Untangling Observed Atlantic Multidecadal Variability

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Motivation

Questions:

1. Is the AMV an internal mode of variability or a response to external radiative forcings?
2. Are ocean circulation changes necessary to produce the AMV?

Approach

Use large ensembles of Pacific Pacemaker experiments to investigate the spatial and temporal features of the observed AMV.

CM2.1 & CESM1 Experiments: Fully Coupled Models

- **FREE Members**
  = Radiative Forcing + Internal Variability
- **NUDG Members**
  = Tropical Pacific Nudging + Radiative Forcing + Internal Variability

- **Radiative Forcing**
  = Free Ensemble Mean
- **Tropical Pacific Nudging**
  = NUDG Ensemble Mean – Free Ensemble Mean
- **Internal Variability**
  = NUDG Members – NUDG Ensemble Mean

CCM3 Experiment: Atmospheric Model Forced with Tropical Pacific SSTs, Mixed Layer Elsewhere

- **POGA-ML Members**
  = Tropical Pacific SST Forcing + Internal Variability

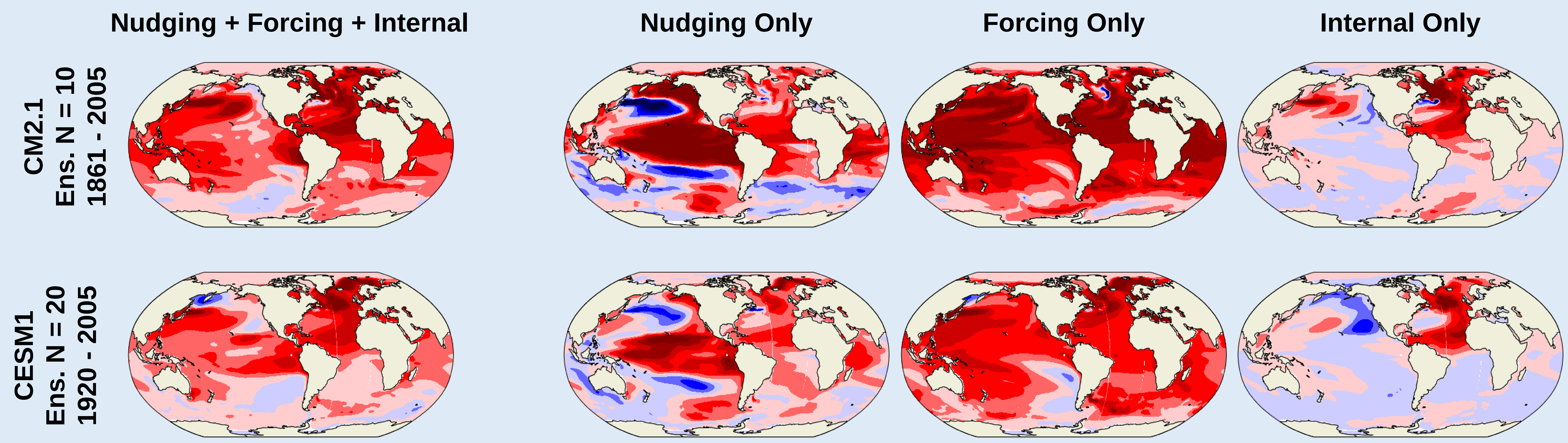
- **Tropical Pacific SST Forcing**
  = POGA-ML Ensemble Mean
- **Internal Variability**
  = POGA-ML Members – POGA-ML Ensemble Mean

Conclusions

1. Tropical Pacific is a key low-frequency driver of the AMV.
2. The spatial features of AMV are driven by internal variability.
3. The amplitude and multi-decadal departures of AMV are driven by external radiative forcing.
4. It is ambiguous whether ocean circulation changes are necessary.

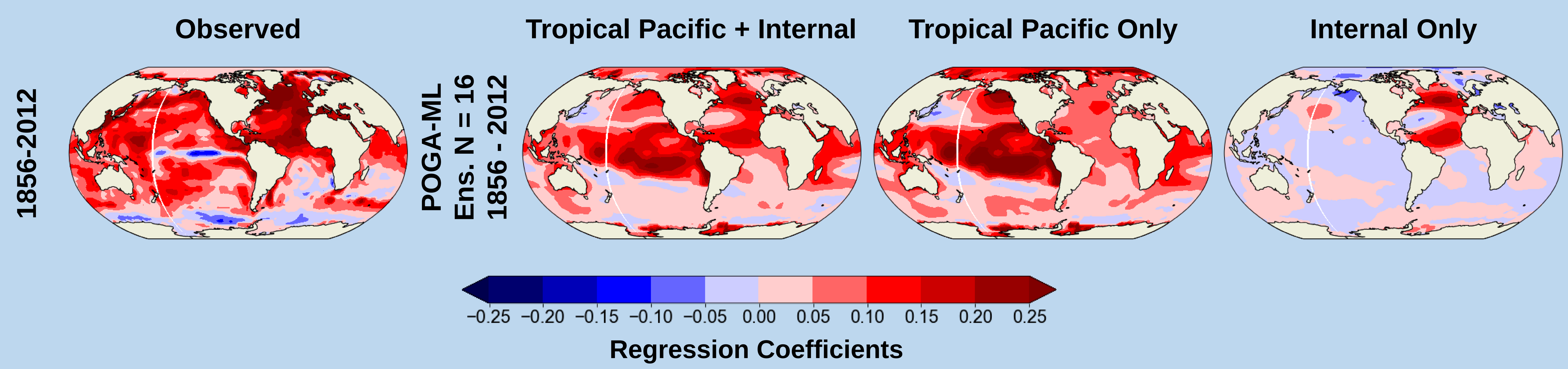
CM2.1 & CESM1 Experiments: Fully Coupled Models

Regression of SSTs on AMV Index

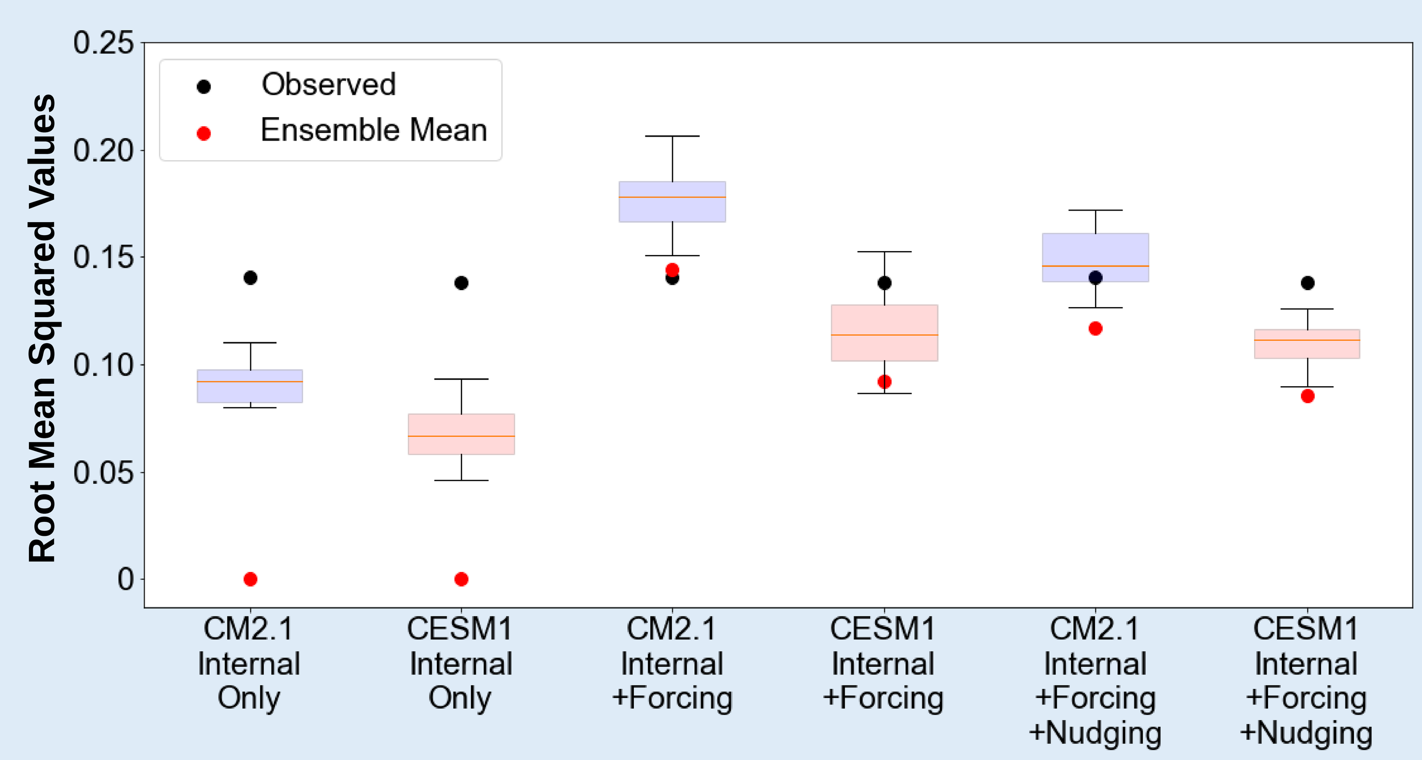


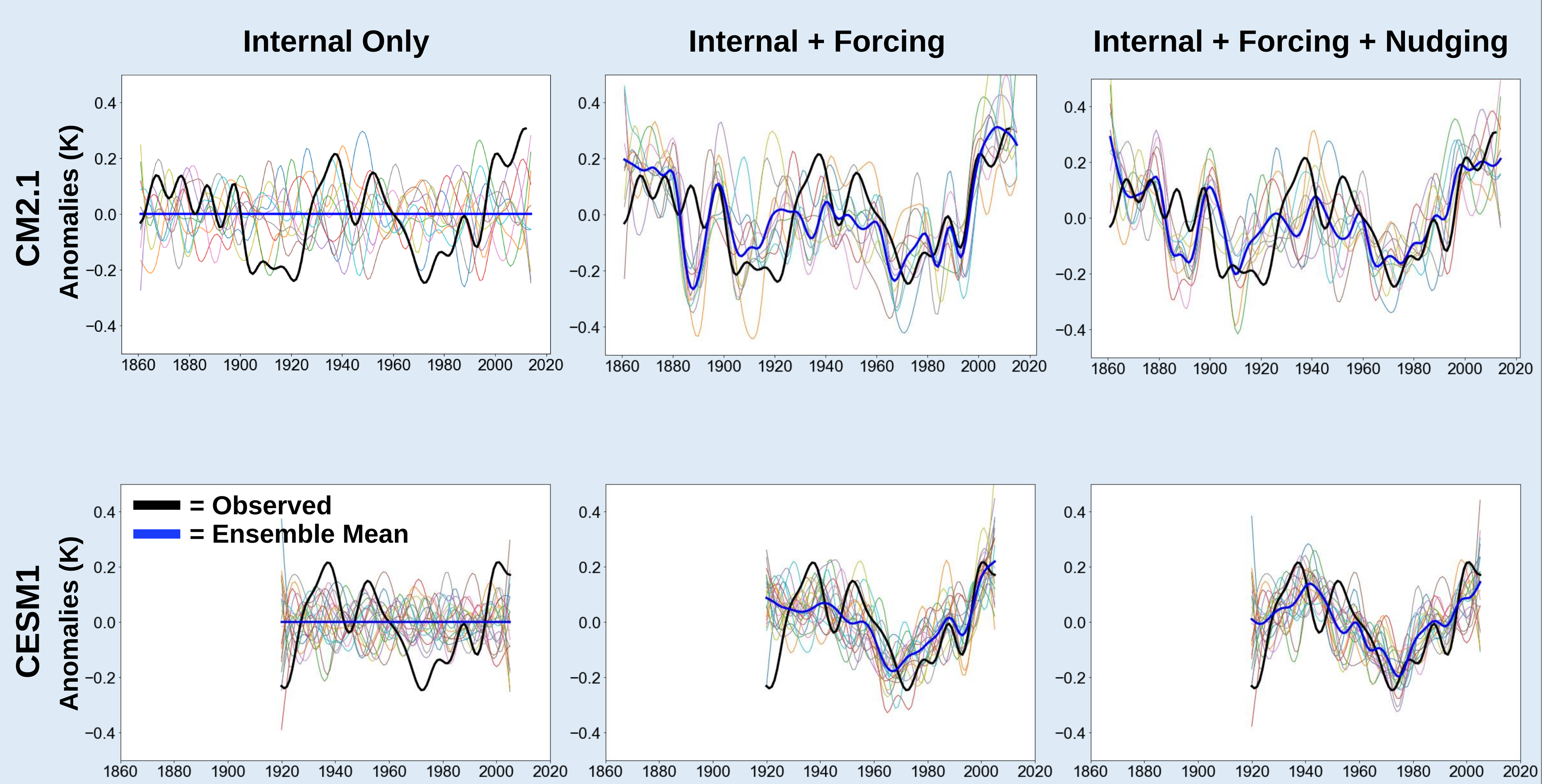
CCM3 Experiment: Atmospheric Model Forced with Tropical Pacific SSTs

Regression of SSTs on AMV Index



CM2.1 & CESM1 Experiments





CCM3 Experiment