**Introduction and background**

North Atlantic SST exhibits a lagged response to the NAO in both models and observations, which has previously been attributed to changes in ocean heat transport (e.g., AMOC). However, variable ocean heat transport is not necessary to reproduce the pattern and statistics of the AMO in climate models. We examine the magnitude and contribution of the ocean heat transport mechanism to the AMO in pre-industrial control runs, historically-forced runs, and observations in order to better understand these seemingly opposite conclusions.

We cannot reject the null hypothesis that positive lagged correlations in the subtropics are an artifact of filtering. The mechanism responsible for the lagged response to the NAO may be limited to the subpolar gyre.

**Results: NAO explains a small portion of AMO variance**

The linear lagged SST response to the NAO only accounts for between 1% and 12% of the variance in the AMO index in control runs of CMIP5 models (4% on average), and 19% in observations. On average, the unlagged, low-pass filtered NAO index explains only ~5% and ~7% of the variability in the AMO index in control runs of CMIP5 models and observations, respectively.

**Results: Variable external forcing obscures NAO-AMO relationship**

In pre-industrial control runs, most models exhibit a lagged warm response to the NAO. However, when model runs account for variations in external forcing, the NAO-AMO relationship is obscured. The influence of external forcing is noted in both an ensemble of a single model (CESM-LENS) and a multi-model ensemble (CMIP5).

**Discussion: Is the observed NAO-AMO relationship due to chance alone?**

In the stochastic, statistical model above, we prescribe the NAO-AMO relationship as well as the influence of variable external forcing. Coefficients are calculated via independent linear regressions, yielding values -0.05 C/STD. dev., 0.1 C/STD. dev., and -0.68 C/unit forcing. Inclusion of the $\beta_3$ term interrupts or obscures the prescribed lagged relationship between the NAO and AMO.

**Summary**

We find evidence to support the hypothesis that ocean dynamics play a role in multidecadal SST variability; however, its contribution to overall variability and predictability in the region is small. When climate models include variable external forcing, the NAO-AMO relationship is obscured. Historical runs of climate models as well as a statistical model allow for the possibility that the observed relationship between the NAO and AMO is due to chance alone.

**Outstanding questions**

- What (if any) is the role of ocean heat transport in setting the timing of AMO transitions?
- Through what mechanism does external forcing change AMO variance?
- What induces non-stationarity in the AMO index?
- When did variable external forcing become a key influence on AMO variability?
- What details of external forcing are valuable for prediction of the AMO?