DCPP
Progress, achievements and plans

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With thanks to Wolfgang Müller

Overview

- DCPP – what is it, and what is the status of experiments

- Science highlights from DCPP-A and DCPP-C

- Future plans for DCPP, including links to WCRP strategy and implementation

# The need for decadal climate predictions

- Over the upcoming decade we want to understand and predict:
  - How regional climates may change
  - How underlying risk changes

- Near-term predictions needed to support
  - Global Framework for Climate services
  - UN sustainable Development Goals
  - Sendai Framework for disaster Risk reduction
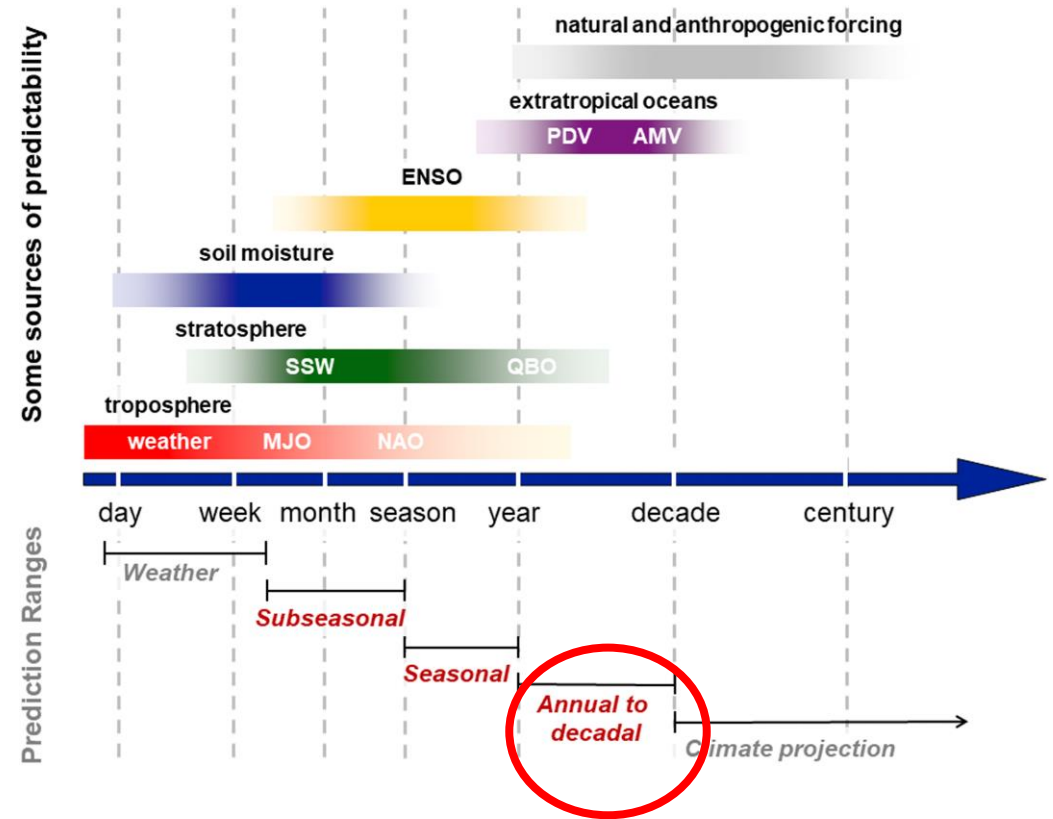
Merryfield et al, 2010, BAMS

DCPP CMIP6 experiments and progress

- DCPP is a CMIP6 endorsed MIP split into three "components"

- **DCPP-A:** co-ordinated multi-model hindcasts
  - Baseline experiments for assessing skill and mechanisms

- ***DCPP-B: real-time quasi-operational predictions***
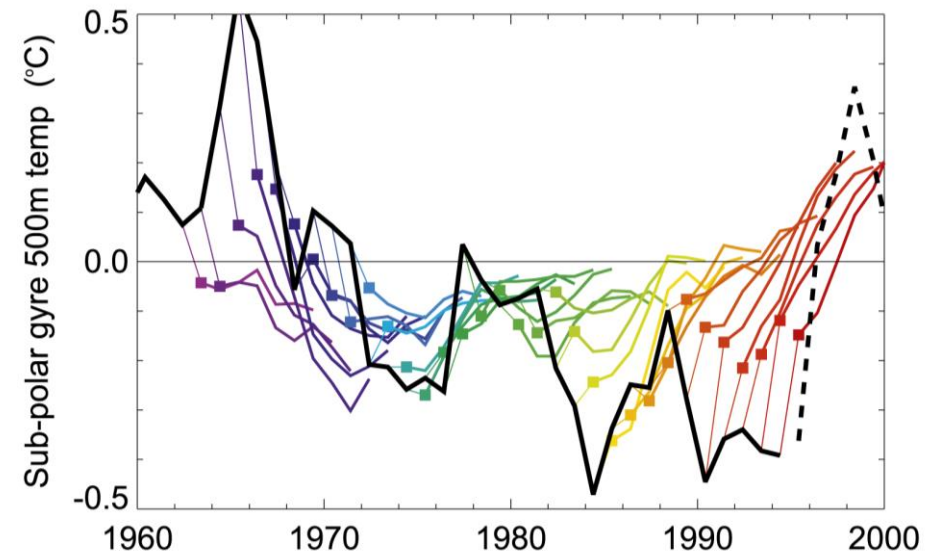
| CMIP6 experiments	Number of models (currently)
DCPP-A	
hindcasts from 1960-2016	10
DCPP-B	
predictions initialised every year	1

DCPP-C: Hypothesis testing and process exploring experiments

- Hiatus+
  - Idealised AMV and IPV experiments
  - Atlantic and Pacific Pace-maker experiments

- Volcano
  - Repeated hindcasts with volcanoes removed (i.e Pinatubo)

- Atlantic gyre experiments
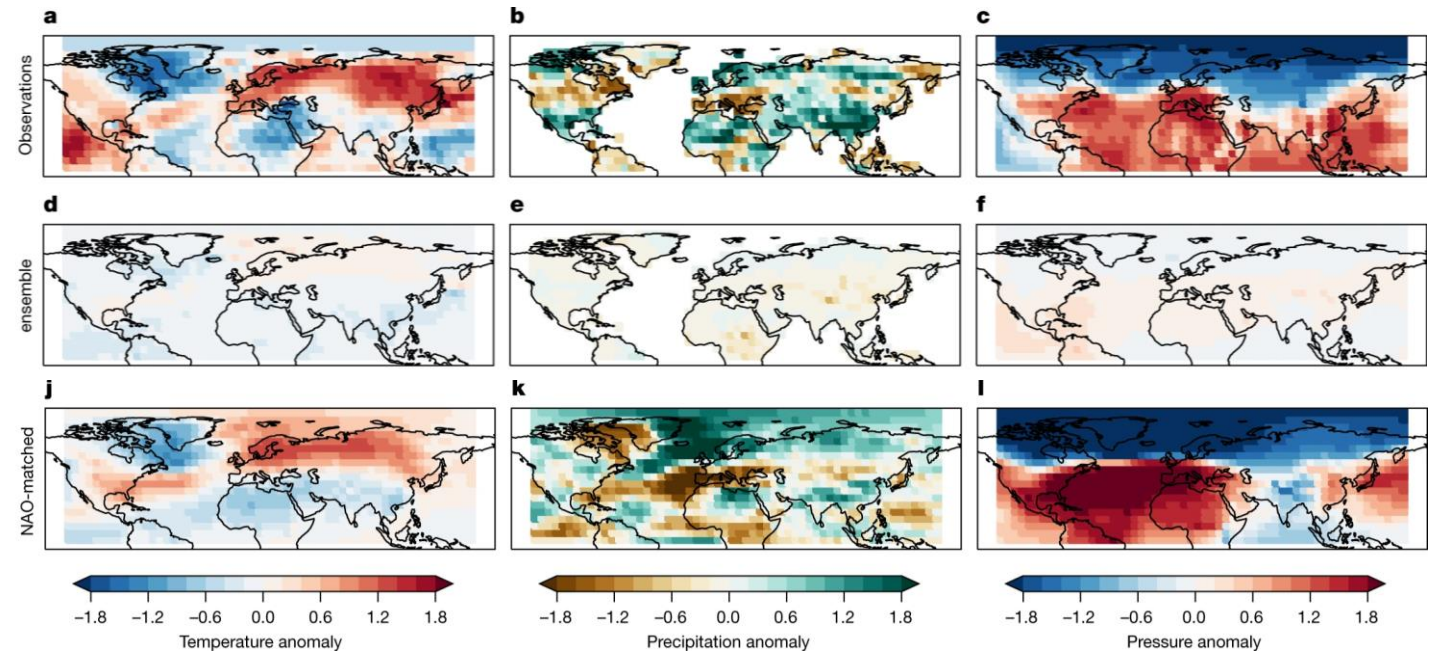 - Initialise Atlantic subpolar gyre from climatology in 1990s

Boer et al, 2016, GMD
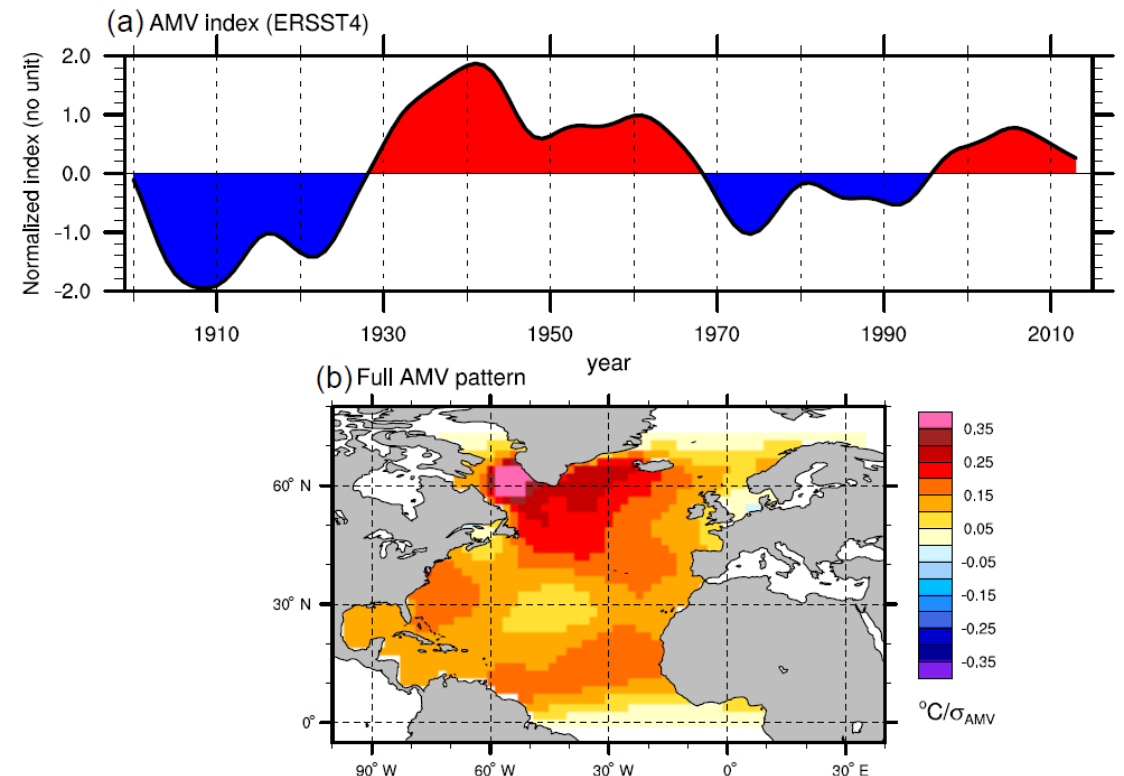
DCPP-A: North Atlantic Climate more predictable than models imply

Predictions of winter NAO for 2-9 year lead

ACC = 0.79 (P = 0.01), RPC = 11.0

Variance-adjusted and lagged

— Observations
— Model
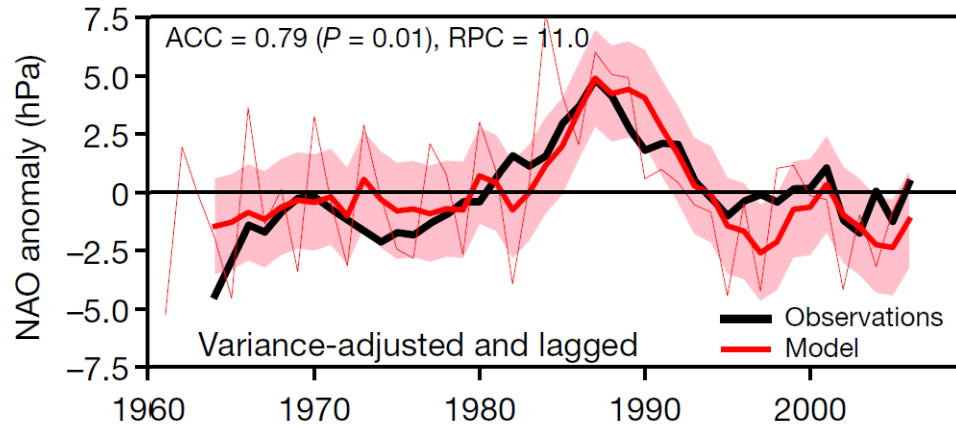
Smith et al, 2020, Nature

Predictions of extreme NAO+ period (1986-1997)

Temperature anomaly

Precipitation anomaly

Pressure anomaly

- Significant skill in 2-9 year NAO found in unprecedently large ensemble using DCPP predictions from CMIP5 and CMIP6
- Calibration of output can be used to provide useful predictions

Recent advances in predicting biogeochemistry

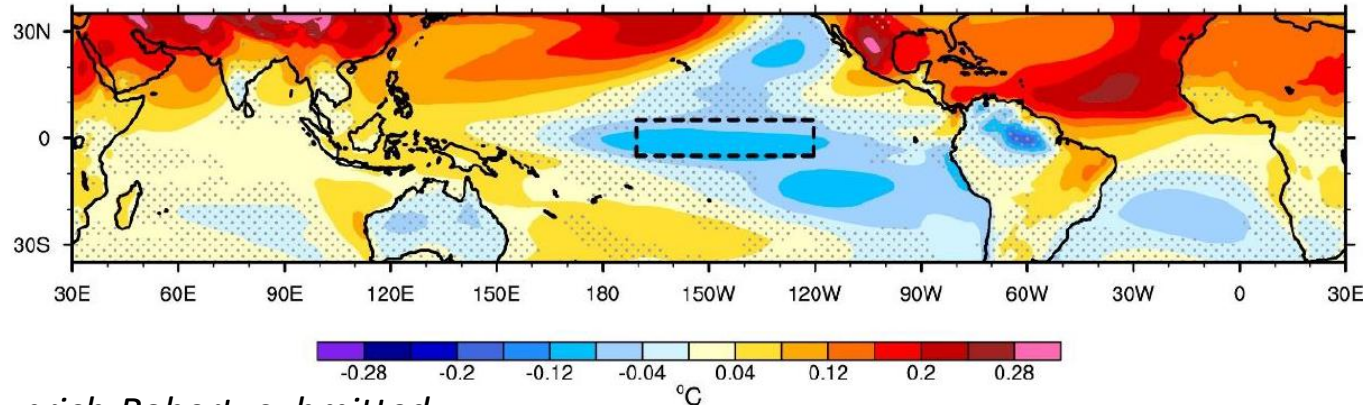A Air-sea CO_2 flux

Ilyina et al, submitted
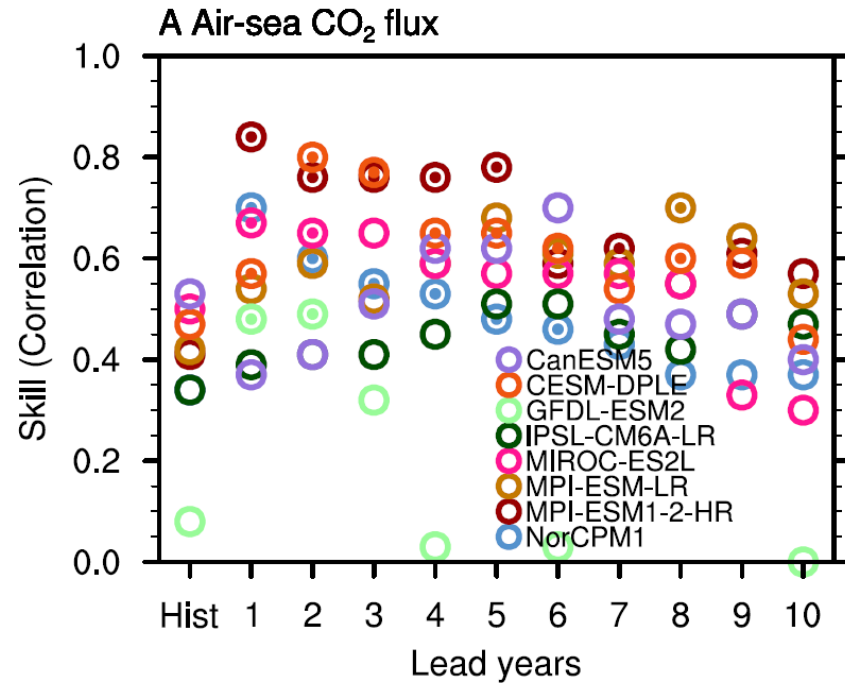
- Growing understanding of skill (or potential skill) in:
  - Air-sea CO2 flux
  - Ocean acidification (Brady et al, 2020)
  - Net primary productivity (Krumhardt et al, 2020)
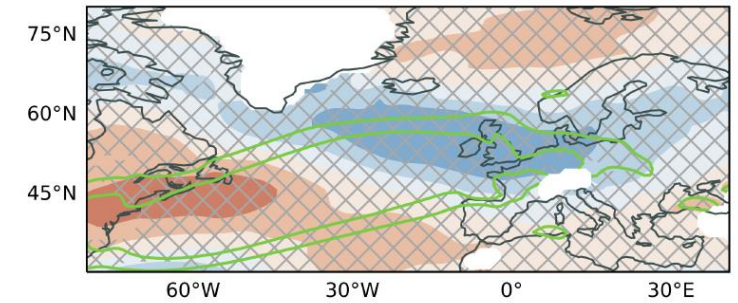
DCPP-C: Impact of AMV on global climate

a) T2m AMV+ - AMV- Multi-Model response - DJFM

Ruprich-Robert, submitted

a) Multi-model mean

b) Subset 5 mean

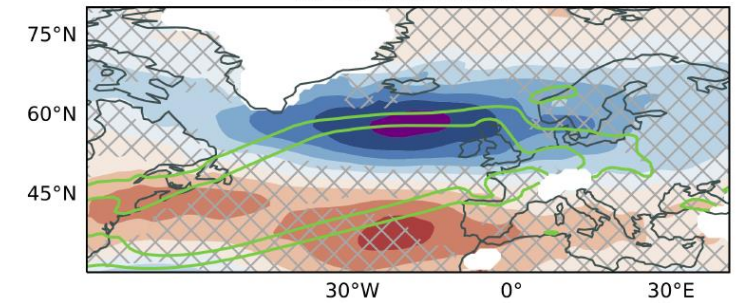c) Subset 2 mean

- DCPP-C idealised AMV experimental protocol has generated a range of studies, including on
  - Impact on the Pacific Decadal Variability
  - Atlantic atmospheric jet in winter
  - Global monsoons (Monerie et al, 2019)
  - Other studies in progress, including on hurricanes and impact on Europe
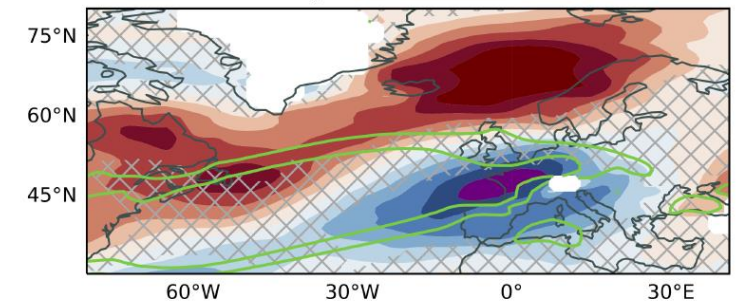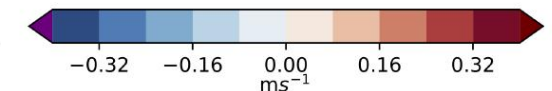
Ruggieri et al, 2020, JClim

Future plans for DCPP

- DCPP's primary mission is to define coordinated, multi-model experiments that advance decadal prediction science.

- But there is more room for coordination on multi-model analysis and forward-looking new science opportunities.
    - DCPP could develop new protocols for multi-model experiments
    - E.g. COVID impact on near-term climate, geoengineering, prediction strategies (initialisation, 30-year predictions etc)?

DCPP, WCRP strategy, and lighthouse activities

- **DCPP helps to address all four of WCRP's main objectives**
  - Fundamental understanding and predictability are central to DCPP, model development is a key opportunity, providing a bridge to society (through partners).
  - Signal-to-noise issues are key example of how predictions provide something complementary to traditional climate modelling approaches.
  - *For DCPP, **International collaboration is key** to develop new understanding – no one centre can produce 600+ member predictions*

- Potentially strong overlaps with Lighthouse activities
  - Especially 'Explaining and Predicting Earth System Change' but also 'My Climate Risk'
  - Co-ordination of underpinning datasets (i.e. hindcasts) **and** co-ordinated hypothesis testing experiments.