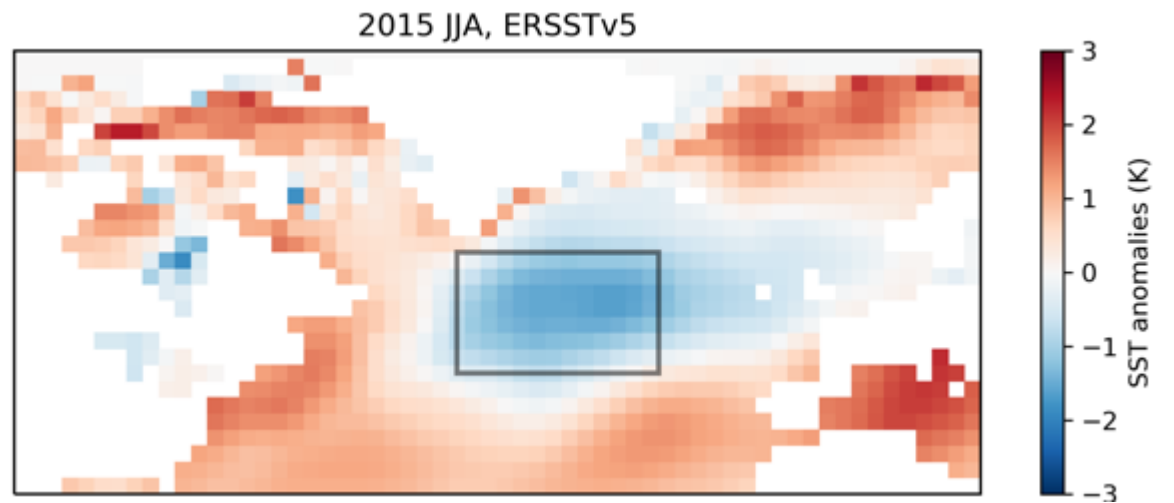
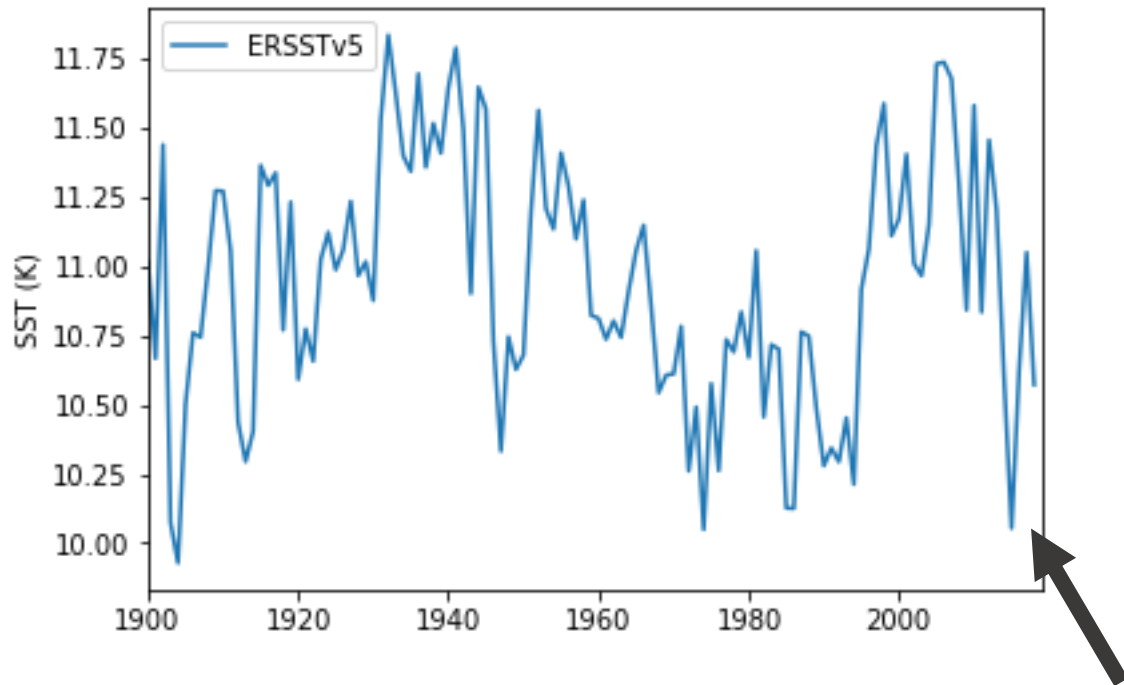


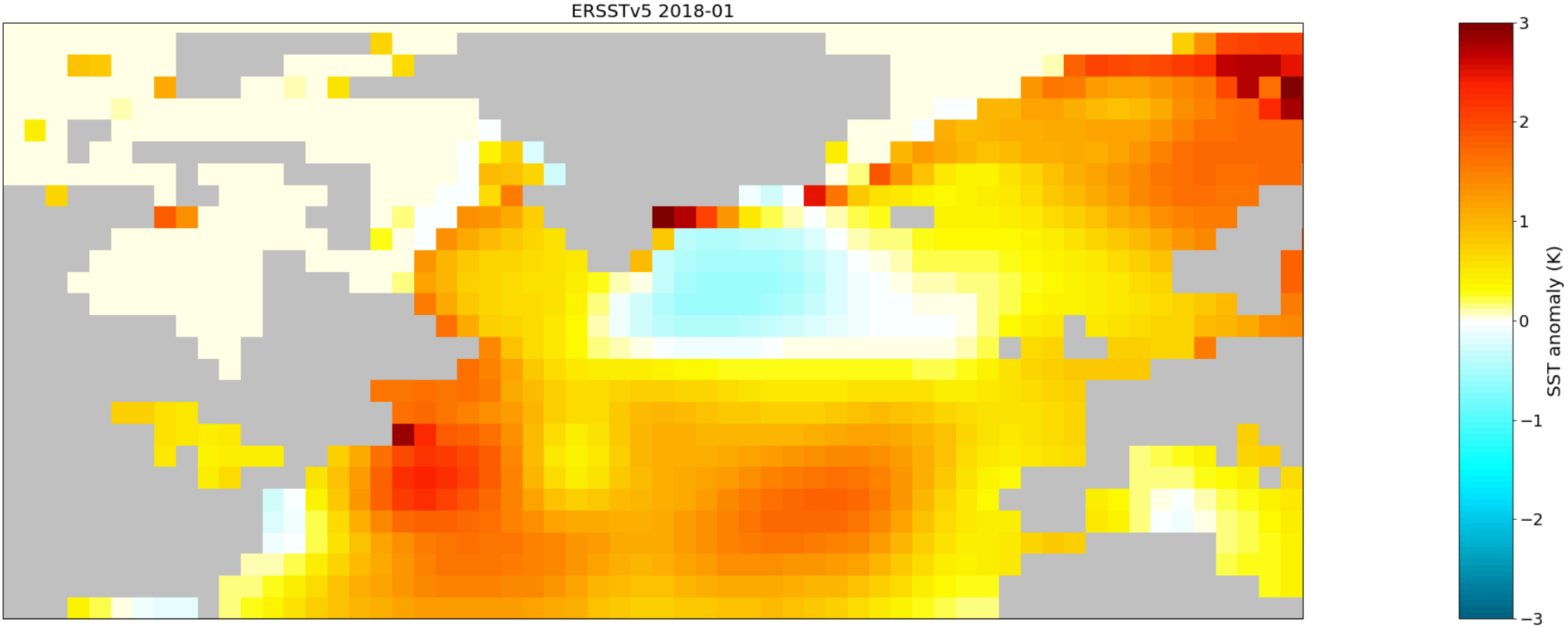
# Was the 2015 subpolar North Atlantic cold blob predictable?

Liz Maroon, Steve Yeager, Gokhan Danabasoglu  
NCAR CGD, Oceanography Section

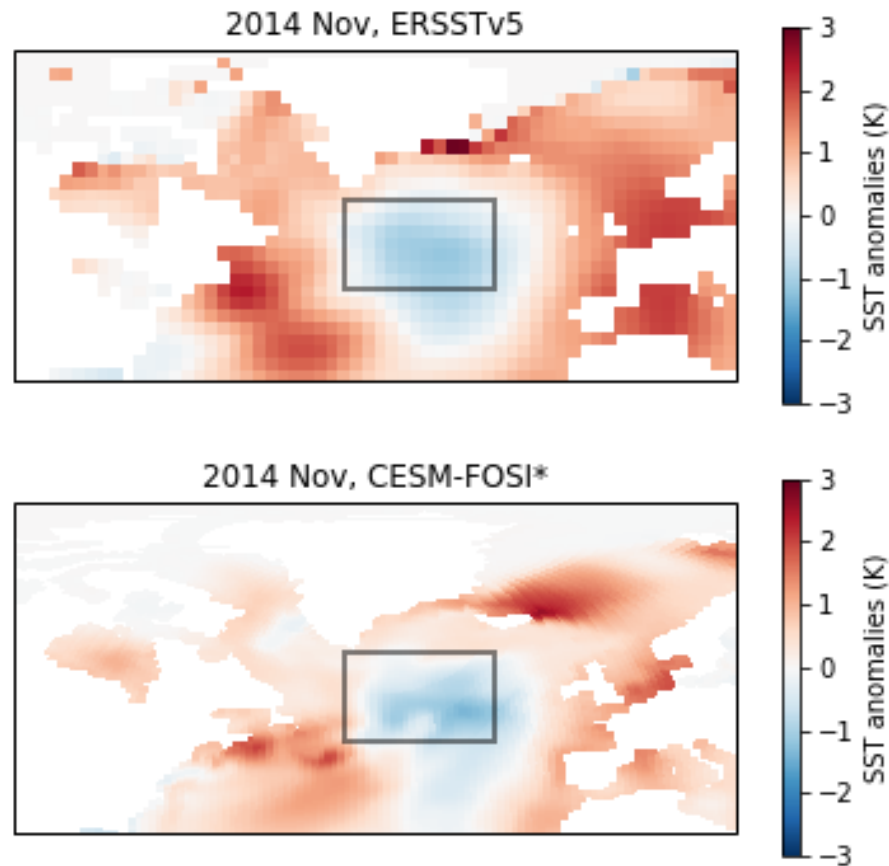
# Anomalously cold subpolar North Atlantic SST in 2015



Cold blob evolved over 2014 and 2015 and peaked in summer 2015.

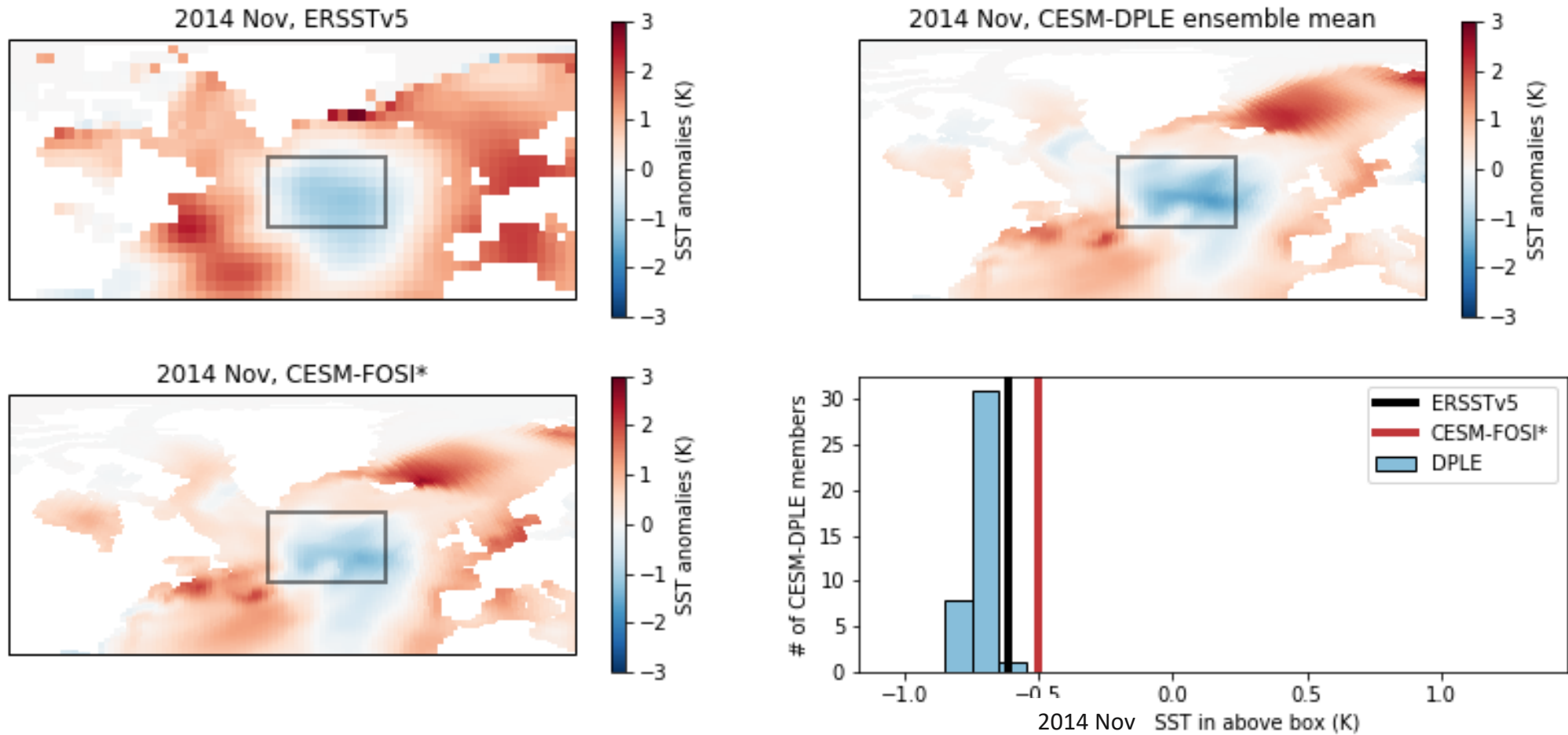


# Was cold blob predicted by the CESM DPLE?



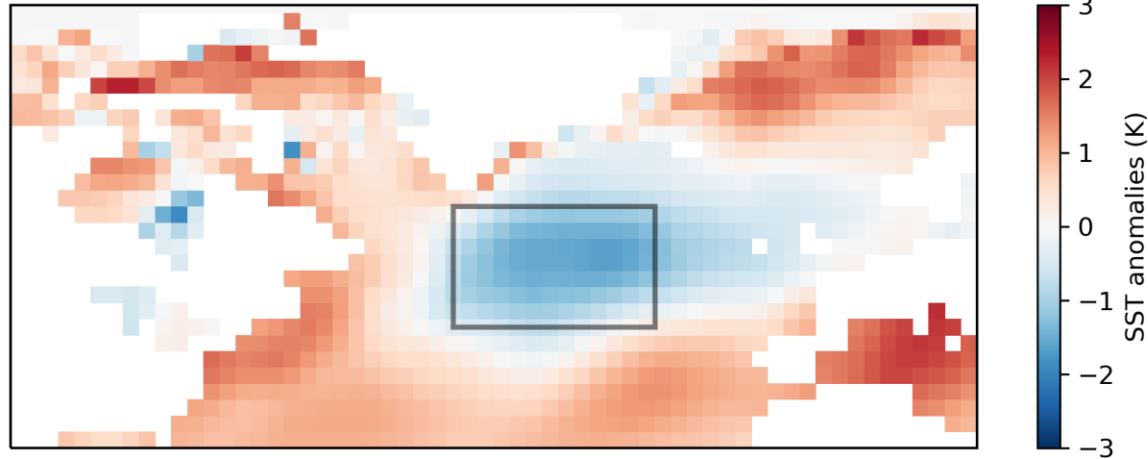
Using the November 2014 initialization of the CESM Decadal Prediction Large Ensemble (DPLE) to assess if the peak cold anomaly in summer 2015 was predictable

# First month of integration looks good...

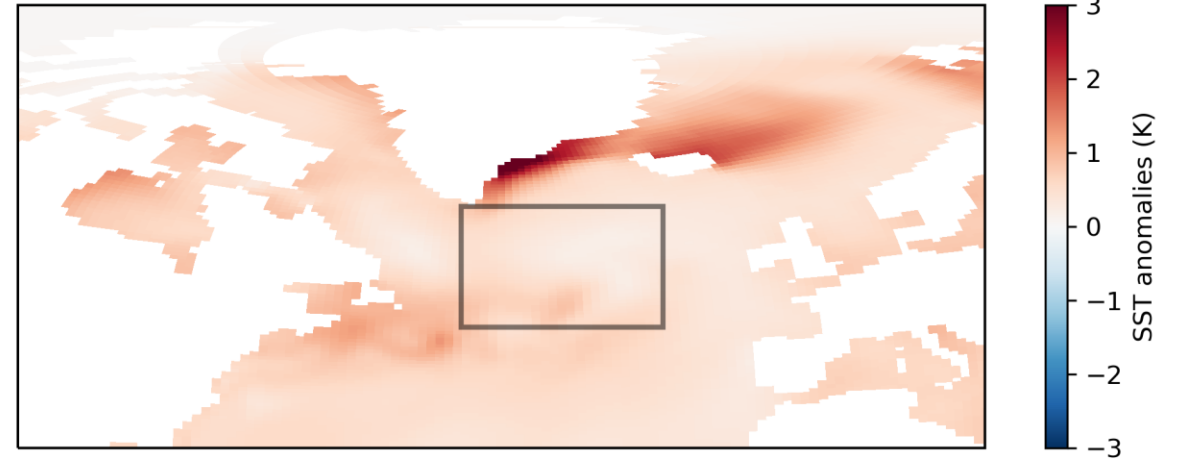


# None of the ensemble members capture the magnitude of the cold anomaly by summer 2015

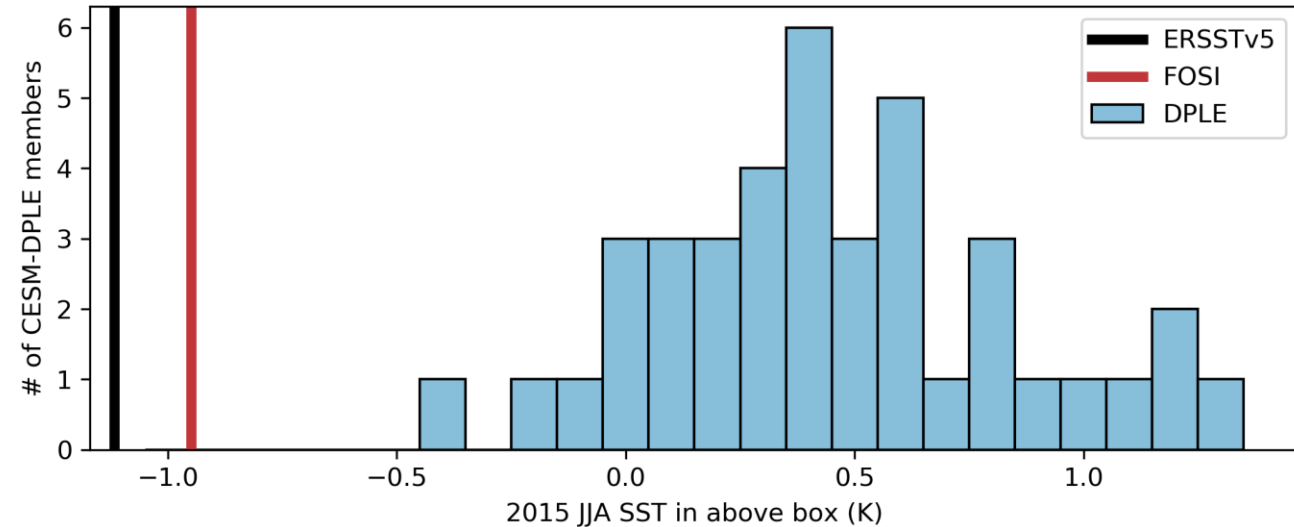
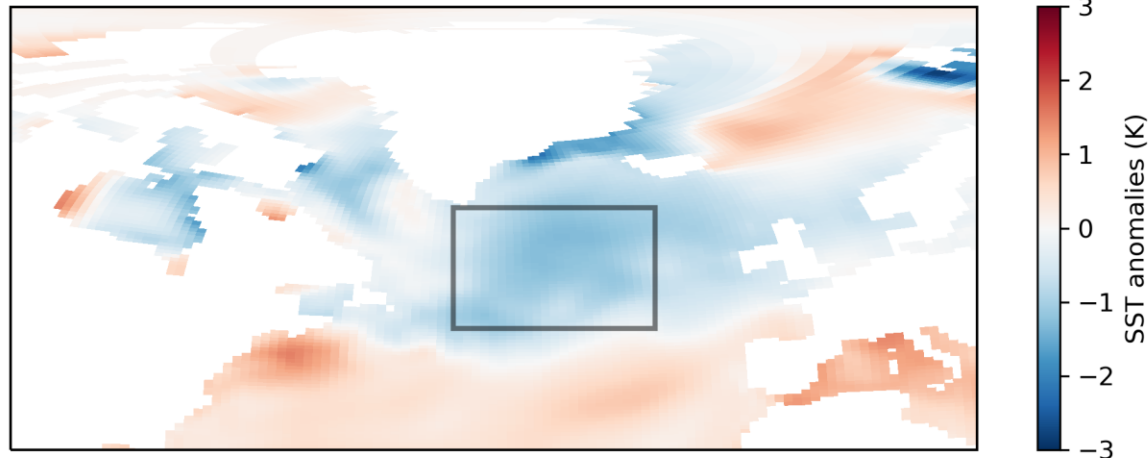
2015 JJA, ERSSTv5



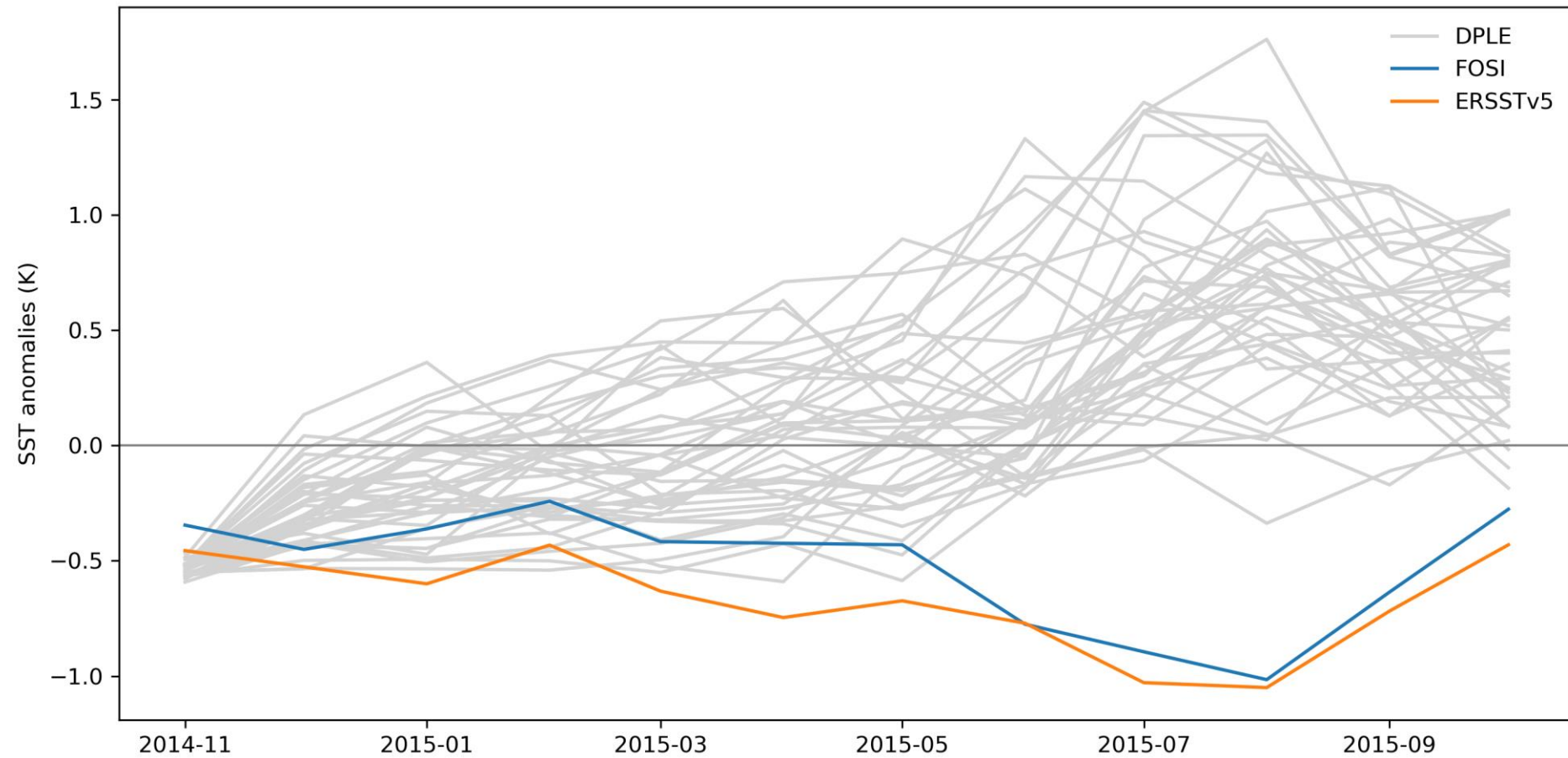
2015 JJA, CESM-DPLE ensemble mean



2015 JJA, FOSI



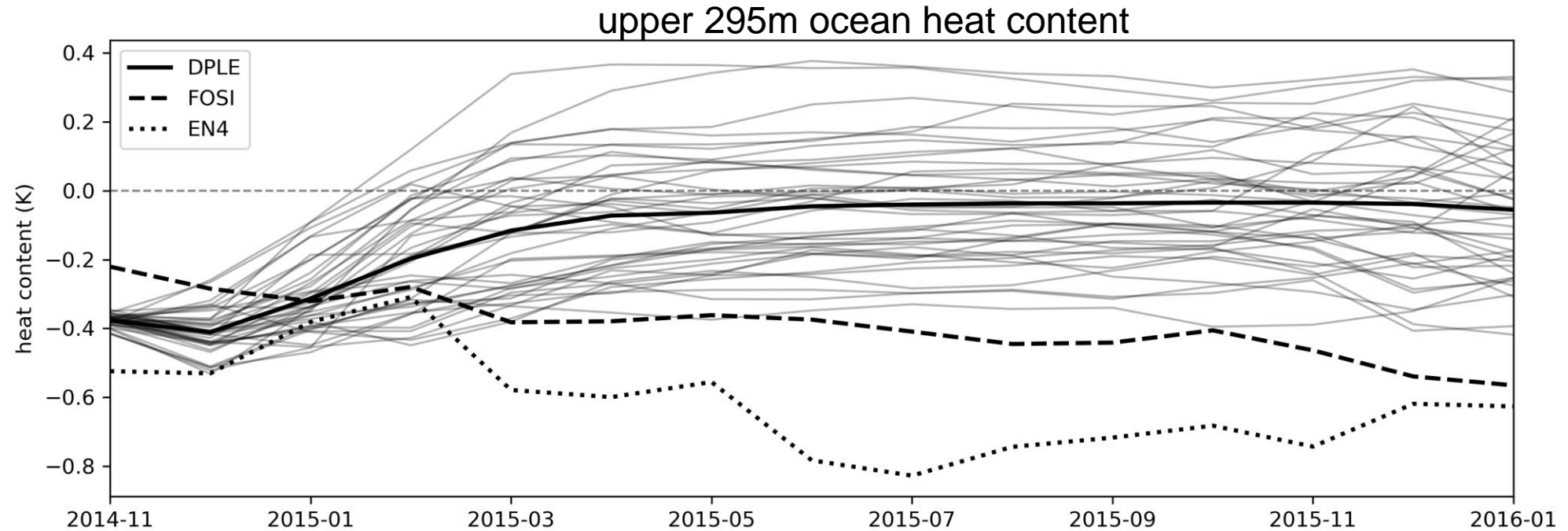
# Observed and DPLE SST trend in opposite directions in 2015



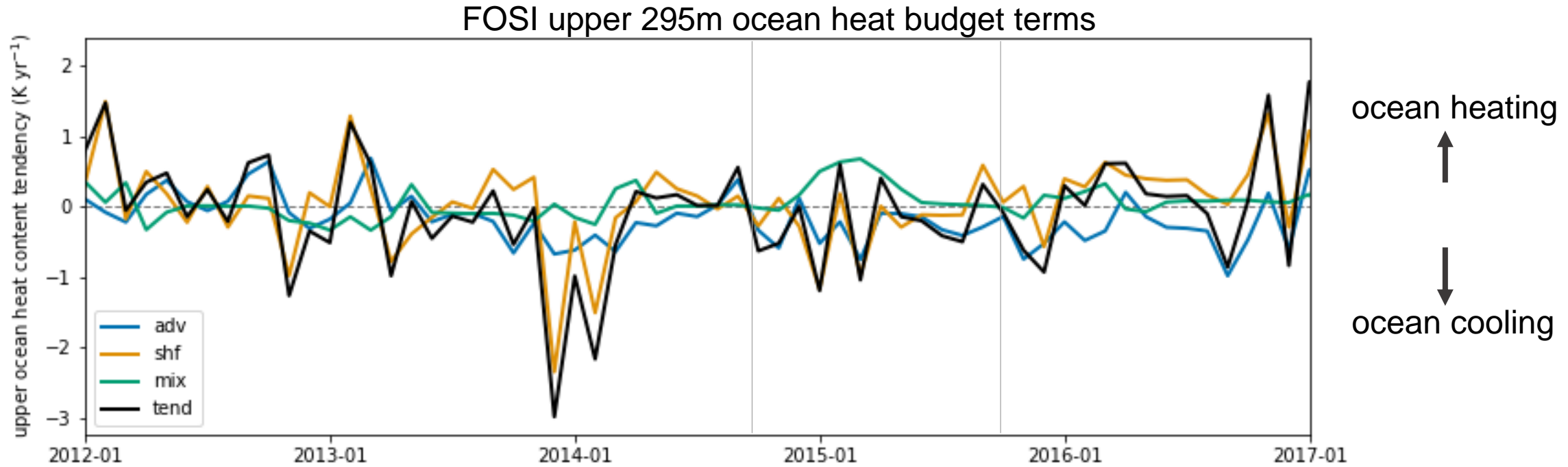
Was upper ocean heat content better predicted?



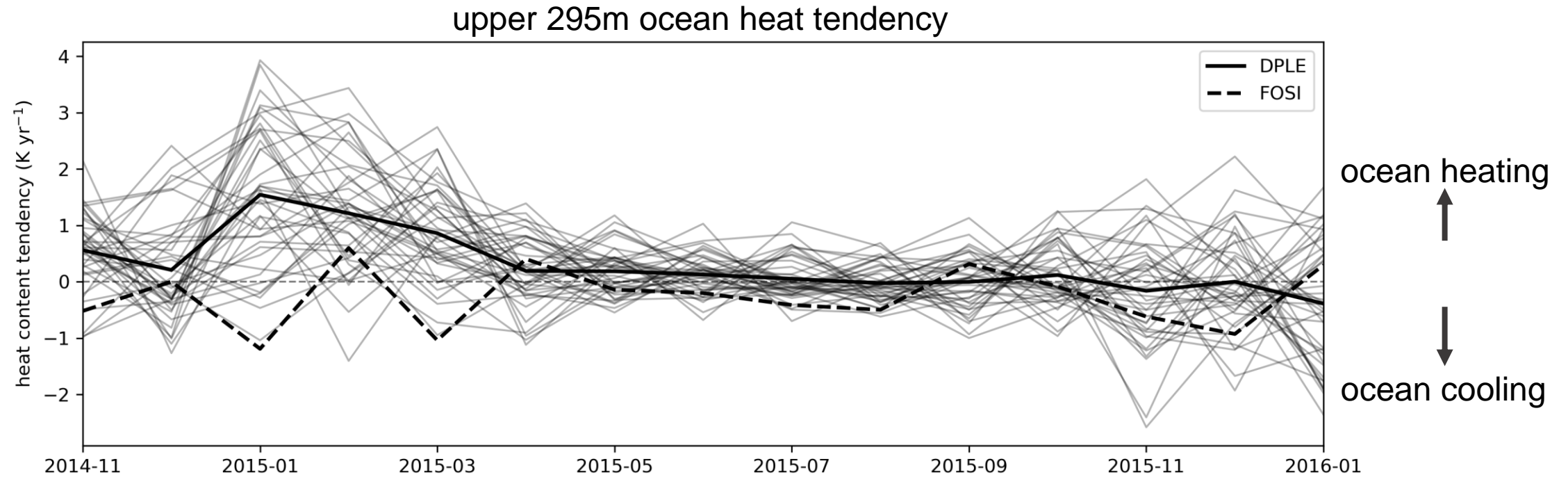
Was upper ocean heat content better predicted? *No.*



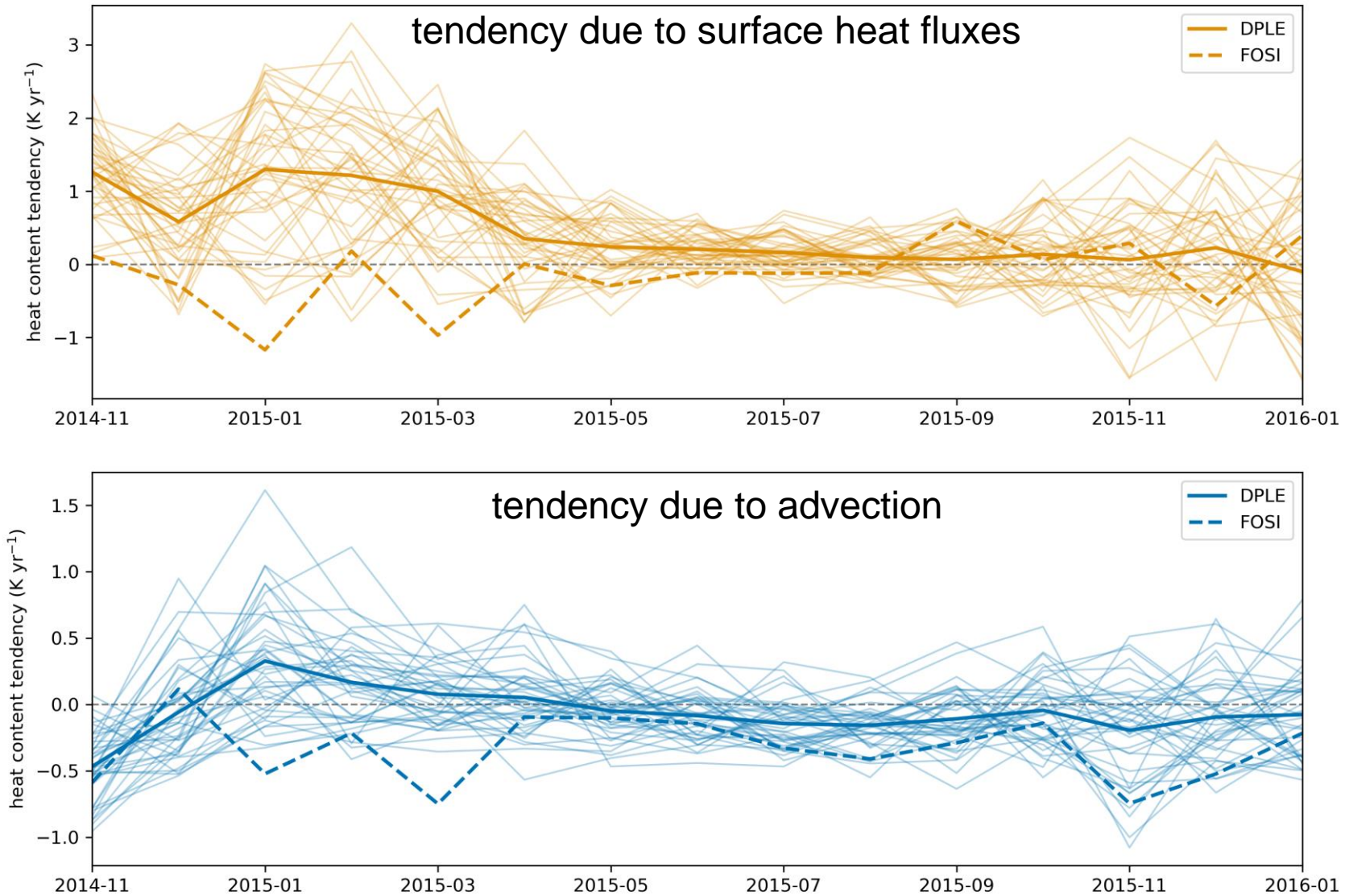
# Both surface heat fluxes and advection contribute to negative heat tendency in early 2015



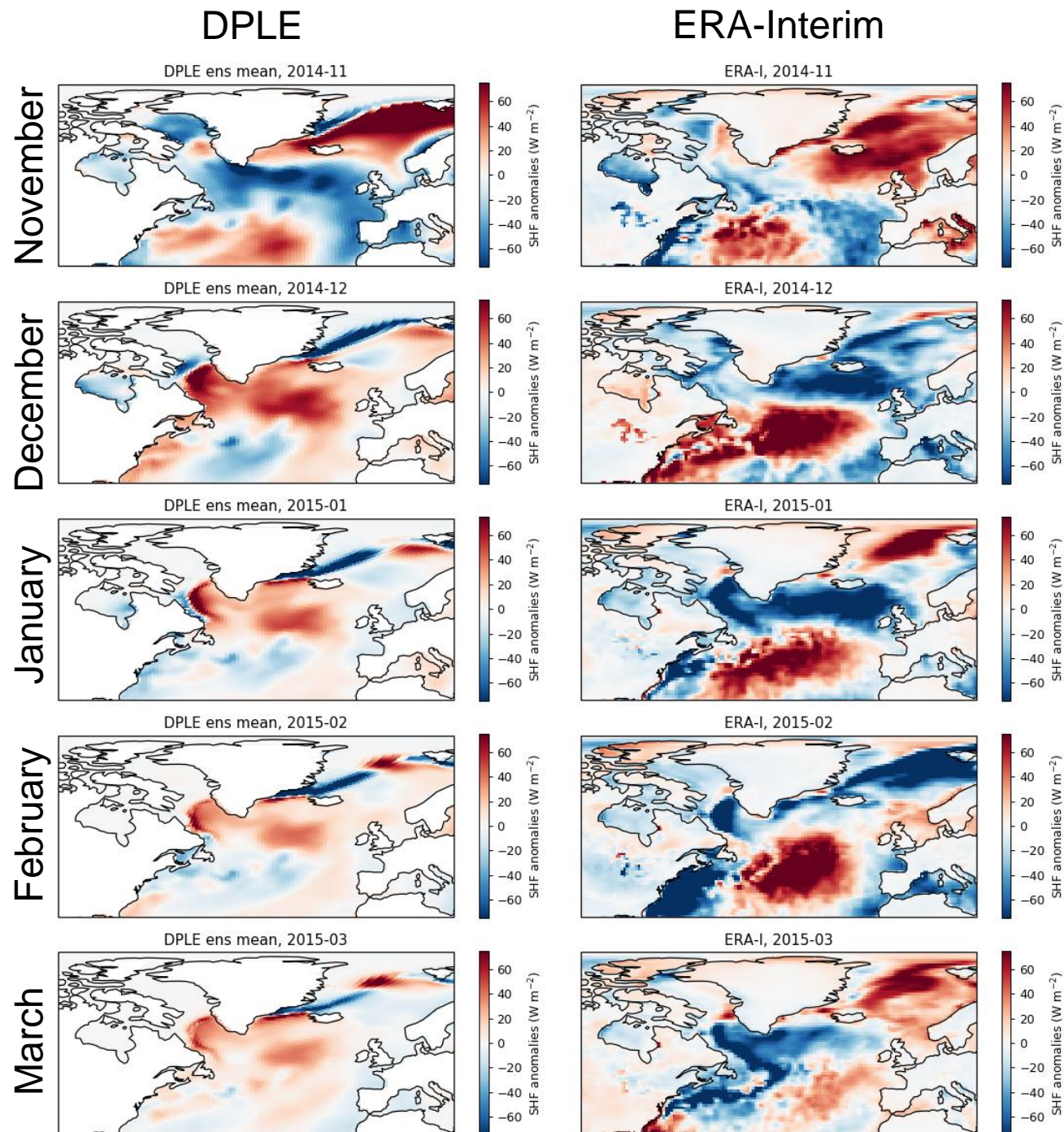
# FOSI tendency has two negative anomalies in January and March 2015



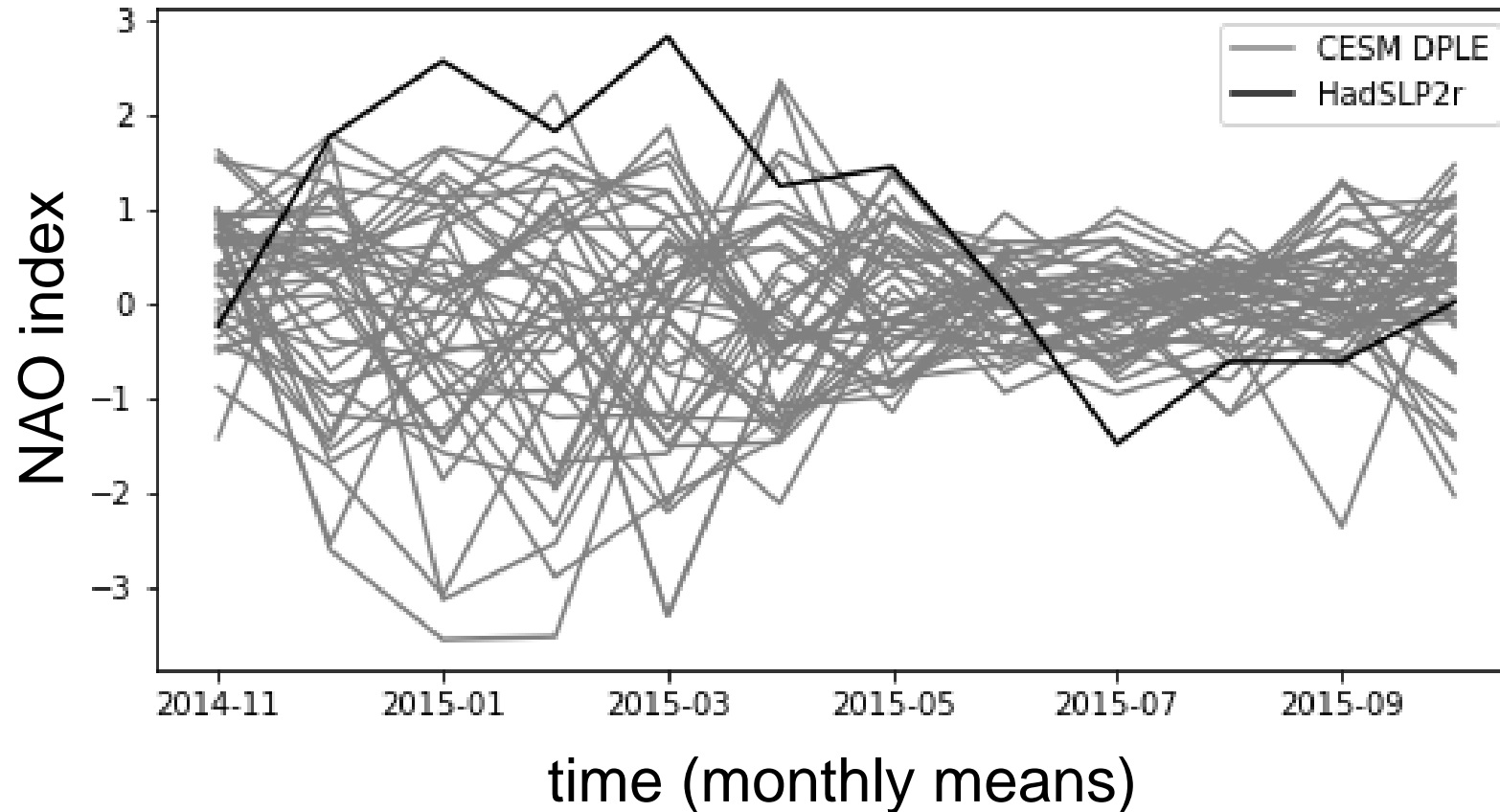
No DPLE members replicate the FOSI's surface heat flux and advection anomalies in January and March.



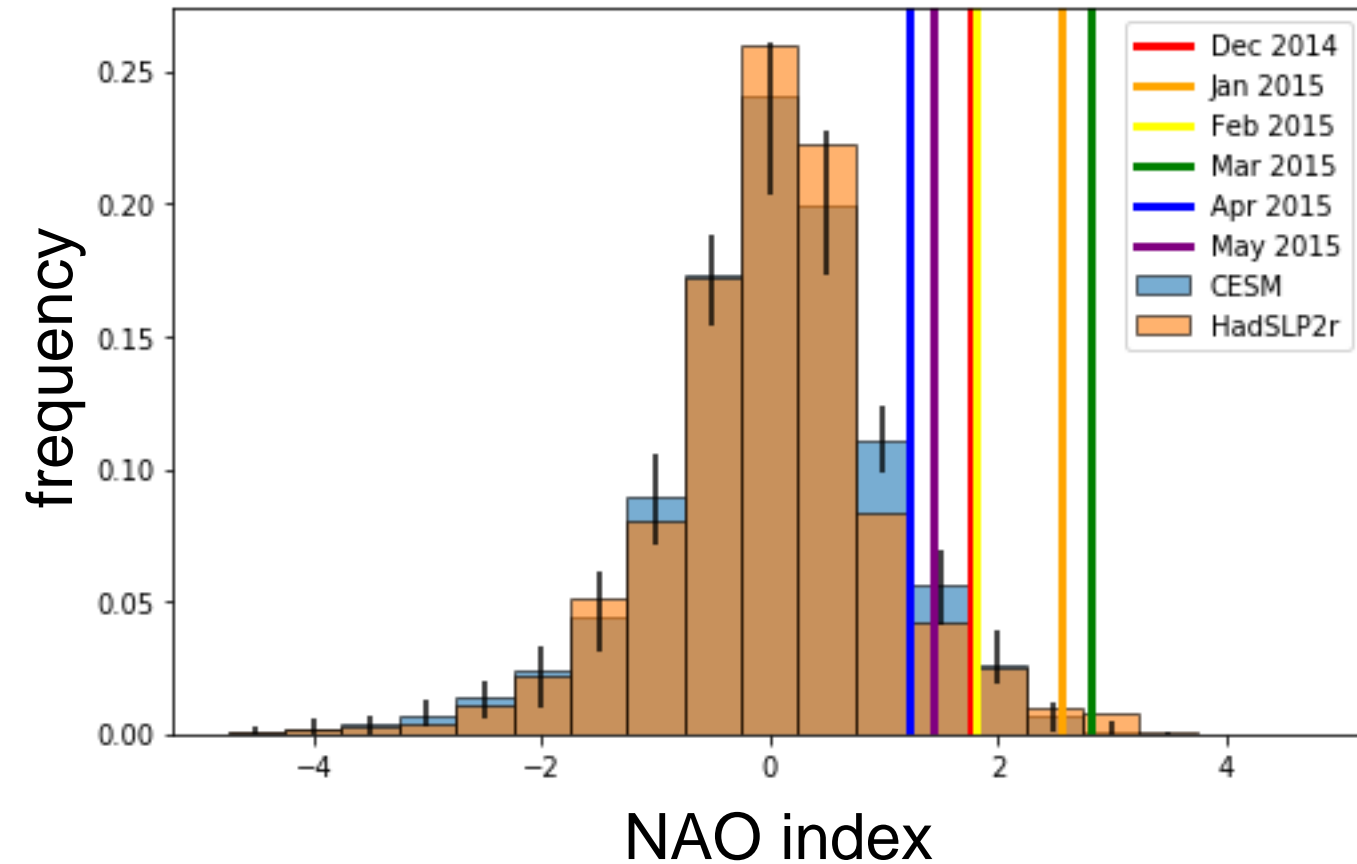
Heat flux out of the subpolar ocean during December, January, and March was critical for the amplification of the cold blob (*Duchez et al. 2016*)



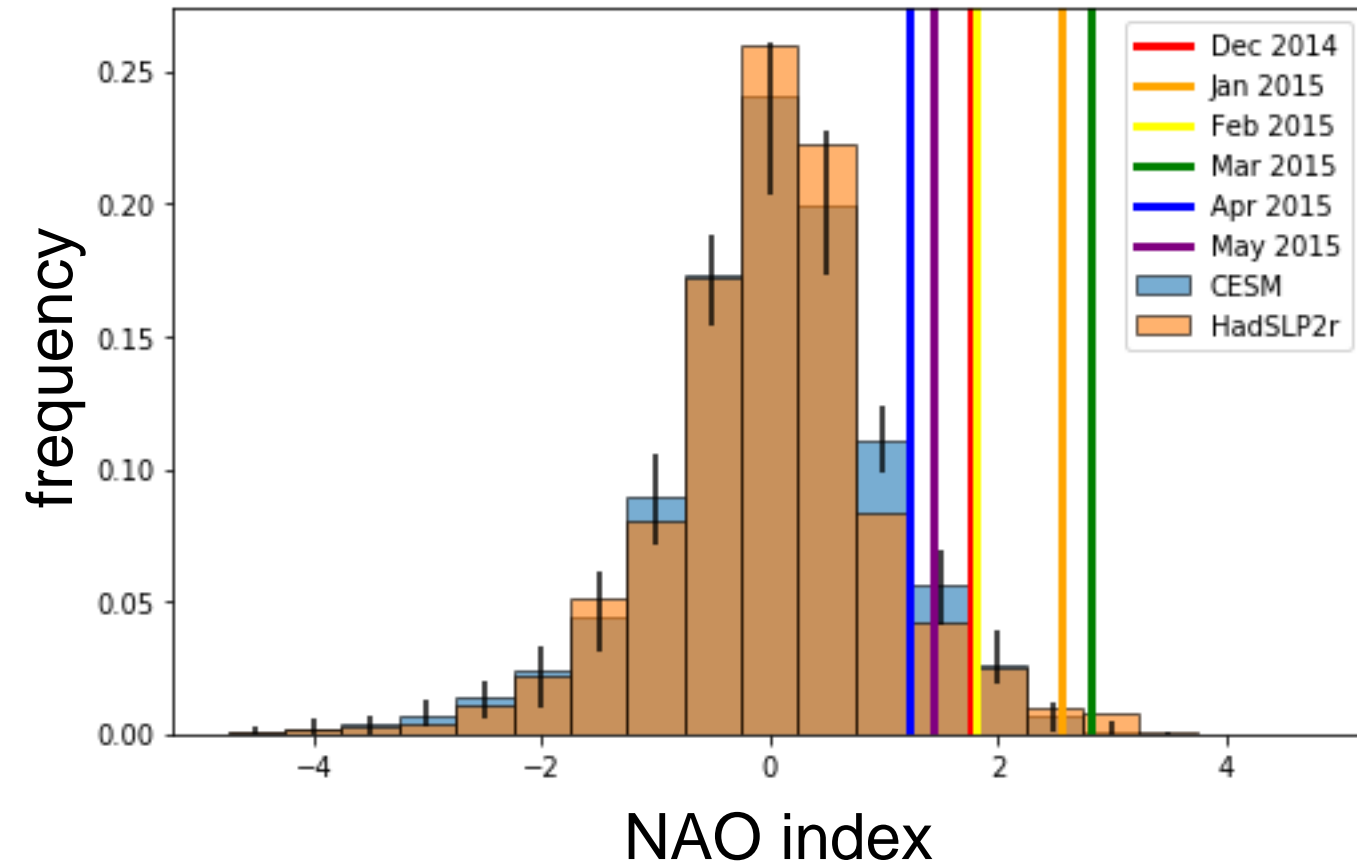
None of the DPLE members reproduce the observed persistently positive NAO in winter 2015



Should we have expected 6 consecutive months of positive NAO conditions in any of the 40 ensemble members?



# Should we have expected 6 consecutive months of positive NAO conditions in any of the 40 ensemble members?



Probably yes:

1. CESM LENS reproduces historical NAO statistics very well
2. CESM LENS/DPLE members have same fraction of persistently positive NAO events as observed record (~3%)



# Summary

- None of the CESM DPLE ensemble members initialized in 11/2014 have a subpolar cold blob of the same magnitude as the 2015 cold blob; most have positive anomalies
- Heat budget analysis indicates January/March 2015 were particularly anomalous and not captured by any ensemble members
- The subpolar cold blob of summer 2015 peaked after a once-in-the-historical record 6-consecutive months of NAO positive conditions

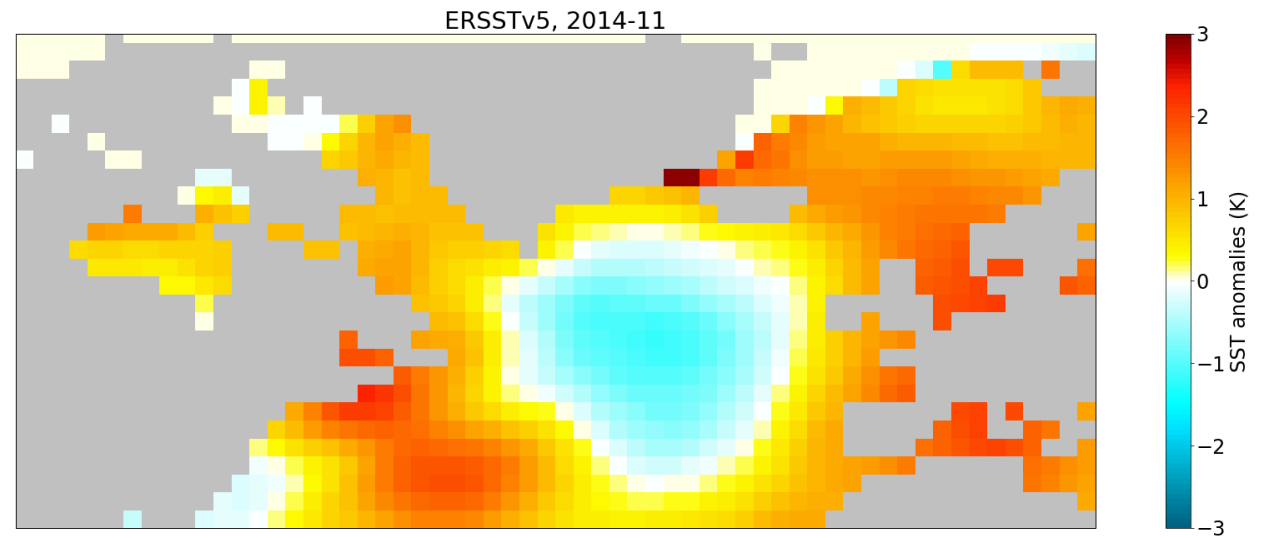
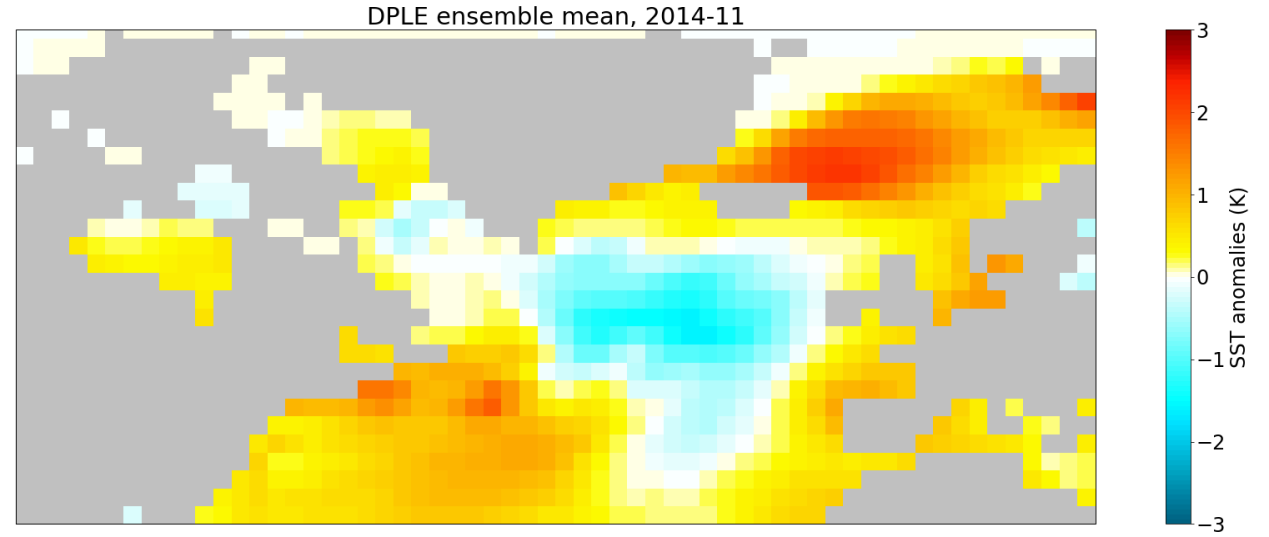
## So, what now?

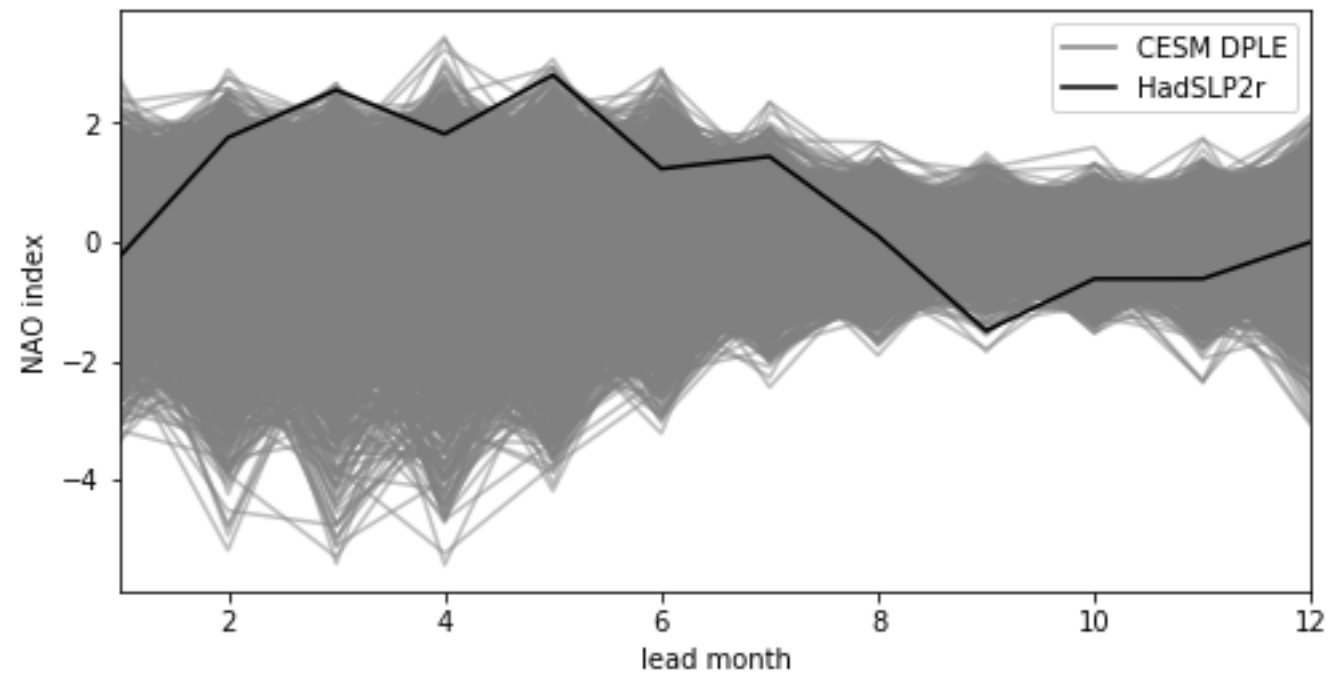
- More ensemble members?
- More advanced calibration/drift-correction methods?
- Experiment with atmospheric/sea ice/land initialization?

Acknowledgments: NSF Award 1737377



# Monthly evolution of DPLE ensemble mean and observed SST anomalies





# Upper 295m heat budget: mixing

