

Initial performance of the Norwegian Climate Prediction model in the Atlantic



Noel Keenlyside (noel.keenlyside@uib.no), Mao-Lin Shen, Francois Counillon, Ingo Bethke, Shunya Koseki, Teferi Demissie, and Thomas Toniazzo

Bjerknes Centre
for Climate Research



1. Introduction

The Norwegian Climate Prediction Model (NorCPM) has been successfully tested in perfect model context, assimilating only SST data¹: SST could be predicted in the North Atlantic on seasonal timescales, and the Atlantic Meridional Overturning Circulation and heat content in the Nordic Seas could be predicted on decadal timescales.

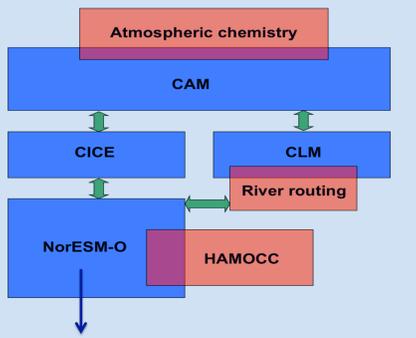
Here we introduce initial results for predictions initialised using only observed SST, with focus on the Atlantic. The strength of the North Atlantic subpolar gyre is well constrained by the analysis, and there appears to be skill in predicting the warming of the gyre in the mid-90's. Despite large model biases (see poster by Shunya Koseki), skill on seasonal timescales is found in the tropical Atlantic. Forecast drift analysis may be useful to understand model biases in this region.

1. Counillon, F., I. Bethke, N. Keenlyside, M. Bentsen, L. Bertino, and F. Zheng, 2014: Seasonal-decadal prediction with the EnKF and NorESM: a twin experiment. Tellus A, 66, 21074

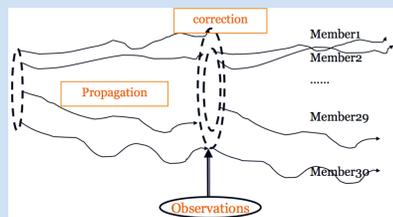
2. NorCPM

Norwegian Earth System Model + Ensemble Kalman Filter Data Assimilation

Based on the Community Earth System Model version 1 (CESM1)



- Sequential Monte-Carlo method with **propagation** and **correction** step
- Forecast = Ensemble mean
- Forecast uncertainty = ensemble standard deviation
- Ensemble covariance used to update the **full water column** from the observations (e.g., SST)
- More information extracted from sparse observations

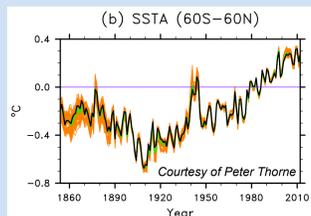


NorESM-O is an isopycnic coordinate ocean model with a bulk mixed layer on top, and is based on MICOM

3. Decadal Prediction

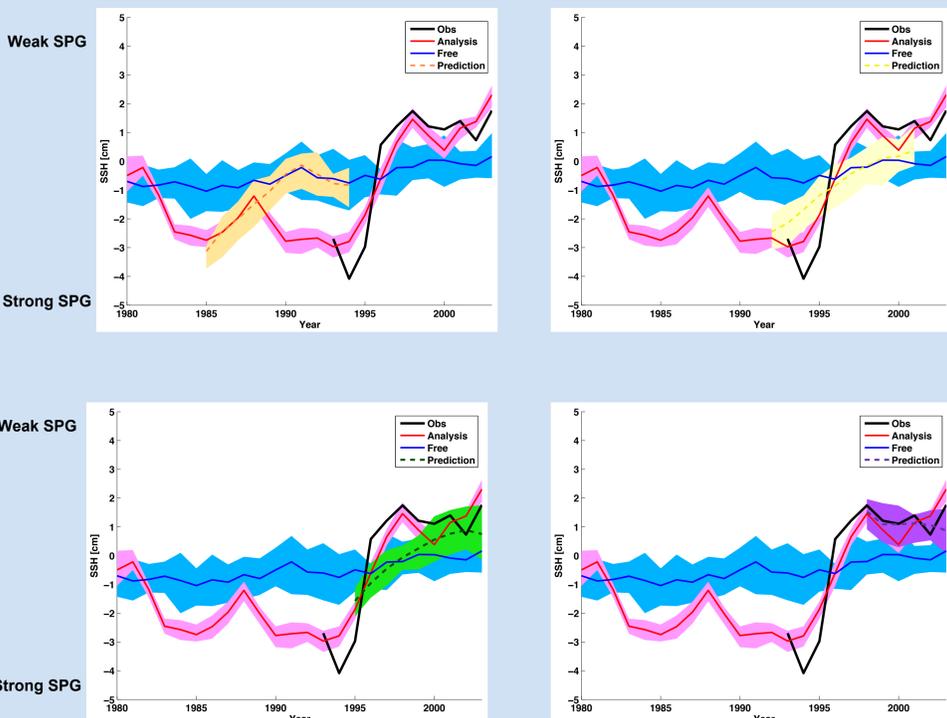
Preliminary experiments using observed SST (anomaly) data

- Period: 1980 to 2005
- Assim. data: HadISST2
- Ens. size: 30 member
- NorESM – ME version (CMIP5)
 - atmosphere: 1.9°x2.5°, 26 levels
 - ocean: 1°, 53 levels
- Four prediction experiments for subpolar gyre shift



Observed error varies in space & time
Assimilate ensemble mean
Ensemble spread = obs error

Subpolar Gyre Index is box-averaged SSH [60W-15W,48N-65N]

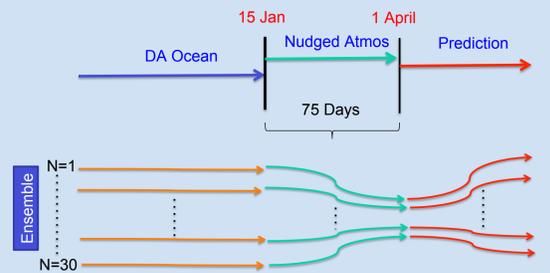


4. Seasonal Prediction

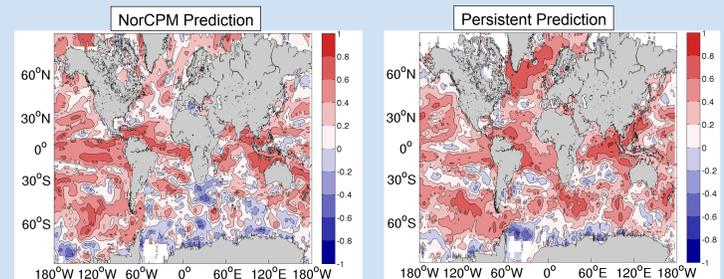
Preliminary experiments using observed SST (full field) data

- Period: 1980 to 2007
- Assim. data: HadISST2
- Atmos nudging data: ERA interim
- Ens. size: 30 member
- NorESM – Xdeg version
 - atmosphere: 1.9°x2.5°, 26 levels
 - ocean: MICOM on 1°, 53 levels
- 27 prediction experiments

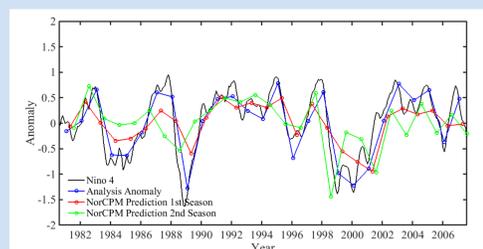
Experiment Design: Case Study



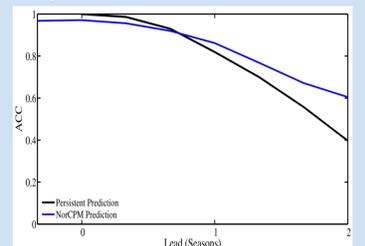
Anomaly Correlation: SST, April start, JAS



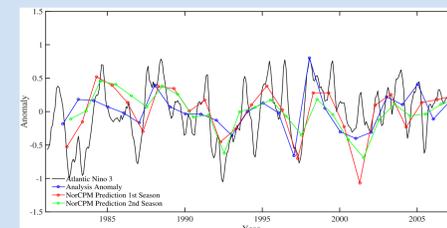
Nino 4 SST



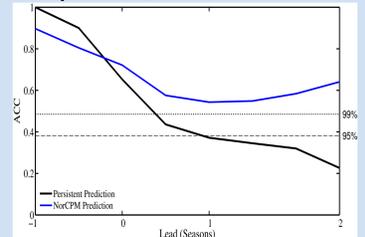
Anomaly Correlation: Nino 4 SST April start, season means



Atlantic-3 SST

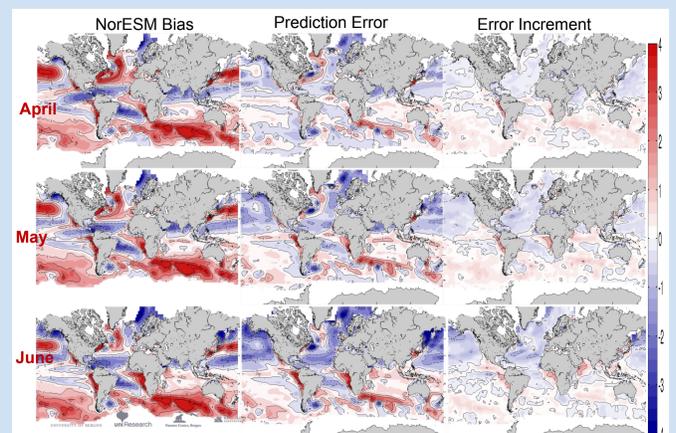


Anomaly Correlation: Atlantic-3 SST April start, season means



5. Forecast drift analysis

SST bias in control simulation and drift in April initiated forecasts



6. Future work in the context of PREFACE

- Full field 3D ocean hydrographic initialised seasonal forecasts (1980-present)
- Forecast drift analysis and coordinated partial coupled prediction experiments
- Anomaly SST initialised decadal predictions (1950-present)
- Anomaly coupled prediction experiments

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