more active collaboration with the deposition modelling community as well as the aerosol and reactive gas scientific communities.

Ocean acidification

17 WMO is partnering with other organizations involved in ocean science to coordinate atmospheric and marine research and increase awareness about ocean acidification. A section on ocean acidification and trends in ocean pCO₂ was published in 2014 in the [WMO Greenhouse Gas Bulletin No. 10](#), and jointly produced by the International Ocean Carbon Coordination Project of the Intergovernmental Oceanographic Commission of UNESCO, the Scientific Committee on Oceanic Research, and the Ocean Acidification International Coordination Centre of the International Atomic Energy Agency with support from WMO. Also, an article on monitoring of ocean carbon and ocean acidification was published in the [WMO Bulletin Vol 64 \(1\) - 2015](#).

18 To ensure better coordination of CO₂ observations between atmospheric and ocean communities, a special session on ocean measurements of pCO₂, other greenhouse gases, and related tracers will be held at the 18th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse

Gases, and Related Measurement Techniques (GGMT-2015) on **September 13-17, 2015** in La Jolla, California.

19 WMO's WCRP maintains its sponsorship of the fruitful IGBP/SCOR/WCRP/iCACGP Surface Ocean – Lower Atmosphere Study (SOLAS, <http://www.solas-int.org>). GAW is also actively pursuing additional coordination and collaboration with the marine research community through SOLAS. WMO and GESAMP representatives will be participating in a side meeting with SOLAS and other groups at the SOLAS Open Science Conference on September 7-11, in Kiel, Germany.

GESAMP Working Group 38: Atmospheric Input of Chemicals to the Ocean

20 WMO continues its support of GESAMP Working Group 38 (Atmospheric Input of Chemicals to the Ocean) in particular through the trust fund established to manage financial contributions of GESAMP partners for the support of WG 38.

21 The Progress Report of the Working Group 38 has been submitted to GESAMP 42 by the Chairman of WG 38.
