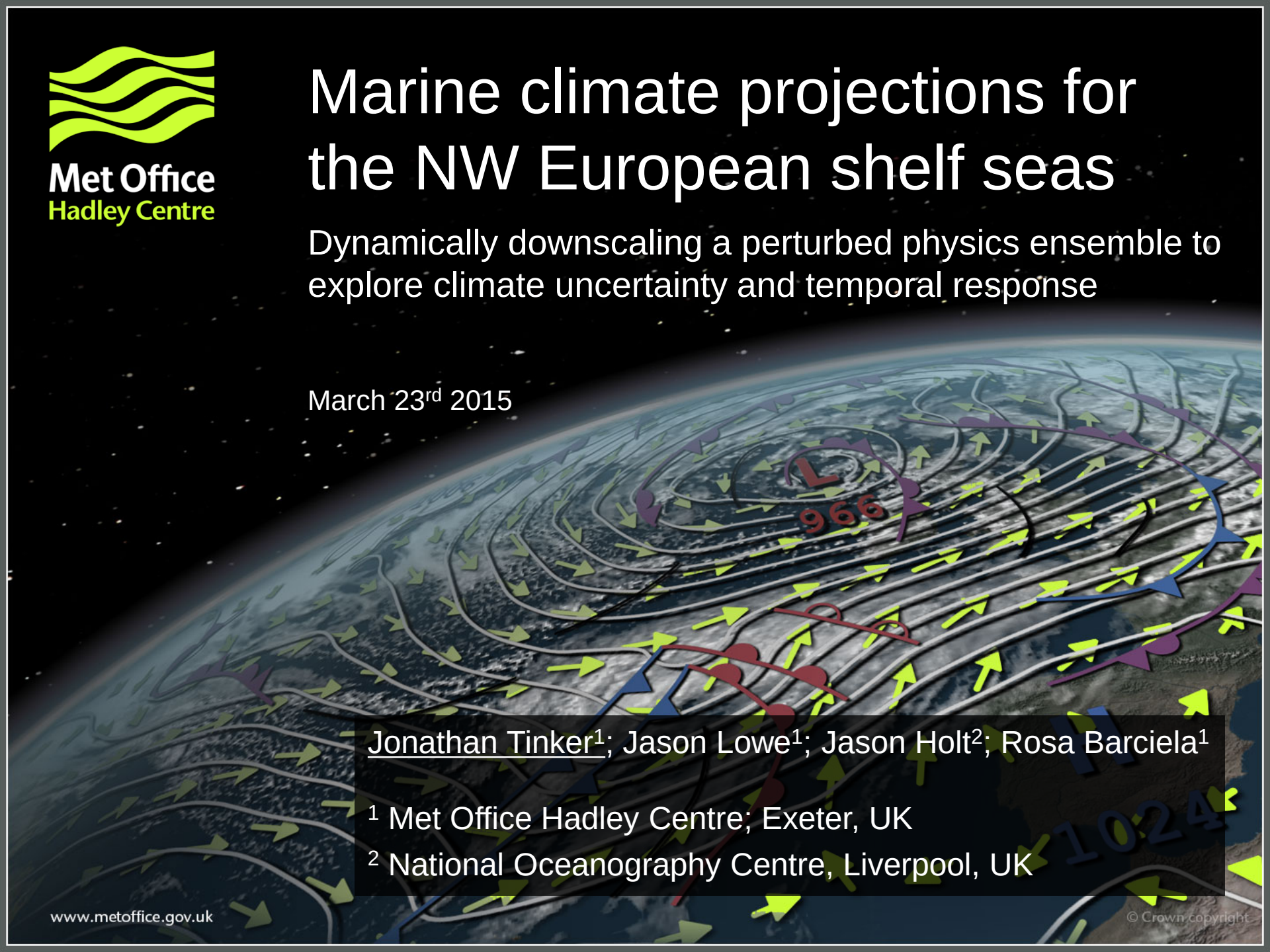
# Marine climate projections for the NW European shelf seas

## Dynamically downscaling a perturbed physics ensemble to explore climate uncertainty and temporal response

March 23rd 2015

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[1] Met Office Hadley Centre; Exeter, UK

[2] National Oceanography Centre, Liverpool, UK

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# Why do we care about climate change in the marine environment?

- Economic value of the shelf seas
- Concern for Biodiversity
- Environmental Policy Drivers

Effective management require foresight

**Marine Climate Projections**

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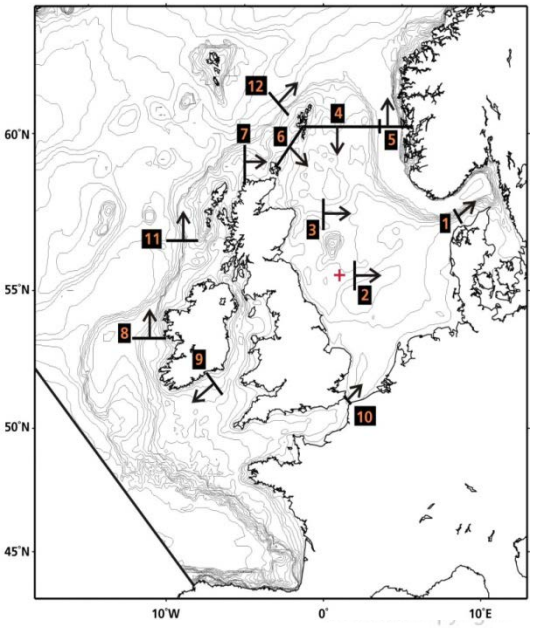
# Overview of study

Shelf Seas Climate Projections:

- Downscale GCM (HadCM3)...
- ... using shelf seas model POLCOMS
- ... under SRES A1B BAU
- Transient Experiments
- Ensemble Approach



# Climate Uncertainty

We do not account for:

- Emission scenario uncertainty
- Model structural uncertainty (GCM or shelf seas model)
- Initial condition uncertainty
- …

But

We do account for model physics uncertainty:

- 30 atmos. parameters perturbed within expert elicited range.
- Parameter space explored with emulators
- 11 GCM and RCM sims run with wide range of clim. sens.

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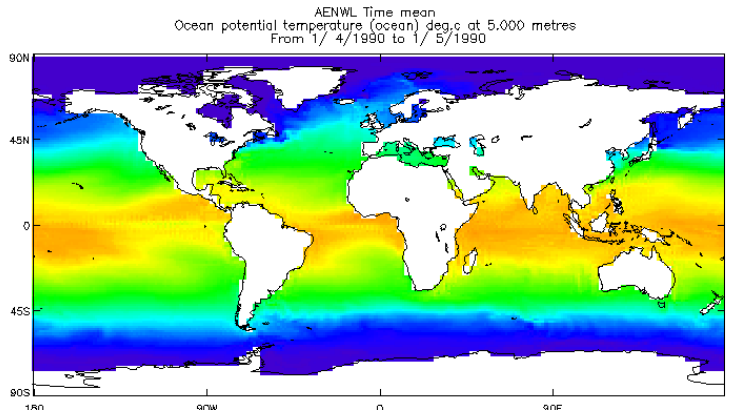
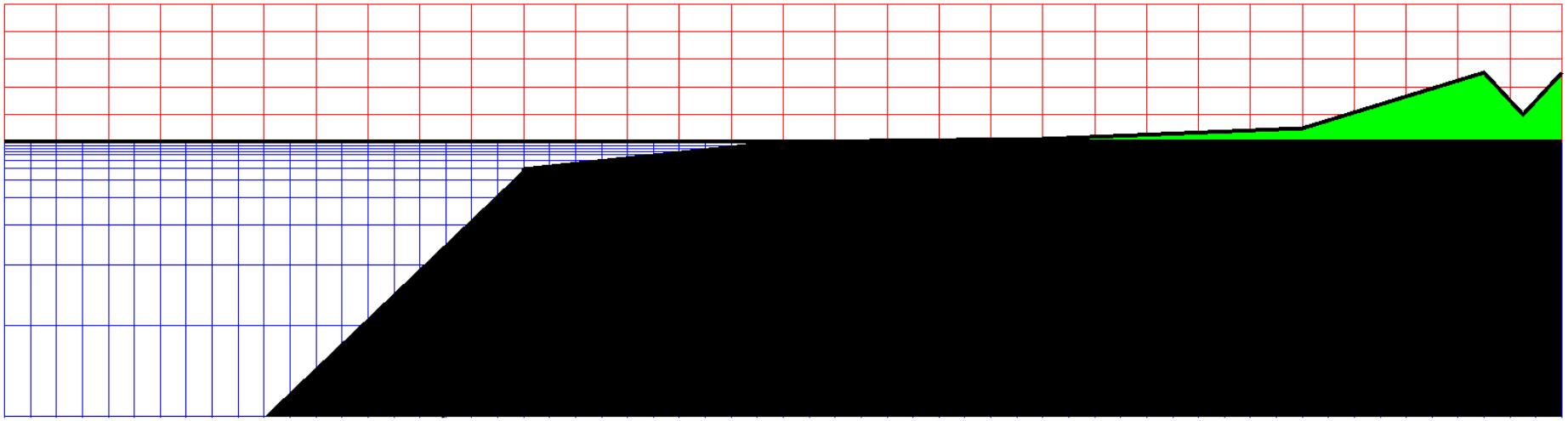
# Model Set-up

# Model setup


AENWL Time mean
Ocean potential temperature (ocean) deg.c at 5.000 metres
From 1/ 4/1990 to 1/ 5/1990
90N
45N
0
45S
90S



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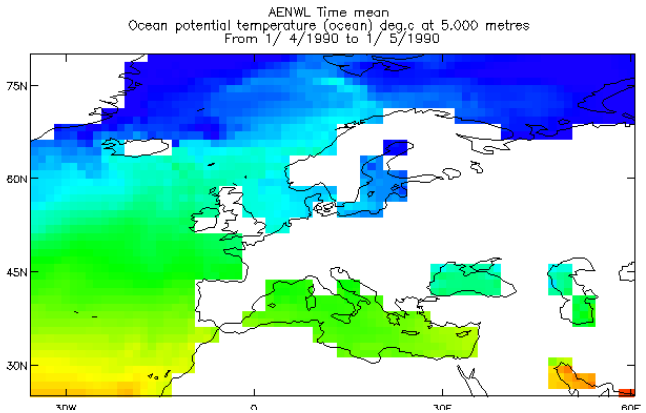
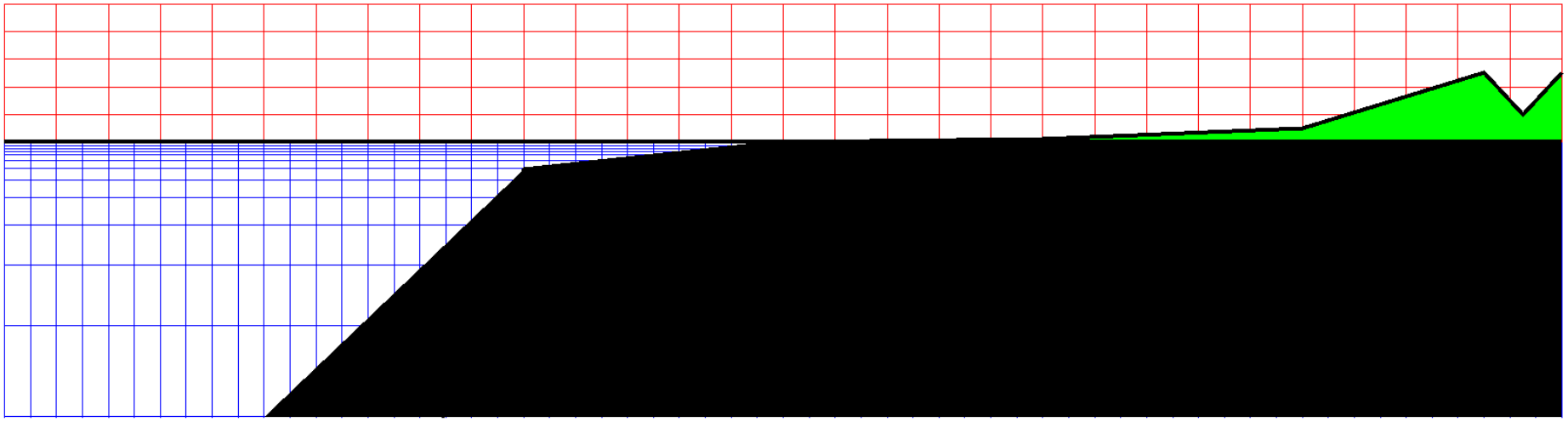

AENWL Time mean
Ocean potential temperature (ocean) deg.c at 5.000 metres
From 1/ 4/1990 to 1/ 5/1990
75N
60N
45N
30N



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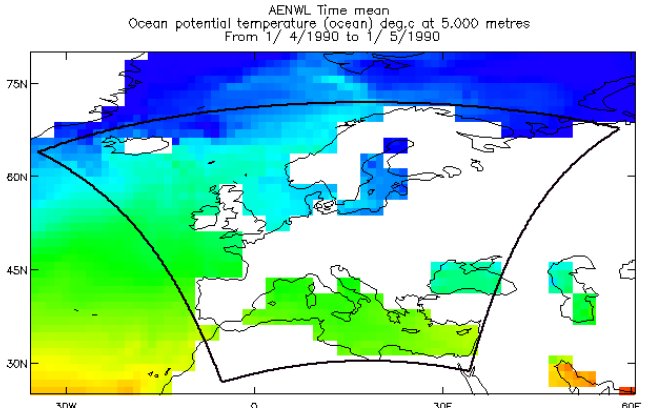
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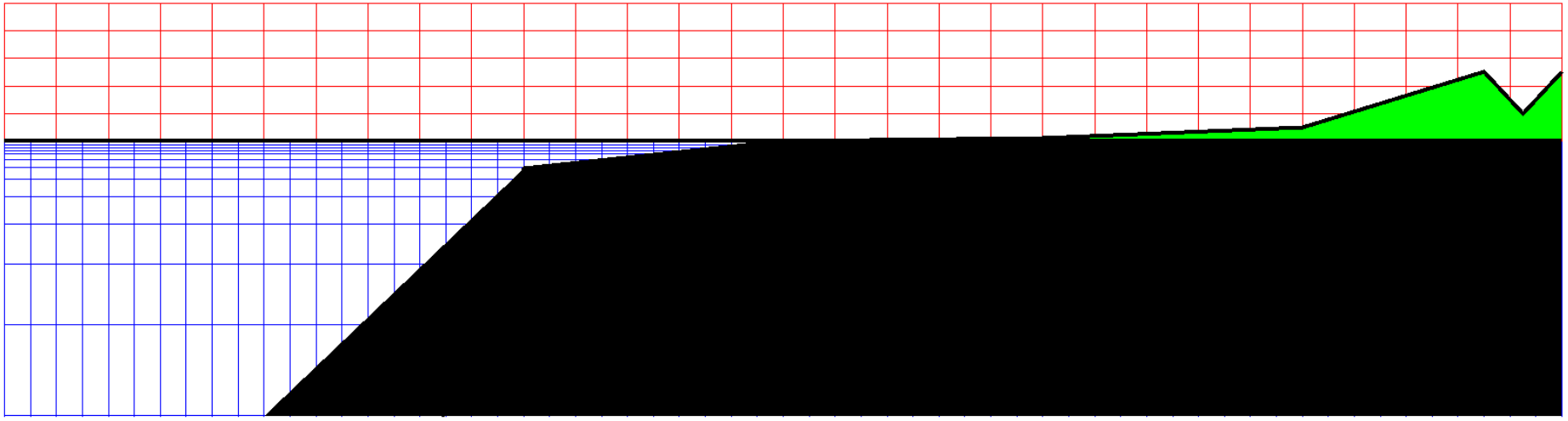

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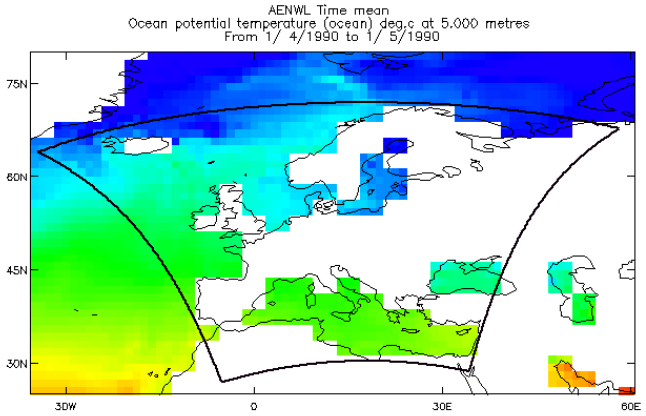
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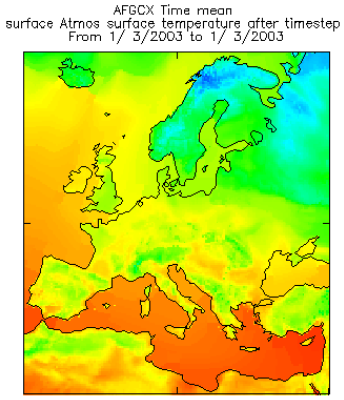
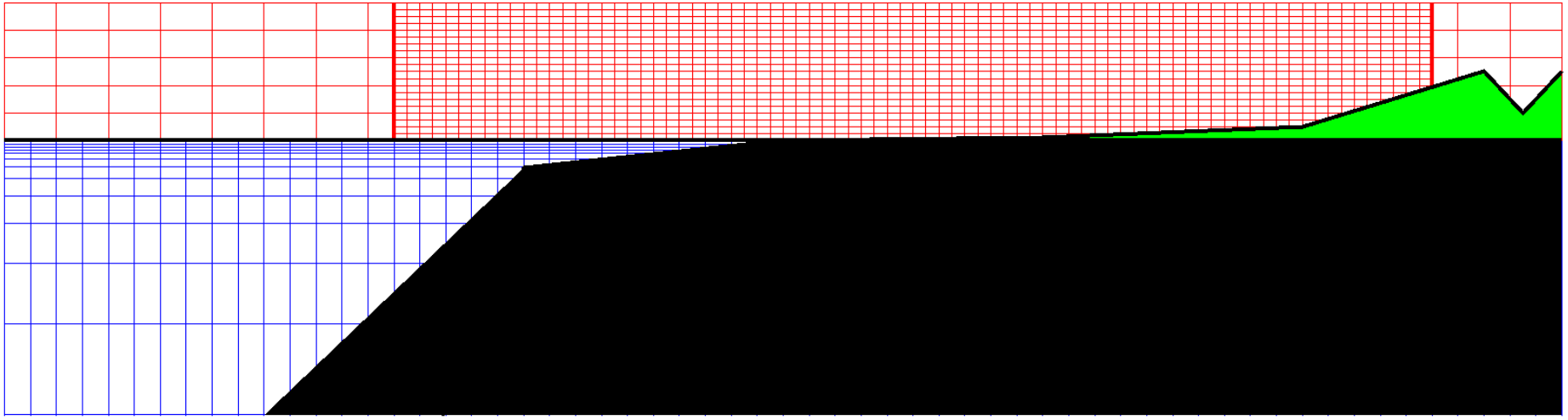

AFGCX Time mean
surface Atmos surface temperature after timestep
From 1/ 3/2003 to 1/ 3/2003



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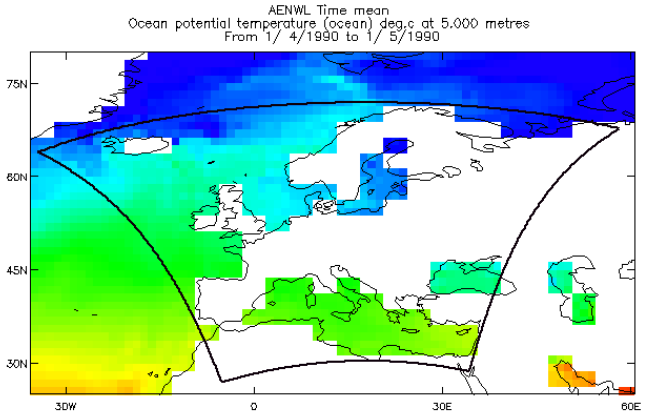
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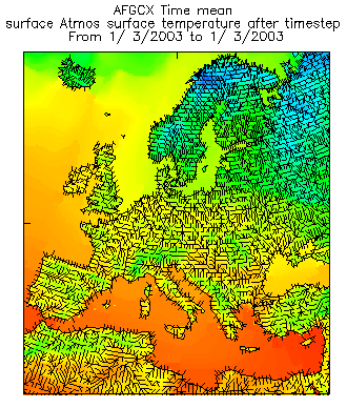
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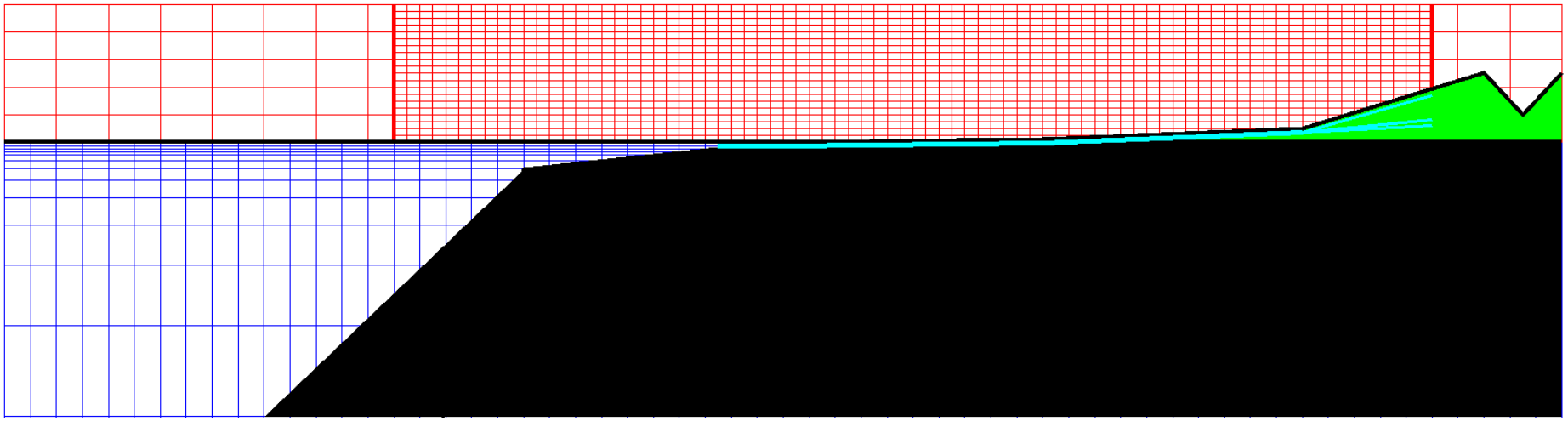

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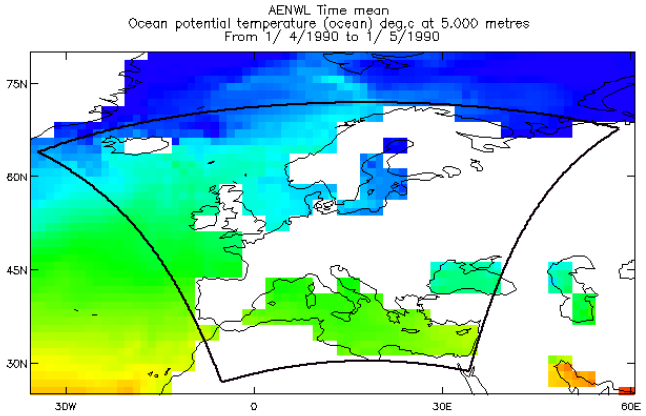
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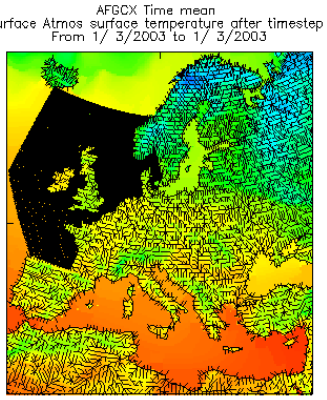
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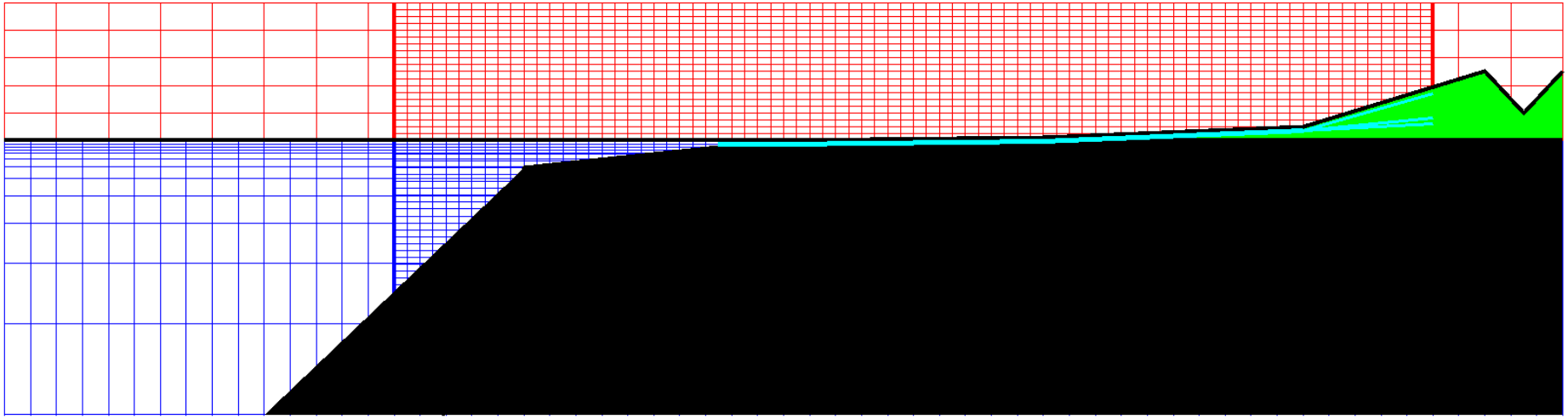

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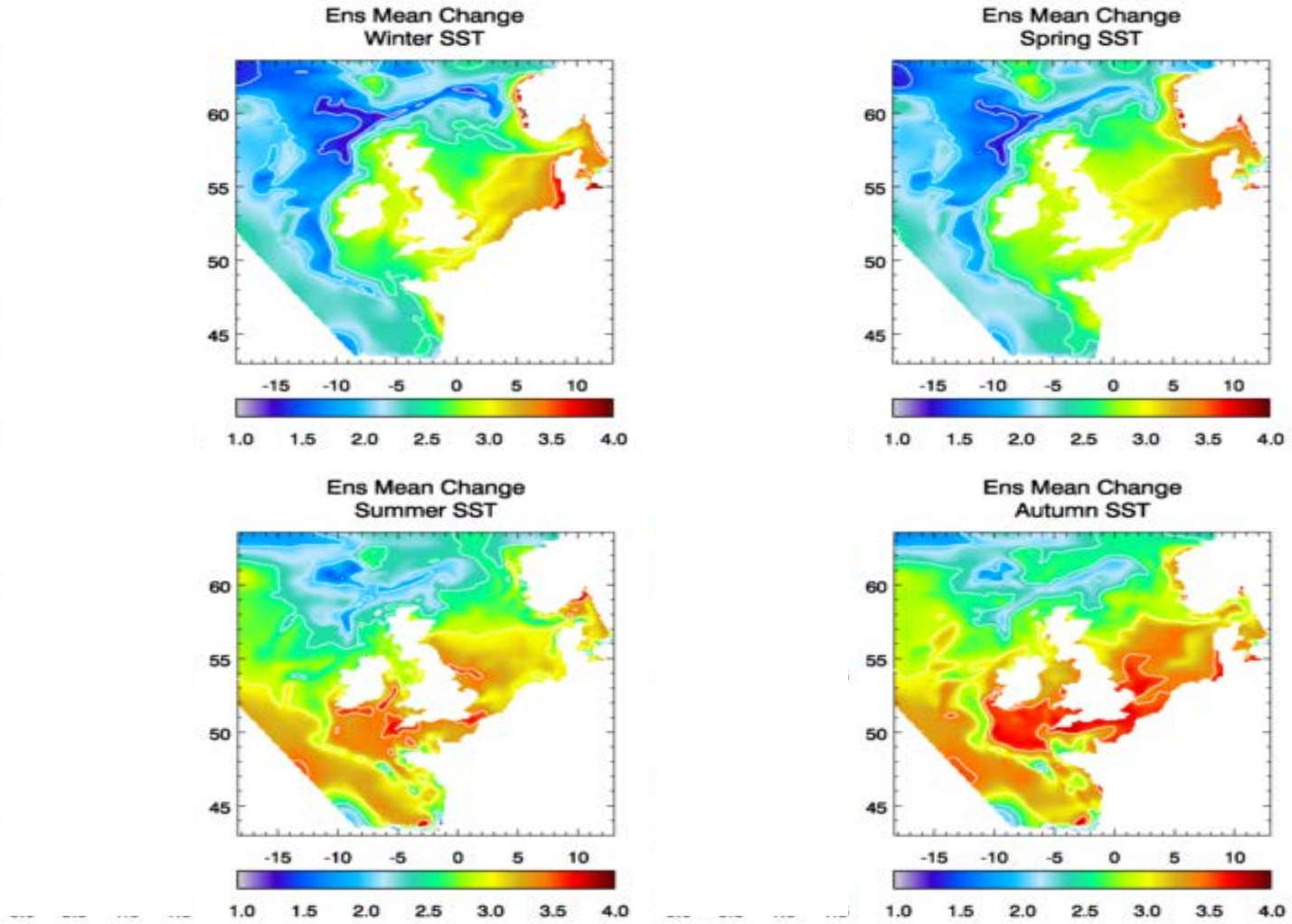
# Results

# Results: SST Projections

(2069-2098) – (1960-1989)

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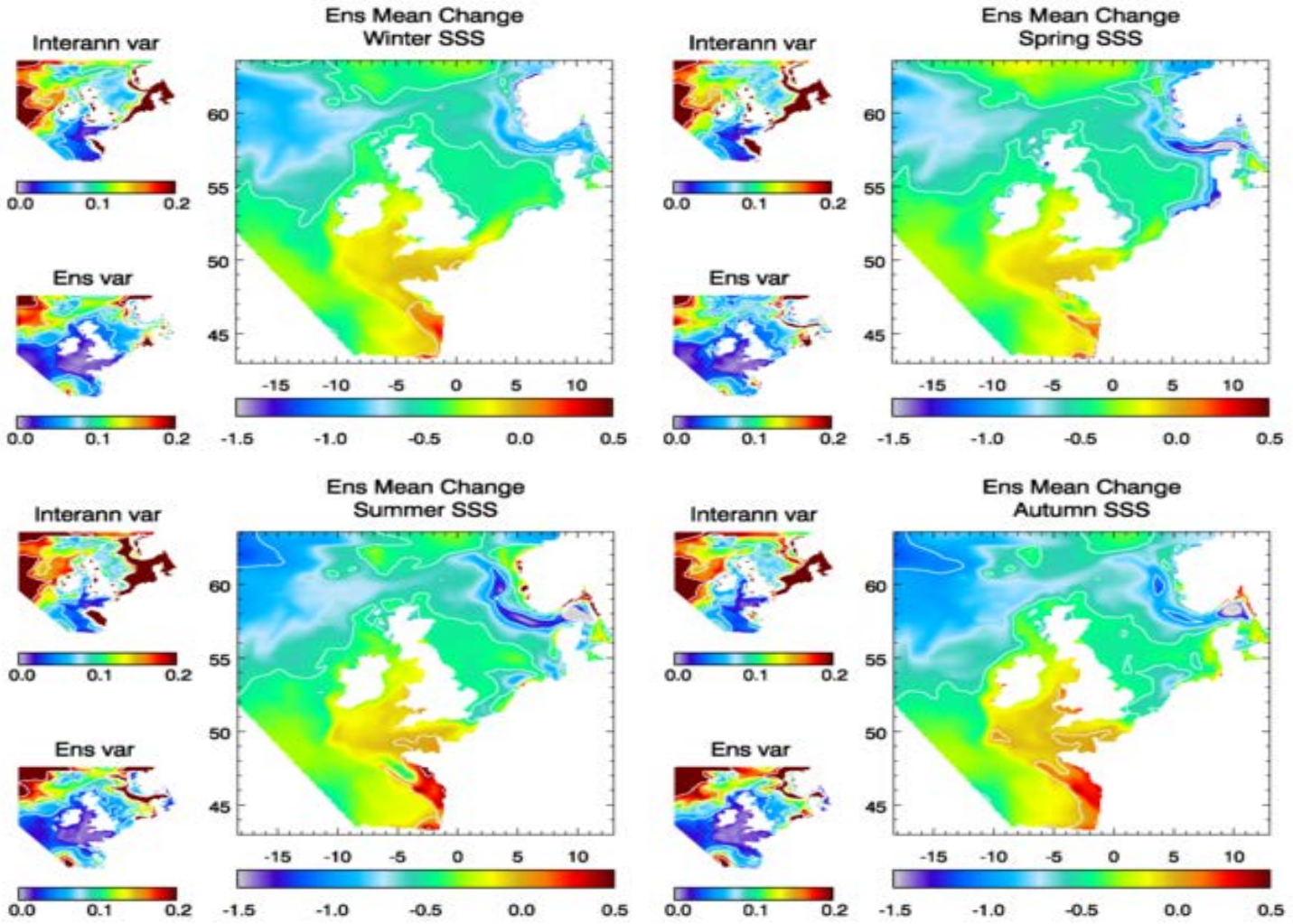
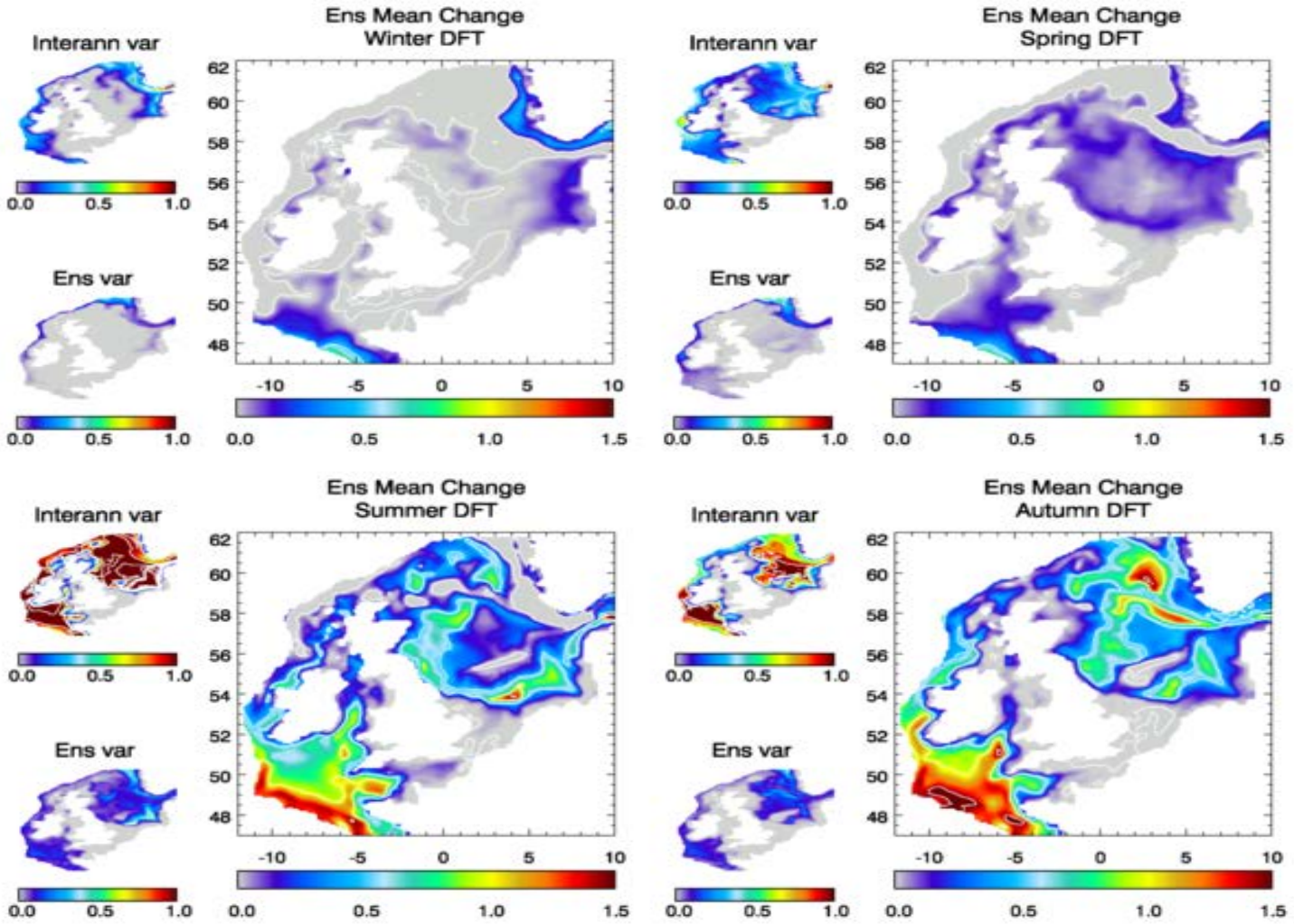
# Results: SSS Projections

(2069-2098) – (1960-1989)



# Results: SST-NBT Projections

(2069-2098) – (1960-1989)



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# Temporal Evolution of NW Europoean Shelf Seas

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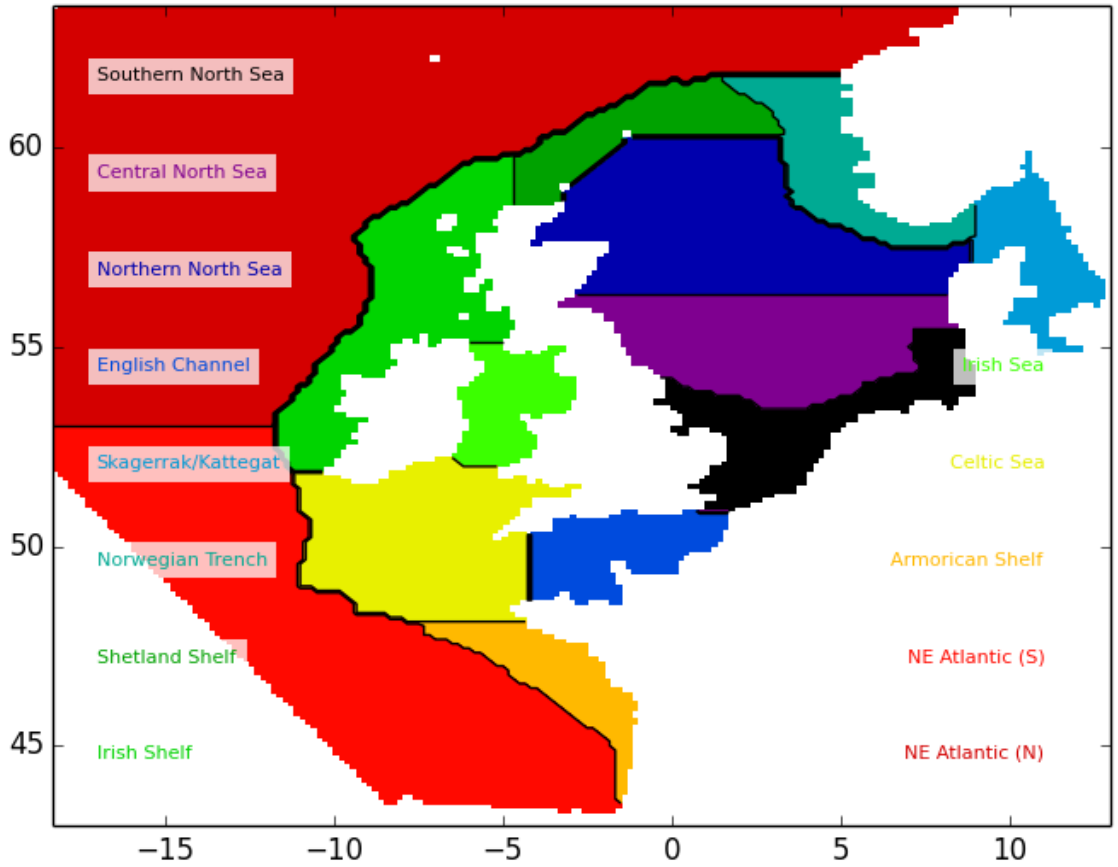
# Regional mean time-series



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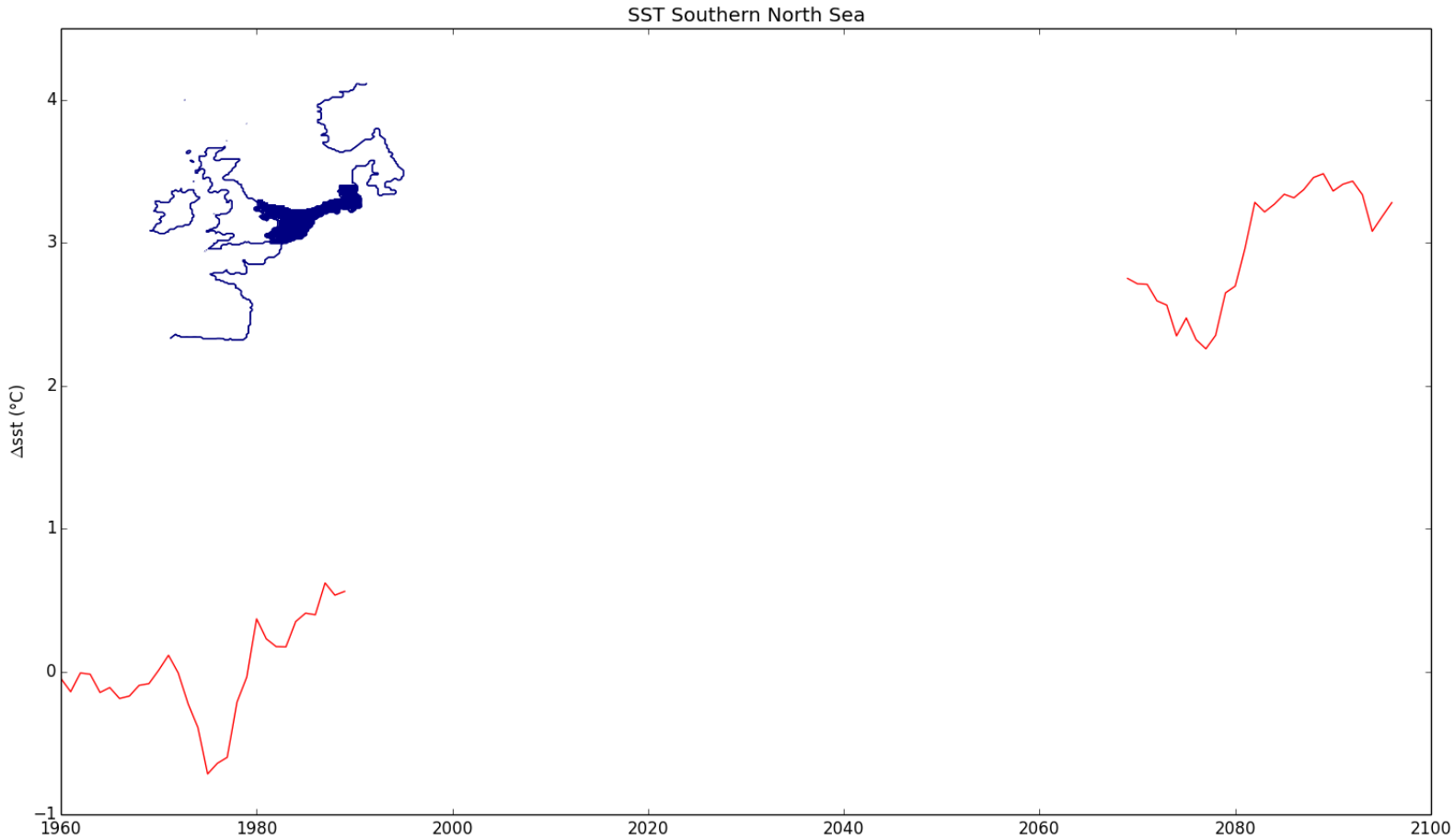

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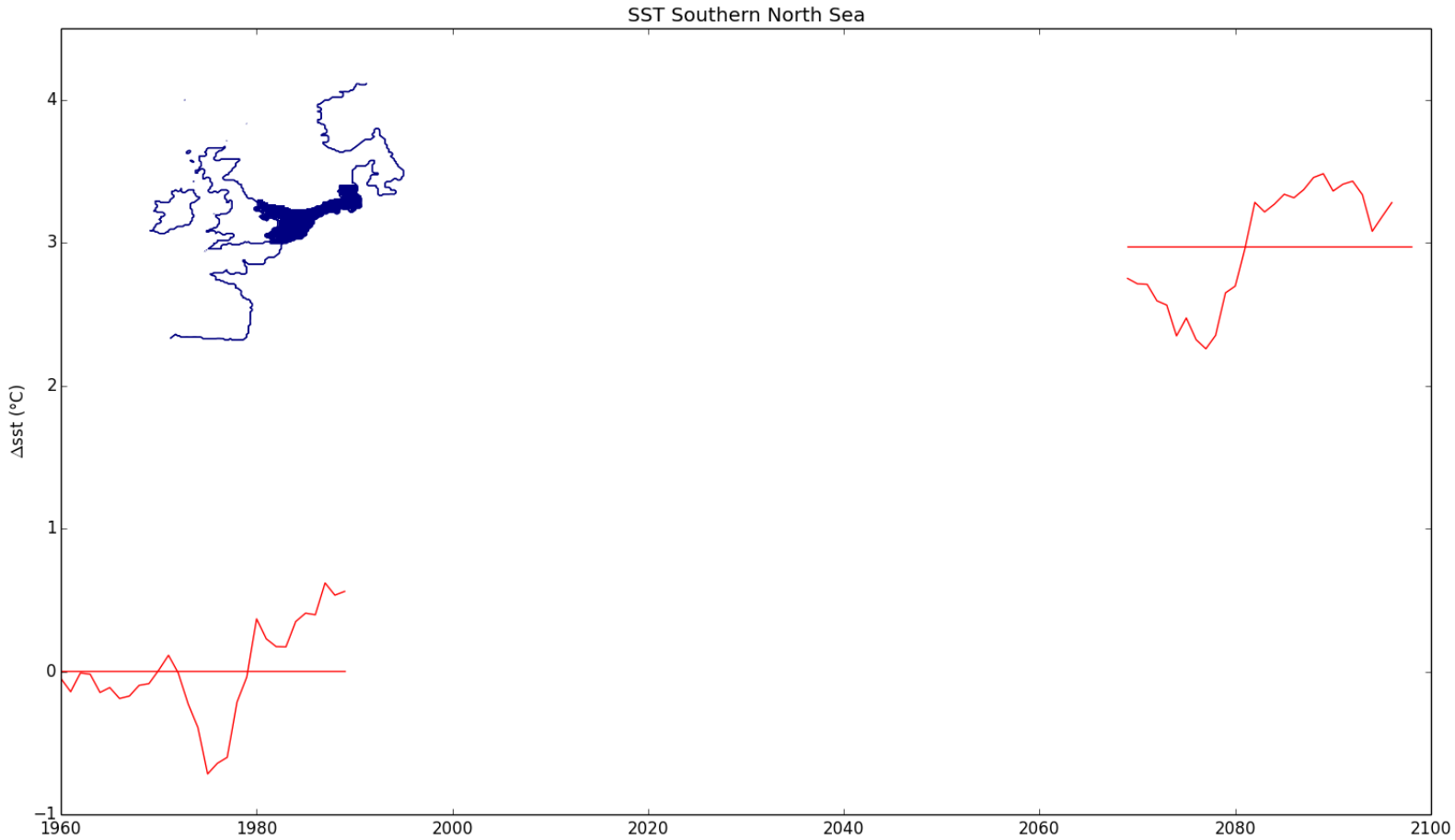

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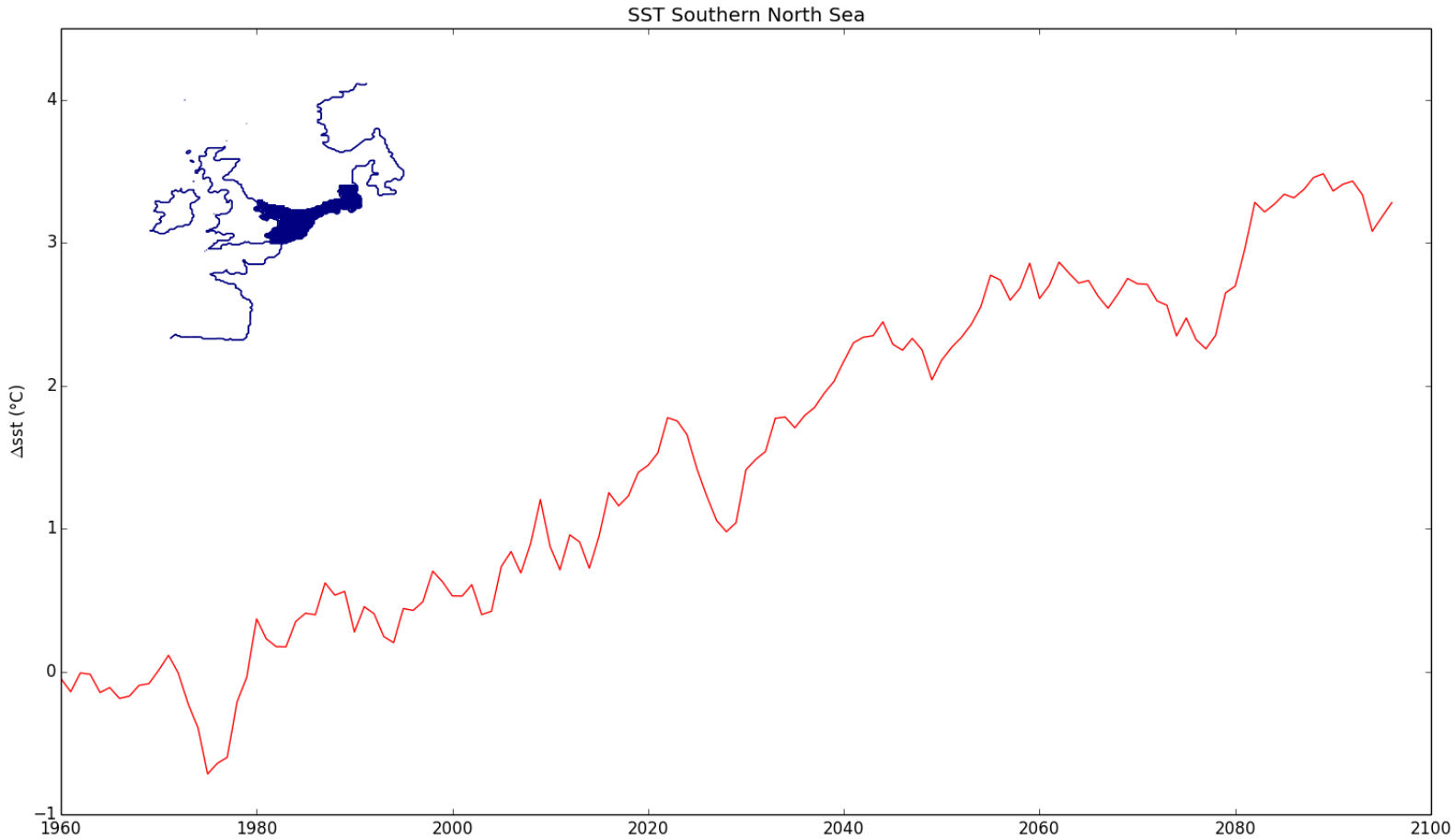

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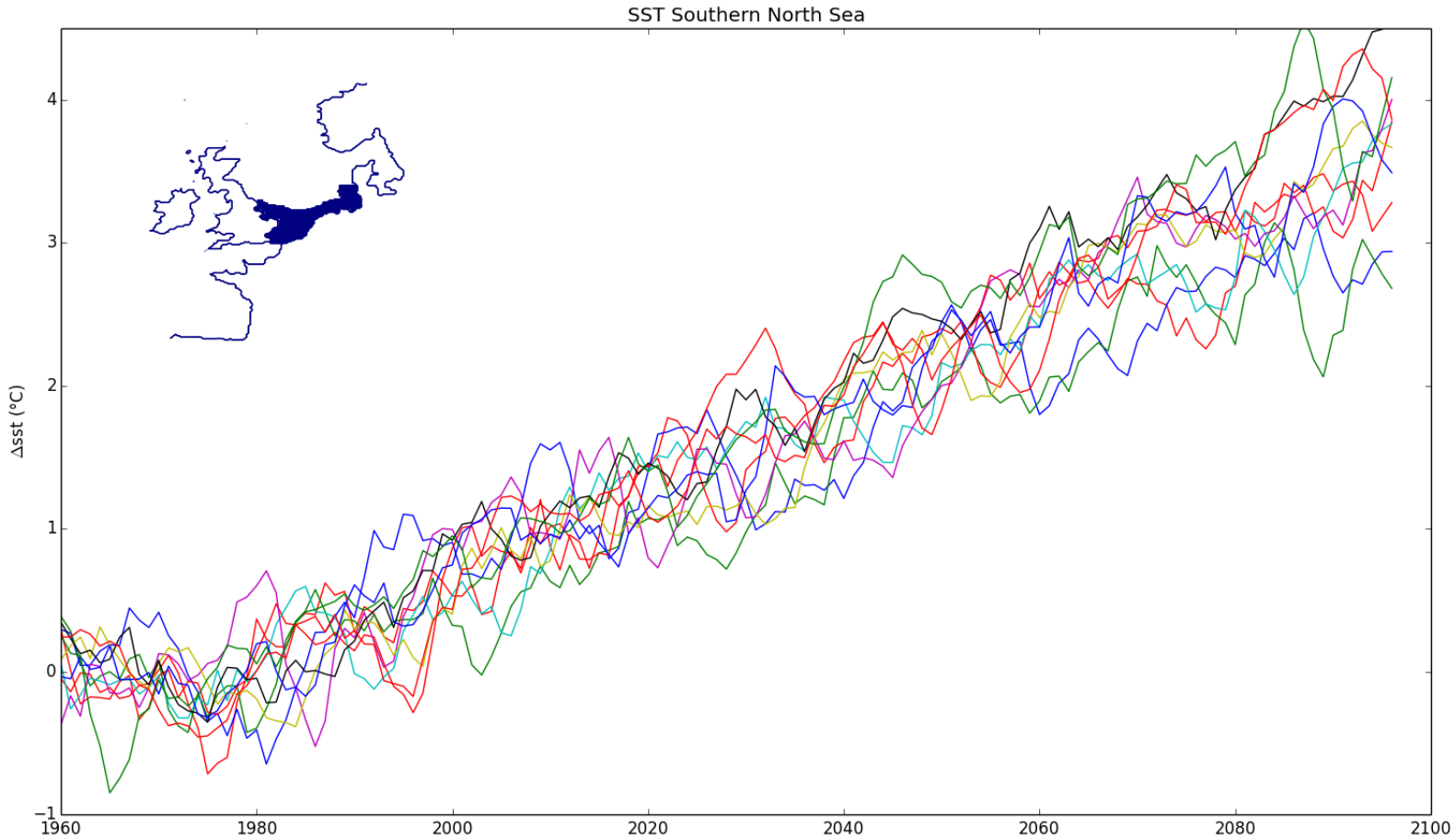

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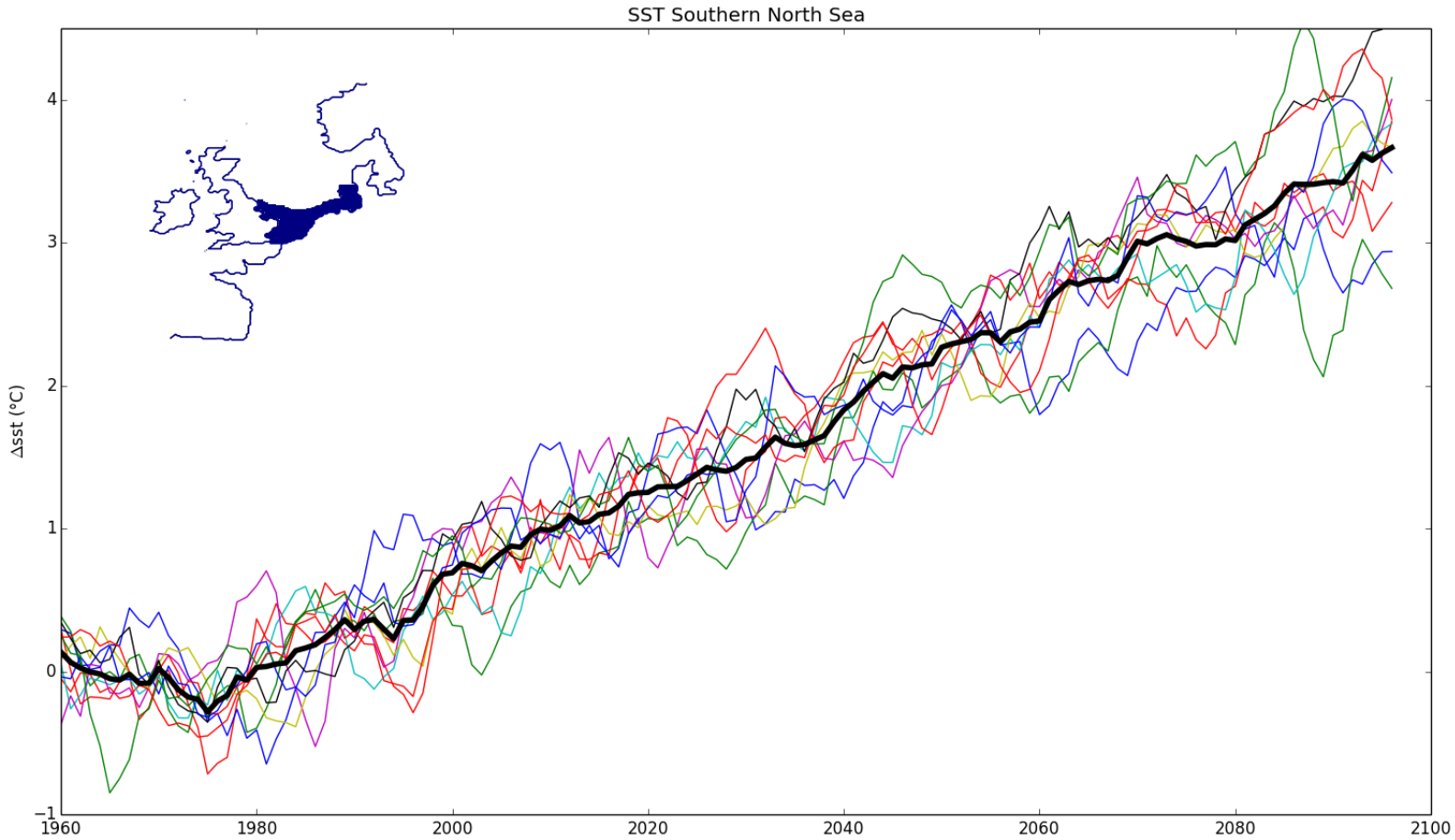

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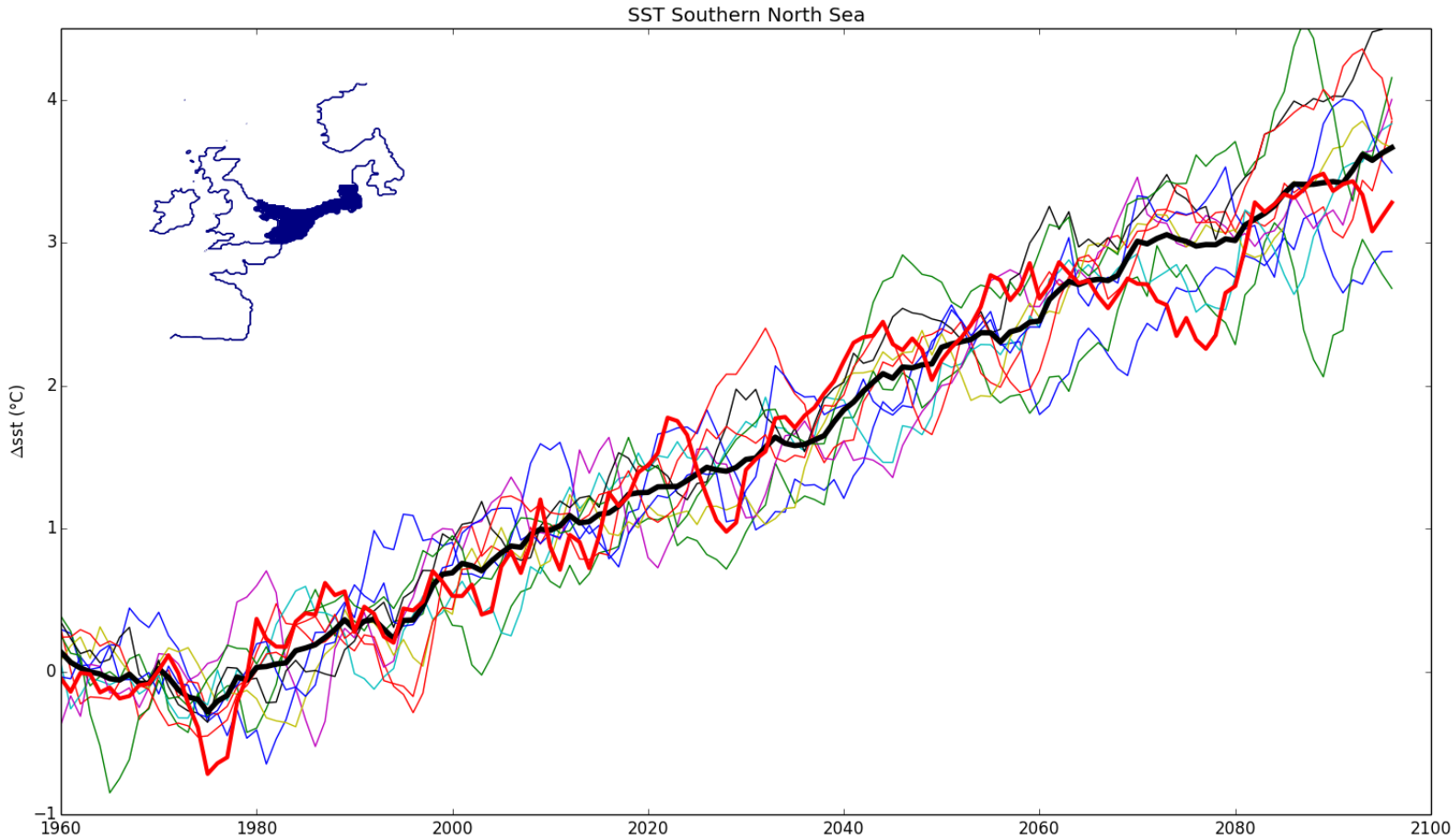

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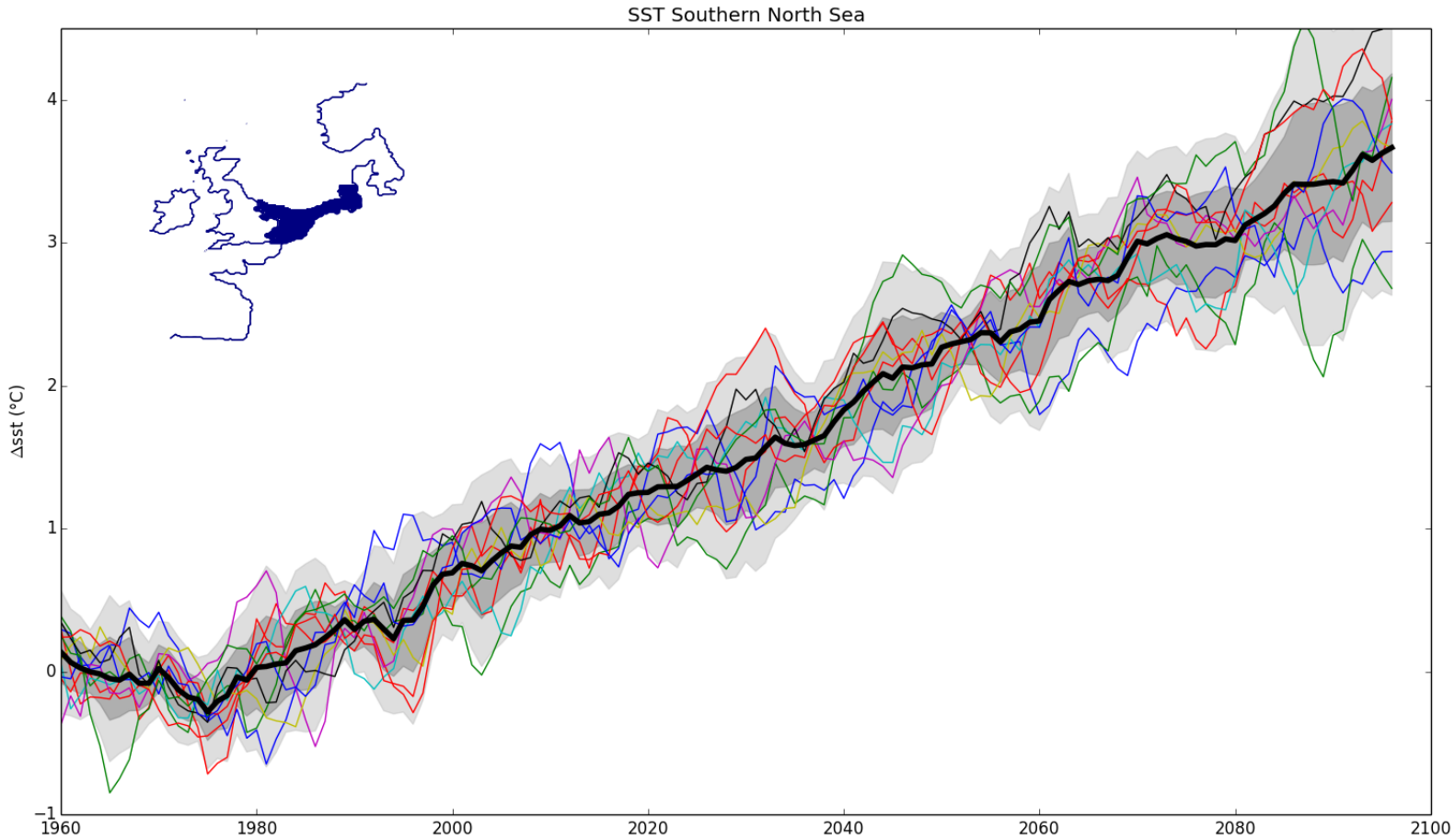

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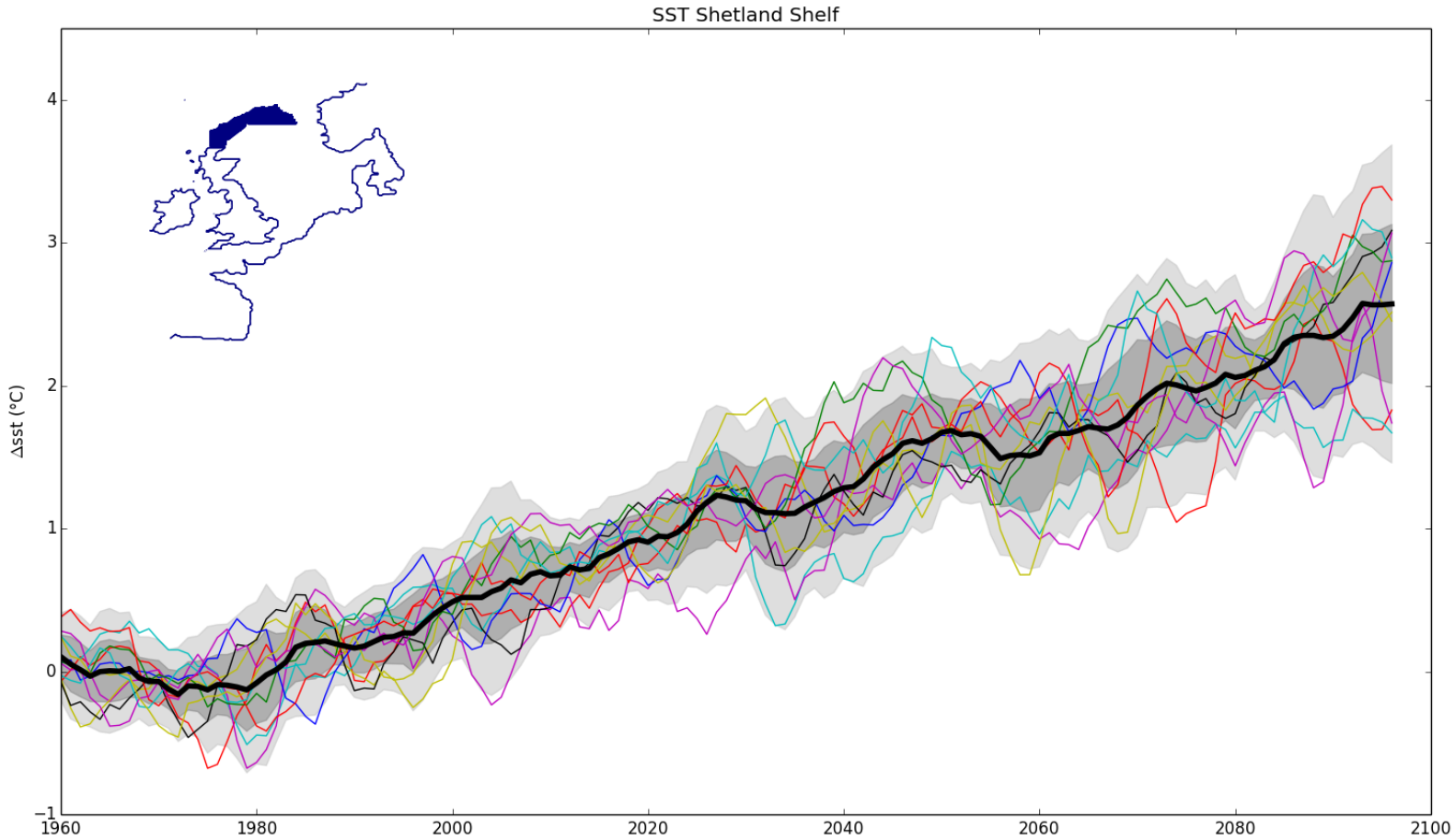
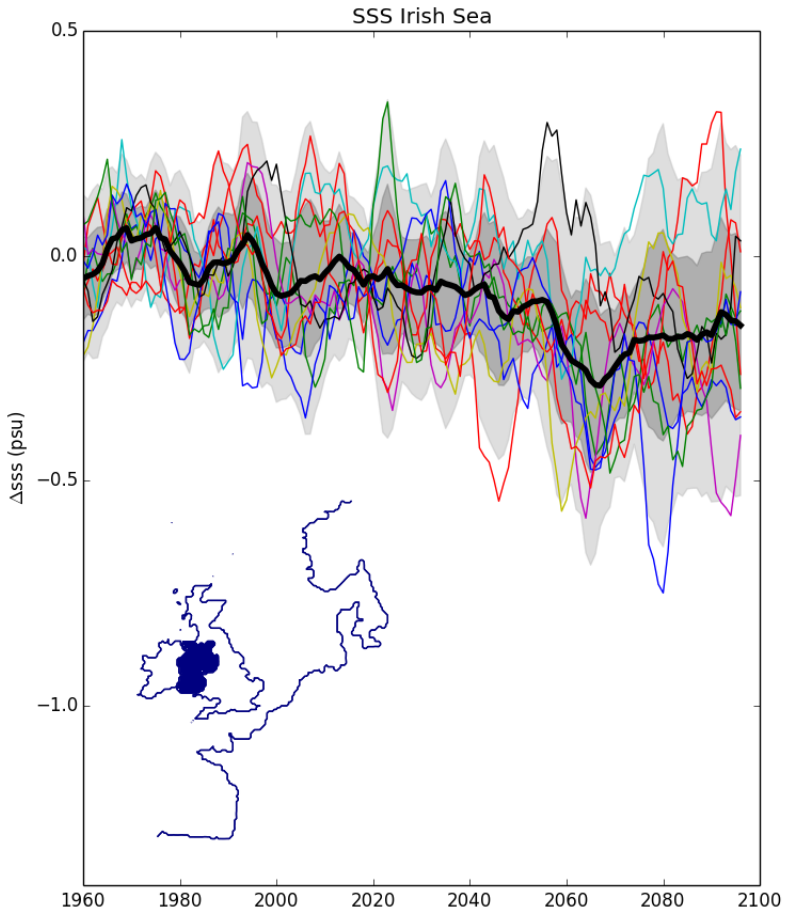
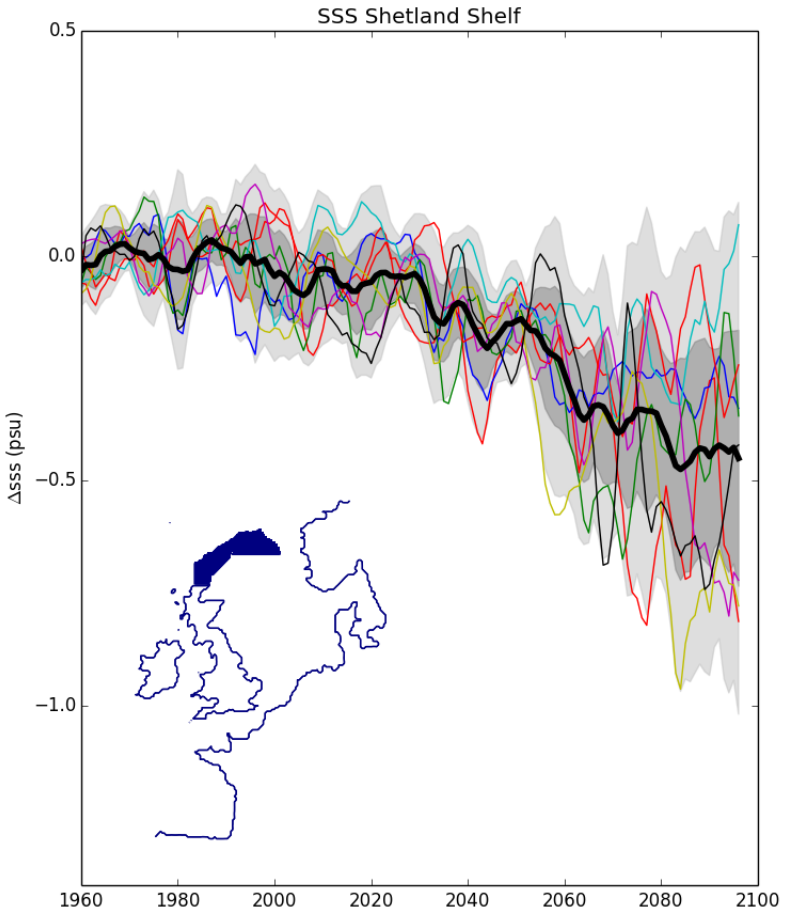


# Projections: SSS Time-series



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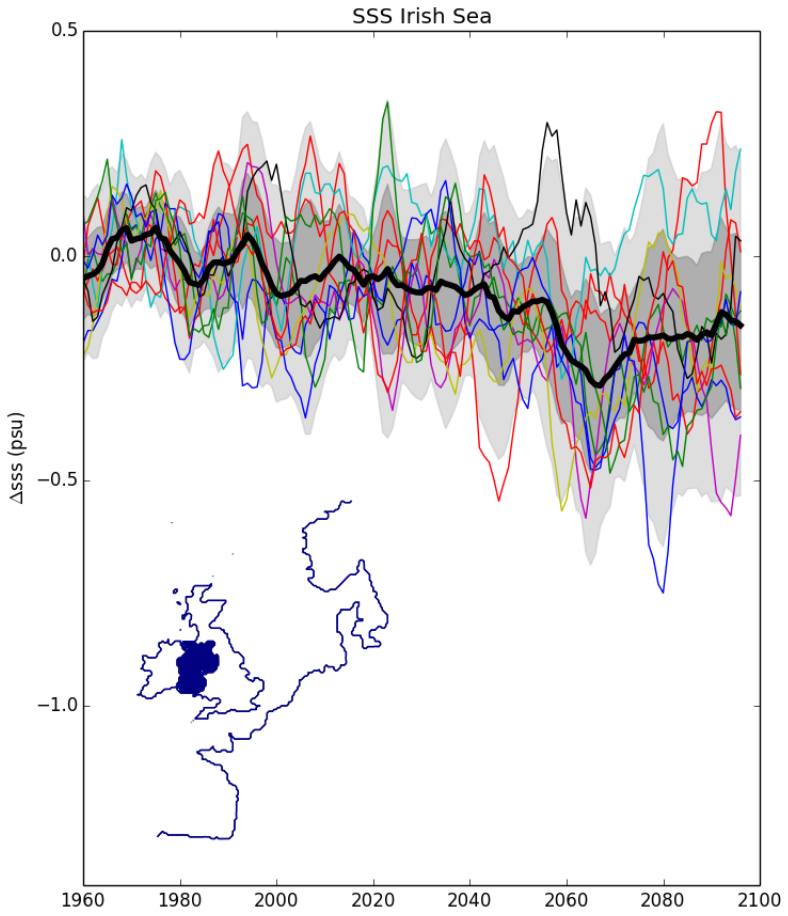


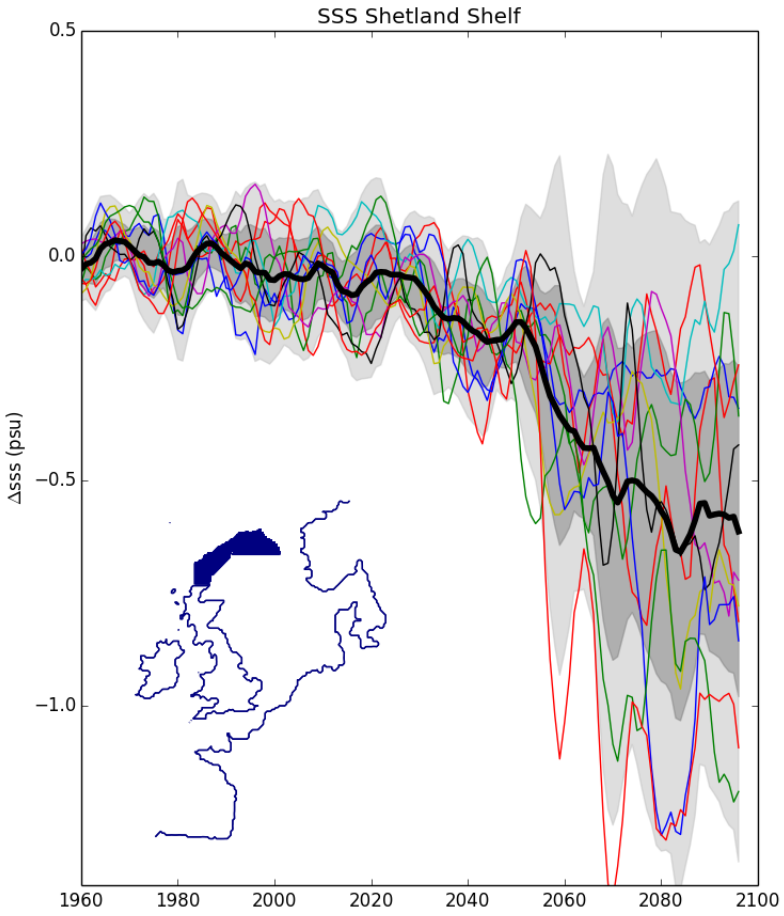

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# Sources of temporal variance

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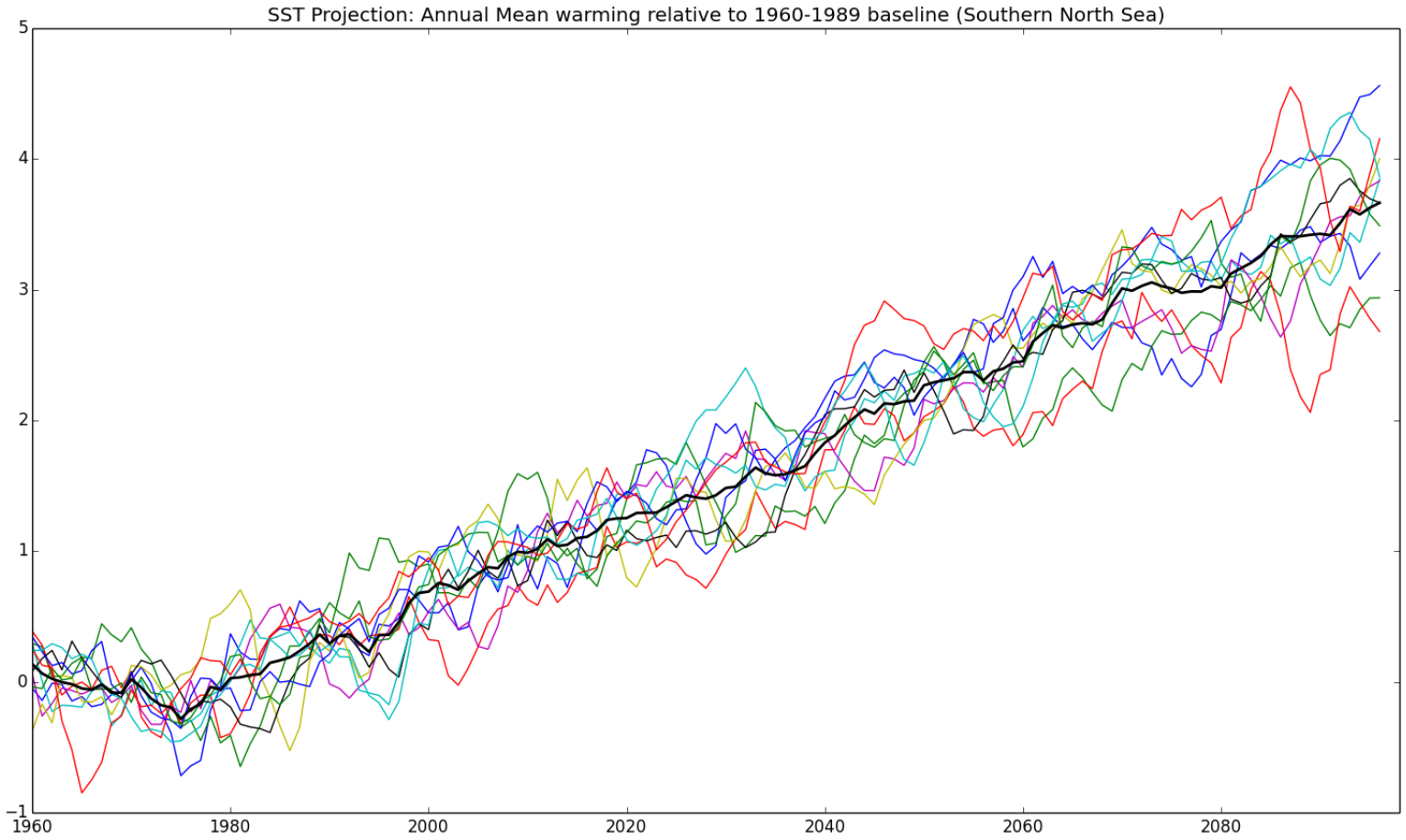

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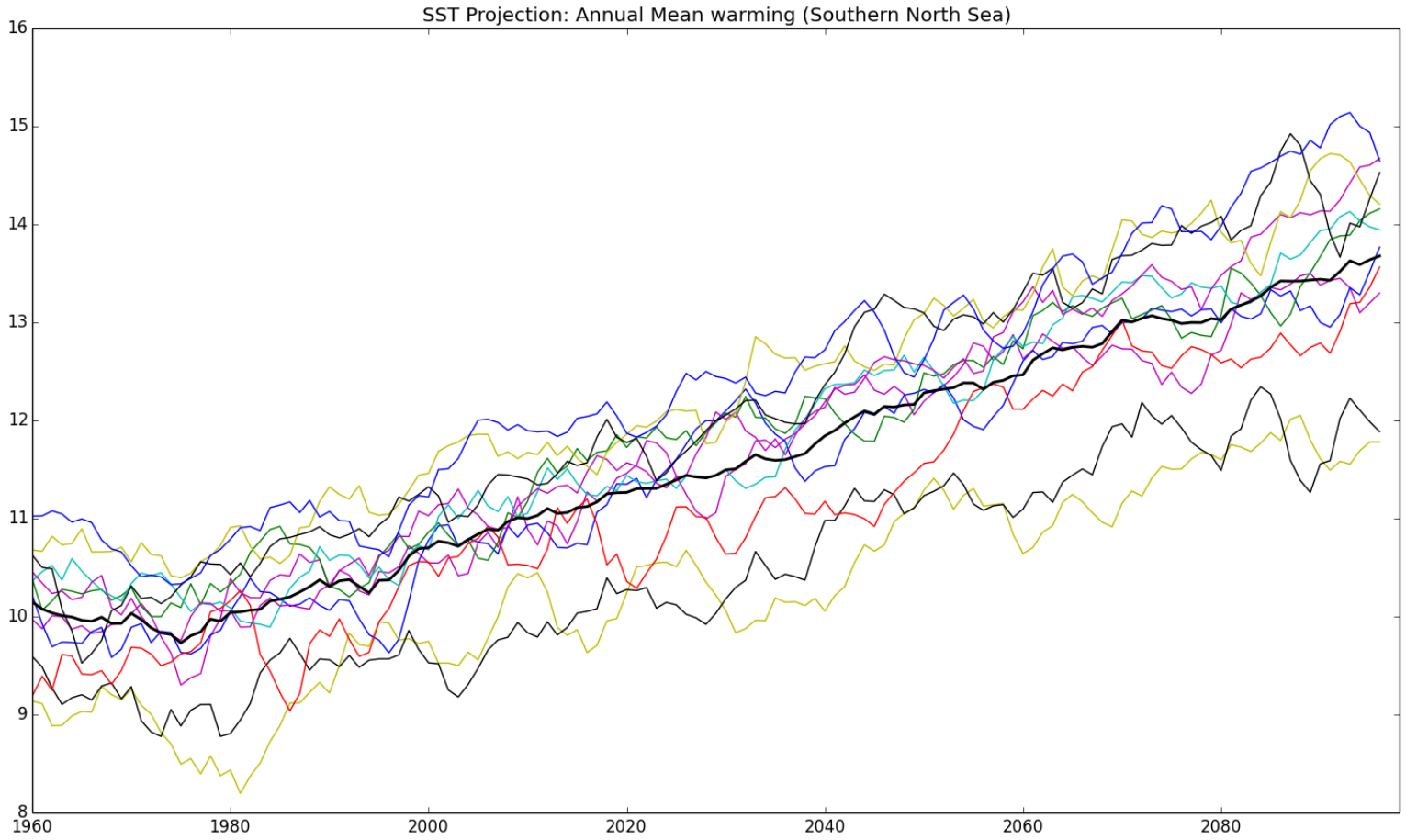

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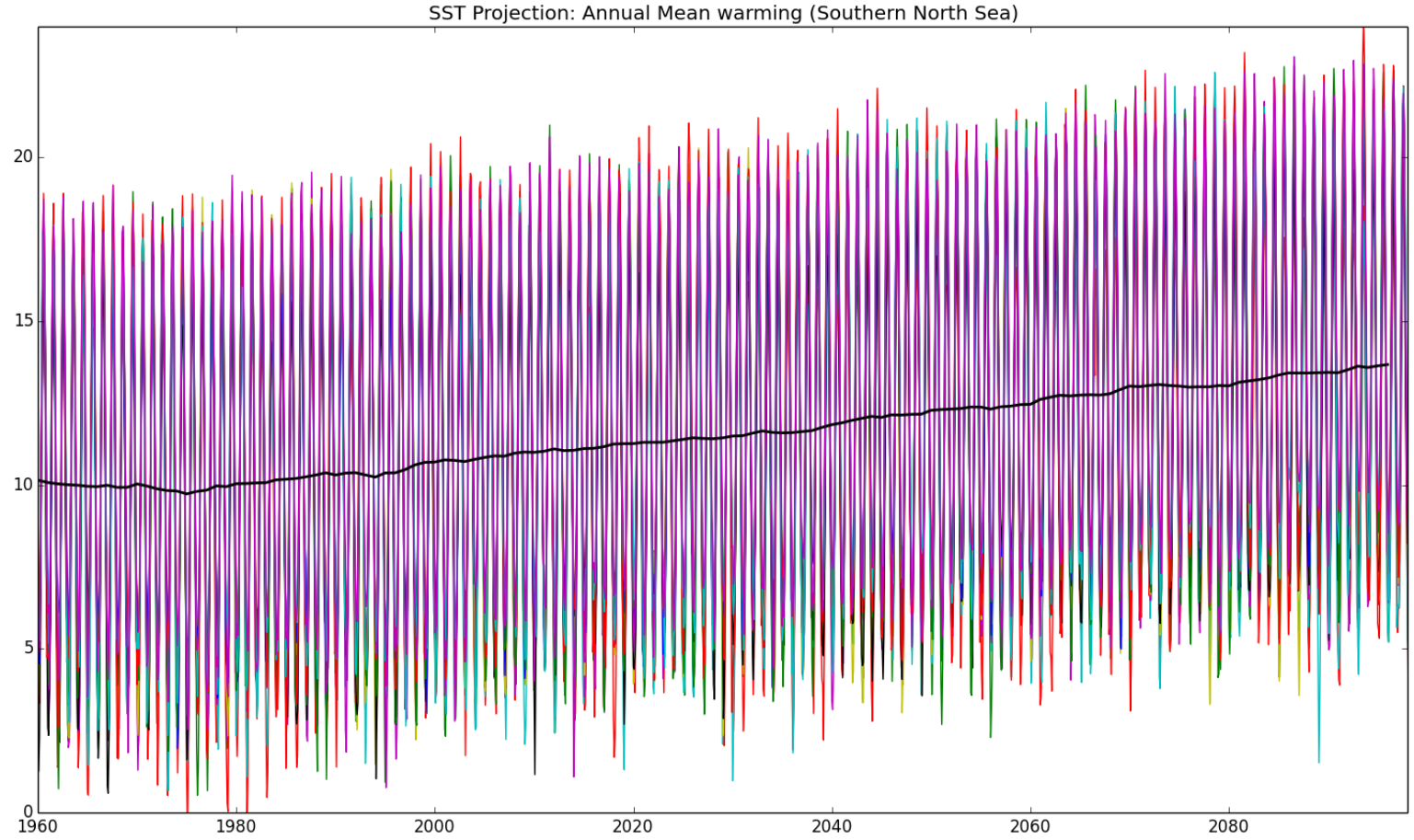

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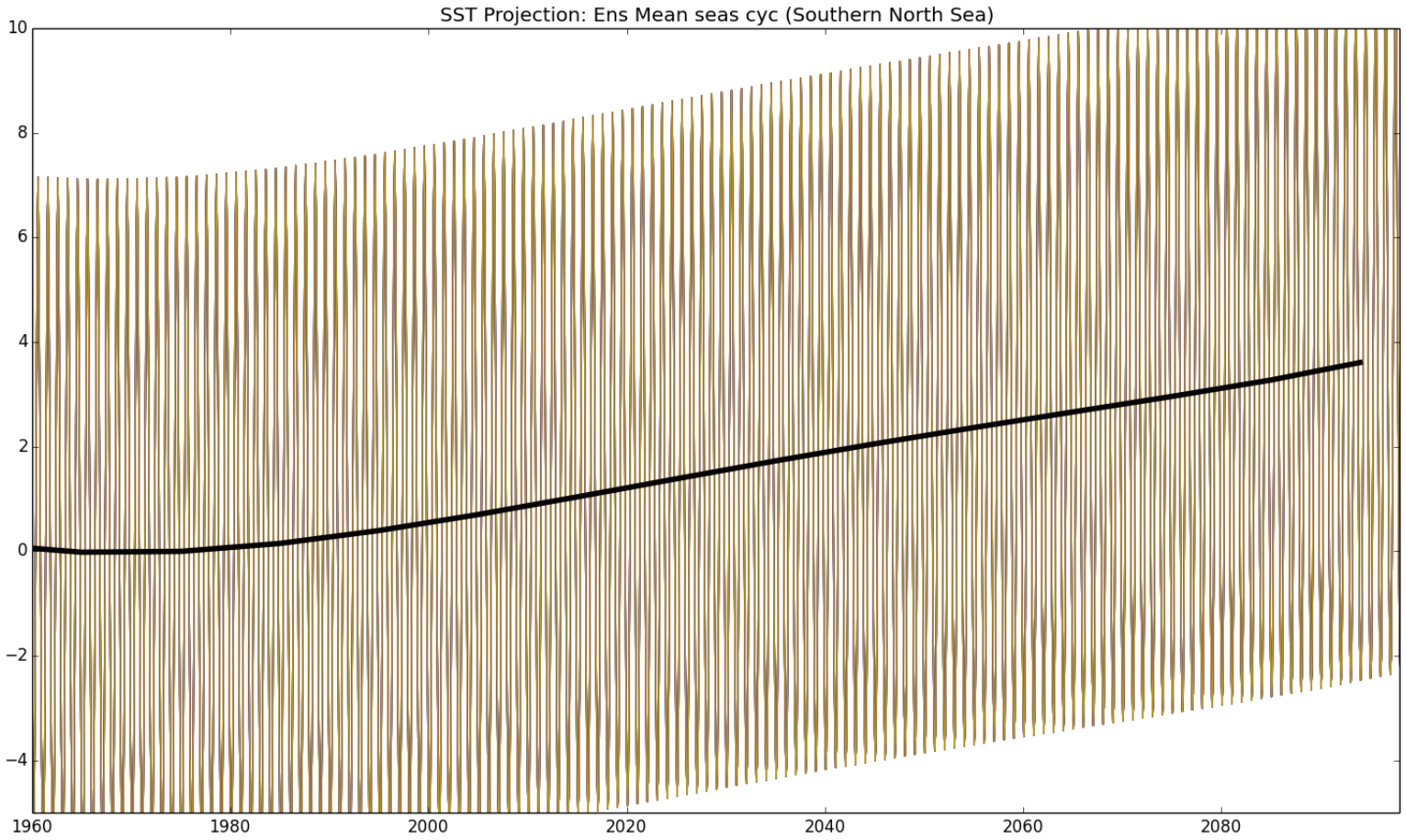

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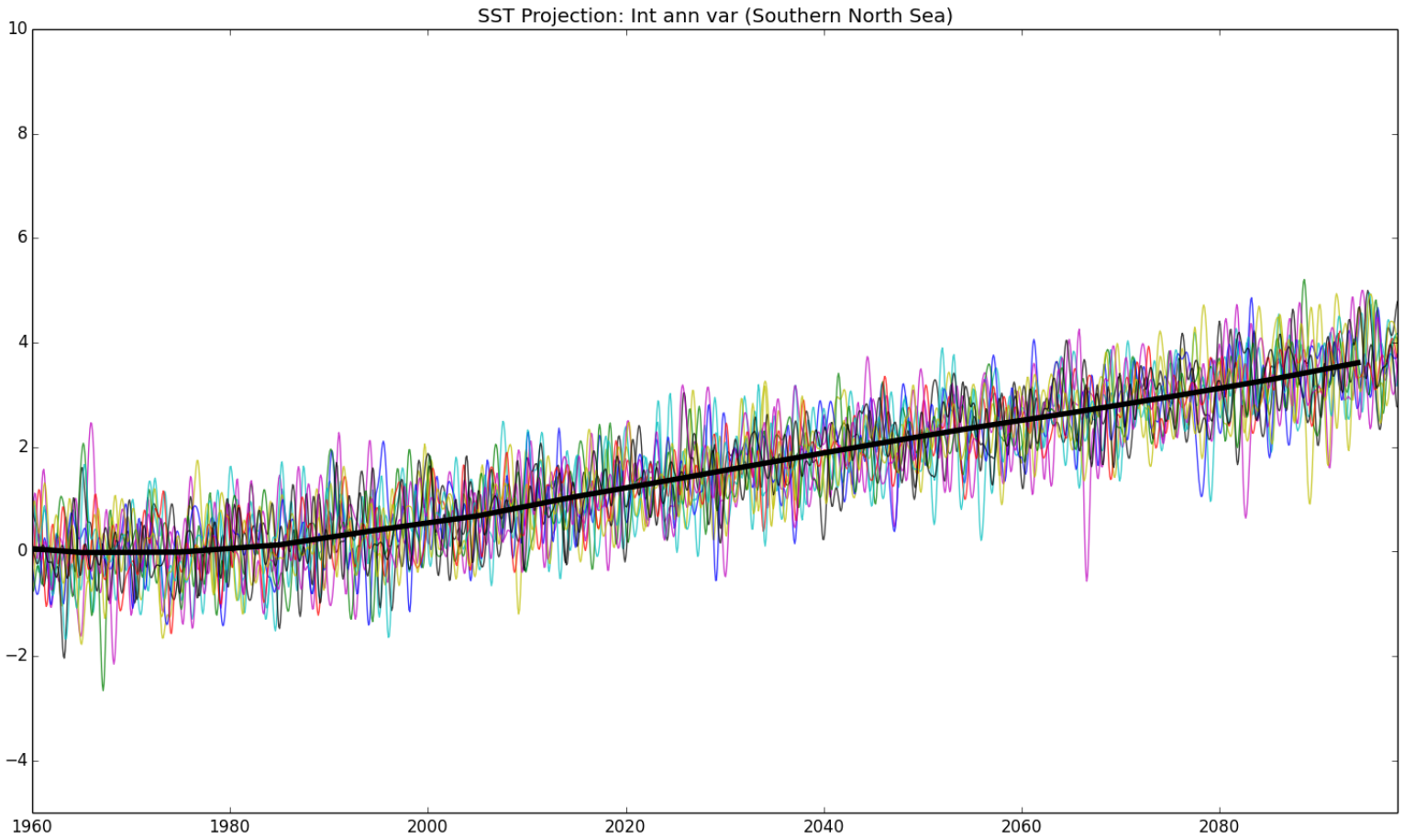

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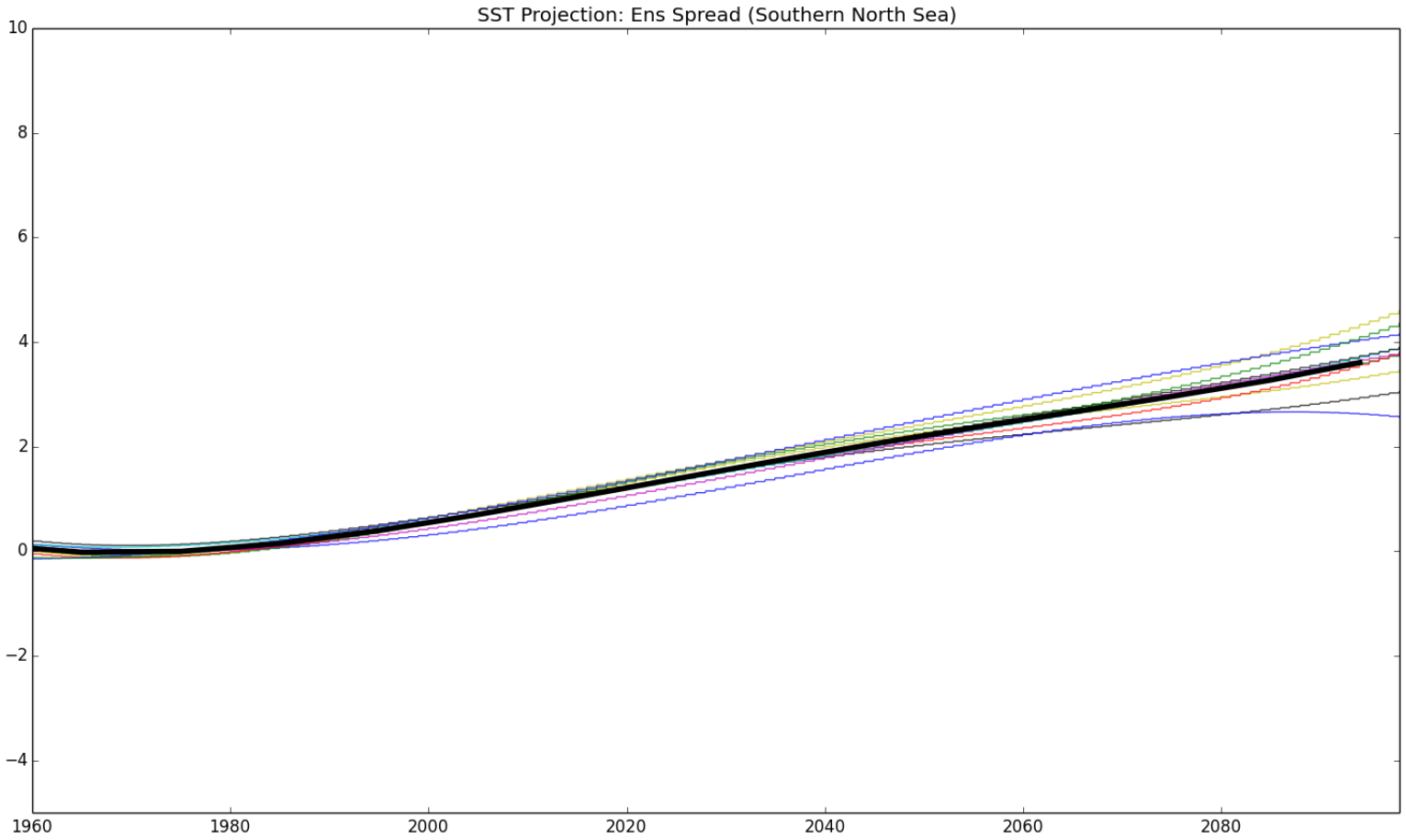

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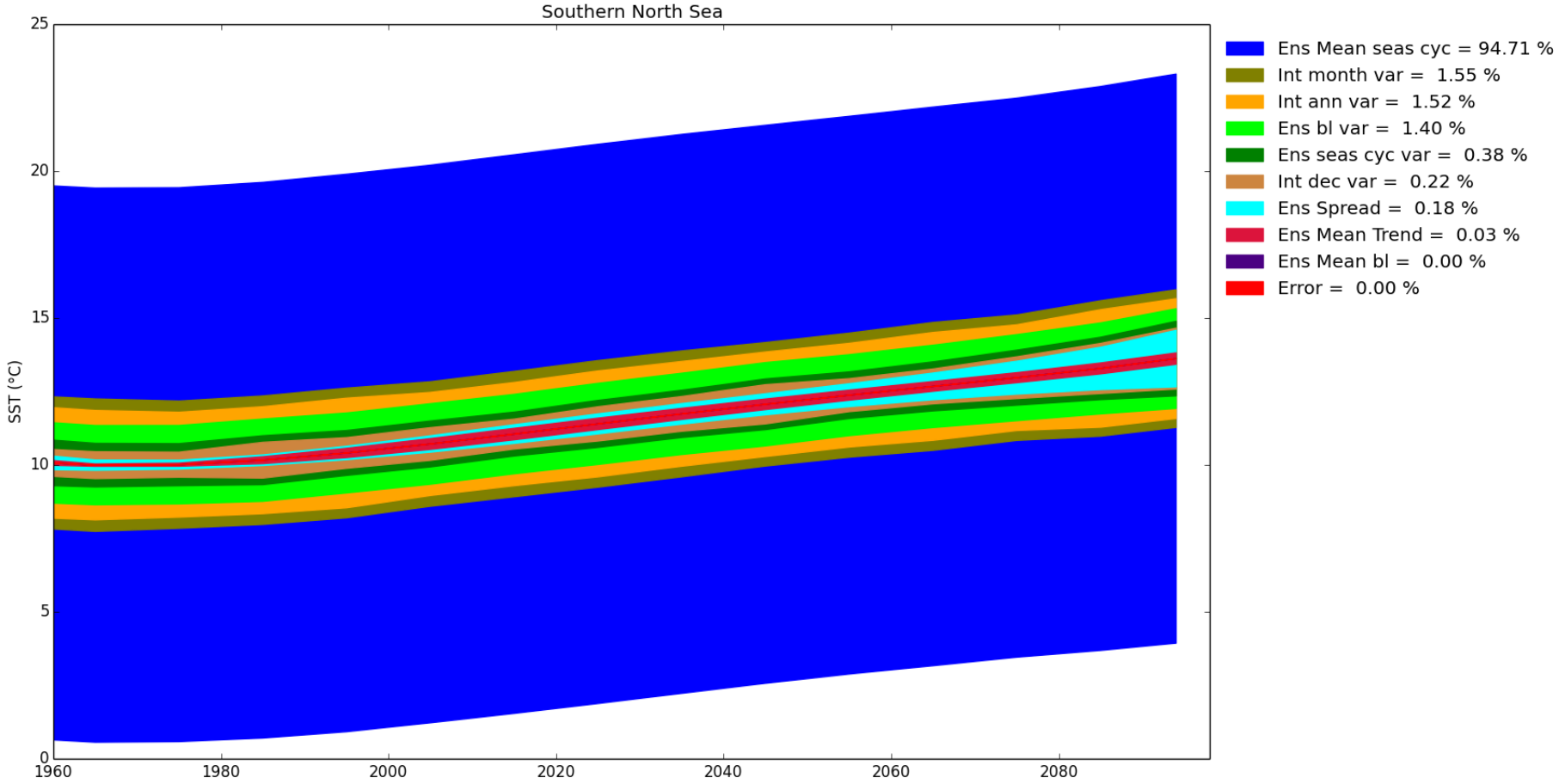
# Separating Variance into Components



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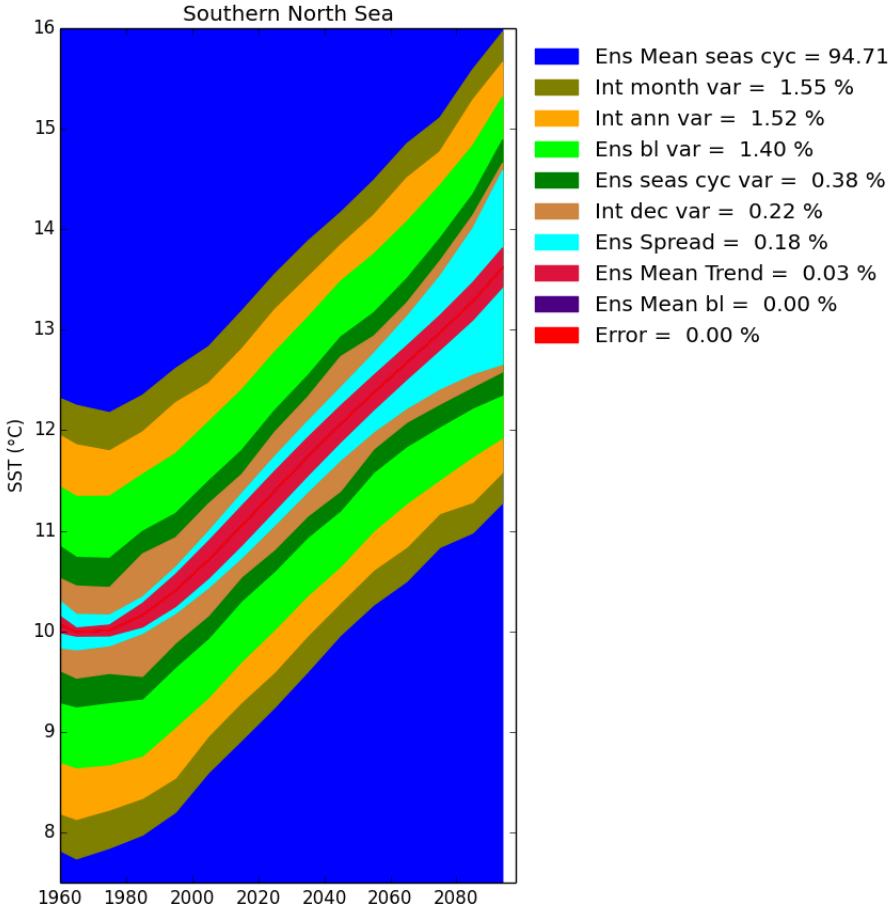


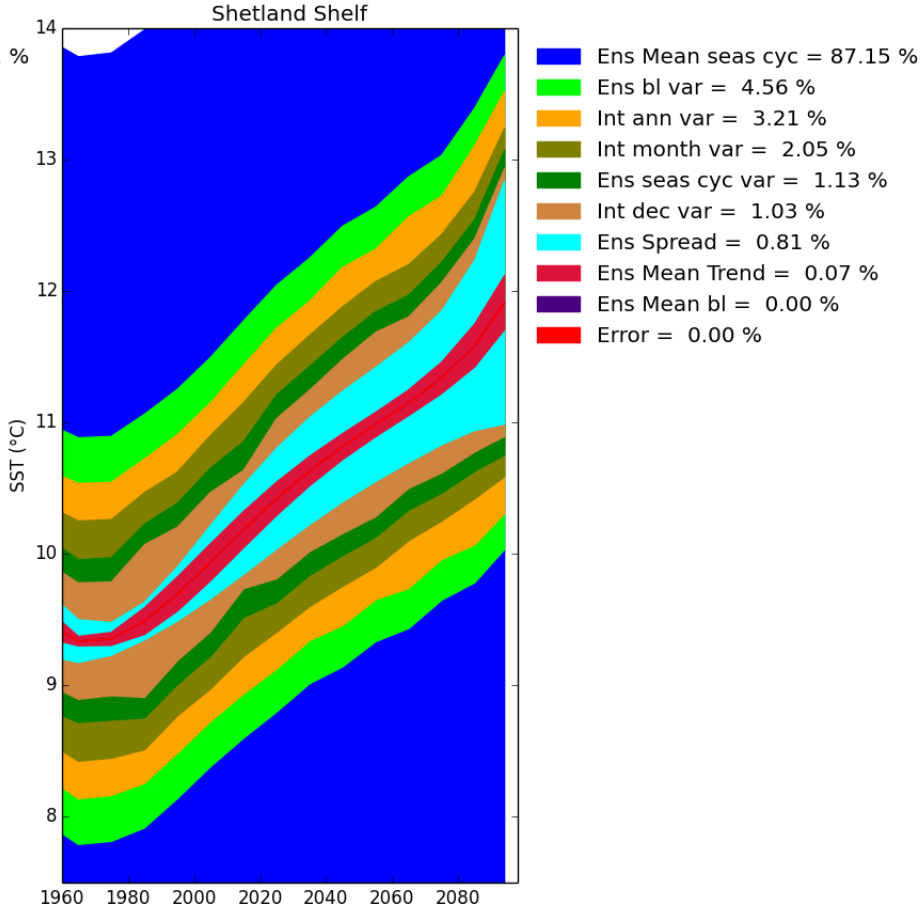

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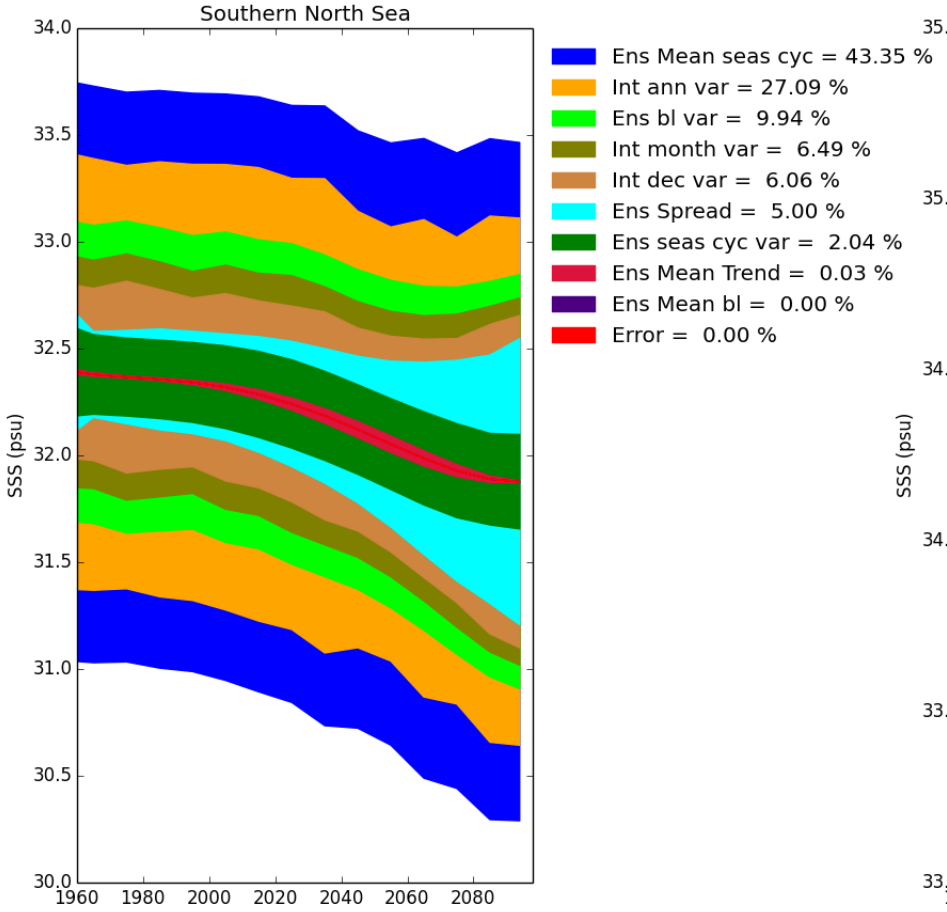


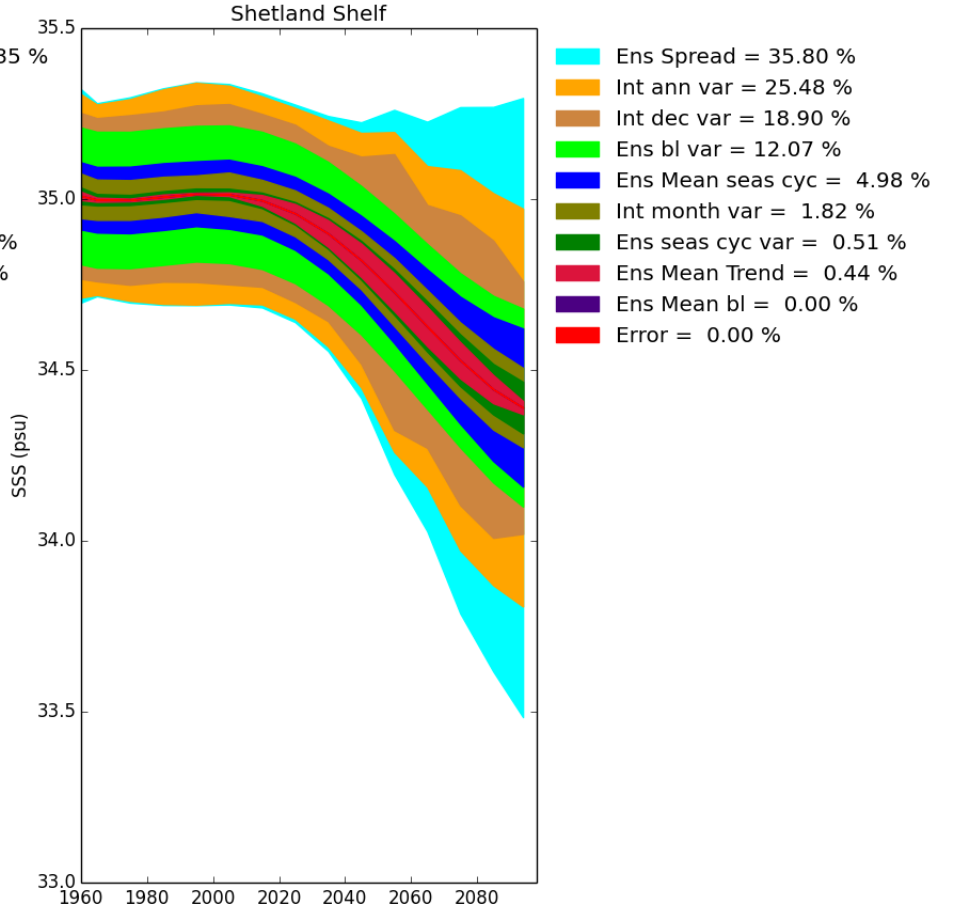

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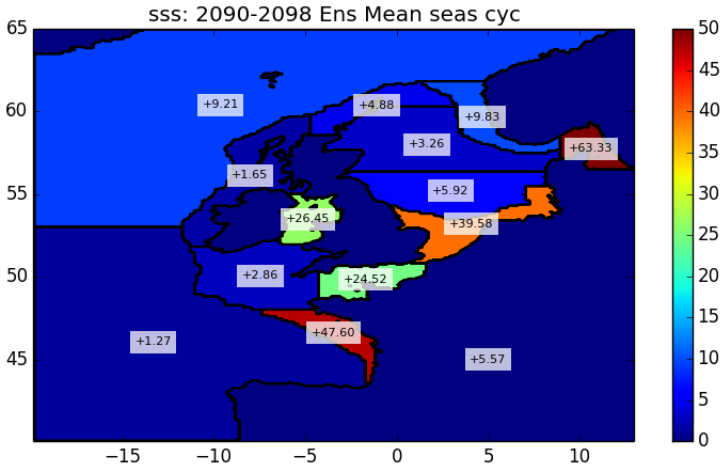


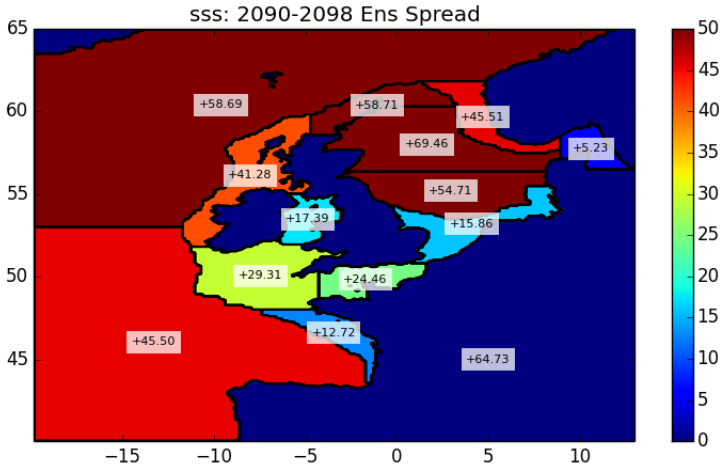


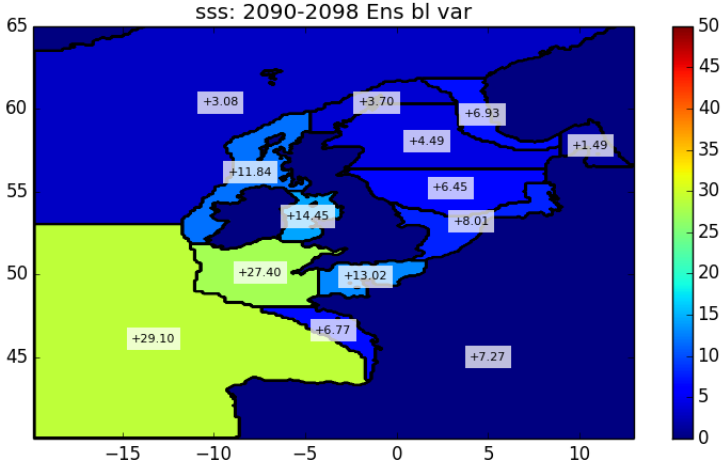


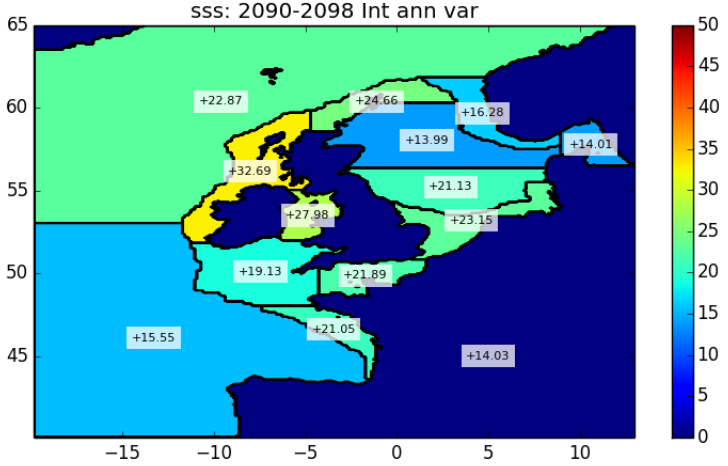

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# Summary:

- Marine Climate projections for the NW European Shelf Seas
  - Physical, Transient, Ensemble
  - Allow climate sig. & variability through atmos., ocean and river
- Temporal evolution complex
  - Different drivers
  - Different sources of variability
- Sources of climate variability can be separated
  - These can be separated
  - Spatially patterns

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# Future Work:

Climate Signal Emergence and
Near future Projections

Model Structural Uncertainty

Seasonal2Decadal Variability

Ecosystem/BGC response to climate change