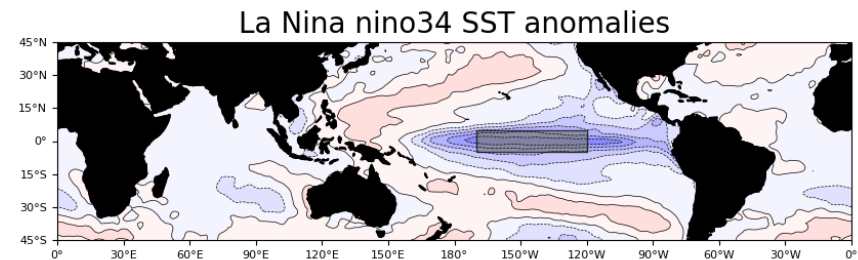
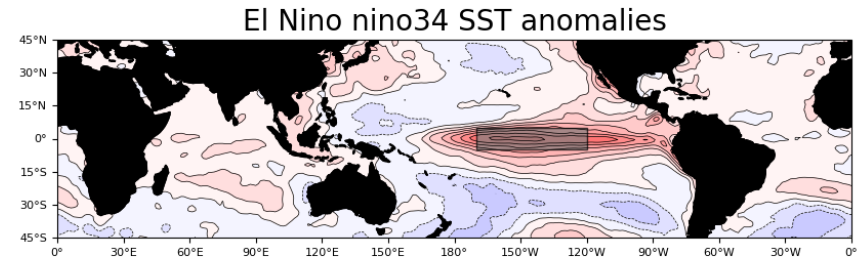
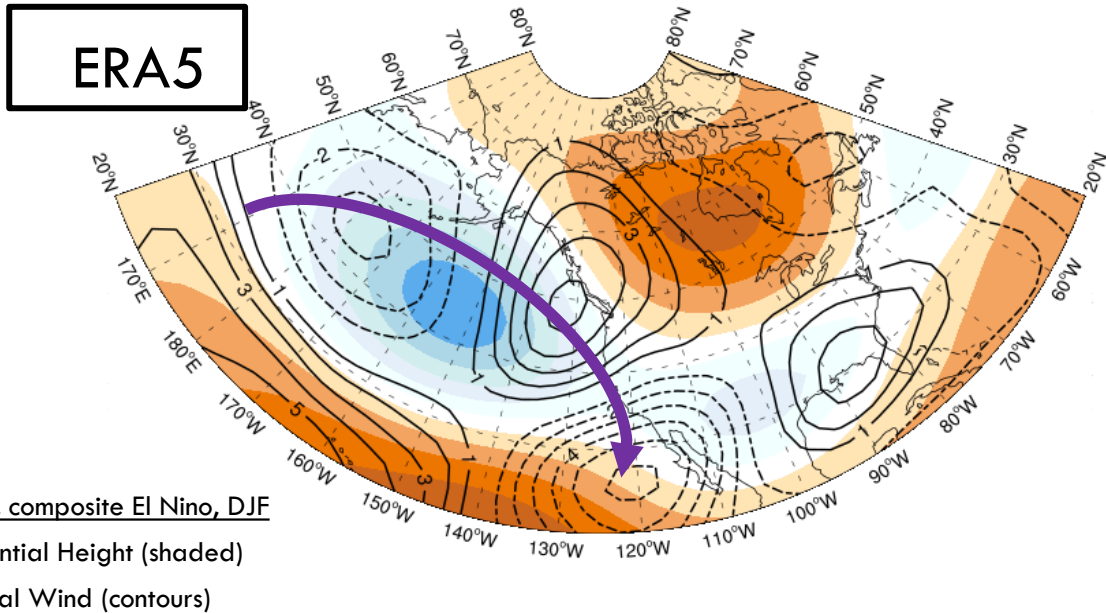
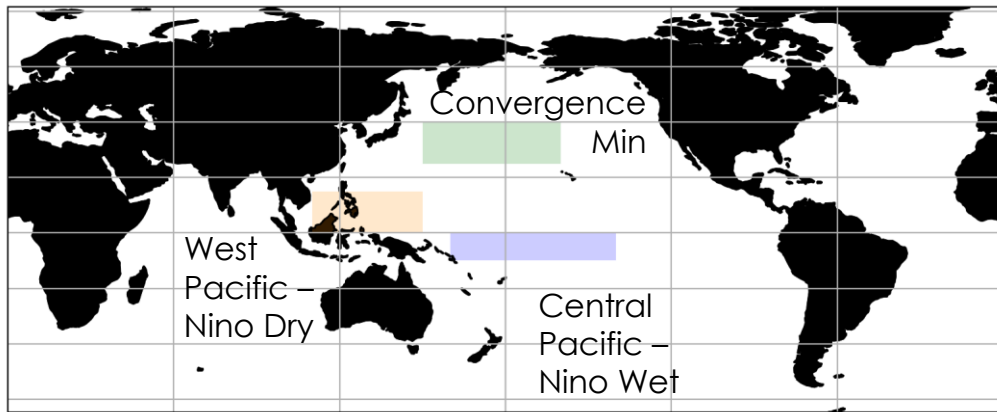


# Connecting Variability in the Tropical ENSO Column Response and the Remote Pacific Response in E3SM and CESM Large Ensembles. Rich Neale (NCAR) and H Annamalai (U. Hawaii)



200 hPa, composite El Niño, DJF  
Geopotential Height (shaded)  
Meridional Wind (contours)

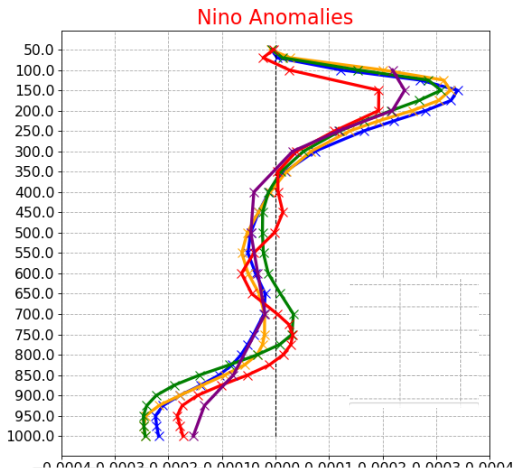


$$RWS' = -\bar{\zeta} \nabla \cdot v_{\chi}' - v_{\chi}' \cdot \nabla \bar{\zeta} - \zeta' \nabla \cdot \bar{v}_{\chi} - \bar{v}_{\chi} \cdot \nabla \zeta'$$

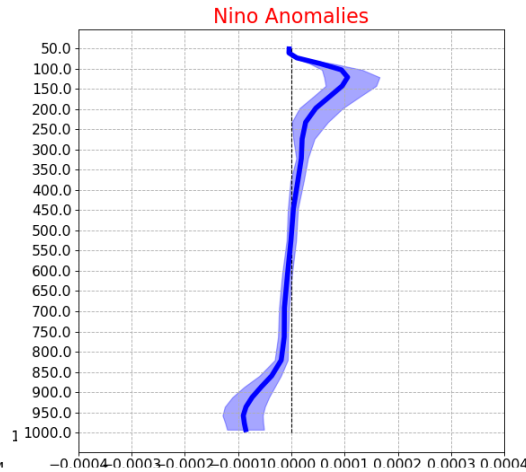
What are the tropical diabatic processes that determine the divergence source terms in the **Rosby Wave Source** response during ENSO?

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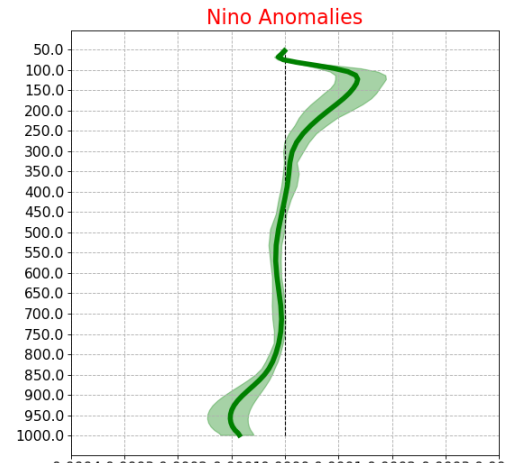
(a) Reanalysis



(b) CESM2



(c) E3SMv2

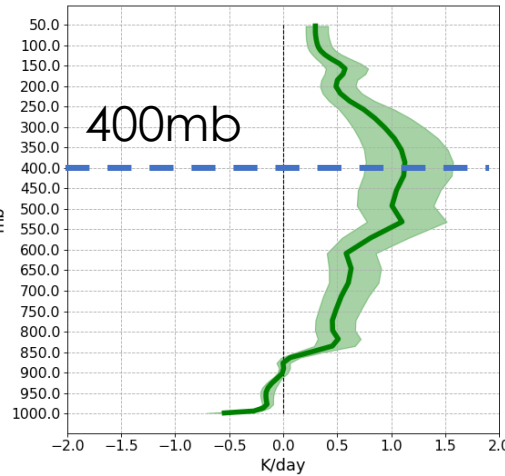
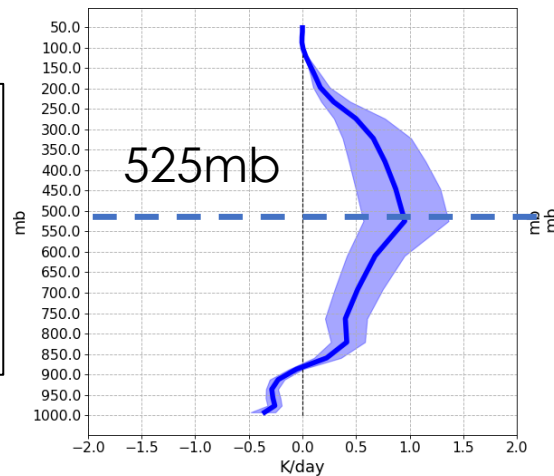


Divergence ( $s^{-1}$ )

- Reanalysis uncertainty
- As large as model internal variability
- Mean convection depth
- Mean heating maximum
- Model response varies by
  - 50% divergence
  - 100% heating

## Central Pacific – Nino Wet

- 20 ensemble members
- 1979-2005
- Composite El Nino



Convective Heating ( $K/day$ )

Annamalai, H., R. B. Neale, J. Hafner, 2023: ENSO-induced teleconnection: process-oriented diagnostics to assess Rossby wave sources and ambient flow properties in climate models, *J. Climate*, 36, 3015–3041  
<https://doi.org/10.1175/JCLI-D-22-0346.1>