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Decadal Prediction of the North Atlantic

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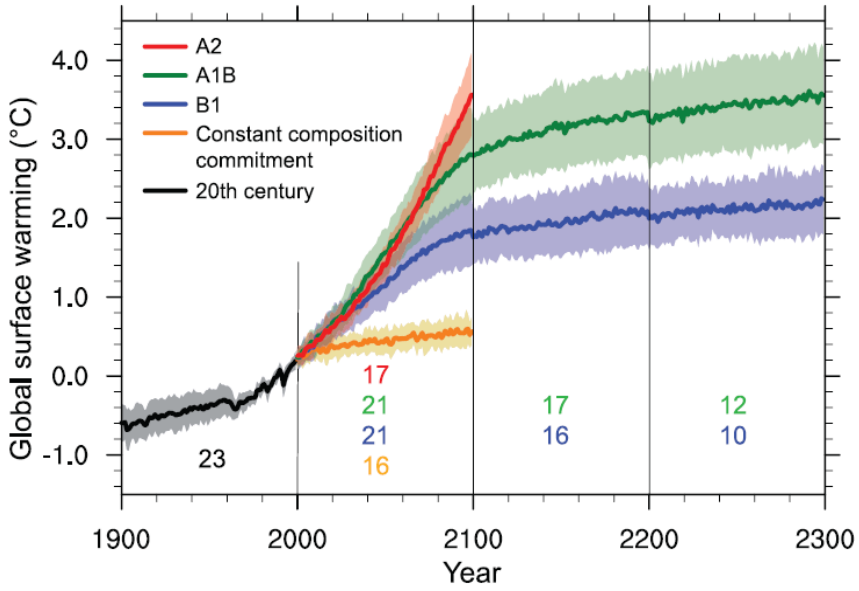
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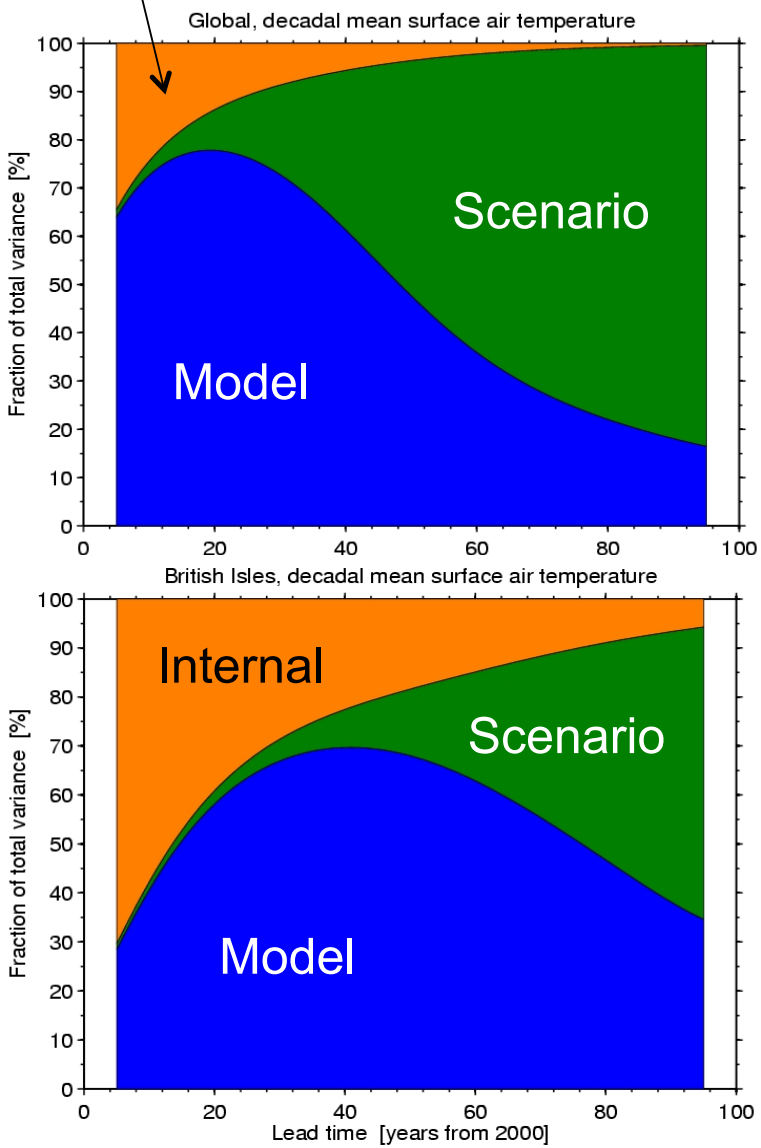
Why Decadal Prediction?

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Global

Regional



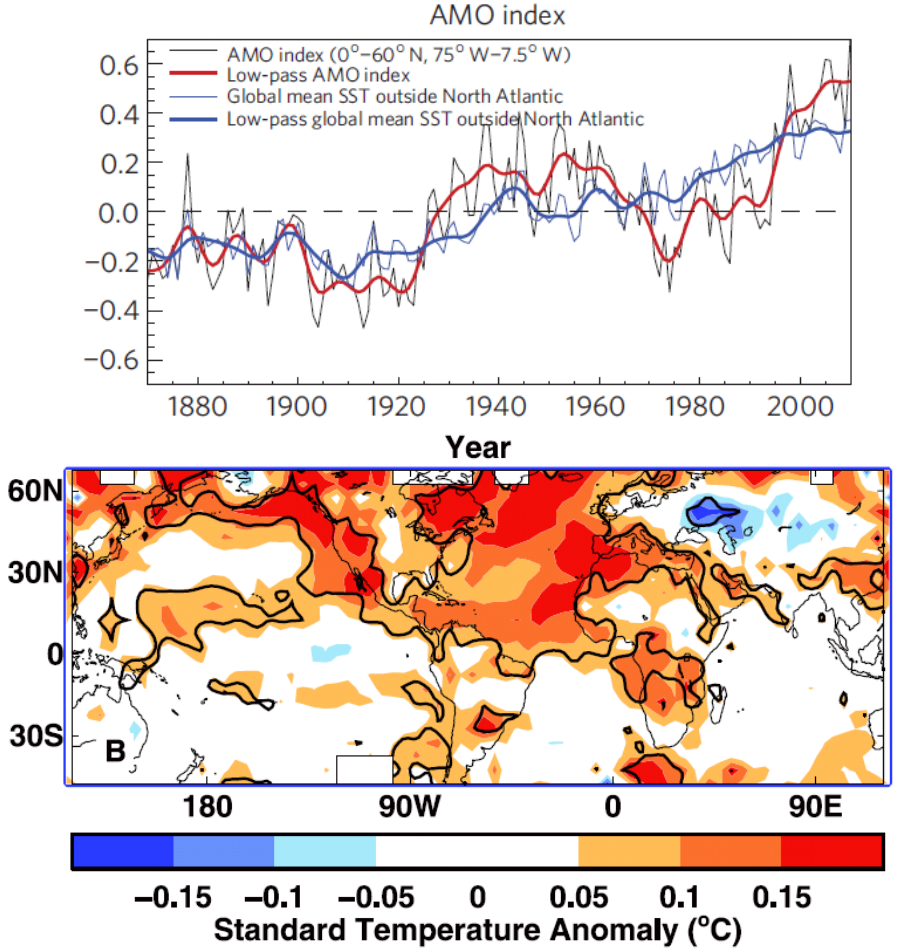
Need for the best information available to make adaptation decisions by trying to predict internal variability of the climate system.

(Hawkins and Sutton, 2009)

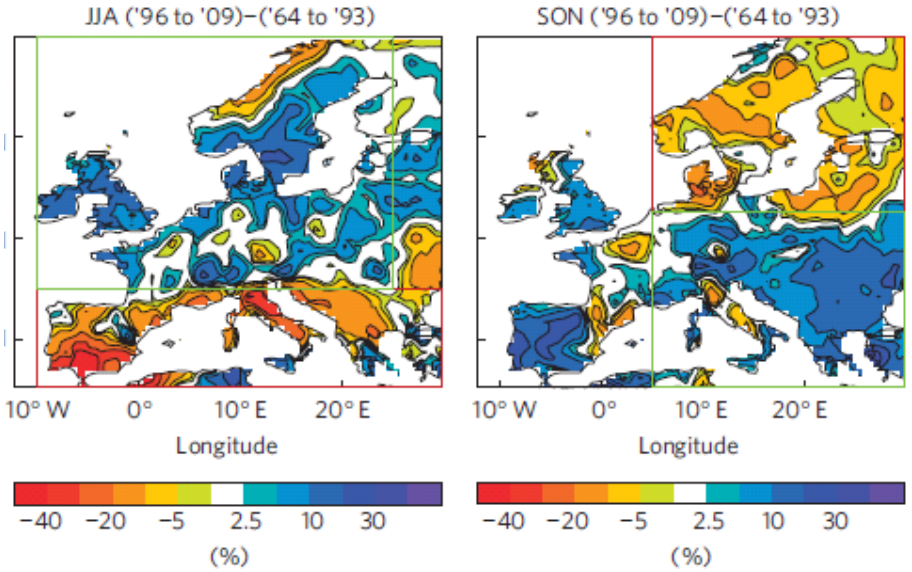
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Atlantic Multidecadal Variability (AMV) and its climate impacts

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Knight et al, 2005



Sutton and Dong, 2012

Evidence that North Atlantic SSTs can effect the surface climate across The Americas, Europe and Africa

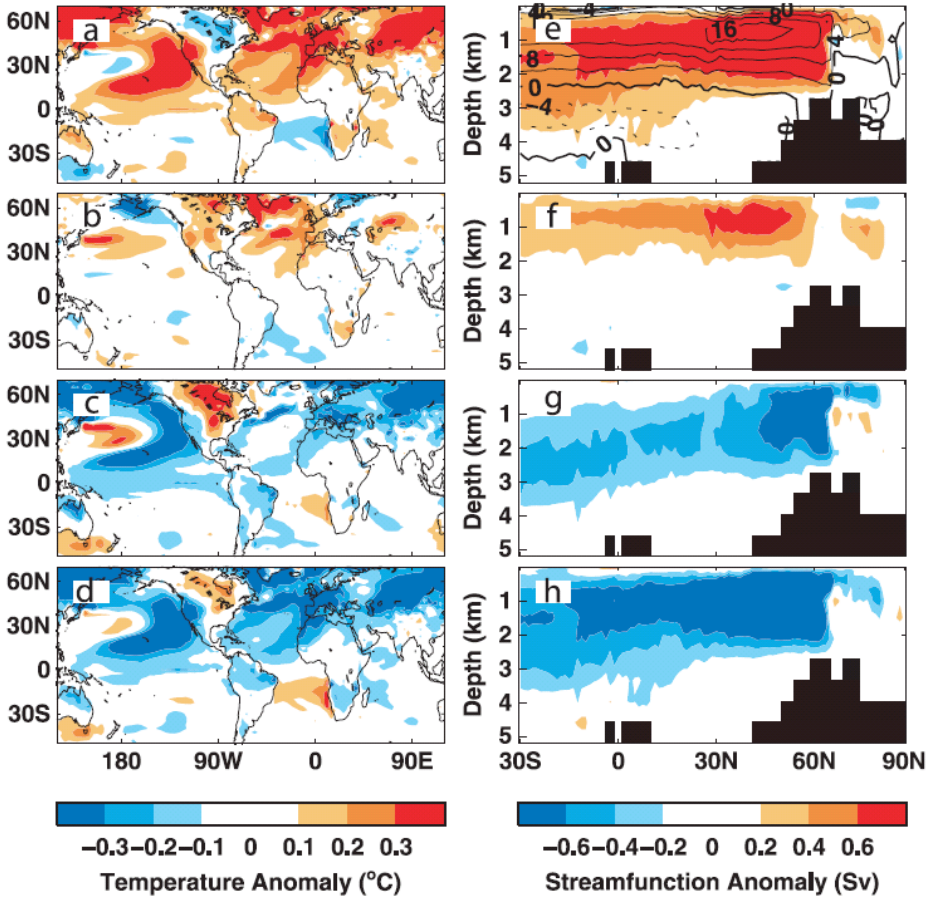
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Can we predict the low frequency variability?

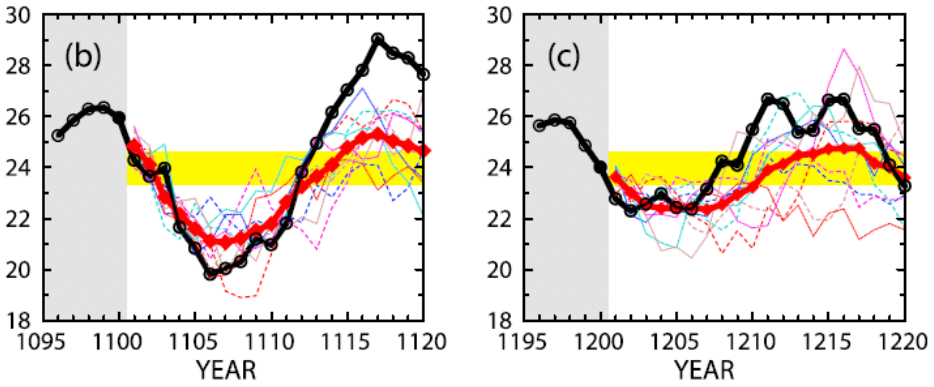
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AMV in many models is associated with changes in ocean circulation and heat transport – particularly the AMOC



Knight et al, 2005

Msadek et al, 2010

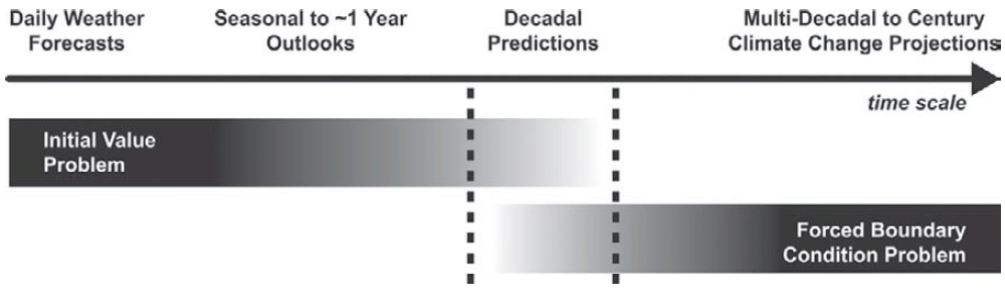


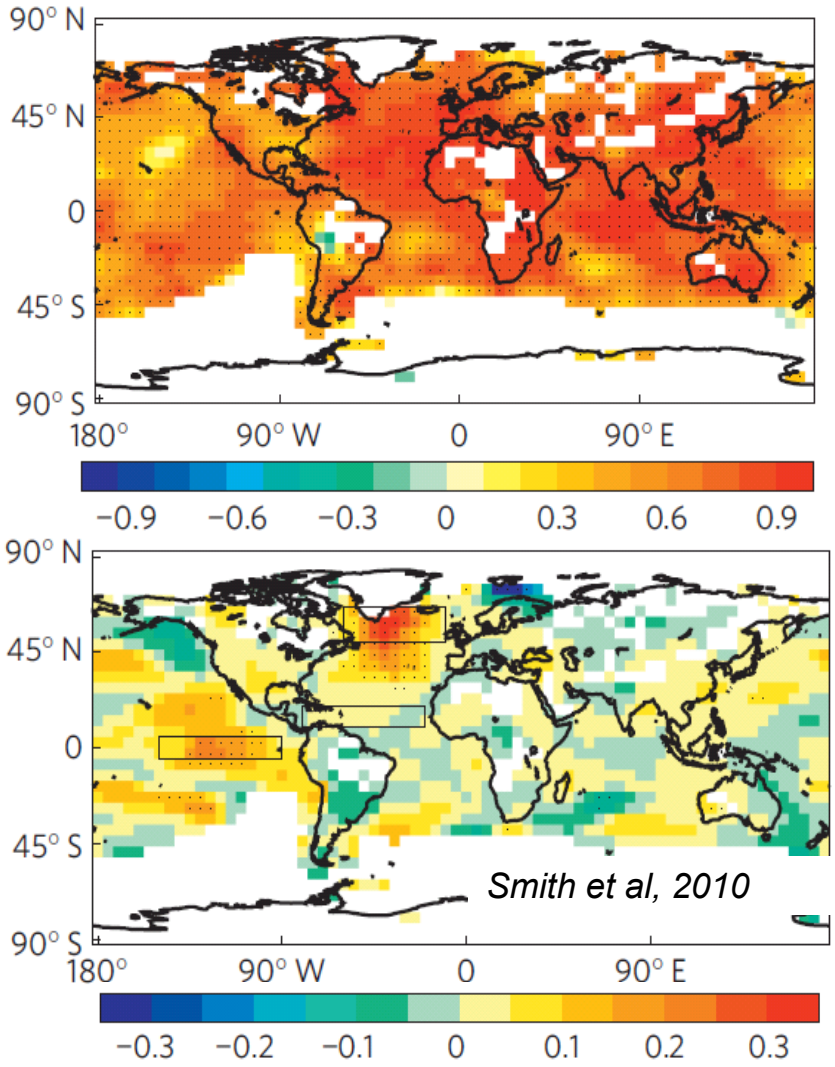
- Ocean evolves slower than atmosphere → could be predictable for much longer
- **Models suggest potentially predictable for at least a decade – but large uncertainty**
- **Decadal Prediction → process based evolution of models**

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Decadal prediction - Is there skill?

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So far, Not much evidence for improved skill over land - But, limited hindcasts, limited validation (i.e. 1960 - 2005)

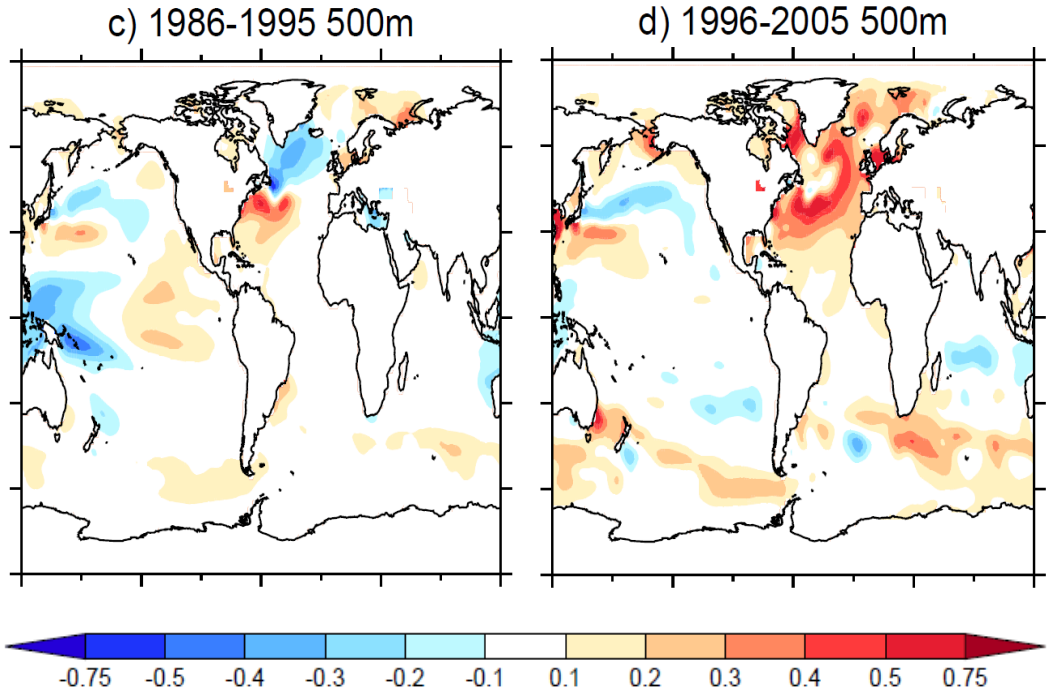
Why improvement over the North Atlantic? → importance of case studies

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Case study of Decadal Prediction: the Mid 1990s rapid warming

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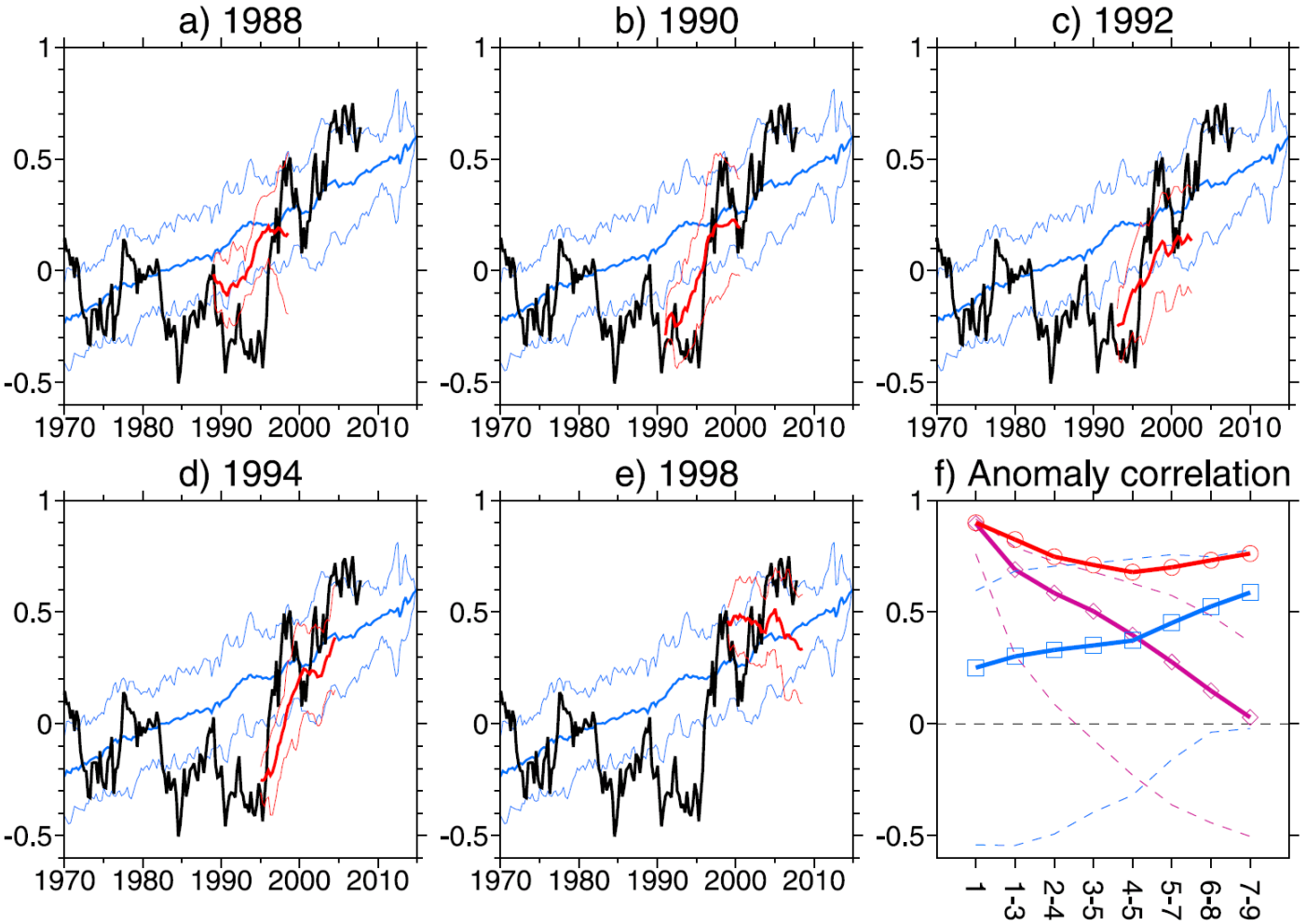
All anomalies relative to 1961-1990 climatology

- Experiments suggest that warming was largely due to ocean heat transport changes
- Largely a **lagged response** of the AMOC to persistent positive *NAO in late 1980s early 1990s (see Robson et al, 2012, JClim)*
- **This suggests that this event could have been predicted?**

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Was the event predictable?

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0-500m subpolar gyre heat content anomaly

Obs
DePreSys
NoAssim

Ocean heat transport into subpolar gyre key to predicting the warming

Robson et al, 2012, GRL

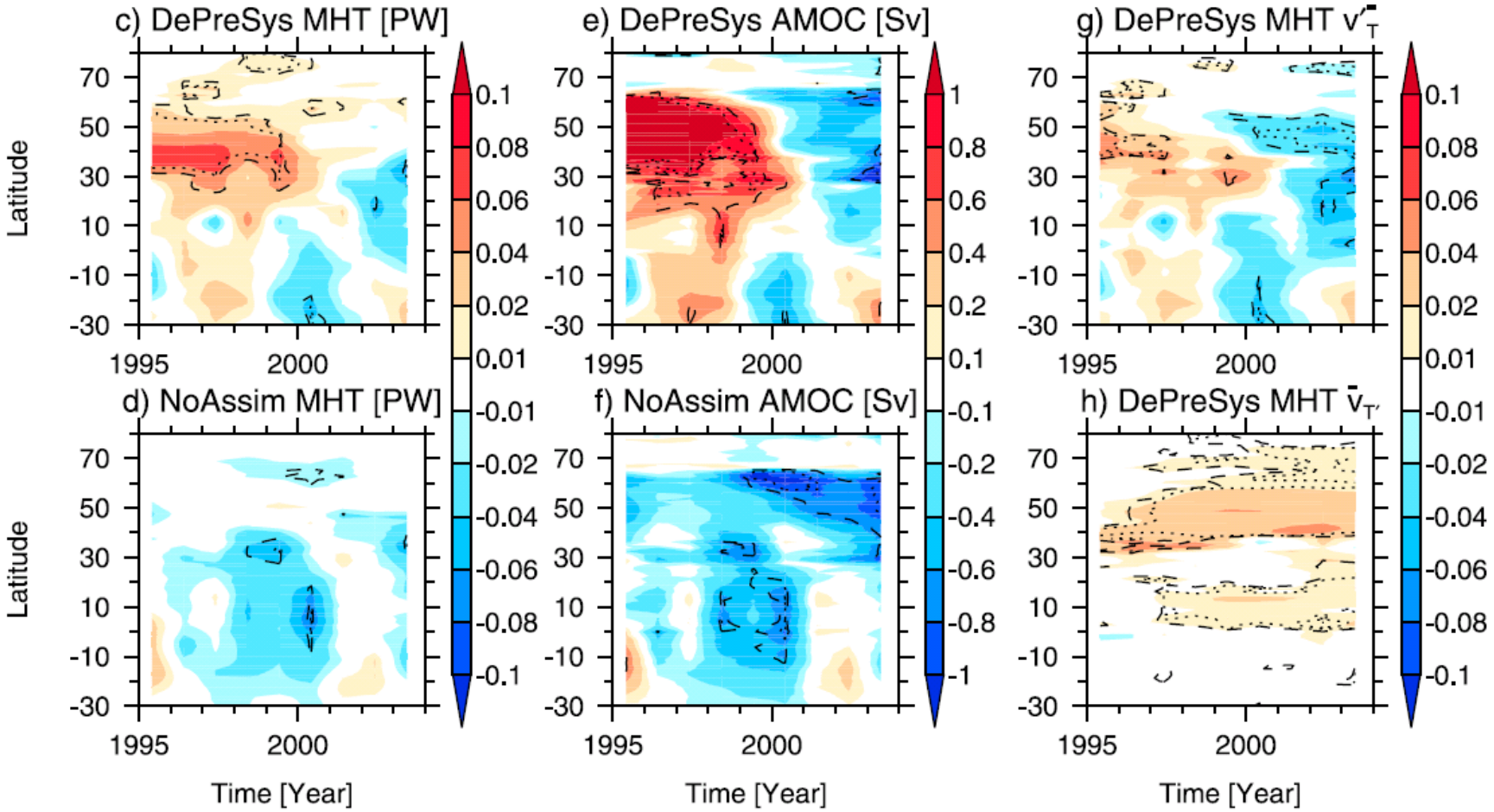
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Initialisation of Heat transport key

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1994 hindcasts

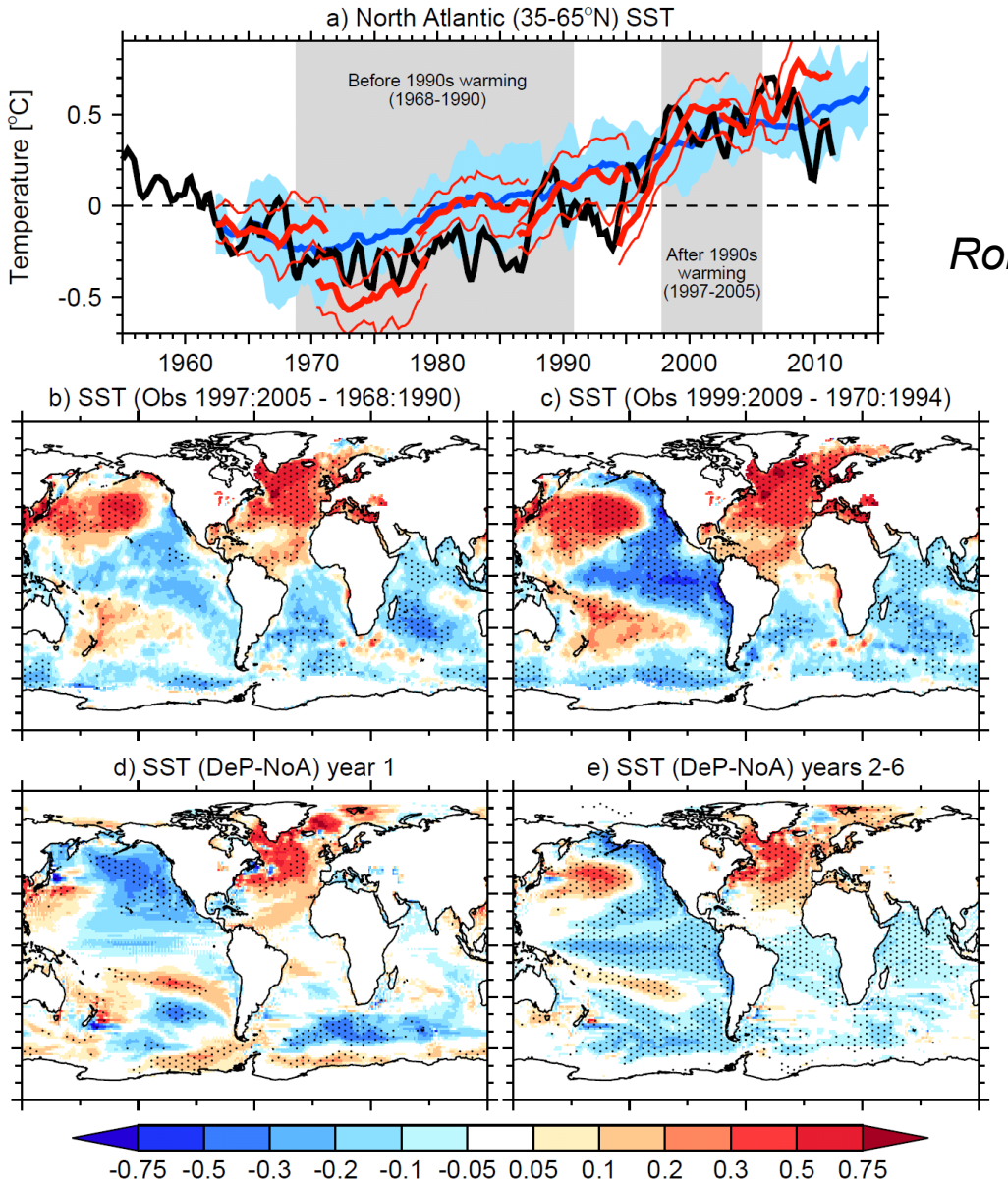


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What about climate impacts over land?

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Robson et al, in prep

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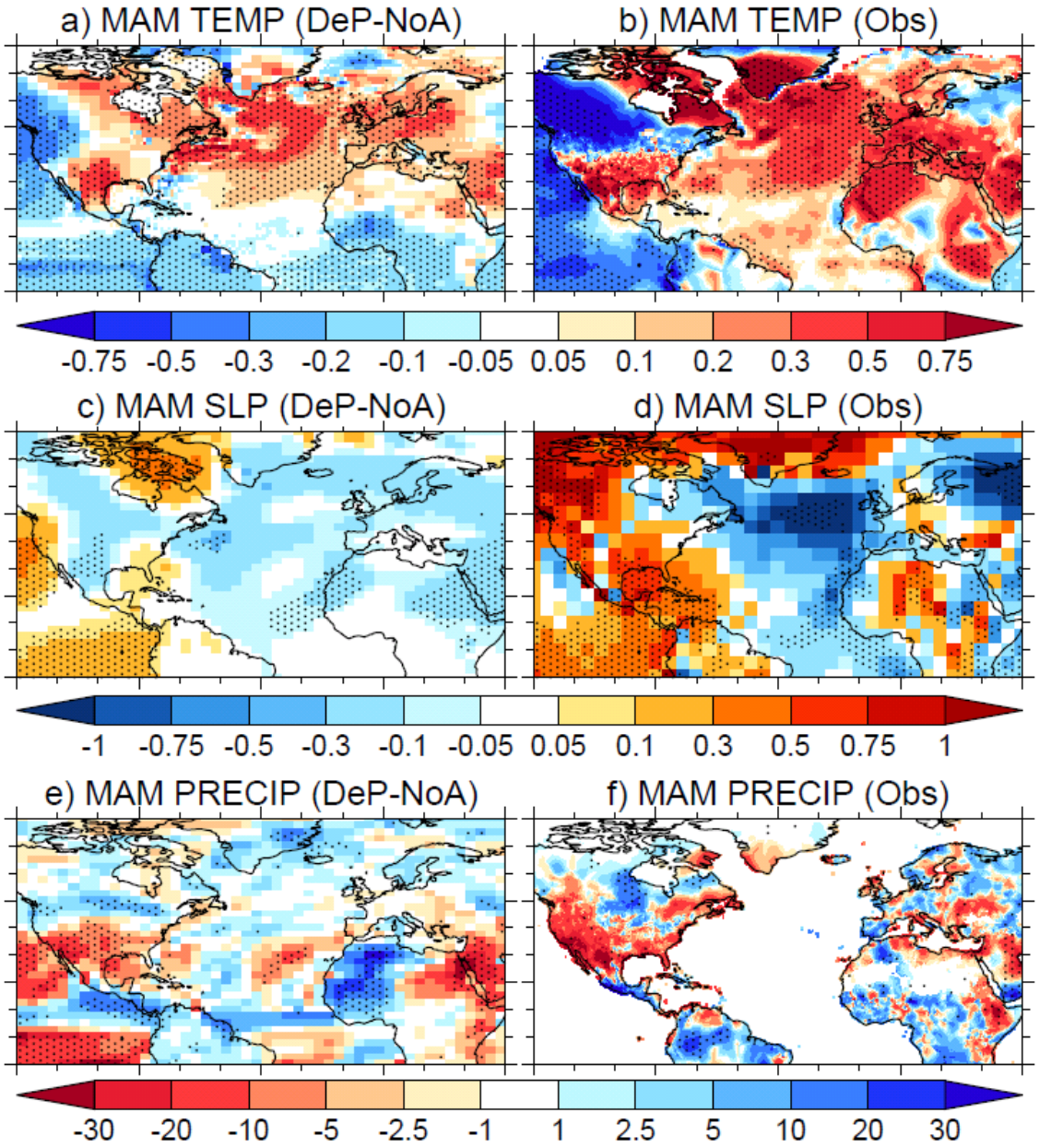
Climate impact - MAM

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Obs:-
1999 to 2009
minus
1970 to 1994

model:-
All hindcasts starting
1997 to 2005
minus
1968 to 1990

Years 2-6



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Summary

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- Decadal Prediction is an exciting new area of Climate Science
- Slower parts of the climate system (e.g. the ocean) is key for successful predictions
- Big uncertainties in the mechanisms of decadal change, and of its potential for prediction. Significant opportunity to improve climate models and understanding of important processes
- In the mean, most skill in surface temperature comes from the forced trend - little impact of initialisation beyond a few years? However, there is apparently state dependent/regional skill
- Case studies are an important route to understand decadal predictions, e.g. the mid 1990s Atlantic warming
  - The UK Met Office Decadal Prediction System (DePreSys) is able to capture the rapid warming, and its climate impacts

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