

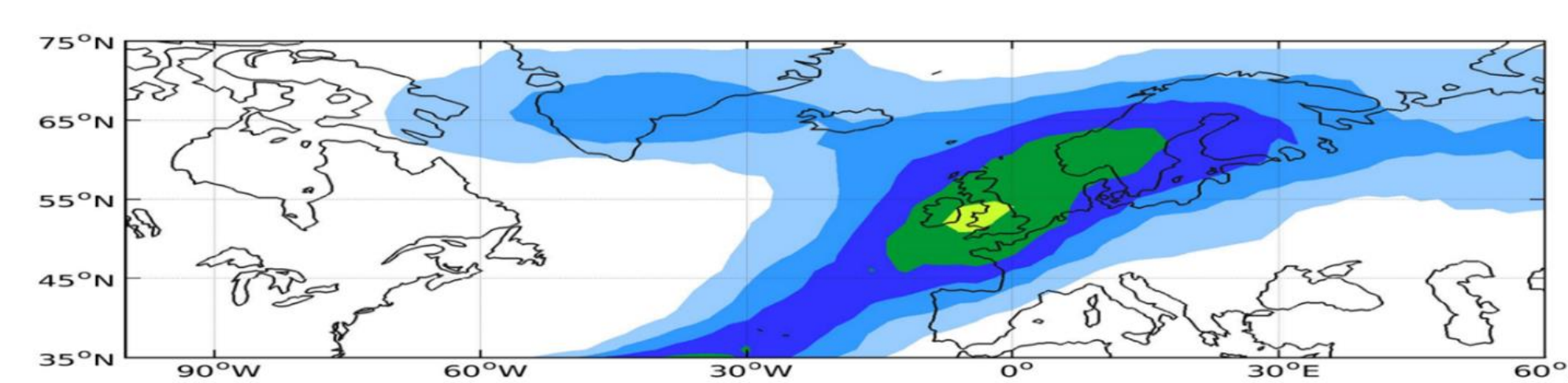
Introduction

Atmospheric blocking is associated with an anticyclone that blocks the typical westerly flow over the Atlantic Ocean and causes the jet to move north or south around the anticyclone. This can cause severe weather events such as cold spells, heat waves, and droughts over Europe and Russia. The North Atlantic Oscillation (NAO) has been observed to be anticorrelated with blocking over Greenland due to a southerly displacement of the jet during this phase of the NAO (Woollings 2008; Davini et al. 2012). Climate models have been underestimating the blocking over Greenland as seen below (Davini and Cagnazzo 2013).

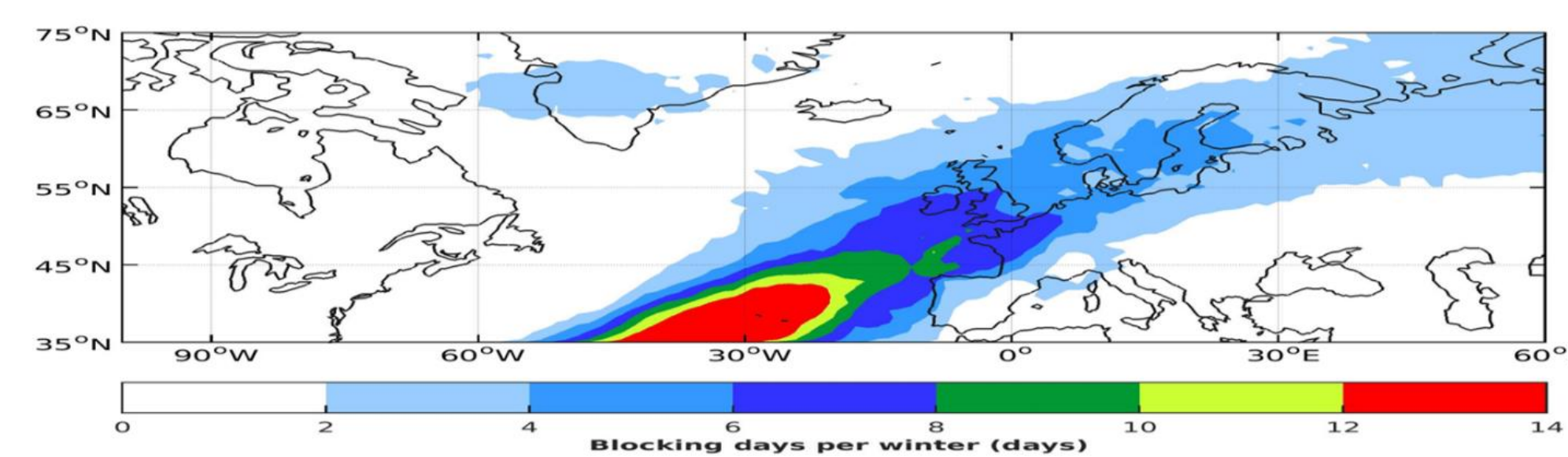
The objective of this study is to evaluate the cause of the blocking bias within a climate model.

Climatological Mean # of Blocking Days in DJFM

Observation 1901-2010 (20 CR)



Climate Model 1920-2005 (CESM1 LE #013)



Datasets and Methods

NCEP/NCAR Reanalysis-I (NCEP): DJF 1951-2005

20th Century Reanalysis (20CR): DJF 1951-2005

Community Earth System Large Ensemble (CESM1):

- 30 Simulations
- DJF 1951-2005
- DJF 2046-2100

Blocking Days:

- Reversal of 500 hPa height gradient
- Blocking event: 5 days

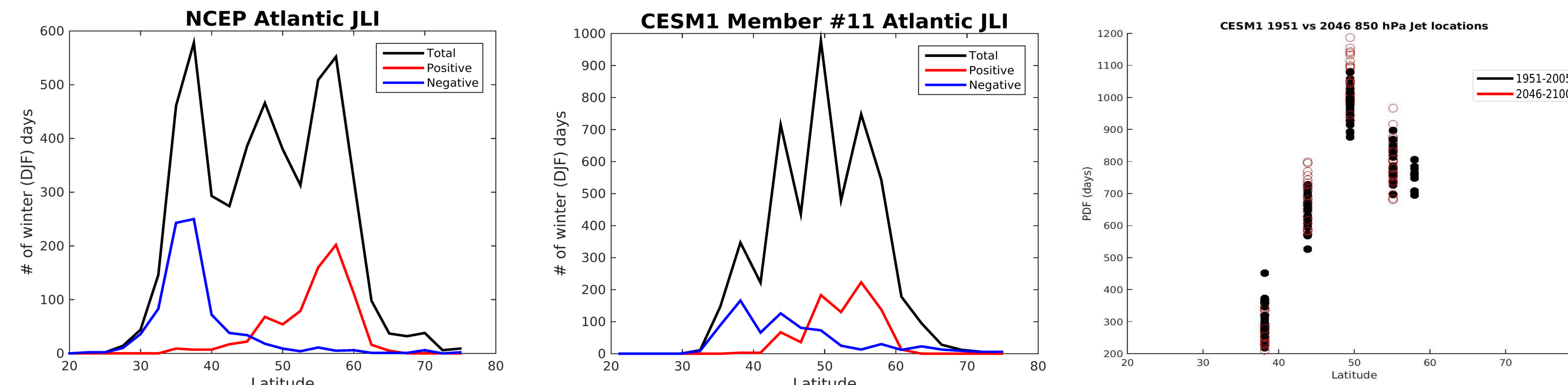
NAO Index:

- Principal Component of 500 hPa height

Jet Latitude Index (JLI): 850 hPa

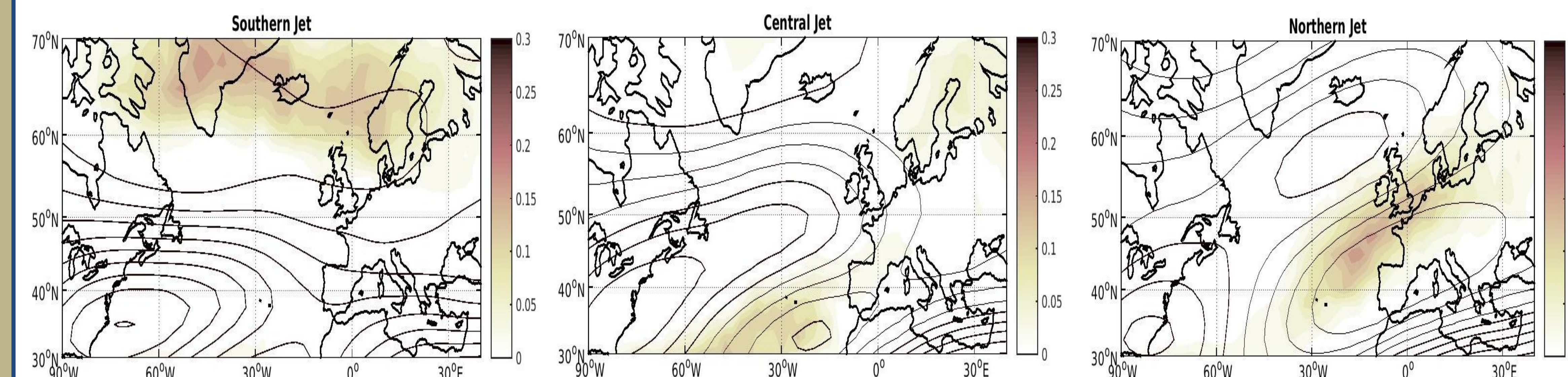
- Zonally Averaged Zonal Winds (75W-15E)
- 5 day running mean

Histograms of Daily DJF Jet Latitude Index



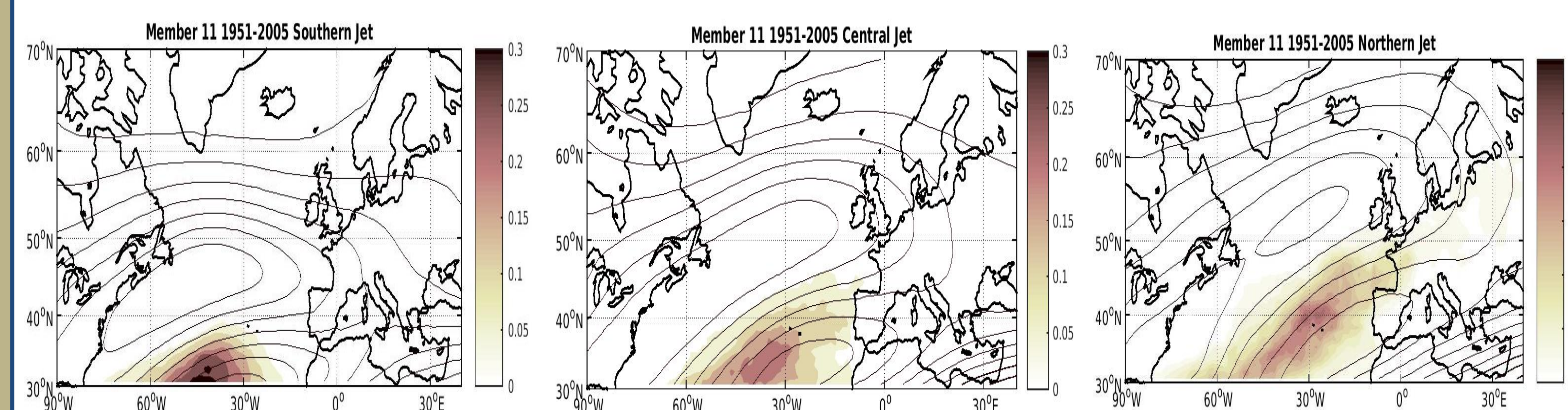
The three main jet locations observed in the reanalysis data is observed in the CESM1, but the range between the jet locations is smaller than in the reanalysis data. For both the reanalysis data and CESM1, the positive NAO leads to the jet locations being in the northern locations and the negative NAO is the northern locations. The future data also shows to be favoring the three main locations.

NCEP (1951-2005) U200 & Blocking Daily Composites based on Jet locations



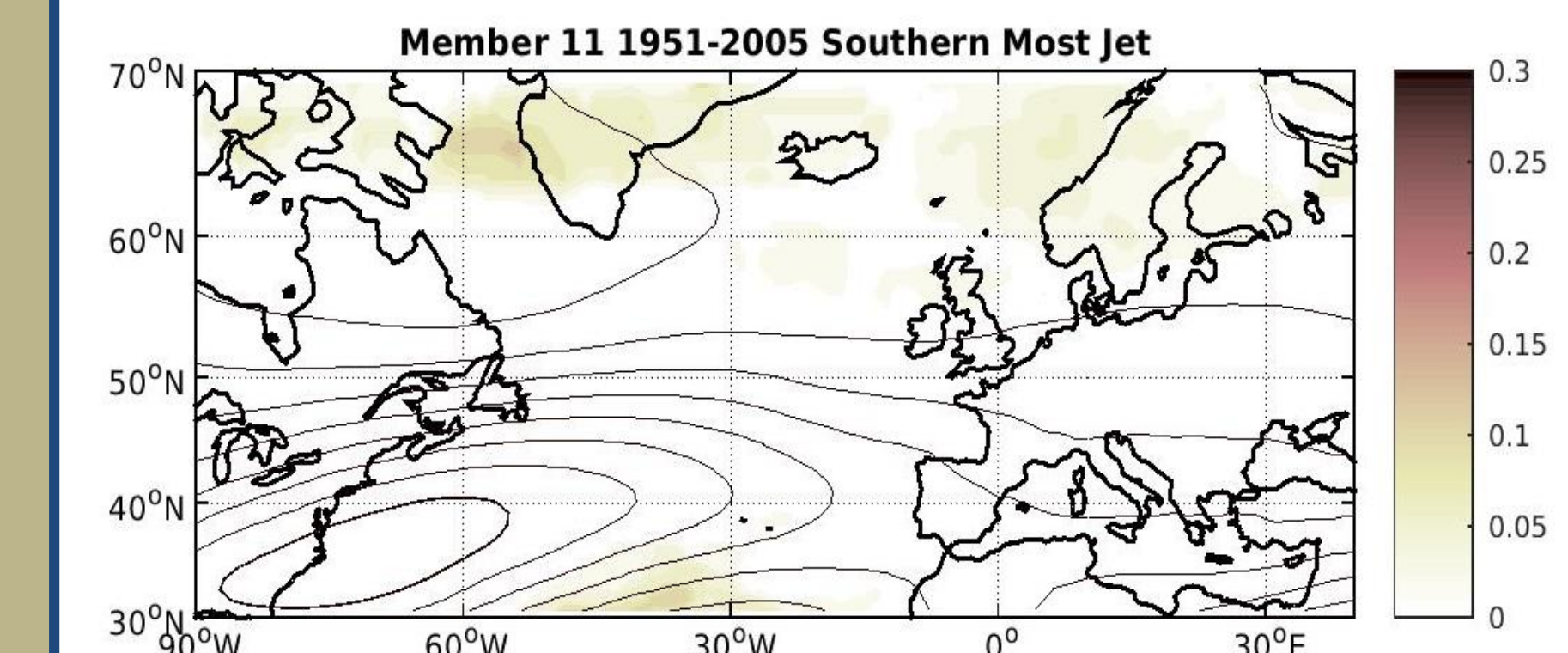
The jet location (contoured every 5 m/s) is related to the location for the highest atmospheric blocking frequency (shading), such that a southern jet location is accompanied by the blocking north of the jet near Greenland.

CESM1 (1951-2005) U200 & Blocking Daily Composites based on Jet locations



The southern jet location is farther north than in the reanalysis data, which leads to blocking occurring to the south of the jet and no blocking over Greenland during the time spent in the three main jet locations (in all 30 members).

CESM1 Southernmost Jet



When CESM1 jet location is far enough south the Greenland blocking is present, but the amount of time at this location is small compared to the other main locations.

Conclusions

CESM1 Model 1951-2005:

- Improved from previous model
- Range between jet locations is too small
- Model will produce blocking over Greenland if Jet goes far enough south
- Not enough days far enough south

CESM1 Model 2046-2100:

- Has same distribution as 1951-2005
- Fewer days in southernmost jet
- More days in 3 main jet locations

Acknowledgements

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References

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