Tropical Pacific Climate & ENSO

in the GFDL CM2/2.1 control simulations

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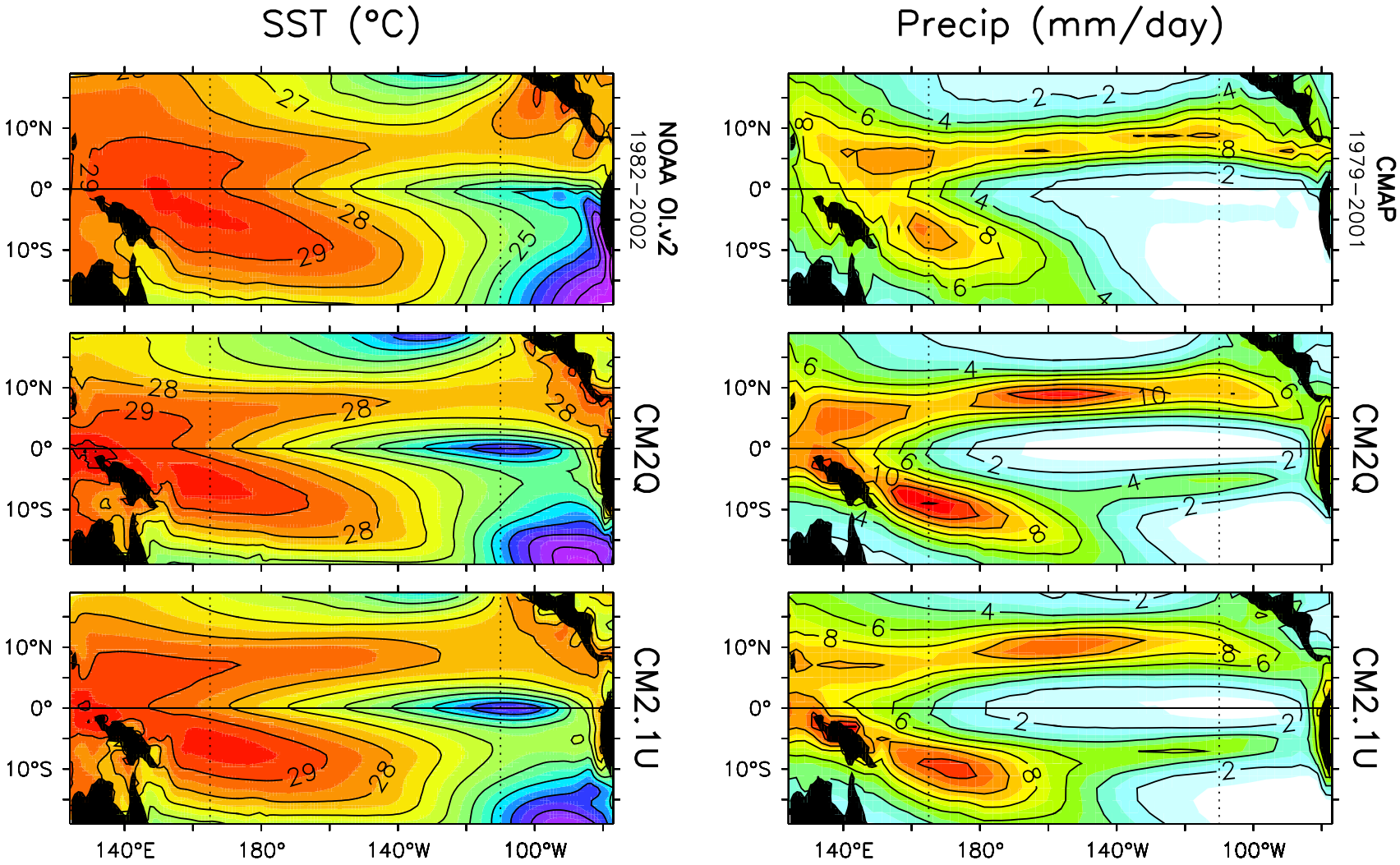
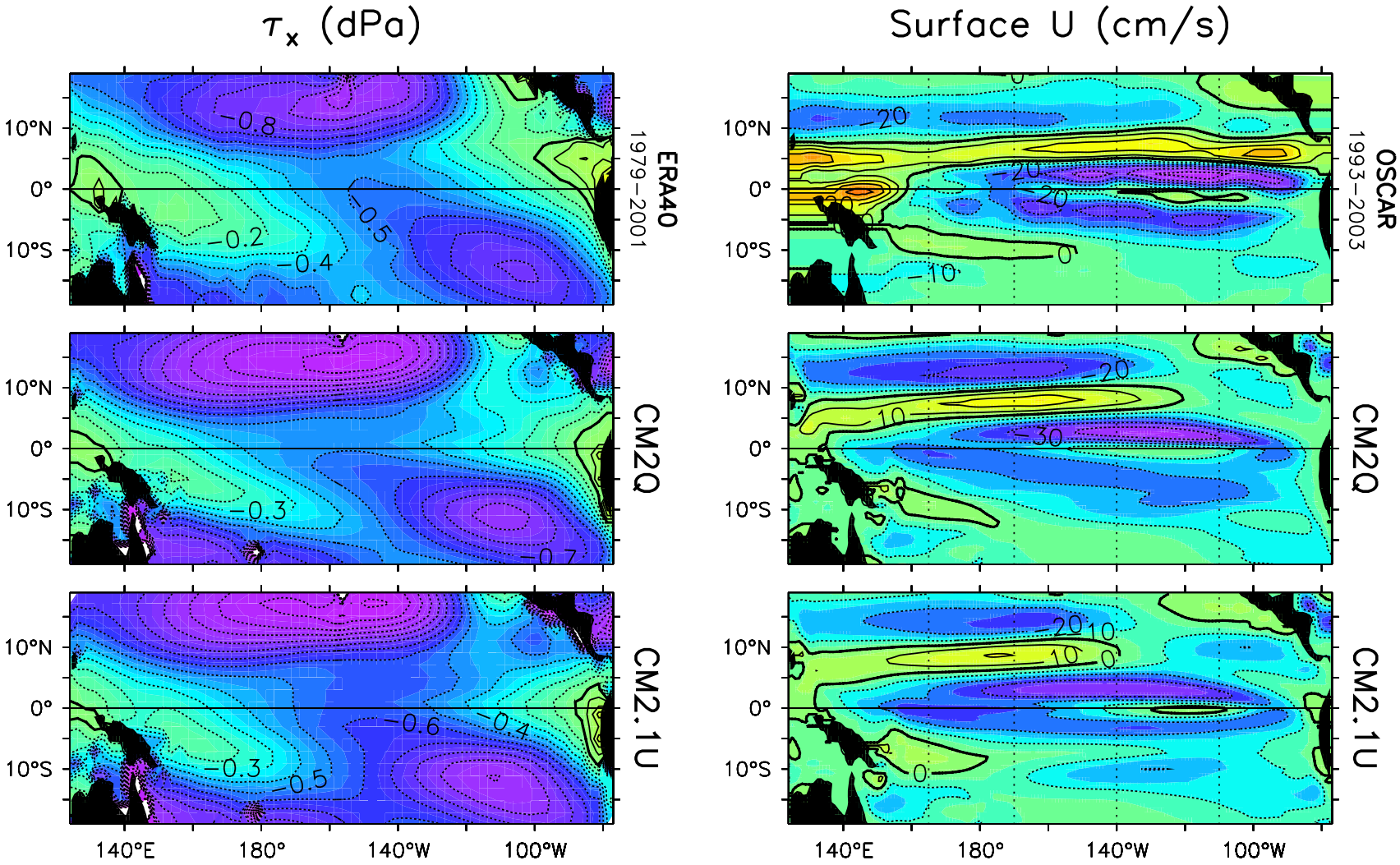
Princeton, NJ

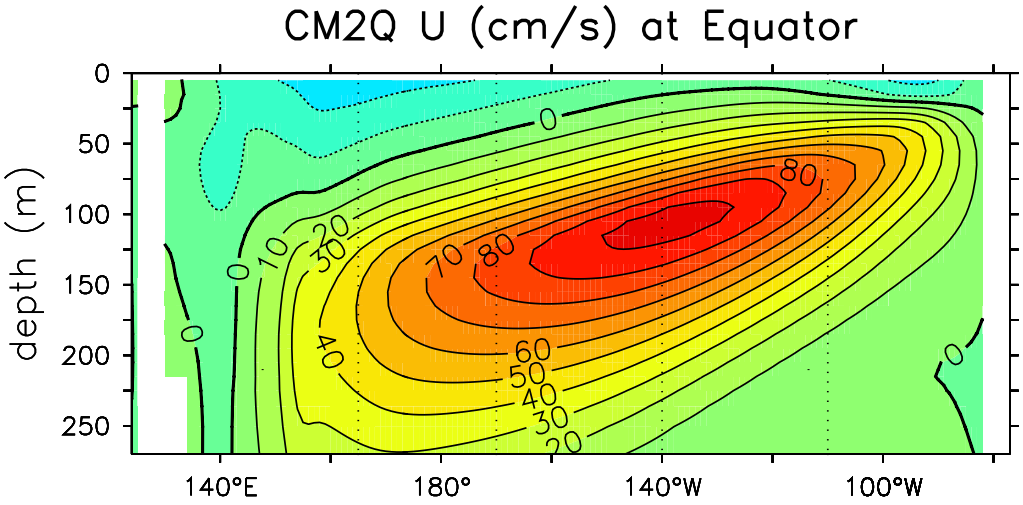
Annual Mean: SST & Precip

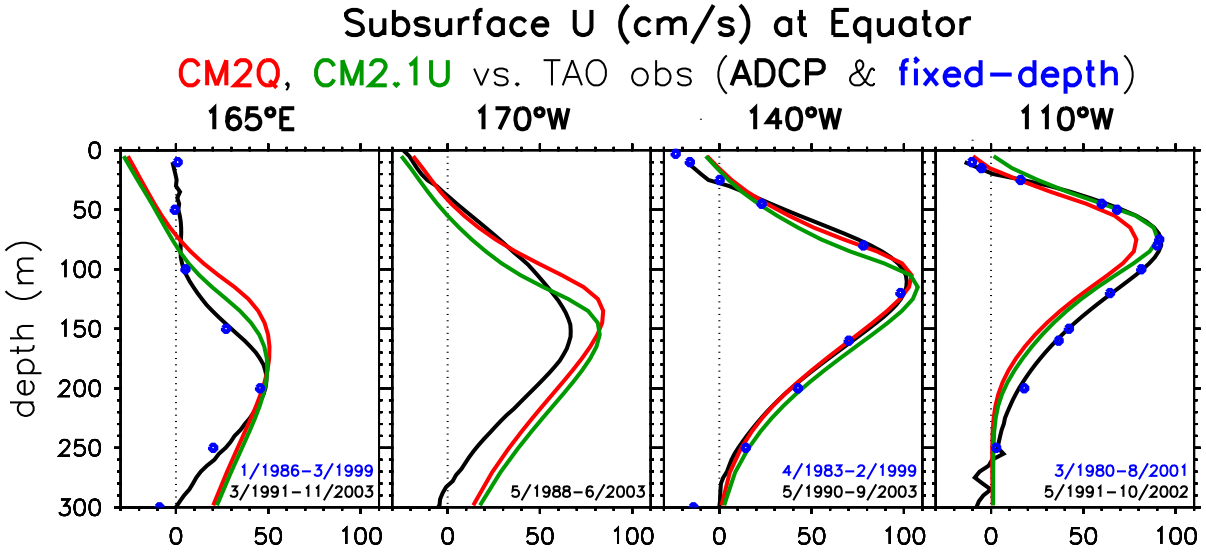


Annual Mean: Zonal Stress & Surface Current

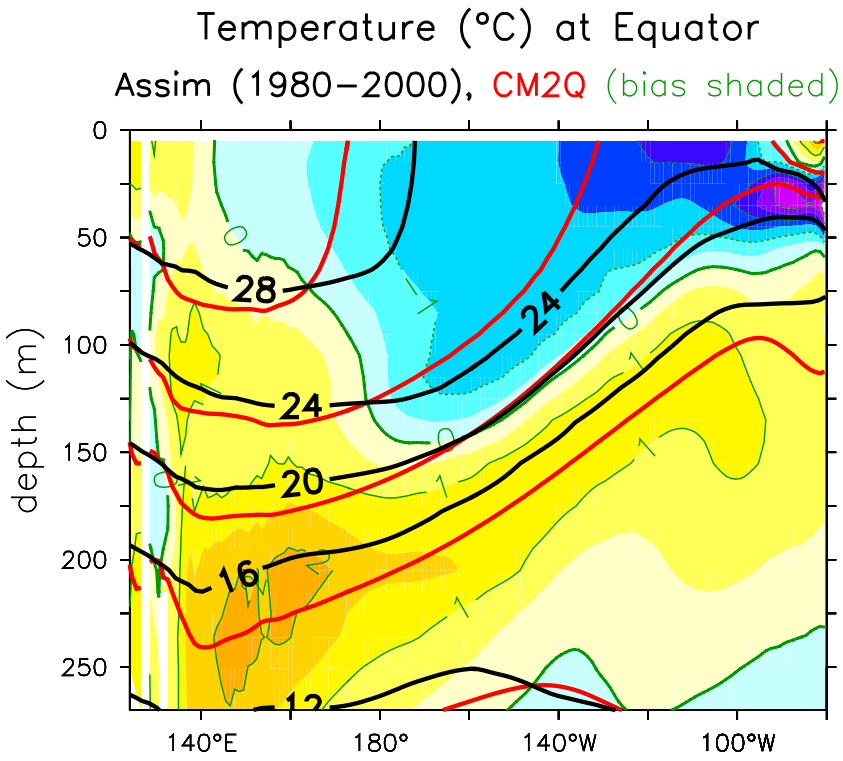


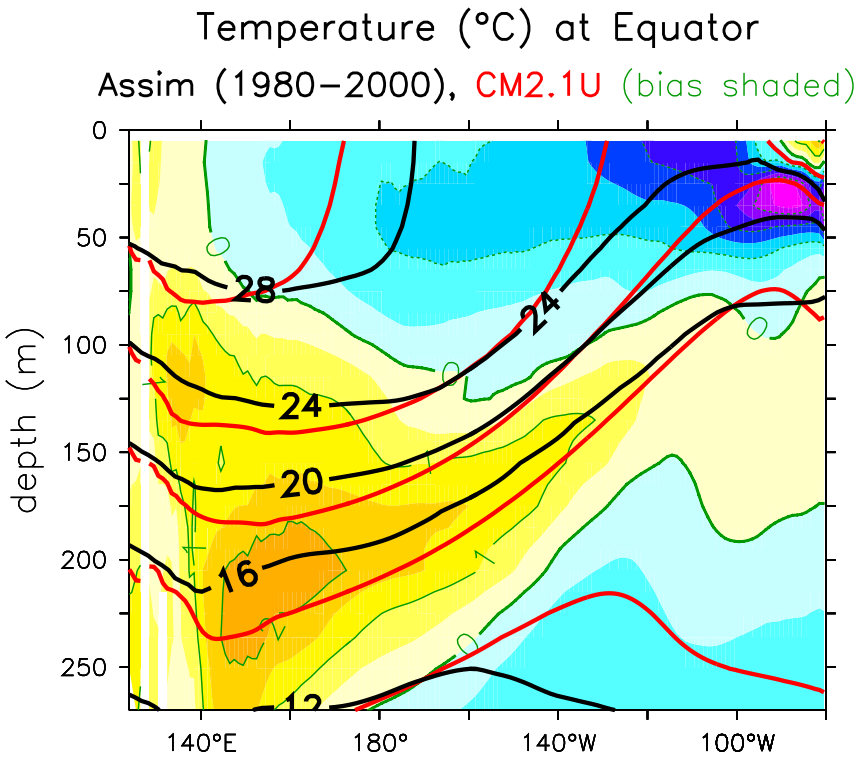
Annual Mean: EUC



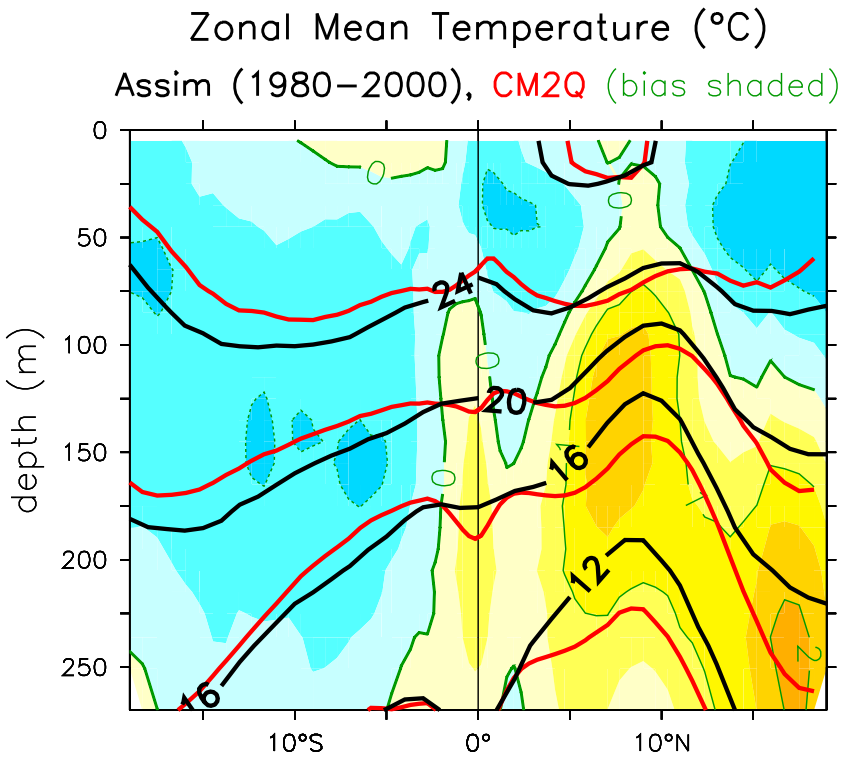


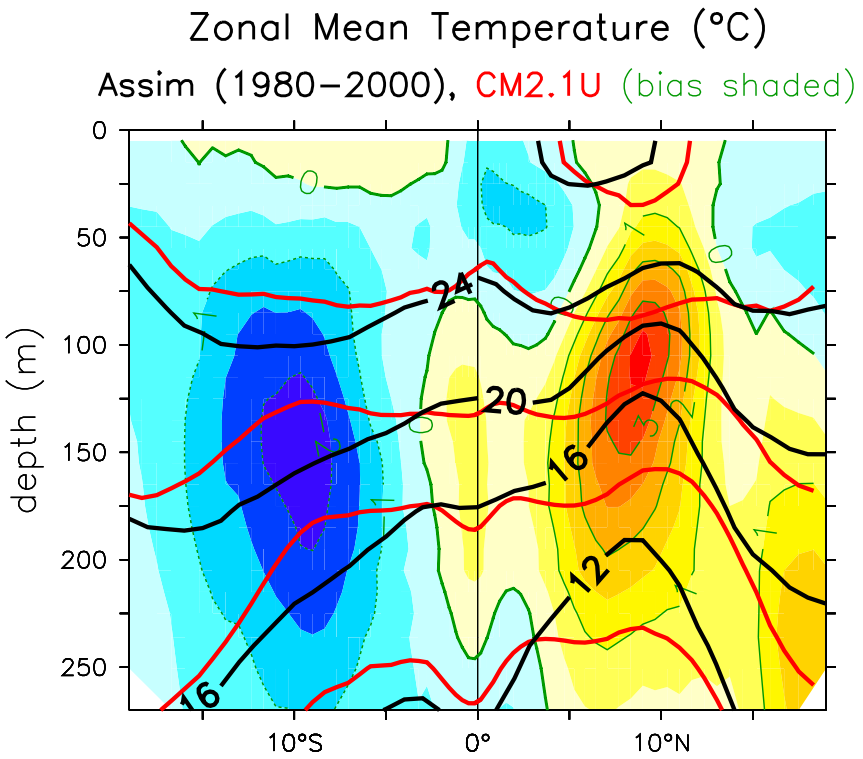
Annual Mean: Equatorial Temperature



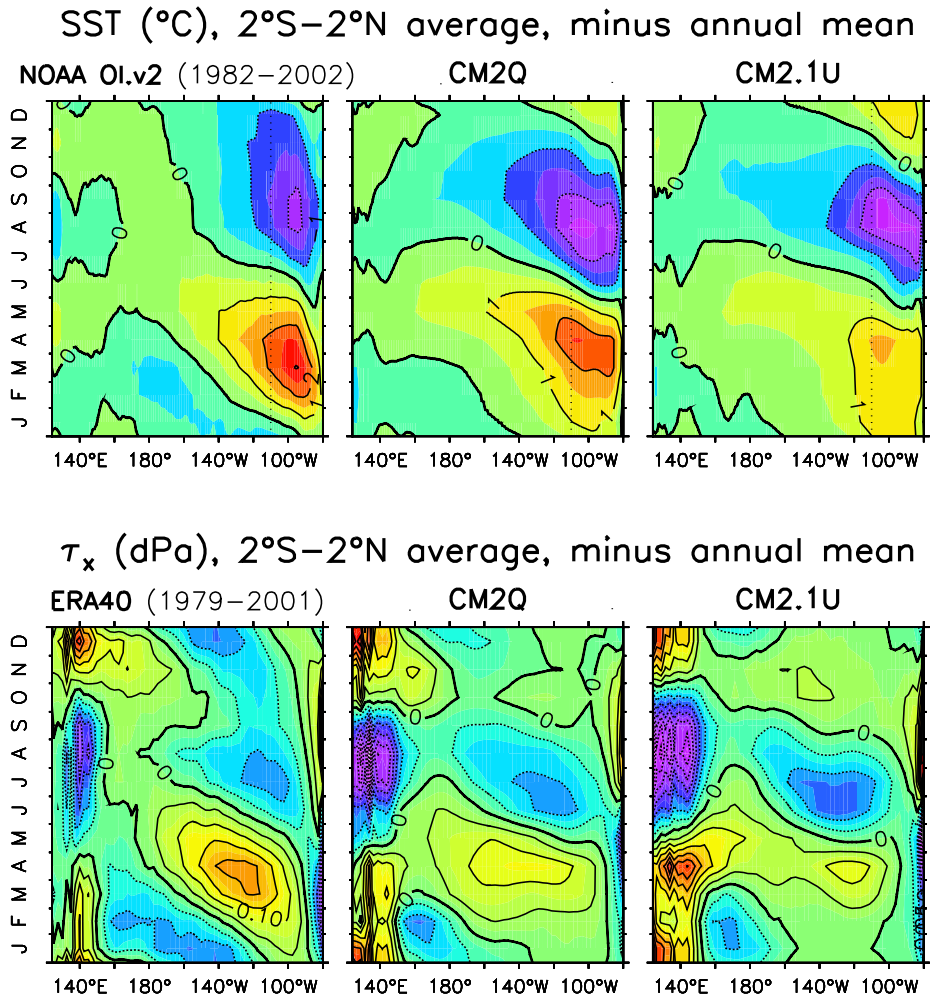


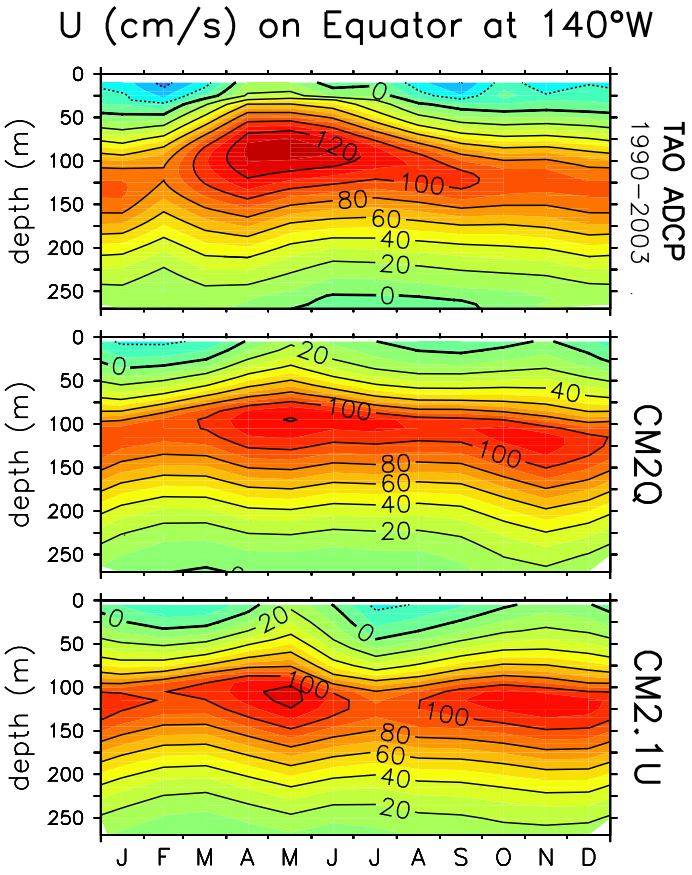
Annual Mean: Zonal Mean Temperature



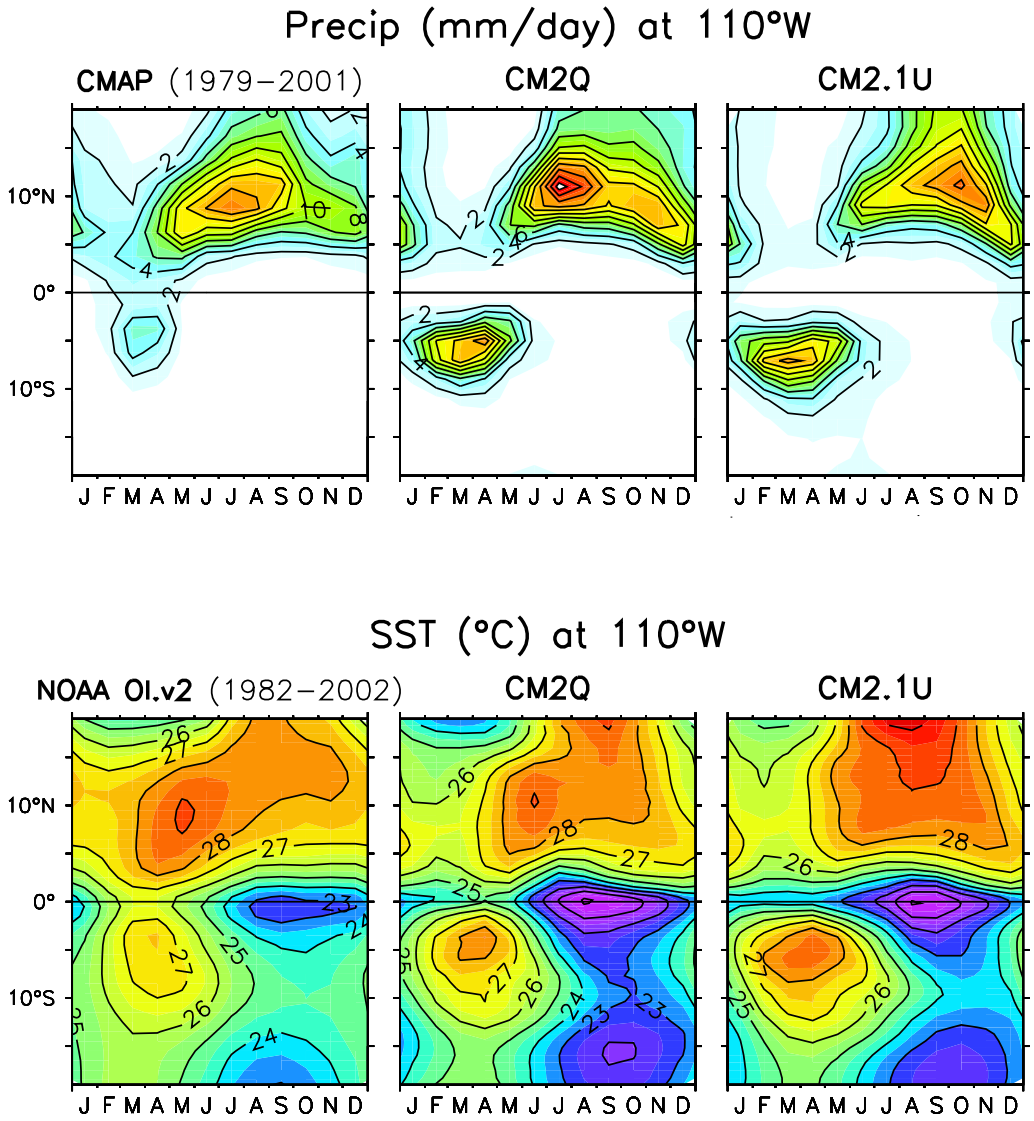


Seasonal Cycle at the Equator

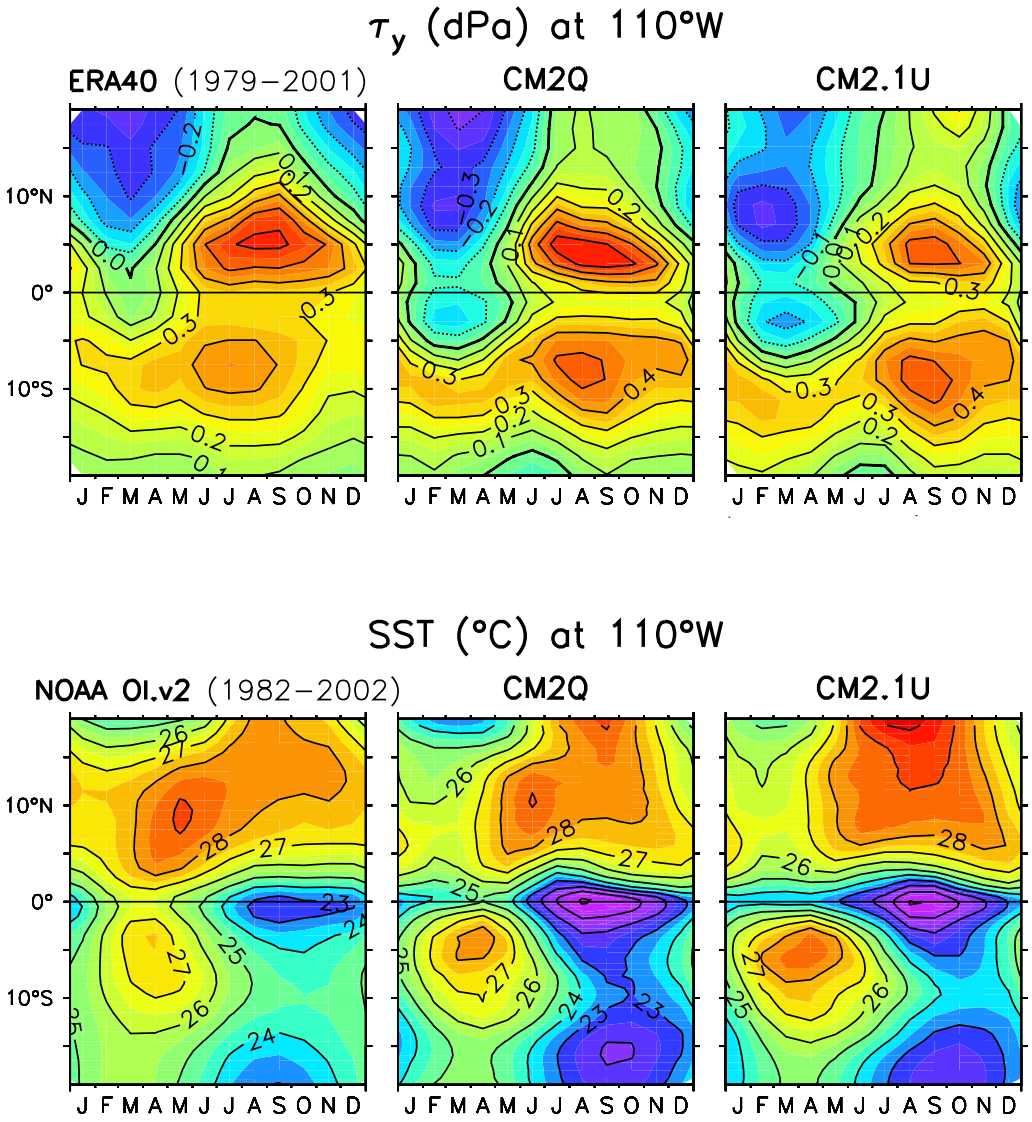




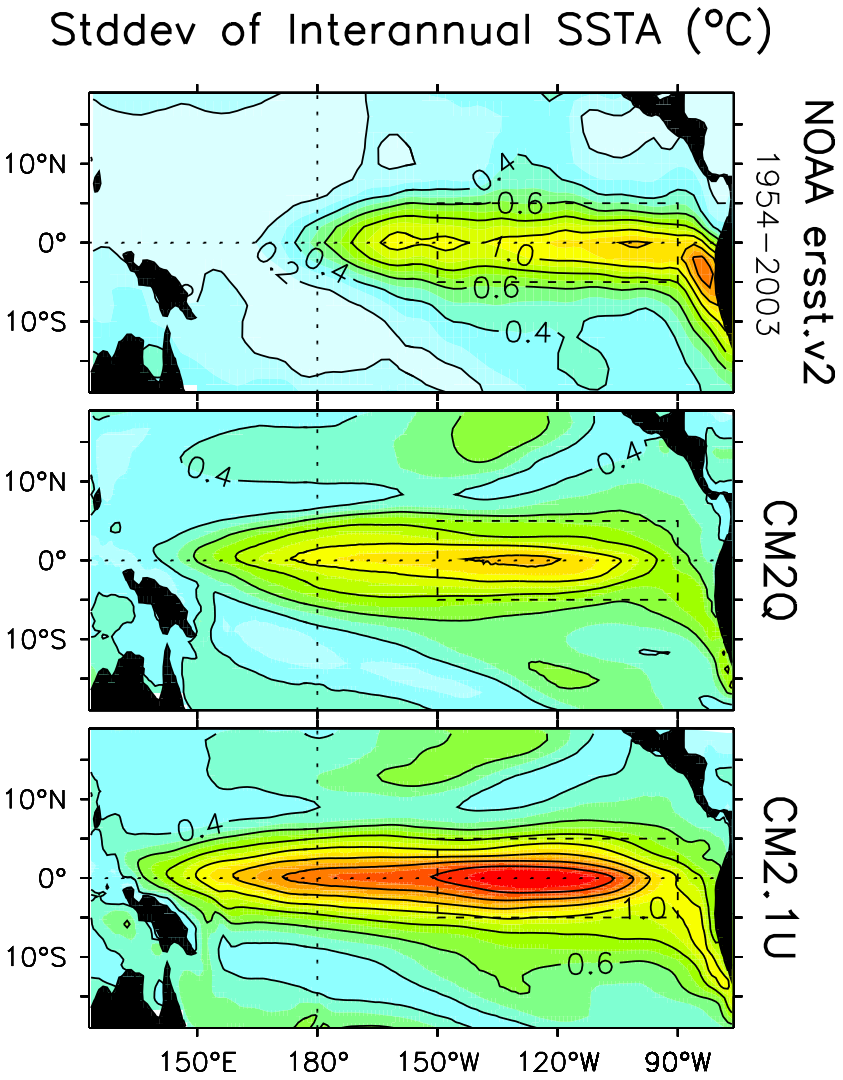
Seasonal Cycle at 110°W

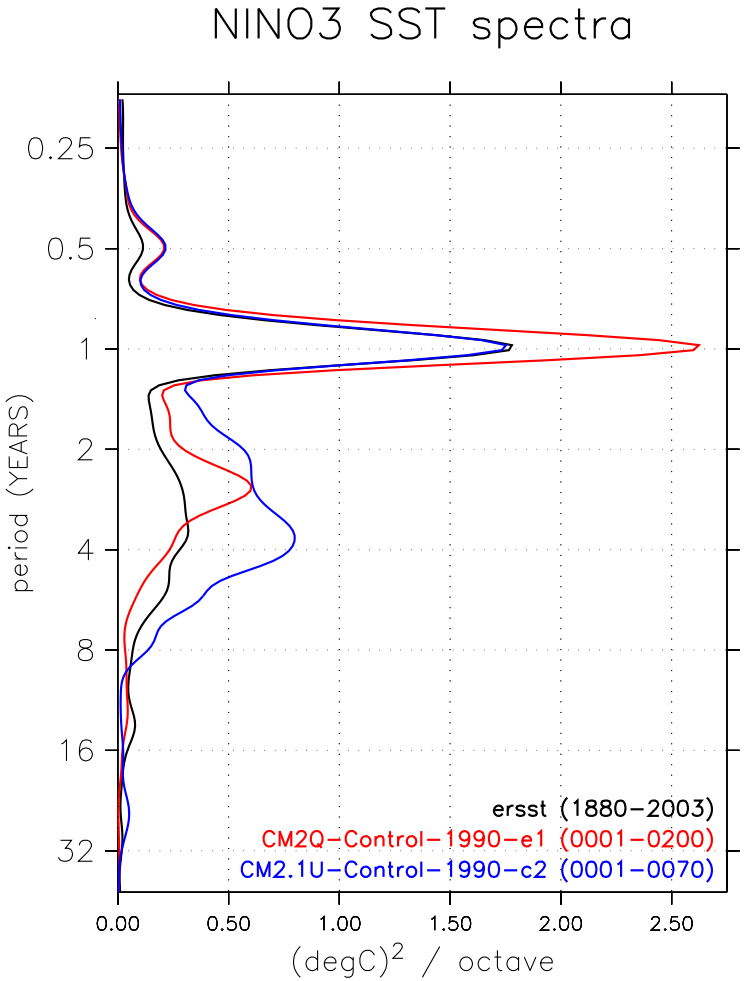


Seasonal Cycle at 110°W

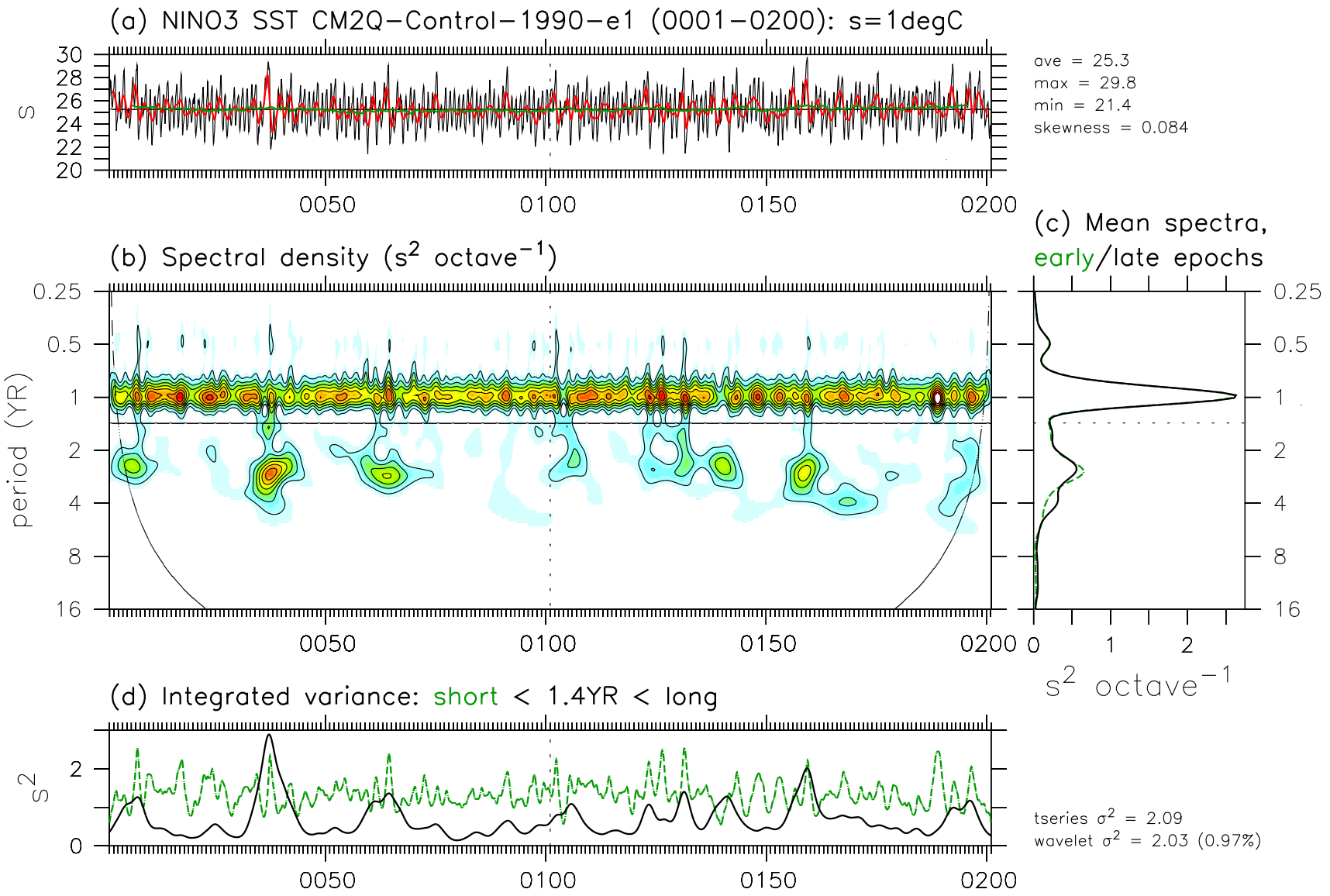


ENSO Variability

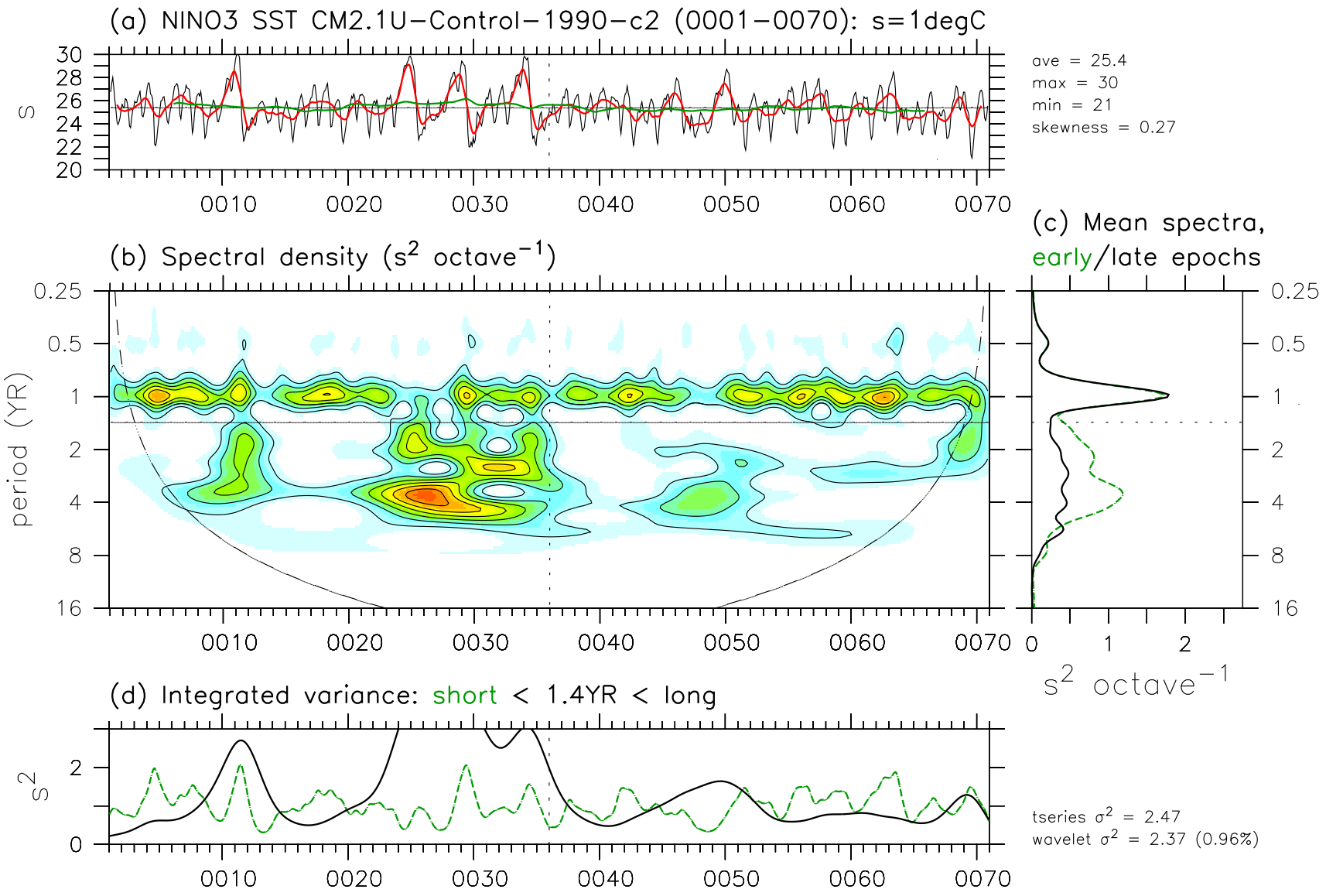




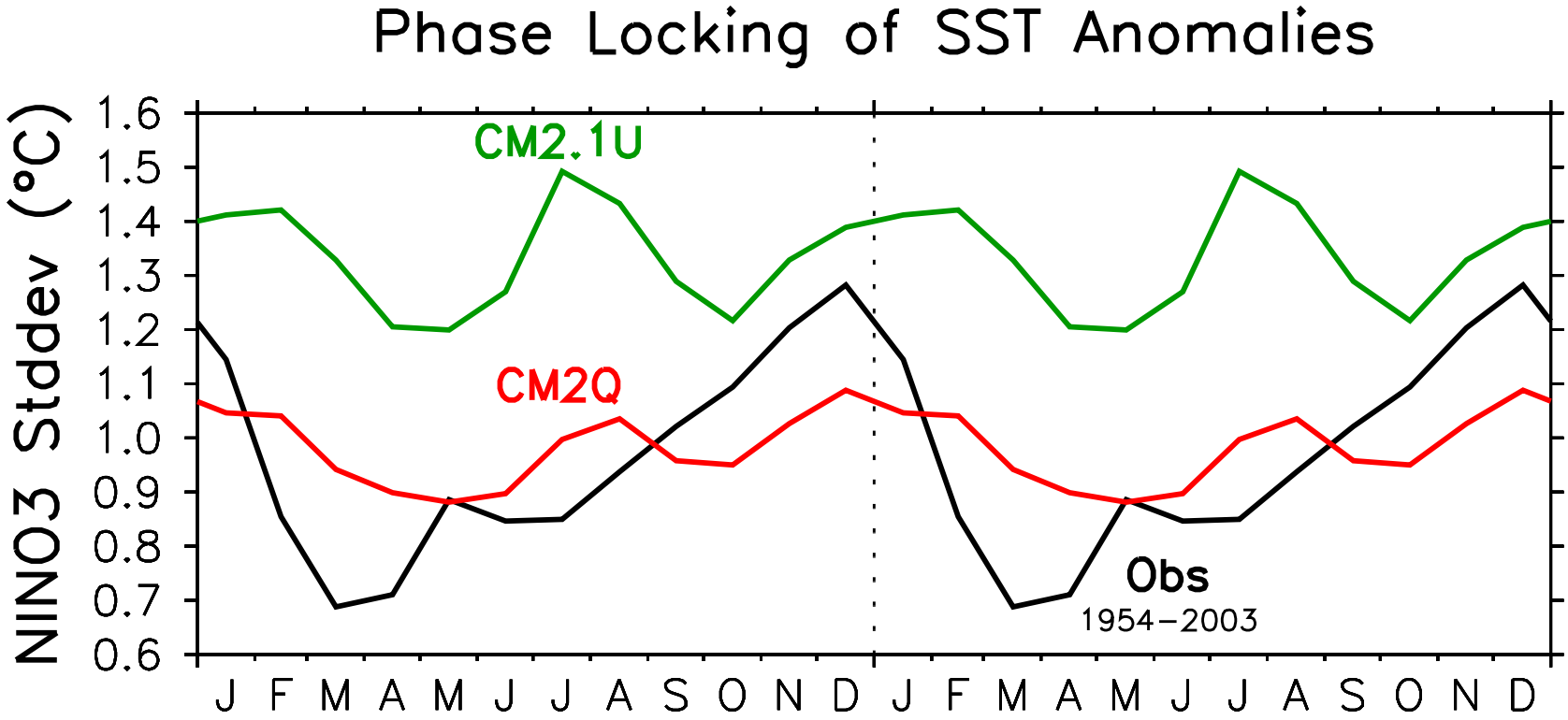
CM2Q: NINO3 SST Timeseries



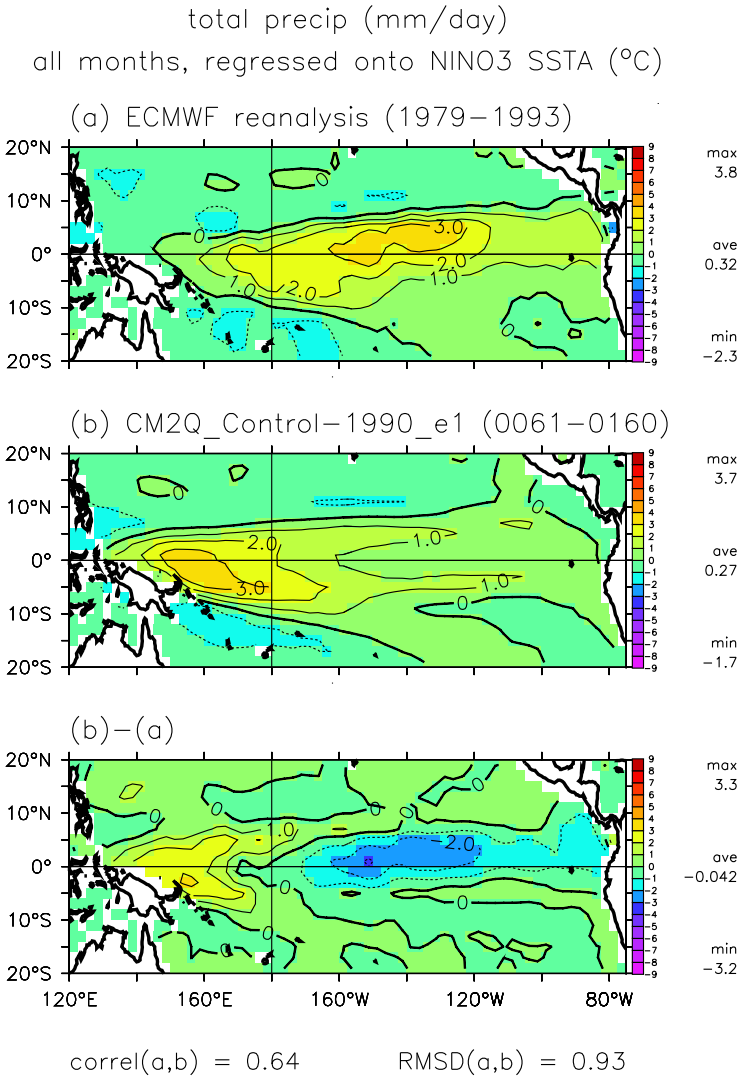
CM2.1U: NINO3 SST Timeseries



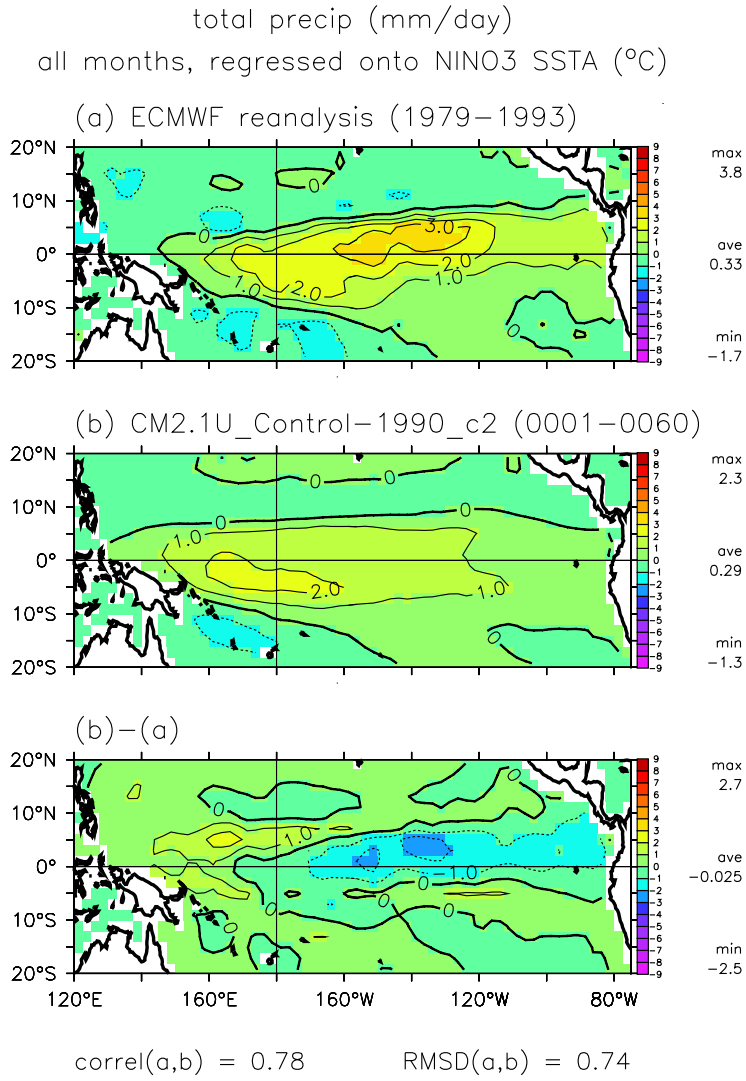
ENSO Phase Locking to Seasons



ENSO Precip Anomalies

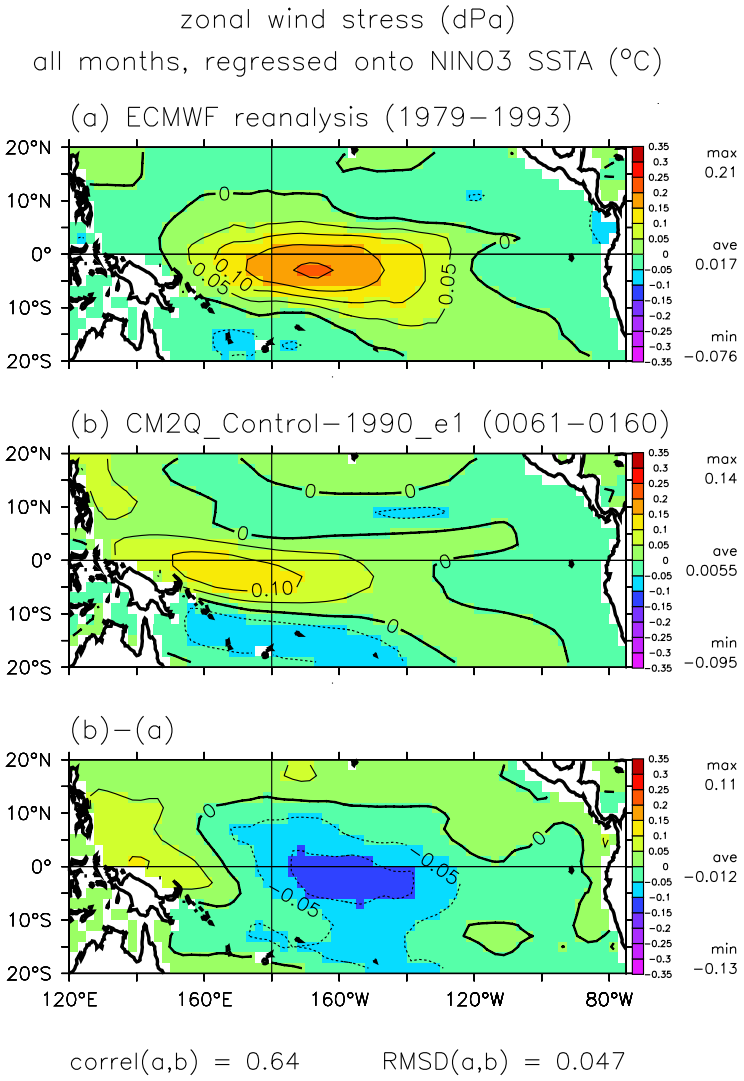


correl(a,b) = 0.64 RMSD(a,b) = 0.93

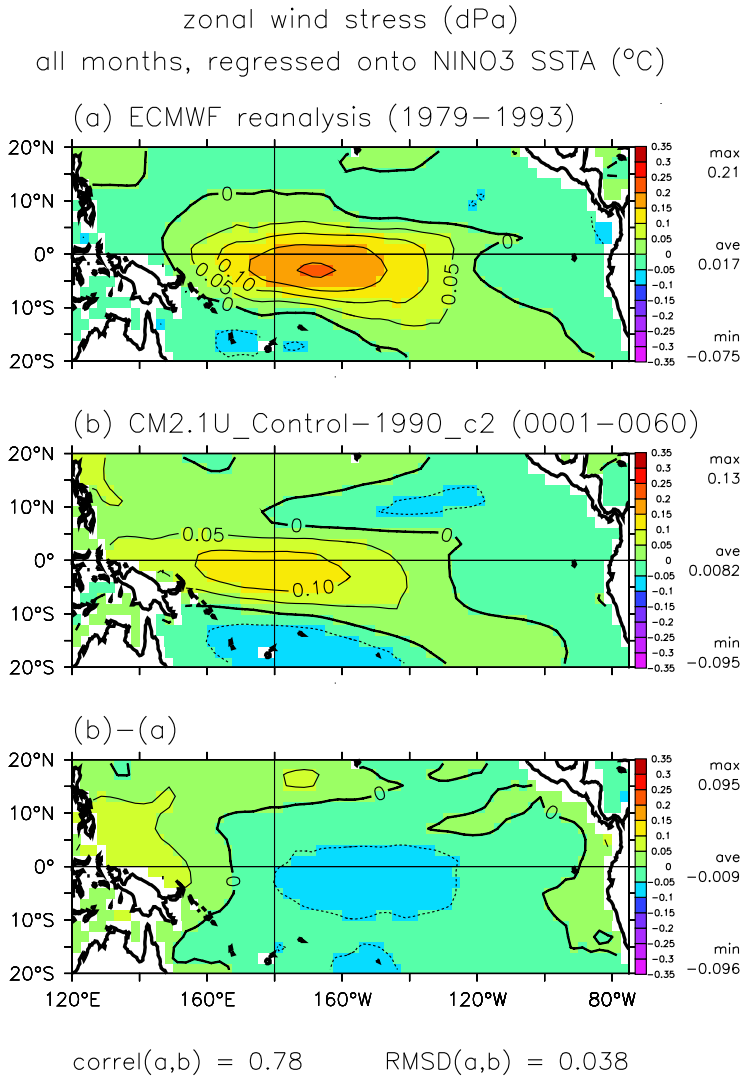


correl(a,b) = 0.78 RMSD(a,b) = 0.74

ENSO Zonal Stress Anomalies

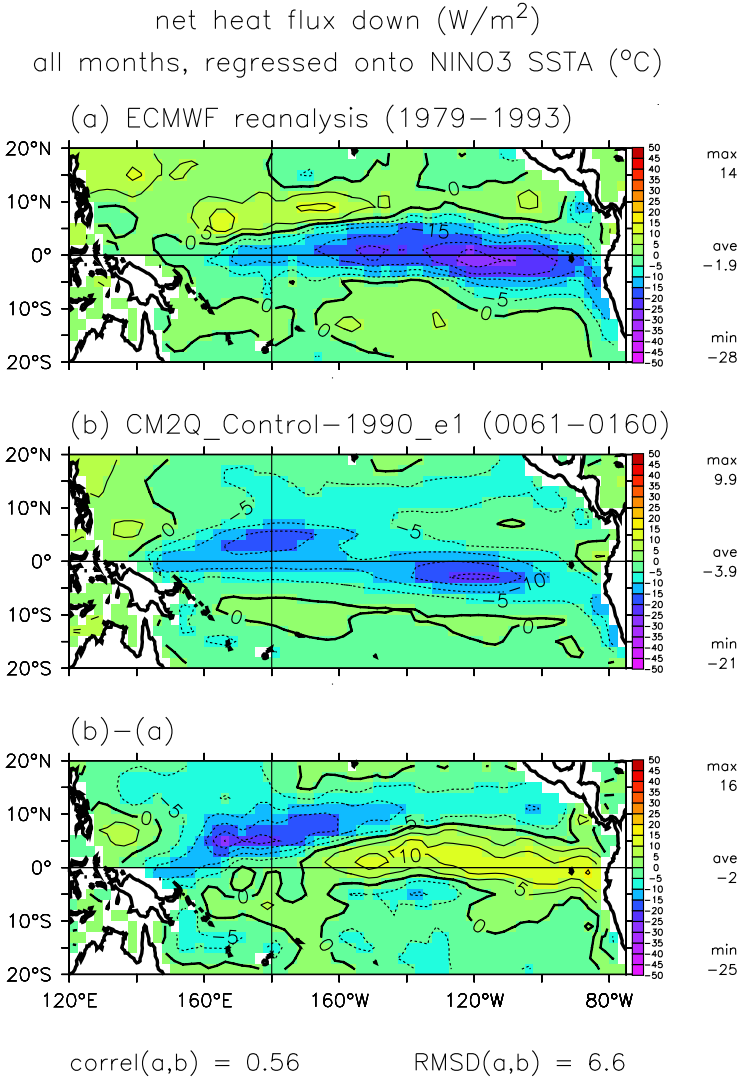


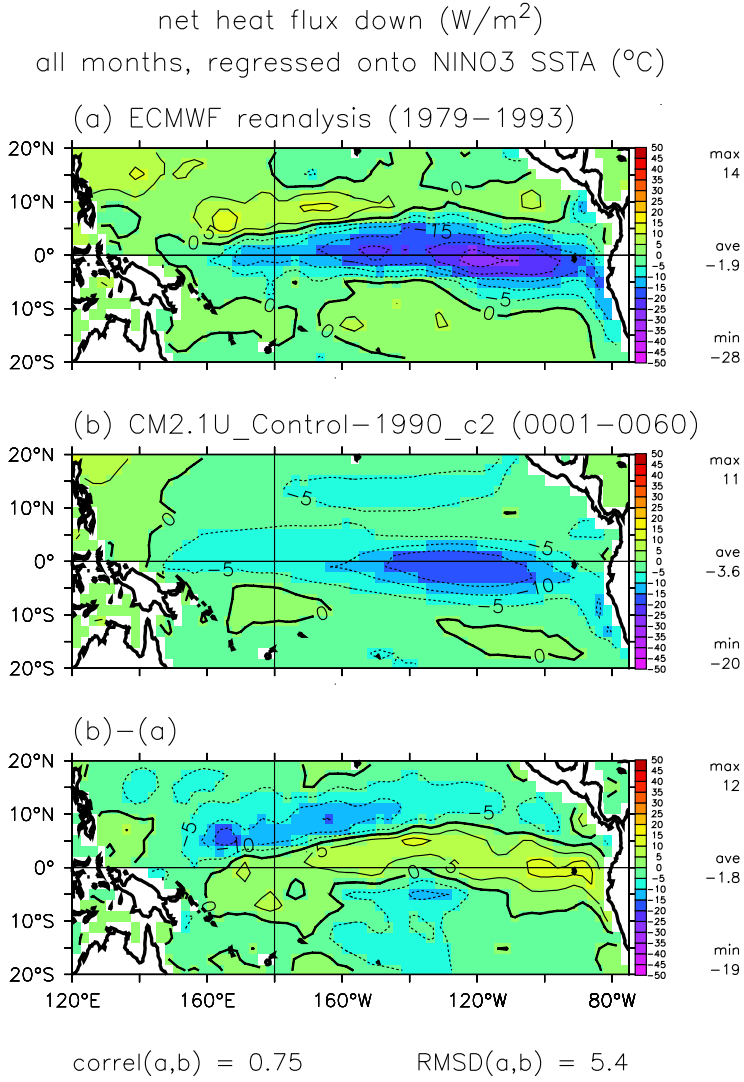
correl(a,b) = 0.64 RMSD(a,b) = 0.047



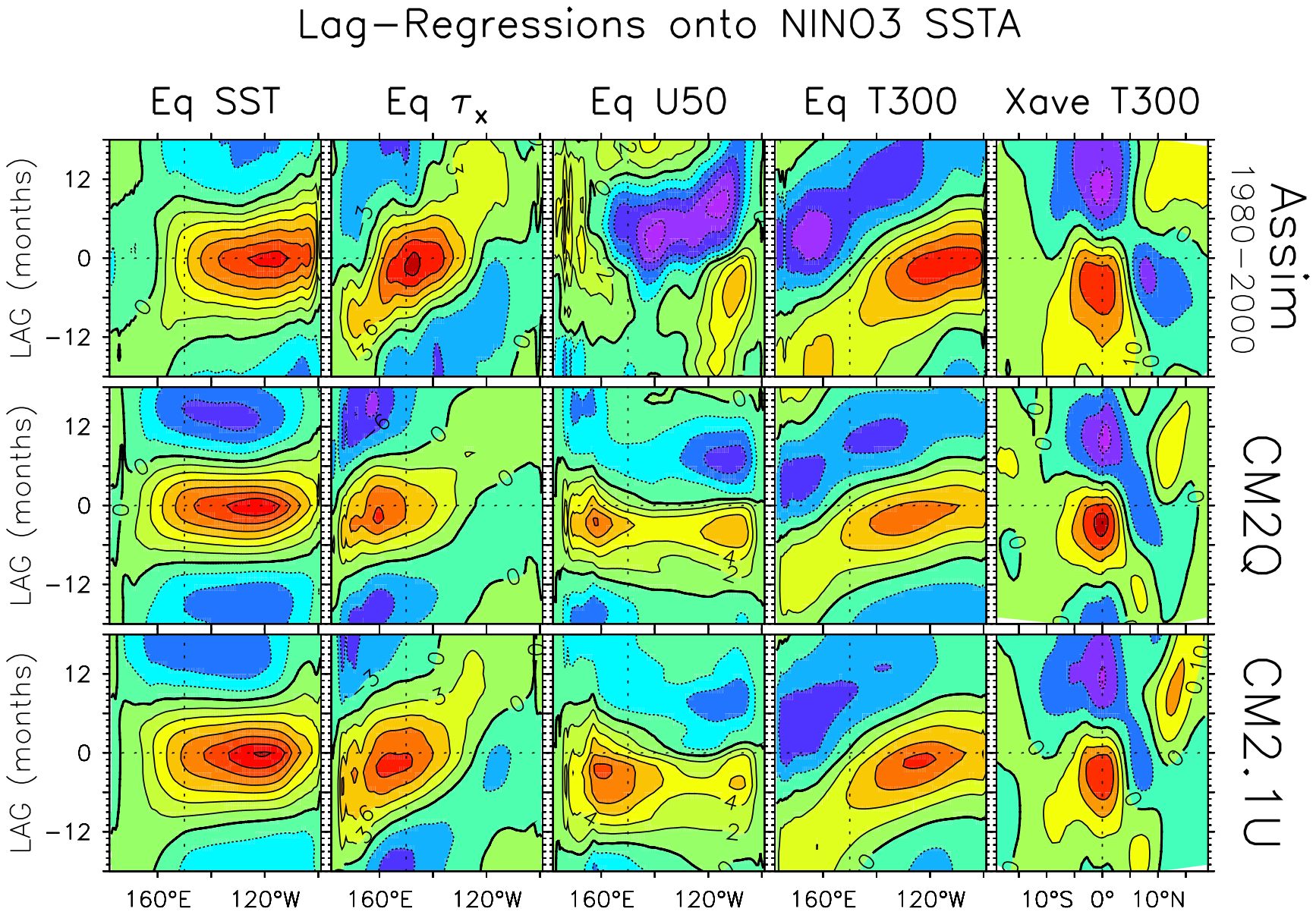
correl(a,b) = 0.78 RMSD(a,b) = 0.038

ENSO Heat Flux Anomalies





ENSO Evolution



Summary

- Successes:
  - reduced biases, reasonable ENSO
  - a top CGCM for the tropical Pacific
- Challenges:
  - cold equator, double ITCZ, weak NECC
  - diffuse thermocline
  - surface waters too stable near Peru
  - ENSO too strong, too far west
  - ENSO not phase locked to seasons

Toward a Better Coupled Model

- Analyses!
  - Heat/momentum budgets
  - Uncoupled & flux-adjusted runs
  - Data override, sponged & restored runs
  - Additional tests: ENSO hindcasts, paleo
- Development
  - Atmosphere: convection, PBL, clouds, resolution
  - Ocean: vertical mixing, TIWs, color, resolution

Further Information

http://www.gfdl.noaa.gov/~atw/research/cm2/

CM2Q/poster.pdf

CM2.1U/poster.pdf

CM2Q_vs_CM2.1U/talk_30min.pdf