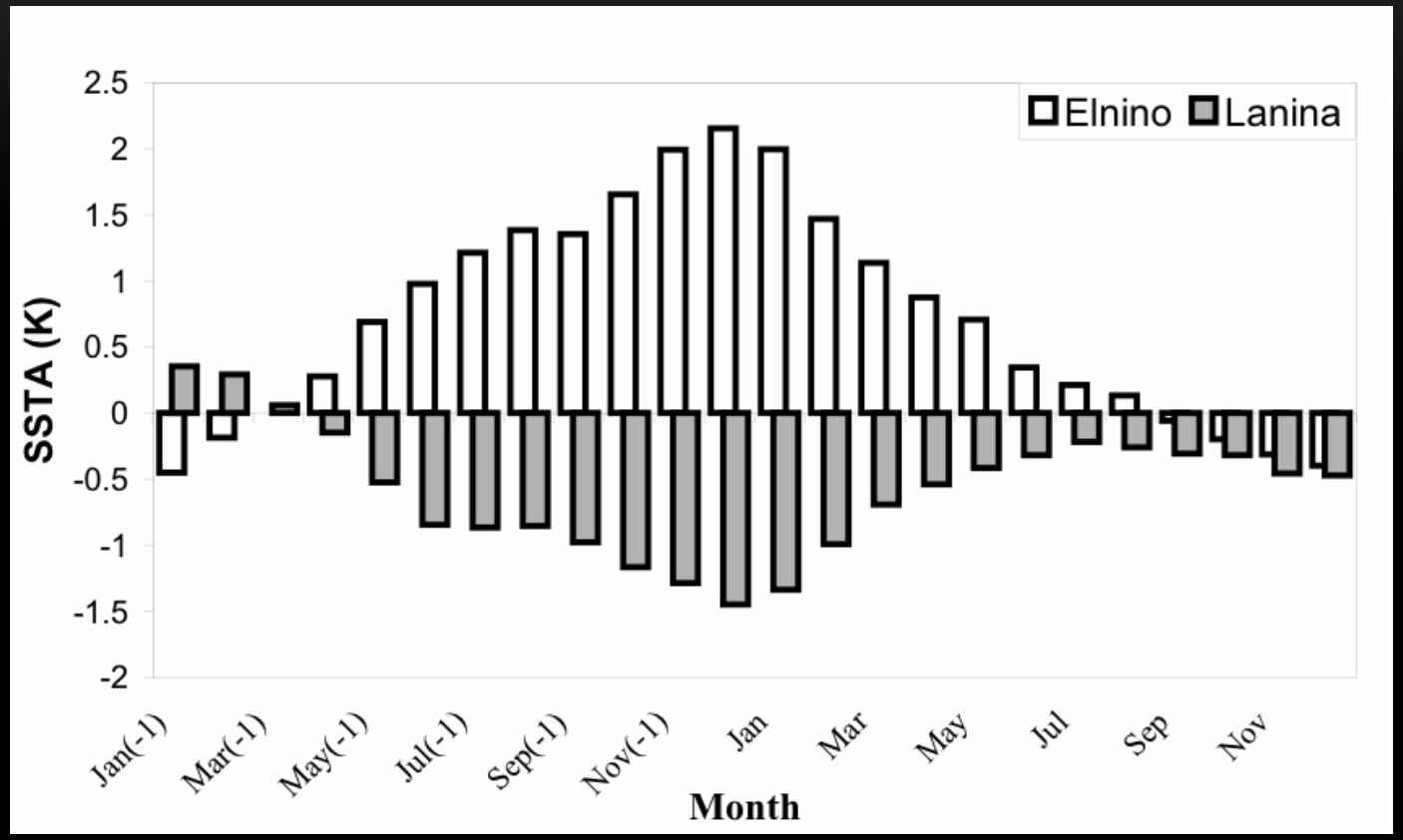
ENSO Characteristics

Life Cycle of El Nino and La Nina: Nino3.4

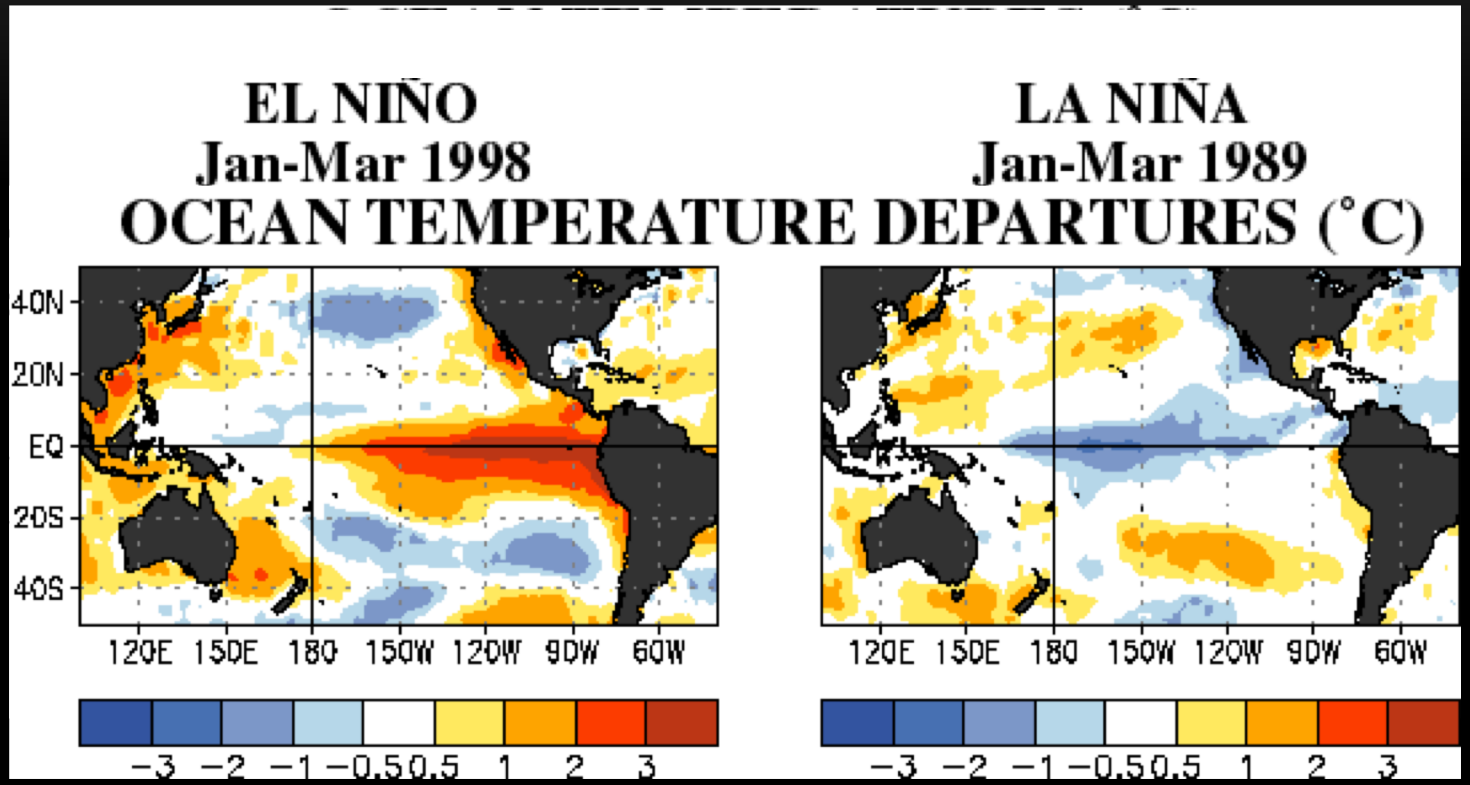


What do you learn about ENSO from this plot?

- El Nino and La Niña episodes typically last approximately 9-12 months.
- ENSO is phase-locked to the annual cycle (related to the seasonal variations of the coupled instability)
- El Nino tends to be stronger than La Nina.

From Wang 2004

An Example: SST Anomalies El Nino vs. La Nina

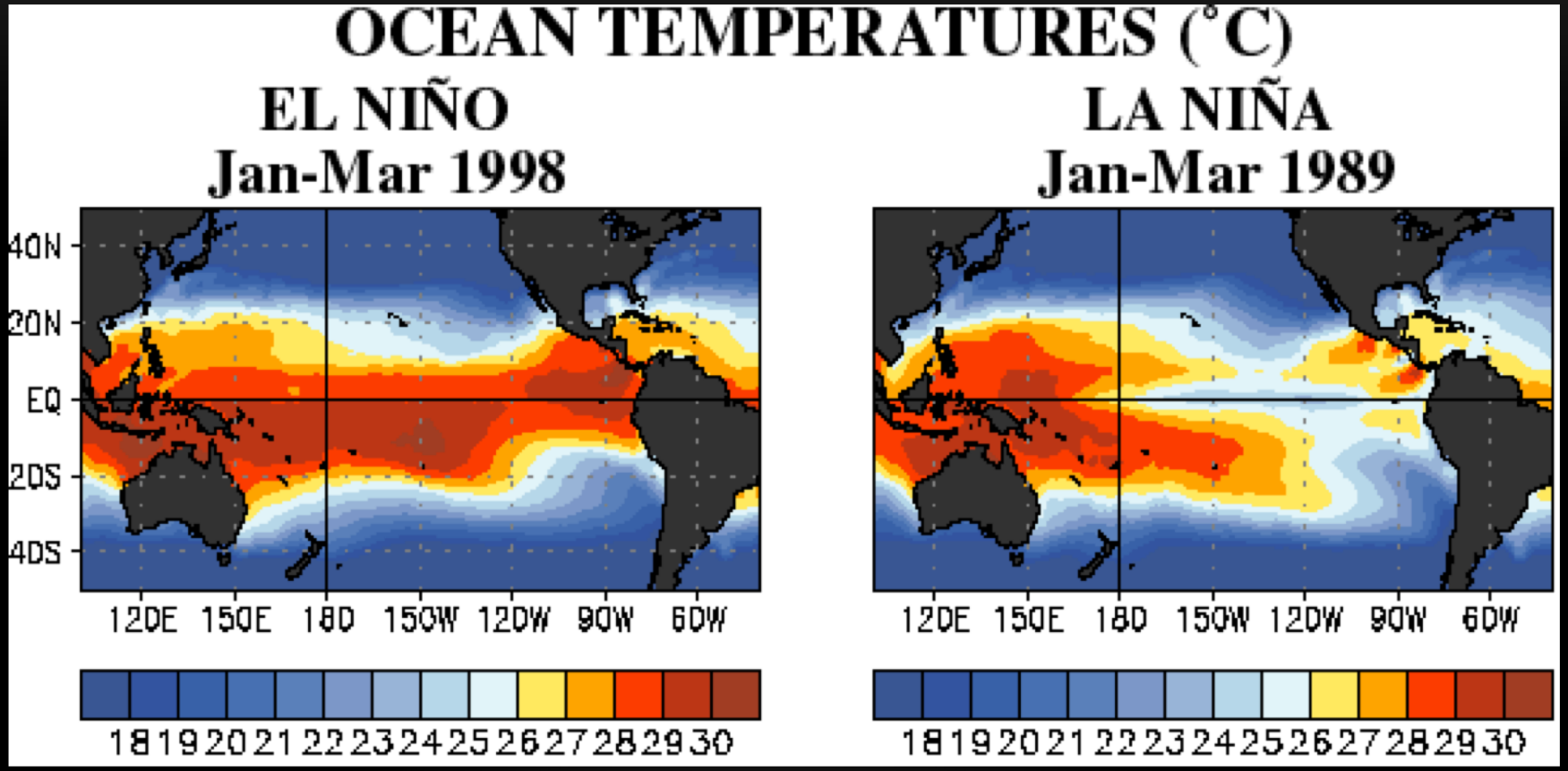


- 1998 and 1989 are the strong Elnino and Lanina years, respectively.
- During a strong El Niño event, SST is about 2°C – 3.5°C above normal between the date line and the west coast of South America. During La Niña SST is about 1°C - 3°C below normal between the date line and the west coast of South America.

https://www.cpc.ncep.noaa.gov/products/

Figures from NOAA, CPC

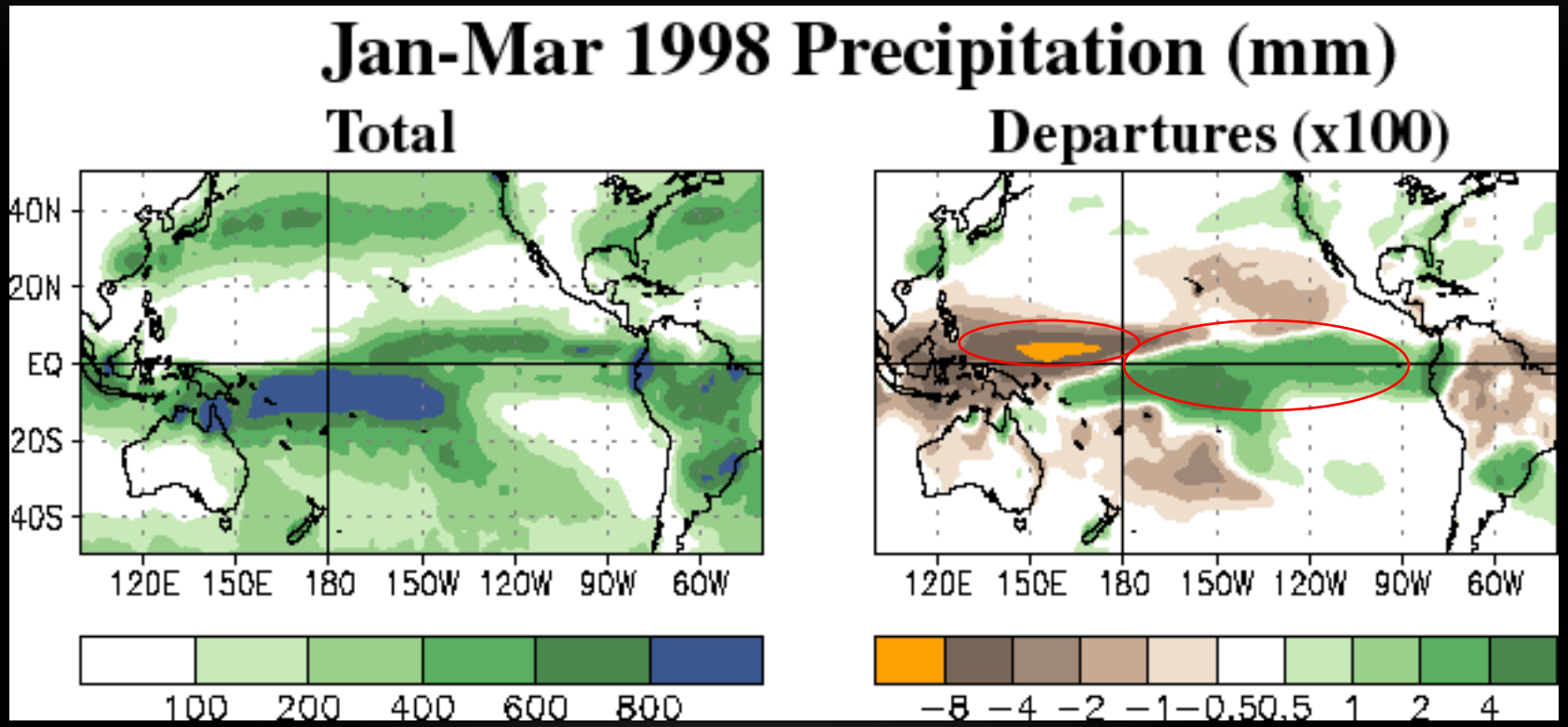
Total SST: El Nino vs. La Nina



- The east-west SST gradient across the equatorial Pacific is reduced (enhanced) in El Nino (La Nina) years
- The mean and total SST distribution is also important!

https://www.cpc.ncep.noaa.gov/products/

Impacts on Rainfall over the Tropical Pacific: El Nino

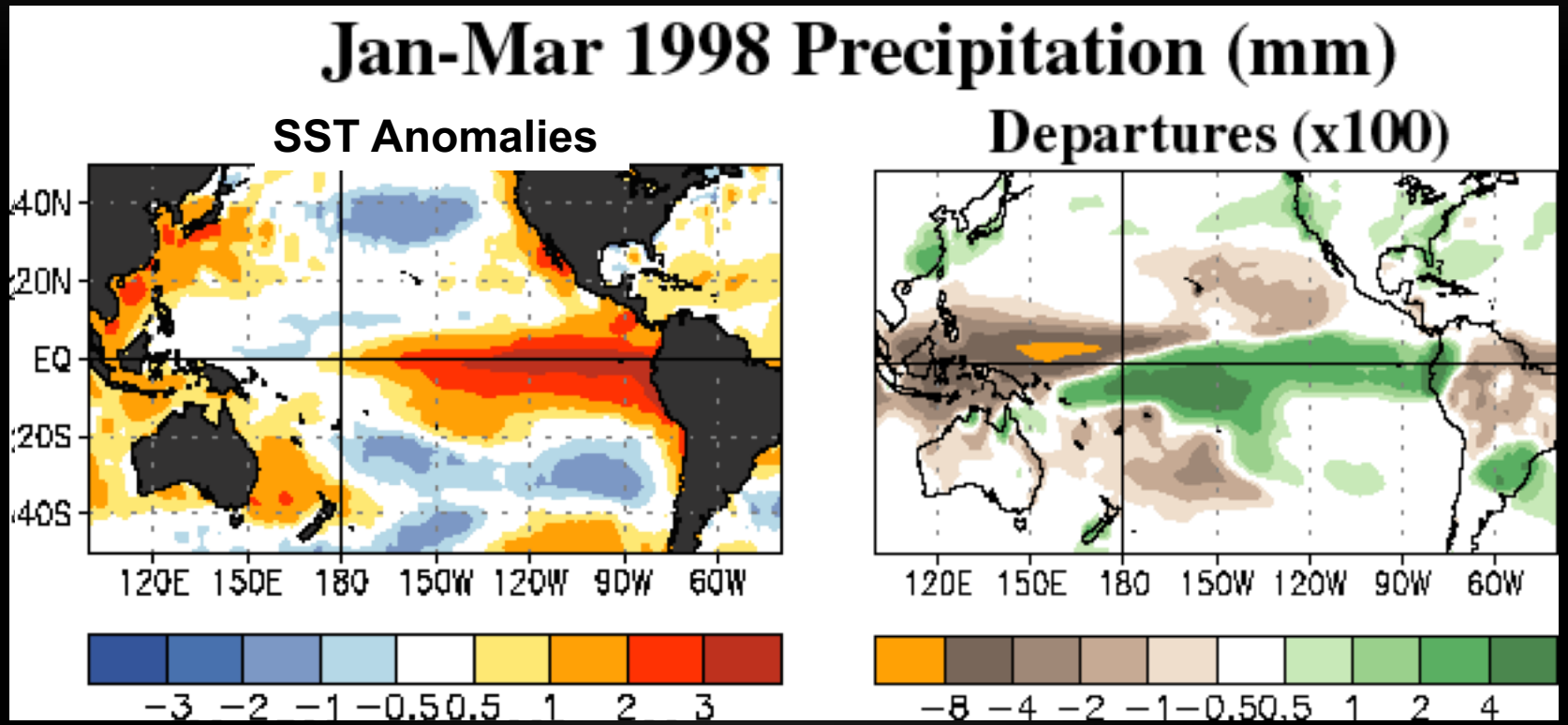


- Heavy Rainfall center shifts to the dateline, with negative anomalies over the West Pac
- Rainfall anomalies span nearly one-half the distance around the globe, and are responsible for many of the global weather impacts caused by El Niño

https://www.cpc.ncep.noaa.gov/products/

Figures from NOAA, CPC

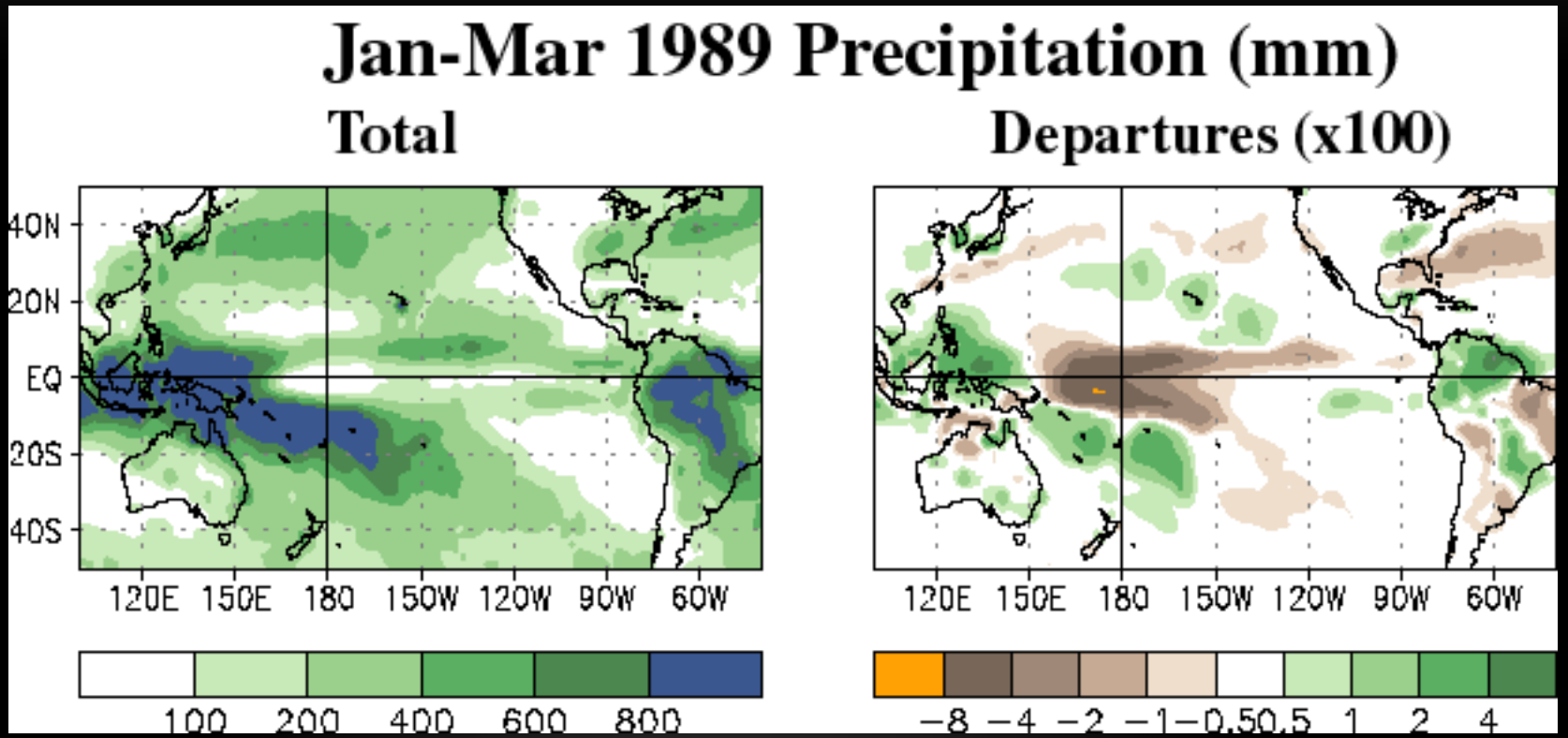
El Nino: SSTA vs. Precip Anomalies



- *Is the maximum precipitation anomaly collocated with the maximum SSTA?*
  No!

https://www.cpc.ncep.noaa.gov/products/

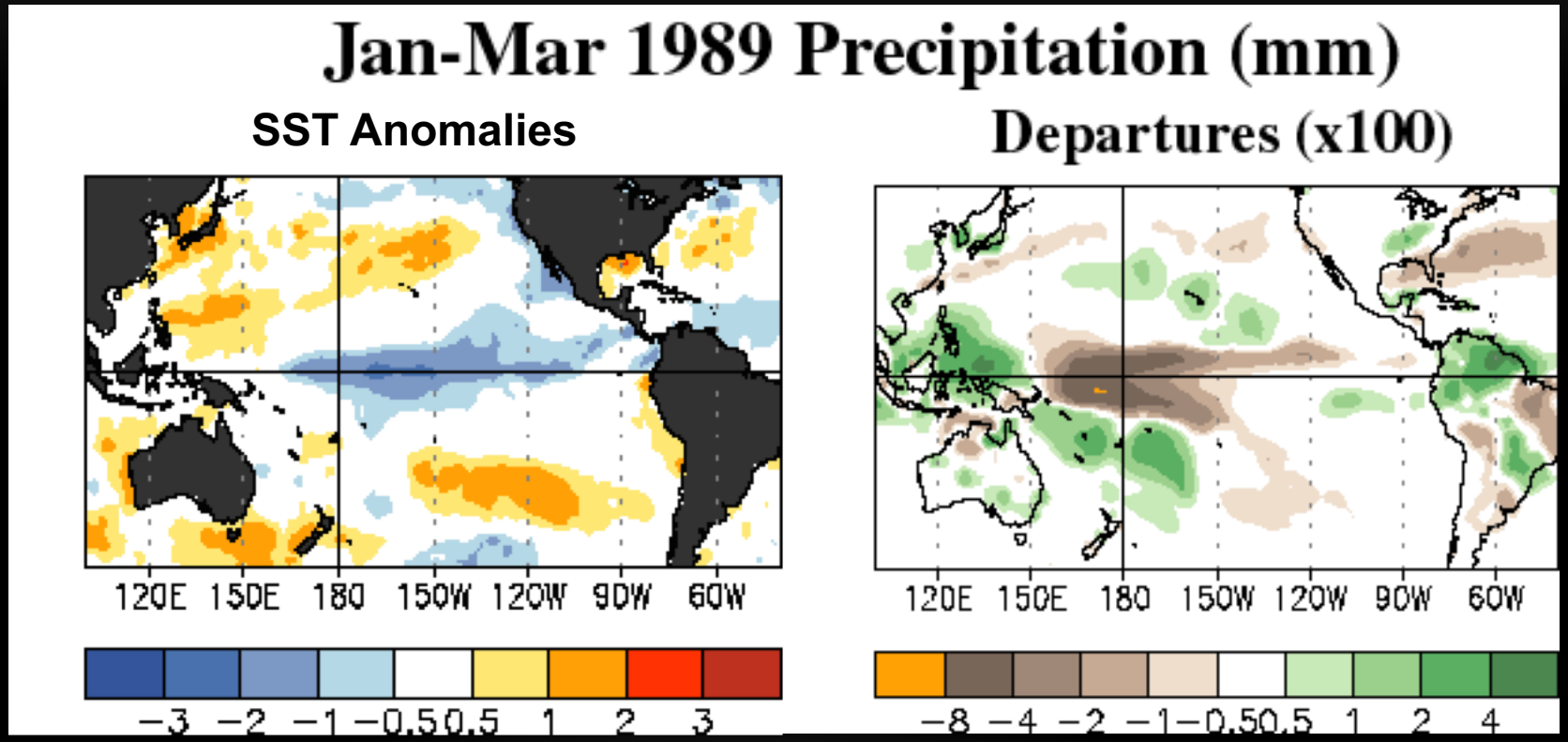
Impacts on Rainfall over the Tropical Pacific: La Nina



- Rainfall diminishes over the central equatorial Pacific, and becomes confined to Indonesia and the western Pacific
- Cold SST extends further eastward compared to the reduced rainfall

https://www.cpc.ncep.noaa.gov/products/

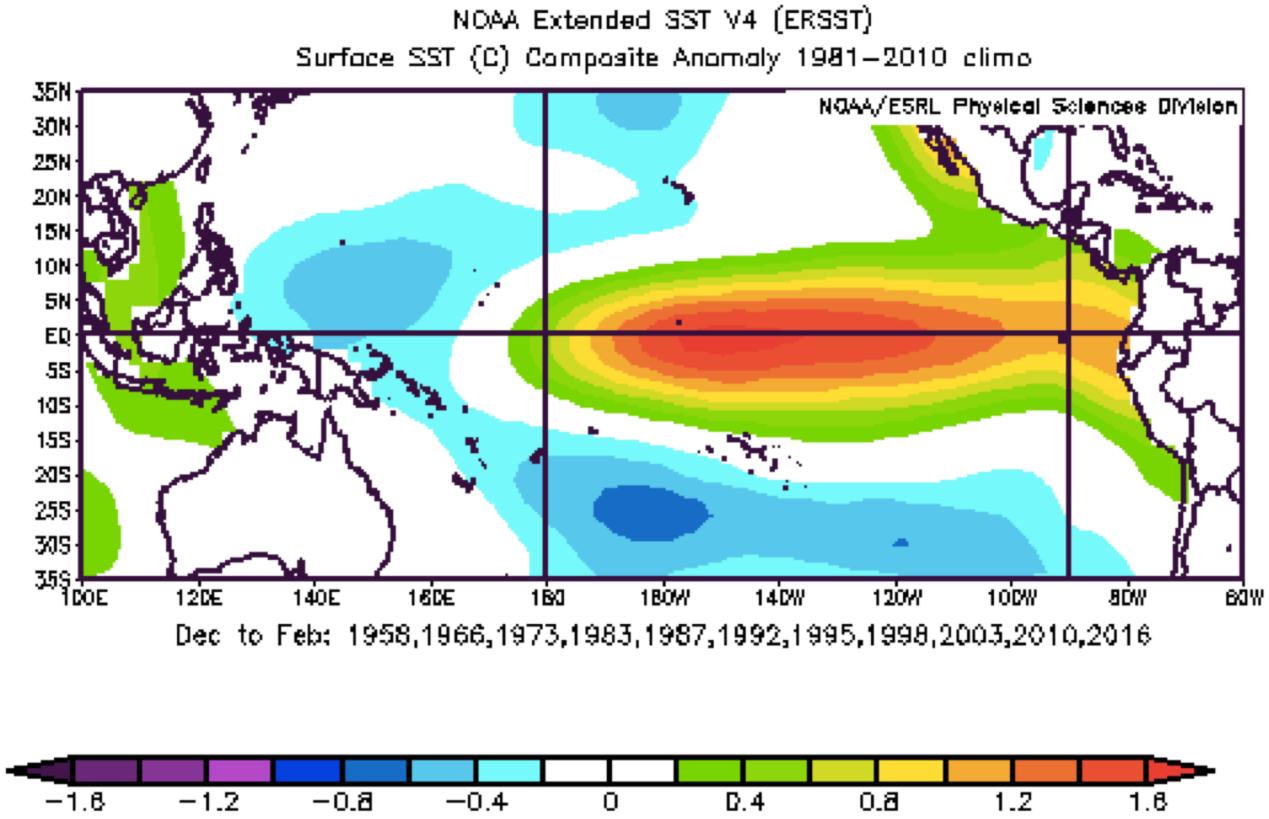
La Nina: SSTA vs. Precip Anomalies



- Tropical convection is more sensitive to the SST variability in the Central Pacific than in the East Pacific due to the higher mean SST

https://www.cpc.ncep.noaa.gov/products/

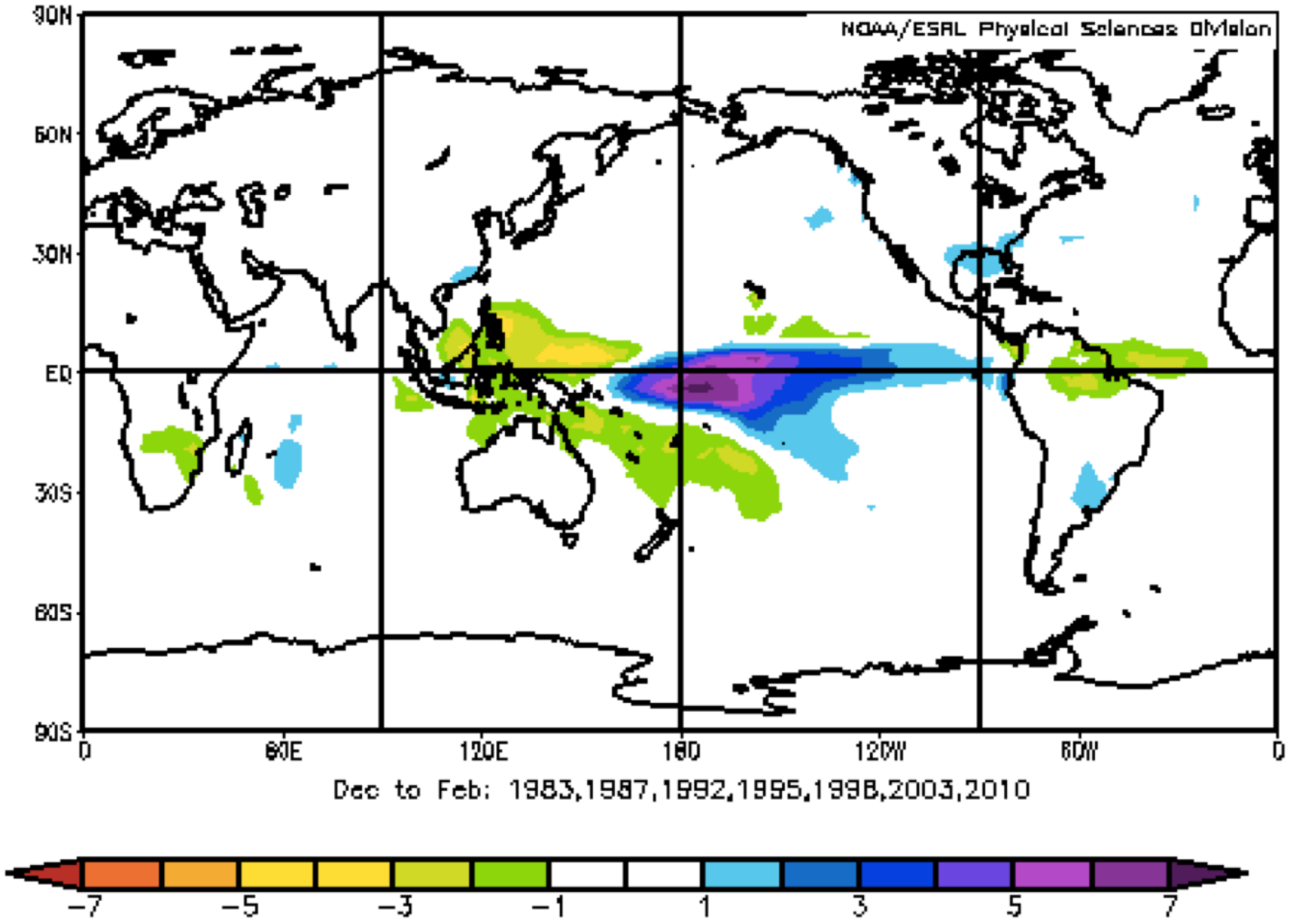
El Nino Composite: SST Anomalies



SSTA warming over the East and Central Pacific + a horse-shoe pattern of cold SST anomalies

Figure produced at https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl

Composite Mean of Precipitation Anomalies in El Nino Years



Strong precipitation anomalies are largely confined to the tropical Pacific.

Figure produced at https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl

Composite Mean of 250-hPa Geopotential Height Anomalies in El Nino Years

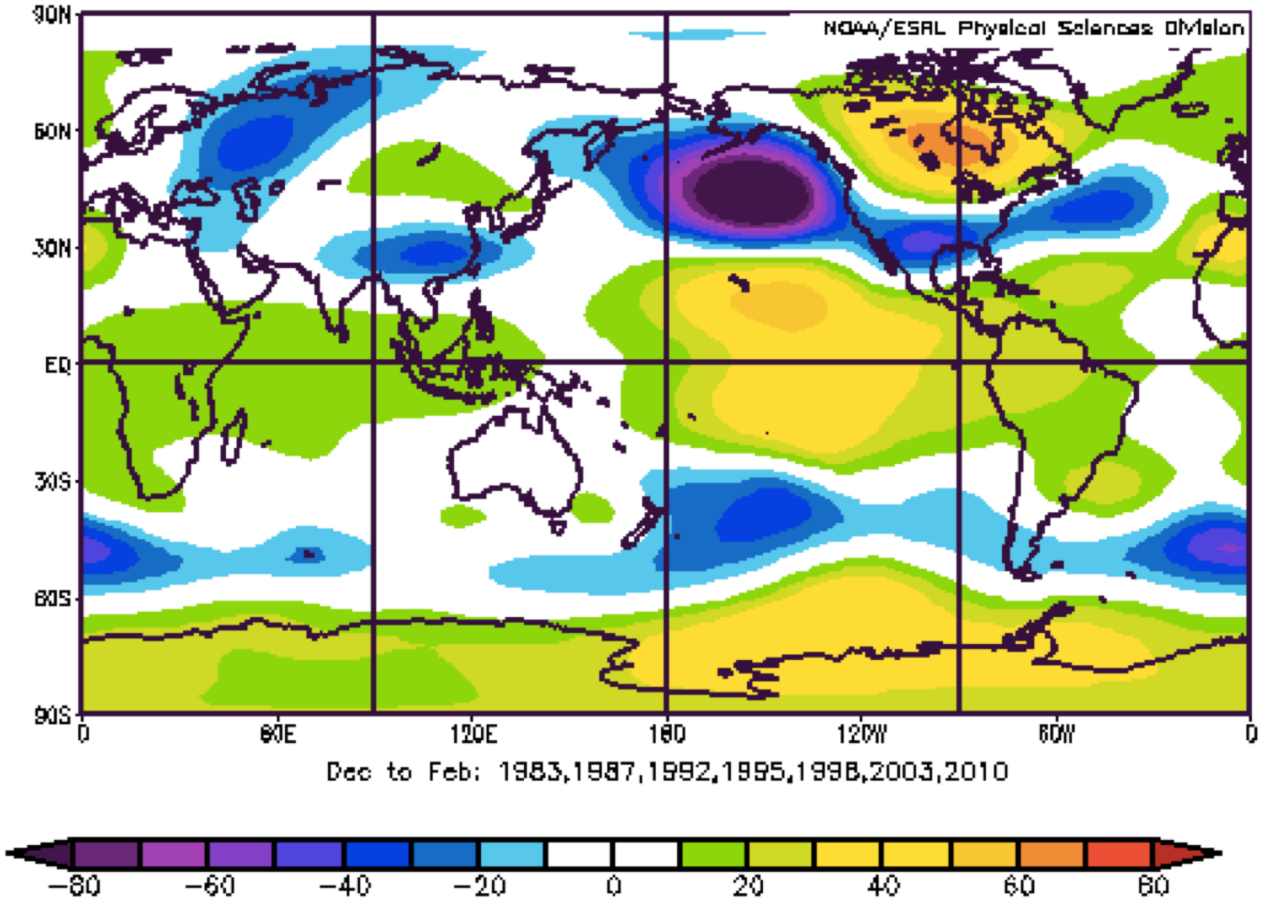


Figure produced at https://psl.noaa.gov/cgi-bin/data/composites/printpage.pl

- *How do SST anomalies in the tropical Pacific affect the global atmosphere?*
- *Or why are the impacts of ENSO not confined to the tropics? – a topic for the next module*

References

- NOAA CPC ENSO Cycle: https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensocycle/enso_cycle.shtml
- Comparison of 2 BIG La Nina events: 88-89 and 98-99

  http://www.esrl.noaa.gov/psd/map/clim/sst_olr/old_sst/sst_anim_2panel_lanina.shtml

- Comparison of 2 BIG El Nino events: 82-83 and 97-98

  http://www.esrl.noaa.gov/psd/map/clim/sst_olr/old_sst/sst_anim_2panel.shtml