

**Report on Outcomes**  
**Earth System Monitoring and Prediction Workshop (Online Workshop 4)**  
**28 October 2020 - 14h00 to 16h00 CET**

This online workshop held in preparation for the WMO Data Conference asked stakeholders to discuss Earth system monitoring and prediction as a policy driver, as well as relevant data requirements and data maturity.

A fundamental principle of seamless prediction is that the Earth-system exhibits a wide range of dynamical, physical, biological, and chemical interactions involving spatial and temporal variability continuously spanning all weather/climate scales. Over the next decades, we expect a better integration of observing systems to support optimally global and regional Numerical Earth-system WeatherClimate Prediction (NEWP) systems.

An integrated observing network will meet the demands of weather and climate forecasting by spanning time scales of minutes-to-decades in a cost-effective manner.

One of the important challenges of NEWP for the next decade is to gain access to, and/or invest in, required observations and modelling resources from a range of Earth-system components (e.g. oceans, cryosphere, and biosphere). Communities external to WMO are leading development in some of these areas. WMO policies, practices, and activities that support, intersect, and advance such activities could effectively leverage these efforts.

Assessing the optimal investment balance across this range of observations and associated NEWP capabilities should be founded on evidence-based tools whenever possible (requiring new Earth-system assessment capabilities).

The workshop was co-chaired by:

- **Dr. Gilbert Brunet**, Chief Scientist and Group Executive Science and Innovation, Bureau of Meteorology, Melbourne, Australia and Chair of the Science Advisory Panel, WMO
- **Dr. David Legler**, Director, Global Ocean Observing and Monitoring Program, NOAA

**Speakers:**

- **Stephen English, ECMWF** gave Presentation 1: "Observational Data Requirements for Earth System Prediction."
- **Toshio Suga, Tohoku University, Japan** gave Presentation 2: "Data Providers Perspective (ARGO)."
- **John Eyre, Met Office UK**, gave Presentation 3: "Observing System Design through Impact Studies; the NWP Experience."

- **Elisabeth Remy, Mercator Ocean International**, gave Presentation 4: “Observing System Design through Impact Studies; Developments in Ocean/Coupled Model Systems.”
- **WMO Secretariat Directors Jürg Luterbacher, Anthony Rea and Lars Peter Riishojgaard** introduced: “Data Exchange and Data Policy from the WMO Convention via Resolutions 40, 25 and 60 to Resolution 42,” and provided a final summary of the workshop.

Approximately 150 stakeholders participated, including individuals from developed and developing Member governments (NMHSs and other services), the research community, development agencies and the private sector.

### **Summary of Outcomes**

- Need for global exchange of as many observations as possible.
- Need to increase coverage and exchange of:
  - Ocean observations, including data from shelves and coasts, vertical constituent profiles, boundary currents
  - Certain terrestrial observations (e.g. snow cover)
  - Certain atmosphere variables (e.g. atmospheric composition and wind profiles, but also other variables in data-sparse areas)
- As ocean observations are not centrally coordinated and include many gaps, integration of observing systems needs to involve diverse communities, which poses technical and organizational challenges.
- Enhanced communication and coordination between modelling/data assimilation experts and observation/network experts is essential for the design and interpretation of observing-system evaluation. This is particularly important for the future evolution of the ocean observing system. This will require additional infrastructure and resources.
- There is need to get globally consistent coverage in measuring key variables through the involvement of regional/local communities. WMO can play an important role by demonstrating the value of monitoring and predicting the living ocean, and by advocating and convincing diverse communities to participate.
- The WMO data policy must ensure the continued availability of all essential observational data to all WMO Members, and the continued adherence to WMO data sharing principles irrespective of the data origin.
- In addition to Observing System Simulation Experiments (OSSEs), Earth System Ensemble of Data Assimilations enables us to assess impact of future systems and networks and can be used to inform decision making on where to invest resources.

- Difficult to impose strict limitations on «Earth system» to encompass physical components alone; impact-based forecasting is driving us in a different direction. We need to distinguish between physical impacts that are closely related to the Earth System variables, and societal impacts that are not.
- WMO encouraged to provide recommendations also on national data exchange.
- WMO requirements would be helpful in the articulation of an "OBON" extension of GBON into the marine domain.
- Strong partnership among diverse communities at international/regional/local levels is required --> WMO network of national weather services and connections to academia, other organizations, e.g. IOC-GOOS, etc. is crucial here.