The pattern effect impact on observationally-constrained warming projections

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**Motivation**

There is a strong impact of the pattern effect in the western tropical Pacific (ETP) on the global mean surface air temperature (SAT) trend (Andrews et al. 2018; Dong et al. 2020; Gregory et al. 2020; Zhou et al. 2020; 2021; Forster et al. 2021).

The observed and simulated pattern effect can be understood as internal variability, which means recent observed trends in the tropical Pacific SST are not expected to continue in the future (Forster et al. 2021; Watanabe et al. 2021).

Can we narrow the uncertainty in projected warming by constraining based on the observed SAT trend with the pattern effect removed?

**Data**

- **Model in use**: 28 CMIP6 models
- **Projected variable**: SAT changes
- **Constraint**: SAT trend in 1993-2012
- **Observation**: HadCRUT5 and ERSST V5

**Step 1**: Remove the model difference in forced response from the ETP trend by regressing out ECS variations

**Step 2**: Regress out the pattern effect (using ETP trend with forced response removed) in simulated and observed SAT trend

**Step 3**: Observationally constrained model projected warming using observed SAT trend with pattern effect removed

**Metric performance**: Raw SAT trend VS SAT trend with pattern effect removed

The GSAT trend metric with the pattern effect removed produces more robust emergent relations, suggesting the pattern effect is likely internal variability.

**Summary & Conclusions**

Projected constraints using observed GSAT warming can be improved by removing the pattern effect first.

Stronger constrained projected warming is obtained when we remove the pattern effect in both observations and model realizations (it is more consistent with other global-scale constraints [Liang et al. 2022]).

**Key Reference**


**Questions, Comments?**

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