Arctic Predictability and Prediction On Seasonal to Inter-annual Timescales (APPOSITE)

The main scientific goals of APPOSITE are to quantify the predictability of the Arctic environment on seasonal to inter-annual timescales, and provide recommendations on required developments in operational prediction systems. The key questions to address are:

A. What are the most important physical processes that determine the predictability of Arctic climate, including Arctic sea-ice, on seasonal to inter-annual timescales?
B. What is the relative importance of ocean and sea-ice initial conditions, and of sea-ice thickness versus sea-ice cover?
C. How does predictability vary seasonally and with the state of the climate system?
D. To what extent, and through what mechanisms, does the Arctic influence the predictability of the wider climate system?
E. To what extent do different GCMs capture similar processes and levels of Arctic predictability?

APPOSITE draft experimental design for an international multi-model comparison
Version 1.3 (6th Feb 2012)

The focus is on quantifying and understanding the *perfect model* dynamical predictability of the Arctic climate system, i.e. many simulations will be started from very similar initial conditions to examine how and why they subsequently diverge.

These experiments will be performed in a range of global coupled climate models with stable 'present-day' radiative forcings, e.g. in a present-day control. Some modelling groups may need to produce an equivalent present day simulation?

Core Design:

Design	Minimum set	Full set	Extended set	Priority for extension
Ensemble members	8	16	16→48	High
Run length (years)	2	3	3→5	Low
Number of start years	8	8	8→16+	Medium
Start dates per year	1st July	1st Jan, July	1st Jan, July, May, Nov	High
Total integrations (years)	128	768	1536+	

Rationale:

The focus is on seasonal to inter-annual timescales, rather than decadal. This allows more ensemble members to explore the spread in predictions in more detail.

Choice of start dates:

The specific start years will be chosen to systematically sample different initial states (high and low), based on, (i) ice thickness, (ii) ice extent, and (iii) Atlantic heat transport (AHT) into the Arctic, for each model system (see example on right).

HIGH ICE, LOW AHT	LOW ICE, LOW AHT
HIGH ICE, HIGH AHT	LOW ICE, HIGH AHT

Multiple start dates per year will test the seasonal dependence of predictability. The start months have been chosen from Blanchard-Wrigglesworth et al. (2011)[1], who suggest there is a barrier to predictability for start dates before June and January. The 'Extended set' will allow this barrier to be explored in more detail, and fits with the Ice Historical Forecast Project (Ice-HFP), which examined operational seasonal Arctic predictions, and used 1st May, Nov as start dates to fit with operational seasonal prediction schedules.

Aim: to determine the important factors of the initial climate state for predictability

[1] doi: 10.1175/2010JCLI3775.1

Ensemble generation:

Initial ensembles will be run with random noise perturbations. Ideally this will be done by adding a small amount of white noise to the SSTs. Other methods, e.g. by using subsequent days in the control, may have issues with the large seasonal cycle in the Arctic when considering larger ensembles.

Data:

To be collected centrally by NCAS Reading in netcdf format. Discussion needed on necessary variables, time resolution etc. Anything 'non-standard'?

All modelling groups within APPOSITE will have open access to the multi-model data after they have submitted their own**.** The multi-model data should be made available to the wider community after 1 year.

APPOSITE Team

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