Modeling the Indonesian Throughflow and ENSO: Past and Present

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with
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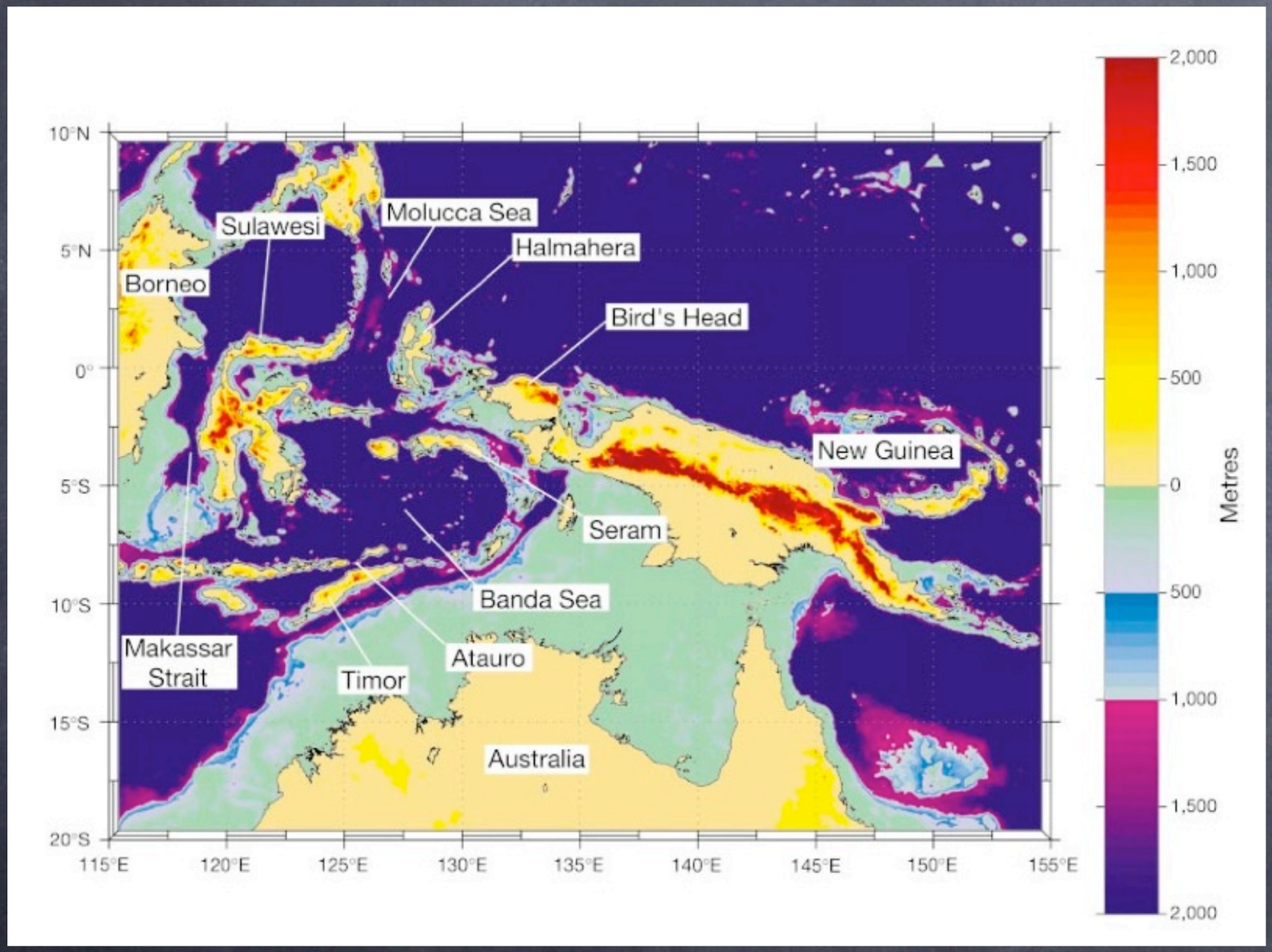
Part I: Cane & Molnar?

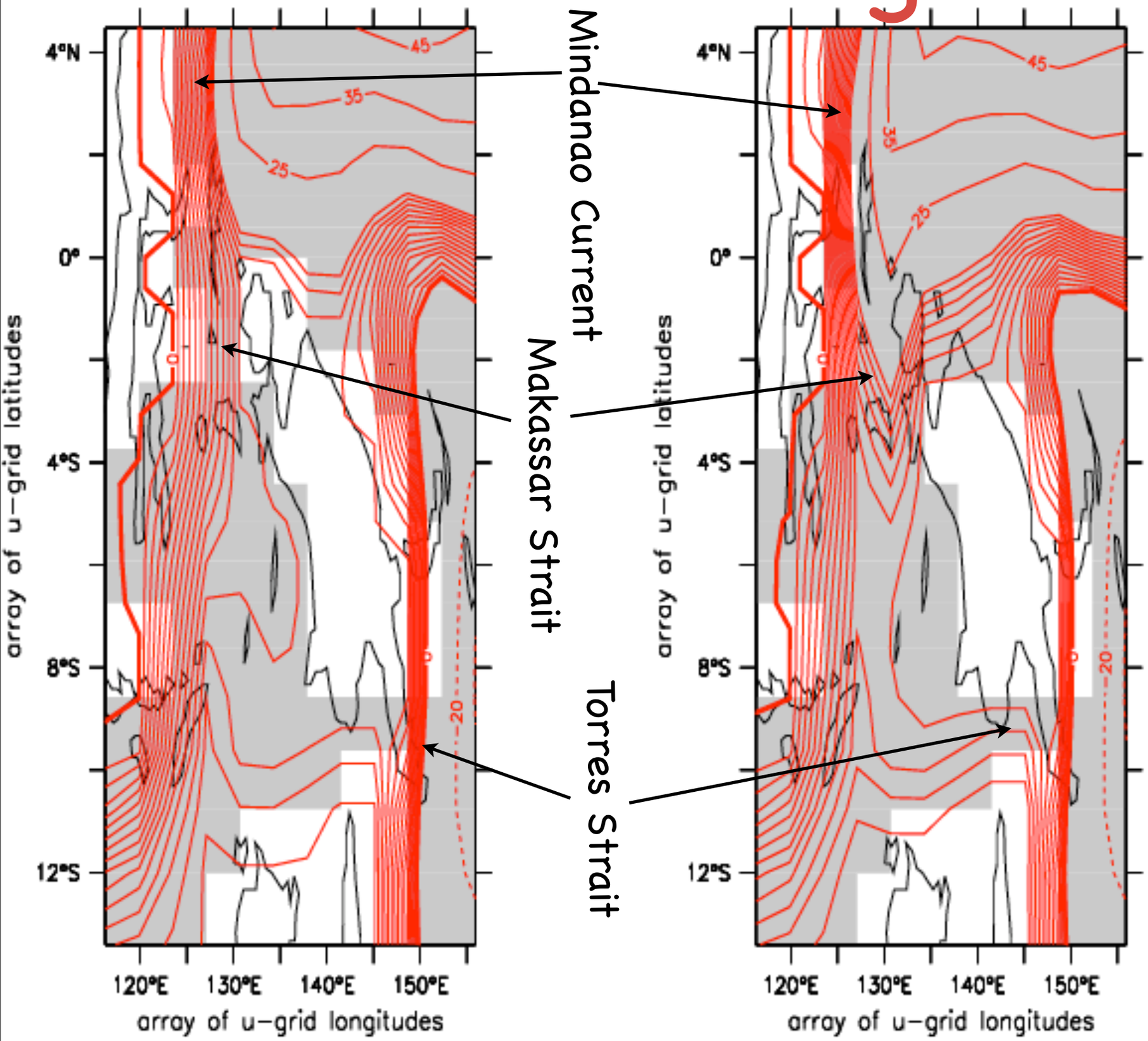


Halmahera consists of very young volcanic material.

Thus, it was likely below sea level during the mid- to late- Pliocene period.

Proxy evidence (Wara et al. 05, Lawrence et al. 06) suggests vastly different Pacific stratification at that time.

The ITF changes:



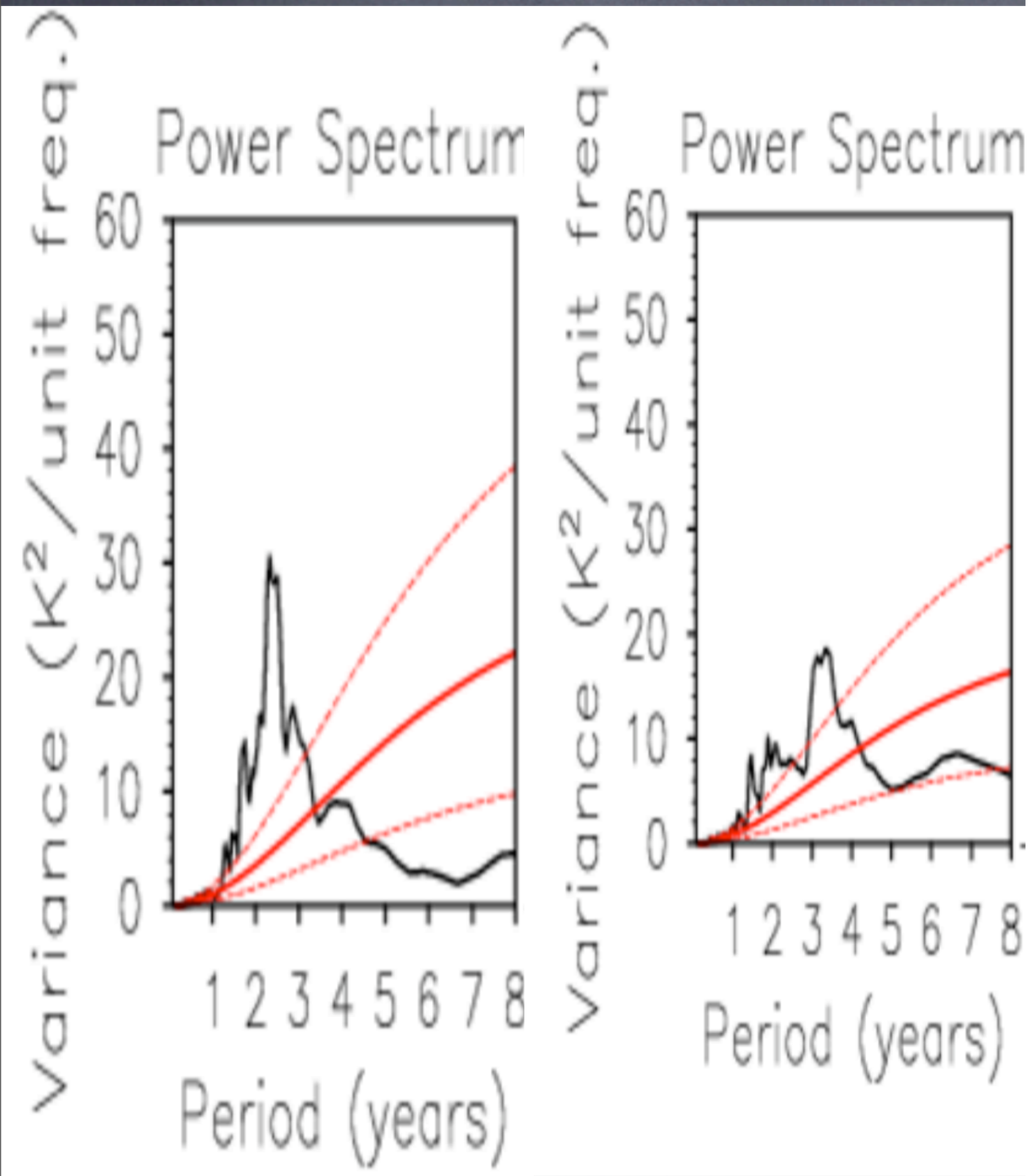
PLIO run has 2 Sv weaker ITF

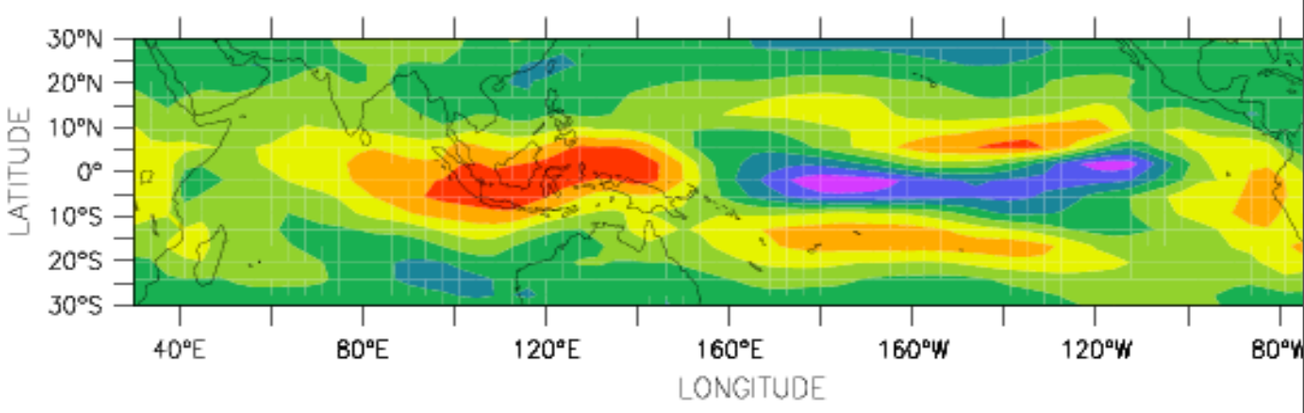
-3 MS
+1 TS

Making ENSO weaker & slower

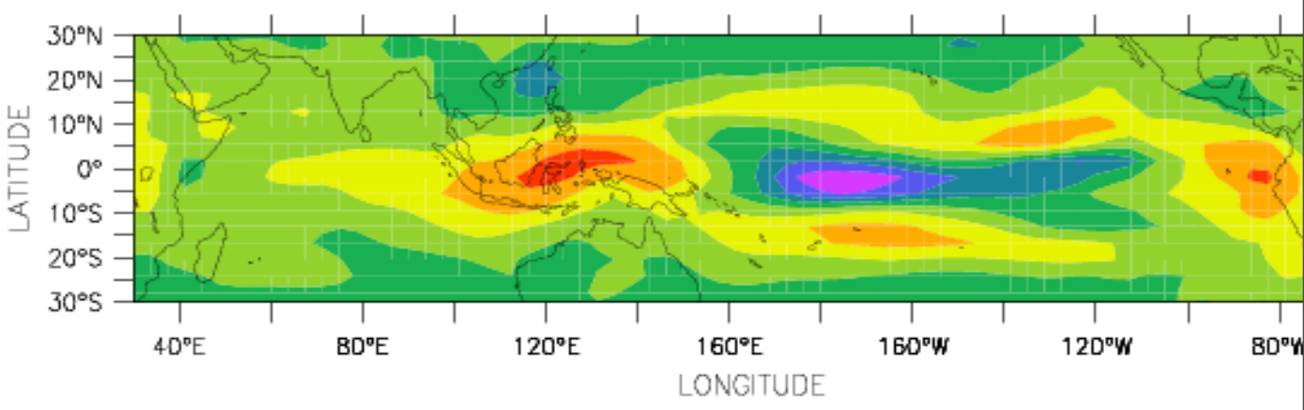
Because of ITCZ to reduced Delayed Osc.

CONT PLIO





correlation between taux' and NINO3, CONTRO

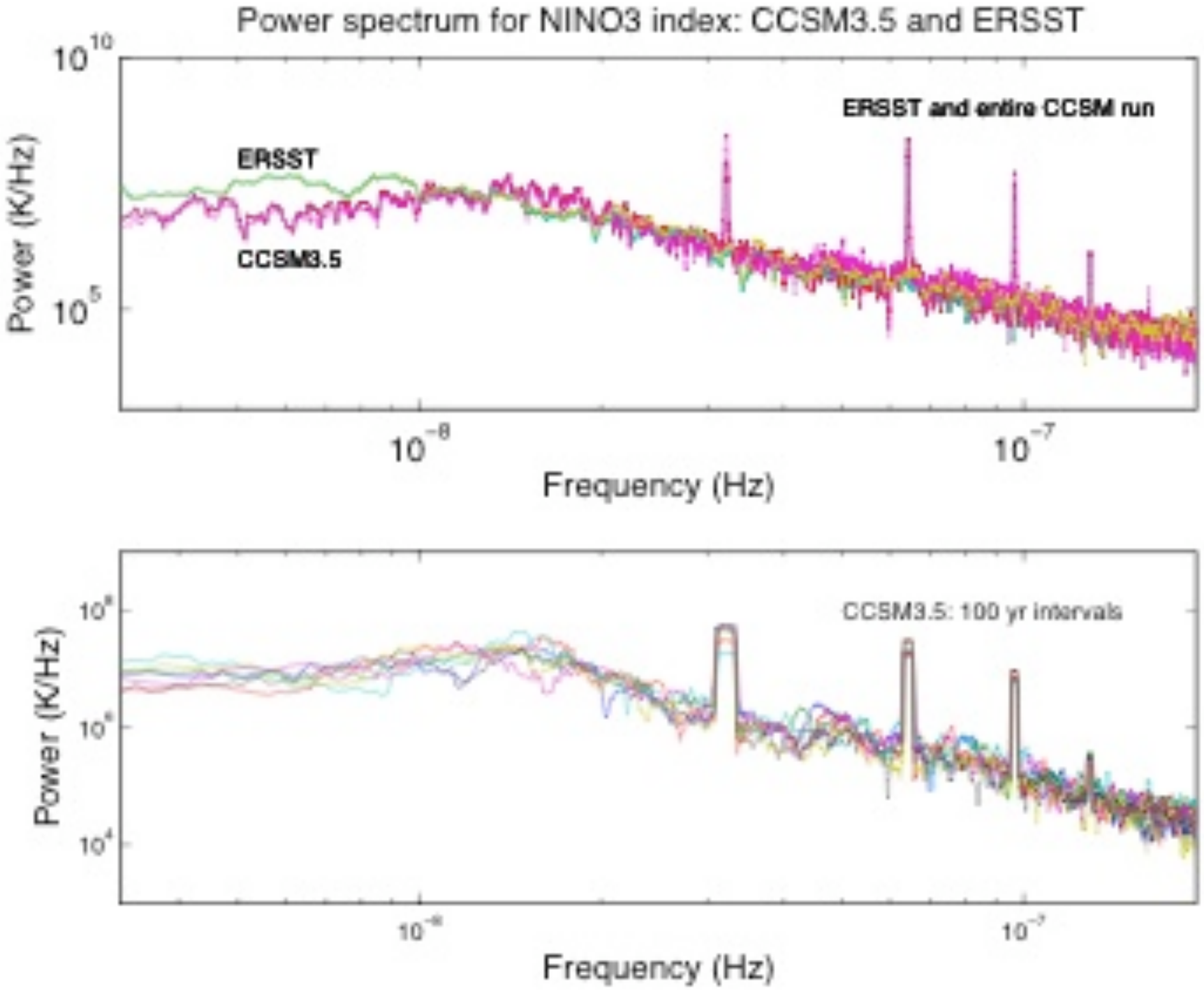


correlation between taux' and NINO3, PLIOCEN

But, no sign of Permanino...

- In PLIO, retroflecting Mindanao Current leads to eastward extension of warm pool
- This leads to southeastern movement of ITCZ
- This leads to changes in ENSO feedbacks.
- But, few global changes and only modest SST/Thermocline changes, not Permanino...
- Also, not ENSO enhancement/duration, etc.

But, how robust are ENSO changes?



700 yr run

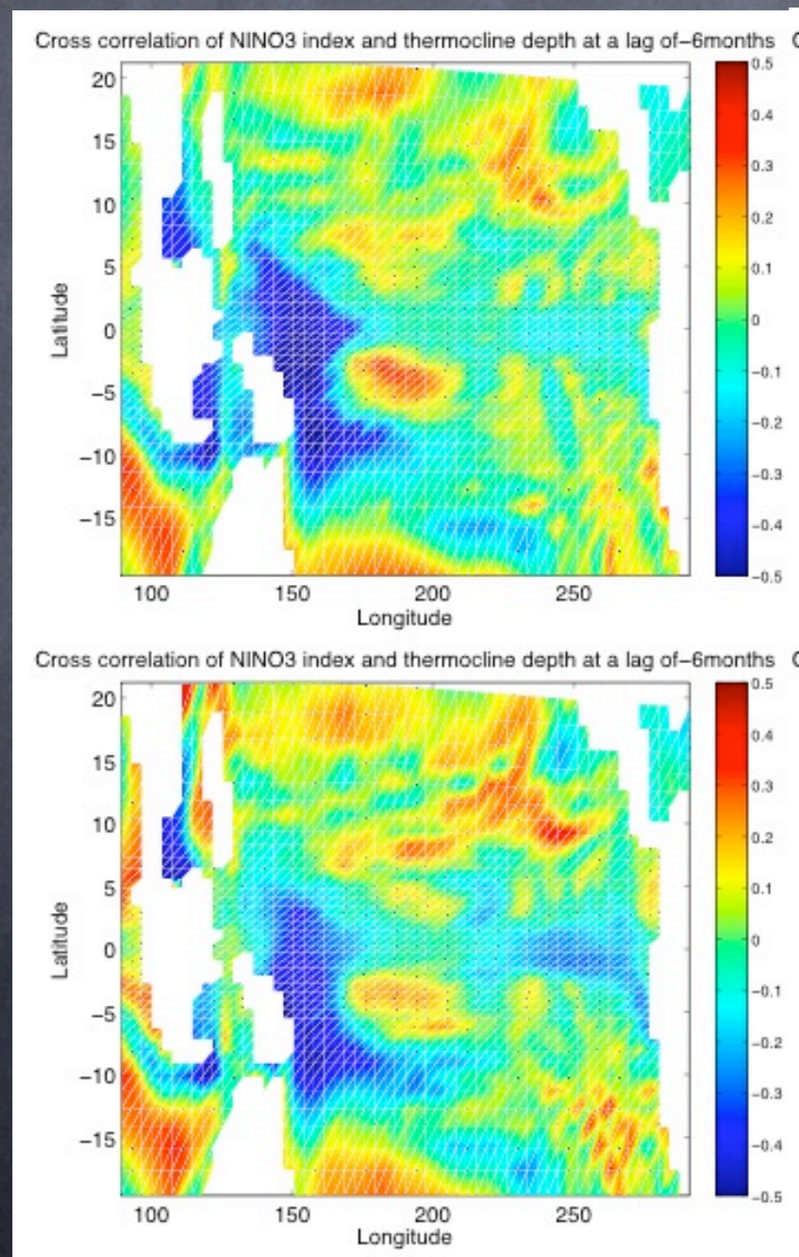
analyzed as 100 yr runs

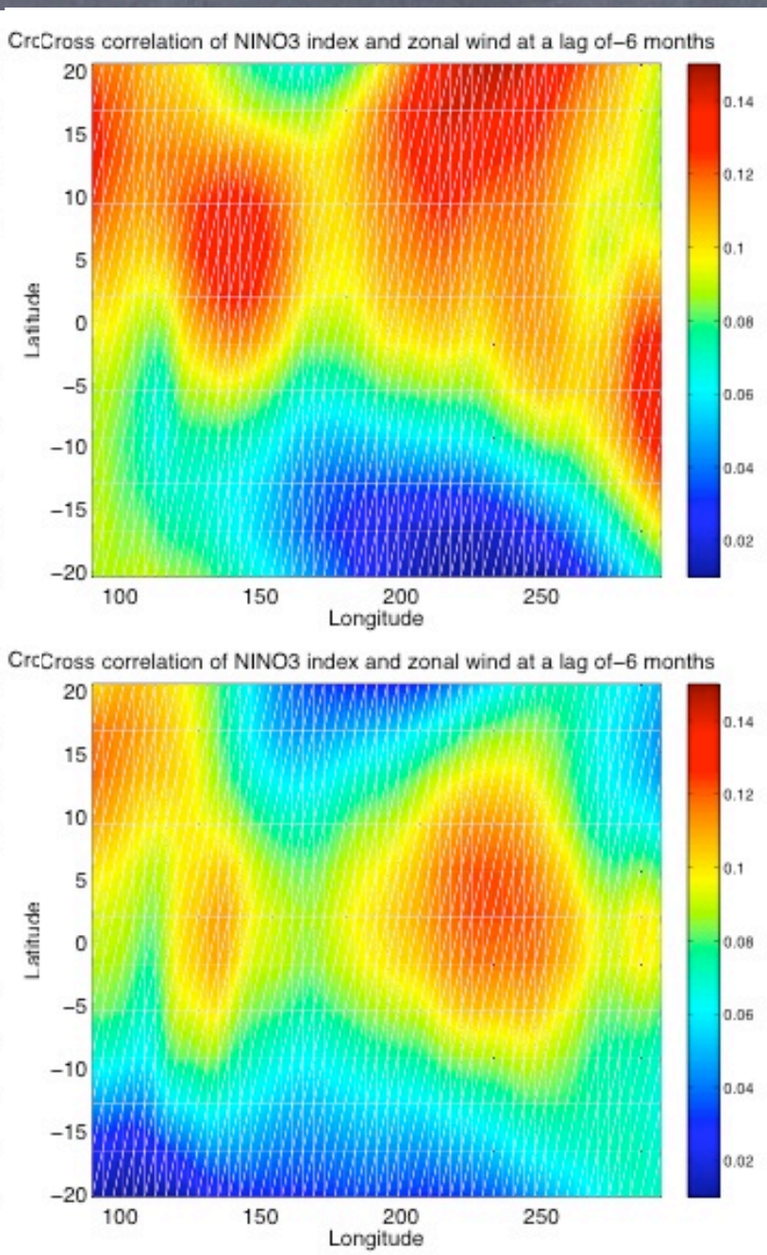
ENSO Varies *within* a run

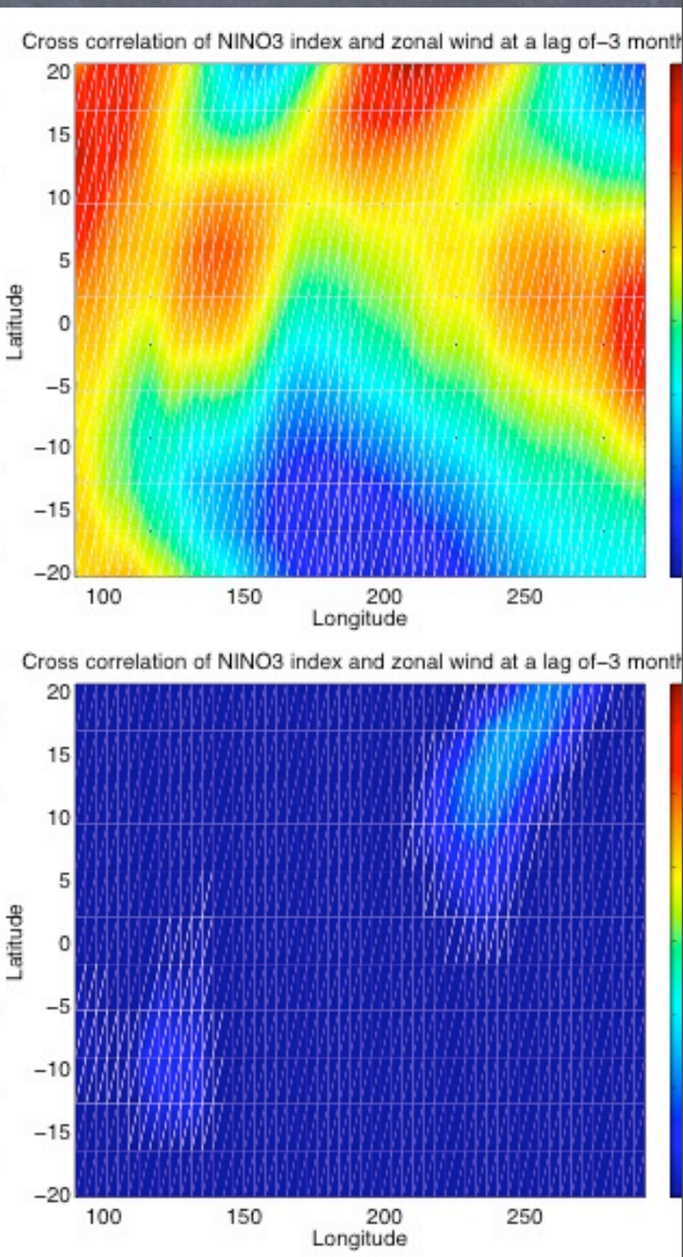
6mo ThermD. 6mo Wind. 3mo Wind.

Lo ENSO

Hi ENSO







Conclusions

- ITF during Pliocene was likely different than today, however, implications of this tectonic rearrangement are nontrivial.
- Results rely upon model quality and underpinning, especially ENSO-related.
- Must be able to capture statistical nature: e.g., ENSO > 100 yrs.
- Holocene coral data (e.g., McGregor & Gagan 04, Brown et al. 08) with models may be best hope for understanding ENSO centennial variability.