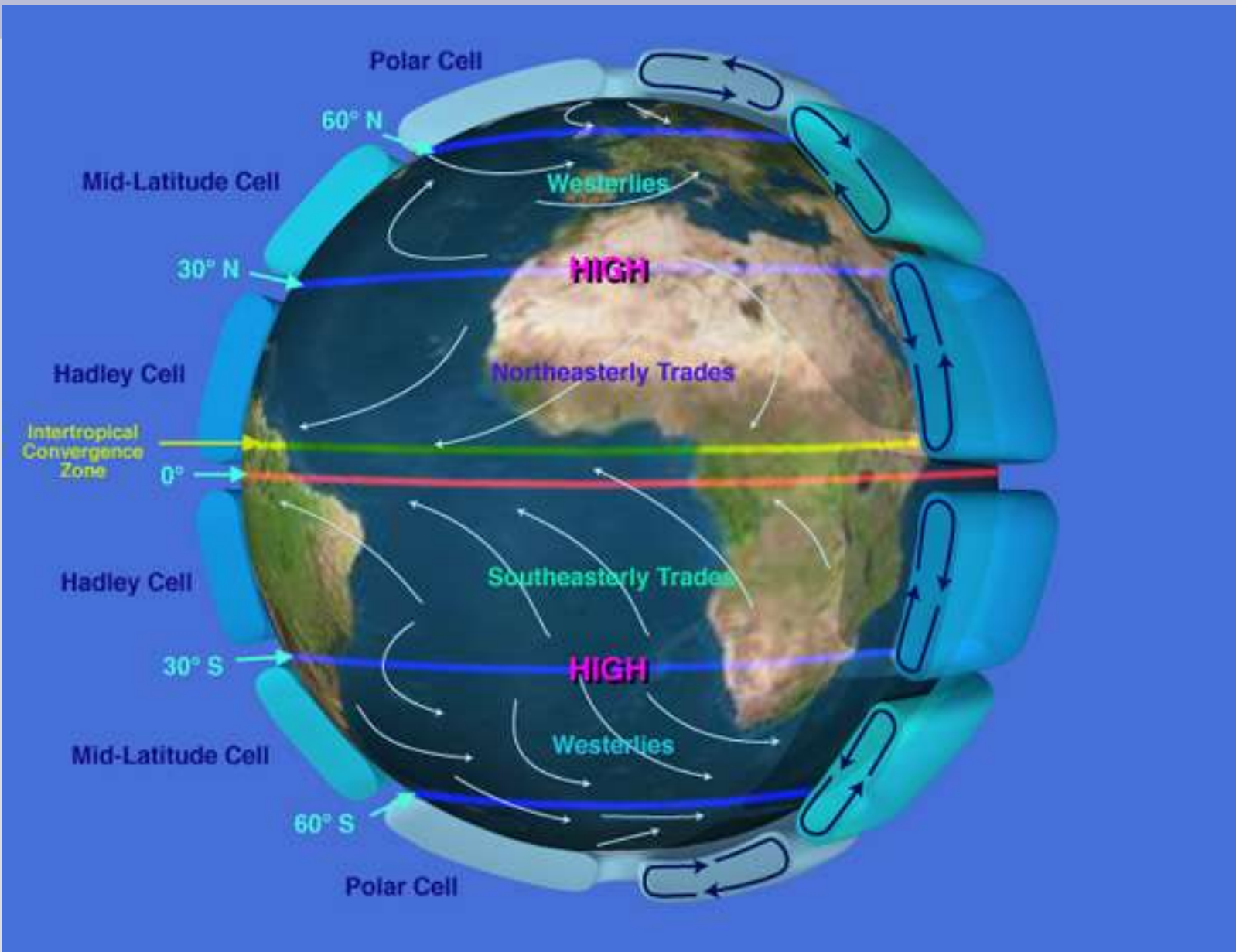


Climate and Human History

Stephan Matthiesen

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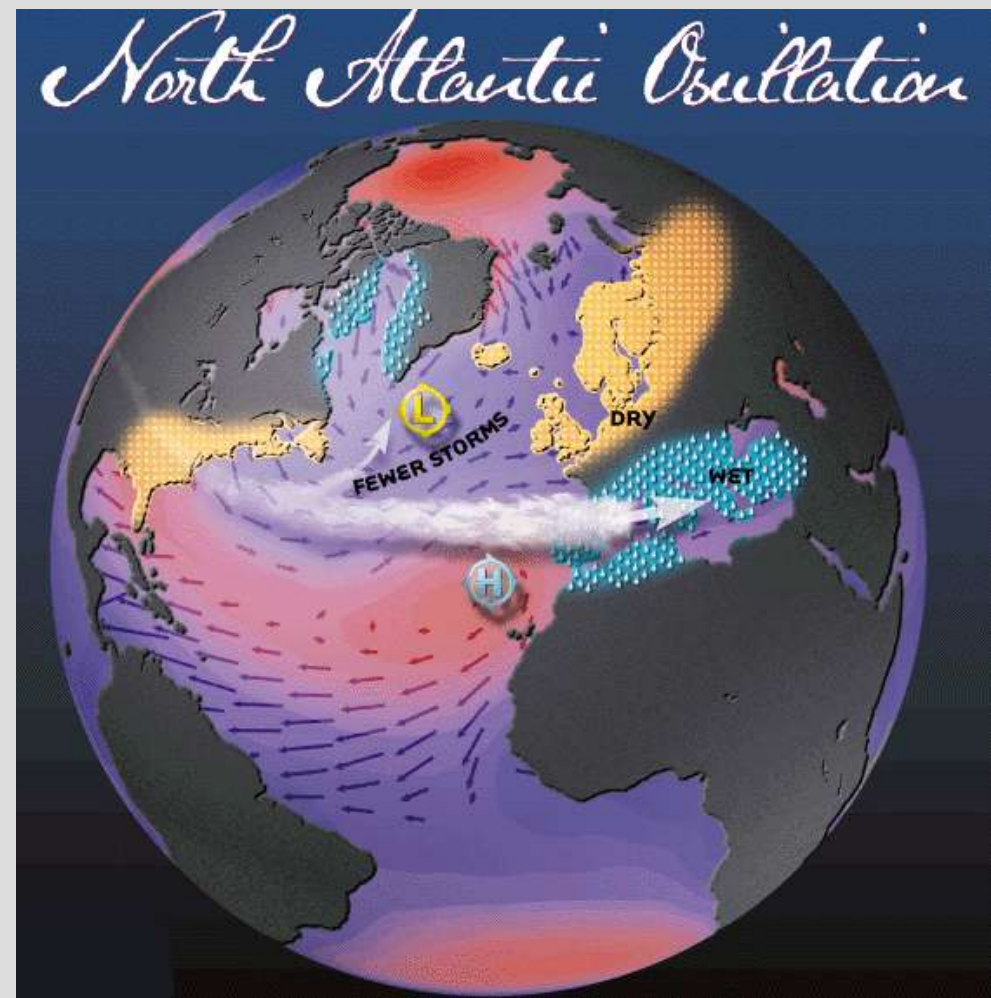
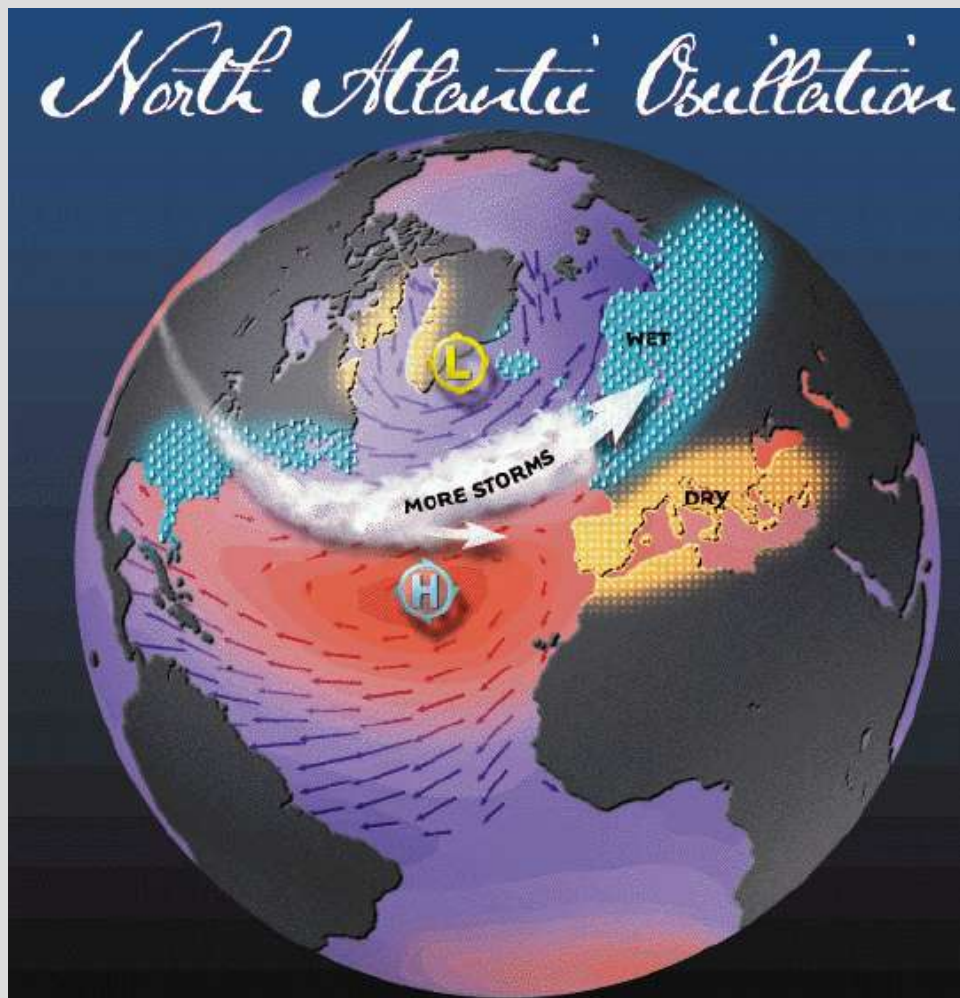
Atmospheric Circulation



North Atlantic Oscillation (NAO)

Positive NAO

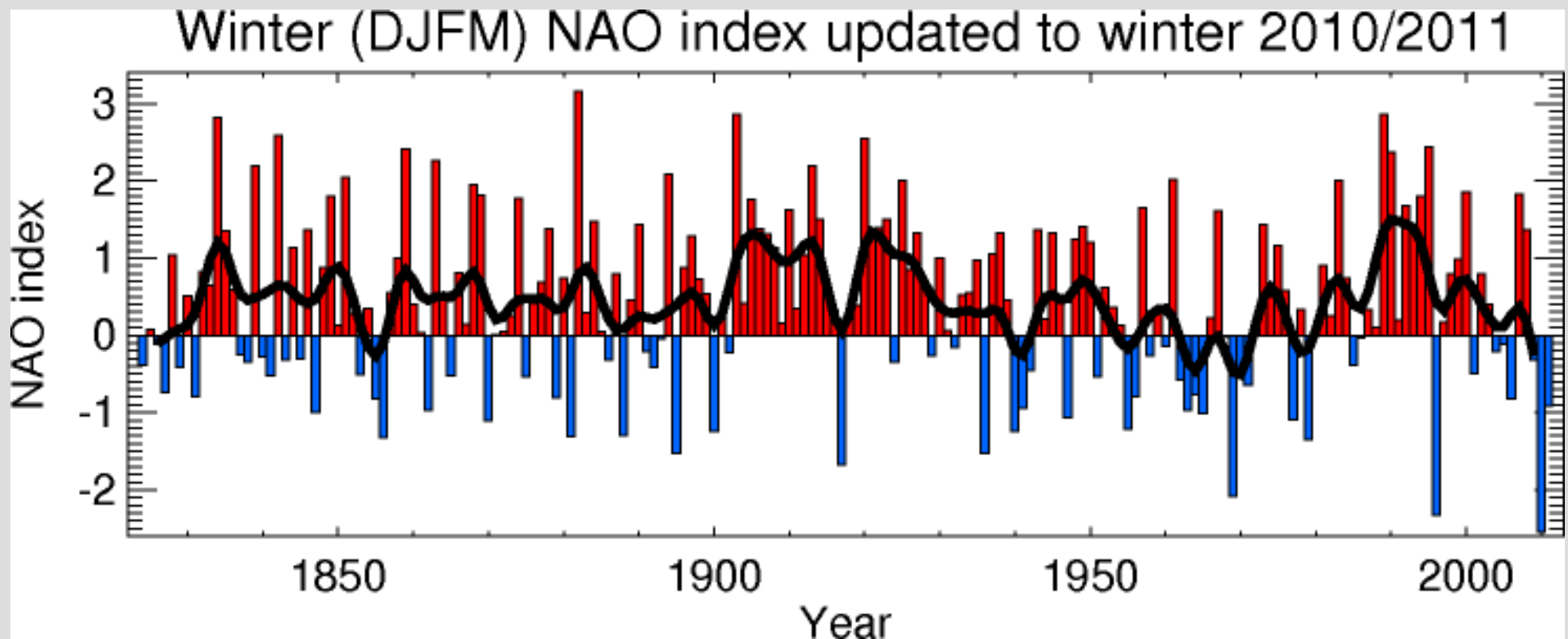
Negative NAO



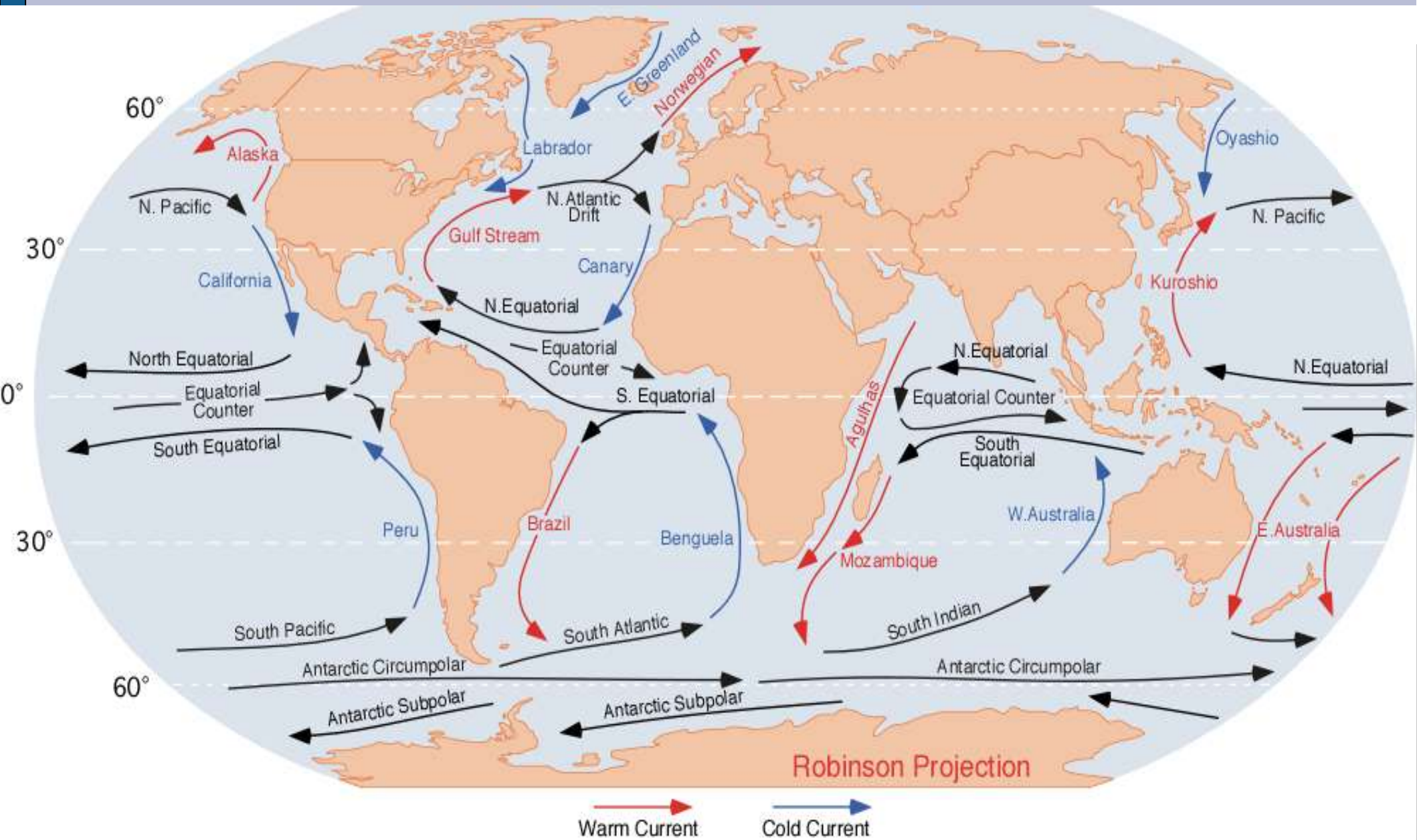
North Atlantic Oscillation (NAO)

NAO Index:
pressure difference between
Azores and Iceland

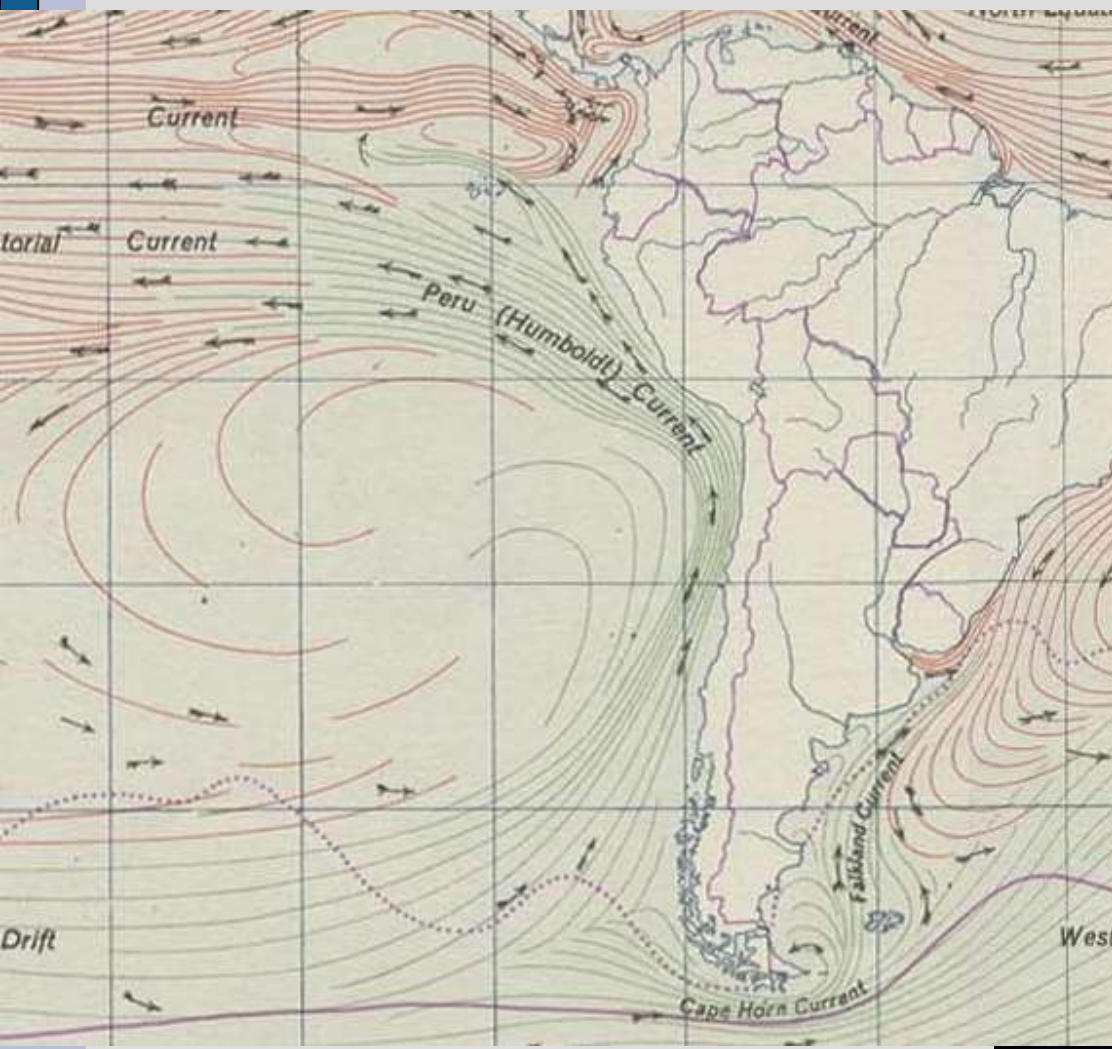
Positive NAO: mild, wet winter in North Europe
Negative NAO: cold, dry winter in North Europe



Ocean currents



The Peru (Humboldt) current



Anchovy



El Nino

Videos:

Intro, summary of impacts on weather patterns

<https://www.youtube.com/watch?v=7FVZrw7bk1w>

Explains circulation nicely, but in Portugese:

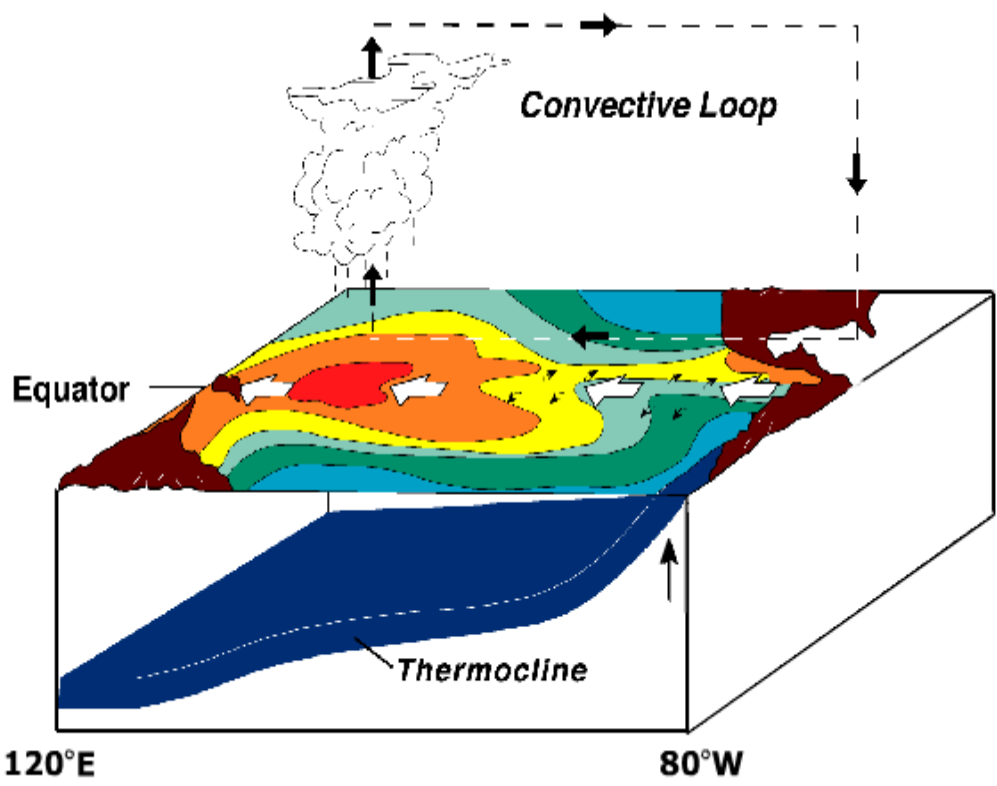
<https://www.youtube.com/watch?v=Qmj53V7qVTY>

From the WMO – weirdest selection of weather clips
(including a car crash), but otherwise disappointing

<https://www.youtube.com/watch?v=PgAufqOCvZs>

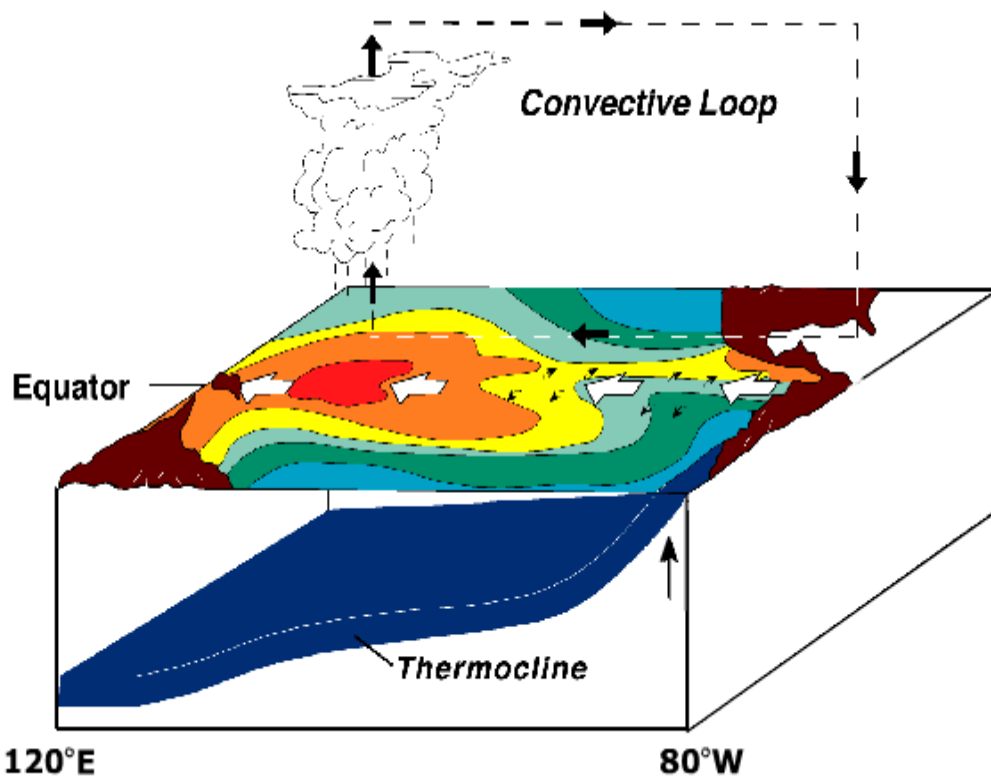
“Normal” Pattern

“Normal”

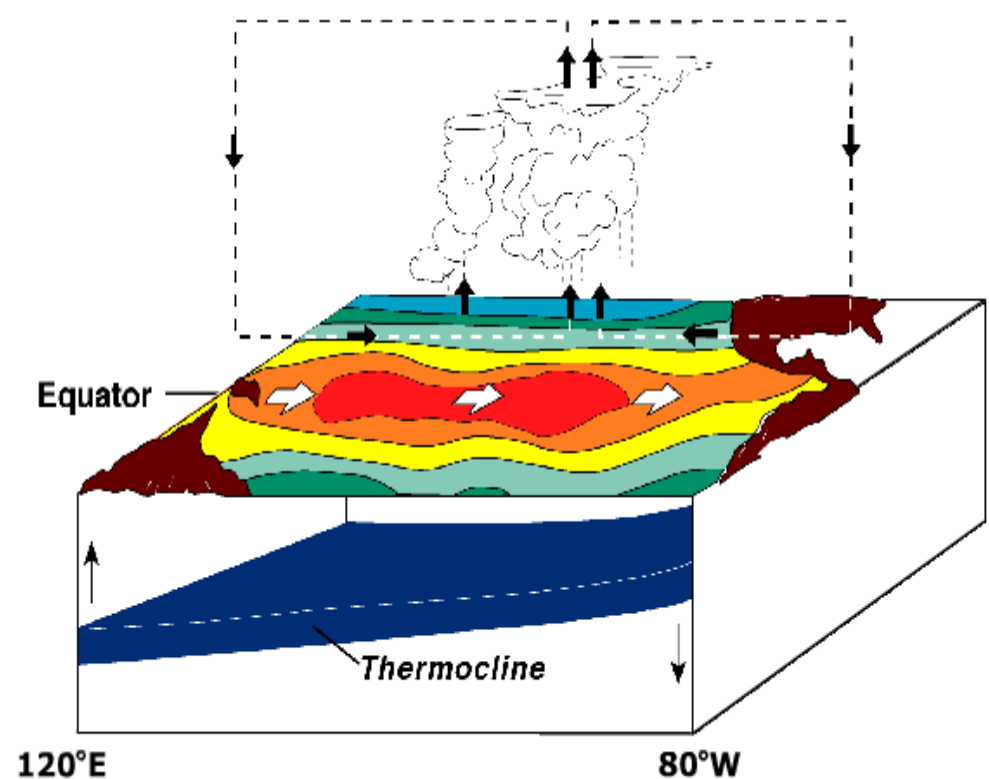


El Niño Pattern

“Normal”



El Niño



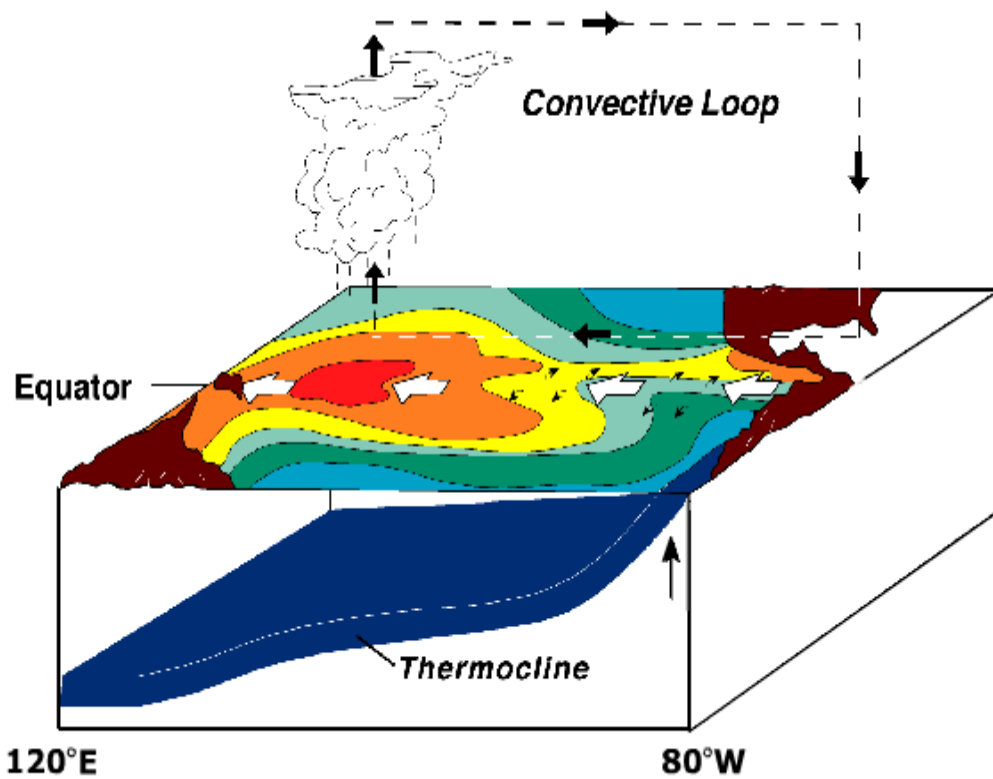
El Niño / Southern Oscillation (ENSO)

Warm ocean current

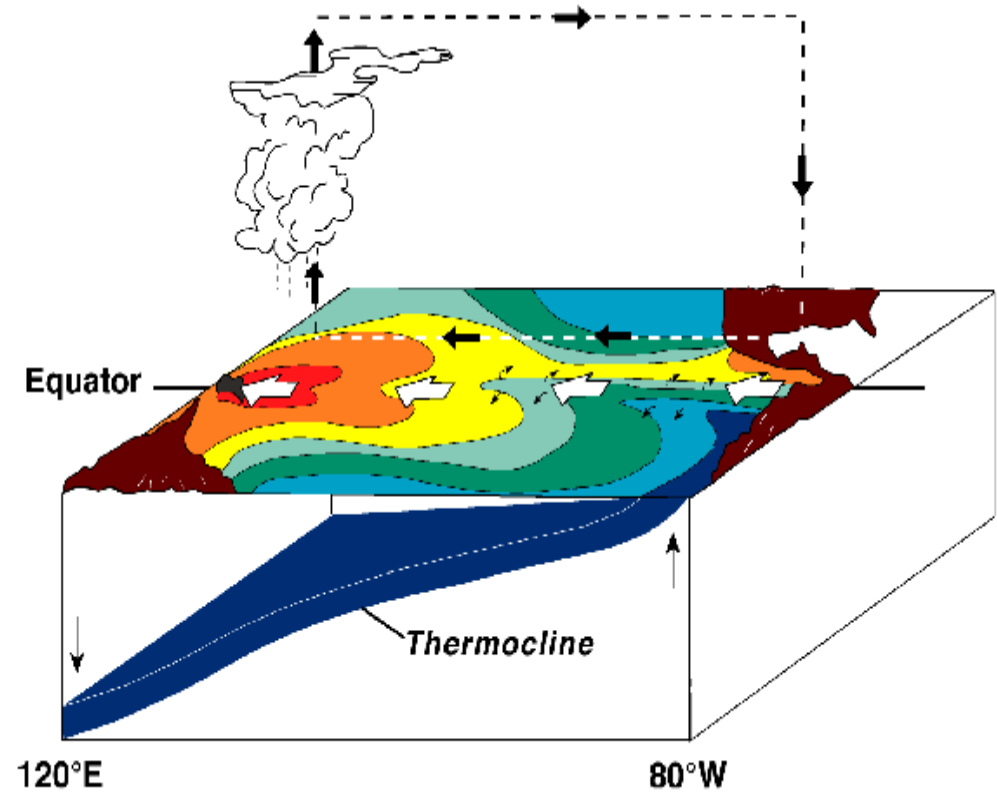
Air pressure change

El Niño Pattern

“Normal”

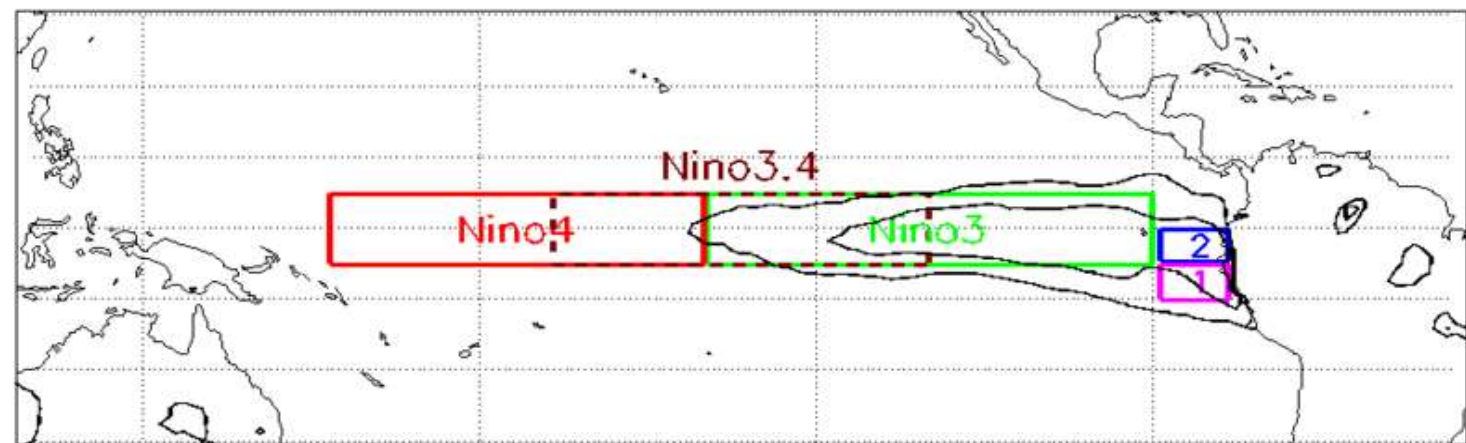
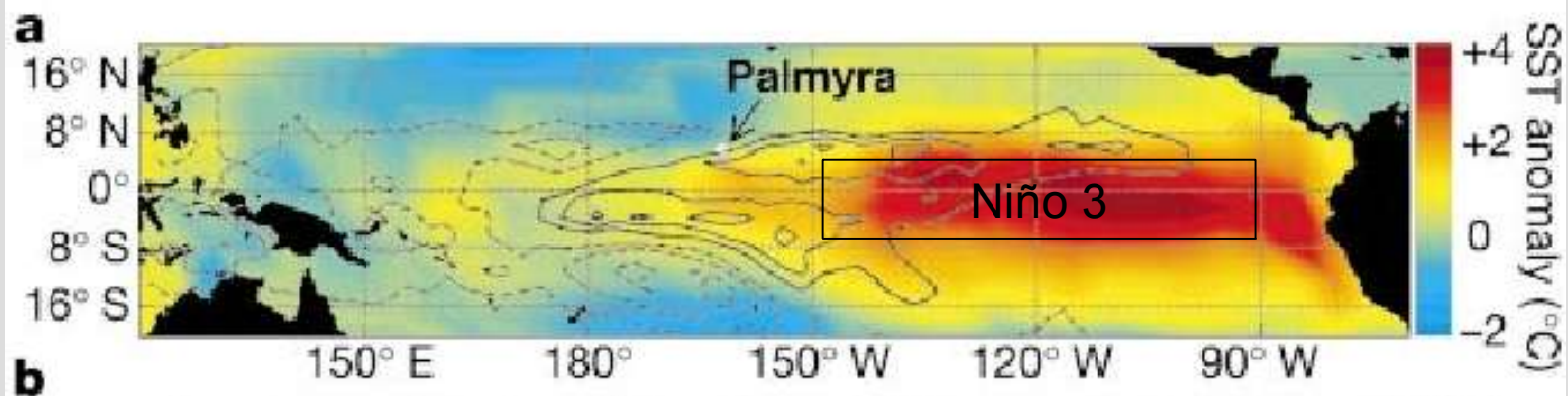


La Niña or Anti El Niño

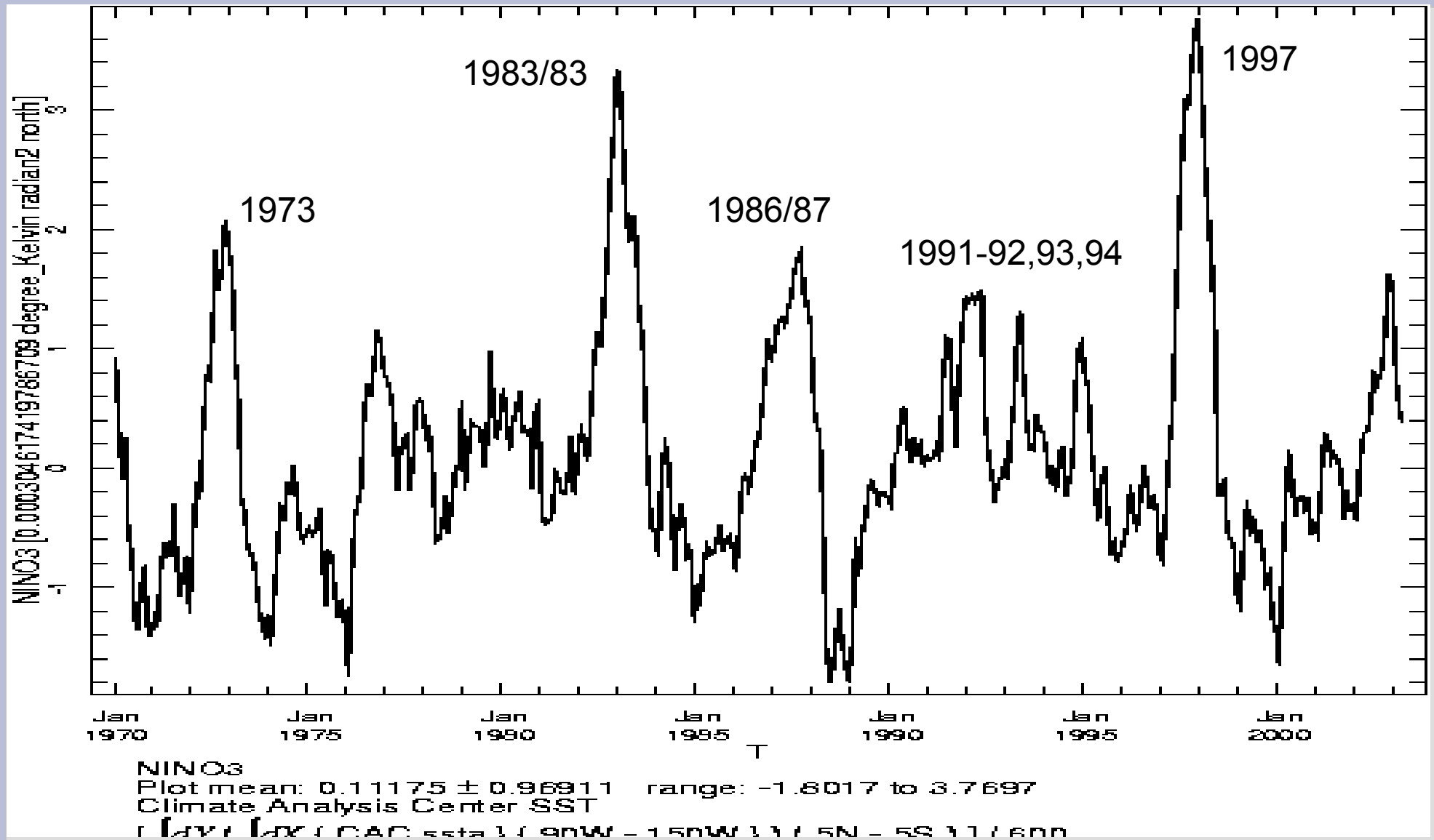


The Niño-3 Index

Average sea surface temperature (SST) over the eastern tropical Pacific (5°S-5°N; 150°-90°W)



El Niño

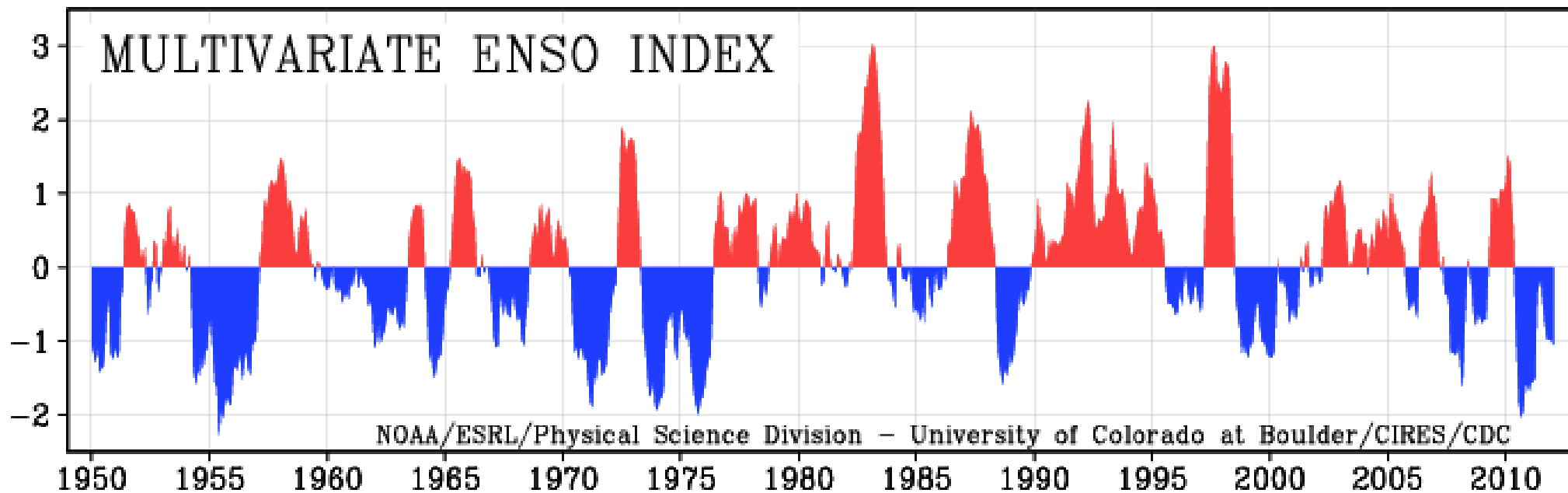


Major ENSO events

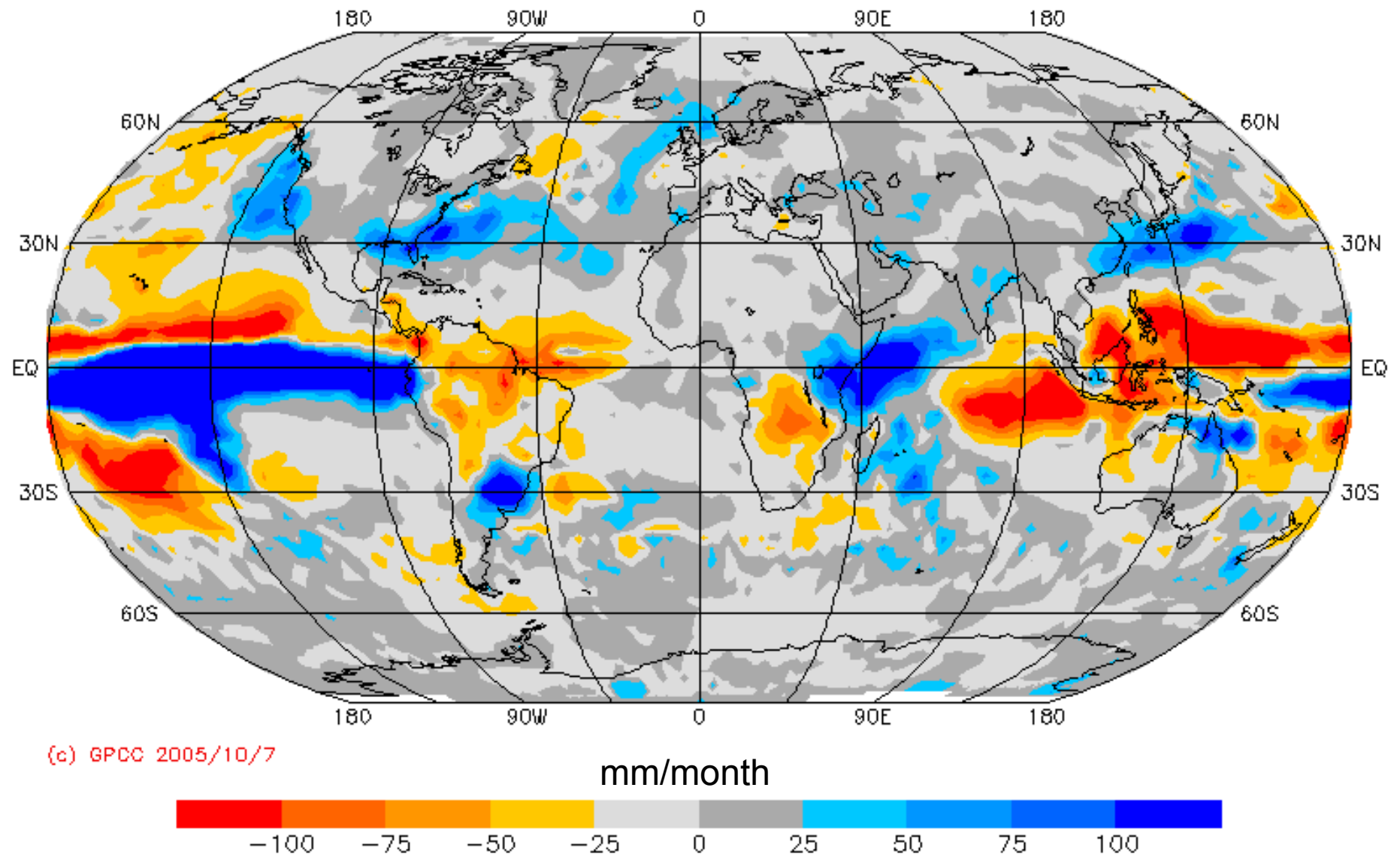
- 1790-93
- 1828
- 1876-78
- 1891
- 1925-26

82/83 86/87 97/98

Standardized Departure



Precipitation change in period Dec 1997-Feb 1998



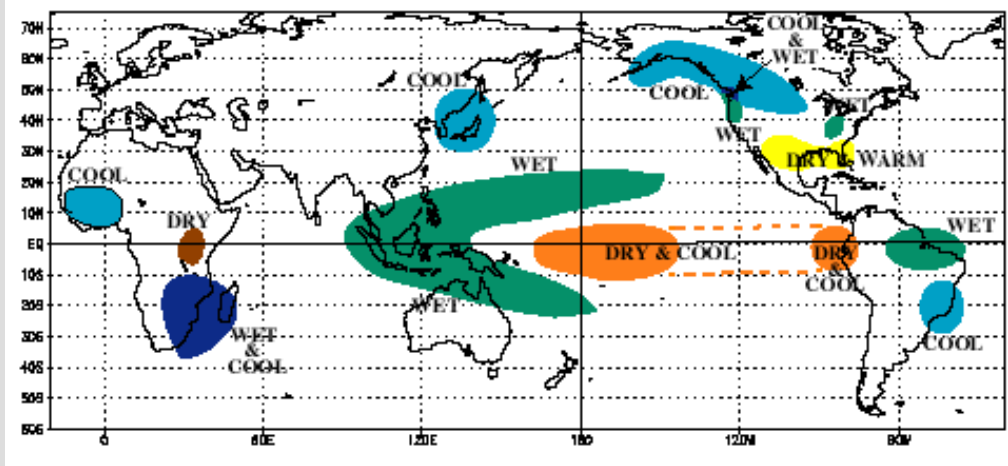
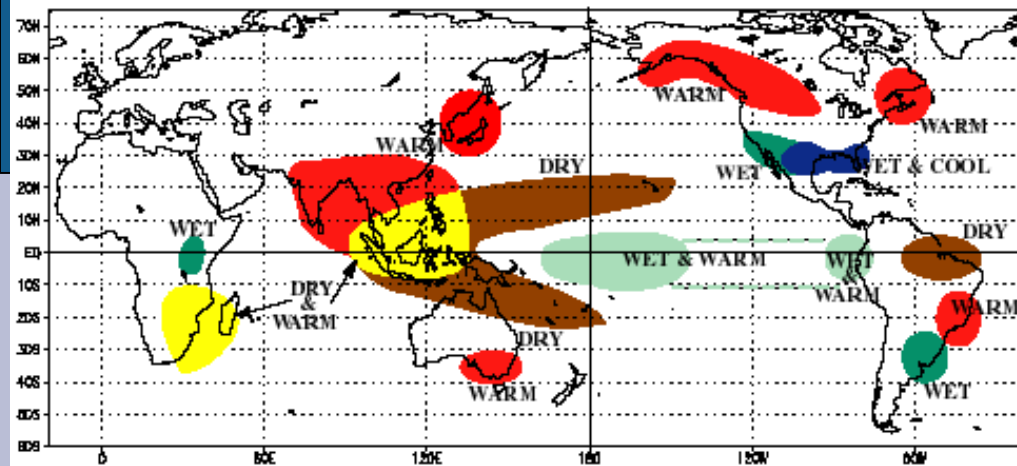
Teleconnections

El Niño

La Niña

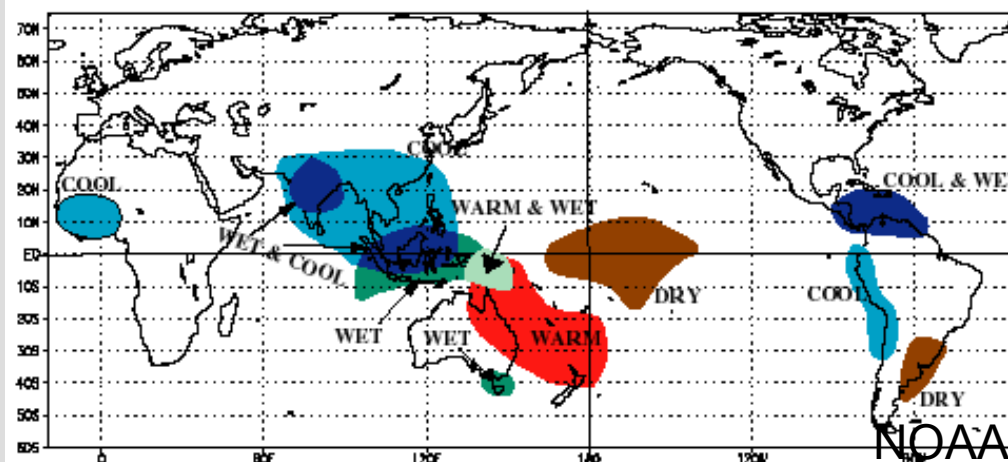
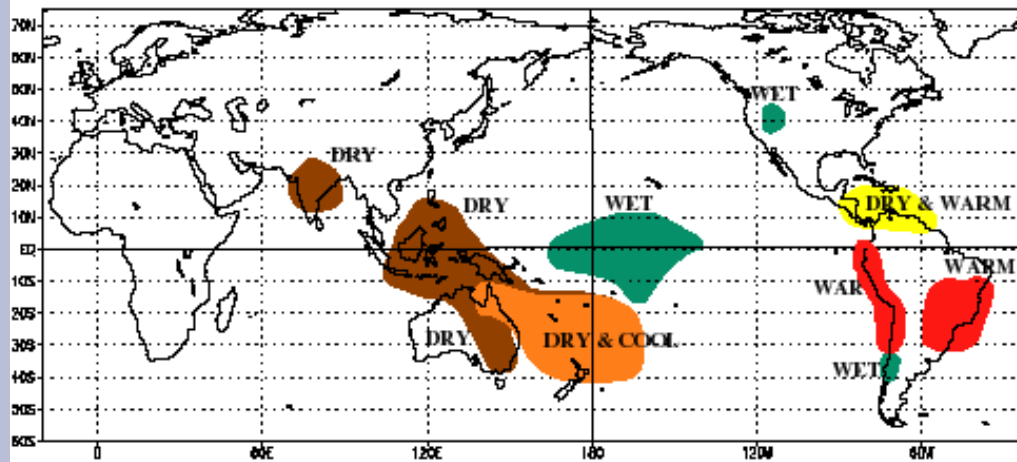
WARM EPISODE RELATIONSHIPS DECEMBER - FEBRUARY

COLD EPISODE RELATIONSHIPS DECEMBER - FEBRUARY

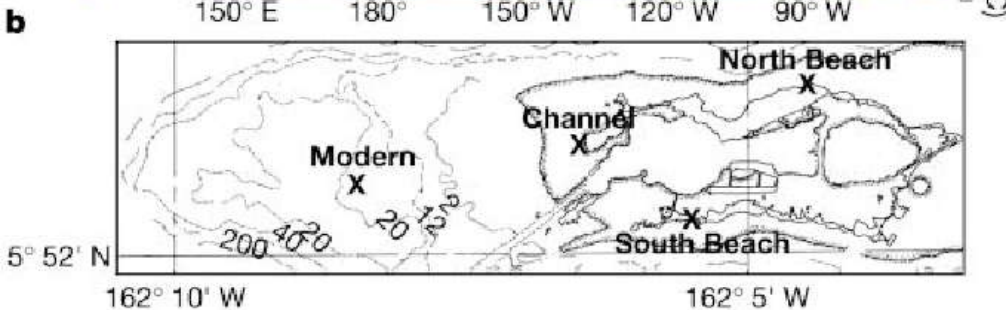
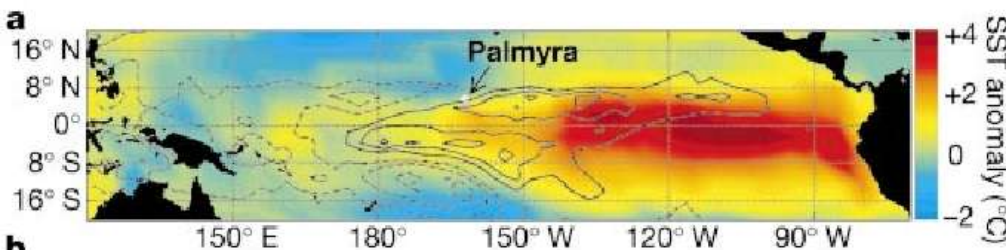
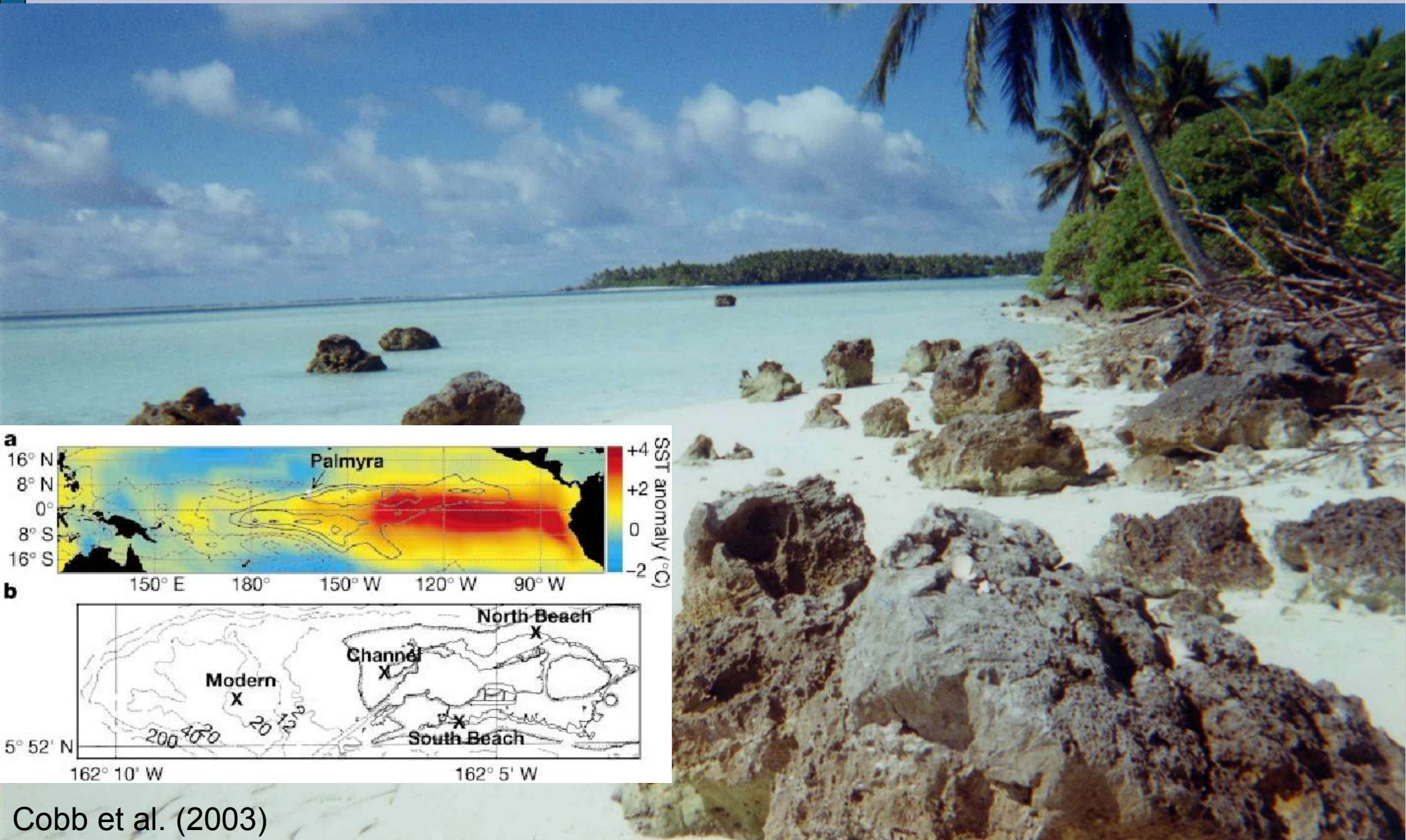


WARM EPISODE RELATIONSHIPS JUNE - AUGUST

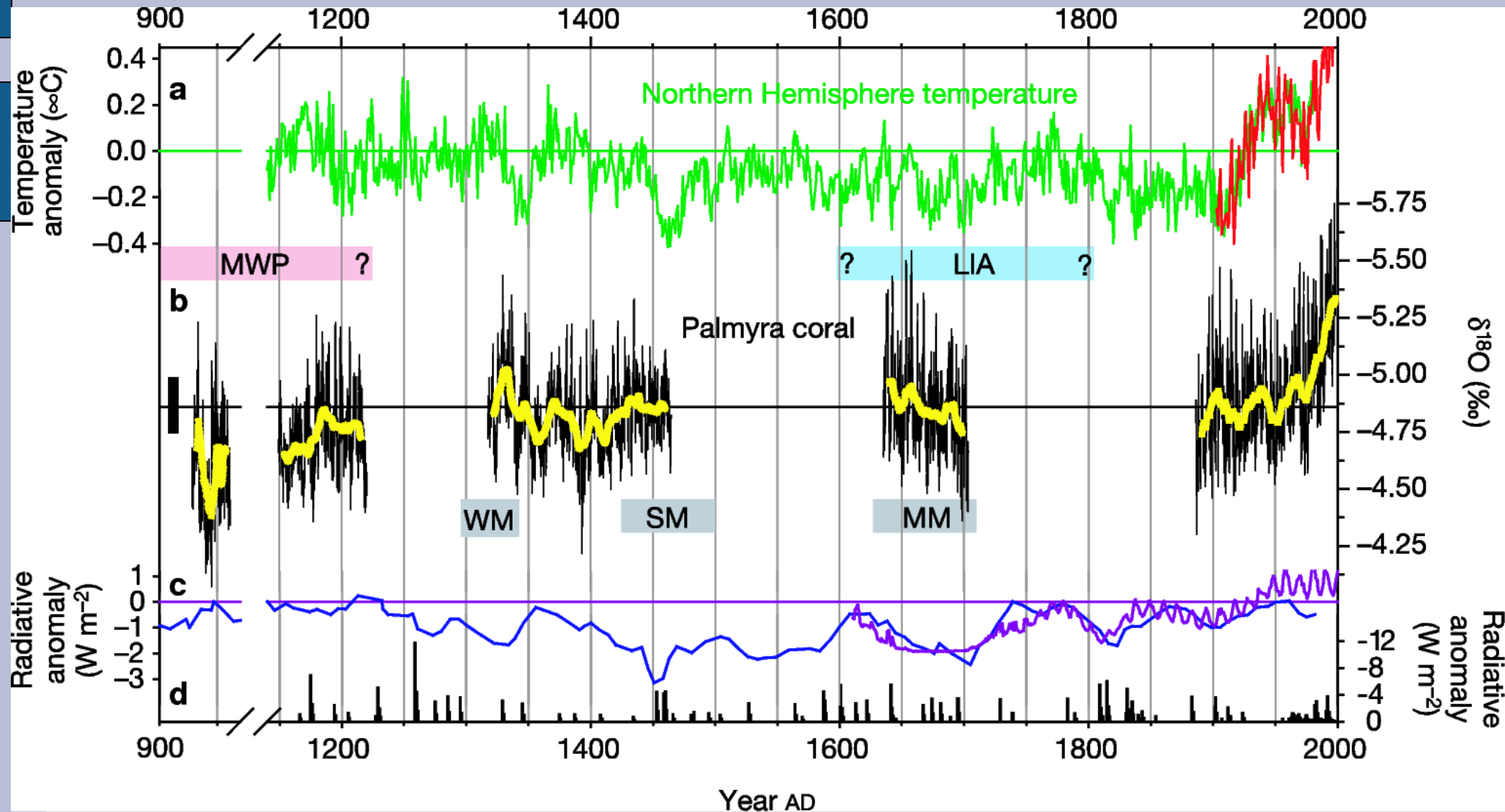
COLD EPISODE RELATIONSHIPS JUNE - AUGUST



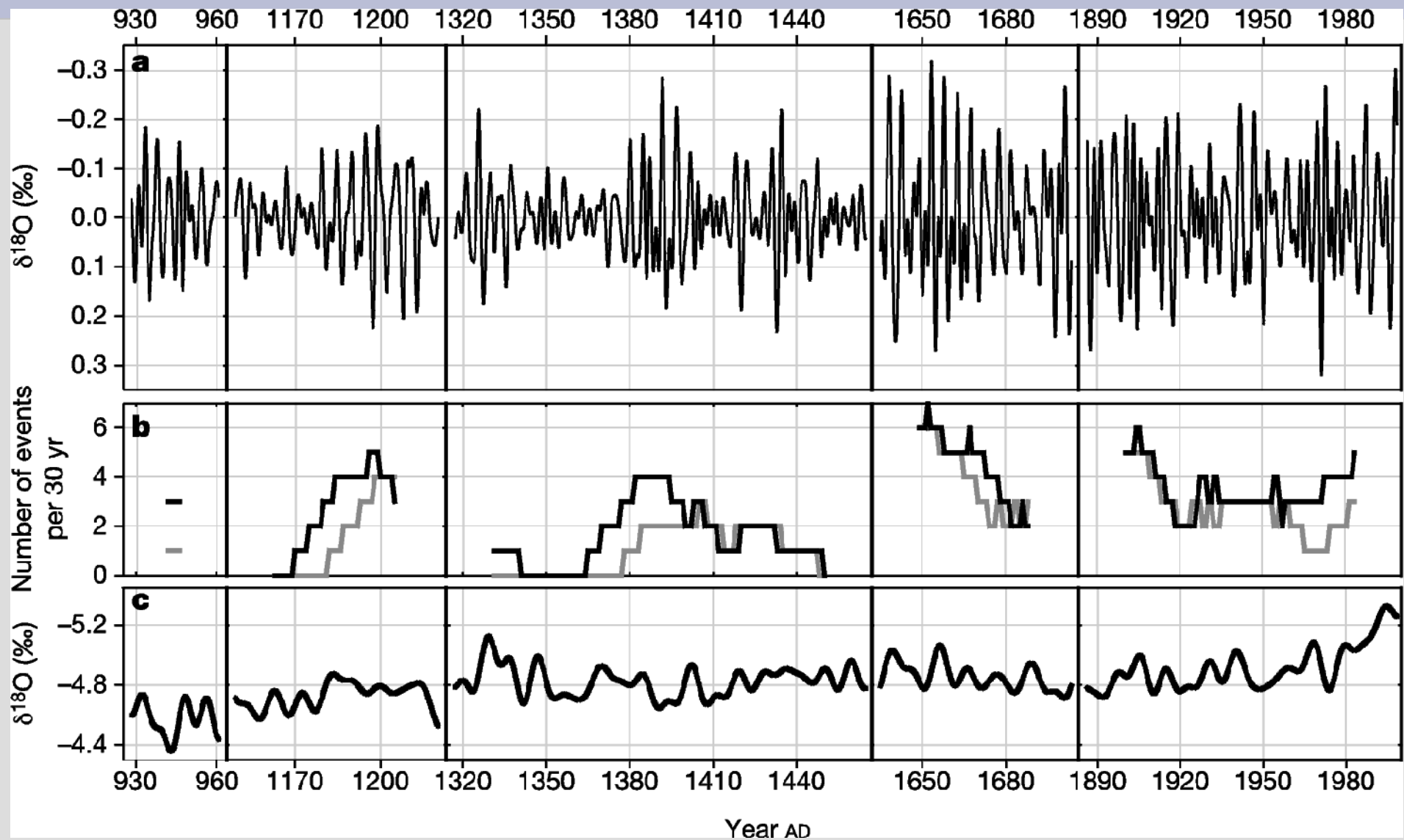
ENSO reconstruction



ENSO reconstruction

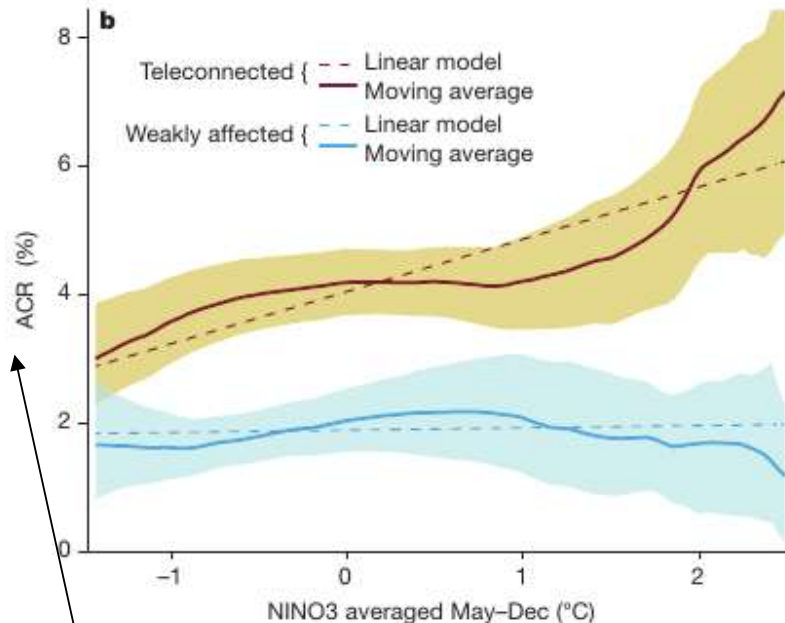
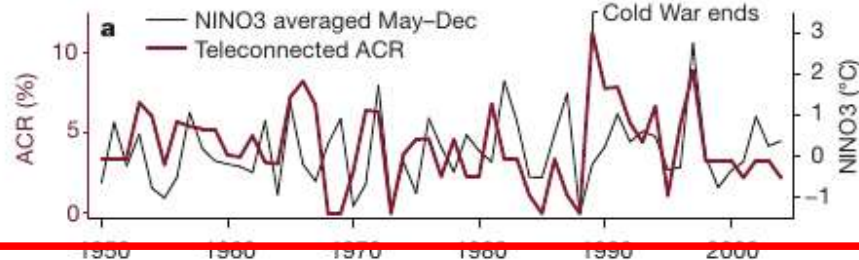
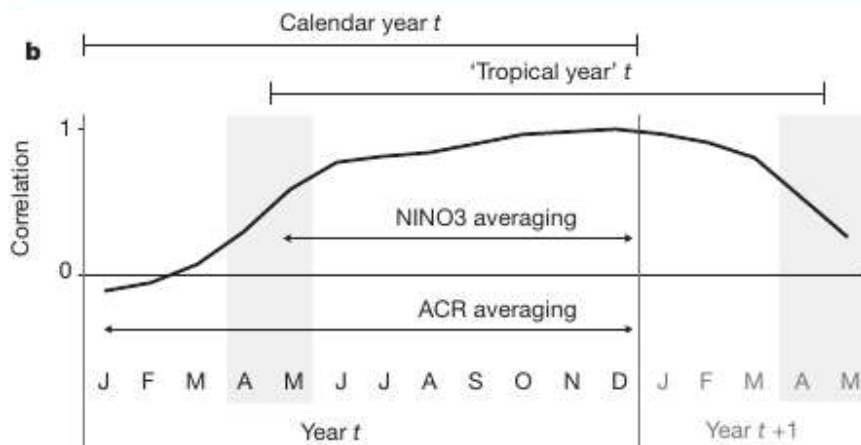
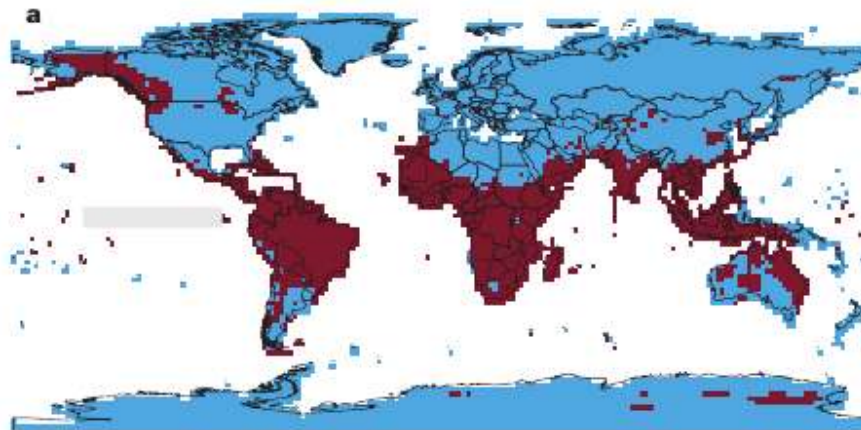


ENSO reconstruction



ENSO and conflicts?

Hsiang, S. M., Meng, K. C., & Cane, M. A. (2011). Civil conflicts are associated with the global climate. *Nature*, 476 (7361), 438-441.



Regions affected by ENSO

Regions not affected by ENSO

But: did not study underlying dynamics

ACR: Annual conflict risk

ENSO in the Past

Comparing reconstructed Nino 3 SST with global temperature patterns suggest

- that some features are robust through time, such as the warming in the eastern tropical Pacific and the western coasts of North and South America,
- whereas teleconnections into North America, the Atlantic and Eurasia are variable

IPCC (2007), p 482

ENSO during the Medieval Climate Anomaly was skewed toward stronger/more frequent La Niña than El Niño

Khider et al. (2011)

Angkor collapse 1431

Droughts ca 1340-80, 1400-20



Angkor Wat

Srah Sang Water reservoir



Buckley, B. M. Et al. (2010). Climate as a contributing factor in the demise of Angkor, Cambodia. *Proceedings of the National Academy of Sciences* , 107 (15), 6748-6752.

Day, M. B. Et al. (2012). Paleoenvironmental history of the west Baray, Angkor (Cambodia). *Proceedings of the National Academy of Sciences* , 109 (4), 1046-1051.

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