A Spring View of ENSO Diversity

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Bjerknes feedback
- Westerly wind anomalies in the western basin
- Maximum warming in the eastern basin ← Eq. wave adjustment.
- Weak precip response over the cold tongue ← cool mean SST
Obs. Precip., SST & wind
120-115°W

FMA: Double ITCZ & weak southerlies
**EOF of FMA rainfall**

**a** Precip, SST and Wind

- Latitude (°)
  - 15N
  - 10N
  - 5N
  - Eq
  - 5S
  - 10S
  - 15S

- Longitude (°)
  - 140W
  - 120W
  - 100W
  - 80W

**b**

- Nino3
- PC1
- r=0.77

**EOF1**
- Extreme El Nino
- No La Nina
ENSO evolution: NDJ

Humidity & circulation

Precip (shaded) & mean SST (contours)

SST (shaded), latent heat flux (contours) & sfc wind vectors
ENSO evolution: FMA

Humidity & circulation

Precip (shaded) & mean SST (contours)

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Deep circulation
In the far eastern Pacific, the zonal wind vanishes and it is the southerlies that maintain the upwelling cooling, slightly south of the equator (centered at 1-2S) in the open ocean, and along the coast.
Extreme El Niño

Anomalies of: precipitation (color shading), SST (contours) and wind (vectors)

Slow decay

Westerly wind intrusion into EP

Convective heating in EP

Reduced upwelling

EPID

Rapid decay

Upwelling south of equator

Anomalies of: precipitation (color shading), SST (contours) and wind (vectors)
Extreme El Niño of 1997-98 as observed by 125⁰W, Eq. buoy

- Diminishing easterlies in early ’98 → intrusion of wind anomalies.
- By April ’98, thermocline depth has returned to normal.
- SST did not decrease until the easterly trades returned → importance of local wind anomalies

Summary

FMA mean state:
Double ITCZ & seasonal eq. warming

Extreme El Nino

Enhanced eq. convect.
EP Bjerknes

Suppressed eq. upwelling
Slow decay
Eastern Pacific ITCZ dipole (EPID): a WES mode in FMA when the mean state is symmetric (and atmospheric feedback is strongest).

- Represents interannual variability in relative intensity of the double ITCZ.
- EPIC is preceded by moderate ENSO and causes the rapid termination of moderate ENSO.
- Extreme El Nino decays slowly because of local Bjerkness feedback in the eastern Pacific, by causing deep convection there.
EOF modes of FMA rainfall variability in CESM (dx=1 deg)