

Proposed WCRP Grand Challenge on Near Term Climate Prediction

Concept Team members:

A.A. Scaife and Y. Kushnir (co-leads), J. Perlwitz (SPARC), G. Boer (DCPP), D. Carlson (WCRP), F. Doblas-Reyes (WGSIP), E. Hawkins (CLIVAR), M. Kimoto(DCPP, CLIVAR, JSC), A. Kumar (ET-OPSLS), K. Matthes (SPARC), S. Power (WGCM, CLIVAR), M. Raphael (CliC), D. Smith (DCPP) and A. Shimpo (CCL)

WCRP Secretariat support:

Michael Sparrow and Matthias Tuma

Background

- Climate **projections** out to a century ahead, based on potential greenhouse gas and aerosol emission scenarios successfully **coordinated under the WCRP/WGCM through the CMIPs and used to inform governments** of *long-term* risks due to climate change via the IPCC.
- **Projections only provide the long-term path** of the anthropogenic-forced climate embedded within a wide envelope of uncertainty that includes internal variability.
- Projections don't account for **imminent, state-dependent evolution of climate** from several months to years (*near term*) ahead.
- **Near-term risks** imposed by the combination of anthropogenic climate trends and natural climate variability are needed by a broad range of users involved in near term planning.
- Such information can be derived from multi-year integrations of **coupled models, initialized with observations** and incorporating external forcing. Such integrations were conducted in CMIP5 and are planned in CMIP6 via the DCP.

The need for a Grand Challenge

- A Grand Challenge (GC) on Near Term Climate Prediction (NTCP) is needed to support three objectives:
 - 1) Research and development to improve multi-year to decadal climate predictions** (fundamental understanding of predictability, specification of forcing, forecast initialization and model bias/drift)
 - 2) Collate and synthesize prediction output** and tailor climate information (including assessments of uncertainty) to form the basis of a service addressing stakeholder needs.
 - 3) Develop organizational and technical processes, including international coordination** to underpin future routine provision of scientifically-sound prediction services.
- The proposal includes **synthesis of real-time prediction information** from multiple existing, initialized prediction systems, and assessment of the confidence the scientific community has in the information.
- The GC on Near-Term Climate Prediction will fill an important gap in **provision of seamless climate information**, between seasonal climate predictions and long-term projections, as recommended by the GFCS.

Scientific Issues

R&D to address objective 1) Research and Development

- Advance decadal variability and predictability science with DCVP & DCPD:
 - understanding **sources of decadal predictability**
 - improvement of the **simulation of decadal variability**
 - quantifying **prediction skill**
- The **GC will engage with the WCRP Projects** e.g. CLIVAR DCVP to build on progress in their research areas and to stimulate development of new projects which address **research gaps revealed during experimental and operational near term prediction activities**
- Improve **initialization methods** and specification of **external forcing agents** (in particular solar variability and aerosols)
- Pursue research on **observational needs, data assimilation and initialization and ensemble methods.**
- Pursue research to reduce the **impact of initialization shock, model drift and model biases** on predictions **with WCRP modelling groups** aimed at reducing their impact on predictive skill.

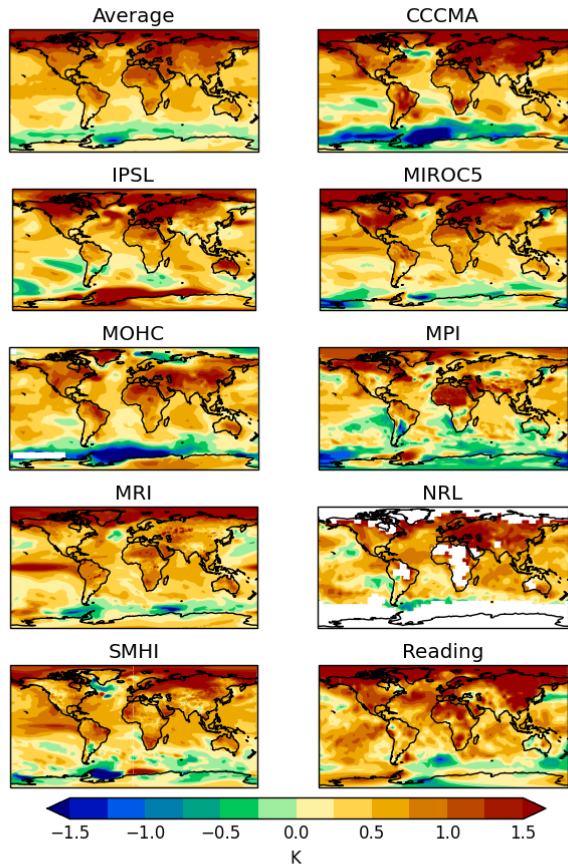
Scientific Issues

R&D to address objective 2) Collate and Synthesize Prediction Output

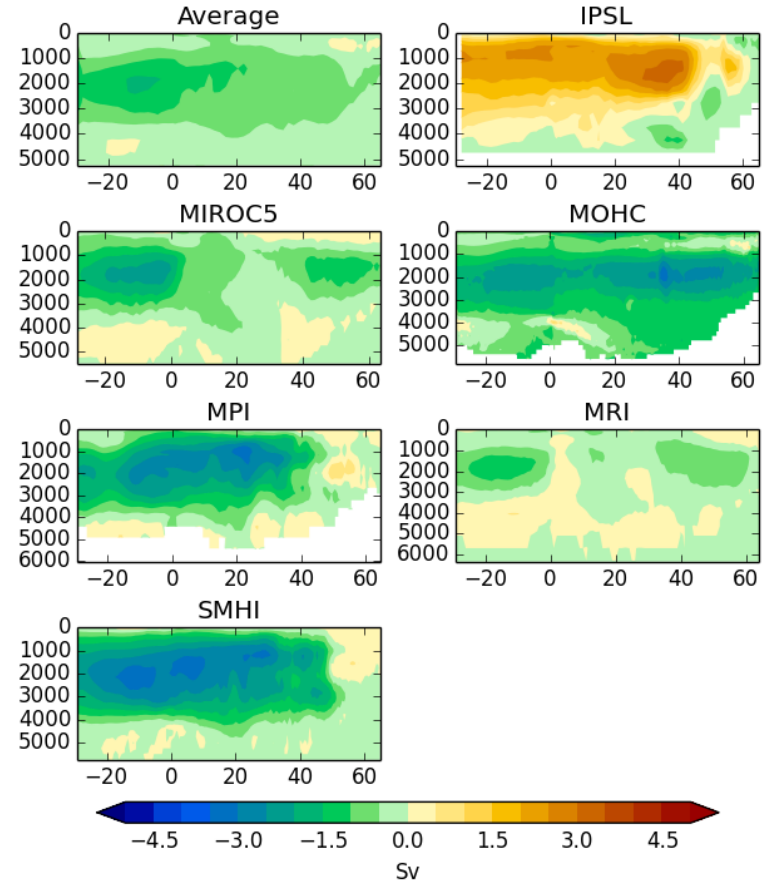
- Mine and understand the **value of information embedded in multi-model hindcast and forecast ensembles**.
- The GC will explore the broad space of ensemble hindcast and forecast outputs **links from predictable variability to land and the changing risk of extreme events** is of particular interest.
- Understand how to **combine forecast output and observational and model statistics and scenarios** in producing relevant near term climate outlooks.
- Research on **how to best produce relevant outlooks including the assessment of the risk of extreme events** on timescales out to decadal.

Example Real Time Forecasts

2014 predictions for 2015 surface temperature



2014 predictions for 2015-2019 Atlantic MOC



Scientific Issues

R&D to address objective 3) Develop organizational and technical processes, including international coordination

- Need to determine and **communicate forecast uncertainty and expert assessment** in delivering of forecasts/outlooks.
- Multi-model ensembles and observations to **quantify uncertainty**. Learn how to incorporate expert assessment of forecast confidence. **Build on experience from seasonal to interannual prediction** in delivering to users.
- Understand **forecaster and user needs** for content and format of outlook.
- **Engage with users, national meteorological and hydrological services** (particularly in under represented countries) through tailored workshops.
- **Develop uniform protocols and procedures** for delivering near-term forecasts/outlooks to forecasters and users.
- Communicate with other WCRP/WMO projects, to address the relevant scientific issues. Strengthen the link to WGSIP, WGCM and the Decadal Climate Prediction Project (DCPP). **Work with WMO CBS-CCL** to determine best presentation and dissemination methods c.f. seasonal forecasts

Proposed Deliverables

- Deliver **concept note** describing the GC to the WCRP JSC for comments and approval (see JSC37 papers).
- Develop a **white paper** on the “Challenge of Near-Term Climate Prediction” with more details on the motivation, aims, existing and proposed research and implementation of this Grand Challenge (in progress).
- The **production of standards, verification methods and guidance** for near term predictions in collaboration with the WMO CBS/CCI Expert Team, which are seamless with long-term projections (2018).
- Pursue **WMO recognition for operational decadal predictions** (2019).
- Initiate and issue a real-time **Global Decadal Climate Outlook** once each year (2016 onwards, with 2 years of dry running before issue) in consultation with CBS-CCL and following the template of the Global Seasonal Climate Update (GSCU) for seasonal predictions.