ENSO and India Precipitation using SODA and 20CRv2

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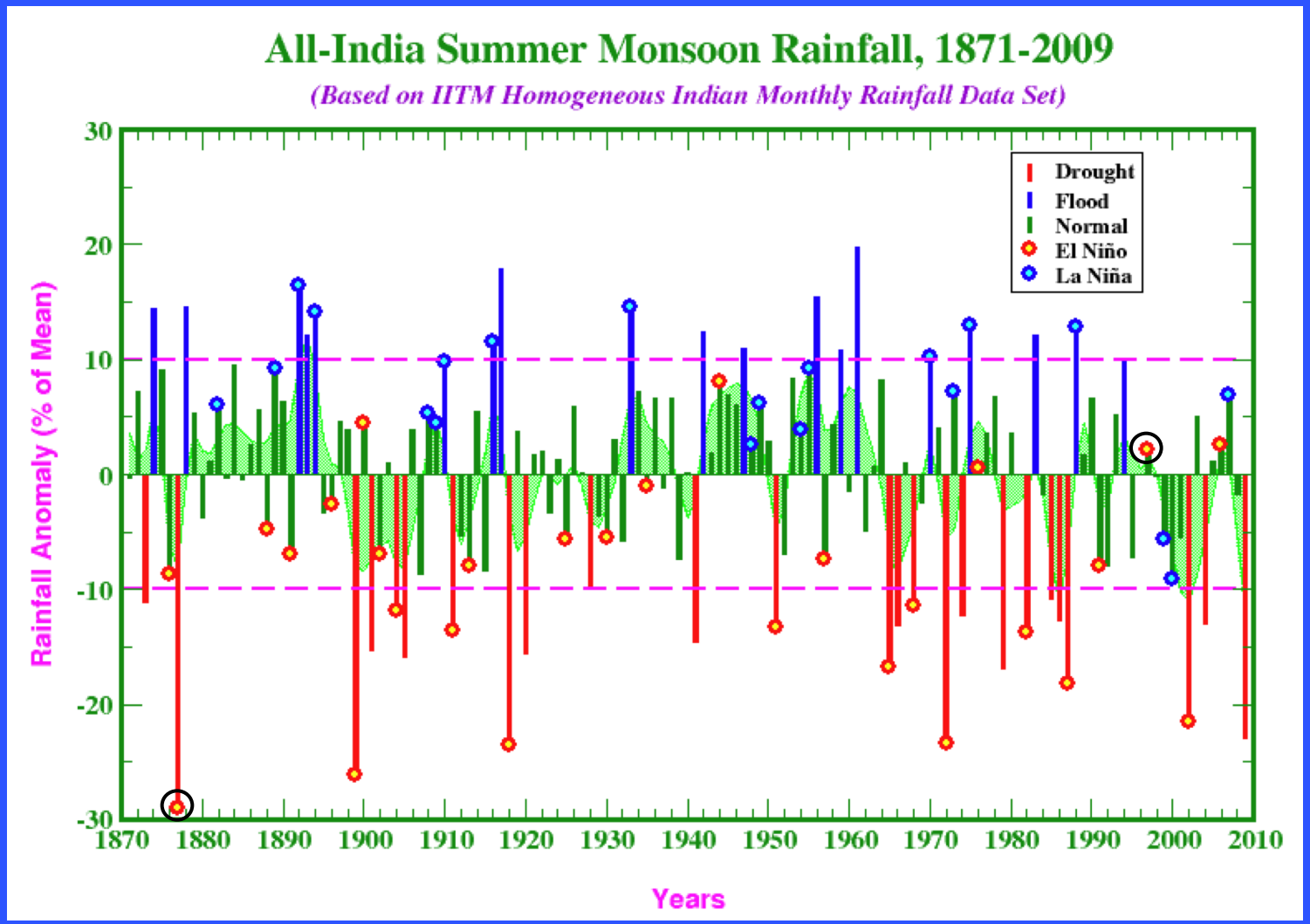
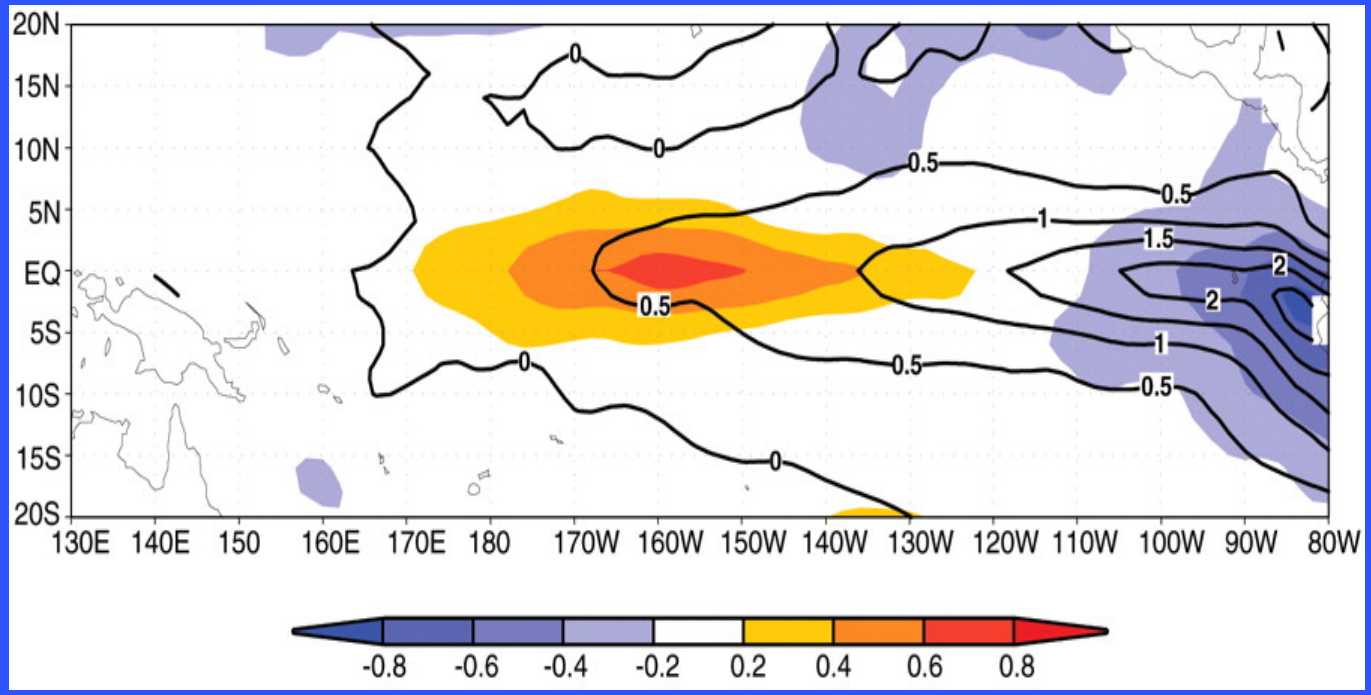
El Niño – Indian Summer Monsoon



Literature:

Difference in Composite SST anomaly during JJAS of Drought and Non Drought El Niño years

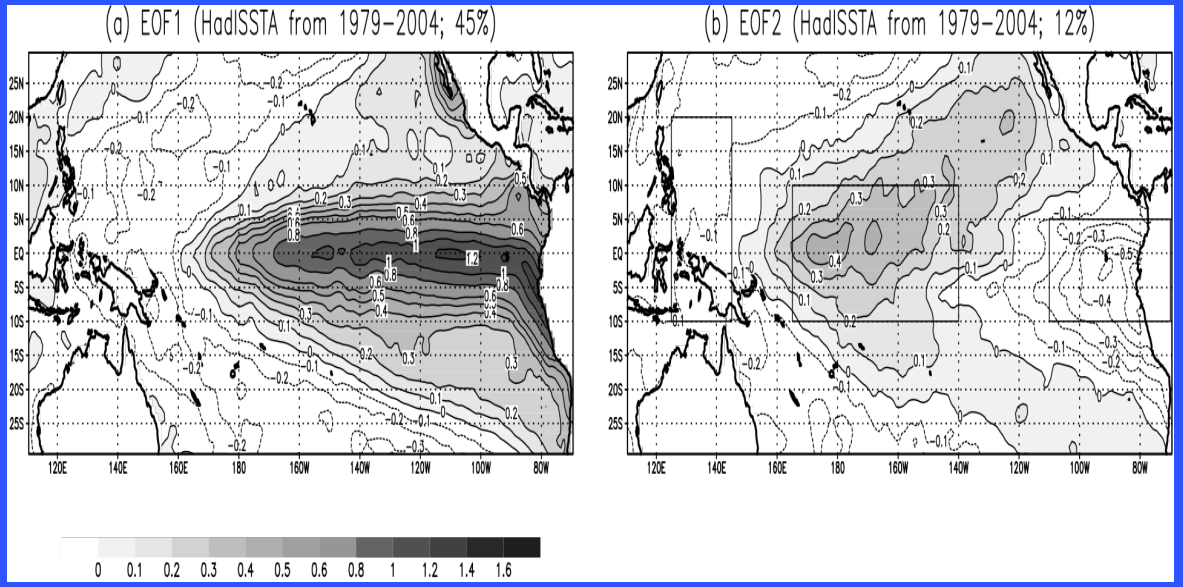


Kumar et al. 2006

Literature:

Different flavors of El Niño

- El Niño Modoki vs. El Niño - Ashok et al. (2007)



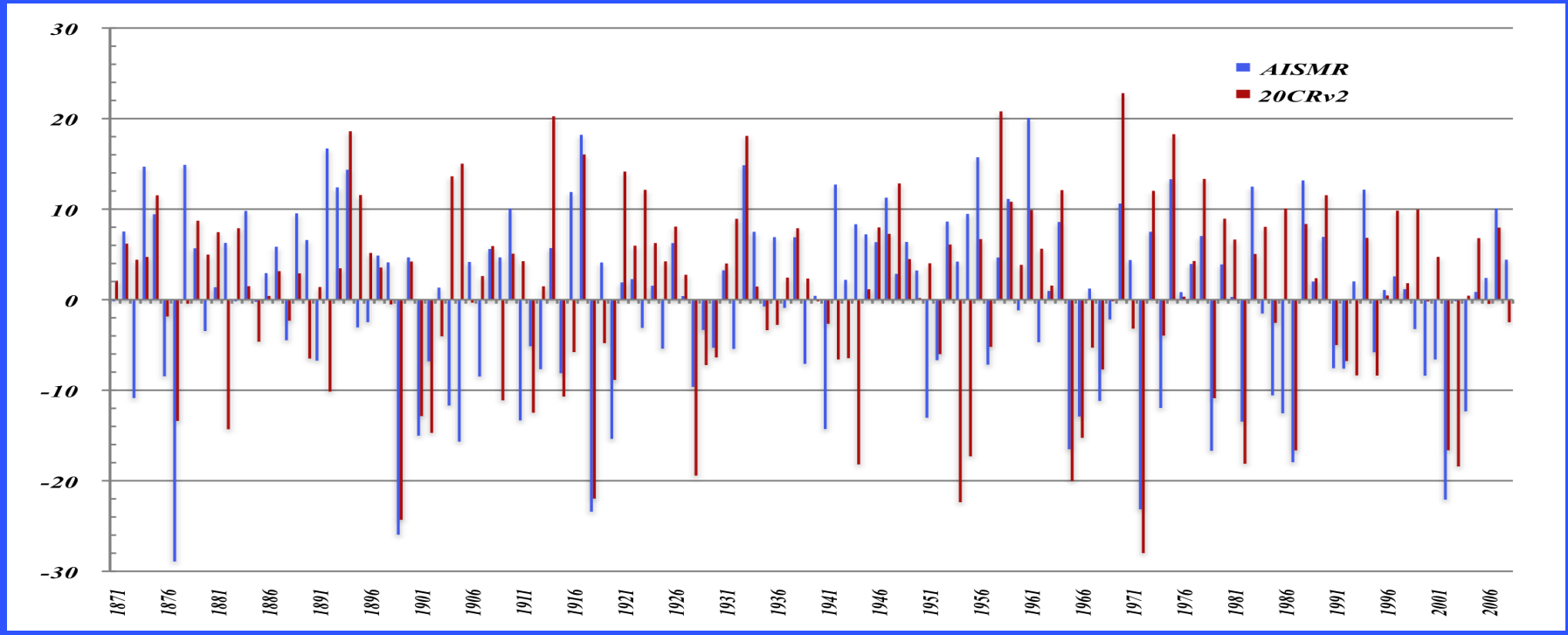
- Central Pacific El Niño – Kao and Yu (2009)

- Warm Pool El Niño – Kug et al. (2009)

Data used in the analysis:

- Precipitation from 20CRv2
- SST from SODA 2.2.4
    - 20CRv2 in surface boundary condition
        - HADISST in surface boundary condition
- Anomalies are calculated

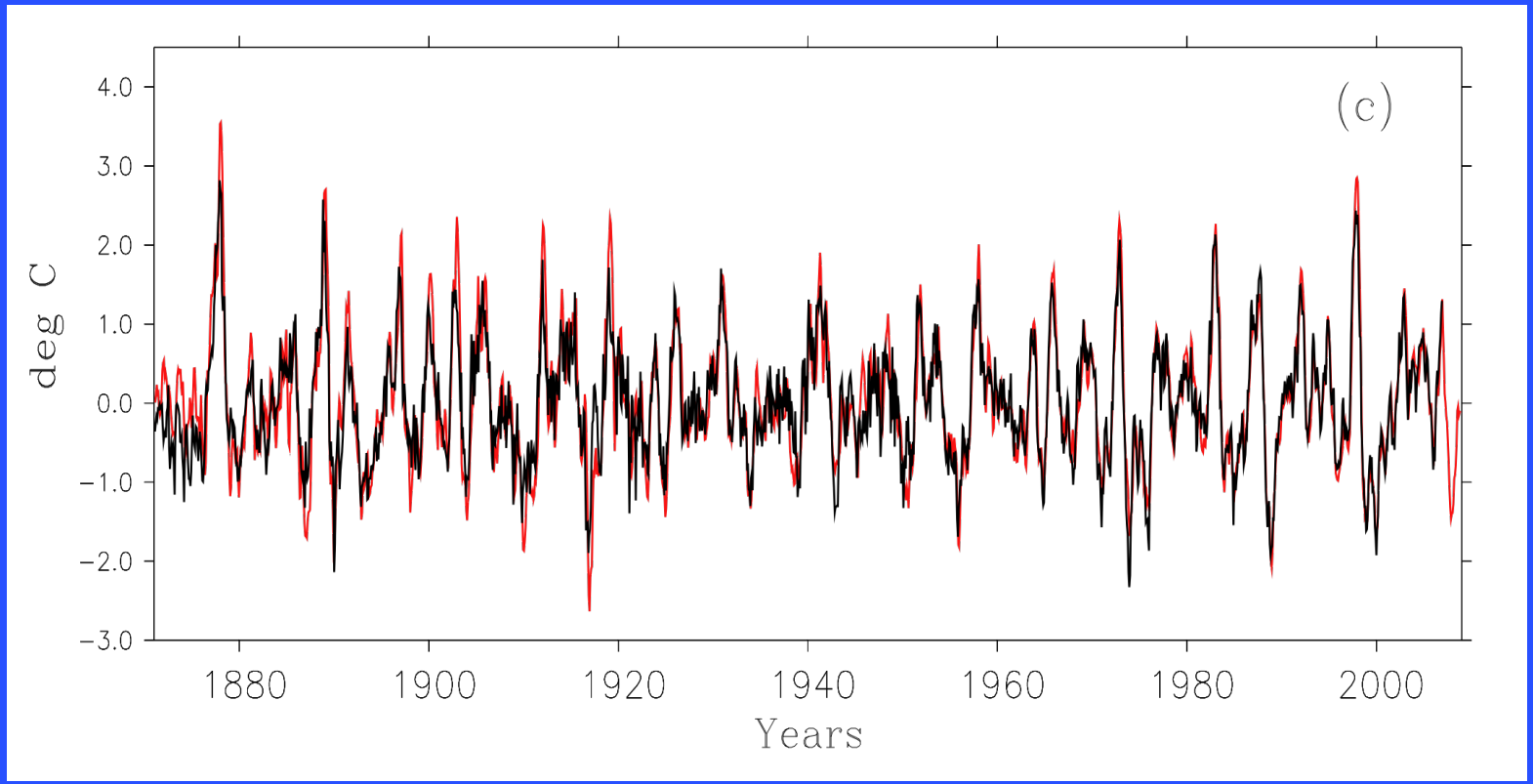
A Comparison of AISMR and 20CRv2



Percentage departure of mean JJAS Precipitation over Indian subcontinent

Most of the droughts are well captured in 20CRv2

Standard Measure of El Niño : NINO-3.4 SST anomaly

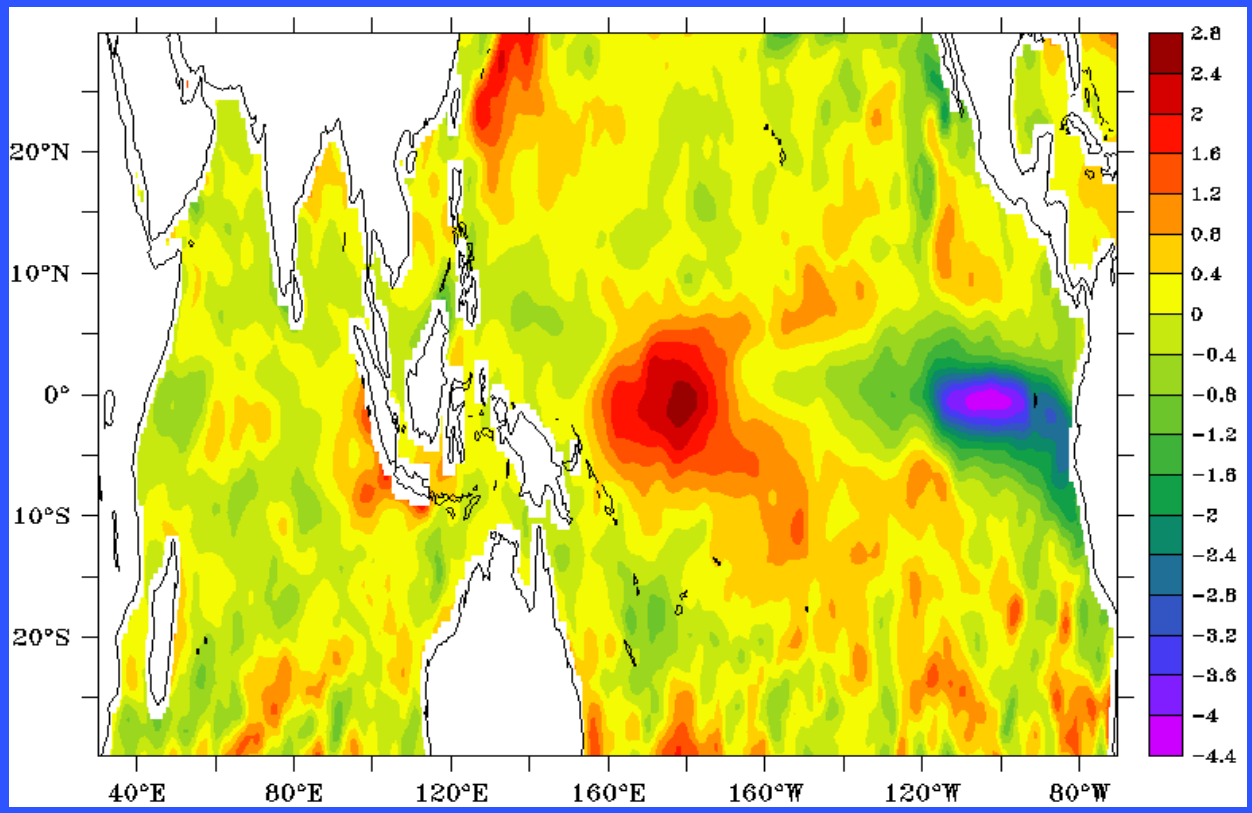


NINO-3.4 SST anomaly from SODA 2.2.4 (Red) and HADISST (Black)

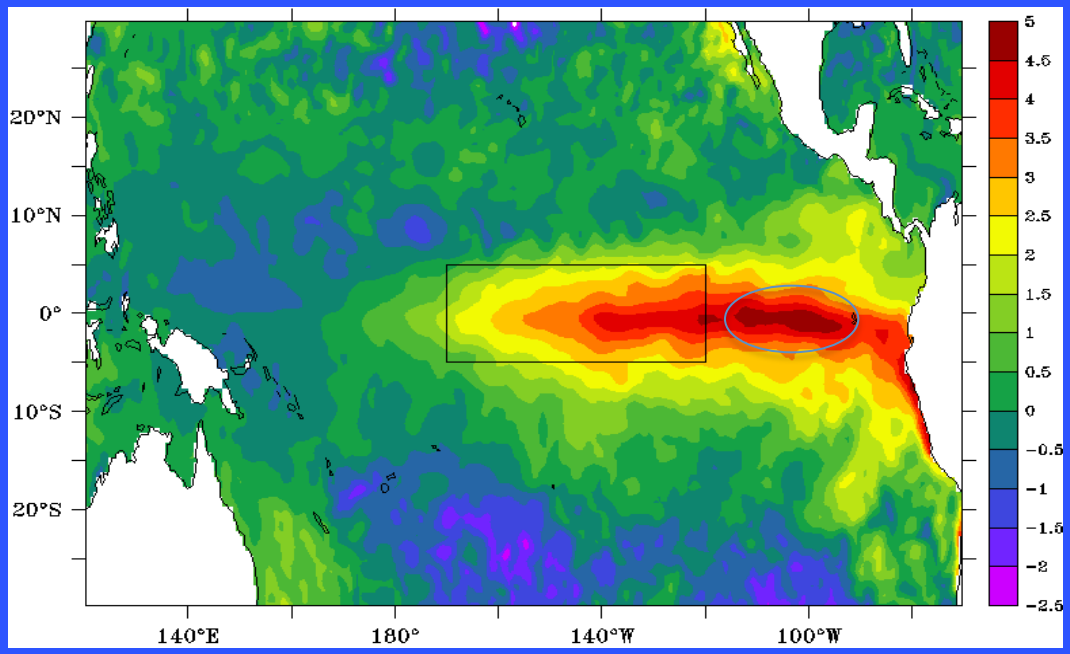
Stronger El Niños in SODA compared to HADISST

Two contrasting El Niños at start and end of the 20th century

Difference in JJAS SST anomaly for a drought El Niño event-1877 and a non-drought El Niño-1997



NINO-3.4 Index

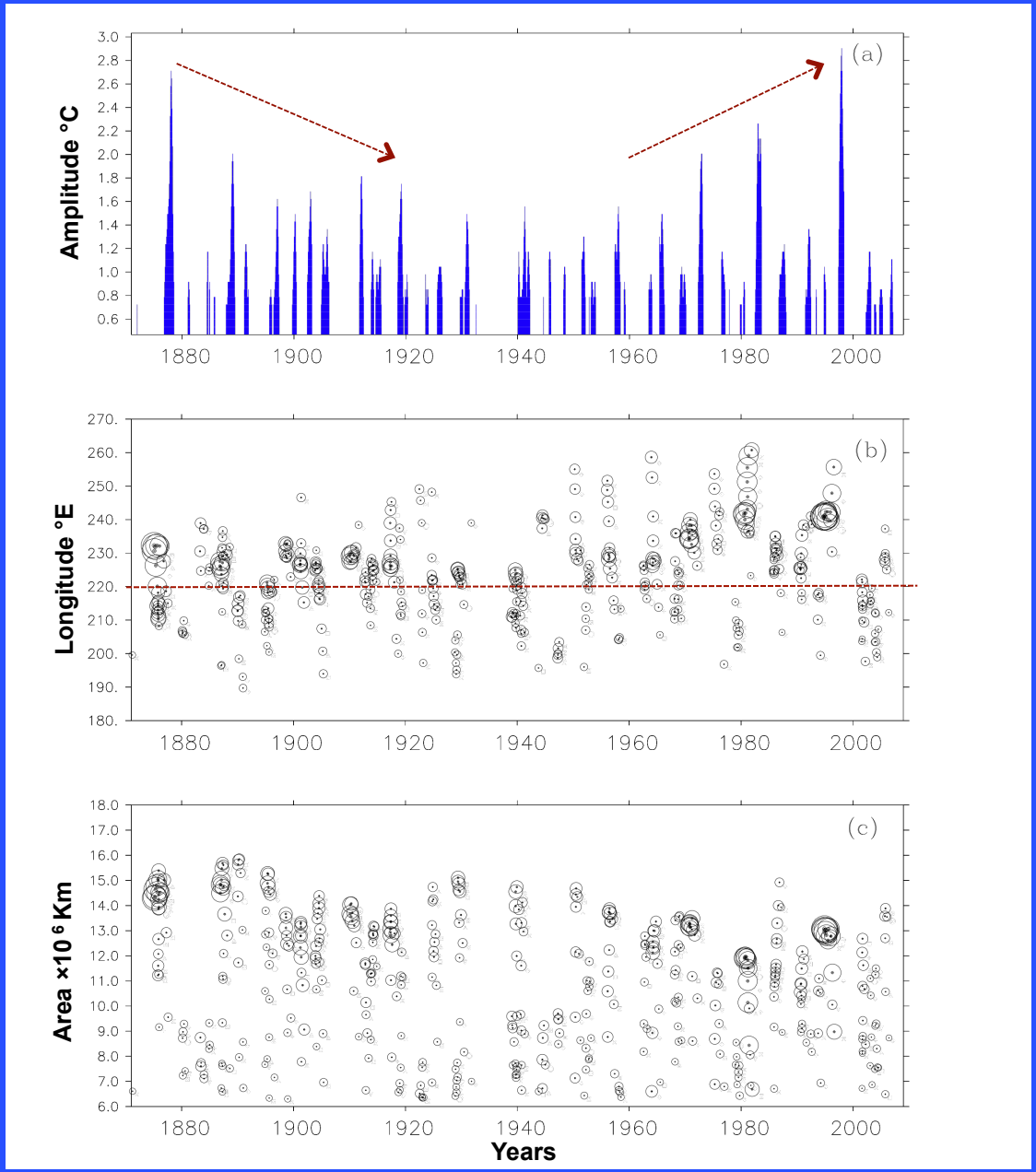


1997-98

Center of Heat Index : CHI

- Locates the longitude of center of heat of anomalously warm waters
  - SST anomaly must be greater than 0.5°C
  - Area must be greater or equal to the NINO-3.4 region

CHI : A measure for El Niño

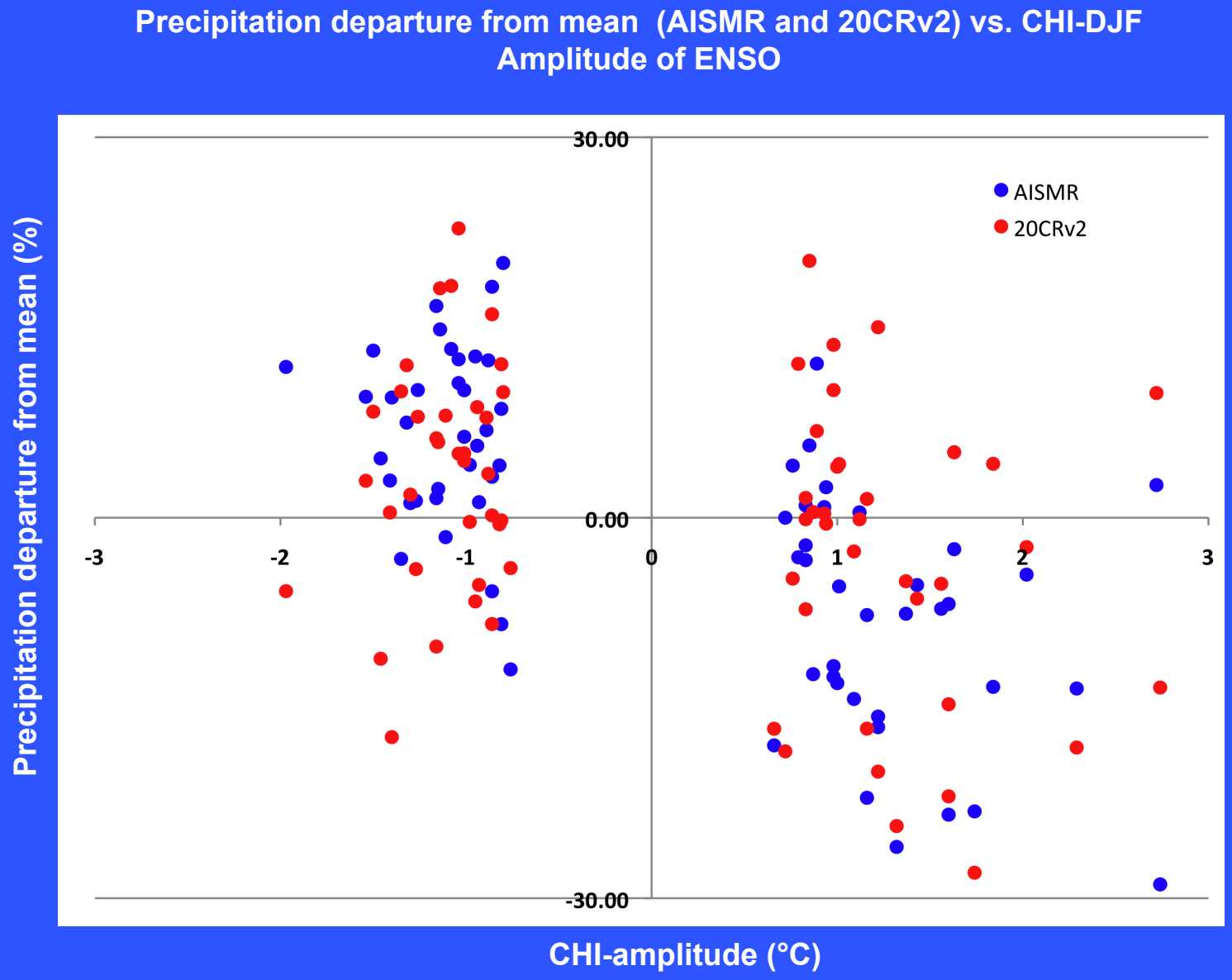


Strength of El Niños

Position of warmest anomaly on equatorial Pacific

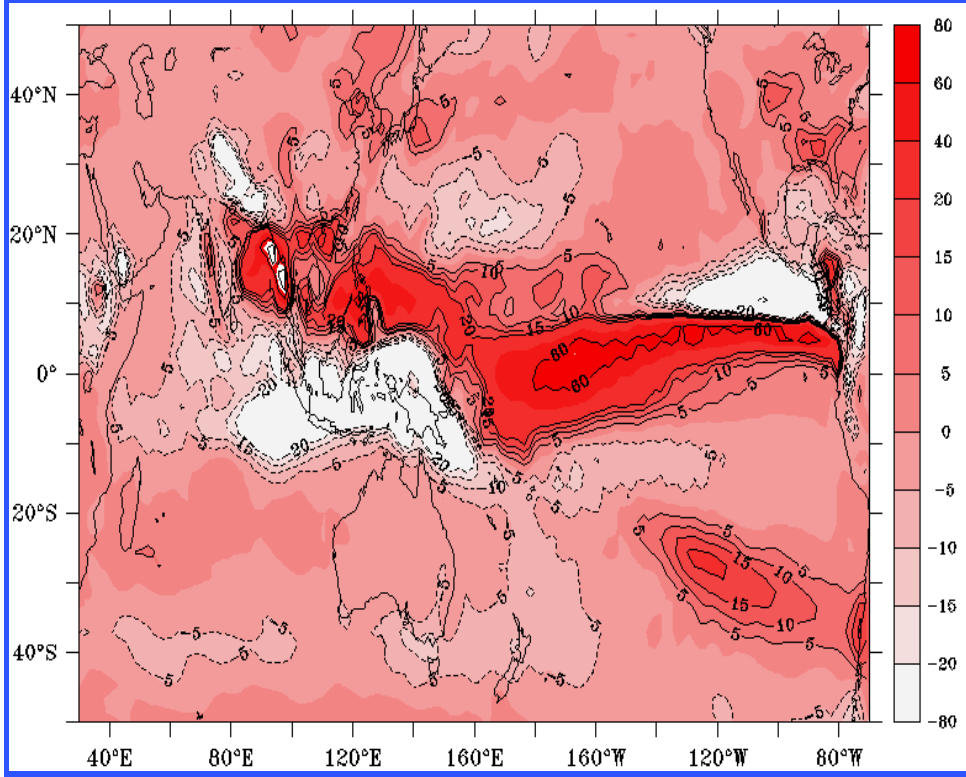
Area of warmest anomaly on equatorial Pacific

ENSO (CHI) – Indian Monsoon Precipitation

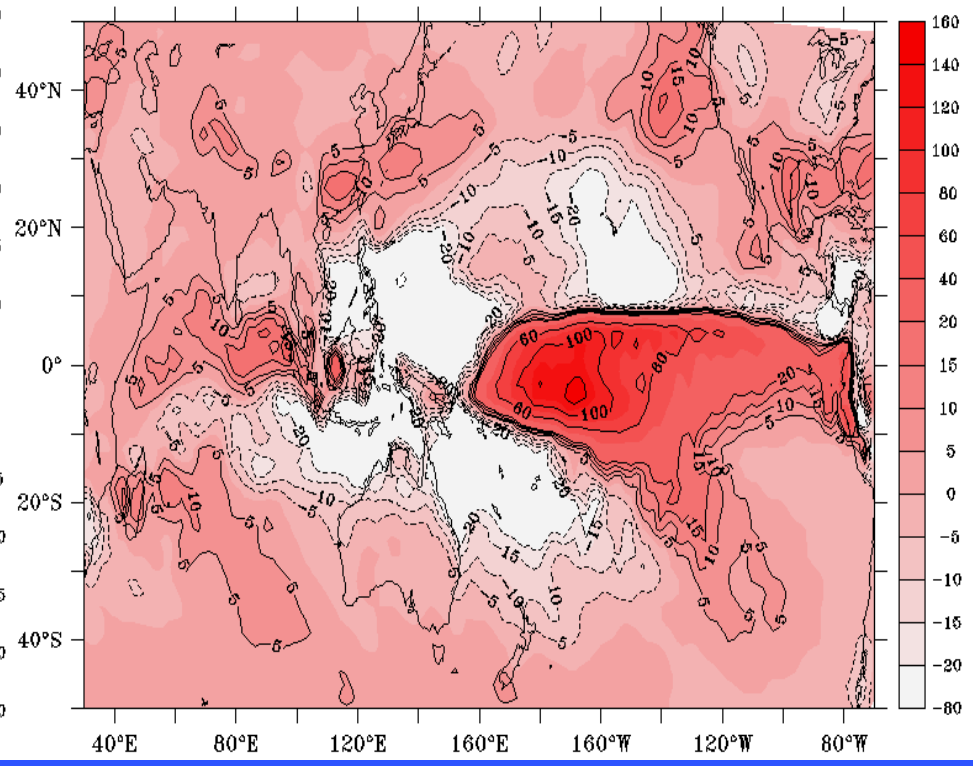


Composites : Precipitation

Composite of Precipitation anomaly during JJAS and DJF of El Niño years from 20CRv2



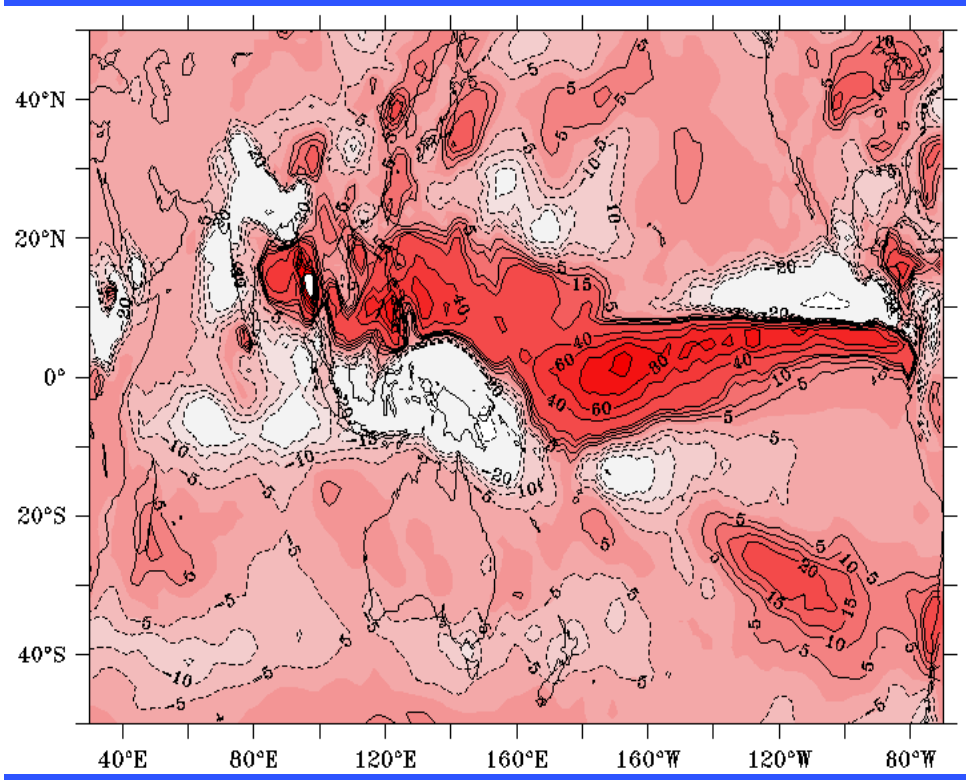
JJAS (mm/month)



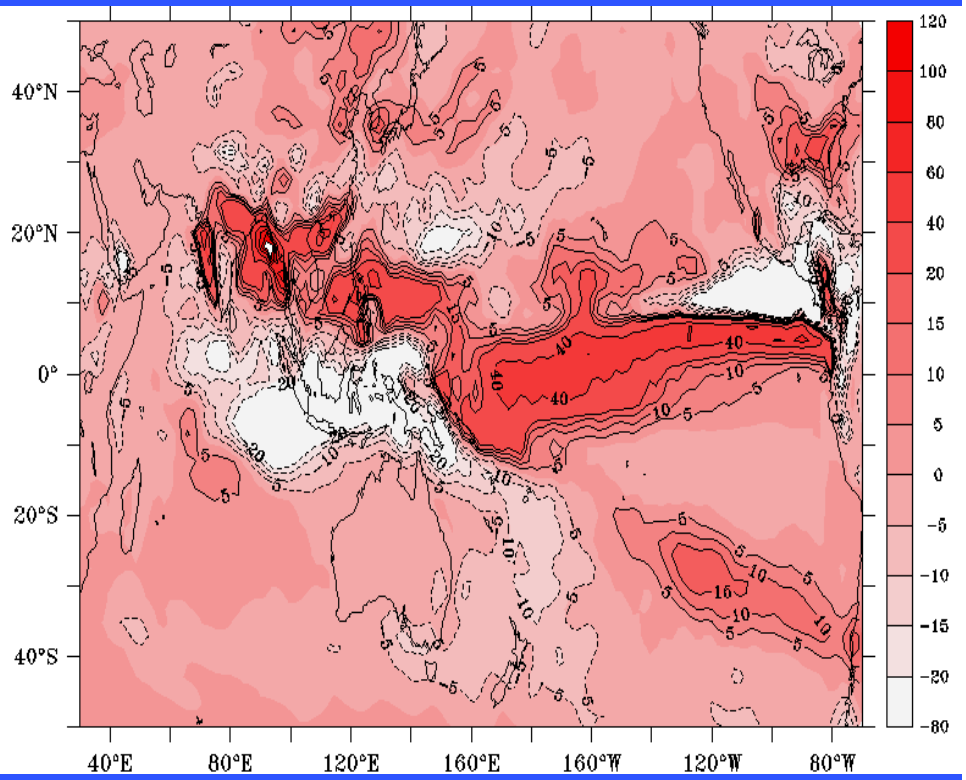
DJF (mm/month)

Composites : Precipitation

Comparison of Composites of Precipitation anomaly for Drought and Non-Drought ENSO years, JJAS



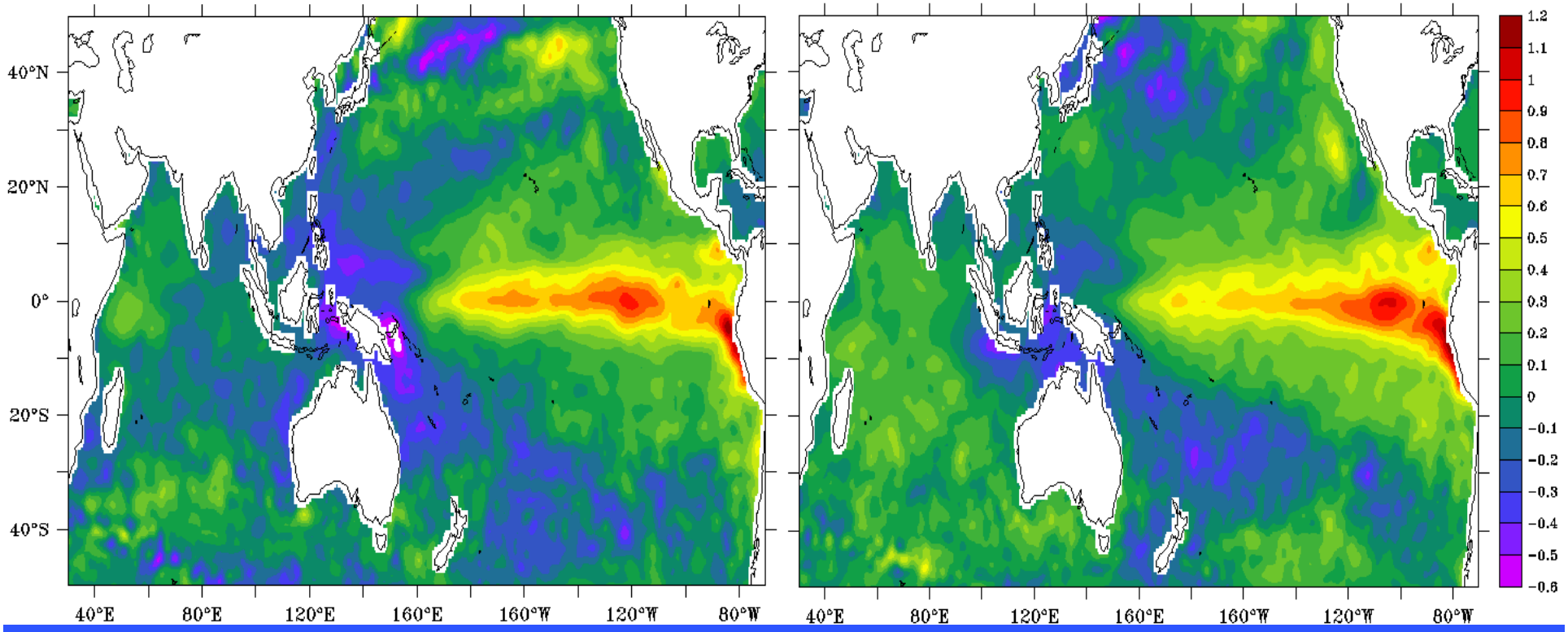
Drought El Niño (JJAS, mm/month)



Non-Drought El Niño (JJAS, mm/month)

Composites : SST

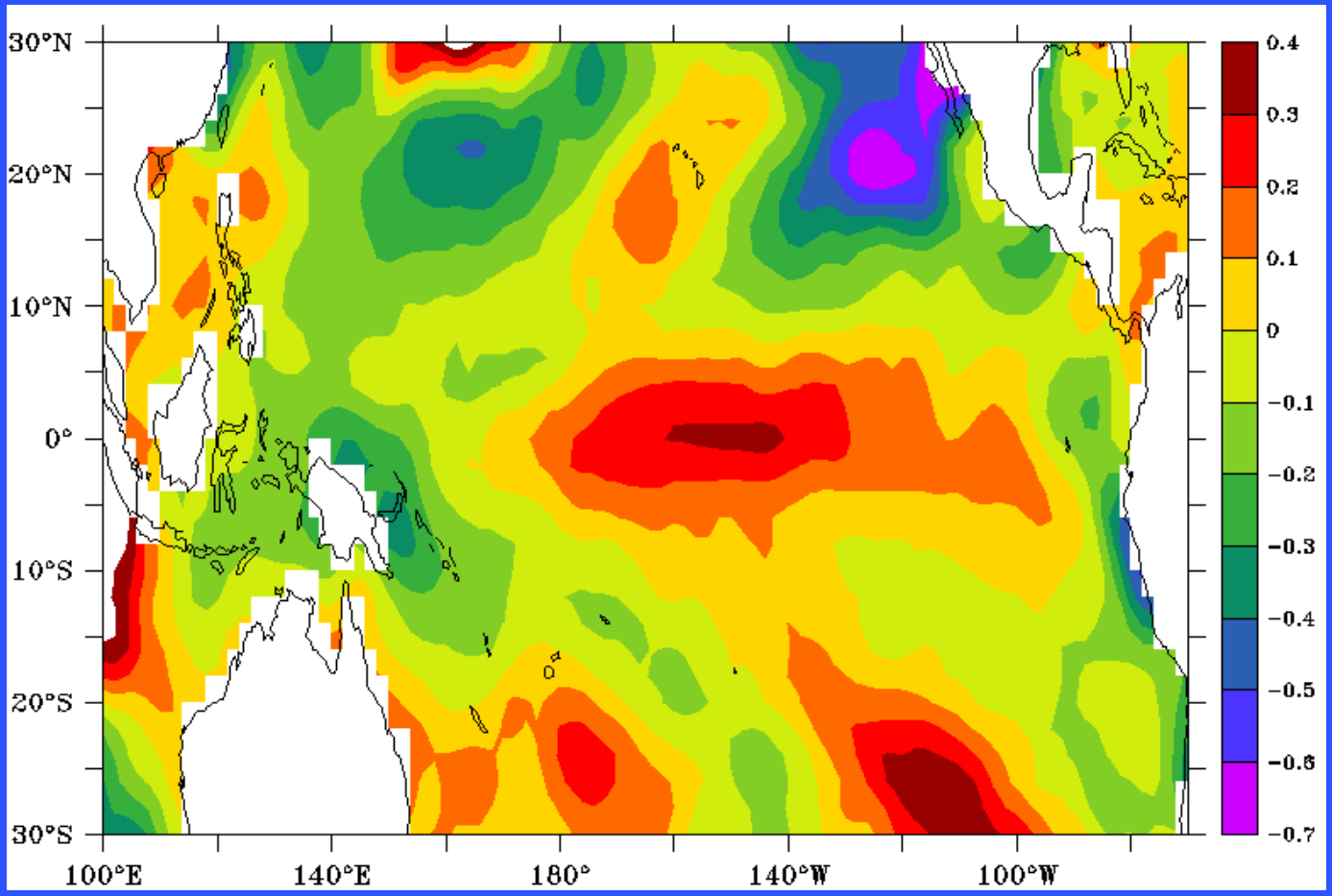
Comparison of Composites of SST anomaly for Drought and Non-Drought ENSO years, JJAS



Drought El Niño (JJAS, ° C)

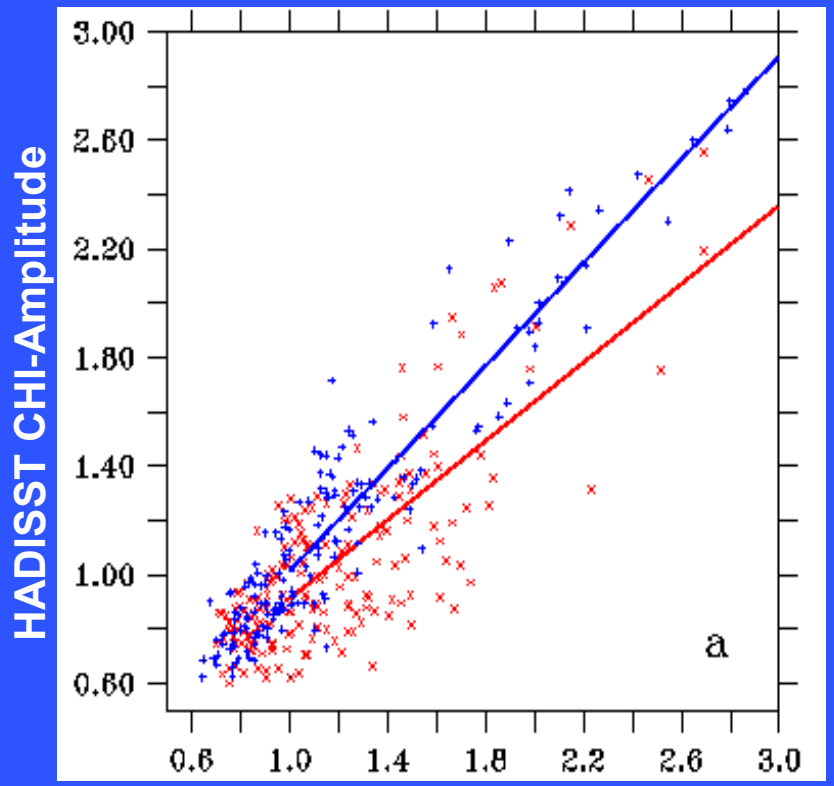
Non-Drought El Niño (JJAS, ° C)

Composite difference of JJAS SST anomaly for Drought and Non-Drought ENSO years based on Kumar et al.'s methodology

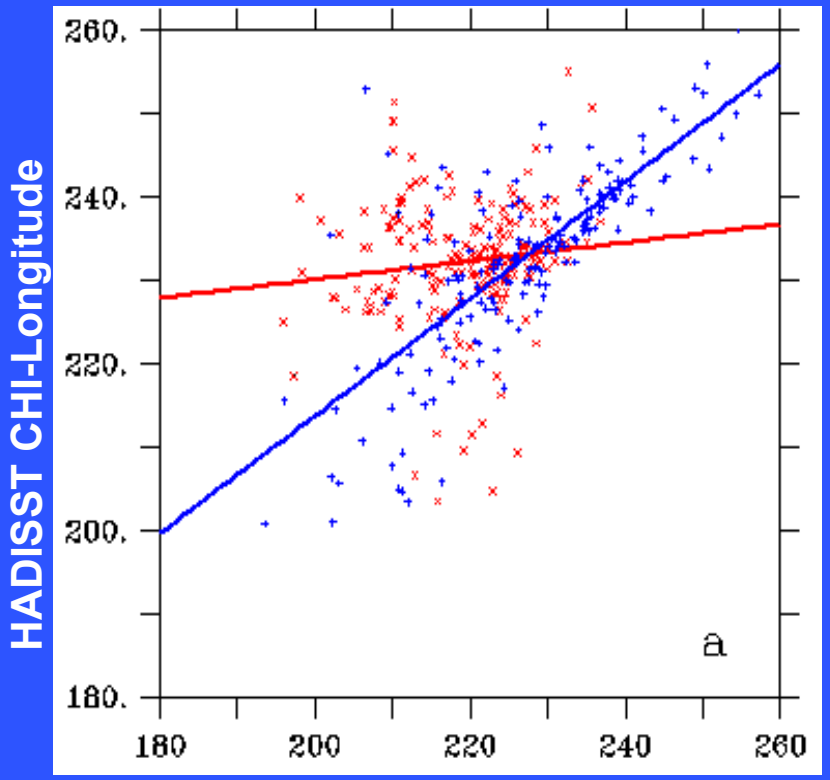


Post-1950 period warmer central equatorial Pacific seen in SODA similar to Kumar et al.'s analysis

Comparison of CHI from SODA and HADISST



SODA 2.2.4 CHI-Amplitude



SODA 2.2.4 CHI-Longitude

CHI longitude and amplitude from SODA 2.2.4 and HADISST for post-1950 (Blue) agree better than pre-1950 (Red) period

Conclusions

- Center of Heat Index is used to explore El Niños over 138-year period
  - El Niños of the late 19th century as strong as late 20th century
  - Late 20th century strong El Niños are smaller compared that of late 19th century

- Drought and Non-drought El Niños show only a weak difference in the composite SST anomaly pattern as compared to the strong difference in Kumar et al. (2006)

- SODA agrees better with HADISST in post-1950 than pre-1950