

**What are the STC PODs** Python scripts that assess the fidelity of important dynamical stratosphere-troposphere coupling processes in reanalysis and in models. Our PODs are freely available through the **NOAA Model Diagnostic Task Force (MDTF)**. MDTF is a framework designed to assist the science community and model developers with determining how accurately climate models represent specific physical processes or emergent behaviors.

## List of STC Pods

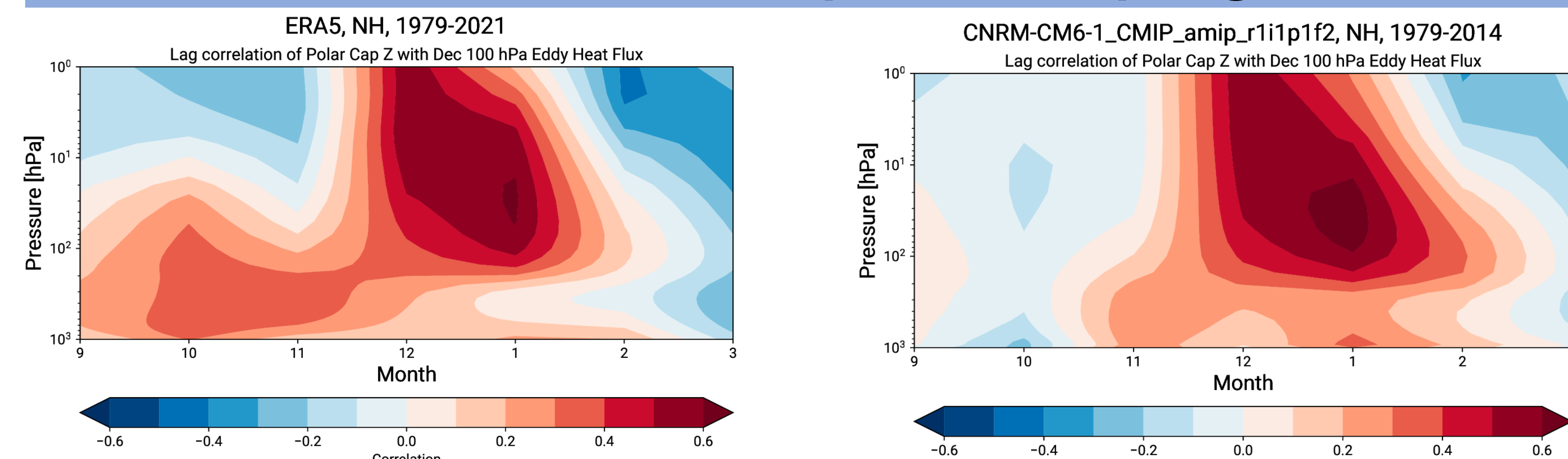
- (1) Annular mode coupling
- (2) Wave coupling and extremes
- (3) Extreme polar vortex events and impacts
- (4) Stratospheric response to planetary waves
- (5) Stratospheric ozone, circulation, coupling, trends
- (6) Stratospheric pathways of ENSO/QBO teleconnections

**On-going work:** applying PODs across all CMIP6 historical/AMIP runs from 1979-2014

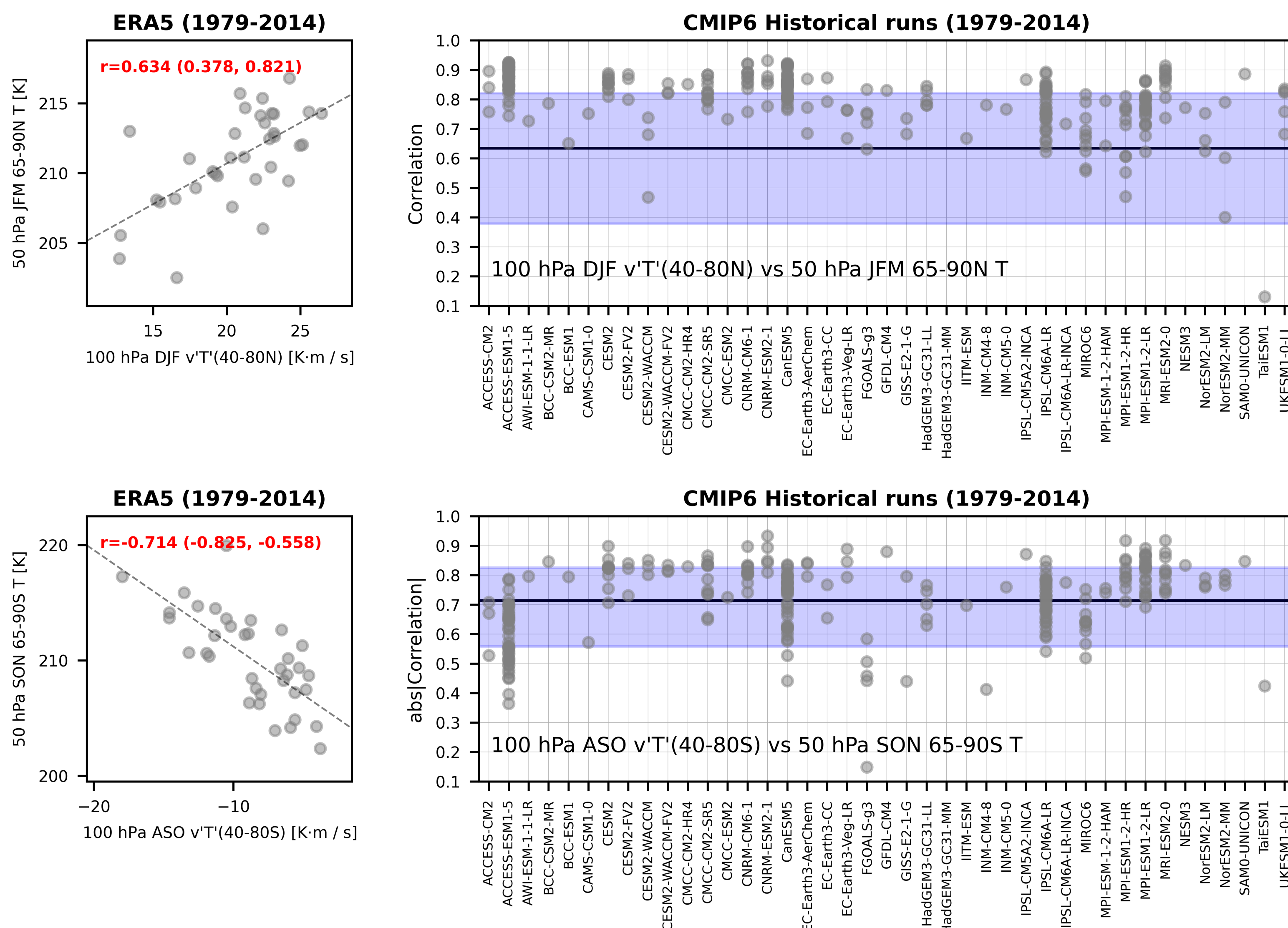
**Future work:** same, but apply to SSPs during mid & late 21<sup>st</sup> century

**Goal:** The STC metrics could be used to test for emergent constraints for the forced polar vortex response to climate change.

## Upward coupling

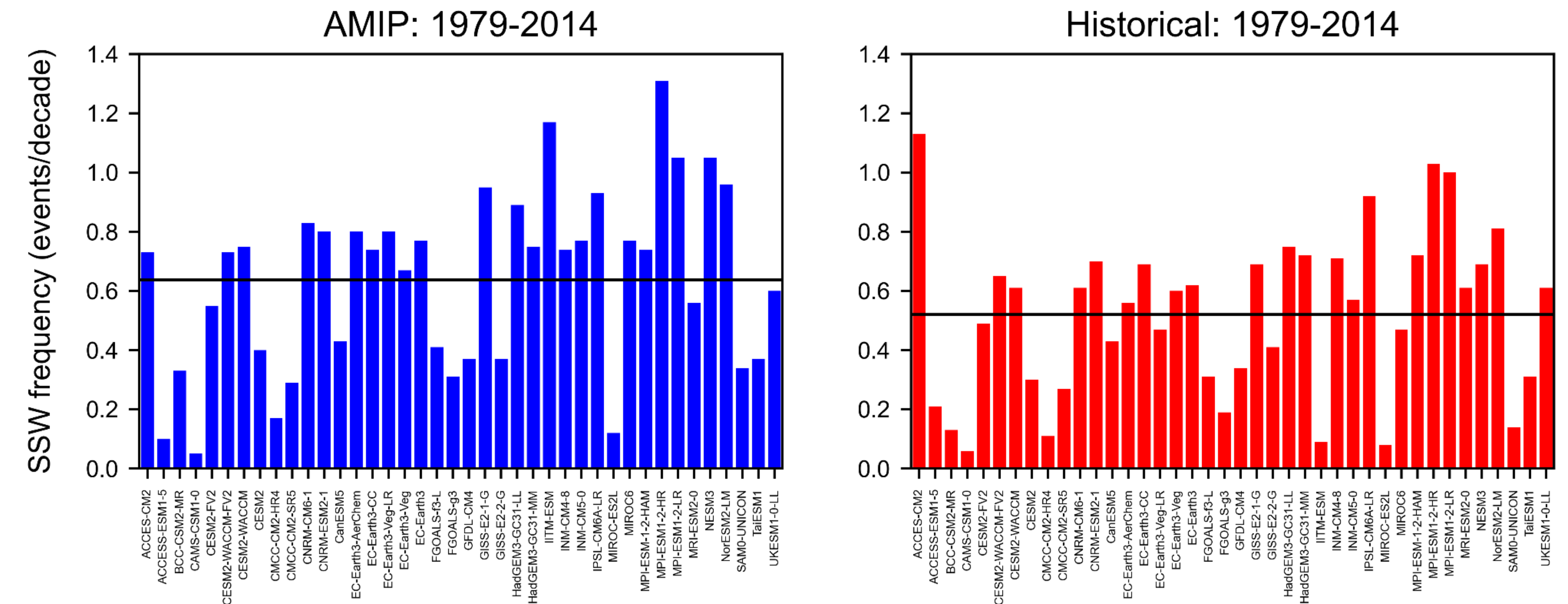


(Left) evaluates the lead-lag relationship between upward eddy heat flux and polar stratospheric warming in ERA5 and CNRM-CM6-1.



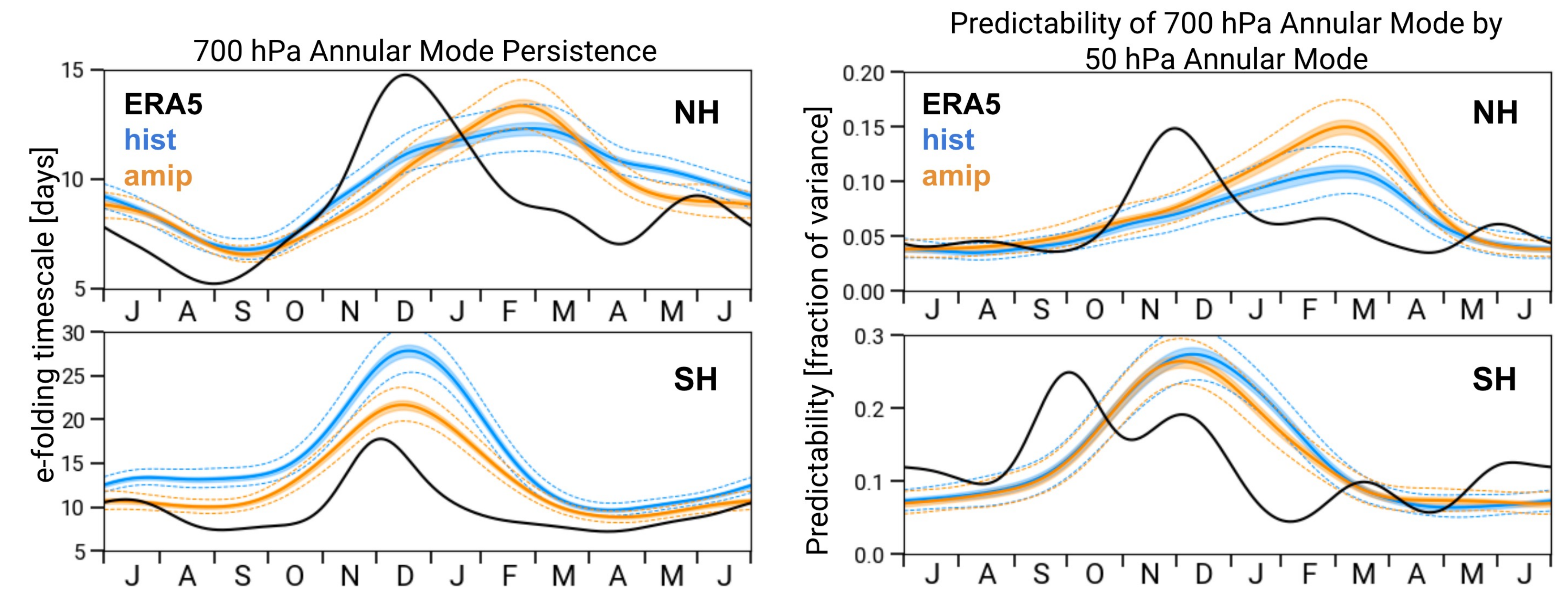
(Left) For both the NH (top) and SH (bottom), the models do a good job of capturing the relationship between upward eddy heat flux and a warmer polar vortex. However, the relationship is slightly too strong in the NH for some models, whereas in the SH the models mimic reanalysis more closely.

## Sudden stratospheric warmings



The historical experiments have reduced SSW frequencies compared with AMIP. Not shown: models simulate more Nov and Mar SSWs compared to reanalysis, but fewer Dec-Feb SSWs.

## Downward coupling



In the NH, models show peak NAM persistence & predictability in Feb-Mar, later in winter compared to ERA5. The historical CMIP experiments show reduced persistence and predictability relative to AMIP.

In the SH, models show peak SAM persistence & predictability in Dec, and the historical CMIP experiments show enhanced SAM persistence and predictability relative to AMIP.