Studies of Meteorological Drought in Mexico

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Objectives

Development of a gridded monthly precipitation dataset, for the period of 1951 to 2000 at a spatial resolution of 0.5 x 0.5.

Evaluation and comparison with others datasets (GPCP, CRU, CMAP)

Construction of a Standardized Precipitation Index (SPI) for monitoring and analysis of meteorological drought for Mexico.

Focus on long term > 5 years of drought in Mexico

Source Datasets

Clicom (National Weather Service, Mexico)

Global Historical Climatology Network V.2 (GHCN)

Global Precipitation Climatology Centre (GPCC)

Comparison with

Climate Prediction Center (CPC)

Climate Research Unit (CRU)

Global Precipitation Climatology Project (GPCP)

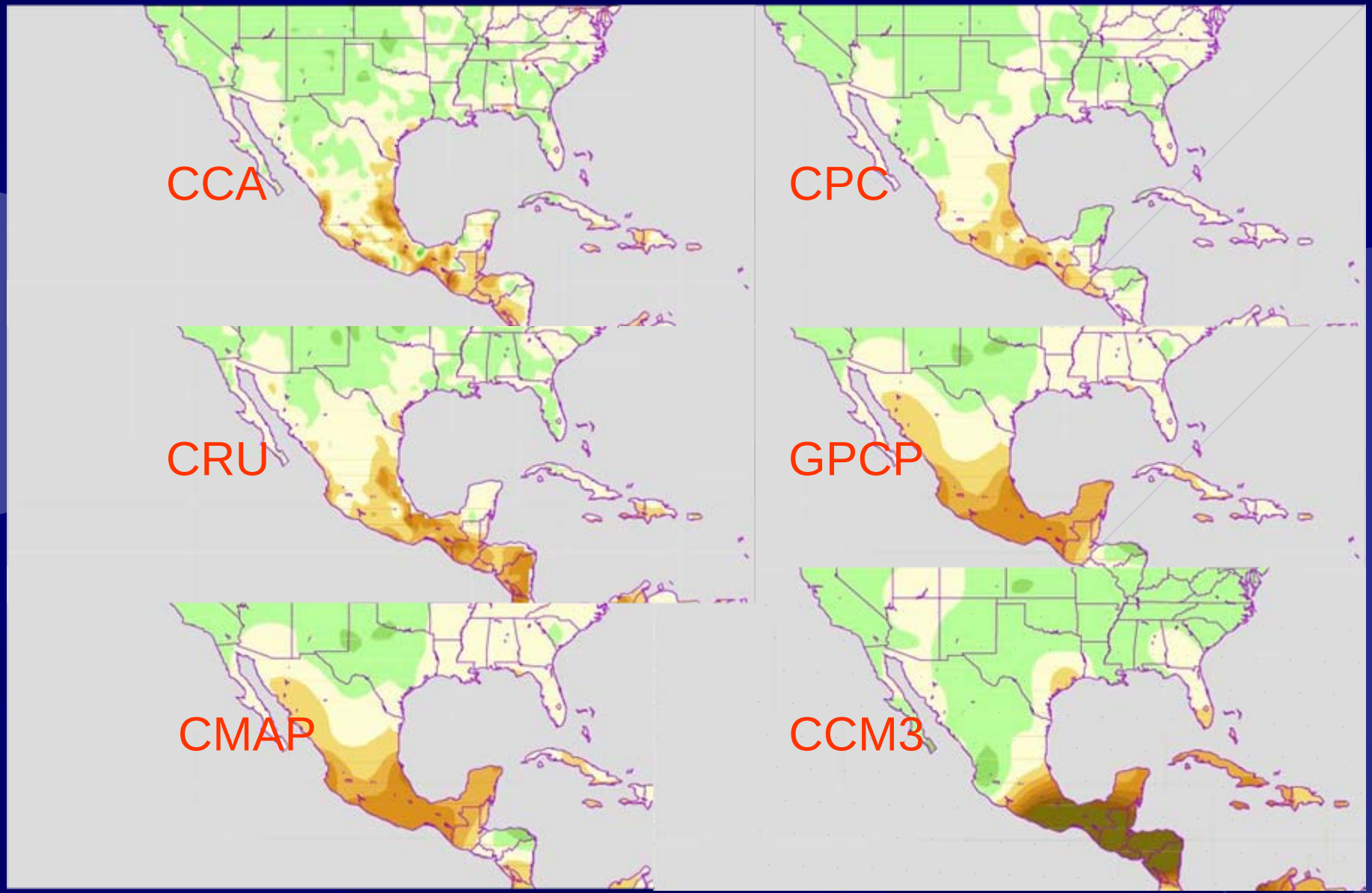
CPC Merged Analysis of Precipitation (CMAP)

NCAR Community Climate Model (CCM3)

On an interannual basis, El Niño and the shift in the mean position of the ITCZ may result in contrasting precipitation anomalies between northern and southern Mexico

Precipitation anomalies

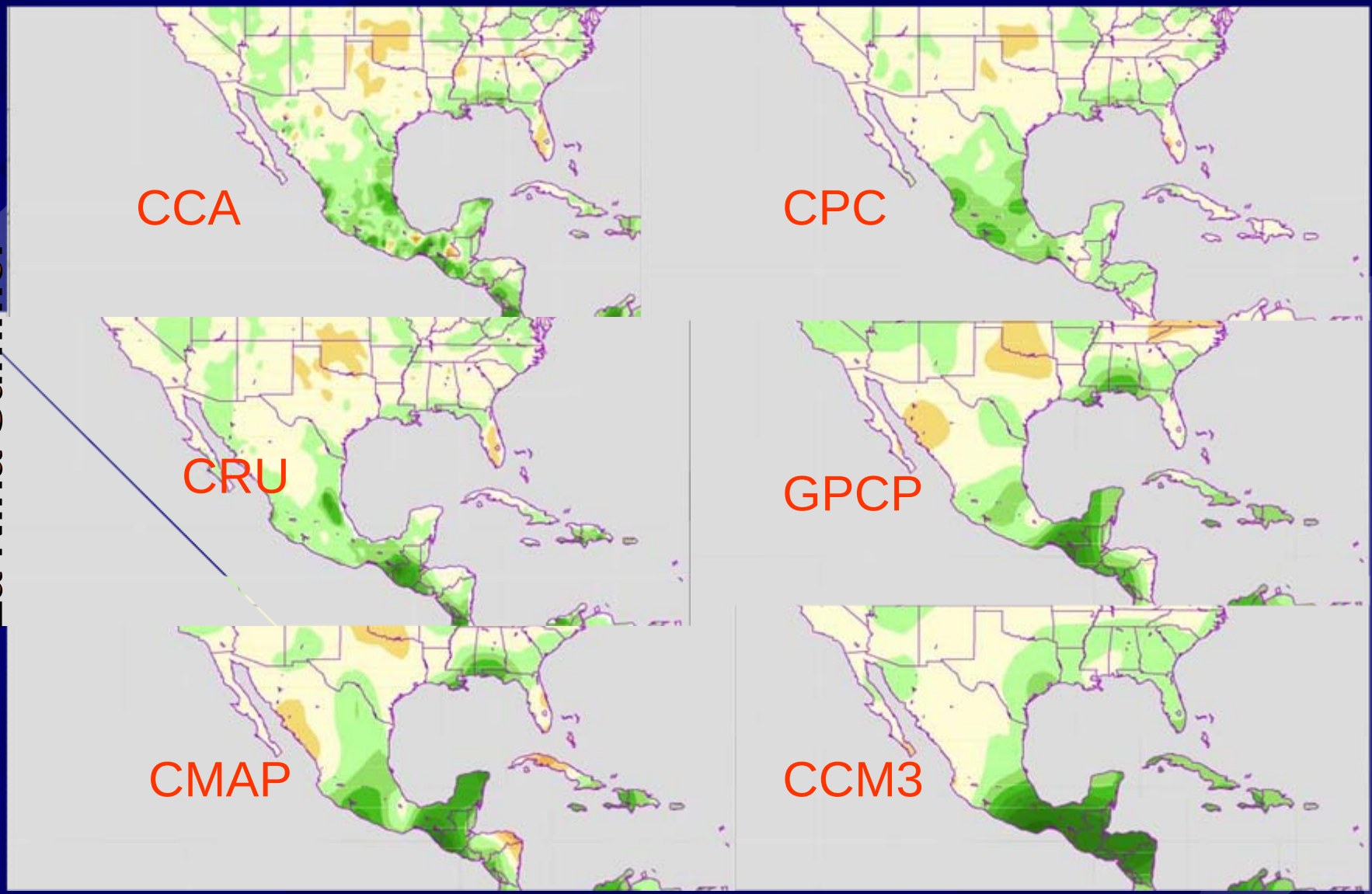
El Niño Summer

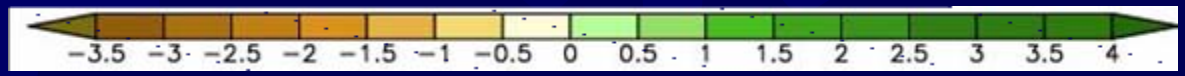


However, during La Niña events, the patterns may be a little more complicated

Precipitation anomalies

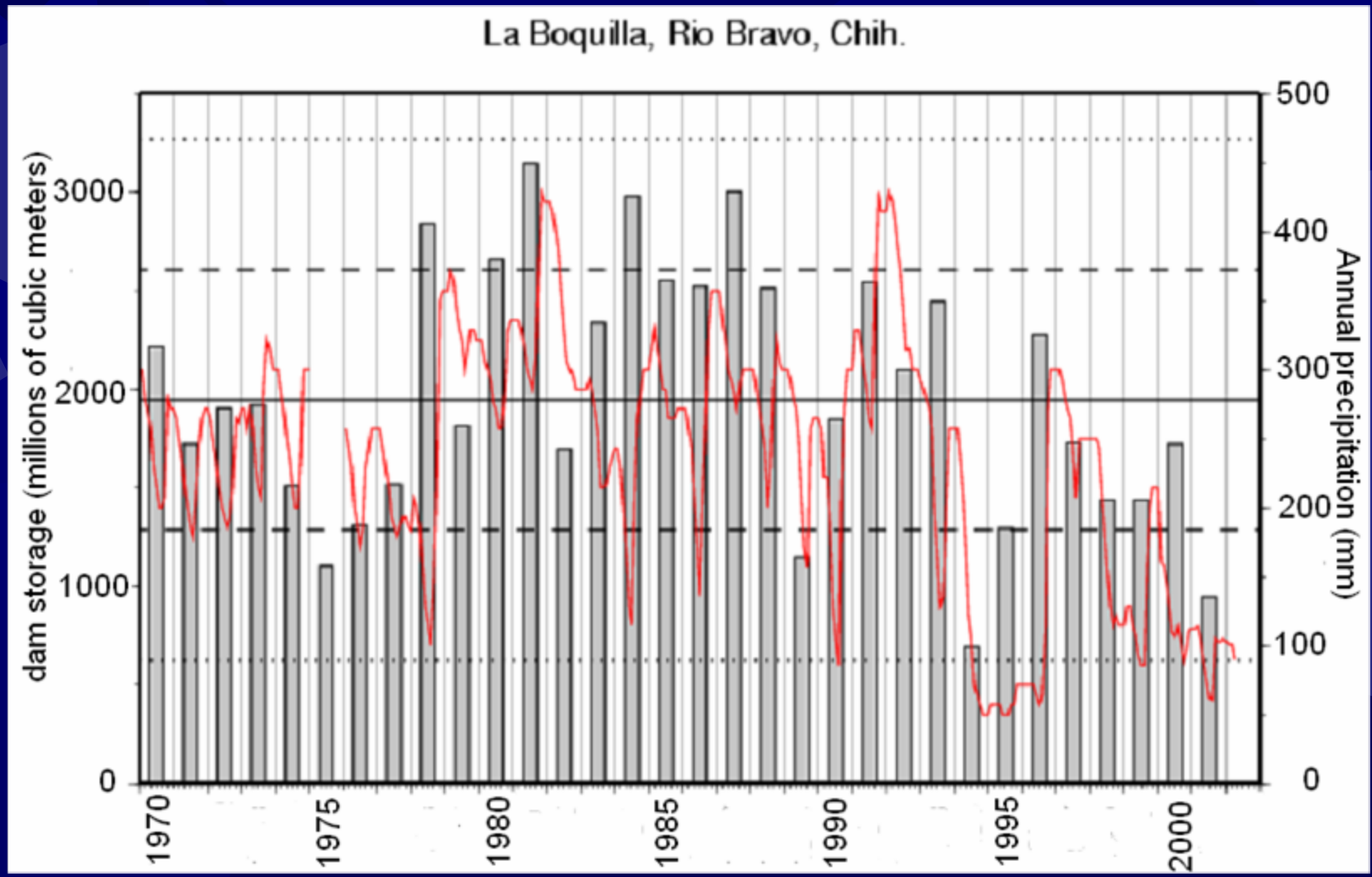
La Niña Summer



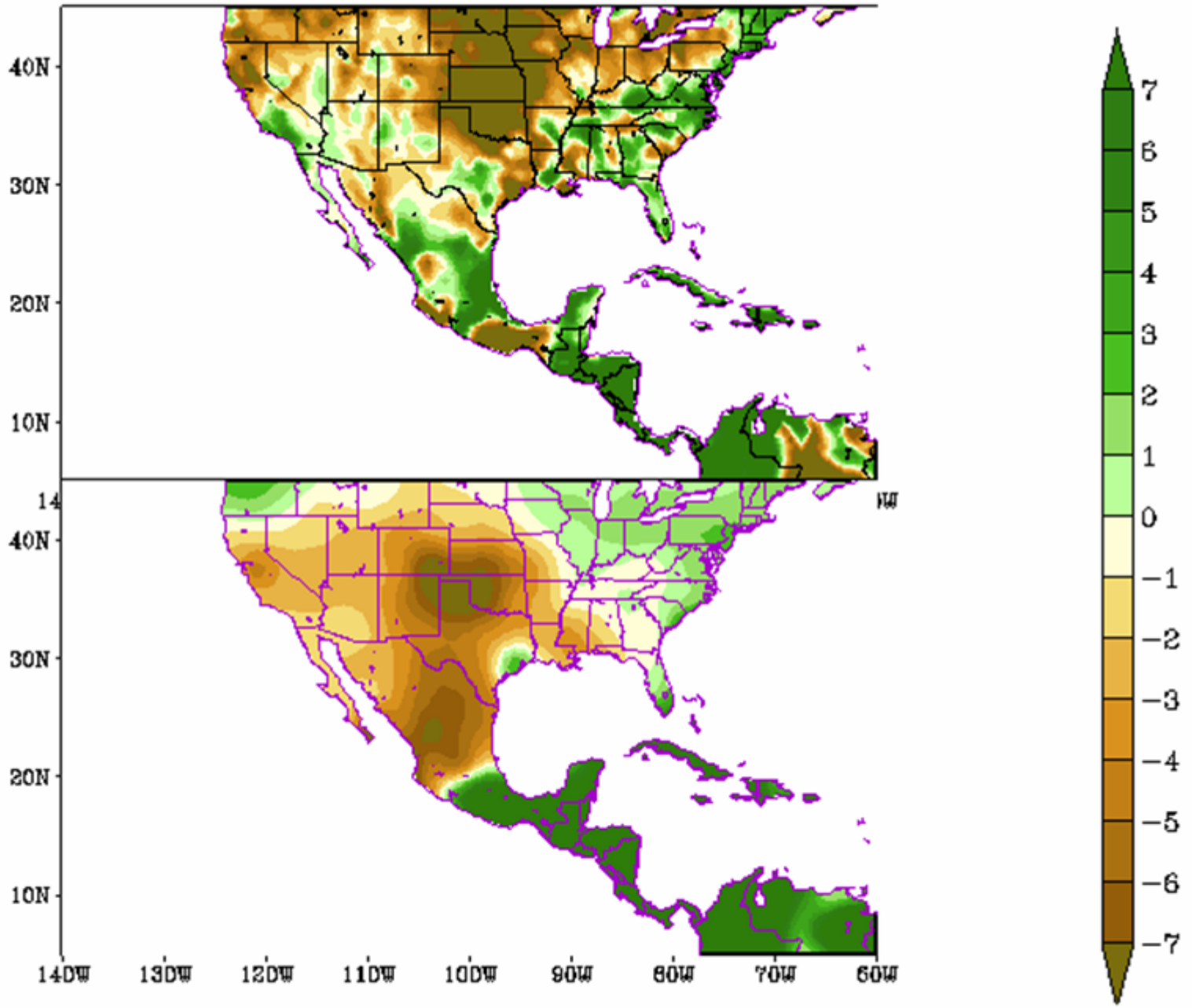


Drought in the northern region

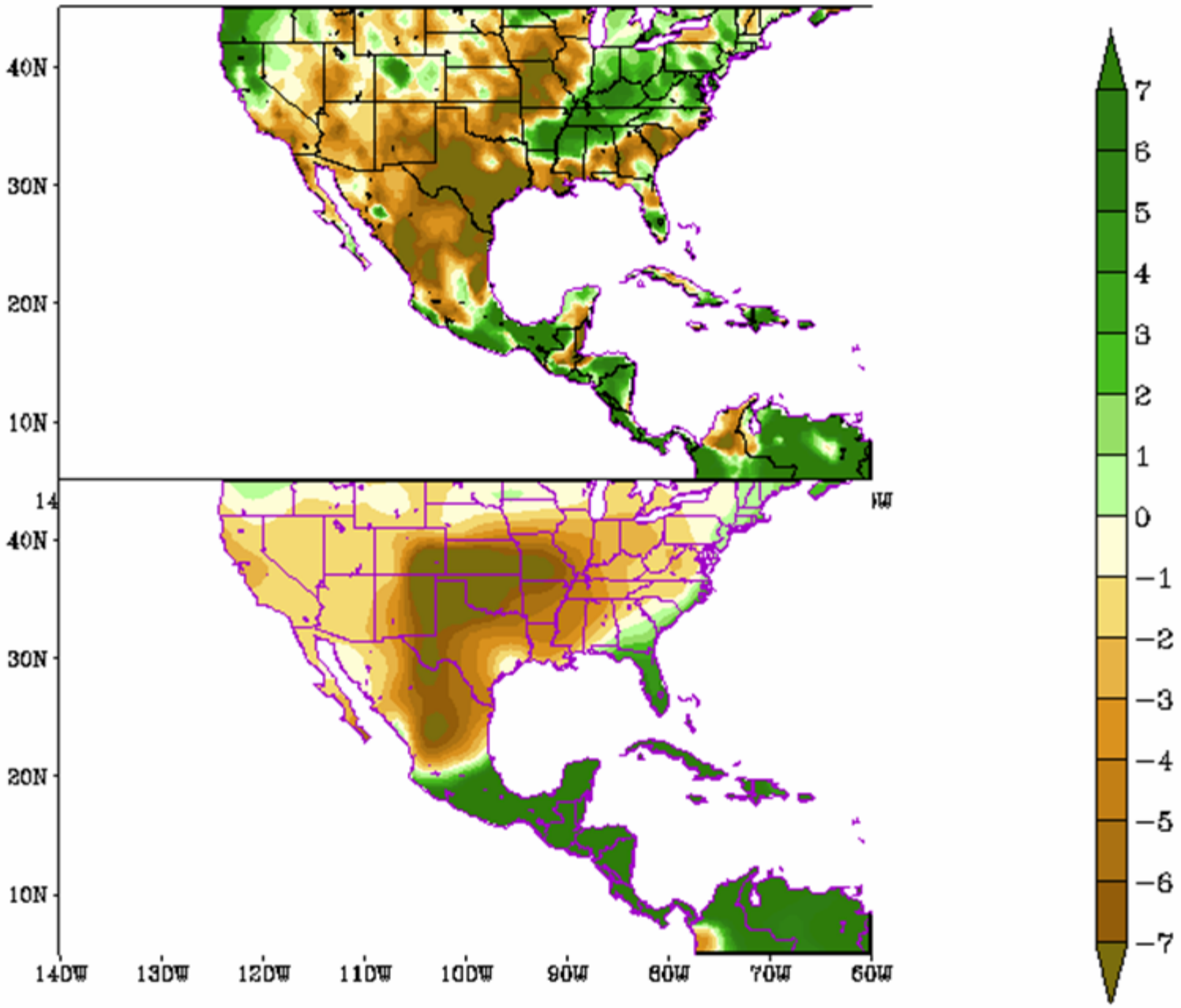
This drought period reflected as a water shortage in the dams at northern of Mexico (Hydrologic drought)

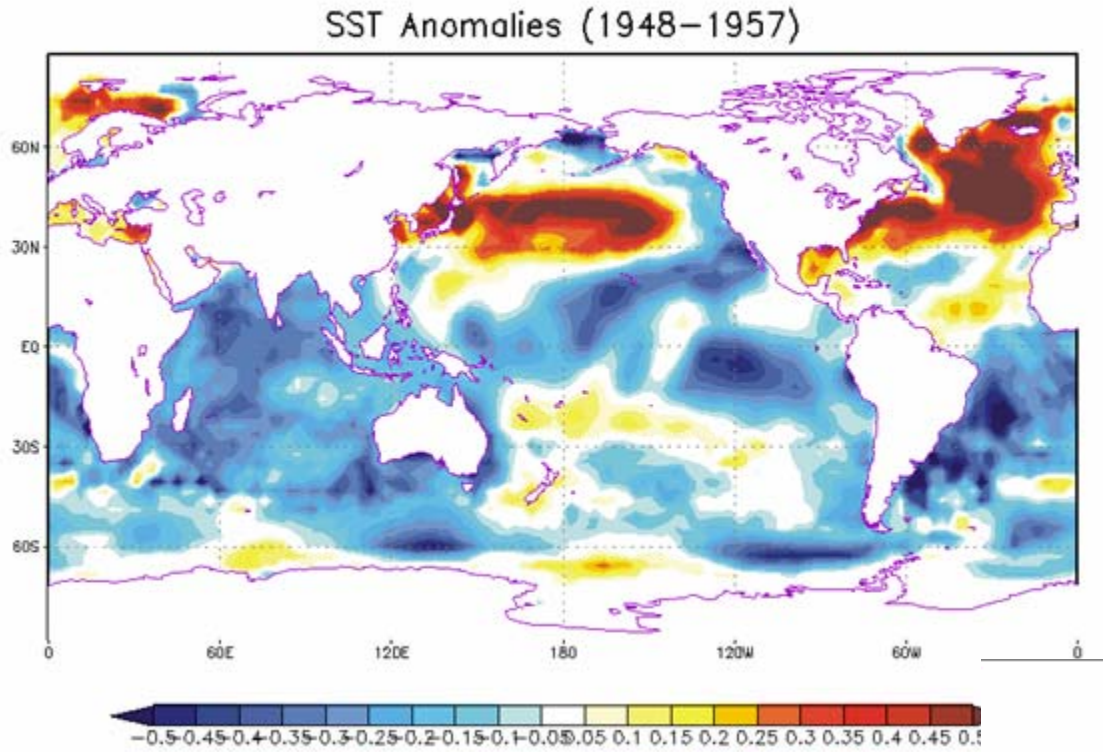


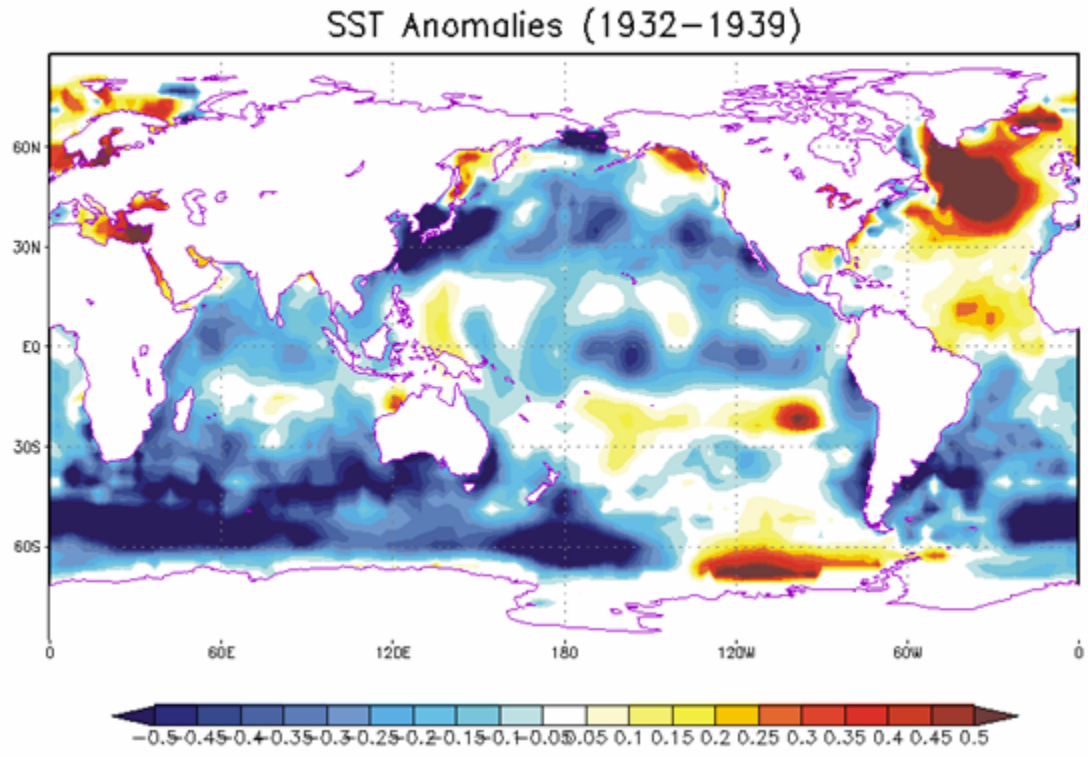
Precipitation Anomalies 1932–1939



Precipitation Anomalies 1948–1957




SST Anomalies (1948–1957)
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
0
−0.5 −0.45 −0.4 −0.35 −0.3 −0.25 −0.2 −0.15 −0.1 −0.05 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5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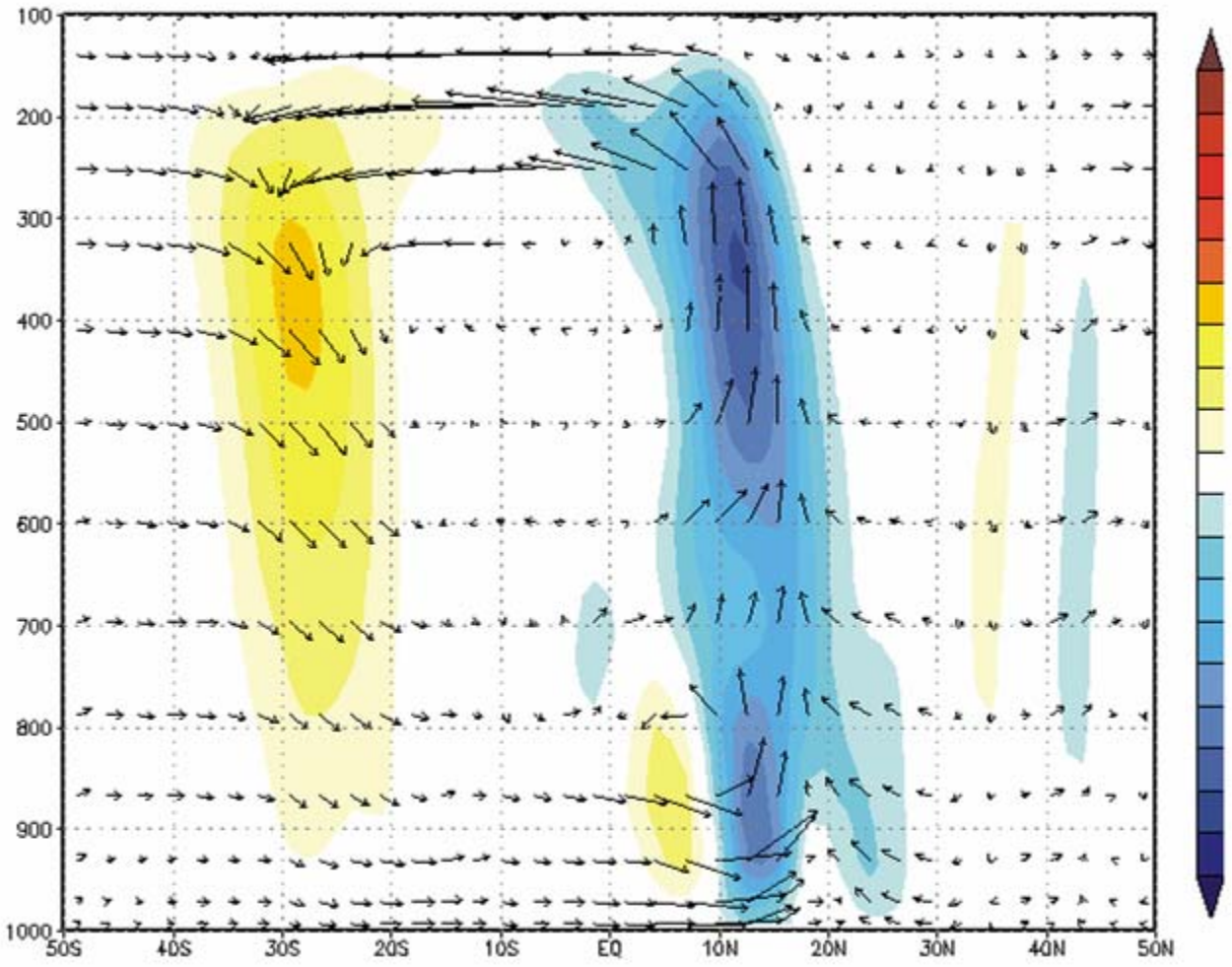
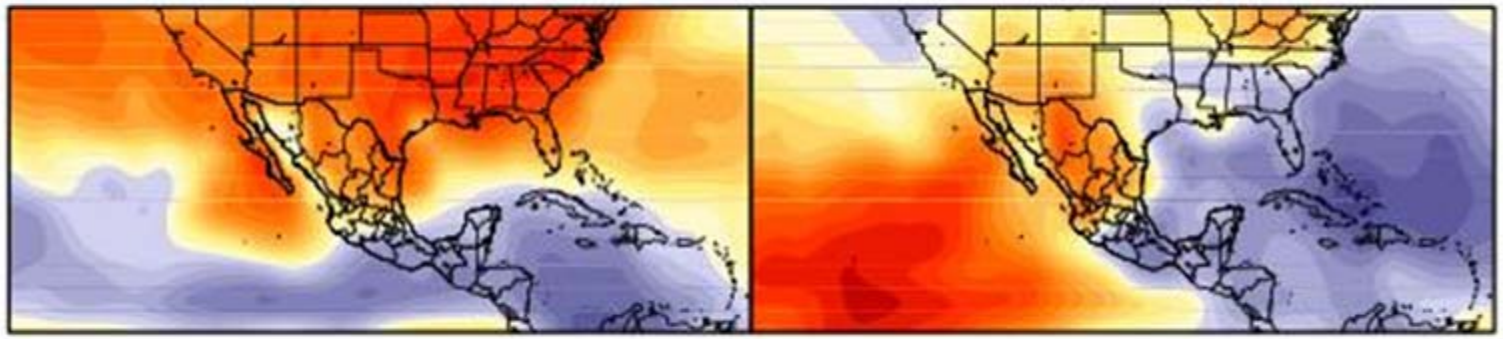
Using CCM3 long term simulations (1856-2004)

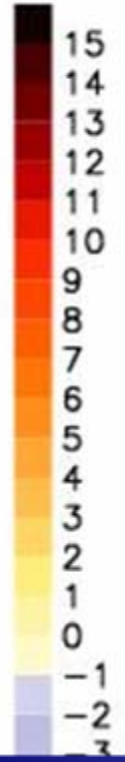
(1948-1957) – (1961-1990)



SPI 12

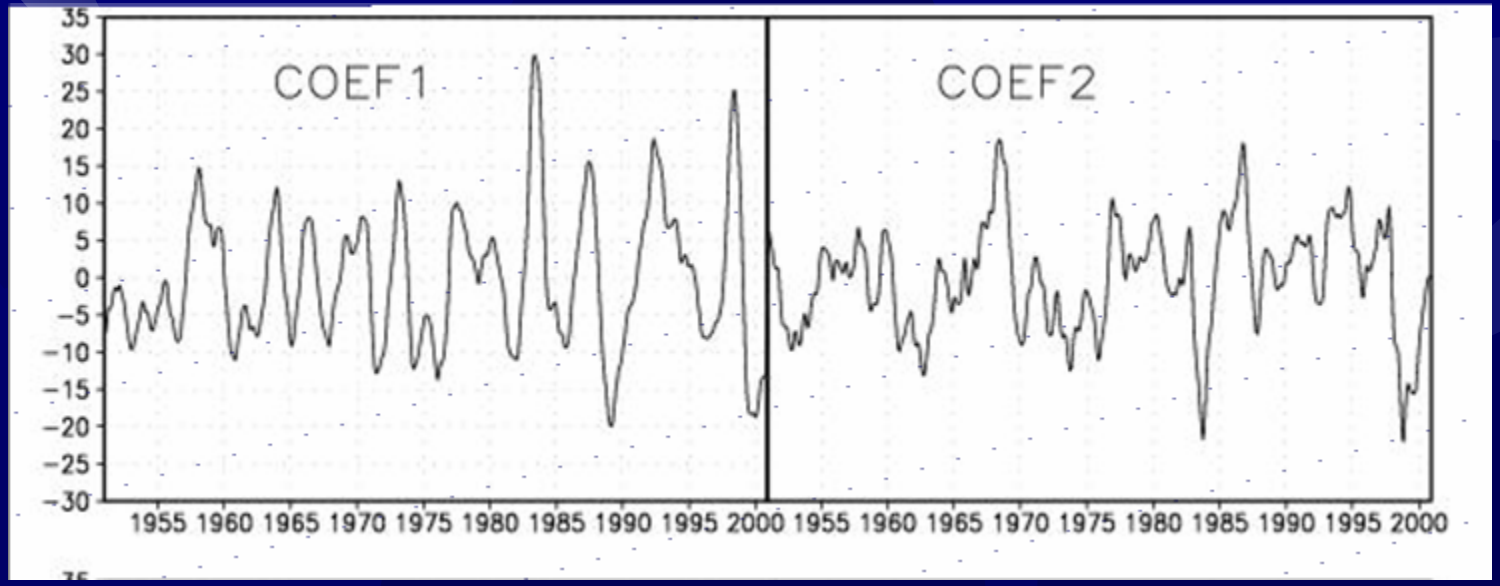
1st and 2nd EOF in SPI using CCM3





EOF1 (27.8 %)

EOF2 (16.5 %)



Conclusions

- Droughts in Mexico are associated with a north south dipole, in close resemblance with anomalies observed ENSO anomalies
- CCM3 is capable of reproducing large scale patterns of drought since SST anomalies are prescribed in simulations (intense local Hadley cell displaced to the north)
- The challenge is to produce reliable SST forecasts if drought over Mexico is to be predicted in time scales longer than a year