Anthropogenically forced wind driven ocean redistribution of heat leads to increased warming over the historical period

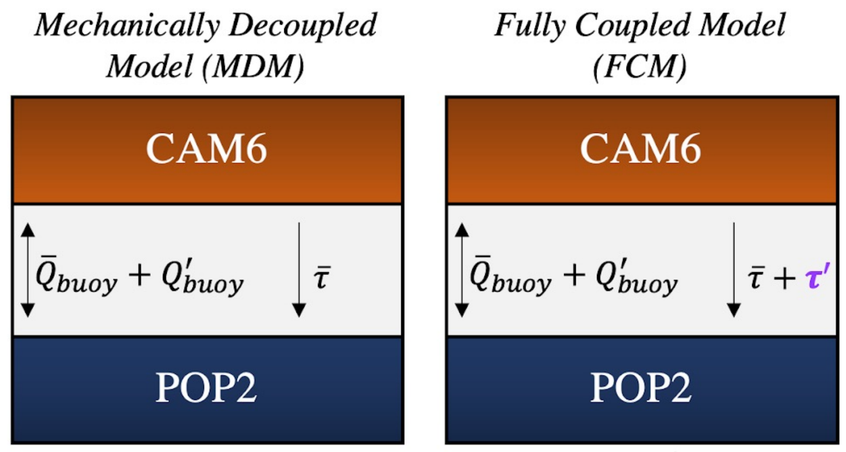
Kay McMonigal & Sarah Larson

Hypothesis

- Rate of climate warming is dependent on pattern of the warming, due to radiative feedbacks (e.g. Armour et al., 2013)
- The ocean redistributes heat
- The ocean is forced by winds
- **Changes to the wind patterns could drive ocean heat redistribution, and feed back onto the atmosphere**

Methods

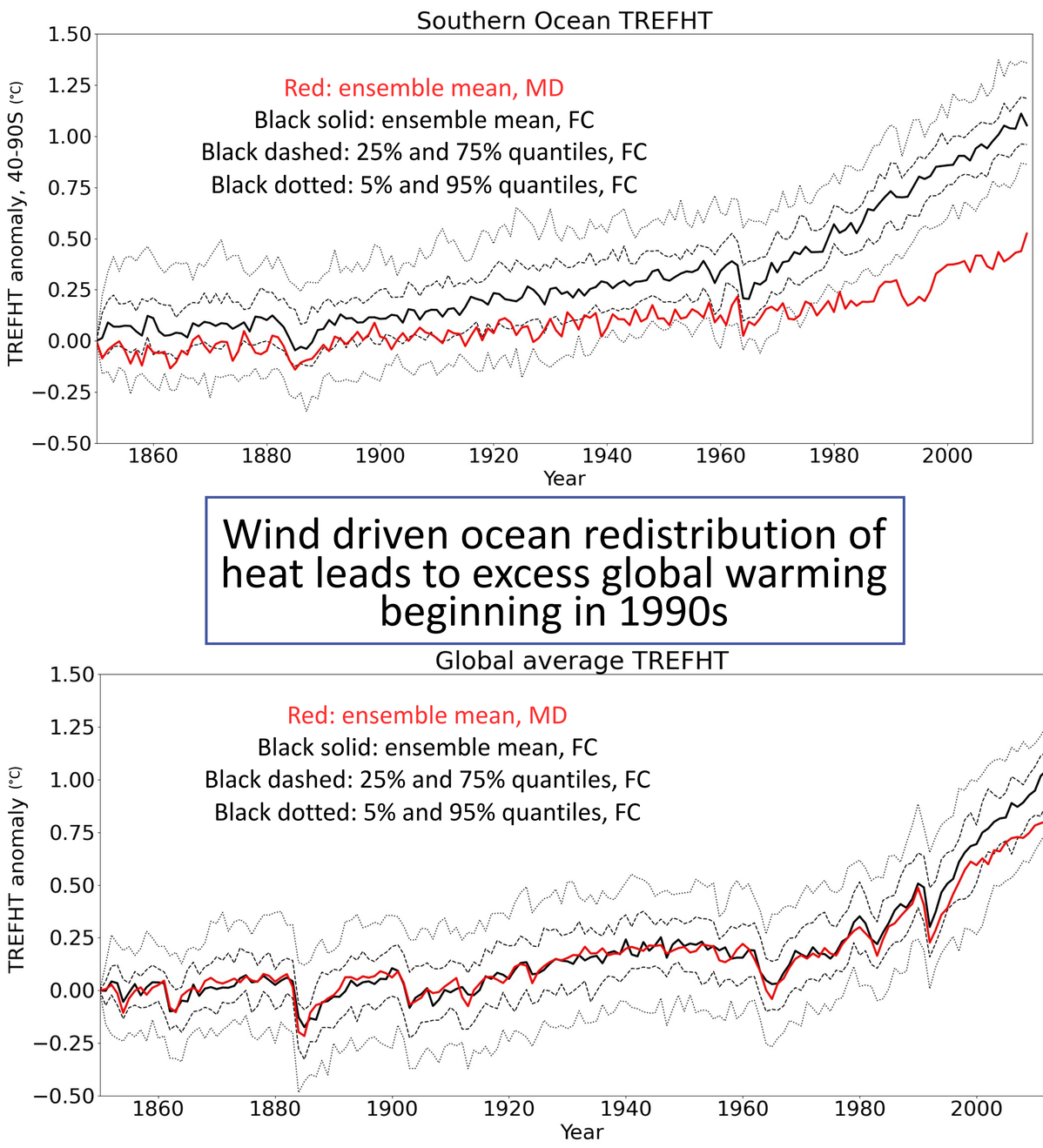
Historical forcing in CESM2



Difference between the two ensemble means isolates forced response to wind driven ocean redistribution of heat

Results

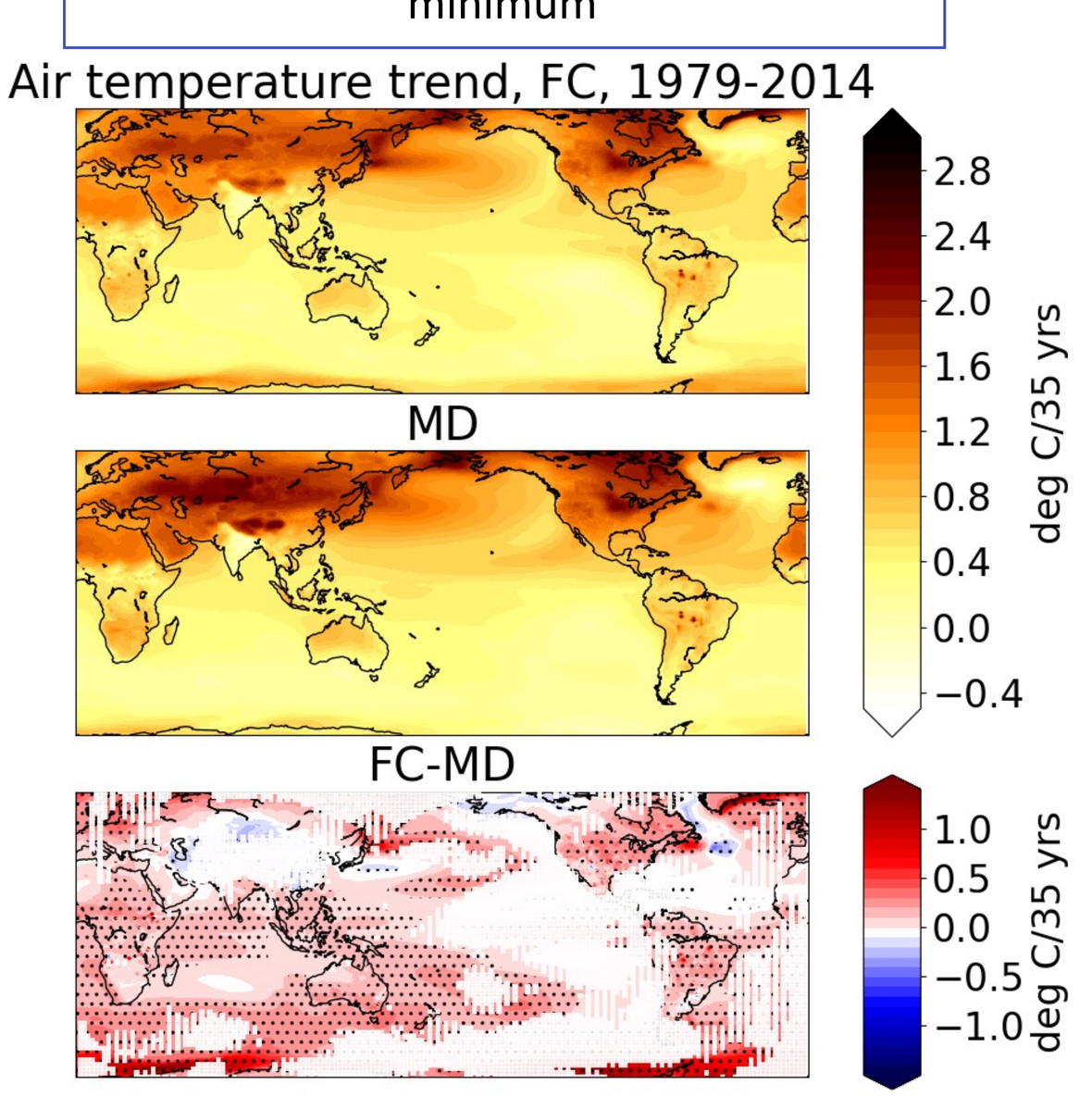
Wind driven ocean redistribution of heat leads to excess Southern Ocean warming beginning in 1960s



Wind driven ocean redistribution of heat leads to excess global warming beginning in 1990s

Over satellite record, wind driven ocean redistribution of heat leads to **more warming** over N and S America, tropical Indian Ocean

Wind driven ocean redistribution of heat **shifts location** of Kuroshio Extension warming maximum and N Atlantic warming minimum



Stippling: statistically significant

Whited out areas: observations fall outside of the FC model ensemble range

Discussion and Future work:

- Wind driven ocean heat redistribution is an essential component of climate sensitivity
- Slab ocean models will not resolve this, potentially biasing equilibrium climate sensitivity estimates
- Investigating mechanisms and wind trends driving changes
- Is everything driven by Southern Hemisphere westerlies change?
- What feedbacks are playing a role?