



Objective

Explore predictability at depth along three transects off the Irish coast;

- **Extended Ellett Line**
- **Porcupine Bank (PB)**
- **Goban Spur**





Longitude

Longitude

Predictability in the Northeast Atlantic for near surface. With the Figure locations of the selected transects, Extended Ellett Line (EEL), Porcupine Bank (PB), Goban Spur.

Introduction

Over the last decade there have been vast improvements in the field of global decadal climate prediction; however, on a regional scale there is still limited confidence. Previous studies with the Max Plank Institute Earth System Model (MPI-ESM) have demonstrated that the model can represent water properties on a regional scale.

References

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Decadal prediction along the Western Irish Coast

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Results







Longitude

Figure 2:. Anomaly correlation coefficient (ACC) maps (corr.) potential temperature at lead years 2 to 5, using the initialised hindcast (a-c), uninitialised simulation (CMIP6) (d-f), hindcast - uninitialised simulation (g-i) for the Extended Ellett Line (EEL), Porcupine Bank (PB), Goban Spur. Where the dark red shows that there is good prediction skill, and the black dots show that this is significant. **MPI-ESM-LR** MPIOM, 2-to-5-year lead time, 1961 to 2008, 16 ensemble members.

Models and Methods

The Max Planck Institute Earth System Model is a global Earth system model and is used in its low-resolution (MPI-ESM-LR) (Mauritsen et al, 2019). The MPIOM is the ocean general circulation component of MPI-EMS-LR, it has a total of 40 z layers in the vertical with horizontal resolution varying from 12 to 150 km (Jungclaus et al, 2013). The model is initialised each November from 1961 – 2008 with a 2-to-5-year lead time and contain 16 ensemble members with the CMIP6 forcing (Hövel, 2022). Skill is assessed using a detrended Anomaly correlation coefficient (ACC) and has as a reference an assimilation simulation.







Figure 3:. Anomaly correlation coefficient (ACC) maps (corr.) Salinity at lead years 2 to 5, using the initialised hindcast (a-c), uninitialised simulation (CMIP6) (d-f), hindcast - uninitialised simulation (g-i) for the Extended Ellett Line (EEL), Porcupine Bank (PB), Goban Spur. Where the dark red shows that there is good prediction skill, and the black dots show that this is significant. **MPI-ESM-LR** MPIOM, 2-to-5-year lead time, 1961 to 2008, 16 ensemble members.

There is predictability for both temperature and salinity at depth for 2 to 5 year lead time. For the temperature results the hindcasts perform better at depth, where uninitialised simulation perform better at the upper layers. For the salinity results the hindcasts perform overall better at depth, compared to uninitialised simulation.

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Results Salinity (c) Hindcast Goban (b) Hindcast PB (e) CMIP6 PB (f) CMIP6 Goban (h) Hind - CMIP6 PB (i) Hind - CMIP6 Goban

Longitude

Summary

Future Work

Further Analysis of predictability on different lead times Application to fish stock and its uncertainty • How to communicate these predictions to stakeholders







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EGU 2023















Explore predictability at depth along three transect off the lrish coast; Extended Ellett Line (Orange Line) Porcupine Bank (Yellow Line) Goban Spur (Navy Line)

25/04/2023

Objective

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MPI-ESM-LR; 1961:2008; initialised each November; 2 to 5 years led time; 15 ensemble member

2019, Neddermann et al, 2019)

- The model was initialised each November from 1961 2008 with a 2-to-5-year lead time and contain 16 ensemble members.
- Skill was assessed using the Anomaly correlation coefficient (ACC) and was detrended.
- Statistical significance by bootstrapping

Models and Methods

• The Max Planck Institute Earth System Model (MPI-ESM) is a global Earth system model and is used in its low-resolution (LR) setup in the present study (MPI-ESM-LR) (Koul et al, 2022, Koul et al,

Results: Temperature

Temperature values (°C) from the model:

- Assimilation run,
- Hindcast run,
- Historical run.
- Red box being the Extended Ellet Line;
- Purple Box the Porcupine Bank;
- Navy box the Goban Spur.

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Results: CMIP 6 Temperature

MPI-ESM-LR MPIOM, 2-to-5-year lead time, 1961 to 2008, 16 ensemble members

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Results: CMIP 5 Temperature

MPI-ESM-LR MPIOM, 2-to-5-year lead time, 1961 to 2008, 16 ensemble members

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Results: Salinity

Salinity values (PSU) from the model:

- Assimilation run,
- Hindcast run,
- Historical run.
- Red box being the Extended Ellet Line;
- **Purple Box the Porcupine** Bank;
- Navy box the Goban Spur.

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Results: CMIP 6 Salinity

MPI-ESM-LR MPIOM, 2-to-5-year lead time, 1961 to 2008, 16 ensemble members

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Results: CMIP 5 Salinity

MPI-ESM-LR MPIOM, 2-to-5-year lead time, 1961 to 2008, 16 ensemble members

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Water mass Analysis

MPI-ESM-LR MPIOM, 2-to-5-year lead time, 1961 to 2008, 16 ensemble members

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Future Work

Of predictability on different Lead times To fish stock and its uncertainty

Application

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How to communicate to stakeholders

Communicate

• There is predictability for both temperature and salinity at depth for 2 to 5 year lead time. • For the temperature results hindcasts preform better at depth, where CMIP6 preform better towards the upper layers. • For the salinity results the hindcasts preform overall better at depth, compared to CMIP6.

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Summary

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Anomaly correlation coefficient (ACC)

+1 good forecast skill

04/05/2021

 Is the difference between the forecast and the observed at each point <= 0 means no forecast skill time; 16 ensemble member

• MPI-ESM-LR; 1961:2008; initialised each November; 2 to 5 years led

Bootstrapping

- Generation of replicated datasets through sampling with replacement of the original dataset (Wang et al 2014)
- The correlation of each new data set was obtained
- Completed 500 times for data set
- Significance level of 5%

Bootstrap replicate 1

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80
45
39
1
79
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•
35
2
57
8

Ori	ginal	data	set
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(a)

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79
80

Bootstrap replicate 2

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25		
51		
38		