WGSIP Report

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WGSIP co-chairs

WCRP Working Group on Subseasonal to Interdecadal Prediction

WGSIP Overview

- Currently 13 members, representing or having cross membership with

    - DCPP (reports to WGSIP)

    - 6 WMO Global Producing Centres for seasonal forecasts

    - 3 pre-Global Producing Centres for Annual to Decadal Climate Prediction

    - GC Near-Term Climate Prediction

    - S2S

    - GEWEX/GLASS

    - WMO Polar Prediction Project

    - WMO Expert Team on Operational Predictions from Sub-seasonal to Longer-time Scales (ET-OPSLS)

    - Various MIPS and funded projects (PA-MIP, Blue Action, FRAMS)

    - Applications (IRI, ICTP/health impacts)

Decadal Climate Prediction Project (DCPP)
Developments in 2017-18

- New co-chair: Wolfgang Müller in place of George Boer who is retiring

- DCPP Panel met October 2017 in Exeter

- Component C protocols (pacemaker experiments, impacts of PDV, AMV, volcanoes) and associated forcing data finalized

- Commitment to CMIP6 DCPP experiments has grown to **20 modelling groups**

- DCPP, together with the SPARC Stratospheric Sulfur and its Role in Climate (SSiRC) initiative, have developed a **response plan for** updated decadal forecasts in the event of a **large volcanic eruption,** with SSiRC to provide observation-based stratospheric sulfur aerosol forcings

WGSIP/DCPP and the current decadal prediction landscape

- Coordination occurring between
  - **DCPP**: research-driven hindcast experiments for CMIP6, but also ongoing ~real-time predictions
  - WMO Lead Centre (**LC**) for Annual to Decadal Climate Prediction: establishing Global Producing Centres, will ingest real time predictions
  - **GC** Near-Term Climate Prediction: Science + activities supporting LC

- WGSIP 19 convened co-chairs of these initiatives to delineate complementary roles, strengthen mutual awareness and coordination

- Interrelated roles:
  - **LC** and **DCPP** both will be ingesting and disseminating ~real time predictions, some from same centres
  - **LC** outputs will be targeted toward services, more extensive **DCPP** outputs toward research + supplementing services
  - **GC** developing standards, verification methods and guidance for **LC** + yearly *Global Annual to Decadal Climate Update* which **WGSIP/DCPP** will review, plus predictions of the **likelihood of exceeding 1.5°C** warming in coming decade

Update on CHFP

- Hindcast data from > 20 systems

- CHFP featured in a Nov 2017 BAMS article   →

- Registered users up by ~50% since 2016

- ~10^5 files downloaded in 2017

- Sea ice hindcast data being added

- NMME hindcasts being added

- CIMA in Argentina continues to support storage & dissemination, although resources for data acquisition and pre-processing are thin

The Climate-System Historical Forecast Project

Providing Open Access to Seasonal Forecast Ensembles from Centers around the Globe

Adrian M. Tompkins, María Inés Ortiz De Zárate, Ramiro I. Saurral, Carolina Vera, Celeste Saulo, William J. Merryfield, Michael Sigmond, Woo-Sung Lee, Johanna Baehr, Alain Braun, Amy Butler, Michel Déqué, Francisco J. Doblas-Reyes, Margaret Gordon, Adam A. Scaife, Yukiko Imada, Masayoshi Ishii, Tomoaki Ose, Ben Kirtman, Arun Kumar, Wolfgang A. Müller, Anna Pirani, Tim Stockdale, Michel Rixen, and Tamaki Yasuda

UNCERTAINTY IN SEASONAL FORE-CASTING. Any prediction of the future evolution of the Earth system requires an associated assessment of its uncertainty. This is true whether the forecast is for the days ahead or is a longer-term prediction for the following months and seasons.

For seasonal forecasts, the uncertainty associated with inexact initial conditions, which can grow rapidly in time, is usually addressed by running multiple forecasts with perturbations applied to the initial state of the ocean and atmosphere (Arribas et al. 2011; Stockdale et al. 2011). The idea is that the perturbed initial conditions are of a suitable magnitude to represent the uncertainty in the observational measurements and the analysis tools that are used to process them. As the forecast evolves, the differences between the forecasts, known as the ensemble "spread," should therefore reflect the typical forecast error, or "uncertainty"; in other words, the eventual real-world evolution should be contained within the cluster of this forecast ensemble. In tandem, uncertainty in forecasts is also contributed to by our inexact representations of the Earth system physics. This contribution to uncertainty is sampled by employing different Earth system models (Yun et al. 2005; Weisheimer et al. 2009; Smith et al. 2013), the so-called multimodel approach, which is often supplemented by the use of perturbations to physical processes, known as stochastic physics schemes, to further account for structural errors in a particular

Current WGSIP projects

- **SNOWGLACE**

  - examining how snow initial conditions influence sub-seasonal skill

  - dependent on snow-atmosphere coupling in models

  - 8 centres participating, funding from EU, Norway, Korea

- **Teleconnections**

  - examining role of tropical rainfall anomalies in driving teleconnections to extratropics

  - will coordinate with S2S Phase 2 teleconnection project (different time scales, ENSO vs MJO etc.)

  - paper on skill of multi-model tropical rainfall seasonal predictions submitted

SLP anomalies & Rossby ray paths in response to ENSO
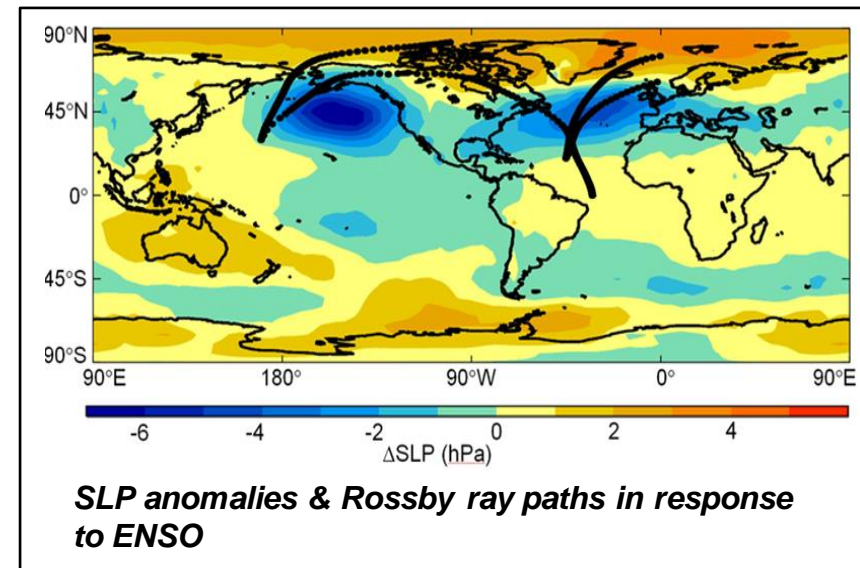
- **Long-Range Forecast Transient Intercomparison Project (LRFTIP)**

  - examining shock/drift in observationally initialized climate models

  - hindcast climatologies for ~40 subseasonal/seasonal/decadal systems

  - subseasonal contributions in collaboration with S2S

 - data, diagnostics, diagnostic scripts served at CCCma (community resource)

Current generation of WGSIP projects

- WGSIP's current projects were highlighted in a Nov 2017 EOS article →

EOS
Earth & Space Science News

Advancing Climate Forecasting

Better forecasts, new products: The World Climate Research Programme coordinates research aimed at improving and extending global climate forecasting capabilities.
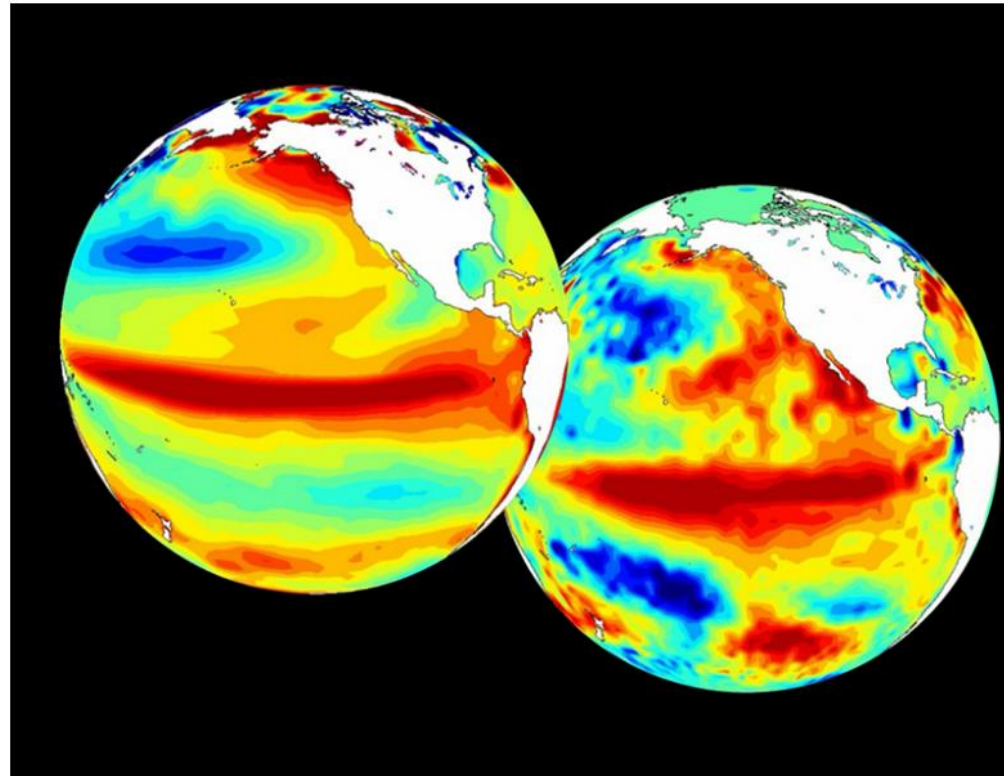
Land initialization experiments

- A growing collection of intercomparison projects exploring sensitivity to land initialization are either planned or underway:

  - WGSIP SNOWGLACE (snow)

  - LS3MIP predictive component (soil moisture, etc.)

  - S2S Phase 2 (soil moisture, etc)

  - GEWEX (under discussion)

  - GLACE-ESM (vegetation)

- WGSIP and GEWEX have agreed to collaborate in order to

  - establish **common experimental protocols**

  - coordinate activities and experimental designs to **avoid overlap**

- These efforts are a natural successor to the influential WGSIP/GEWEX-sponsored GLACE2 experiment

International Conferences on Subseasonal to Decadal Prediction
17–21 September 2018 | NCAR, Boulder, CO, USA

Second International Conference on Subseasonal to Seasonal Prediction (S2S) and
Second International Conference on Seasonal to Decadal Prediction (S2D)

- Largest climate prediction conferences since first S2D in 2013, S2S in 2014
- > 400 abstracts submitted
- 3 days of parallel conferences, 1.5 days of cross-cutting plenary sessions
- WGSIP members comprise 3 of 4 S2S/S2D co-chairs, 5 S2D SOC members
- Strong ECS support
- Opportunity to synthesize current state of climate prediction research to guide R2O, encourage O2R

Coordination with WMO Operations

- WMO subseasonal, seasonal, annual-to-decadal operations overseen by CBS-CCl *Inter-Programme Expert Team on Operational Predictions from Sub-seasonal to Longer-time Scales* (IPET-OPSLS)

- WGSIP + ET working to establish closer cooperation/collaboration on enhancing Research-to-Operations (**R2O**) and Operations-to-Research (**O2R**) transfer of knowledge & expertise
  - WGSIP co-chair participated in ET meeting (2016 Beijing)
  - session with ET co-chairs at WGSIP 19 (2017 Exeter)
  - WGSIP participation in 2nd WMO Workshop on Operational Climate Prediction (May 2018 Barcelona)
  - ET participation in organization of International Conferences on Subseasonal to Decadal Prediction (Sep 2018 Boulder)

- In March 2018, the WMO seasonal Lead Centre **opened its graphical products to the public, hindcasts to follow** (advocated by WGSIP, complementing CHFP)

- GC-NTCP/DCPP/WGSIP supporting **setting up of WMO annual to decadal Lead Centre**, identification of GPCs

Further outcome: Closing the gap between research and operations

- Need identified to expedite
  - **R2O** leading to enhanced climate prediction services for society
  - **O2R** to inform research directions

- **Untapped potential** beyond "traditional" forecast products, e.g. for
  - prediction of a **wider range of earth system variables** (land, ocean, sea ice, ecosystems)
  - prediction of evolving **risks of weather and climate extremes**, including unprecedented extremes
  - **event timings** (e.g. monsoon onset/cessation, sea ice advance/retreat)
  - forecast **information tailored for decision making** (probabilities of exceedance, etc.)

- WGSIP + ET co-chairs have agreed to form a **joint task group** on closing the gap between research and operations (exact title TBD)
  - activities to include review paper(s) + meetings to convey results & **recommendations to operational centres** and **assess service needs**
  - Barcelona operational prediction and Boulder research meetings in 2018 provide excellent opportunities to initiate this process

Recent and future WGSIP meetings

- **WGSIP19** (Oct 2017 Exeter)

  - excellent opportunity for cross attendance and joint sessions with DCPP, ET-OPSLS, GC-NCTP, LC-ADCP, S2S, WMAC

  - would be very useful to have regular pan-WCRP modelling meetings

- Interim **WGSIP/DCPP** side meeting to he held at S2S/S2D conferences (Sep 2018 Boulder)

  - opportunity to discuss DCPP CMIP6 issues, early results

  - "   "   for further cooperation with ET, survey current science for R2O

- **WGSIP 20** (June 2019 Moscow)

  - to be held in conjunction with capacity-building climate prediction school, like WGSIP 18 in Dakar

Challenges for WGSIP going forward

- WGSIP committed to increasing gender, geographical and career-stage diversity in its membership

- Issue outlined in report to JSC: under-exploited opportunities exist for coordination of prediction-related activities with other WCRP entities, namely
  - **CliC** (sea ice and snow prediction)
  - **GC Carbon** (C cycle & ecosystem prediction)
  - **GC Extremes** (prediction of changing risks of extremes due to climate variability)
- A **more networked WCRP structure** would aid in developing such linkages

- WGSIP connections to GFCS not strongly developed, could provide further linkage between research and services

WGSIP inputs in relation to SP and IP

- An end-to-end approach is required for climate prediction's potential benefits to society to be realized:

  1) Understanding predictability of the Earth system
  2) Improving models & methodologies
  3) Improving observations & analyses } → *Advancing skill toward natural limits*
  4) Extending what is predicted
  5) Tailoring information for decision making

- Going forward, a more *networked* approach to WCRP organization and membership may be advantageous for realizing prediction R&D potentials

- Regarding the next decade of WCRP, WGSIP strongly agrees that

  > ***"The same fundamental climate science that has underpinned past achievements must now also support new societal needs"****

- In climate prediction realm, close cooperation/collaboration with WMO is essential for realizing this vision

- Objective is to *enable* services rather than provide them

*Section 3 of draft SP