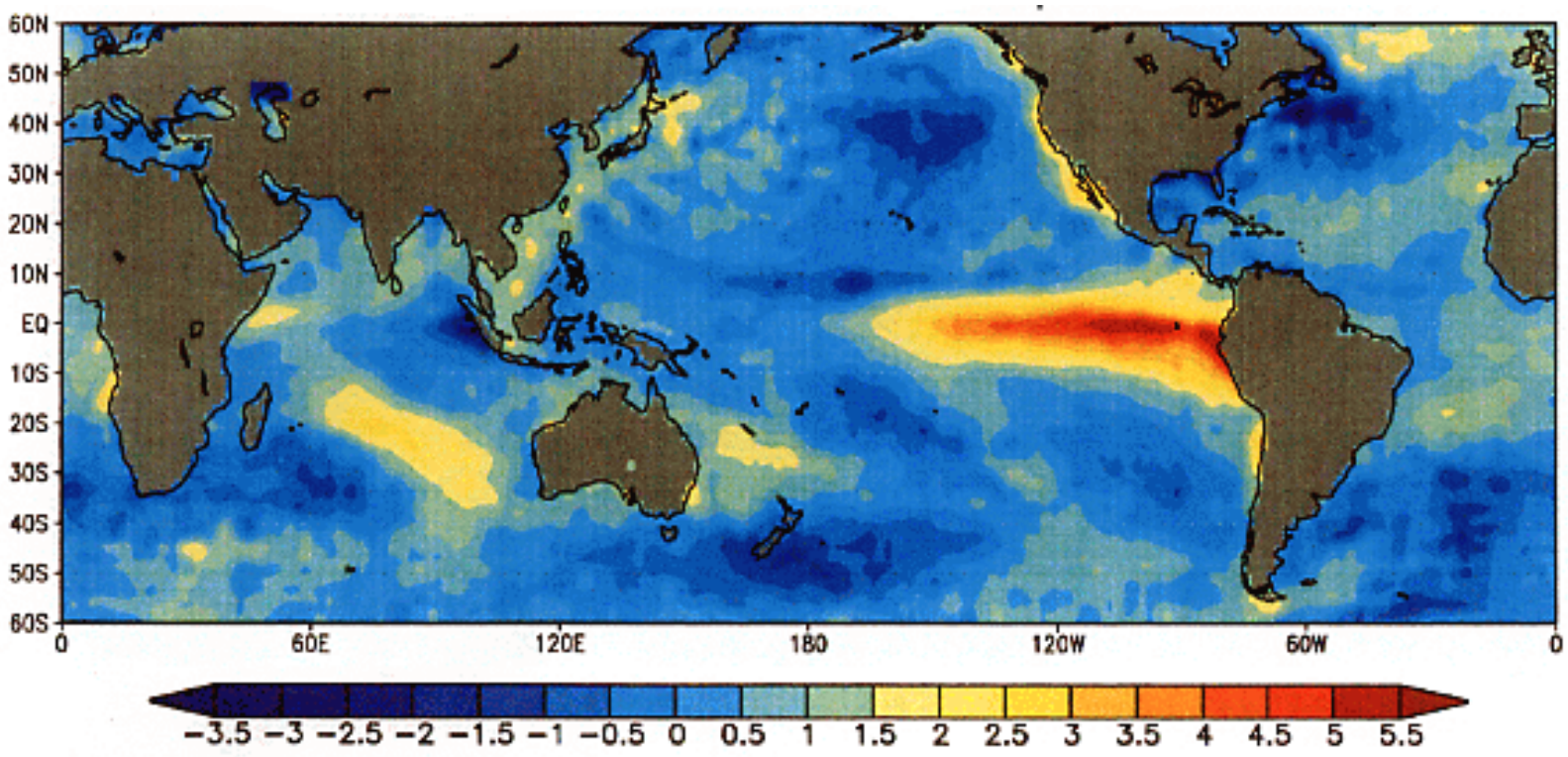
El Niño and La Niña

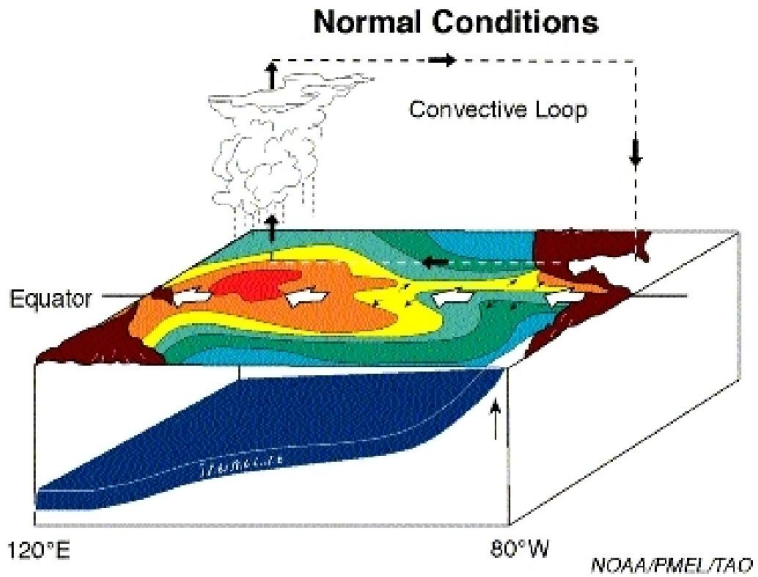


Normal & El Niño Model

- http://esminfo.prenhall.com/science/geoanimations/animations/26_NinoNina.html

Normal Conditions

- Air pressure across equatorial Pacific is higher in eastern Pacific
- Strong southeast trade winds
- Pacific warm pool on western side
- Thermocline deeper on western side
- Upwelling off the coast of Peru



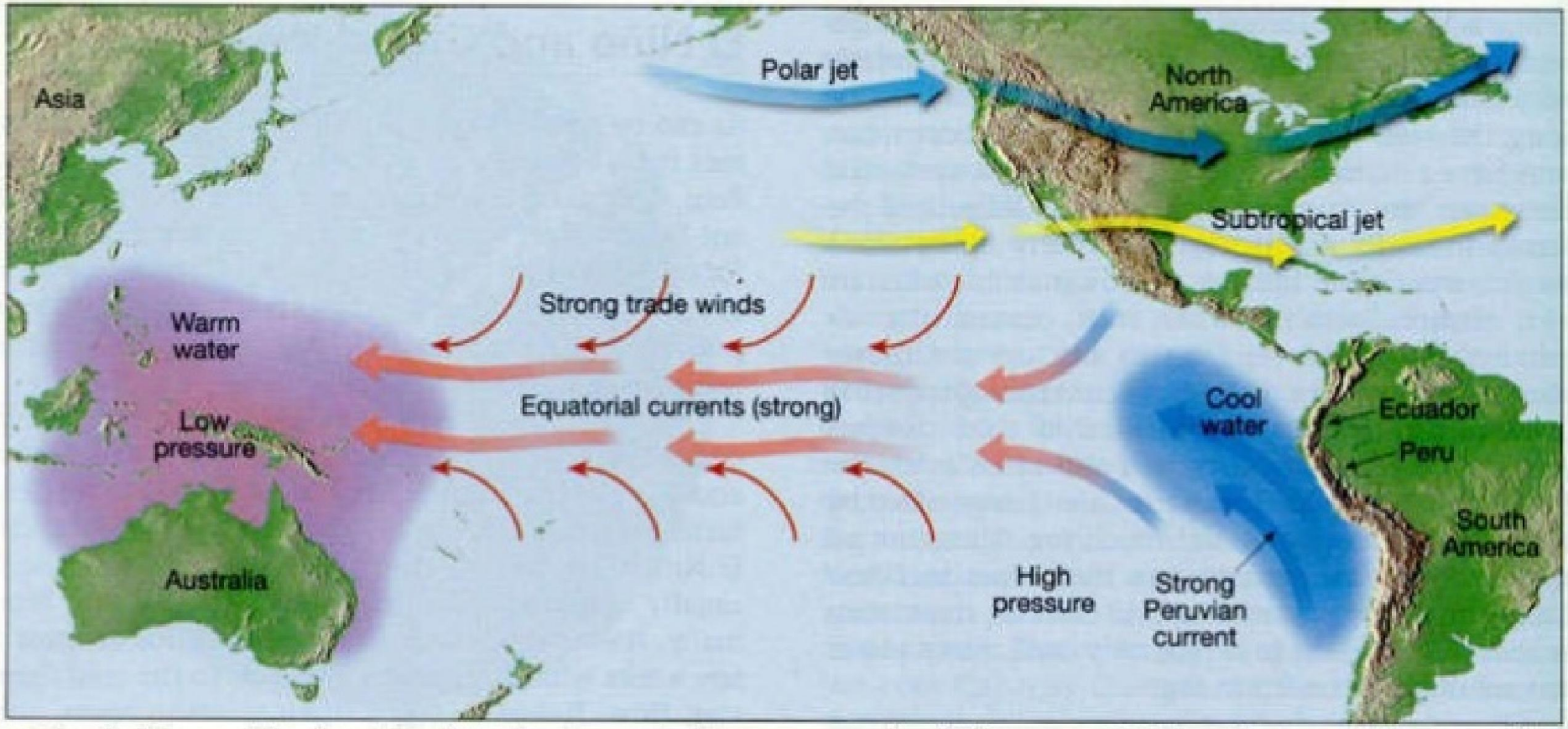
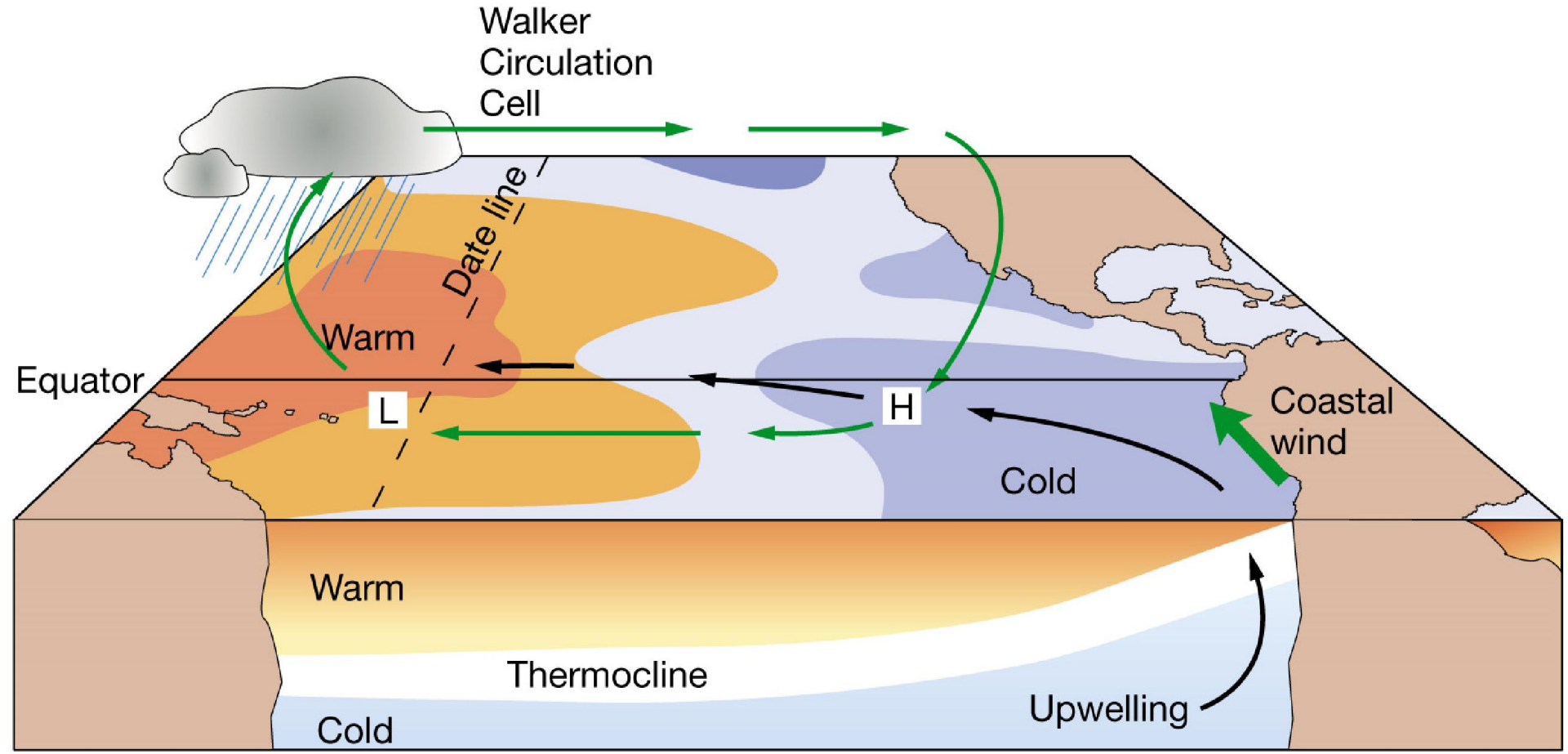


Fig.6 Normally, the trade winds and strong equatorial currents flow toward the west. At the same time, an intense Peruvian current causes upwelling of cold water along the west coast of South America.

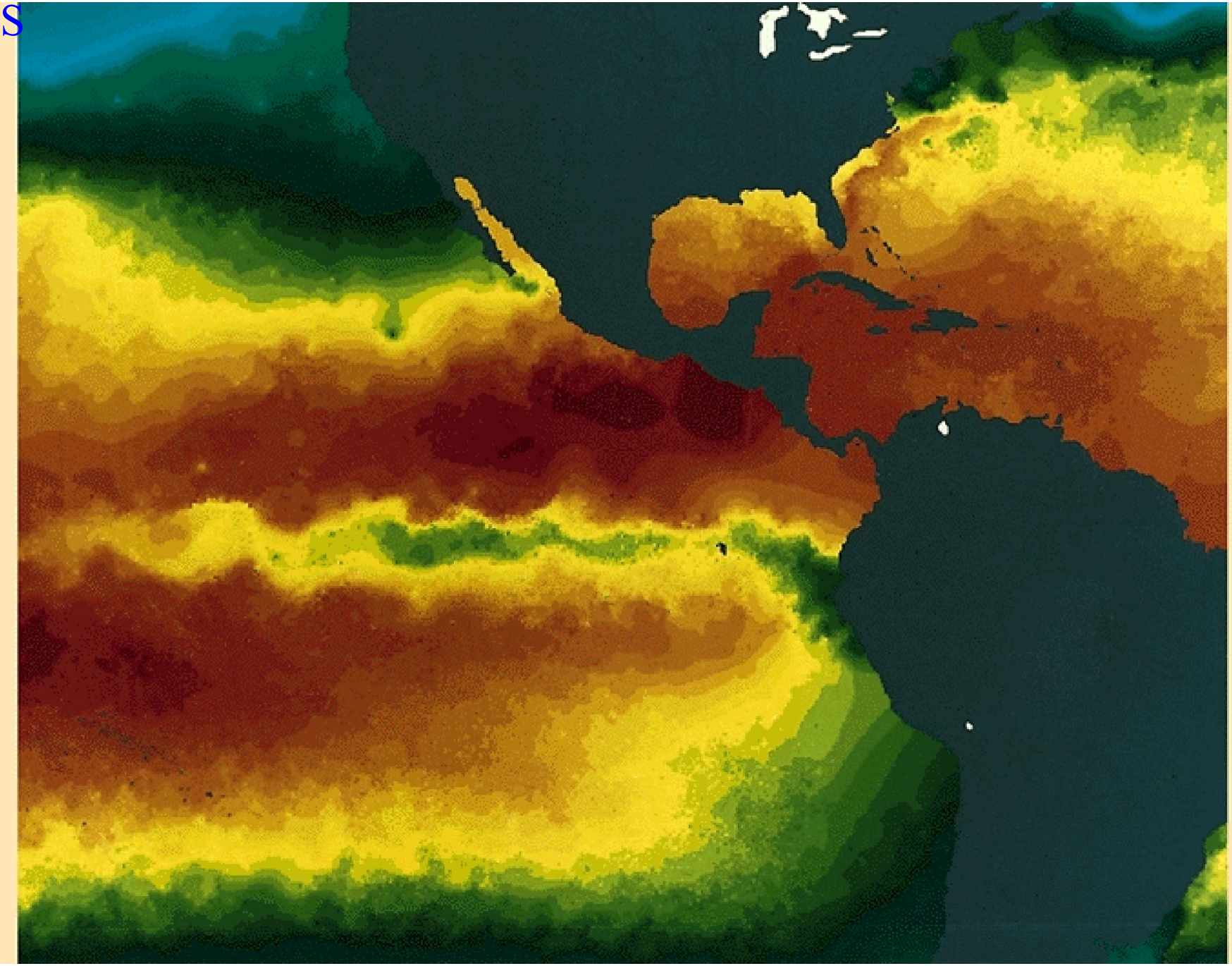
Normal conditions



(a) Normal conditions

Fig. 7.18 a

S



SST 5/31/1988 Normal, non- El Nino

El Niño-Southern Oscillation (ENSO)

- Trade winds weaken
- Warm countercurrents become unusually strong and replace normally cold offshore waters with warm equatorial waters
- High pressure in eastern Pacific weakens
- Warm pool migrates eastward
- Thermocline deeper in eastern Pacific
- Downwelling
- Lower biological productivity
  - Corals particularly sensitive to warmer seawater

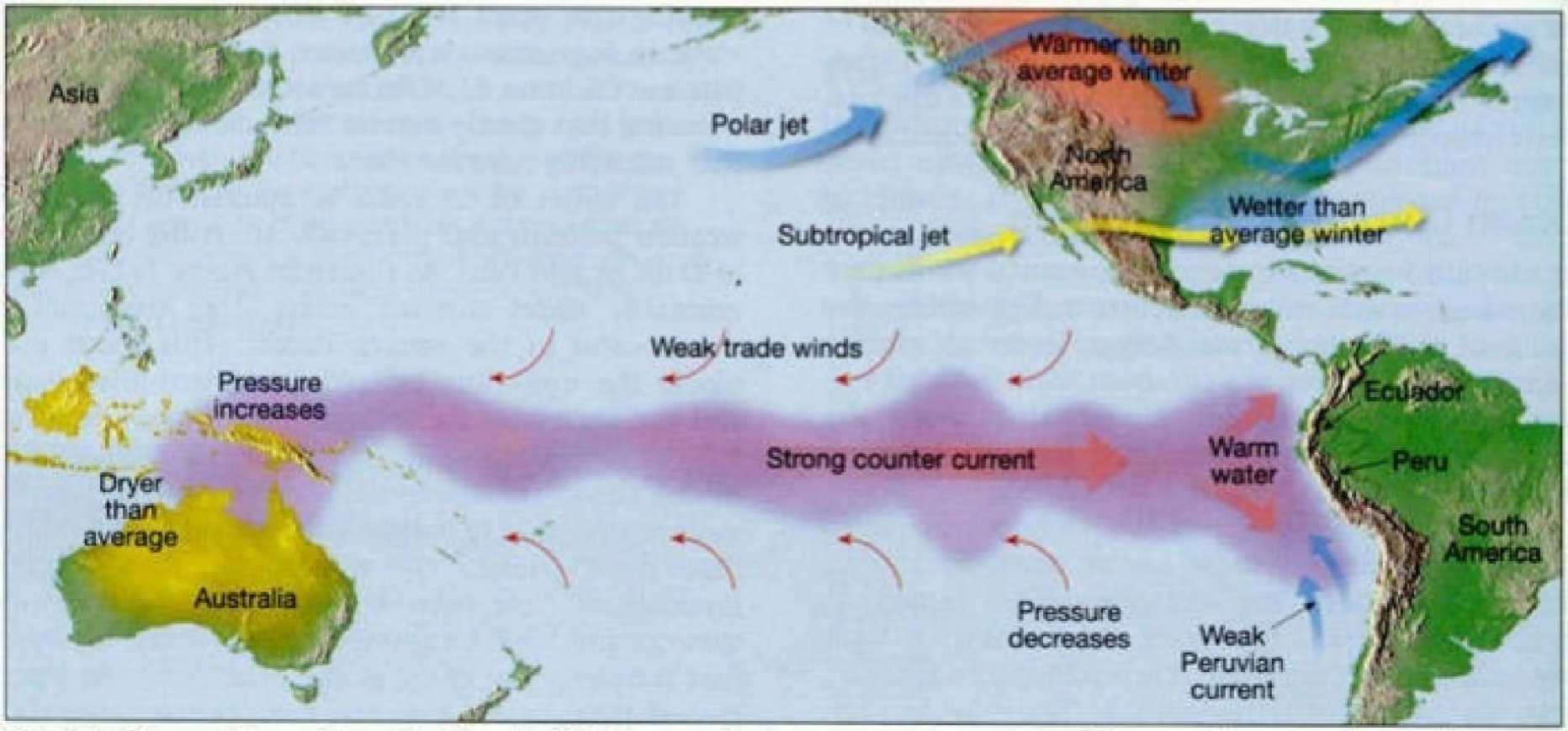
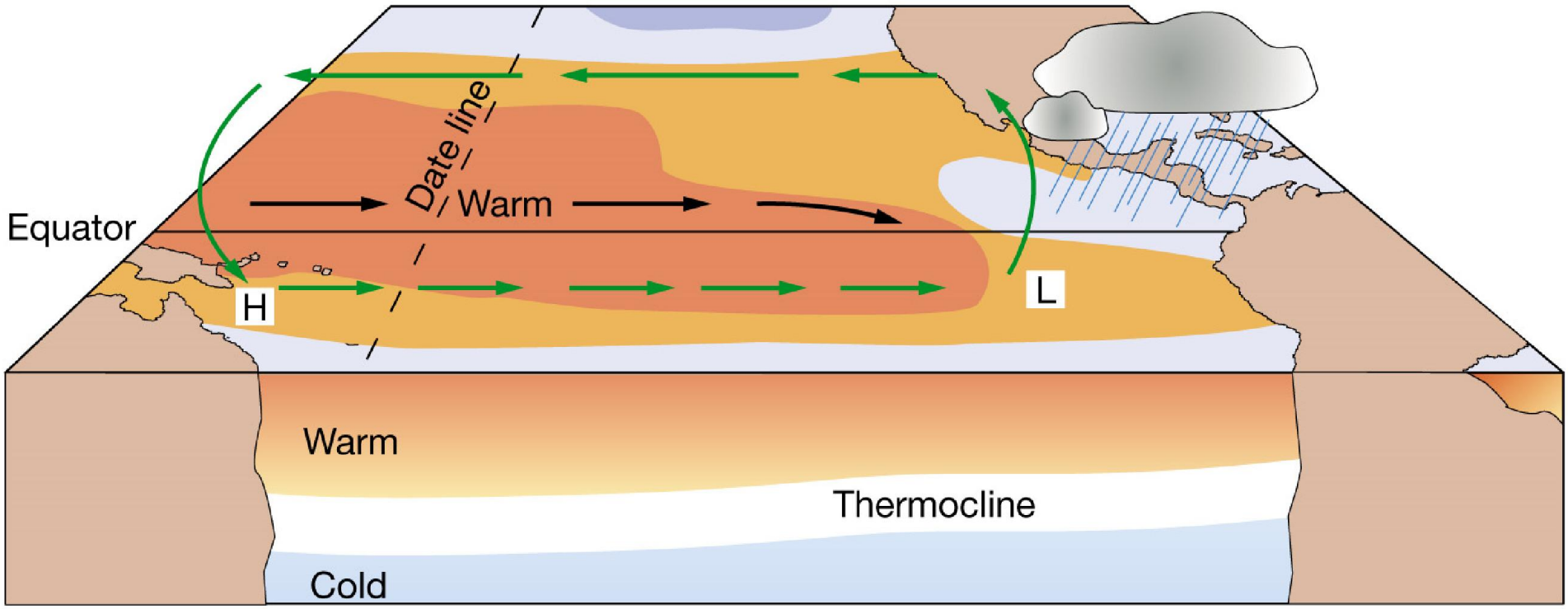


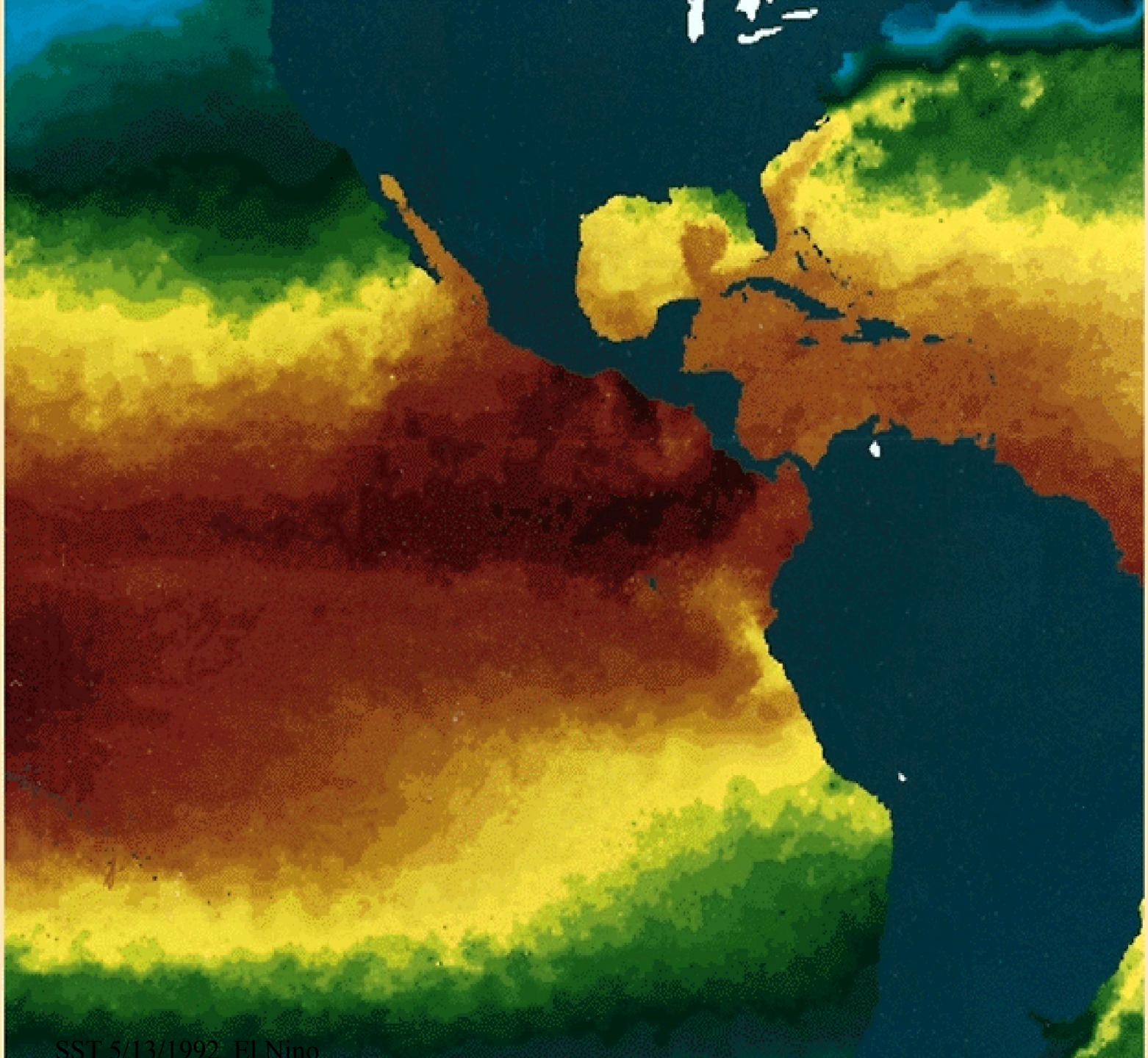
Fig.14 Upon the advent of an ENSO event, the pressure over the eastern and western Pacific flip-flops. This causes the trade winds to diminish, leading to an eastward movement of warm water along the equator. As a result, the surface waters of the central and eastern Pacific warm, with far-reaching consequences to weather patterns.

El Niño-Southern Oscillation (ENSO): Warm phase (El Niño)



(b) El Niño conditions

Fig. 7.18 b



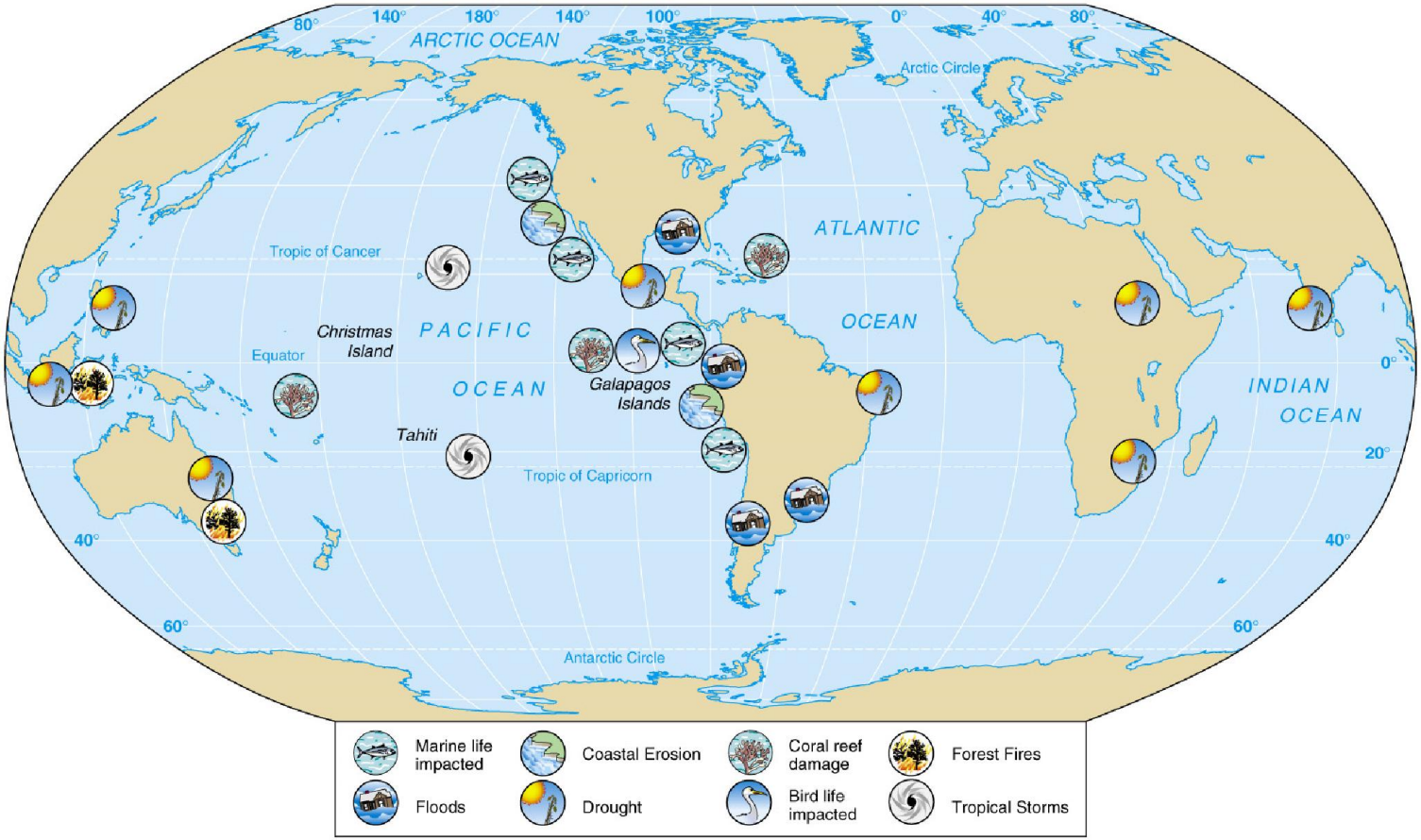
SST 5/13/1992 El Nino

Global consequences of El Niño

- El Niño has global consequences and is both an atmospheric and oceanic phenomena
- Drought in SE Asia and Australia
- Flooding and increased rainfall in S. America
- Strong winter storms on US West Coast
- Northward displacement of Jet Stream
- Weaker trade winds
- Causes more winter rain in Texas, mild winter in Midwest

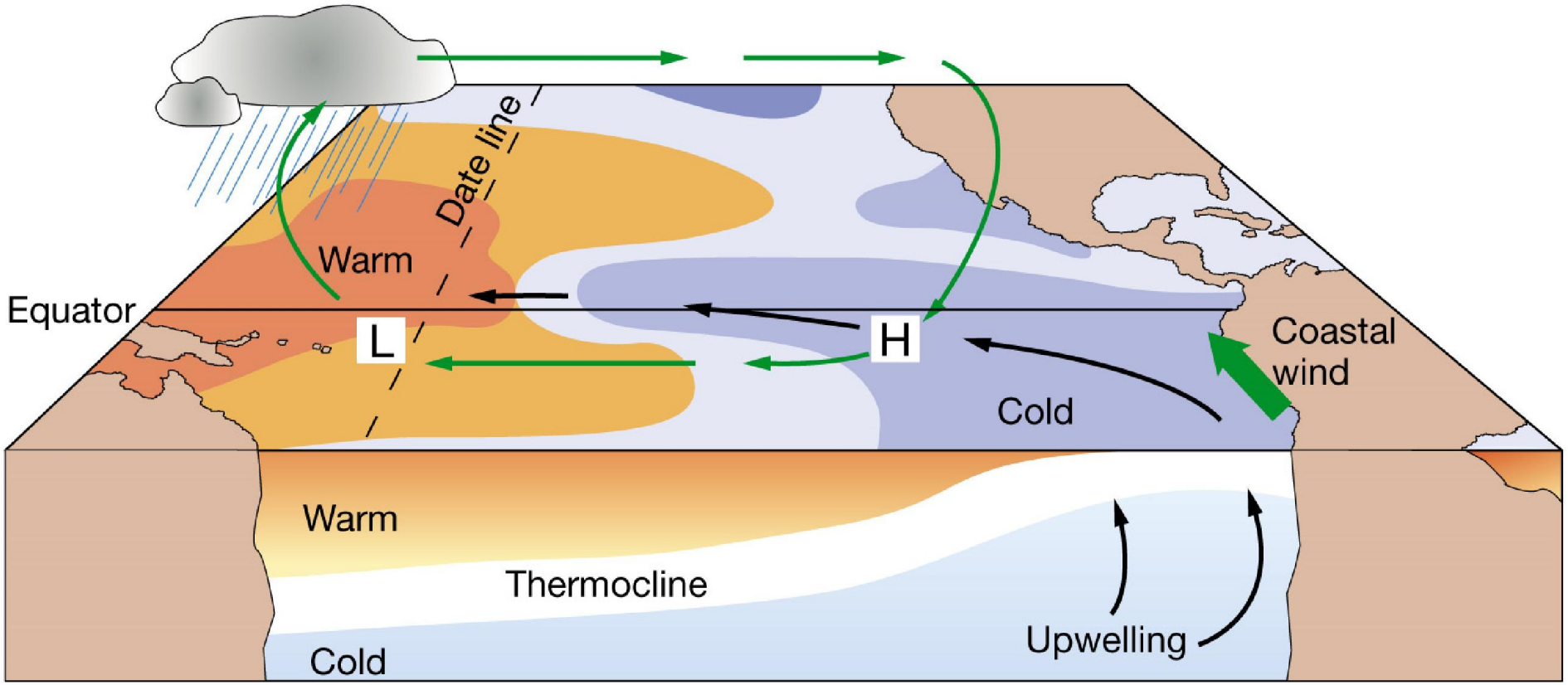
ENSO events

- Strong conditions influence global weather
- Flooding, drought, erosion, fires, tropical storms, harmful effects on marine life

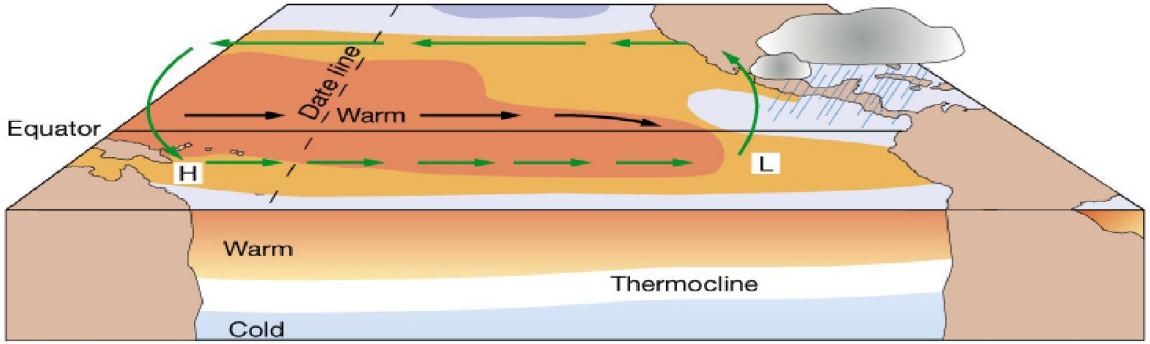


La Niña

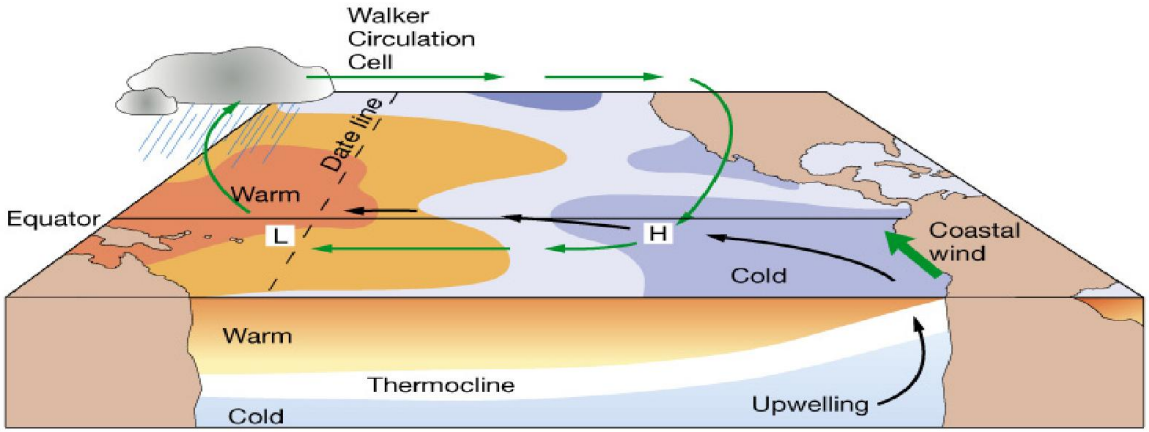
- Opposite of El Niño
- When surface temperatures in the eastern Pacific are colder than average
- During La Niña winter-lots of colder than normal air blows over the Pacific Northwest, but warms the rest of the US
  - Trade winds are especially strong
- Can also increase hurricane activity



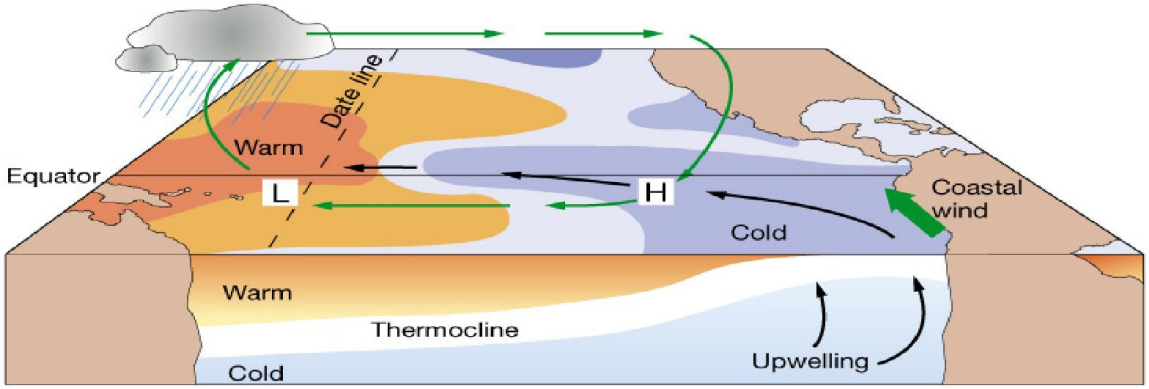
(c) La Niña conditions



El Niño conditions



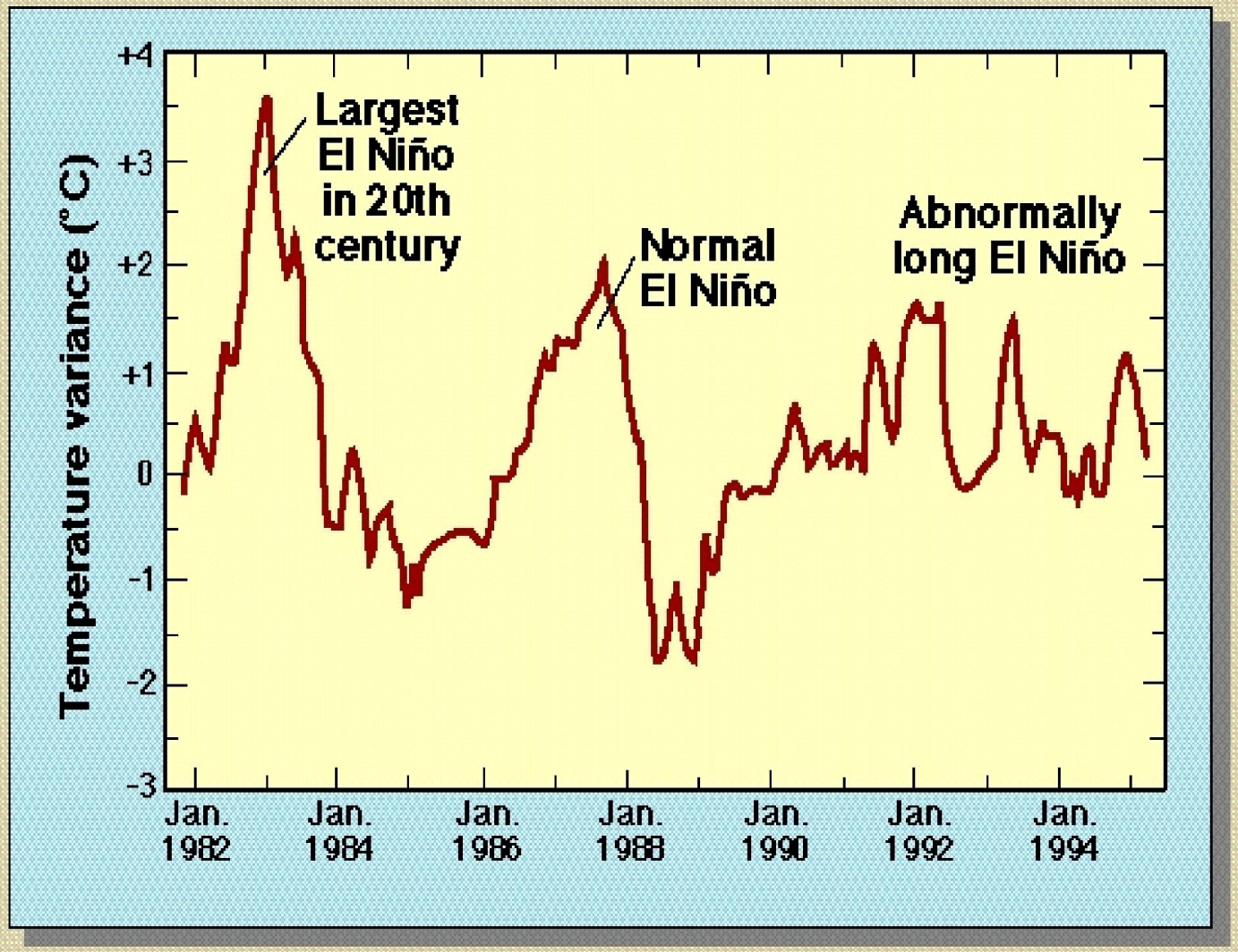
Normal conditions

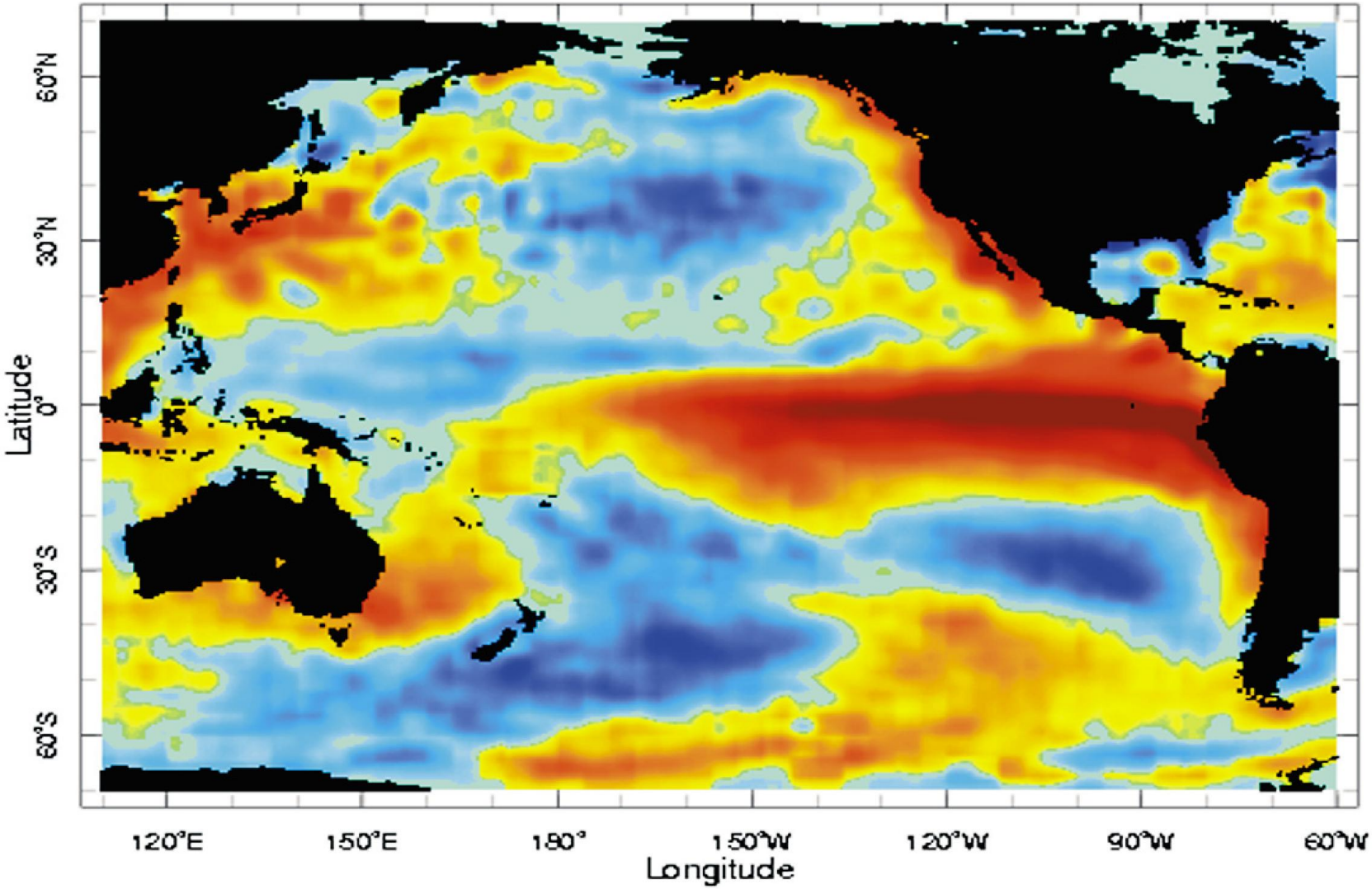


La Niña conditions

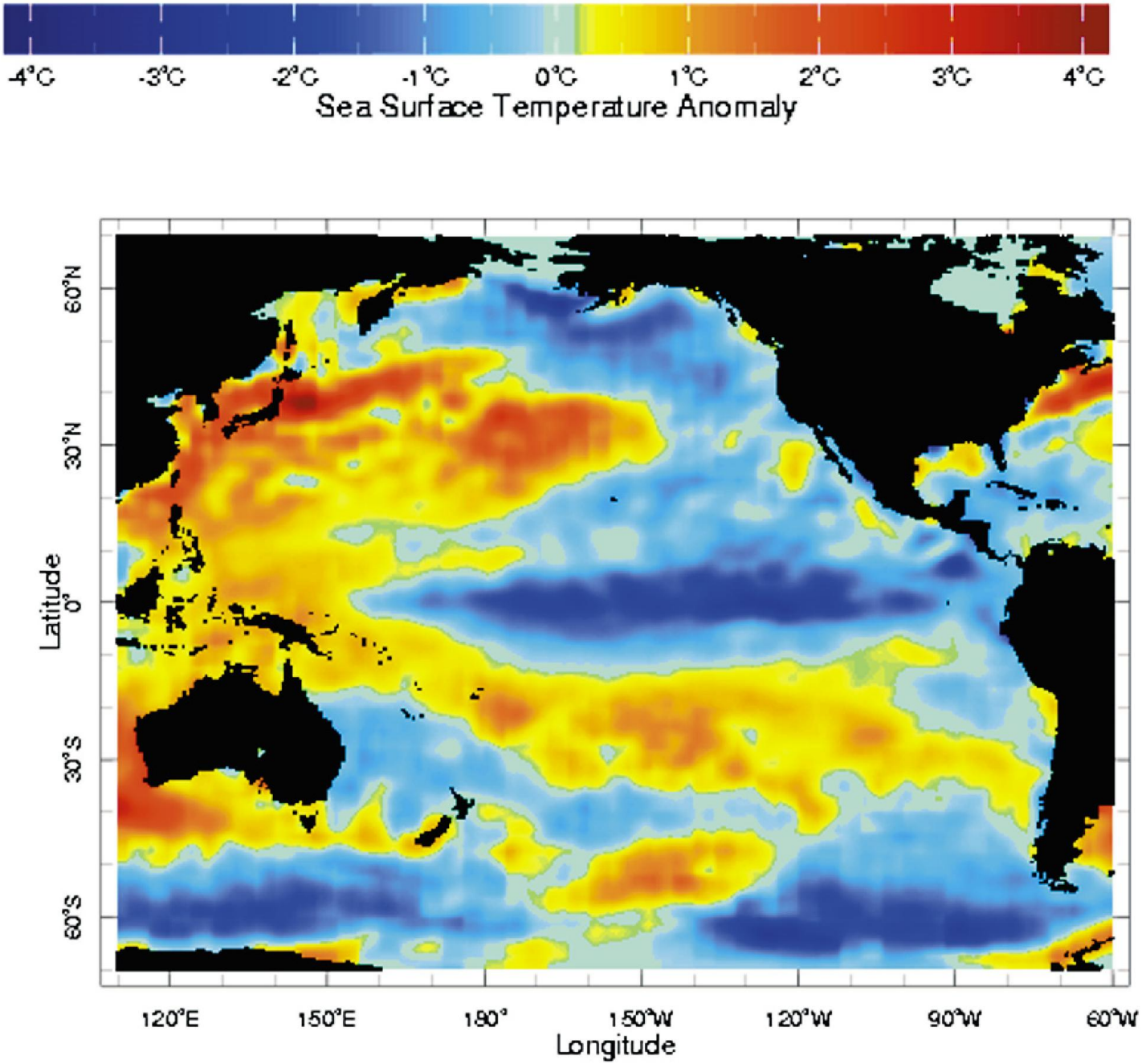
Weak and Strong El Niños

Eastern Pacific Water Temperatures





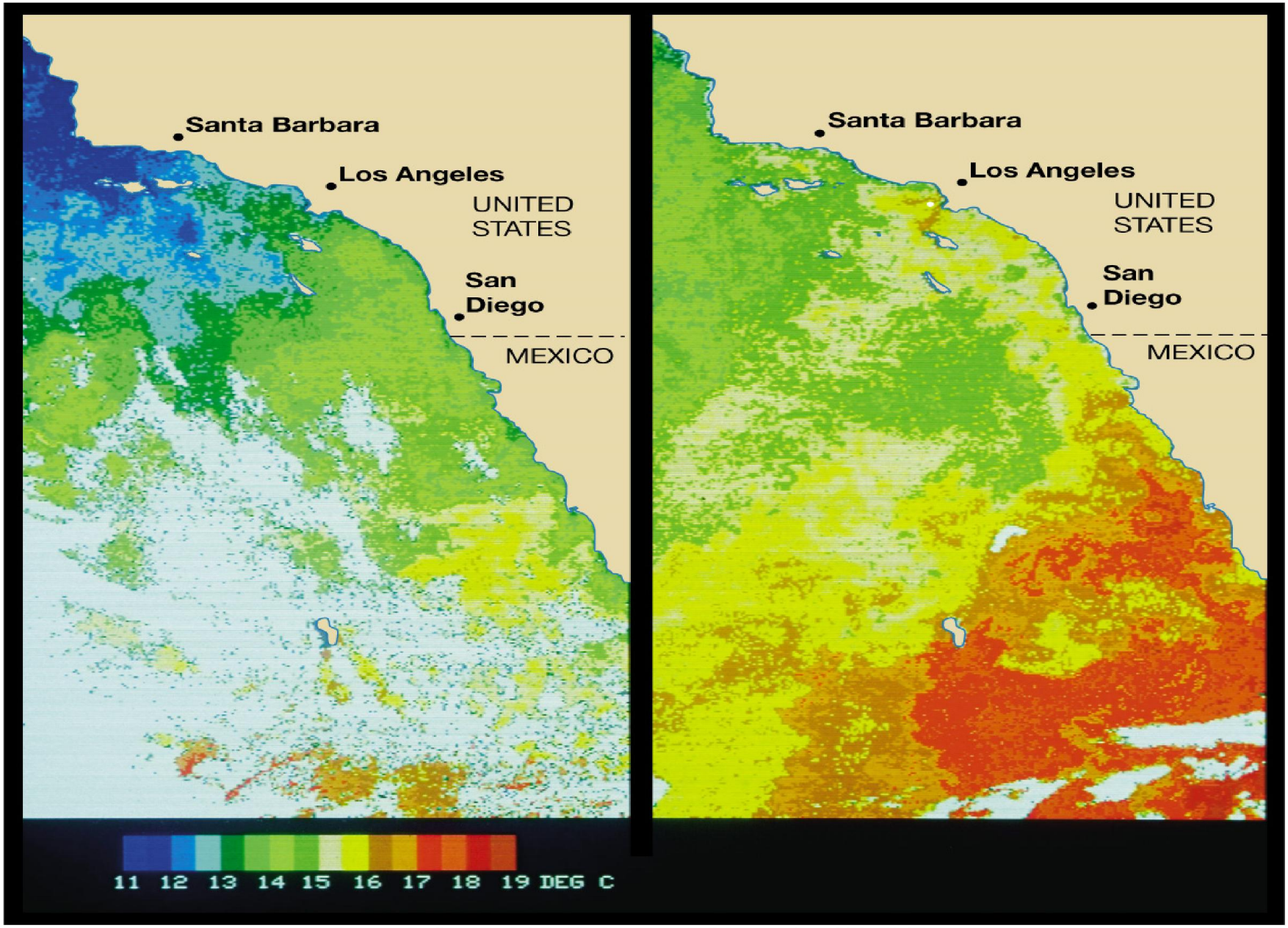
(a) Jan 1998



(b) Jan 2000

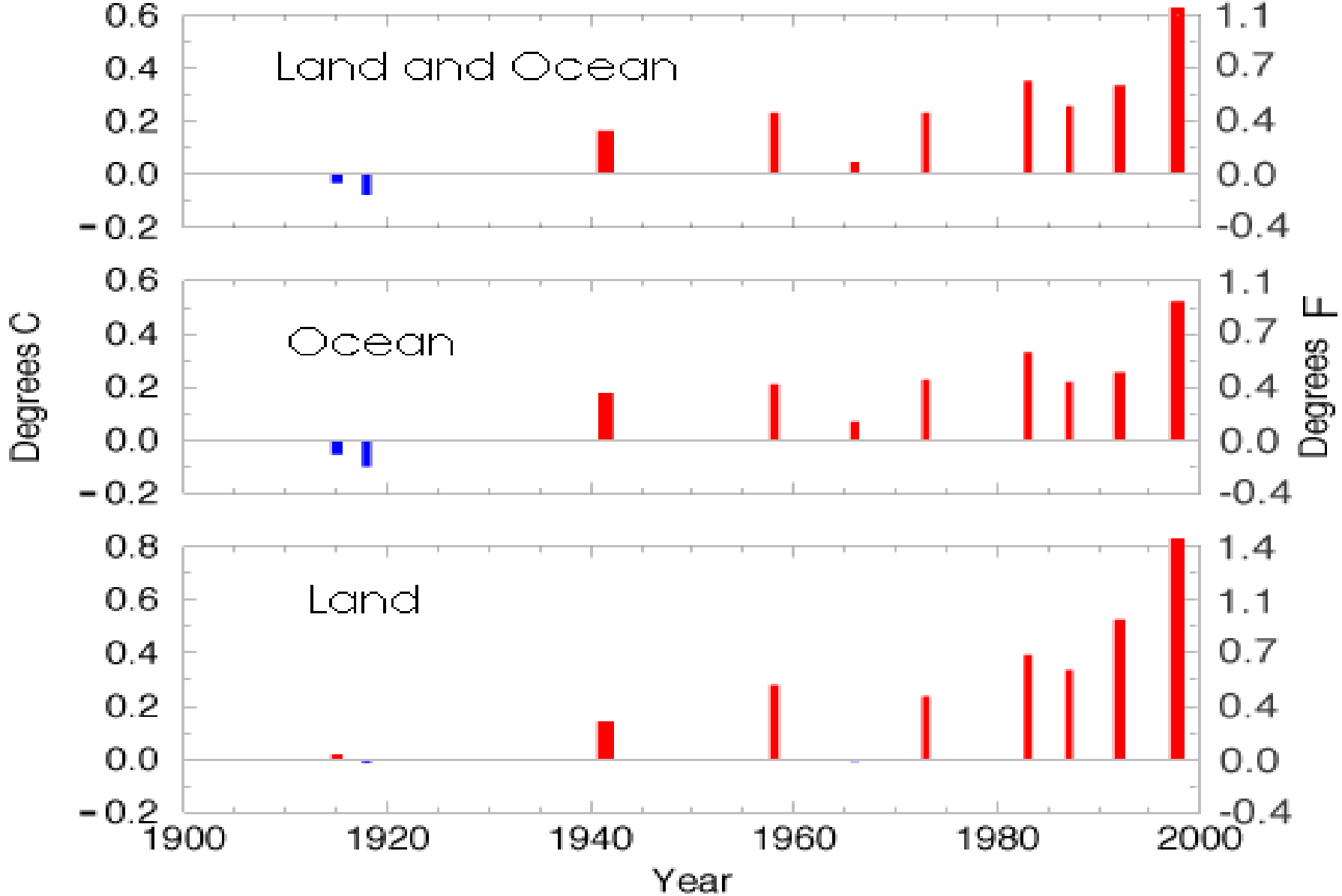
(a) Normal

(b) El Nĩno



Top 10 El Nino Events of this Century

Global Surface Mean Temperature Anomalies



ENSO events

- El Niño warm phase about every 3 to 8 years
- Highly irregular
- Phases usually last 12 to 18 months
- Currently in El Niño!

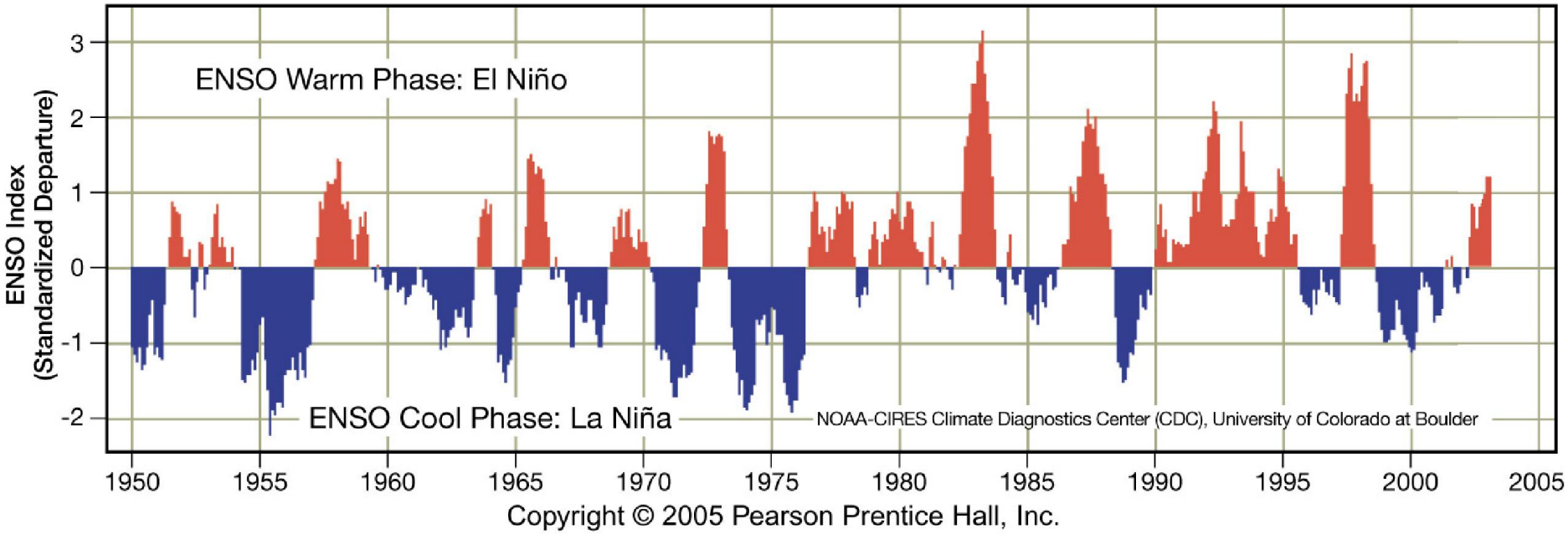


Fig. 7.20