Where are we with the Decadal Climate Prediction Project (DCPP)?

Exeter, October 2017
Where does a decadal climate fit (organizationally)?

Decadal prediction:
- annual, multi-annual, up to a decade
- initialized forecasts of both forced and internally generated components of variability
Where are we with the DCPP?

- 1\textsuperscript{st} International Workshop on Seasonal to Decadal Prediction (Tolouse, May 2013)
- DCPP development (2014)
  - Basic DCPP design agreed to by Panel
  - Development of detailed description of the three Components
- MiKlip/SPECS/DCPP/CLIVAR meeting (Feb 2015)
  - Review of common interests, actions
  - Component C specifications
- CMIP6
  - DCPP data retention table to CMIP (Feb 2015)
  - “Final” DCPP design to CMIP (Mar 2015)
  - CMIP6 “endorsement” of the DCPP (April 2015)
- Aspen Workshop (June 2015)
  - Latest results wrt decadal prediction/predictability/mechanisms
  - Adjustments to DCPP specifications special attention to Component C
Where are we with the DCPP?

• Publication “The Decadal Climate Prediction Project (DCPP) contribution to CMIP6”. *Geosci. Model Dev.*, 9, 1–27, 2016
• JSC/WMAC meeting (April 2016)
  – Approval of a WCRP **Grand Challenge** on Near Term Climate
  – Lack of approval for WG on Decadal Climate (WGDC)
• SPECS/PREFACE/WCRP Workshop on Initial Shock, Drift, and Bias Adjustment in Climate Prediction (Barcelona, May 2016)
• DCPP Panel Meeting (Barcelona, May 2016)
• Website update, Component C data (Sept, 2017)
• pan-WCRP, CMIP, DCPP Panel meetings (Exeter, Oct. 2017)
Model experiment description paper

The Decadal Climate Prediction Project (DCPP) contribution to CMIP6

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WCRP Grand Challenge

1. Context

Why do we need a Grand Challenge on Near-Term Climate Prediction?

White Paper on WCRP Grand Challenge on Near Term Climate Prediction
Draft, January 2016

Near Term Climate Prediction

Lead Coordinators: Yochanan Kushnir and Adam Scaife
Members: George Boer, David Carlson, Francisco Doblas-Reyes, Ed Hawkins, Masahide Kimoto, Arun Kumar, Katja Matthes, Judith Perlwitz, Scott Power, Marilyn Raphael, Doug Smith and Akihiko Shimpo

- Concept Note accepted and Grand Challenge approved
- White paper under development
- One goal is WMO annual/multi-annual forecasts (as current seasonal forecasts)
Broad interests in decadal climate variability and prediction

- **WGSIP**
  - Sub-seasonal to (inter)annual prediction

- **WGCM**
  - Forced climate change and natural variability

- **CMIP**
  - Coordinated experimentation including scenarios, decadal prediction ...

- **CLIVAR**
  - “Focus” on decadal variability and predictability
  - Ocean aspects, initialization

- **Grand Challenge of Near Term Climate Prediction**
  - Research and development leading toward operational annual, multi-annual forecasts

- **IPCC**
  - Near term climate a focus of AR5 and expected to be an important contribution to AR6

- **DCPP**
  - Decadal climate prediction project currently reports to WGSIP and WGCM, is an endorsed CMIP MIP and has connections to all groups
Where are we with CMIP?
The Decadal Climate Prediction Project (DCPP)

The term ""decadal prediction"" encompasses predictions on annual, multi-annual to decadal timescales. The possibility of making skilful forecasts on these timescales and the ability to do so is investigated by means of predictability studies and retrospective predictions (hindcasts) made using the current generation of climate models and by empirical methods. Skilful decadal prediction of relevant climate parameters is a Key Deliverable of the WCRP’s Grand Challenge of Near-term Climate Prediction.

The DCPP envisions three components:

A. **Hindcasts**: the design and organization of a coordinated decadal prediction (hindcast) component of CMIP6 in conjunction with the seasonal prediction and climate modelling communities.

B. **Forecasts**: the ongoing production of experimental quasi-operational decadal climate predictions in support of multi-model annual to decadal forecasting and the application of the forecasts.

C. **Predictability, mechanisms and case studies**: the organization and coordination of decadal climate predictability studies and of case studies of particular climate shifts and variations including the study of the mechanisms that determine these behaviours.
<table>
<thead>
<tr>
<th>Component A: Decadal Hindcasts</th>
<th>Experiment</th>
<th>Tier</th>
<th>Years</th>
<th>Description</th>
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<tbody>
<tr>
<td>A1</td>
<td>1</td>
<td>3000</td>
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<td>Five year hindcasts each year from 1960 to present</td>
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<tr>
<td>A2.1</td>
<td>2</td>
<td>3000</td>
<td></td>
<td>Extend A1 hindcast duration to 10 years</td>
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<td>A2.2</td>
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<td>Ensemble of historical simulations</td>
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<td>A3.1</td>
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<td>Increase ensemble size by $m$ for A1</td>
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<td>300m</td>
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<td>Increase ensemble size by $m$ for A2.1</td>
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<table>
<thead>
<tr>
<th>Component B: Decadal Forecasts</th>
<th>Experiment</th>
<th>Tier</th>
<th>Years</th>
<th>Description</th>
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<tbody>
<tr>
<td>B1</td>
<td>1</td>
<td>50</td>
<td></td>
<td>Ongoing near real-time forecasts</td>
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<tr>
<td>B2.1</td>
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<td>5m</td>
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<td>Increase ensemble size by $m$ for B1</td>
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<th>Component C: Hiatus+</th>
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<td>Idealized Atlantic control</td>
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<tr>
<td>C1.2</td>
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<td></td>
<td>Idealized impact of AMV+</td>
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<tr>
<td>C1.3</td>
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<td>Idealized impact of AMV-</td>
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<tr>
<td>C1.4</td>
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<td>Idealized Pacific control</td>
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<td>C1.5</td>
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<tr>
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<td>Repeat 1991 hindcast but without Pinatubo forcing</td>
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<td>C3.2</td>
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<td>50-100</td>
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<td>Repeat 1982 hindcast but without El Chichon forcing</td>
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<td>C3.3</td>
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<td>Repeat 1963 hindcast but without Agung forcing</td>
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<td>Repeat 2015 forecast with added Pinatubo forcing</td>
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<tr>
<td>C3.5</td>
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<td>Repeat 2015 forecast with added El Chichon forcing</td>
</tr>
<tr>
<td>C3.6</td>
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<td>50-100</td>
<td></td>
<td>Repeat 2015 forecast with added Agung forcing</td>
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A: New hindcast results

- a multi-year multi-model collection of decadal hindcast data for climate science
- an end-to-end view (initialization, ensembles; forecasts, post processing, assessment....)
- current levels of attainable skill
- sources and limits of potential skill/predictability
- benchmarks against which to judge improvements
- new information on processes and mechanisms (e.g. the hiatus, climate shifts, AMOC etc.) affecting forecast skill
- ......
B: Ongoing multi-model Forecasts

Decadal forecast

Forecast issued in January 2016. The forecast will next be updated in January 2017. Further discussion and background information can be found in a research news article.

Decadal forecasts, also called 'near-term' climate predictions, range up to a decade ahead. Predictions account for natural variability and climate change as these are expected to be of similar size in many parts of the world over this forecast period. Forecasts are experimental, so at this early stage of development expert advice is needed to assess the reliability of regional predictions.

Important

- Long-range forecasts are unlike weather forecasts for the next few days.
- Forecasts are for a range of possible conditions over a wide region and time period.

Temperature anomalies for 2017
C: Response to AMV+/AMV-
C: Response to PDV+/PDV-
C: Pacemaker

Figure 1: a. Original Atl (=AMV) mask on ERSSTv4 grid. b. Extrapolation of the mask over land. c. Interpolation on the ocean model ORCA1 grid. d. Final mask after correction of spurious points along continents.
C: Volcanic effects on prediction
Data aspects

- Experiment names (i.e. in filenames)
- Retained variables and priorities
- Earth System Grid (ESG) data approach
CMIP Panel’s timeline and the DCPP

- Comp B: Forecasts
- Comp A: Hindcasts
- Comp C: Studies

IPCC-ready publications
- submit Jan 2020
- accepted Oct 2020
Where are we?

- **DCPP Phase 1 (nearing completion)**
  - experimental protocol endorsed and published
    - required data sets and tech notes
    - data retention tables specified
    - website and forum established
  - as contribution to
    - CMIP6
    - Grand Challenge of Near Term Climate Prediction
    - interest in decadal variability and prediction across WCRP

- **DCPP Phase 2**
  - Panel and WCRP organization/renewal
  - development and evolution of connections
    - within WCRP
    - WMO and operational aspects
    - IPCC, Stocktake, ...
  - support of activities in production, analysis and application
    - multi-model comparison with DCPP co-authors
    - actions in support of
      - drift amelioration, bias adjustment
      - statistical/empirical benchmarks
      - combination, calibration, skill assessment
    - climate services
  - meetings and workshops
    - s2S and S2d Workshop, NCAR, Sept 2018
end of presentation