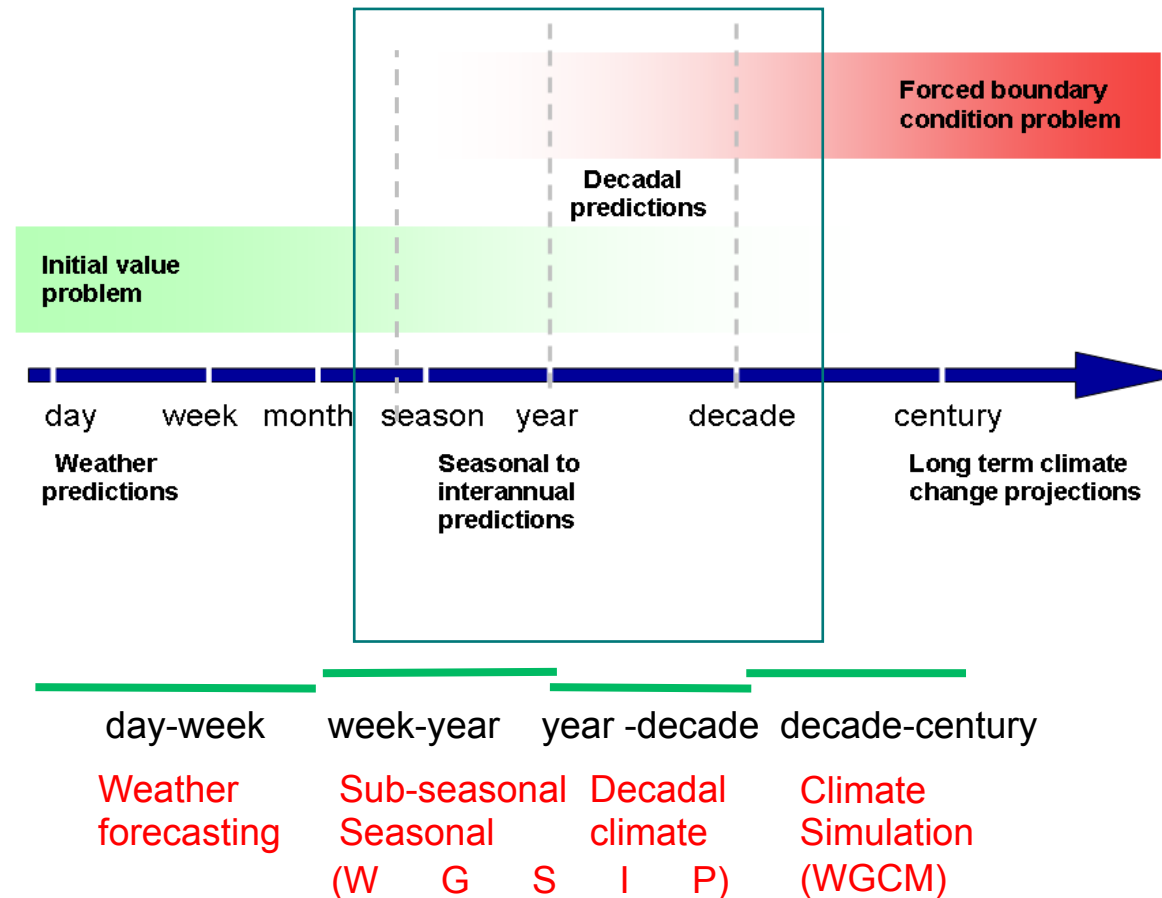


# Where are we with the Decadal Climate Prediction Project (DCPP)?

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 DCPD?

- 1<sup>st</sup> International Workshop on Seasonal to Decadal Prediction (Toulouse, May 2013)
- DCPD development (2014)
  - Basic DCPD design agreed to by Panel
  - Development of detailed description of the three Components
- MiKlip/SPECS/DCPD/CLIVAR meeting (Feb 2015)
  - review of common interests, actions
  - Component C specifications
- CMIP6
  - DCPD data retention table to CMIP (Feb 2015)
  - “Final” DCPD design to CMIP (Mar 2015)
  - CMIP6 “endorsement” of the DCPD (April 2015)
- Aspen Workshop (June 2015)
  - latest results wrt decadal prediction/predictability/mechanisms
  - adjustments to DCPD specifications special attention to Component C

# Where are we with the DCPD?

- Publication “The Decadal Climate Prediction Project (DCPD) 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)
- DCPD Panel Meeting (Barcelona, May 2016)
- Website update, Component C data (Sept, 2017)
- pan-WCRP, CMIP, DCPD Panel meetings (Exeter, Oct. 2017)

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Model experiment description paper

25 Oct 2016

## The Decadal Climate Prediction Project (DCPP) contribution to CMIP6

George J. Boer<sup>1</sup>, Douglas M. Smith<sup>2</sup>, Christophe Cassou<sup>3</sup>, Francisco Doblas-Reyes<sup>4</sup>, Gokhan Danabasoglu<sup>5</sup>, Ben Kirtman<sup>6</sup>, Yochanan Kushnir<sup>7</sup>, Masahide Kimoto<sup>8</sup>, Gerald A. Meehl<sup>5</sup>, Rym Msadek<sup>3,12</sup>, Wolfgang A. Mueller<sup>9</sup>, Karl E. Taylor<sup>10</sup>, Francis Zwiers<sup>11</sup>, Michel Rixen<sup>13</sup>, Yohan Ruprich-Robert<sup>14</sup>, and Rosie Eade<sup>2</sup>

# WCRP Grand Challenge



**Near-Term Climate Prediction**  
*A Concept Note Submitted to WCRP JSC*  
26 January 2016



## 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**

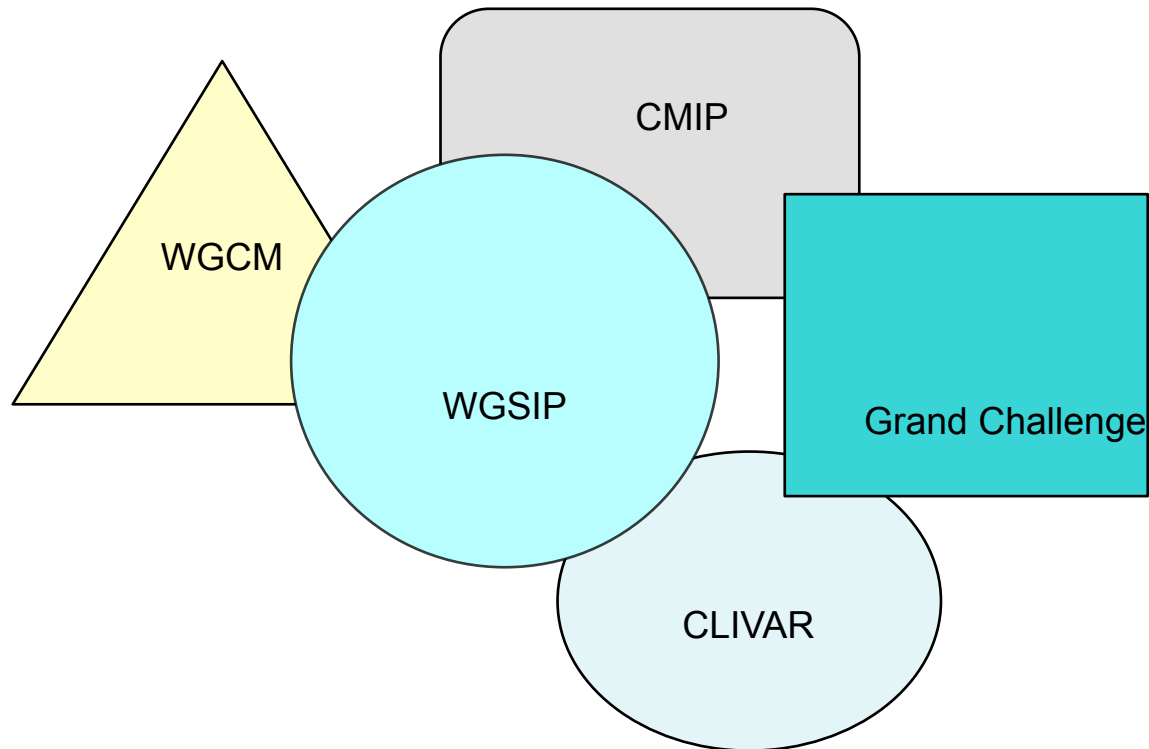
Lead Coordinators: Yochanan Kushnir and Adam Scaife

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

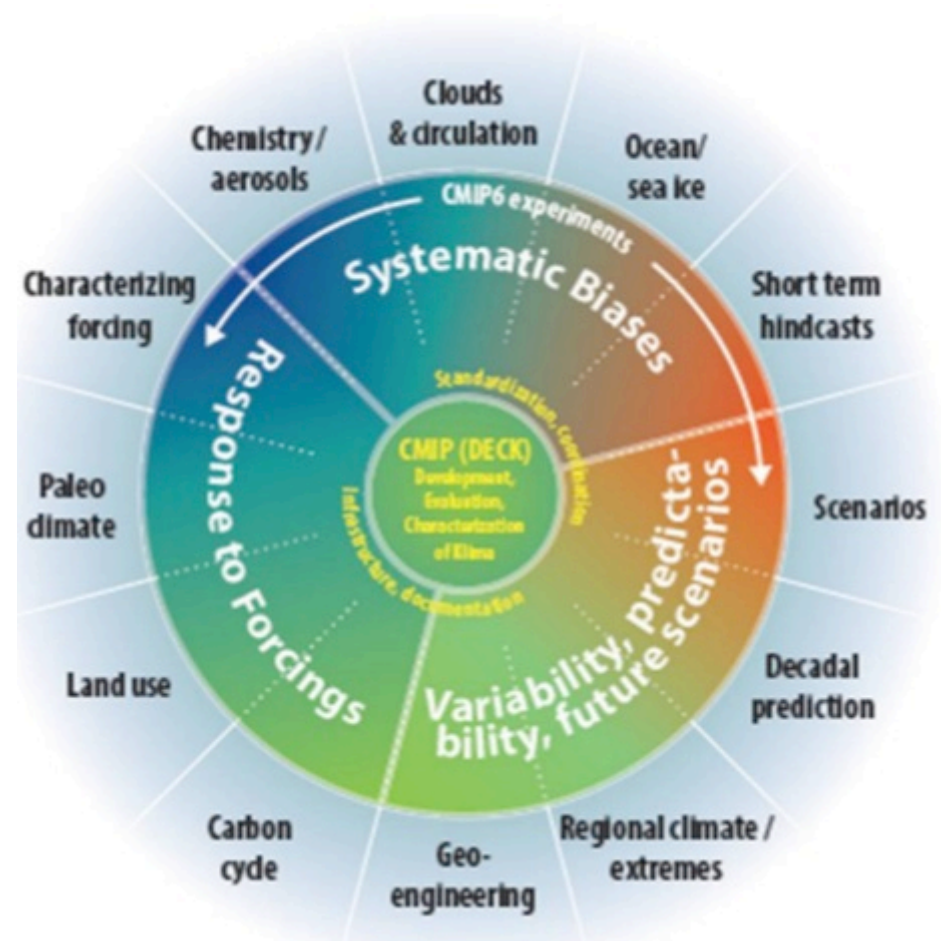
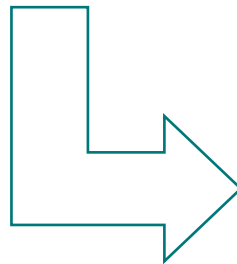
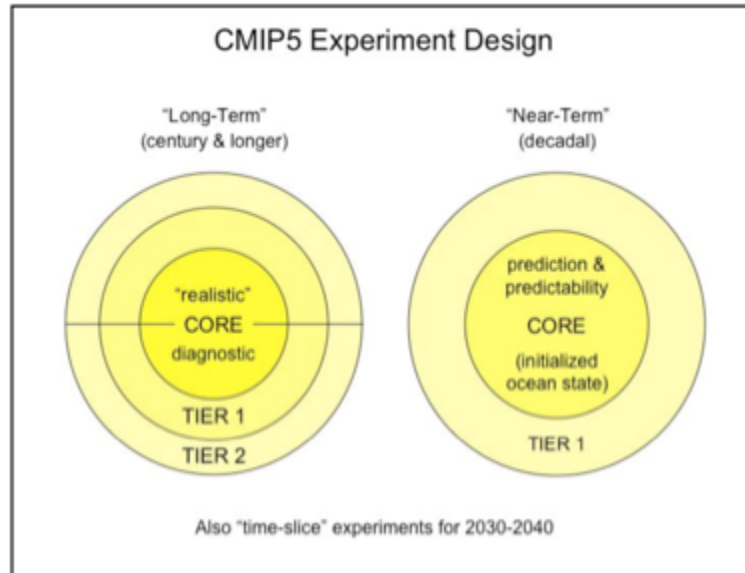
- Concept Note accepted and **Grand Challenge** approved
- White paper under development
- One goal is WMO annual/multi-annual forecasts (as current seasonal forecasts)

## 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:

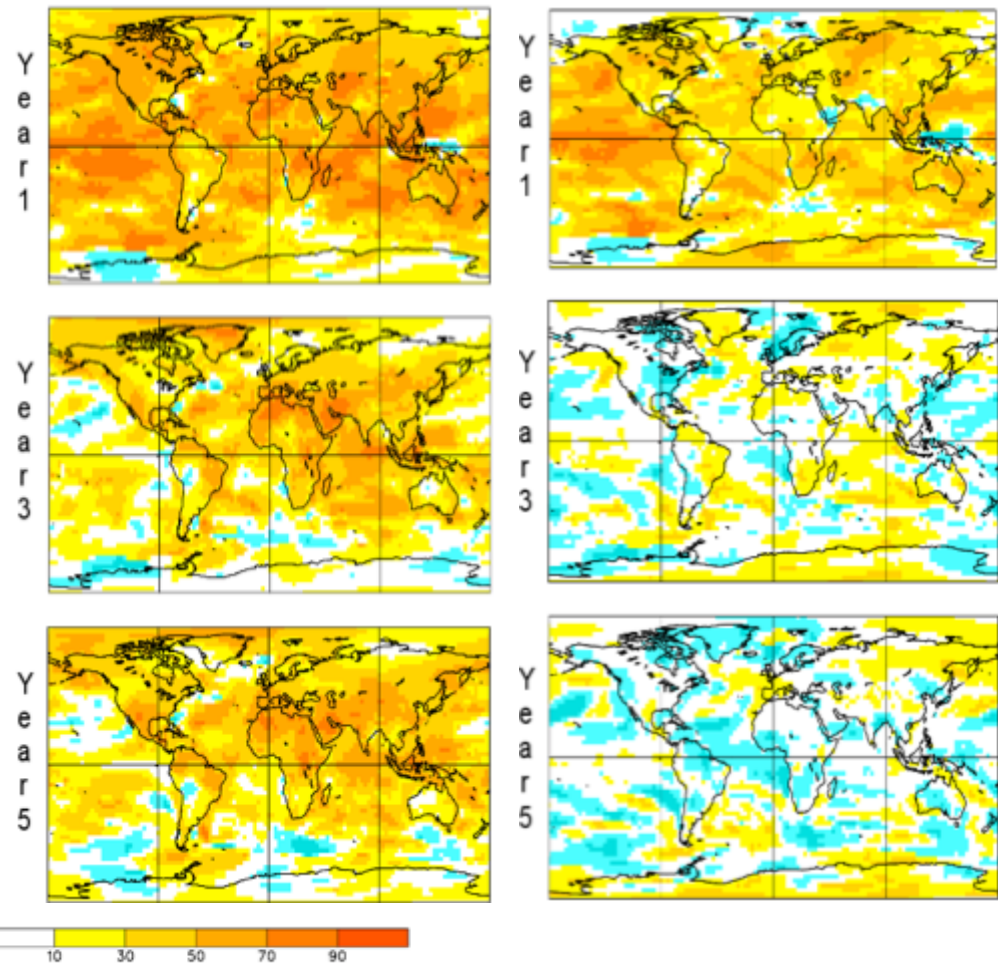
- A** ○ **Hindcasts**: the design and organization of a coordinated decadal prediction (hindcast) component of CMIP6 in conjunction with the seasonal prediction and climate modelling communities
- B** ○ **Forecasts**: the ongoing production of experimental quasi-operational decadal climate predictions 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

## DCPP Experiment Table

	Experiment	Tier	Years	Description
Component A: Decadal Hindcasts	A1	1	3000	Five year hindcasts each year from 1960 to present
	A2.1	2	3000	Extend A1 <u>hindcast</u> duration to 10 years
	A2.2	2	1700	Ensemble of historical simulations
	A3.1	3	300m	Increase ensemble size by <u>m</u> for A1
	A3.2	3	300m	Increase ensemble size by <u>m</u> for A2.1
Component B: Decadal Forecasts	B1	1	50	Ongoing near real-time forecasts
	B2.1	2	5m	Increase ensemble size by <u>m</u> for B1
	B2.2	2	50	Extend forecast duration to 10 years for B1
Component C: Hiatus+	C1.1	1	250	Idealized Atlantic control
	C1.2	1	250	Idealized impact of AMV+
	C1.3	1	250	Idealized impact of AMV-
	C1.4	1	100	Idealized Pacific control
	C1.5	1	100	Idealized impact of PDV+
	C1.6	1	100	Idealized impact of PDV-
	C1.7	2	500	Idealized impact of <u>extratropical</u> AMV
	C1.8	2	500	Idealized impact of tropical AMV
	C1.9	3	650	Pacemaker Pacific experiment
	C1.10	3	650	Pacemaker Atlantic experiment
Component C: <u>Atlantic gyre</u>	C2.1	3	200-400	Predictability of 1990s warming of <u>Atlantic gyre</u>
	C2.2	3	200-400	Additional start dates
Component C: Volcano	C3.1	1	50-100	Repeat 1991 <u>hindcast</u> but without <u>Pinatubo</u> forcing
	C3.2	2	50-100	Repeat 1982 <u>hindcast</u> but without <u>El Chichon</u> forcing
	C3.3	2	50-100	Repeat 1963 <u>hindcast</u> but without <u>Agung</u> forcing
	C3.4	1	50-100	Repeat 2015 forecast with added <u>Pinatubo</u> forcing
	C3.5	3*	50-100	Repeat 2015 forecast with added <u>El Chichon</u> forcing
	C3.6	3	50-100	Repeat 2015 forecast with added <u>Agung</u> forcing

# A: New hindcast results

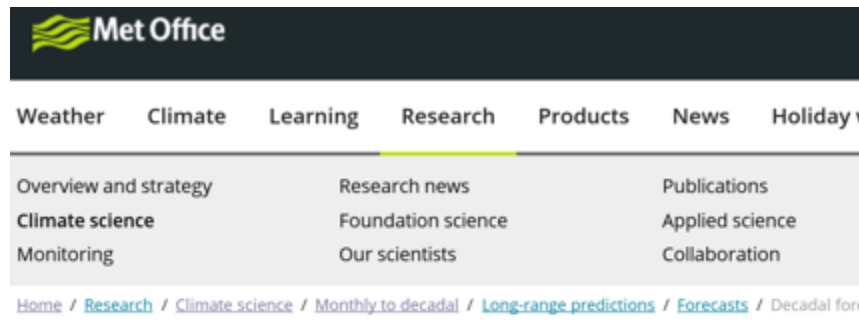
- a multi-year multi-model collection of **decadal hindcast data** for climate science
- an **end-to end view** (initialization, ensembles; forecasts, post processing, assessment....)
- current levels of **attainable skill**
- sources and limits of **potential skill/predictability**
- **benchmarks**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



Forced plus internally  
generated components

Internally generated  
component

# 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](#).

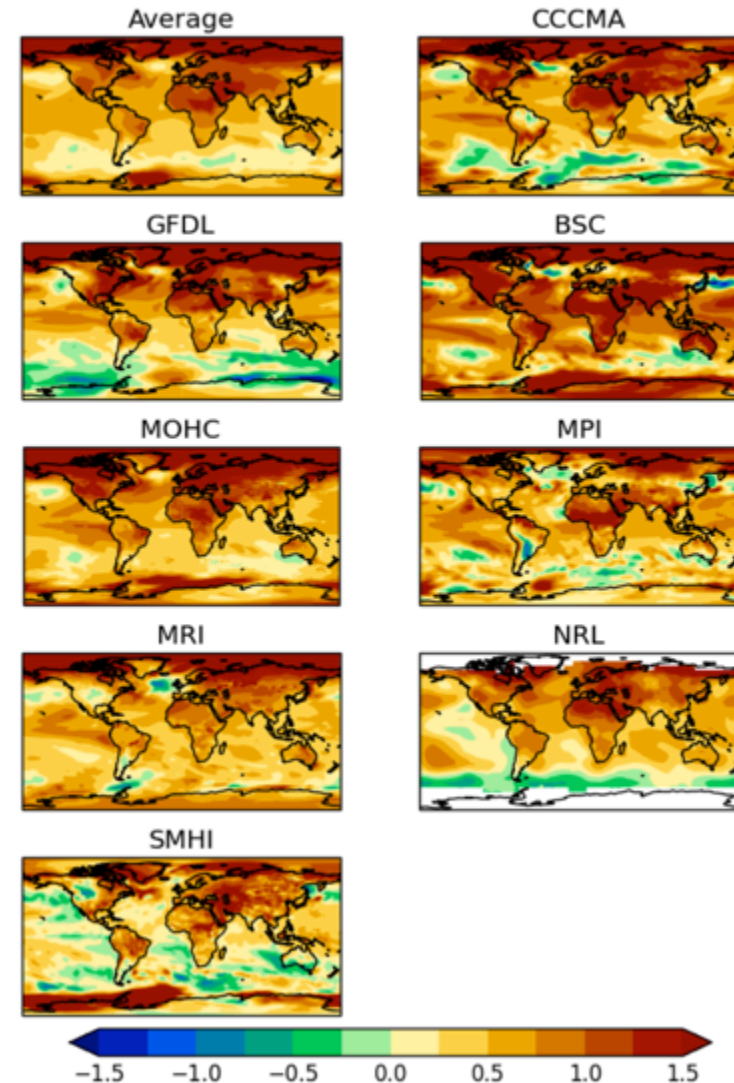
Decadal forecasts, also called 'near-term' climate predictions, range up to a decade ahead. Predictions account for natural variability and climate change as these are expected to be of similar size in many parts of the world over this forecast period. Forecasts are experimental, so at this early stage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

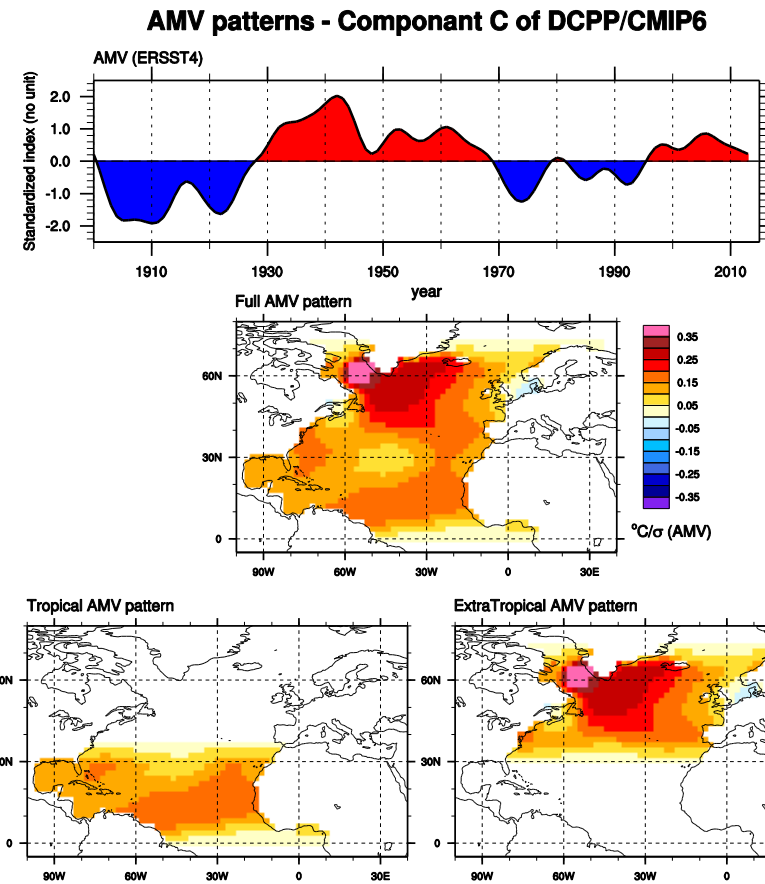
## Temperature anomalies for 2017

2016 predictions for 2017 surface temperature



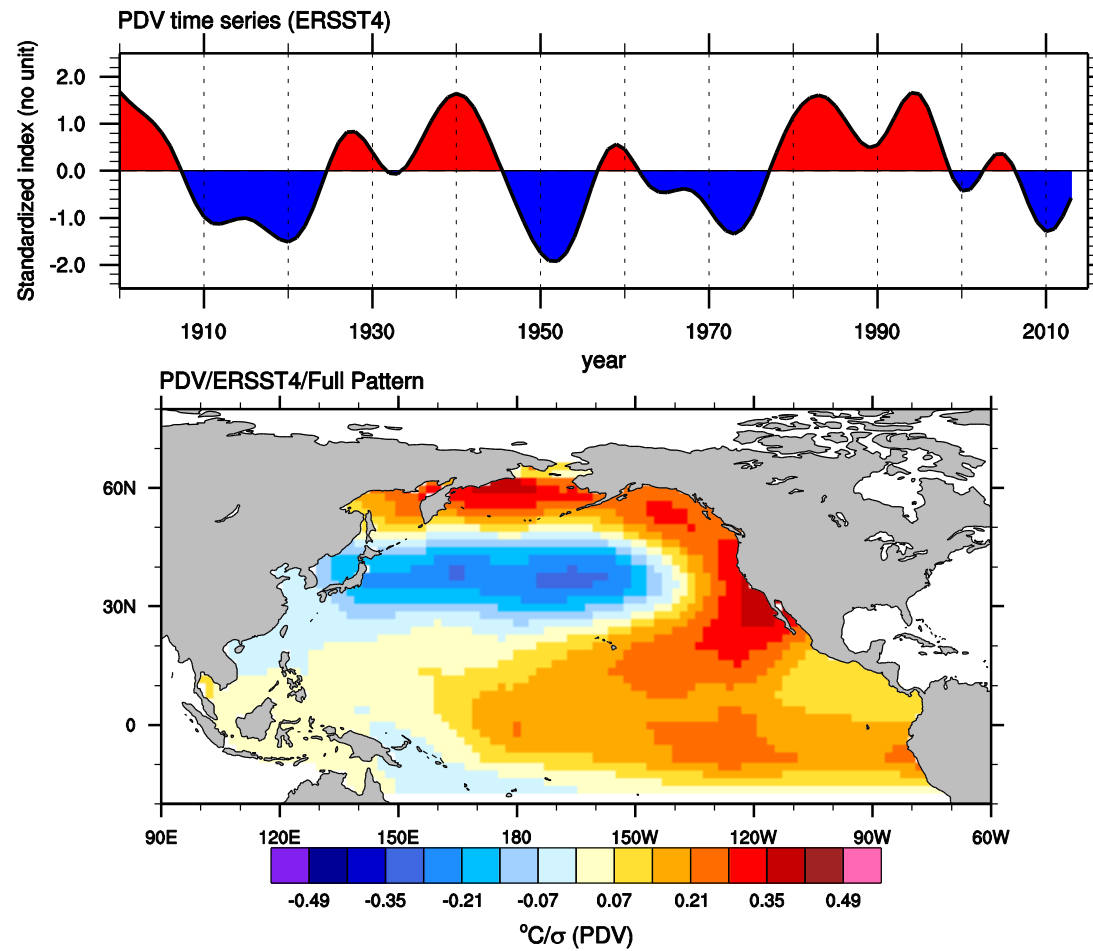


# C:Response to AMV+/AMV-

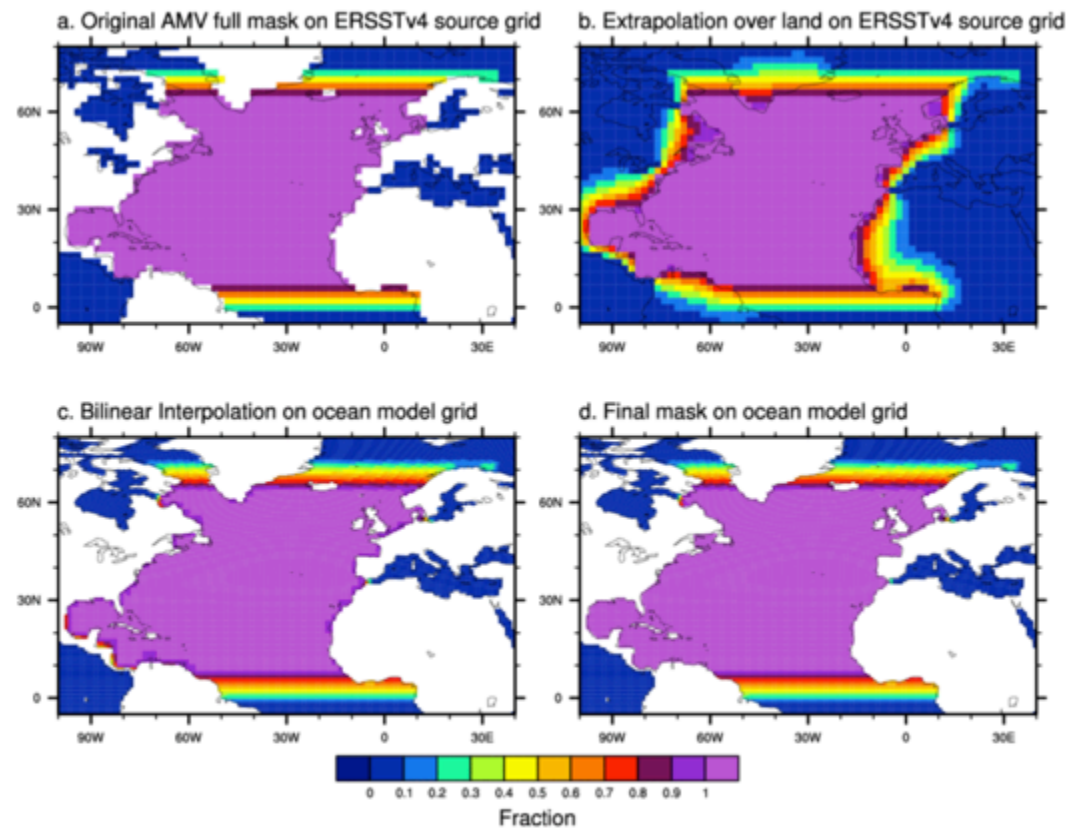


# C: Response to PDV+/PDV-

**DCPP/C PDV pattern (ERSST4)**

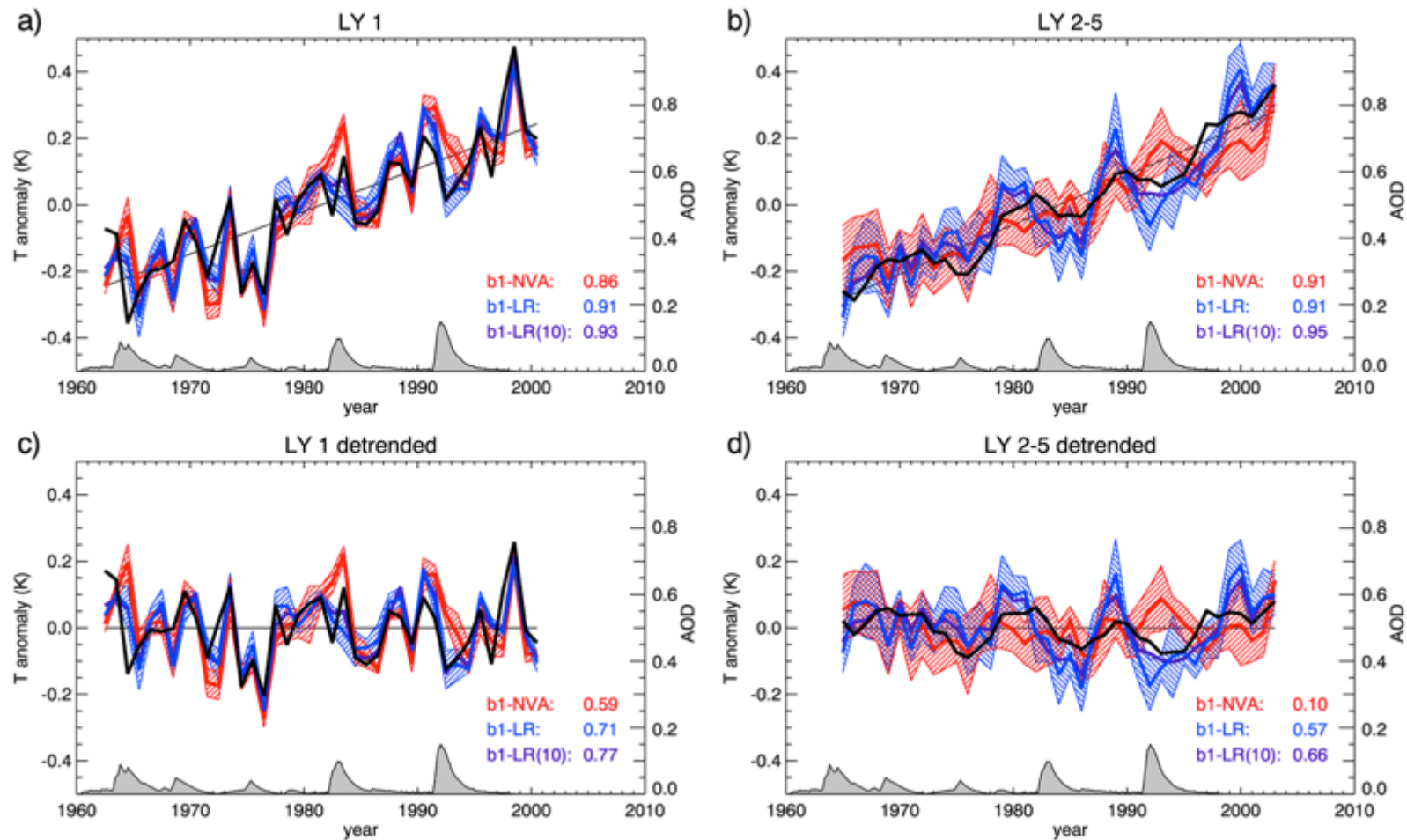


# C: Pacemaker



**Figure 1:** a. Original Atl (=AMV<sub>Full</sub>) 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.

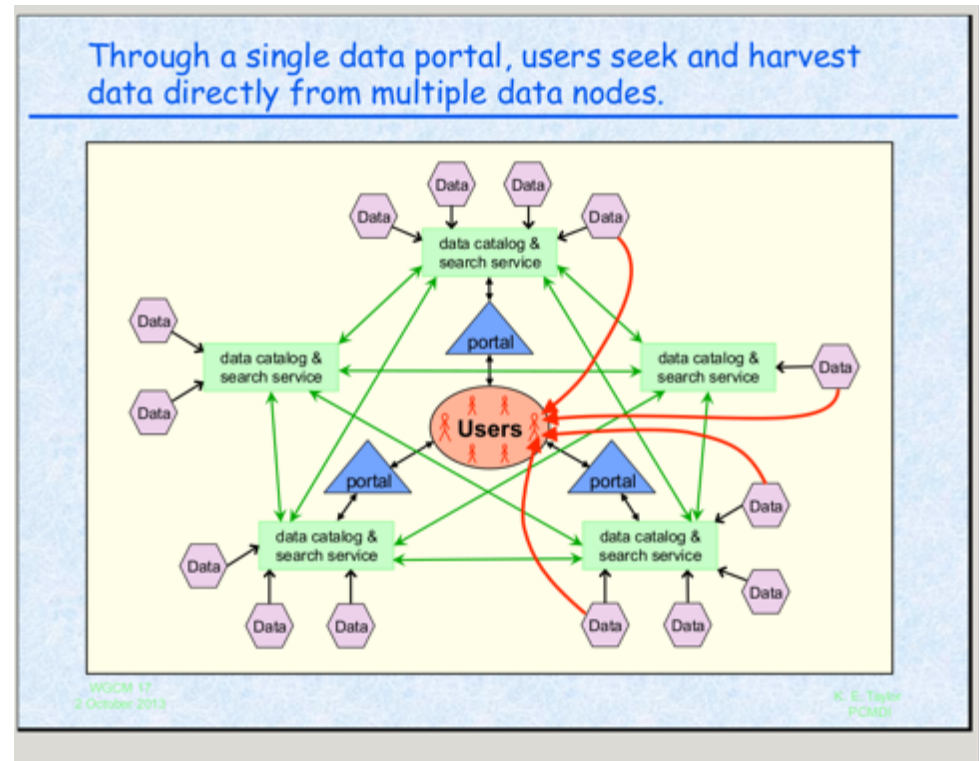
# C: Volcanic effects on prediction



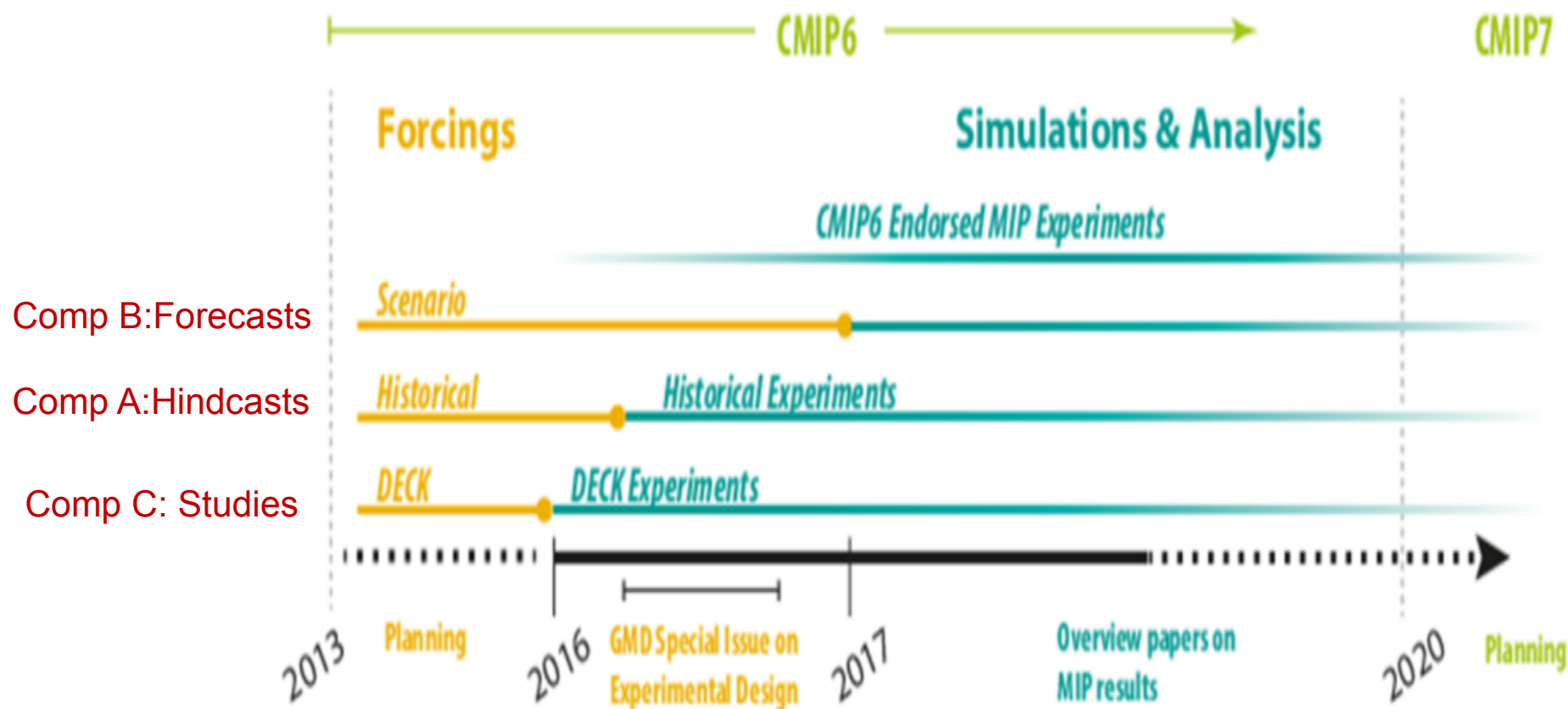


# Data aspects

- Experiment names (i.e. in filenames)
- Retained variables and priorities
- Earth System Grid (ESG) data approach



# CMIP Panel's timeline and the DCPP



IPCC-ready publications

- submit Jan 2020
- accepted Oct 2020

# Where are we?

- DCP 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
- DCP 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 DCP 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