



WMO interests in coupled data assimilation R&D

Tom Hamill

*NOAA Earth System Research Lab, Boulder
Colorado*

& WMO/WWRP/DAOS co-lead

WWRP / S2S Project



Objectives

1. To improve forecast skill and understanding on the subseasonal to seasonal timescale with special emphasis on high-impact weather events
2. To promote the initiative's uptake by operational centres and exploitation by the applications community
3. To capitalize on the expertise of the weather and climate research communities to address issues of importance to the Global Framework for Climate Services



Scientific issues

1. Identify sources of predictability at the sub-seasonal to seasonal time-range.
2. Prediction of the MJO and its impacts in numerical models
3. Teleconnections - forecasts of opportunity
4. Monsoon prediction.
5. Rainfall predictability and extreme events
6. Polar prediction and sea-ice
7. Stratospheric processes



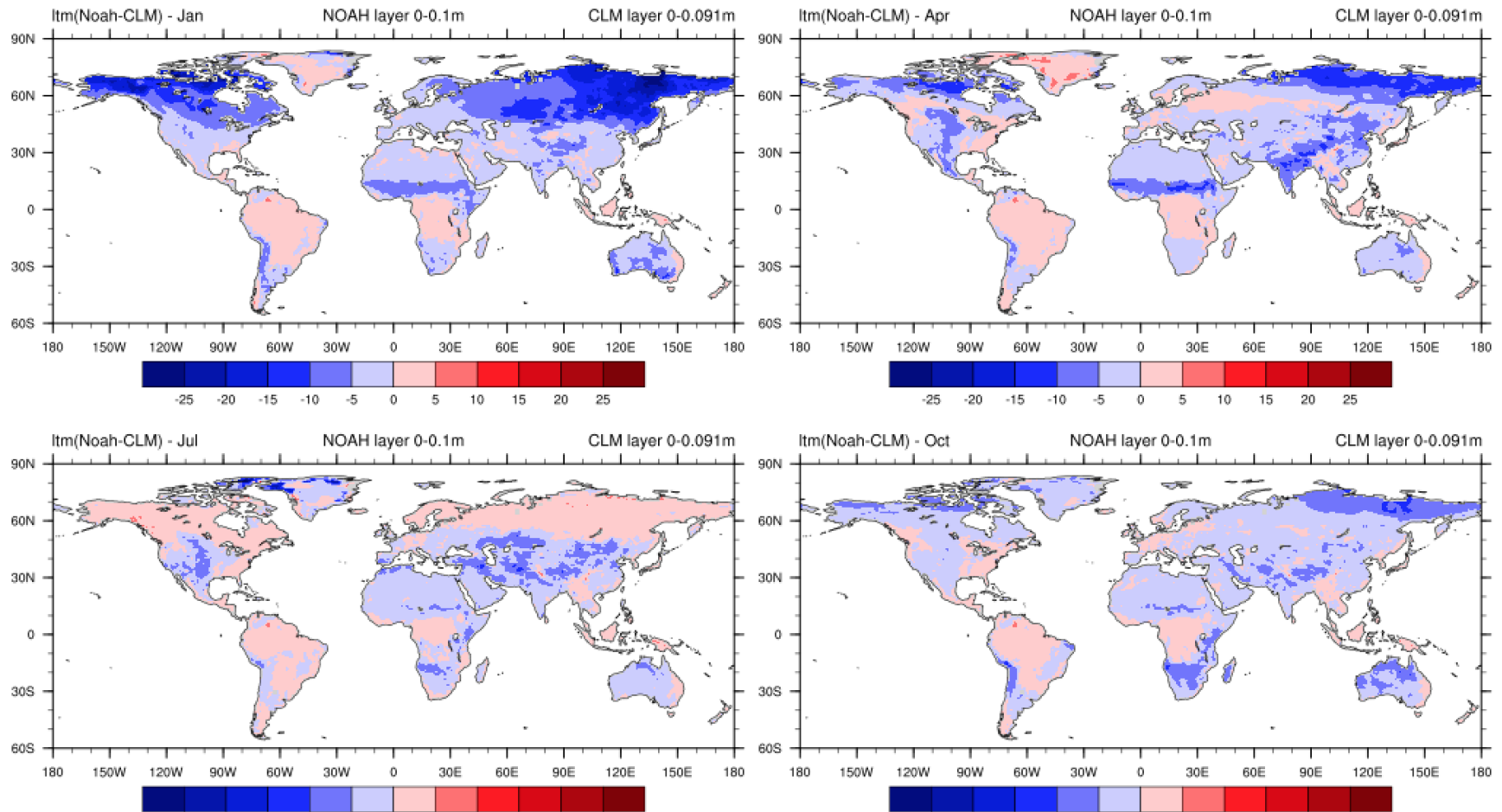
Modelling issues

1. Role of resolution
2. Role of ocean-atmosphere coupling
3. Teleconnections - forecasts of opportunity
4. Systematic errors.
5. Initialisation strategies for subseasonal prediction
6. Ensemble generation
7. Spread/skill relationship
8. Verification

WMO Polar Prediction Project goals

- Improve the understanding of the requirements for, and evaluate the benefits of, enhanced prediction information and services in polar regions
- Establish and apply verification methods appropriate for polar regions
- Provide guidance on **optimizing polar observing systems**, and coordinate additional observations to support modeling and verification
- Improve representation of key processes in models of the polar atmosphere, land, ocean and cryosphere
- Develop **data assimilation systems that account for the unique characteristics of polar regions.**
- Develop and exploit **ensemble prediction systems with appropriate representation of initial condition and model uncertainty for polar regions.**
- Determine predictability and identify key sources of forecast errors in polar regions.
- Improve knowledge of two-way linkages between polar and lower latitudes, and their implications for global prediction.

Differences between NOAA's and NCAR's land-surface temperature climatology



Two community land-surface models forced with the same temperature, precipitation, etc.

WGNE terms of reference

- The Working Group on Numerical Experimentation (WGNE), jointly established by the [WCRP Joint Scientific Committee \(JSC\)](#) and the WMO Commission for Atmospheric Sciences ([CAS](#)), which is responsible for [WWRP](#) and [GAW](#), has the responsibility of fostering the development of atmospheric circulation models for use in weather, climate, water and environmental prediction on all time scales and diagnosing and resolving shortcomings (WMO/TD 121). WCRP-JSC/CAS **WGNE promotes co-ordinated numerical experimentation for validating model results**, observed atmospheric properties, exploring the natural and forced variability and predictability of the atmosphere, (e.g. the Atmospheric Model Intercomparison Project, [AMIP](#)), as well as studies aimed at refining numerical techniques, and the formulation of atmospheric physics processes. **WGNE also monitors the advances in data assimilation** and analysis methods and is the focal point in the WCRP for encouraging and reviewing the reanalysis projects carried out at various centres with fixed state-of-the-art assimilation systems providing a multi-year homogenous data set for a range of atmospheric and climate diagnostic studies.

DAOS terms of reference

The Data Assimilation and Observing Systems (DAOS) working group (WG) will **provide guidance to the WWRP on international efforts to optimise the use of the current WMO Global Observing System (GOS). It will also provide guidance on which data assimilation methods may provide the highest quality analysis products** possible from the GOS. Through these activities, the DAOSWG will facilitate the development of advanced numerical weather prediction (NWP) capabilities, especially to improve high impact weather forecasts. DAOS will be primarily concerned with data assimilation and observing system issues from the convective scale to planetary scales and for forecasts with time ranges of hours to weeks. To achieve its mission, the DAOS WG will:

- a. **Provide community consensus guidance on data assimilation issues, including the development of advanced methods for data assimilation.**
- b. **Promote research activities that will lead to a better use of existing observations** and that will objectively quantify the impact of current and future observation for NWP.
- c. Assist WWRP projects and other WMO working groups in achieving their scientific objectives by providing expert advice on the use of observations and data assimilation techniques.
- d. Organize and provide the scientific steering committee for the WMO Data Assimilation Symposium, which is to be held approximately every 4 years.

WMO is interested in these outcomes from the workshop

- What can WMO do to facilitate more rapid progress in research and development of coupled DA methods? Are there DA R&D aspects that are better handled internationally rather than nationally, or by independent investigators?
- Identify gaps in current and planned observing systems related to their capacity to define the coupled environmental state accurately.
- Identify major problems with the forecast system related to providing improved coupled background state estimates.
- Identify scientific hurdles that need to be overcome to provide the higher-quality initial conditions of the coupled state necessary for S2S forecast initialization.
- What are the major scientific problems in coupled data assimilation related to polar prediction
- **Identify a few concrete next steps**

A summary for the WMO and for program managers at funding agencies.