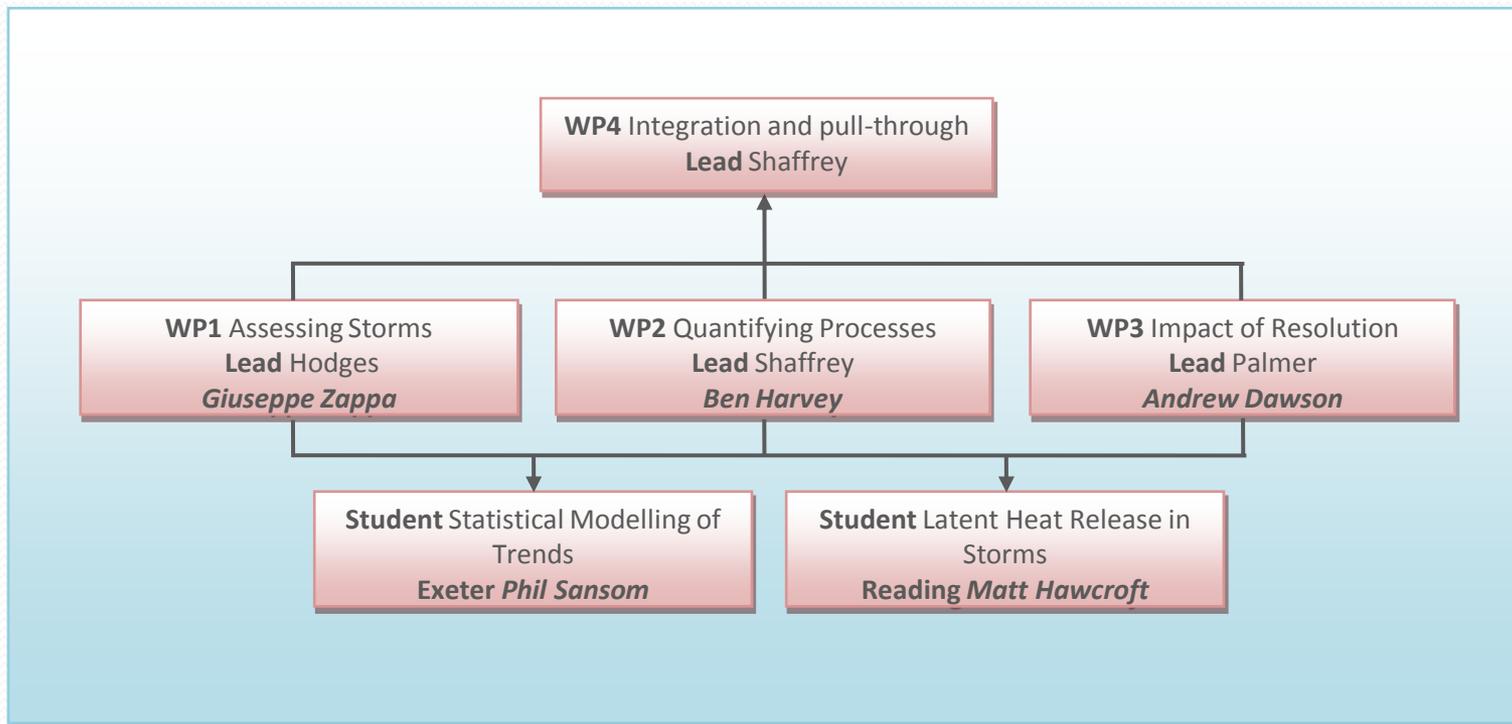


TEMPEST WP2

Ben Harvey, Len Shaffrey, Tim Woollings

SRM Annual meeting, 2nd November 2011

Position within TEMPEST



WP2 aim: Understand which processes are leading to the large spread of climate predictions for European extra-tropical cyclones

CMIP3

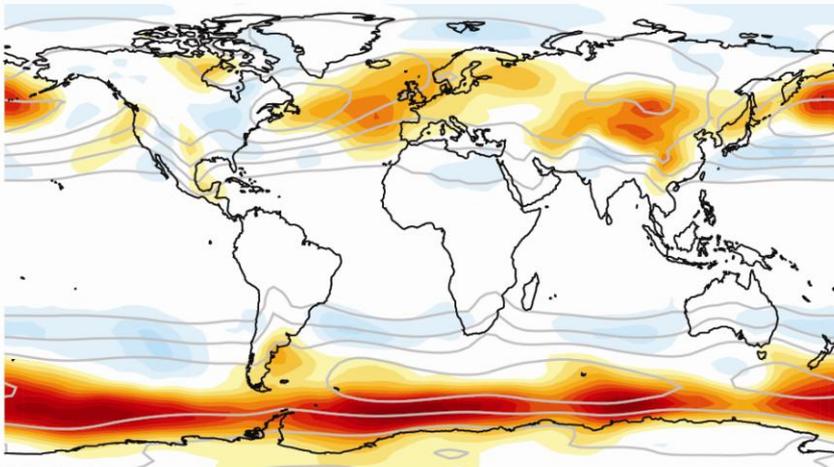
23 models

The database only contains daily mean data

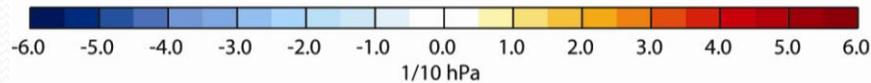
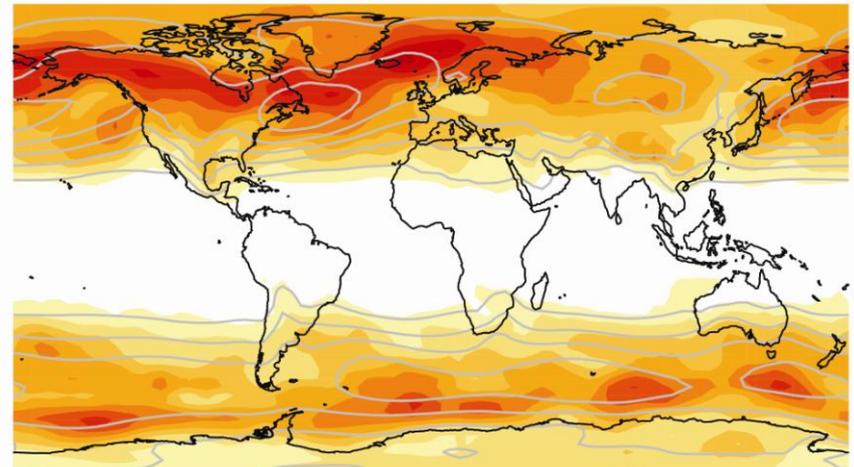
- Cannot track individual storms
- Instead use Eulerian diagnostics
- Here focus on time-filtered variance statistics

CMIP3 storm tracks

Mean response (DJF)



Inter-model standard deviation of response (DJF)

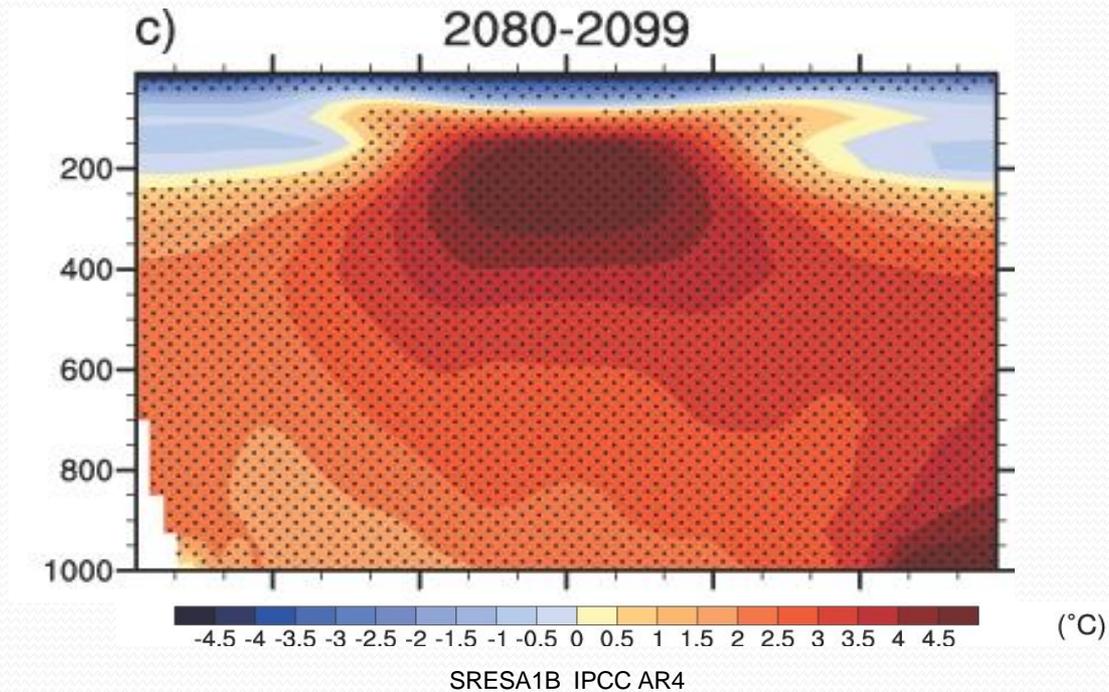


Data: J. Pinto & M. Meyers (Uni. Cologne)
(only 15 models used)

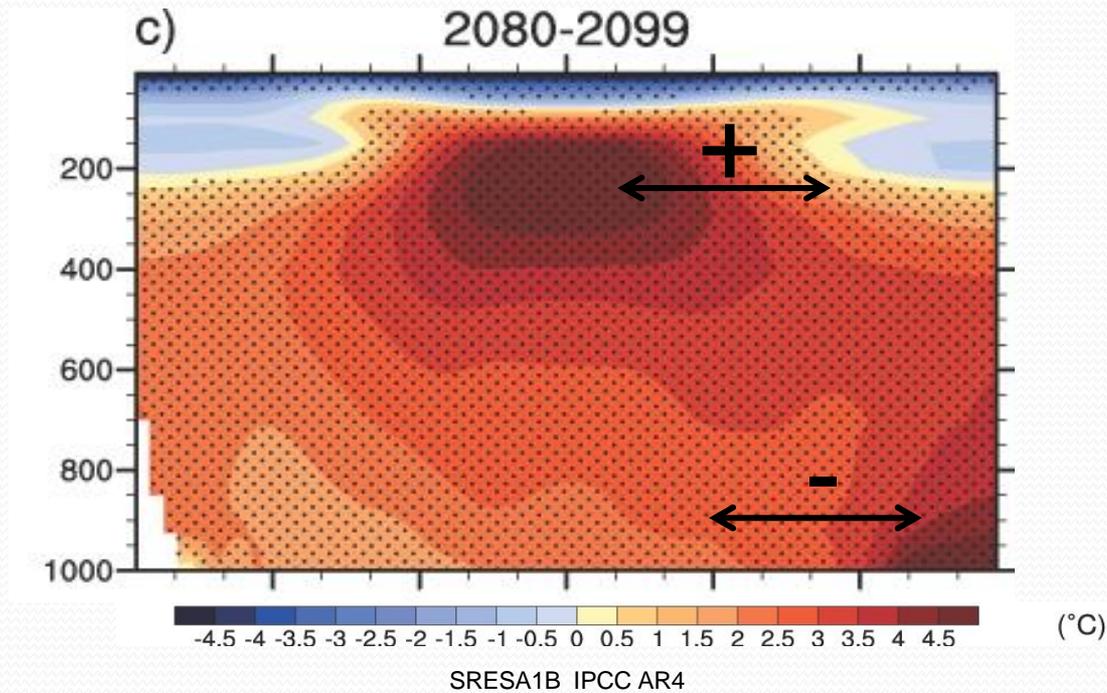
Possible drivers of change

Global drivers	Regional drivers	
Upper level pole-equator ΔT	Atlantic SSTs	AMOC?
Lower level pole-equator ΔT	Arctic sea ice extent	
Stratification	Land-sea contrast	
Local moisture content	Tropically-forced stationary waves	

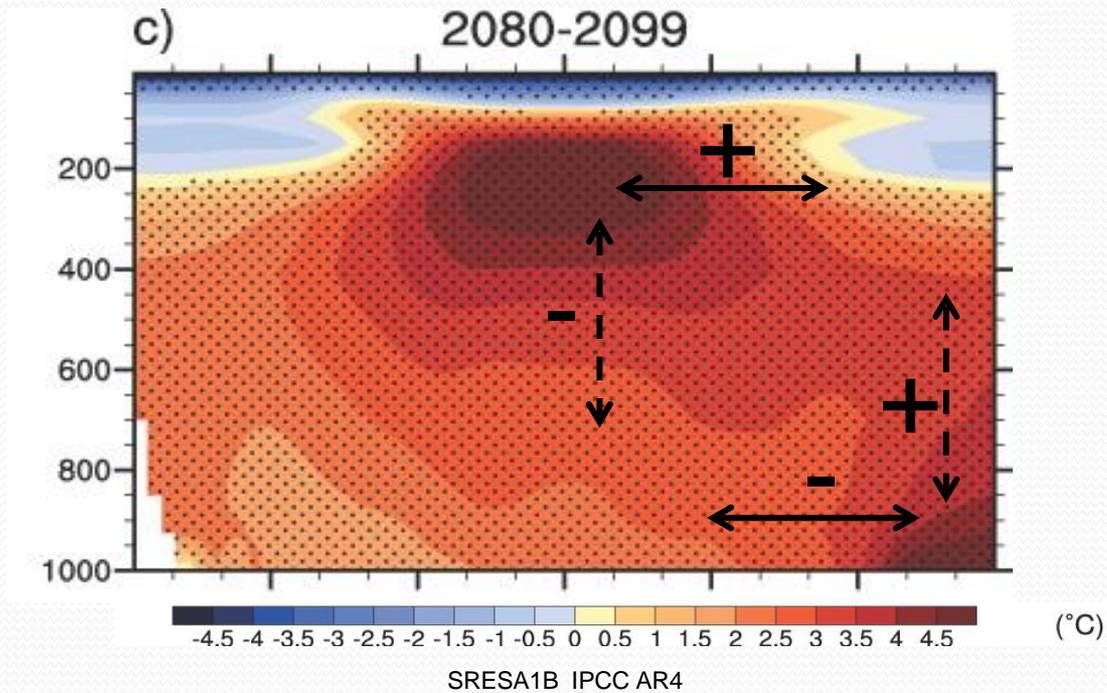
Possible drivers of change



Possible drivers of change



Possible drivers of change

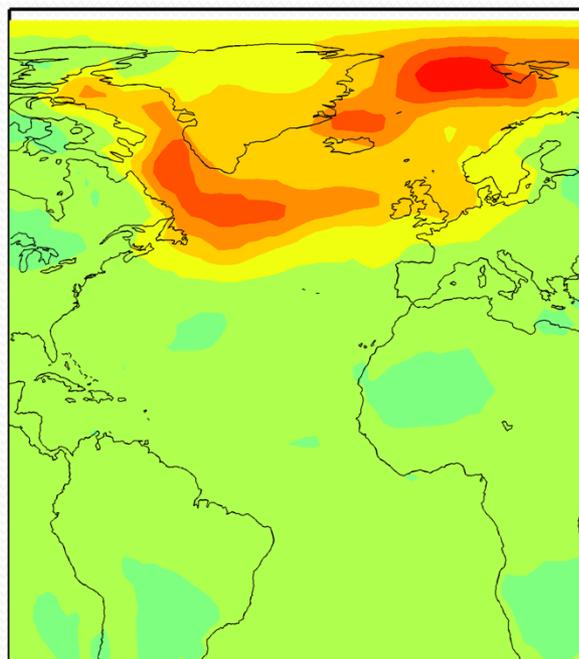


Possible drivers of change

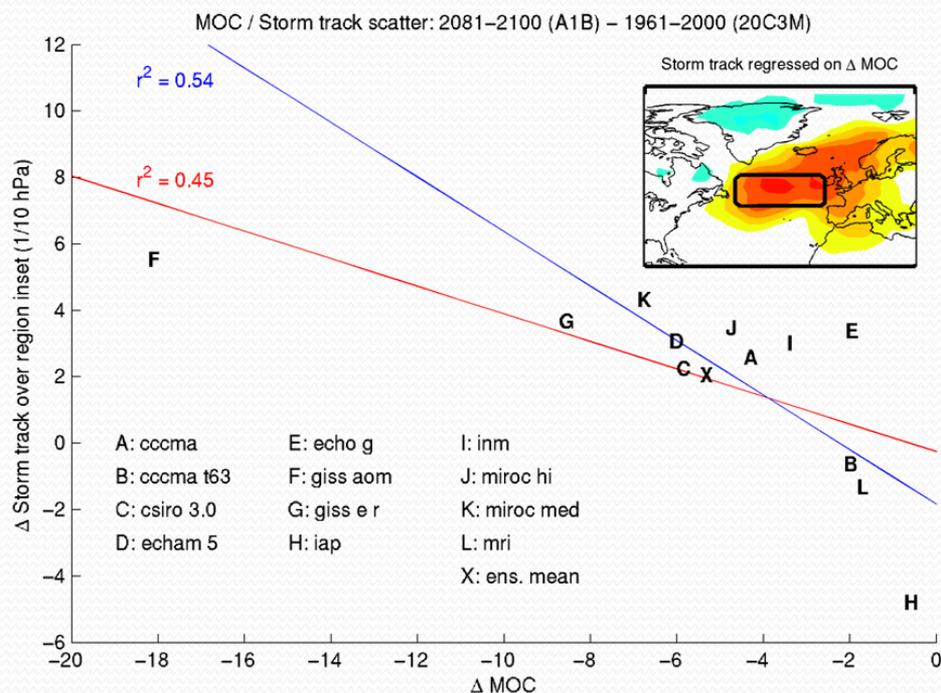
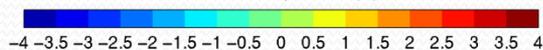
Global drivers	Regional drivers	
Upper level pole-equator ΔT	Atlantic SSTs	AMOC?
Lower level pole-equator ΔT	Arctic sea ice extent	
Stratification	Land-sea contrast	
Local moisture content	Tropically-forced stationary waves	

Possible drivers of change

T_s response regressed on MOC response



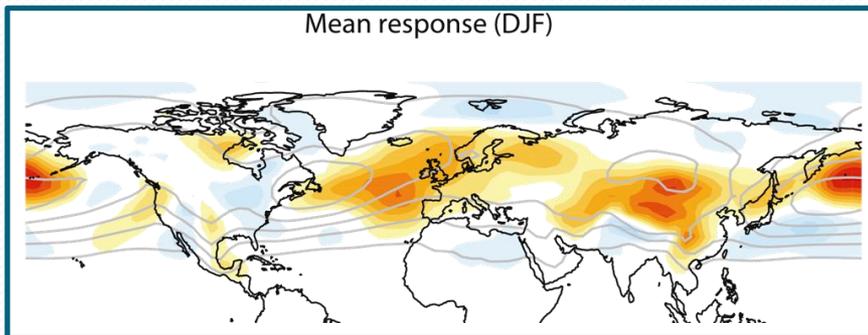
Surface Temperature (K)



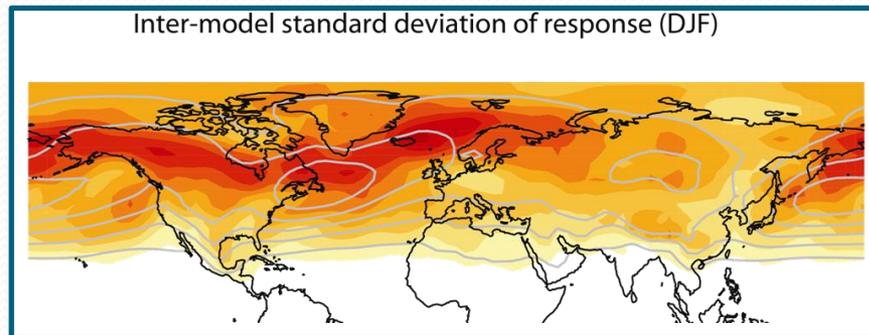
Experimental design

We force HadGAM1.2 with SSTs and sea ice patterns taken from the CMIP3 multi-model ensemble

Mean response (DJF)



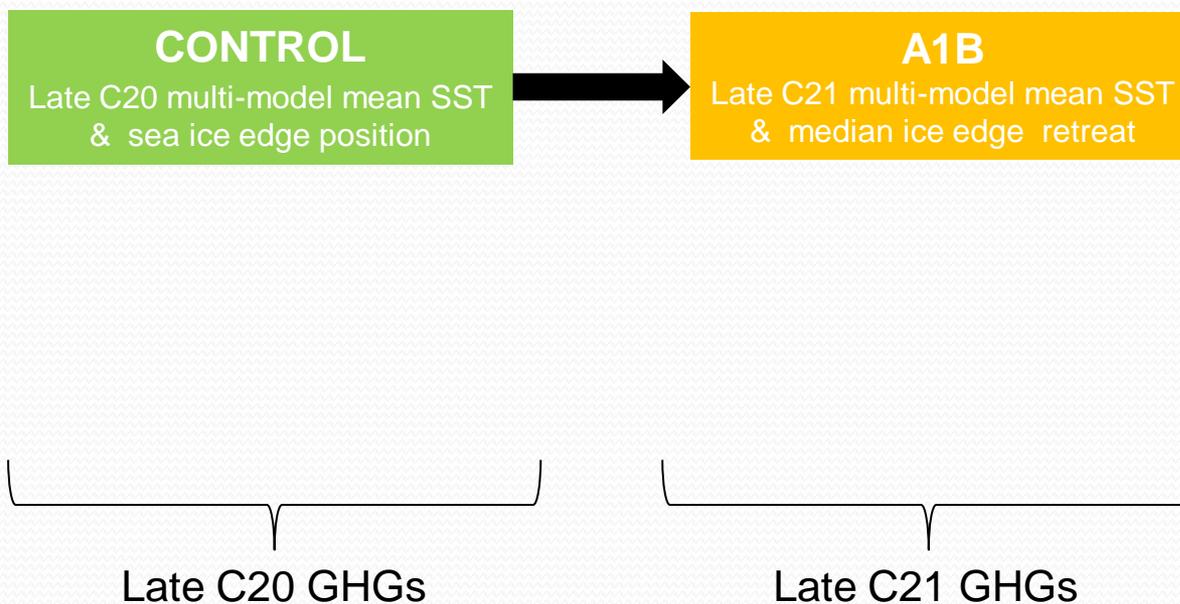
Inter-model standard deviation of response (DJF)



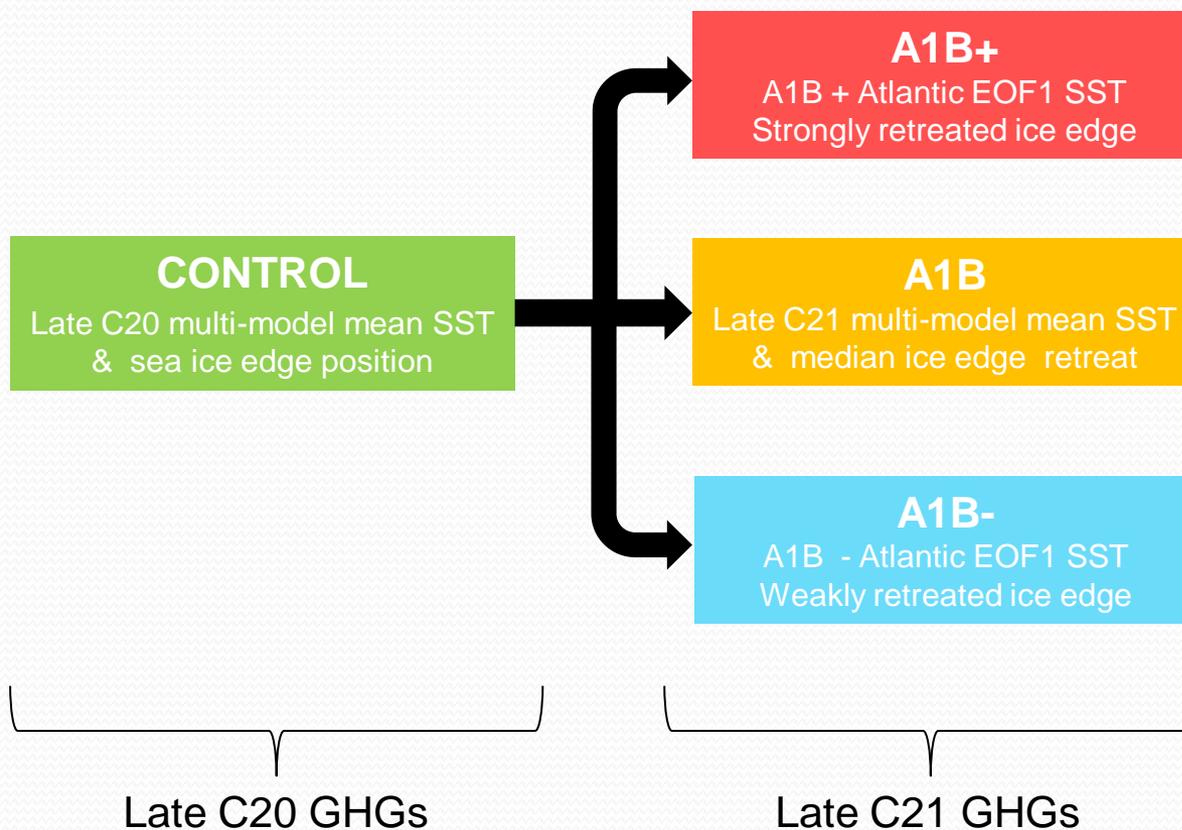
Key questions:

1. How much of the **mean response** is reproduced using the CMIP3 multi-model mean SST and sea ice extent responses?
2. How much of the **spread** is reproduced using forcing fields that represent the range of SST and sea ice responses?

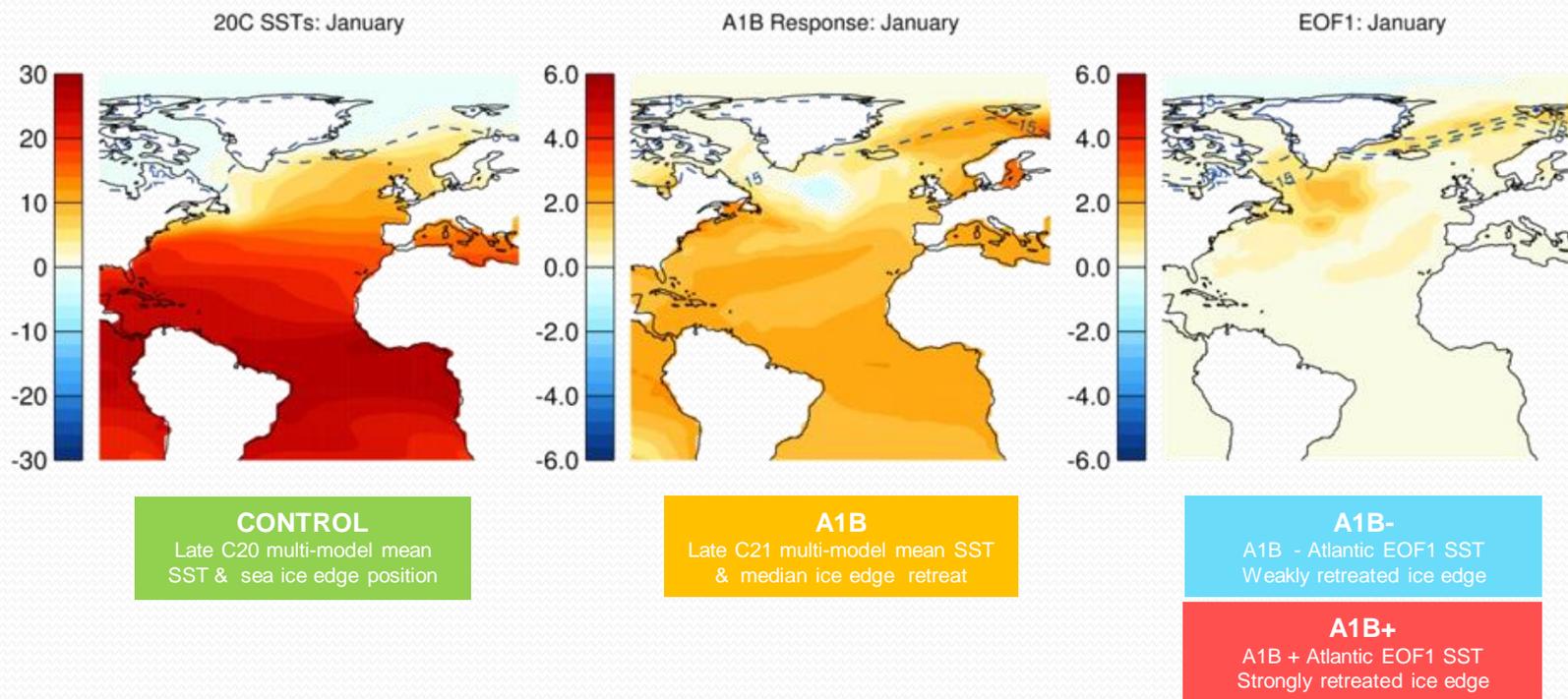
Experimental design



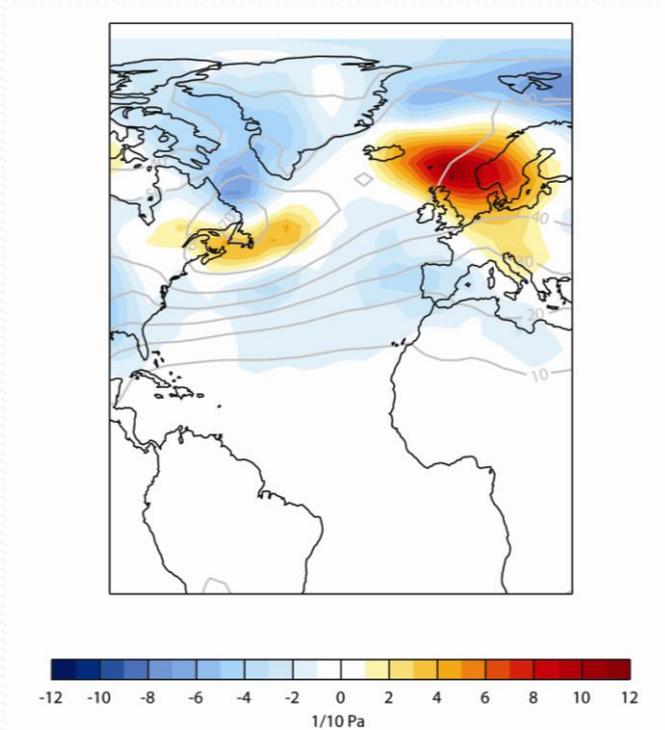
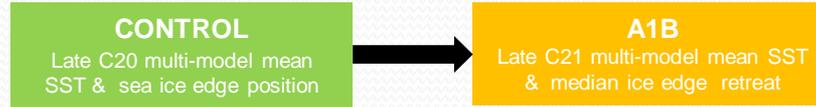
Experimental design



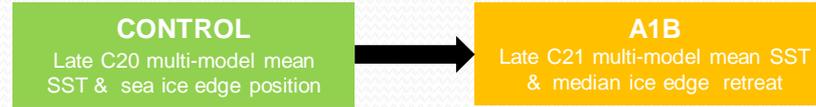
Experimental design



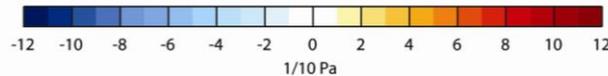
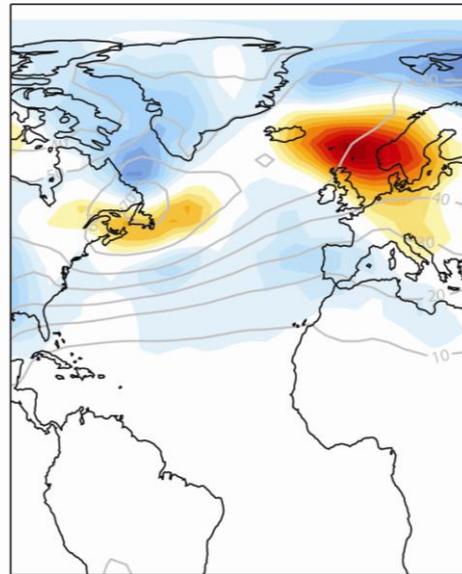
Results



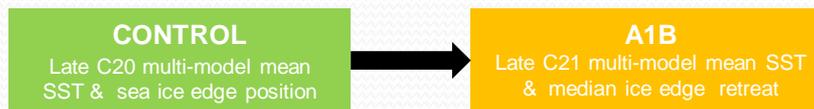
Results



Does this look like the multi-model mean response?



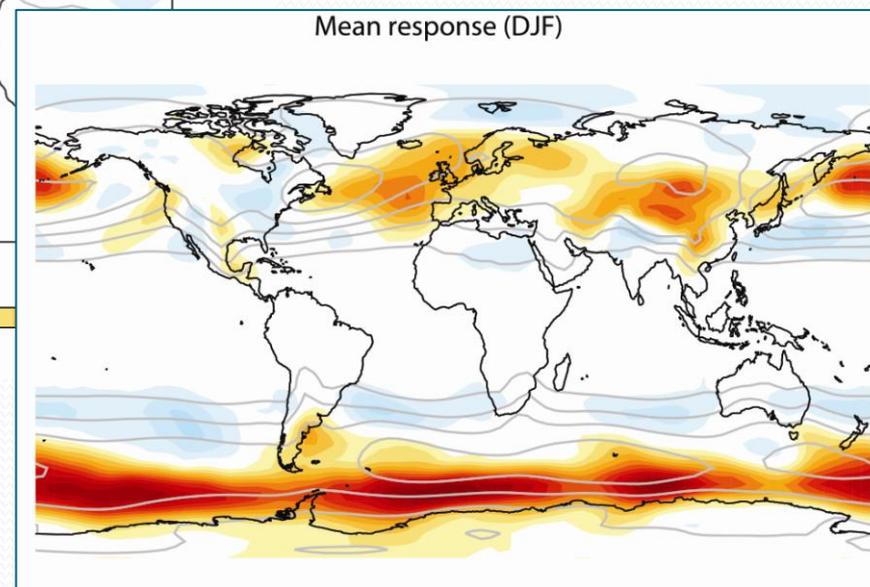
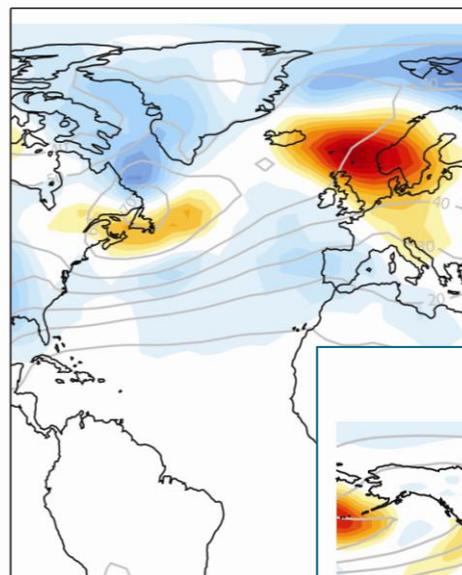
Results



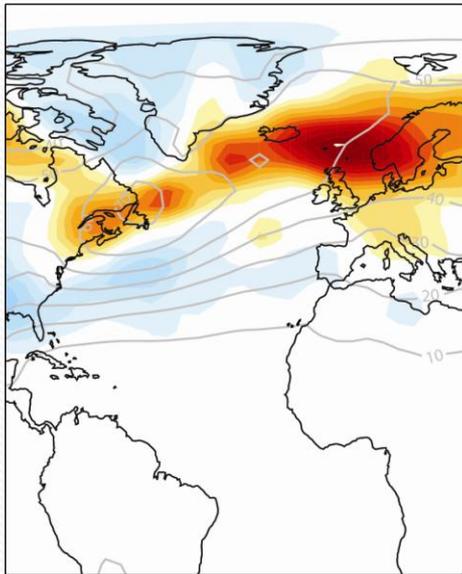
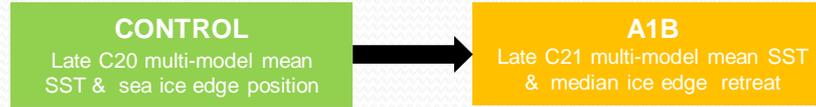
Does this look like the multi-model mean response?

- Yes in the SH and the Pacific

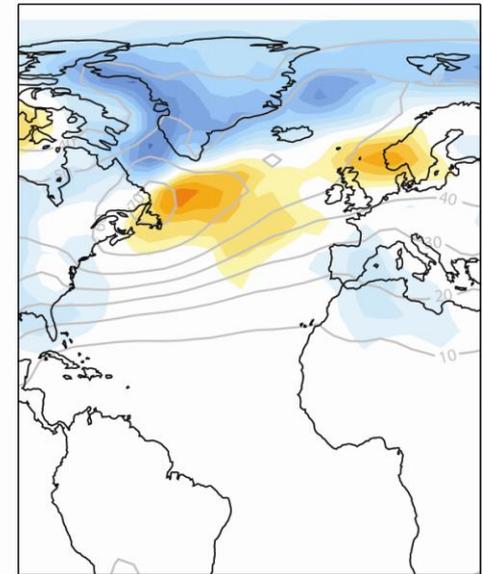
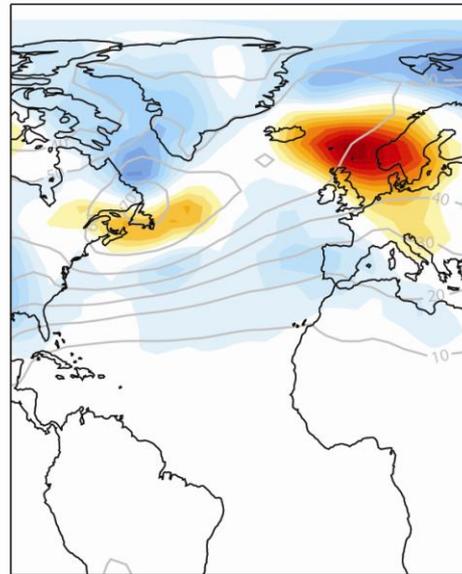
- Not so much in the Atlantic, but there are qualitative similarities



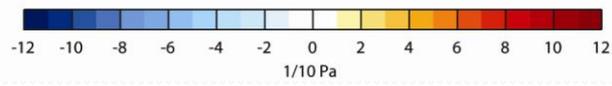
Results



A1B-
A1B - Atlantic EOF1 SST
Weakly retreated ice edge

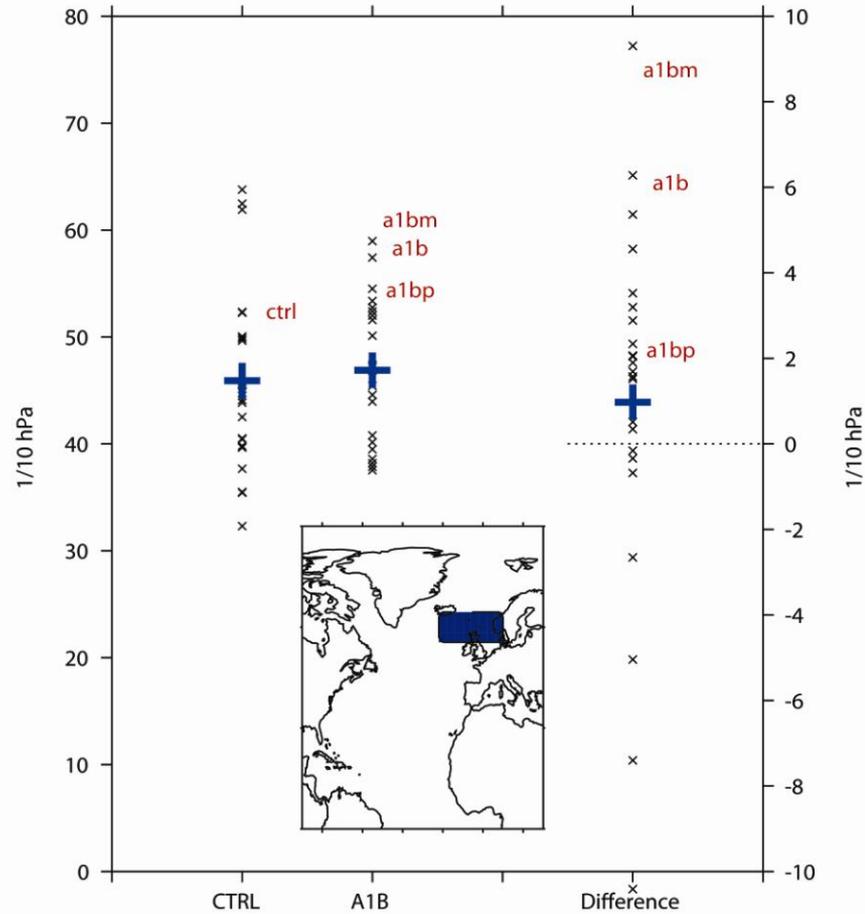


A1B+
A1B + Atlantic EOF1 SST
Strongly retreated ice edge



Results

DJF storm track responses: 340-10E, 55-65N



Summary

We have forced an atmosphere model with SST and sea-ice fields based on those produced by the CMIP3 models

- The multi-model mean storm track response is qualitatively reproduced using the multi-model mean SSTs and sea ice extents
- The magnitude of the inter-model spread is captured by the range of SSTs and sea ice extents

What's next?

- Analyse the structure of the responses in more detail
- Run ice-only and SST-only experiments
- Design experiments to look at the large-scale drivers of change