

Exploring the potential for a North West European shelf seas ecosystem seasonal forecast

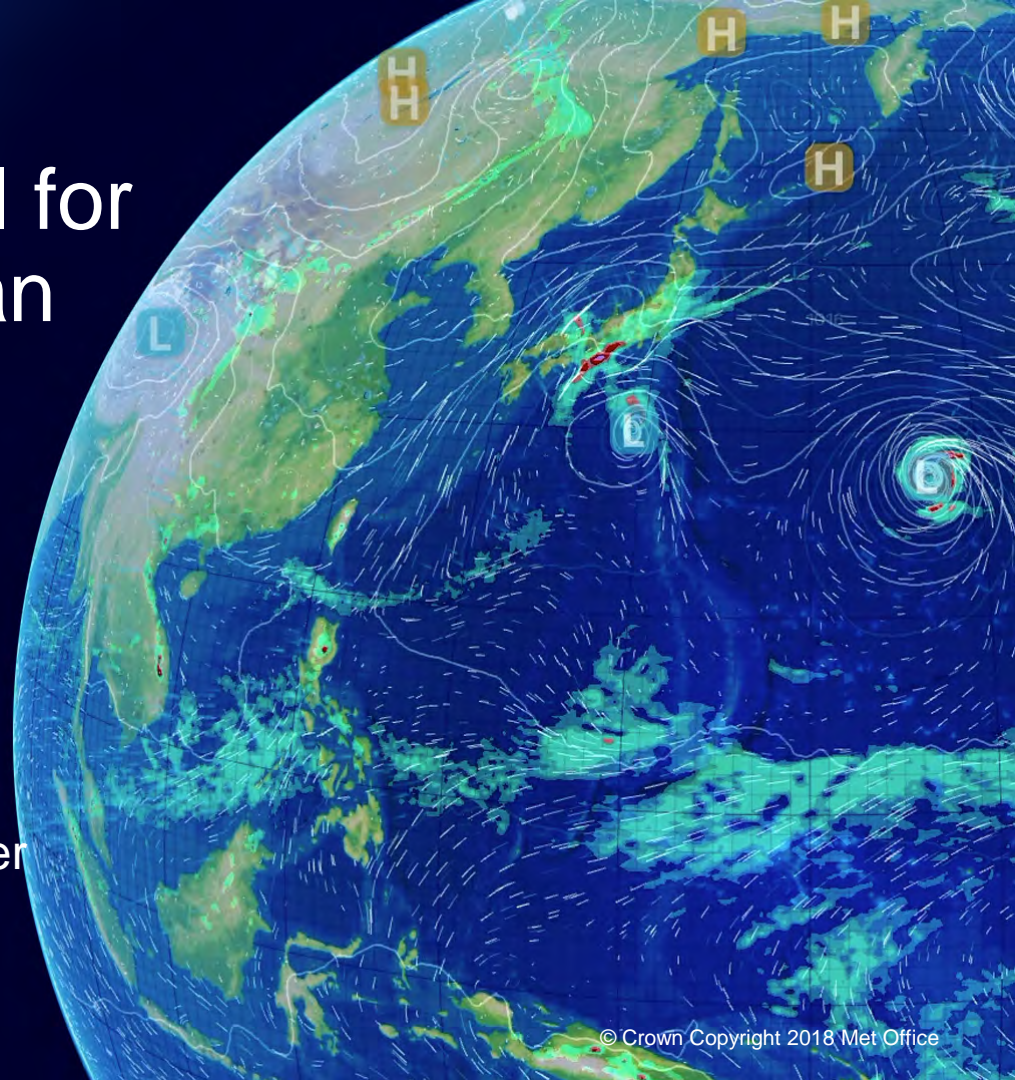
Jonathan Tinker

Richard Wood, Adam Scaife, Matt Palmer

jonathan.tinker@metoffice.gov.uk

Met Office Hadley Centre UK

www.metoffice.gov.uk



Introduction

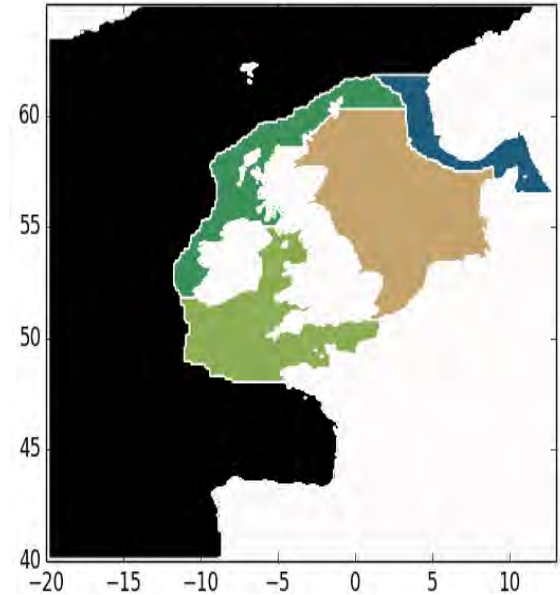
NW European Shelf Seas are broad continental shelf seas;
seasonally stratify with large tides

so typically poorly modelled in global ocean models

Bounded by a number of (populous) European countries.
Economically, culturally, environmentally important.

5 day operational forecasts; Climate Projections (e.g. Tinker et al. 2016)
but user interest in seasonal forecasts for NWS

Is there seasonal predictability for the NWS?

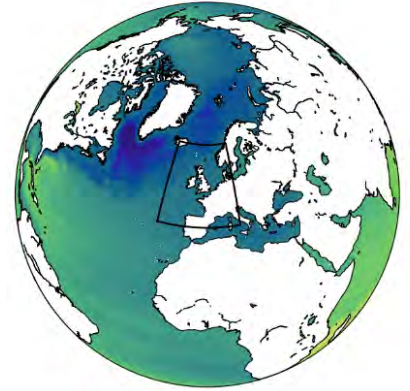


Global Seasonal Forecasting System: GloSea5

Based on a coupled climate model HadGEM3, 60km atmos, 0.25° Ocean

Full field initialisation, Assimilates LOTS of obs.

Skilful prediction of DJF NAO

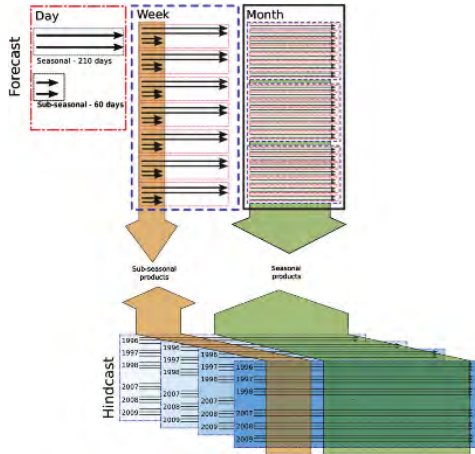
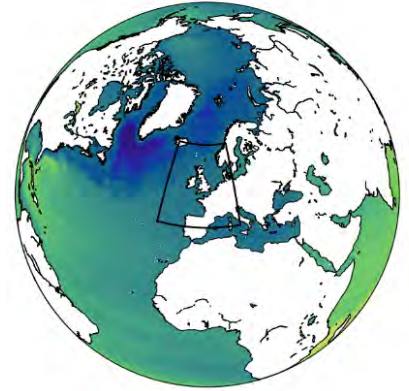


Global Seasonal Forecasting System: GloSea5

Based on a coupled climate model HadGEM3, 60km atmos, 0.25° Ocean

Full field initialisation, Assimilates LOTS of obs.

Skilful prediction of DJF NAO



GloSea5 runs a (lagged) ensemble of 6 month forecasts every day/week.

Removing model drift requires a forecast climatology

A set of hind casts, to match the start dates of the forecast, for every year between 1993 and the present day.

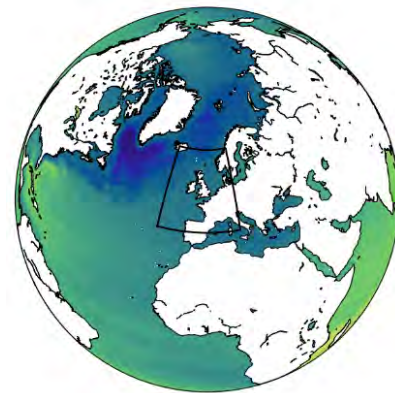
Constant updating the hindcast clim allows regular updates to GloSea5.

Global Seasonal Forecasting System: GloSea5

Based on a coupled climate model HadGEM3, 60km atmos, 0.25° Ocean

Full field initialisation, Assimilates LOTS of obs.

Skilful prediction of DJF NAO



Shelf Seas Model Nemo Shelf (CO6)

7km horizontal resolution 51 terrain following s-levels, Tides

Not assimilation 1-coupled (forced) with GloSea5

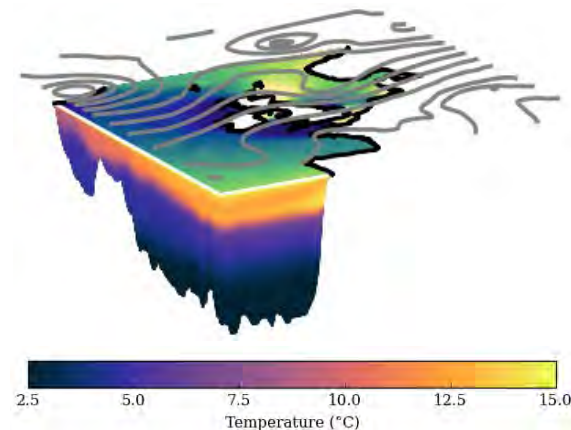
Initialised from CMEMS reanalysis

Reanalysis CMEMS V2 AMM7 reanalysis

NEMO Shelf (CO5) 7km, 51 s-levels, Tides, Assimilates SST,

Driven by ERAI

Evaluated by CMEMS **Considered Truth**



Experimental Design

Can we model the difference between years? Does this compare to the observed differences?

Downscale 2 contrasting case studies

Winter (Nov) 2010/2011 and 2011/2012 (12 member ensemble with 4 start dates)

Spring/Summer (April) 2003 and 2007 (9 member ensemble with 3 start dates)

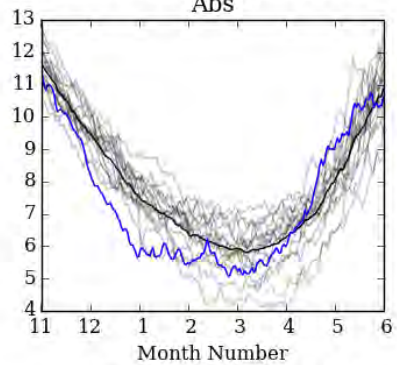
Also:

Reduced winter “hindcast” 1993-2013 - one start date, one member PPE

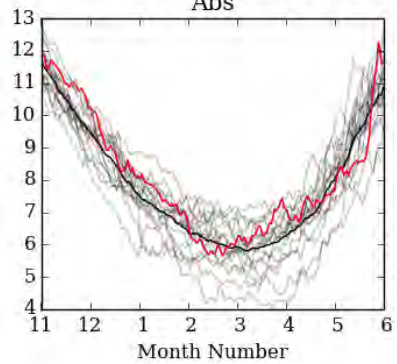
Spring/summer Biogeochemistry with ERSEM

Results

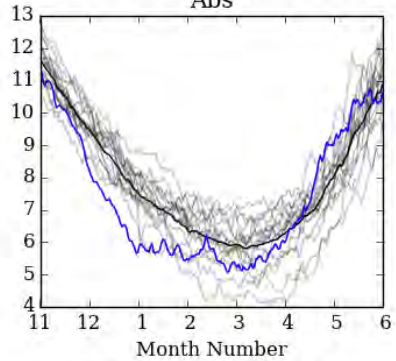
CMEMS Reanalysis 2010
Abs



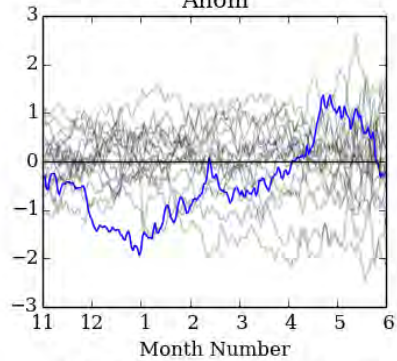
CMEMS Reanalysis 2011
Abs



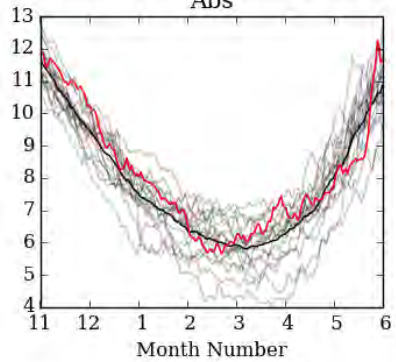
CMEMS Reanalysis 2010
Abs



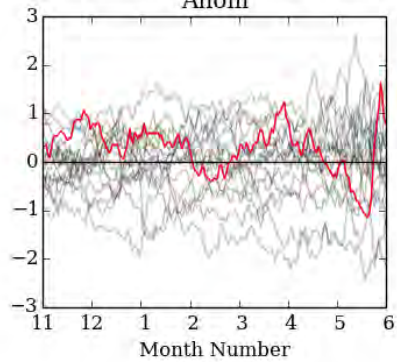
CMEMS Reanalysis 2010
Anom



CMEMS Reanalysis 2011
Abs

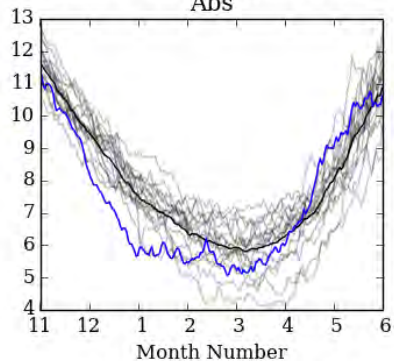


CMEMS Reanalysis 2011
Anom



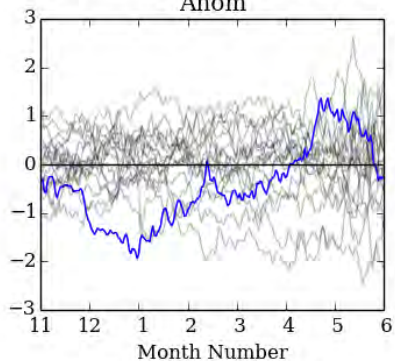
CMEMS Reanalysis 2010

Abs



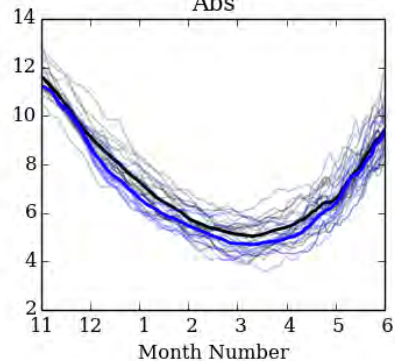
CMEMS Reanalysis 2010

Anom



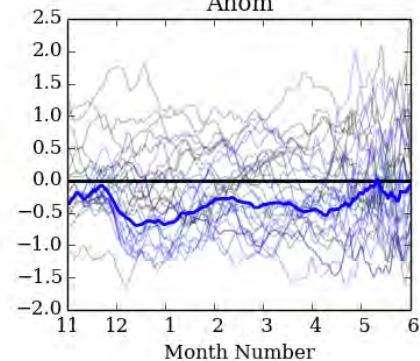
GloSea FC 2010

Abs



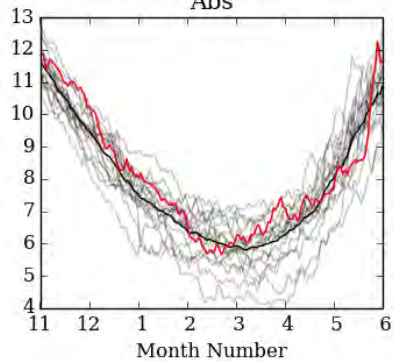
GloSea FC 2010

Anom



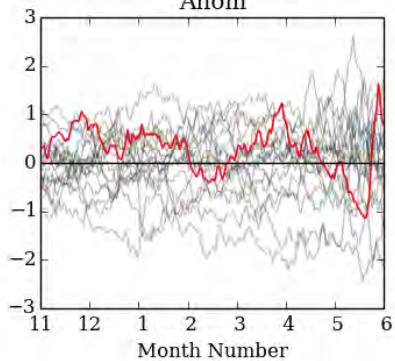
CMEMS Reanalysis 2011

Abs



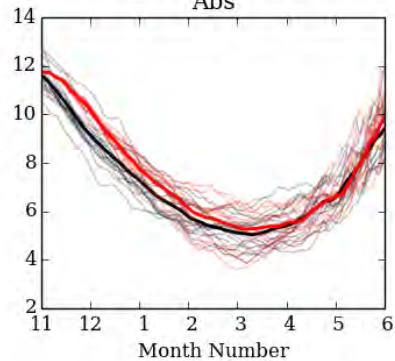
CMEMS Reanalysis 2011

Anom



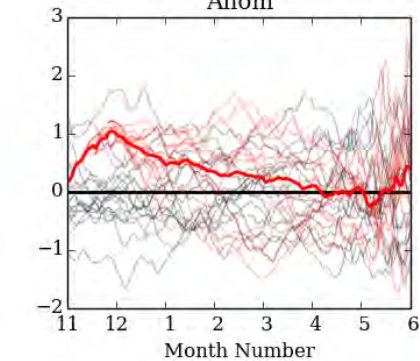
GloSea FC 2011

Abs



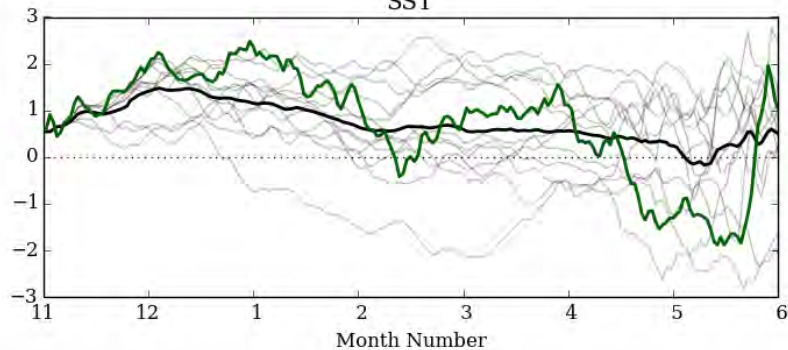
GloSea FC 2011

Anom

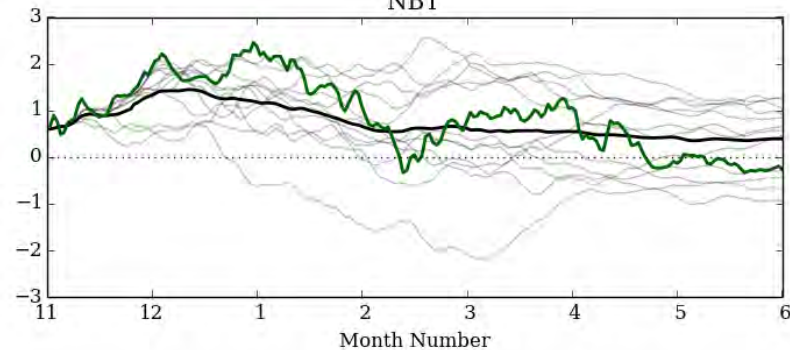


2011-2010 difference region mean time series for North Sea
(CMEMS rean in green)

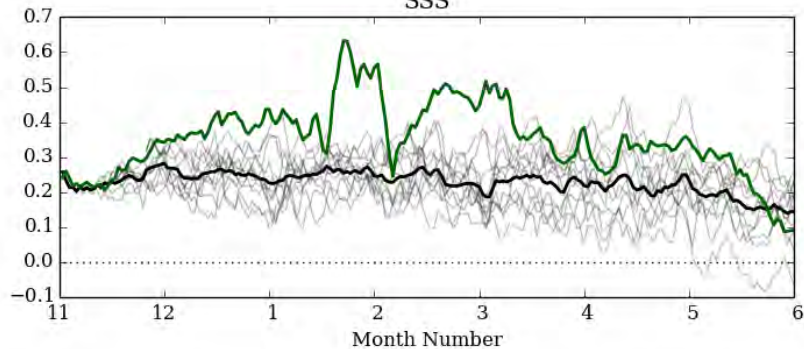
SST



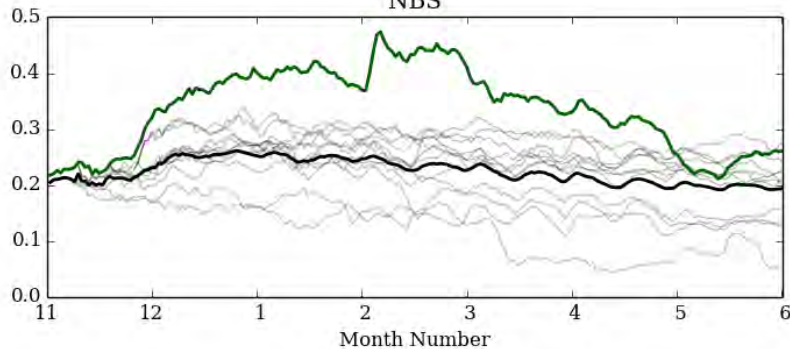
NBT



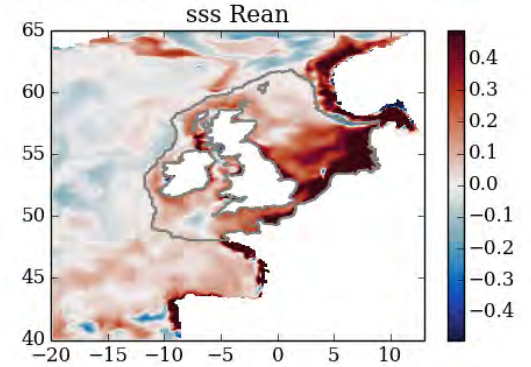
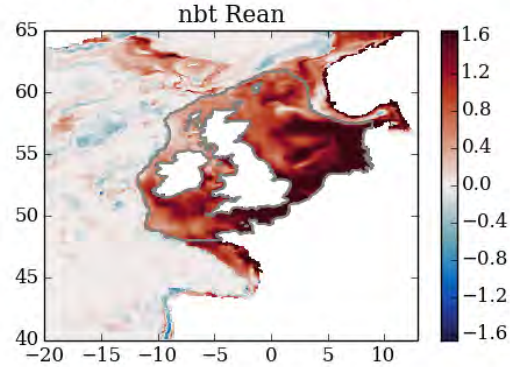
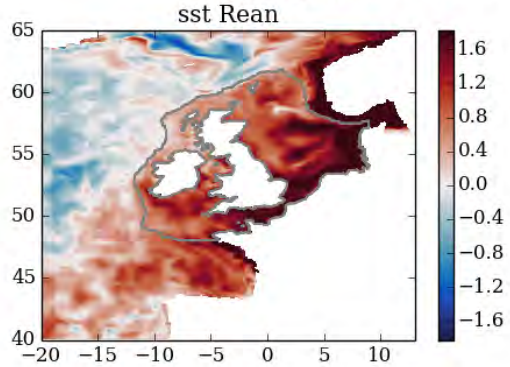
SSS



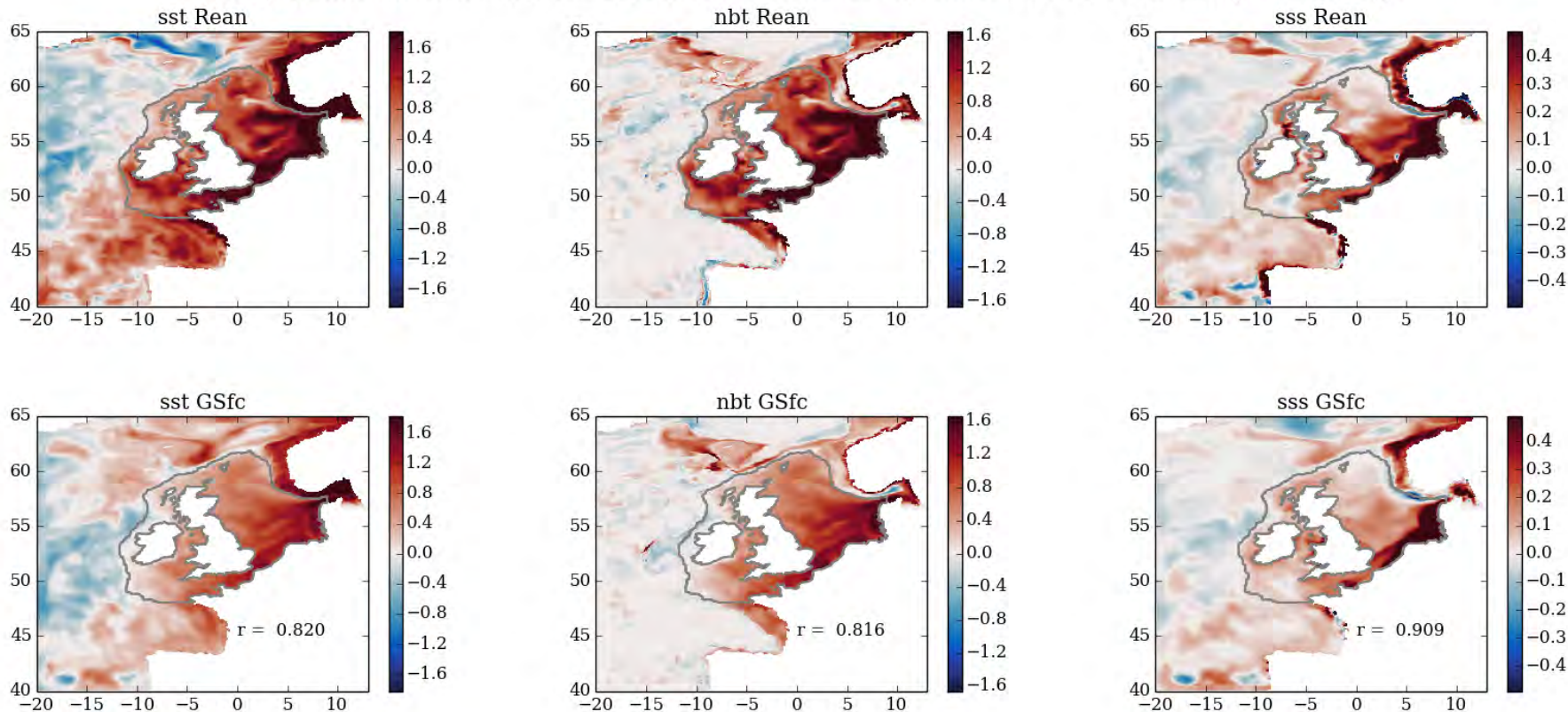
NBS



Comparison of CMEMS Rean and GloSea5 Ens 201111-201011 Anomaly. Per = DJF

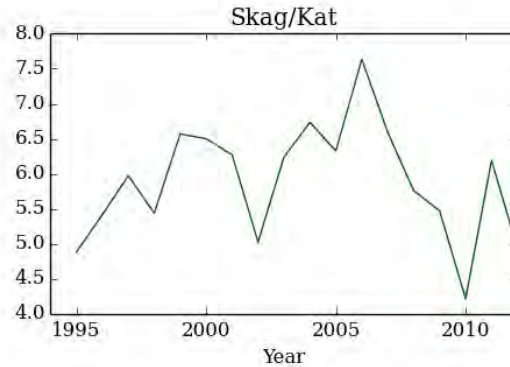
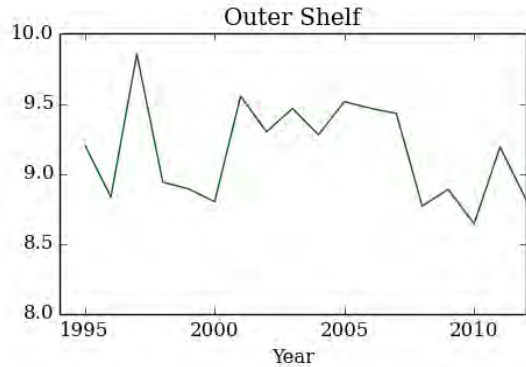
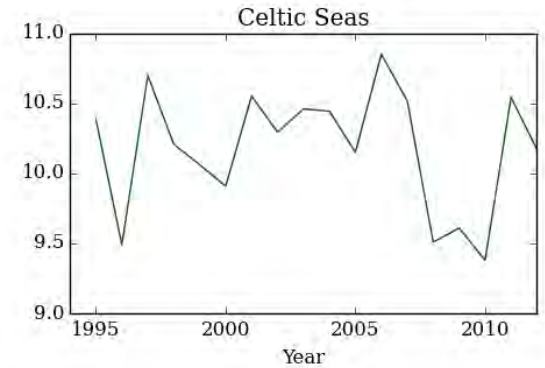
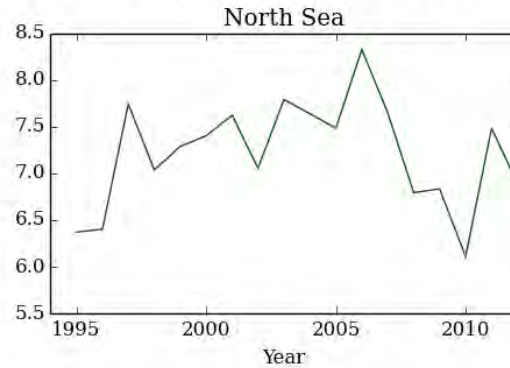
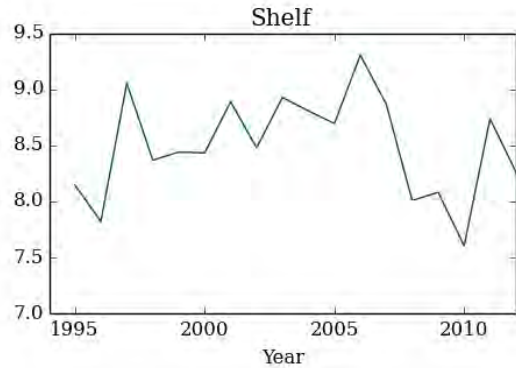


Comparison of CMEMS Rean and GloSea5 Ens 201111-201011 Anomaly. Per = DJF

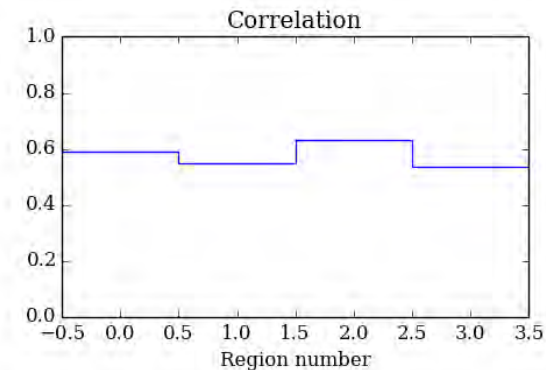
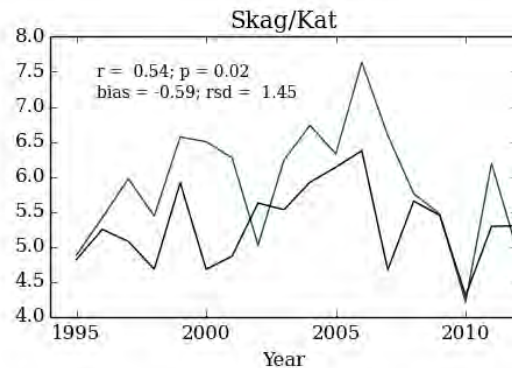
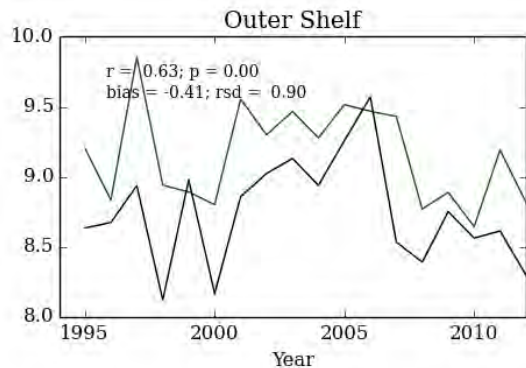
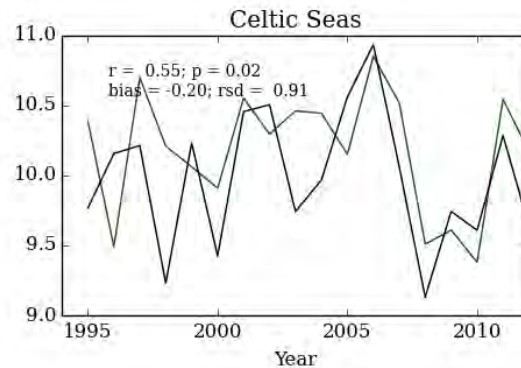
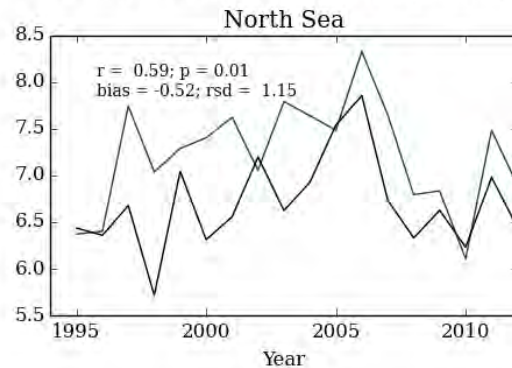
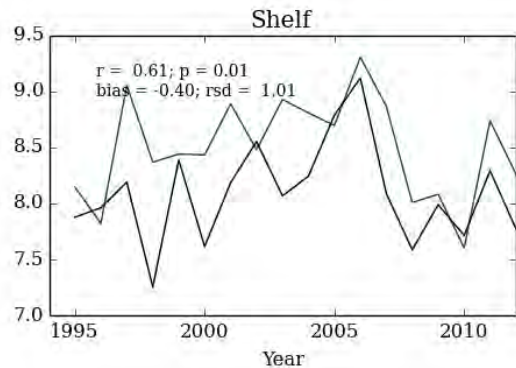


How representative are these exemplars?

SST CMEMS and Gc DJF reanalysis 1995-2012 (GloSea5 k; CMEMS green)

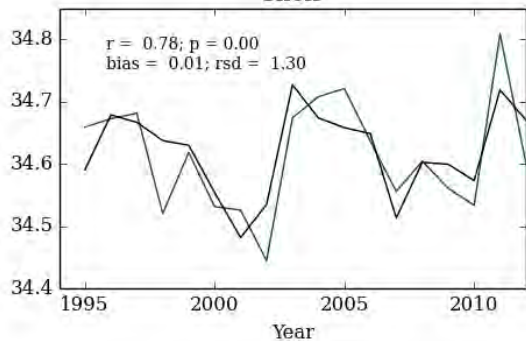


SST CMEMS and Gc DJF reanalysis 1995-2012 (GloSea5 k; CMEMS green)

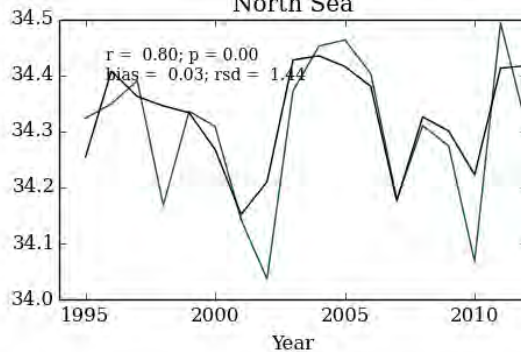


SSS CMEMS and Gc DJF reanalysis 1995-2012 (GloSea5 k; CMEMS green)

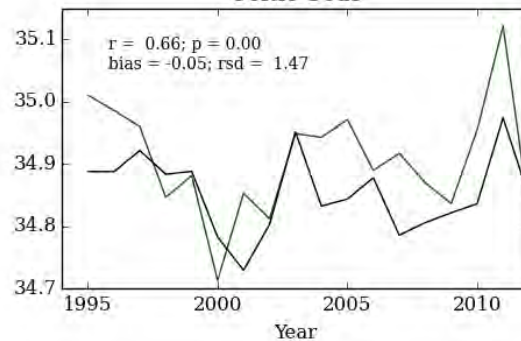
Shelf



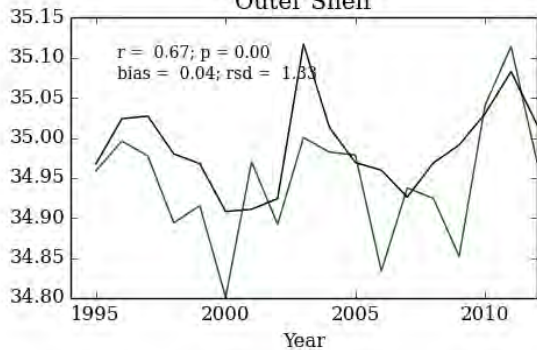
North Sea



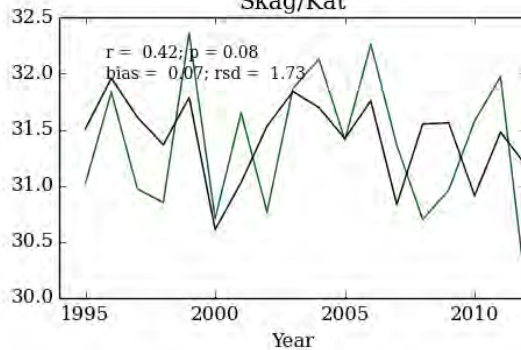
Celtic Seas



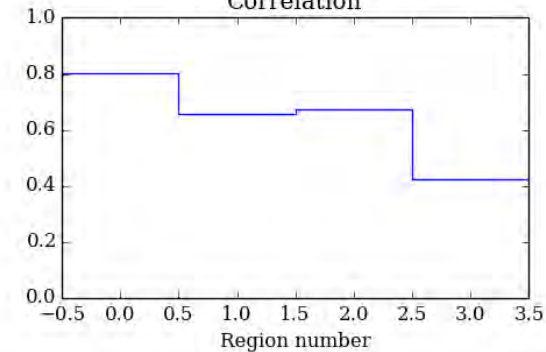
Outer Shelf



Skag/Kat

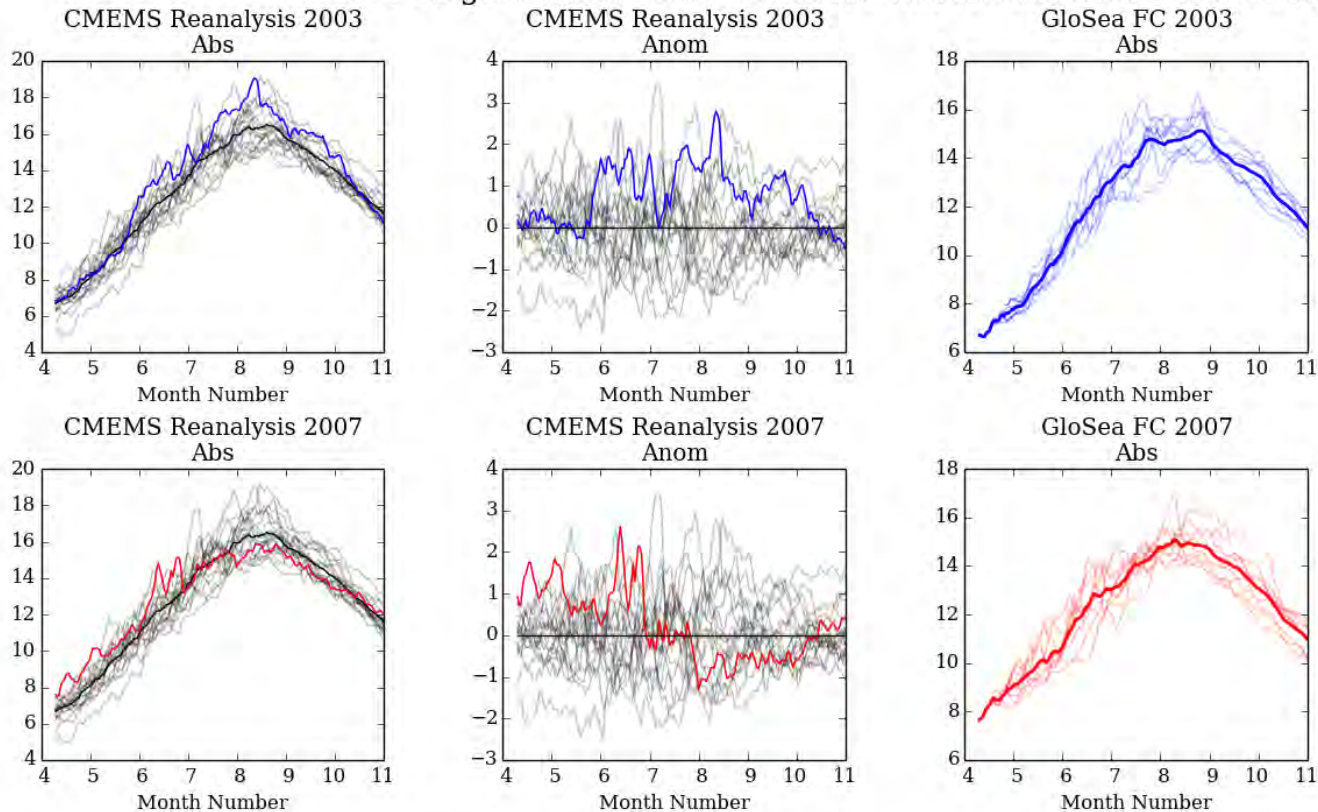


Correlation

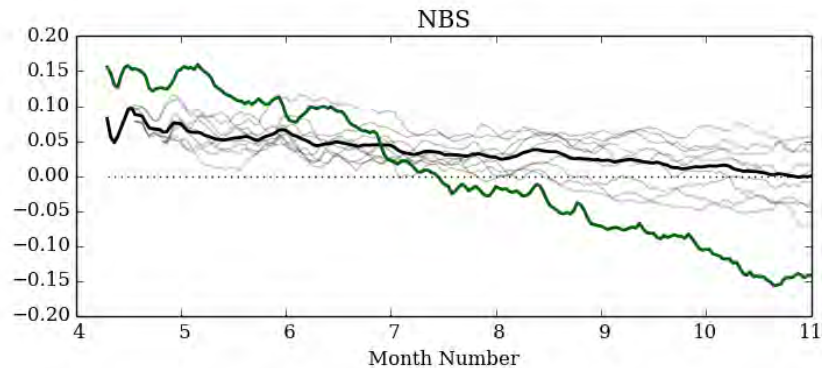
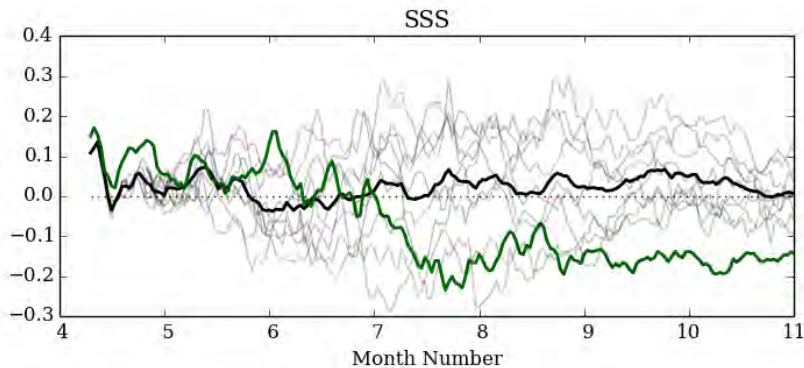
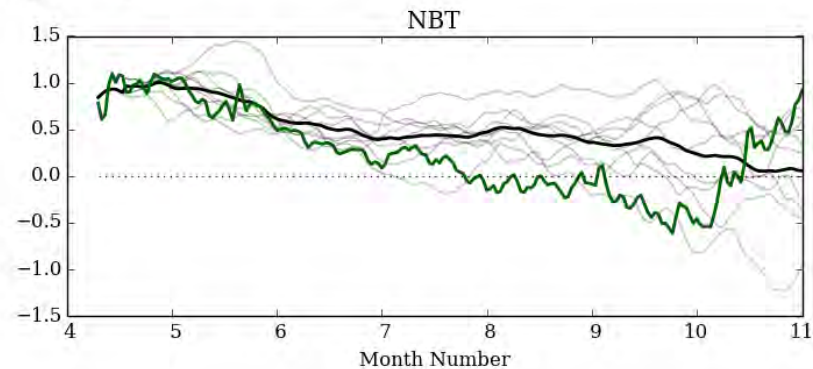
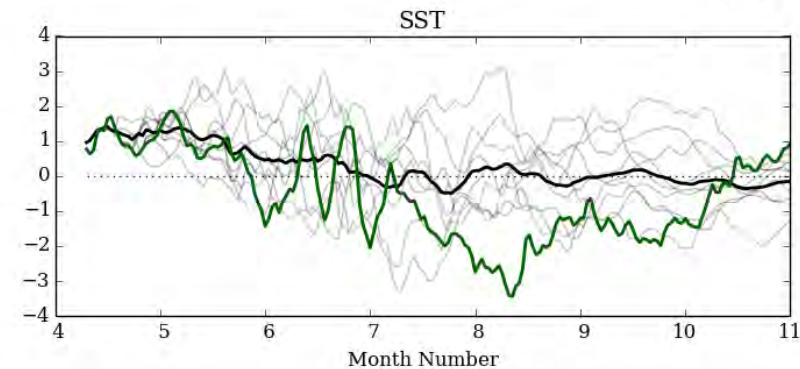


Spring/Summer

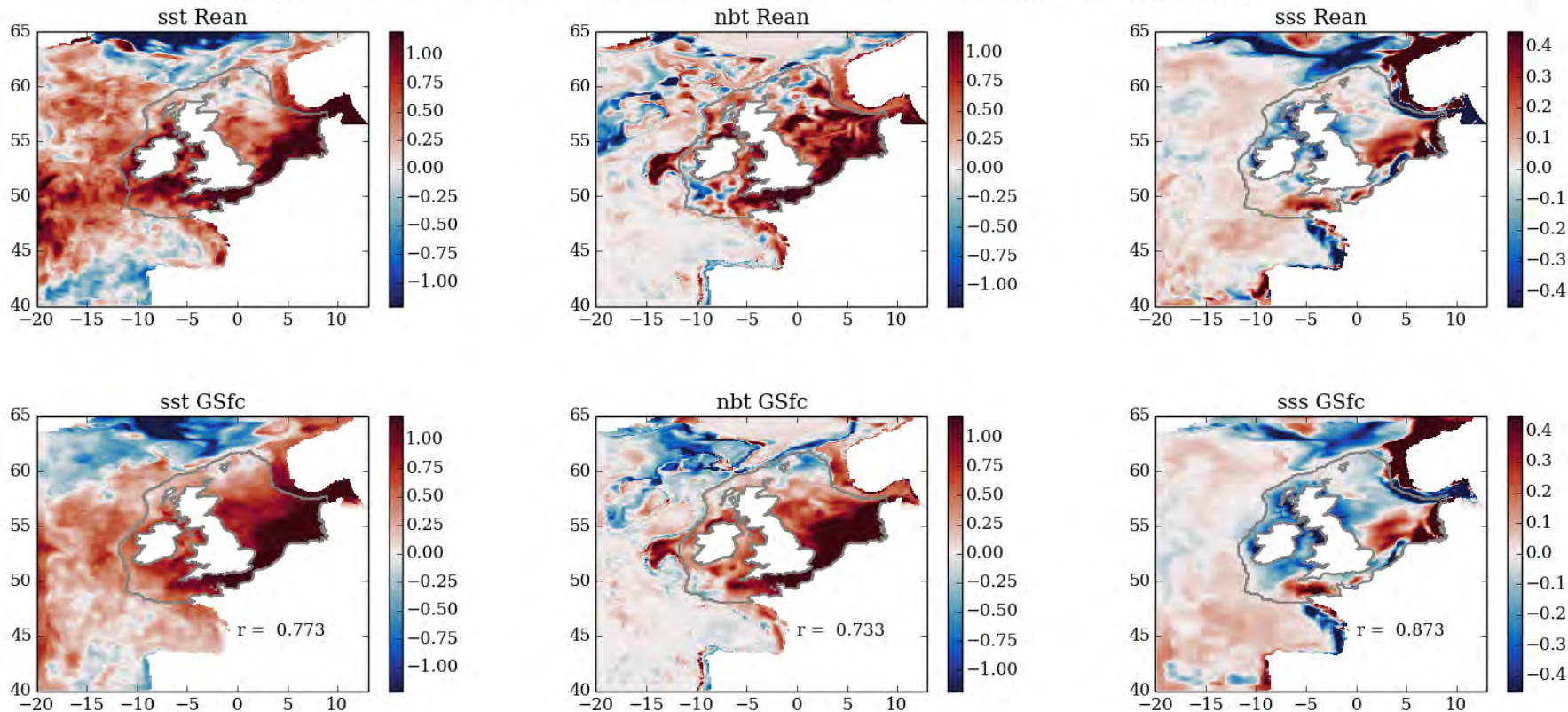
SST Region mean time series for North Sea with 1995-2012 baseline



2007-2003 difference region mean time series for North Sea
(CMEMS rean in green)



Comparison of CMEMS Rean and GloSea5 Ens 200704-200304 Anomaly. Per = 05



Conclusions

Evidence suggests GloSea5-CO6 is able to predict the difference between NWS winter conditions in different years

There is potential for the NWS summer predictability on shorter lead times

Not able to assess skill with only two case studies

BGC needs much more work!

Further Work

Complete analysis

Improve methodology

(ask GloSea5 team to run some specific test cases for me?)

Methodical!

Assess GloSea5 directly for skill in NWS

Assess persistence

Assess skill

BGC!



jonathan.tinker@metoffice.gov.uk

Tinker et al. (in review)

Ocean Science

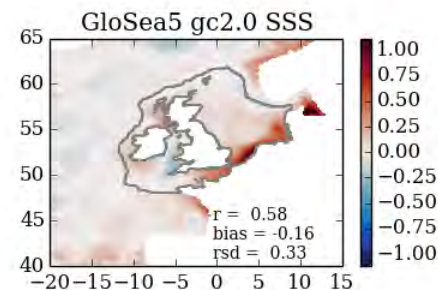
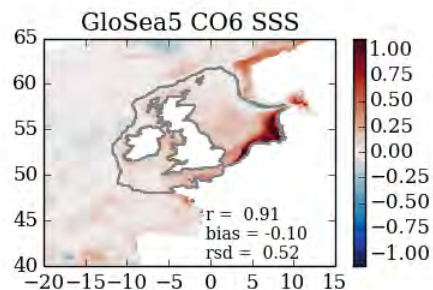
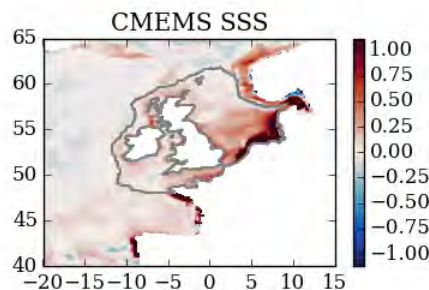
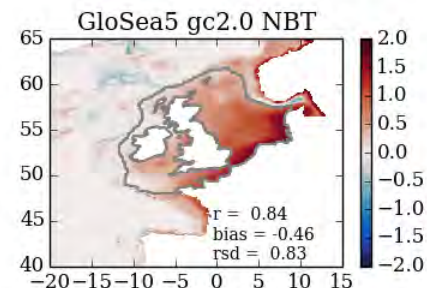
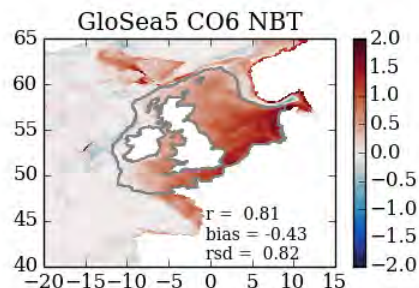
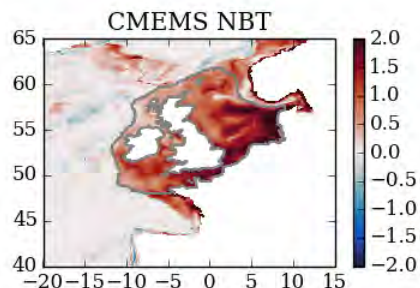
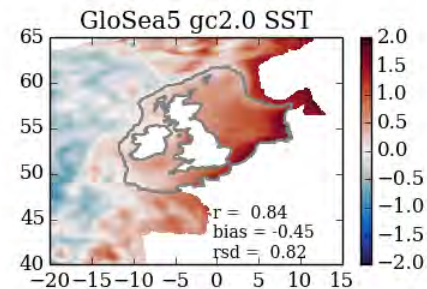
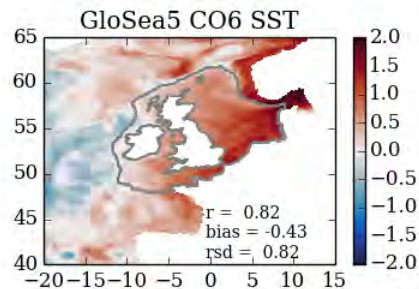
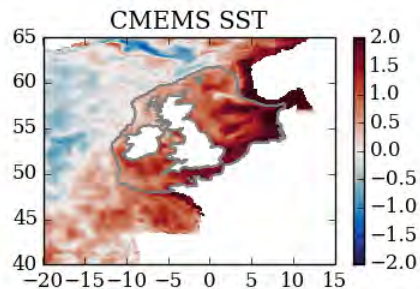
What are the prospects for seasonal prediction of the marine environment of the Northwest European shelf?

How important is downscaling?

DJF

2011-2010
(Nov start)

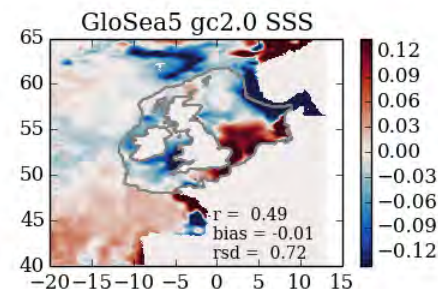
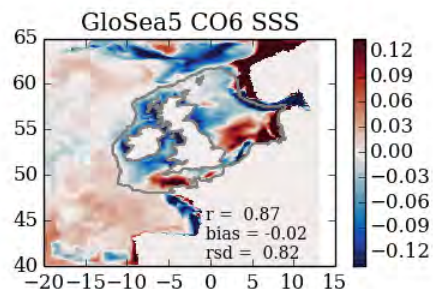
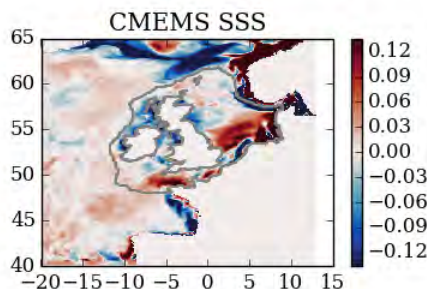
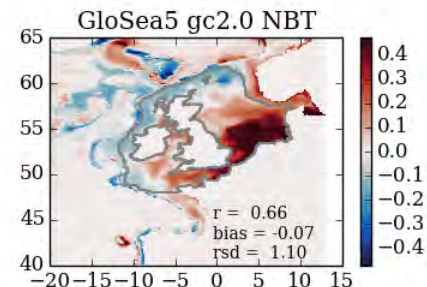
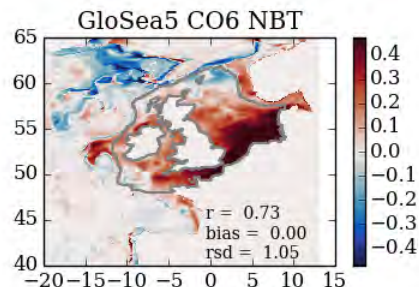
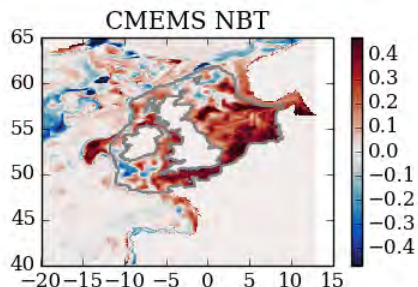
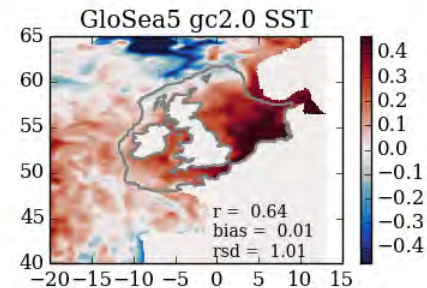
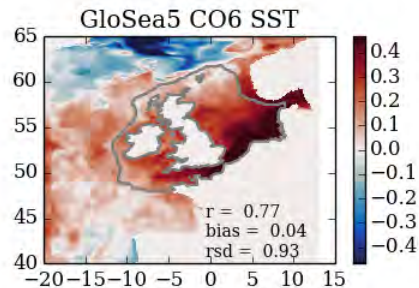
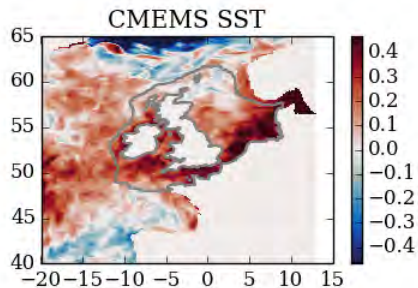
Difference
Maps



May

2007-2003
(Apr start)

Difference
Maps

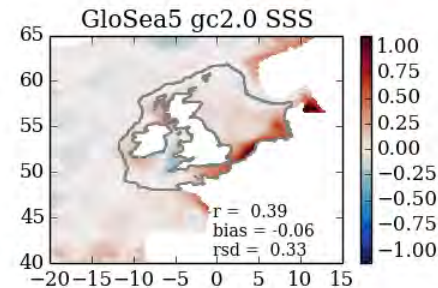
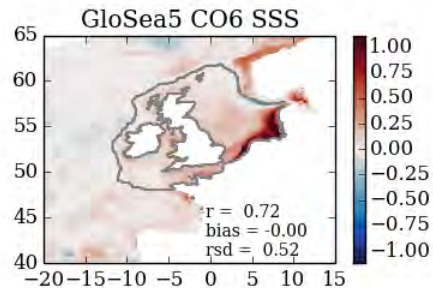
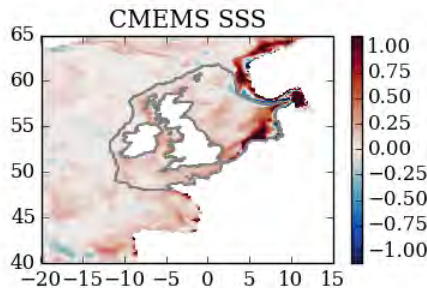
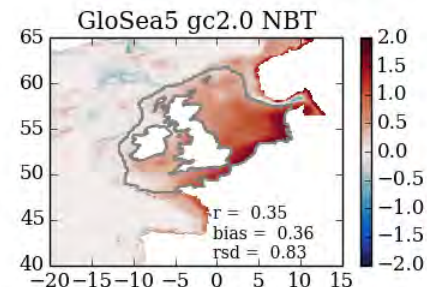
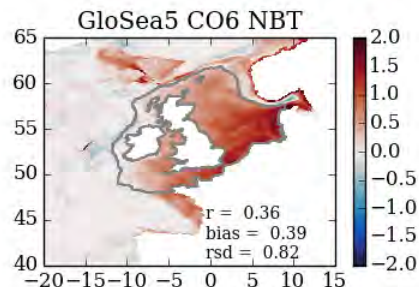
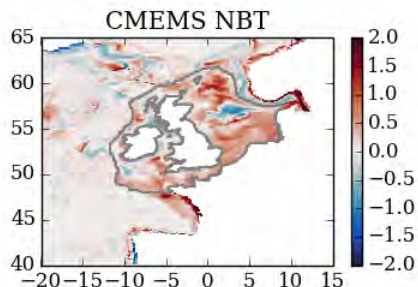
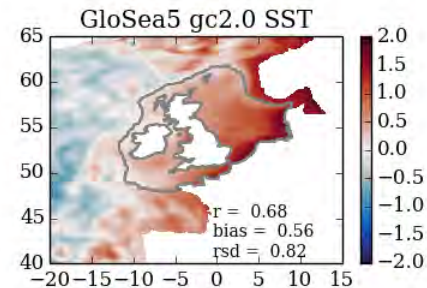
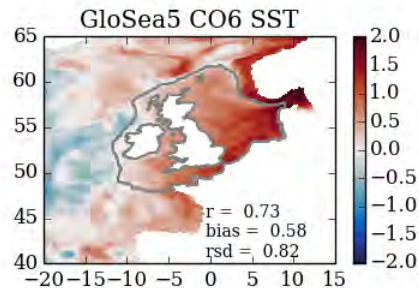
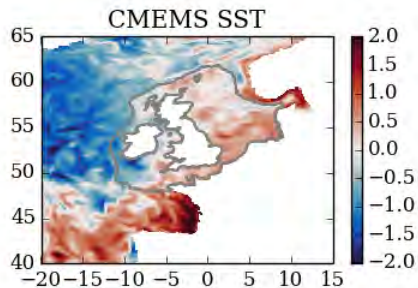


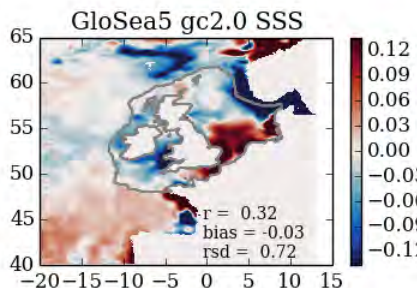
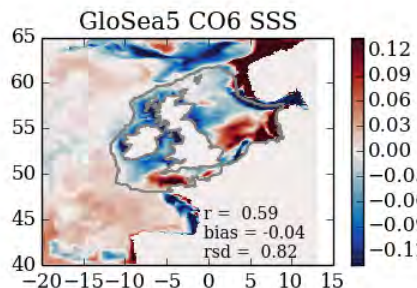
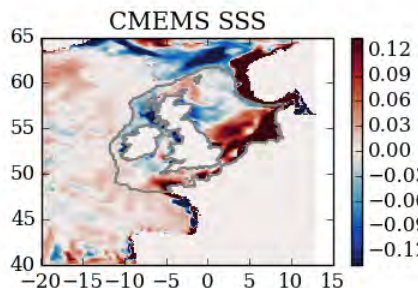
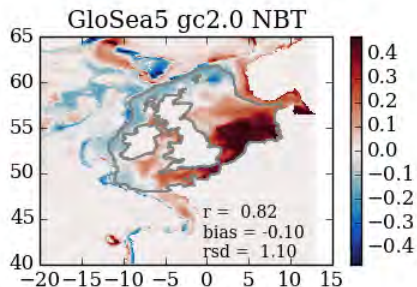
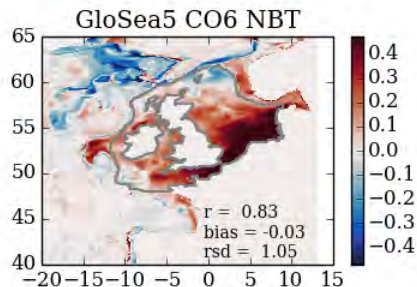
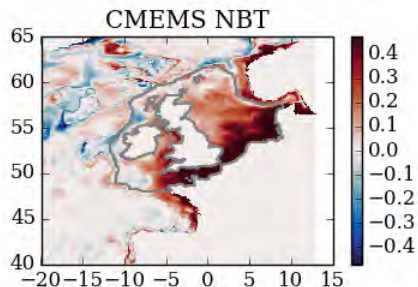
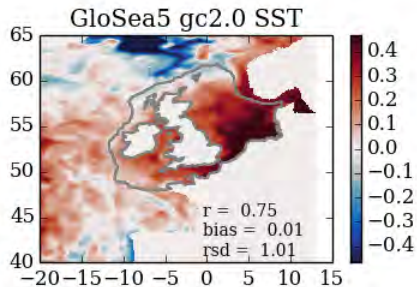
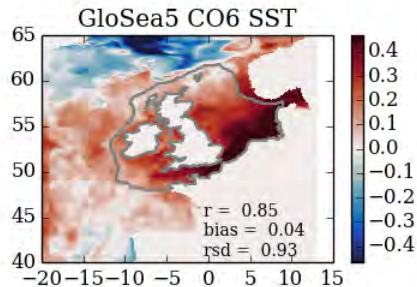
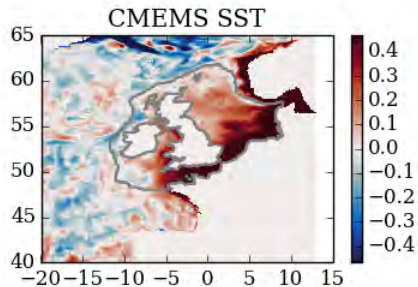
Assessment of Persistence

Persistence

Oct. vs DJF

2011-2010
(Nov start)





Persistence
Mar. vs May

2007-2003
(Apr start)

Difficulties with BGC

