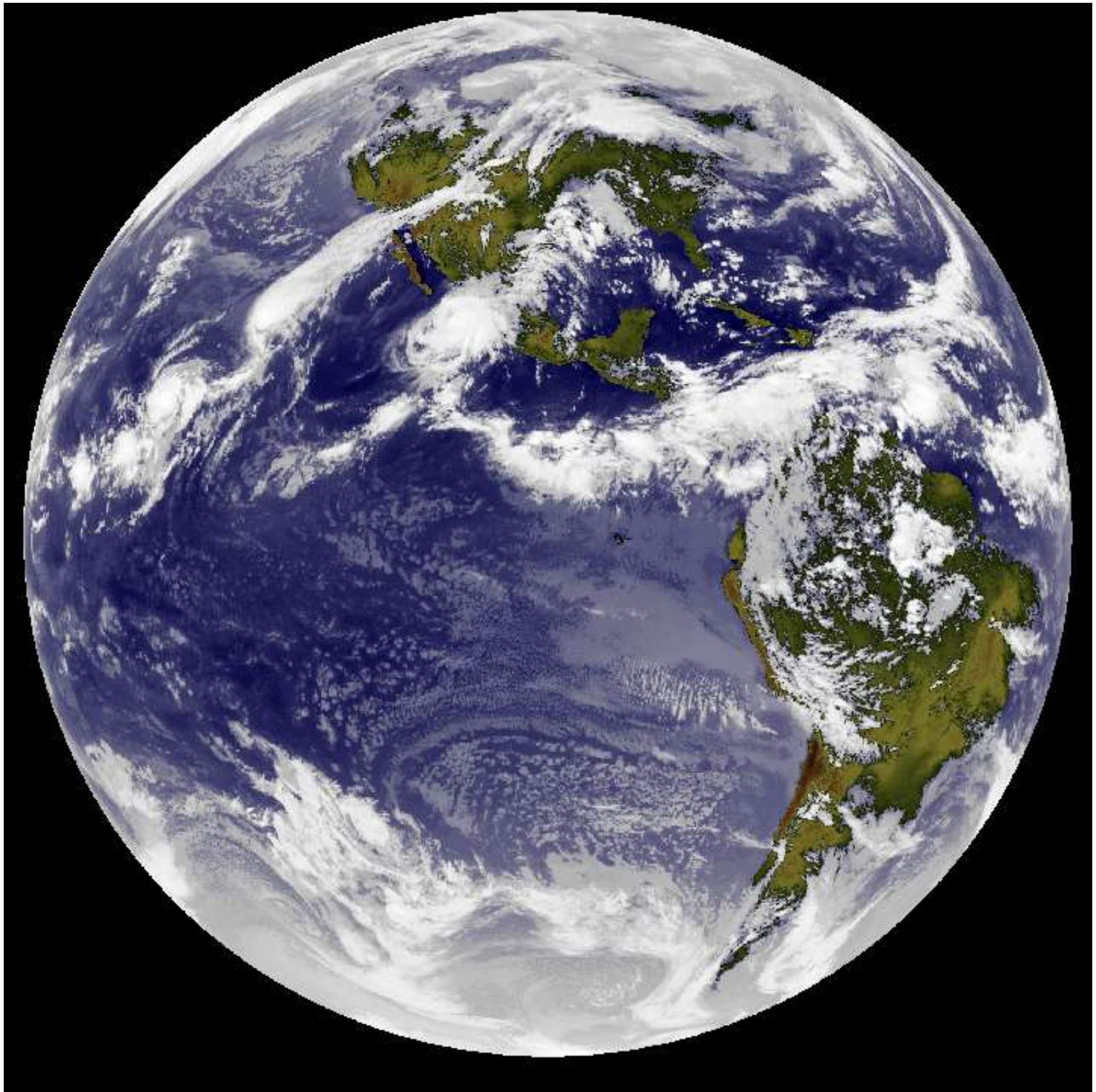
Tropical areas: geography and abiotic conditions

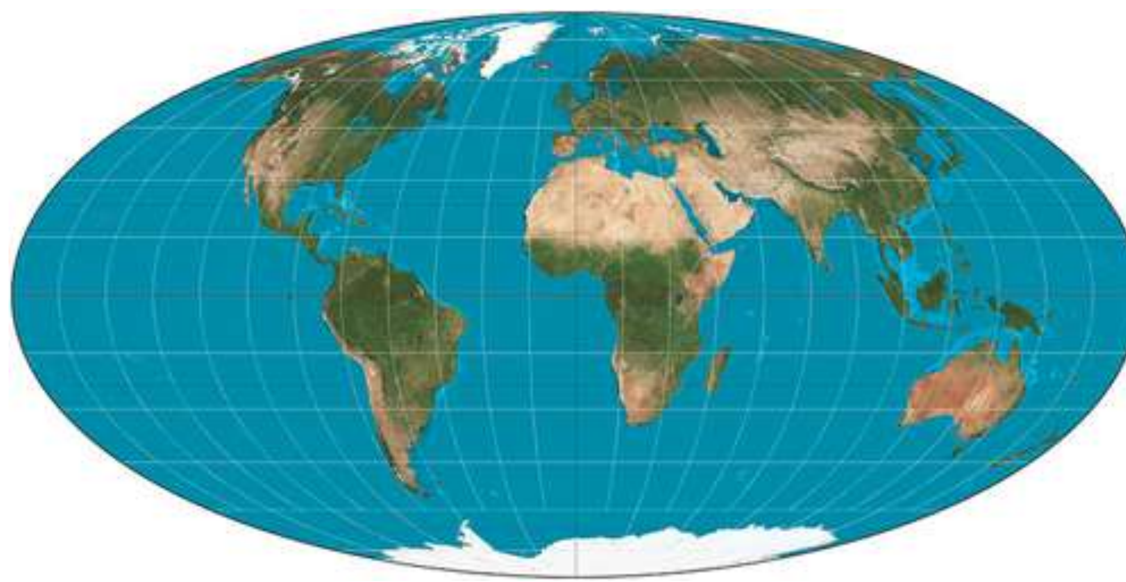


The tropics are BIG: they only look small in Mercator projection

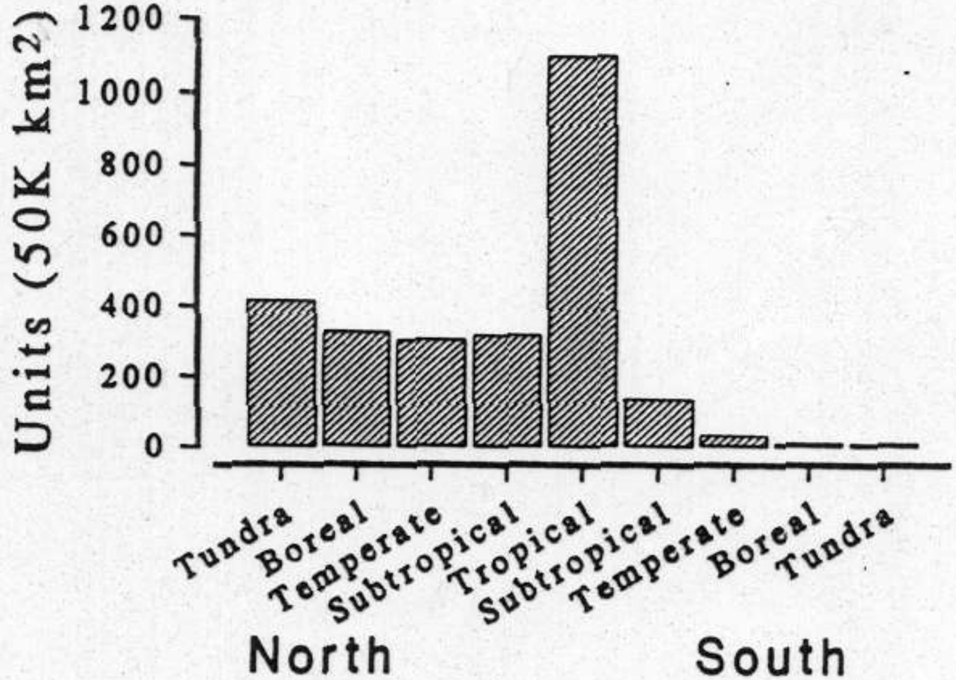
DR Congo in Mercator projection at different latitudes

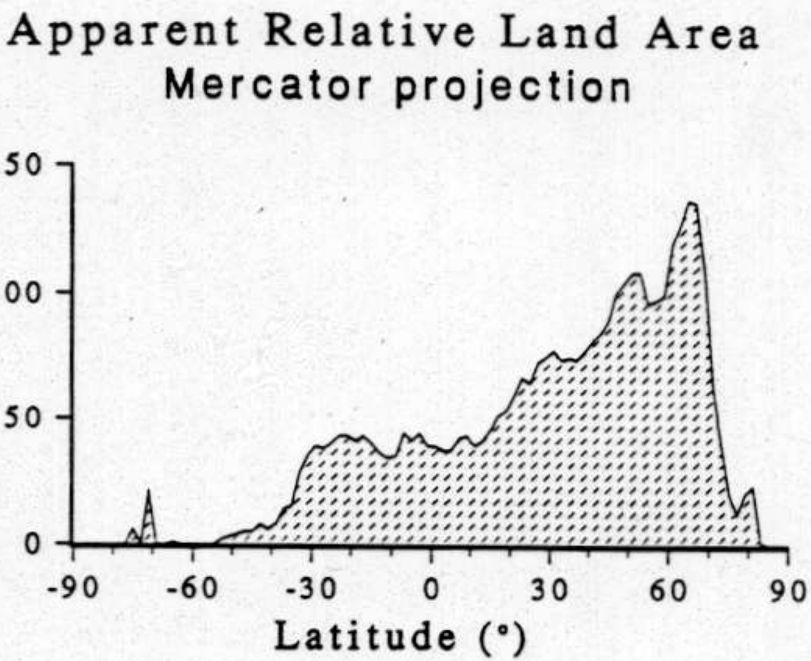
Mercator projection

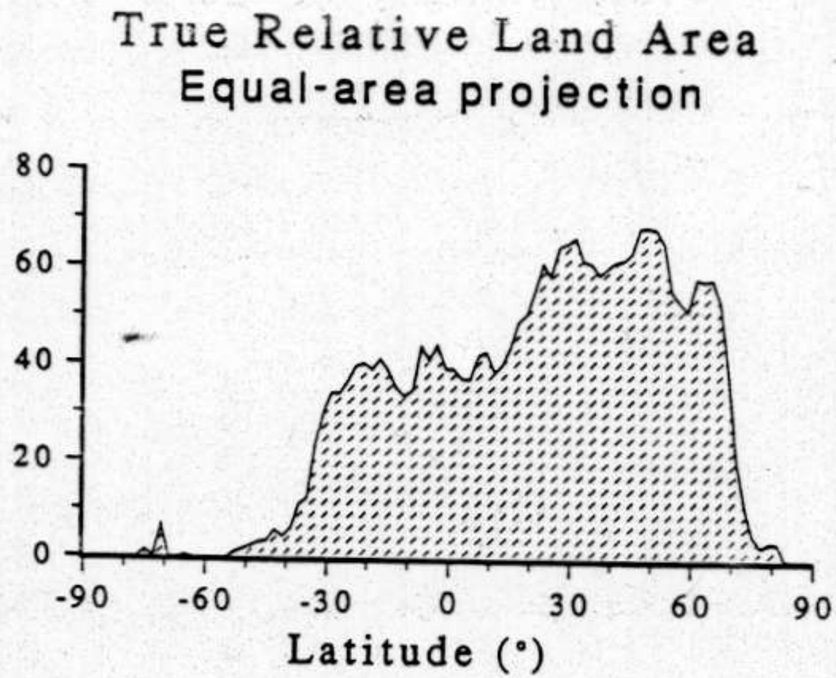
Equal-area projection



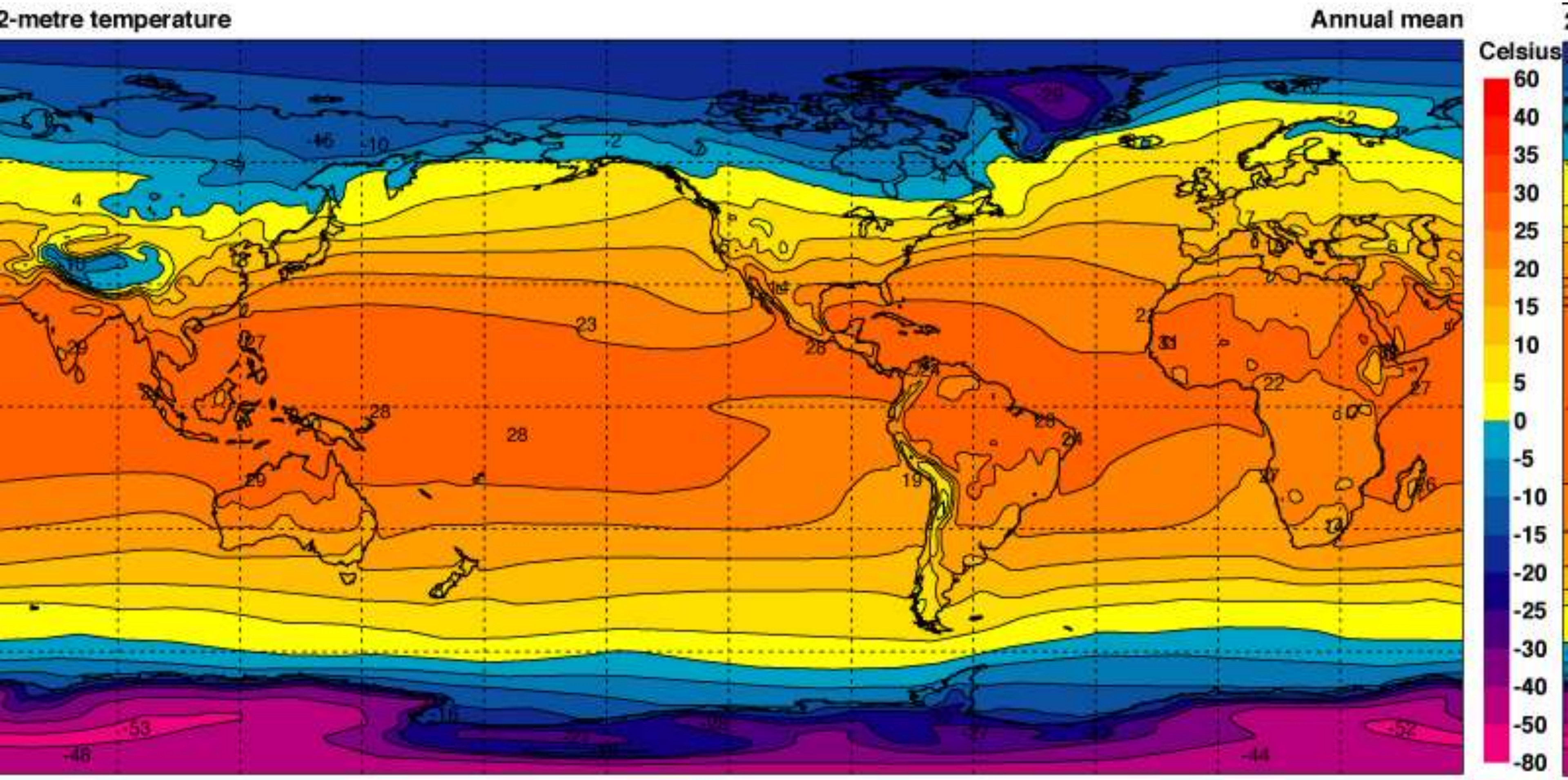
The tropics are BIG: they only look small in Mercator projection





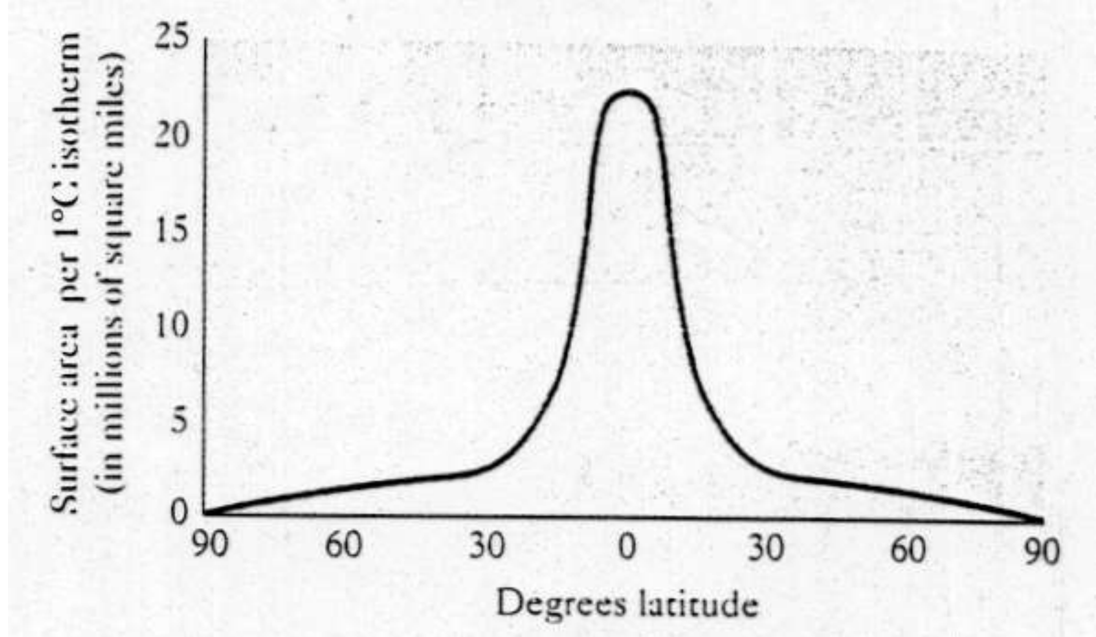


The tropics are HOT

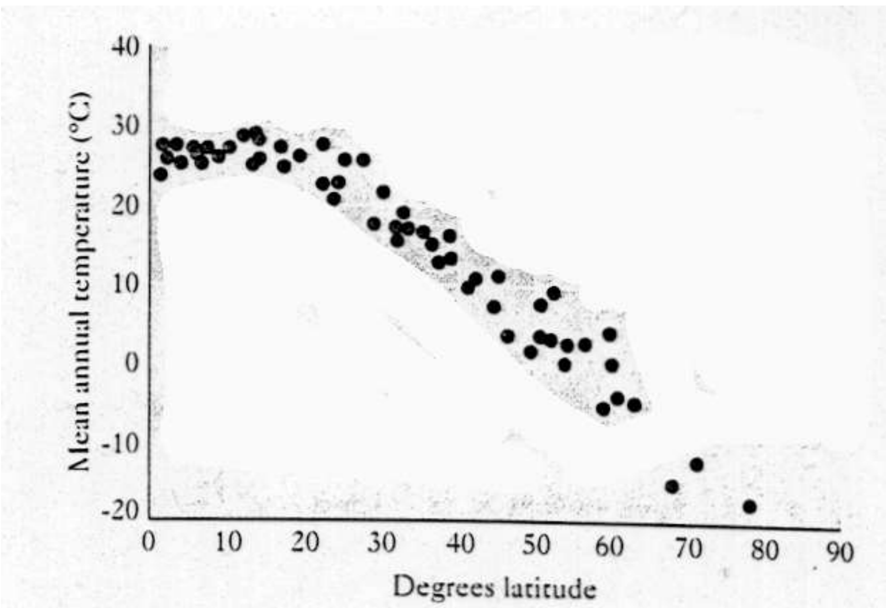


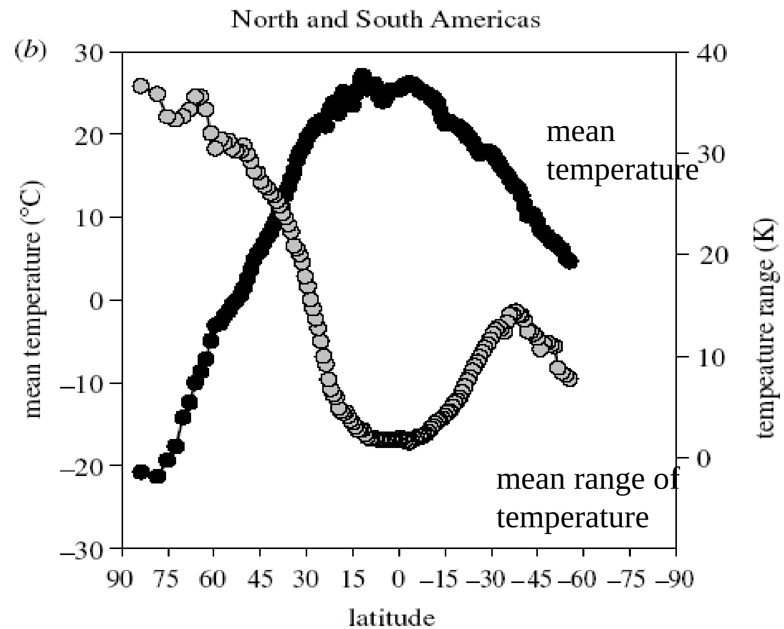
Latitudinal trends in temperature

No change in temperature in a wide belt around the equator



Latitudinal trends in mean temperature, and mean annual range of temperature

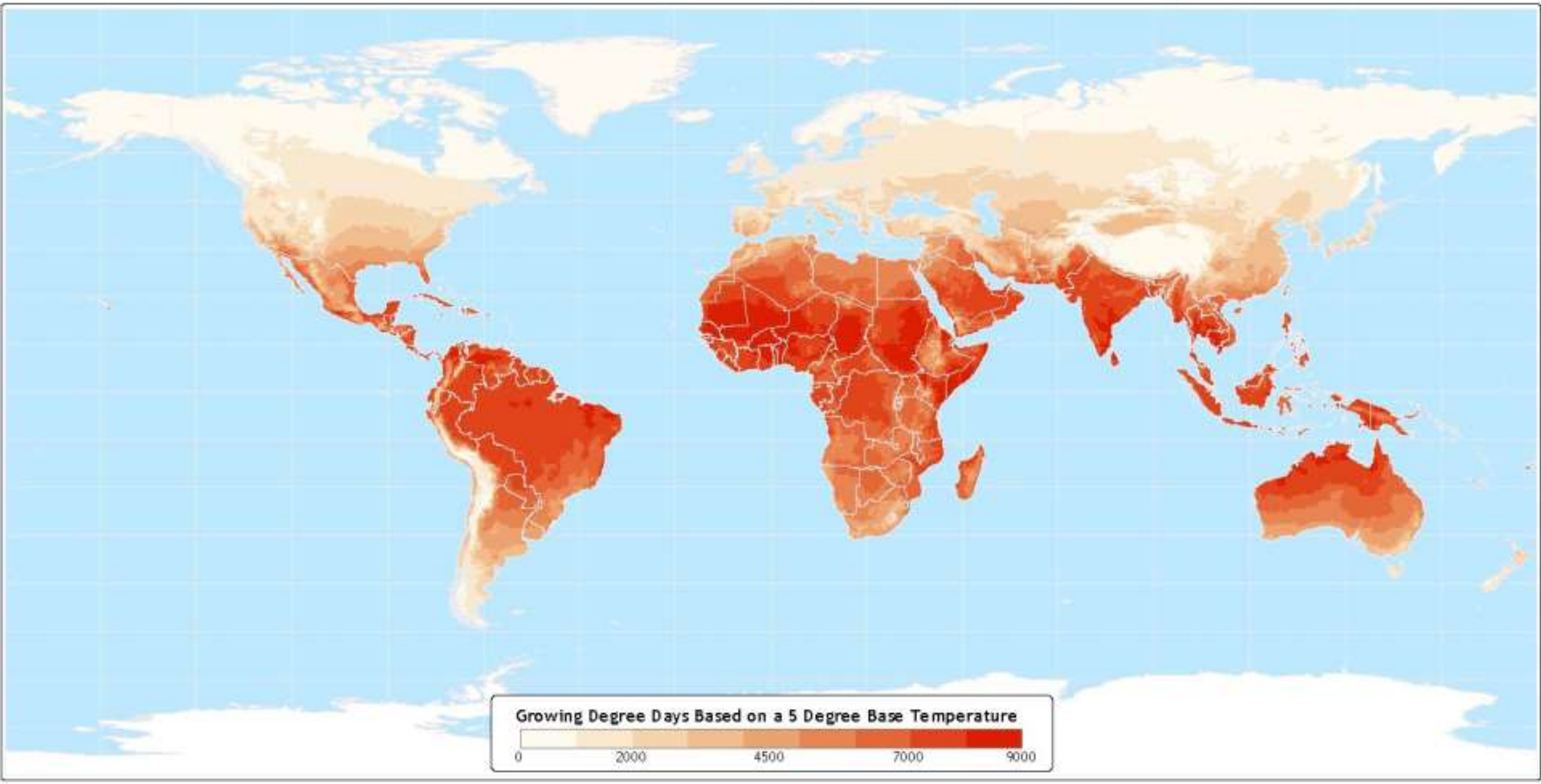




more than 10 times greater at the equator than at mid latitudes.

Clarke & Gaston 2006, Proc. R. Soc. B 273:2257

Annual Growing Degree Days



Data taken from: CRU 0.5 Degree Dataset (New et al.)

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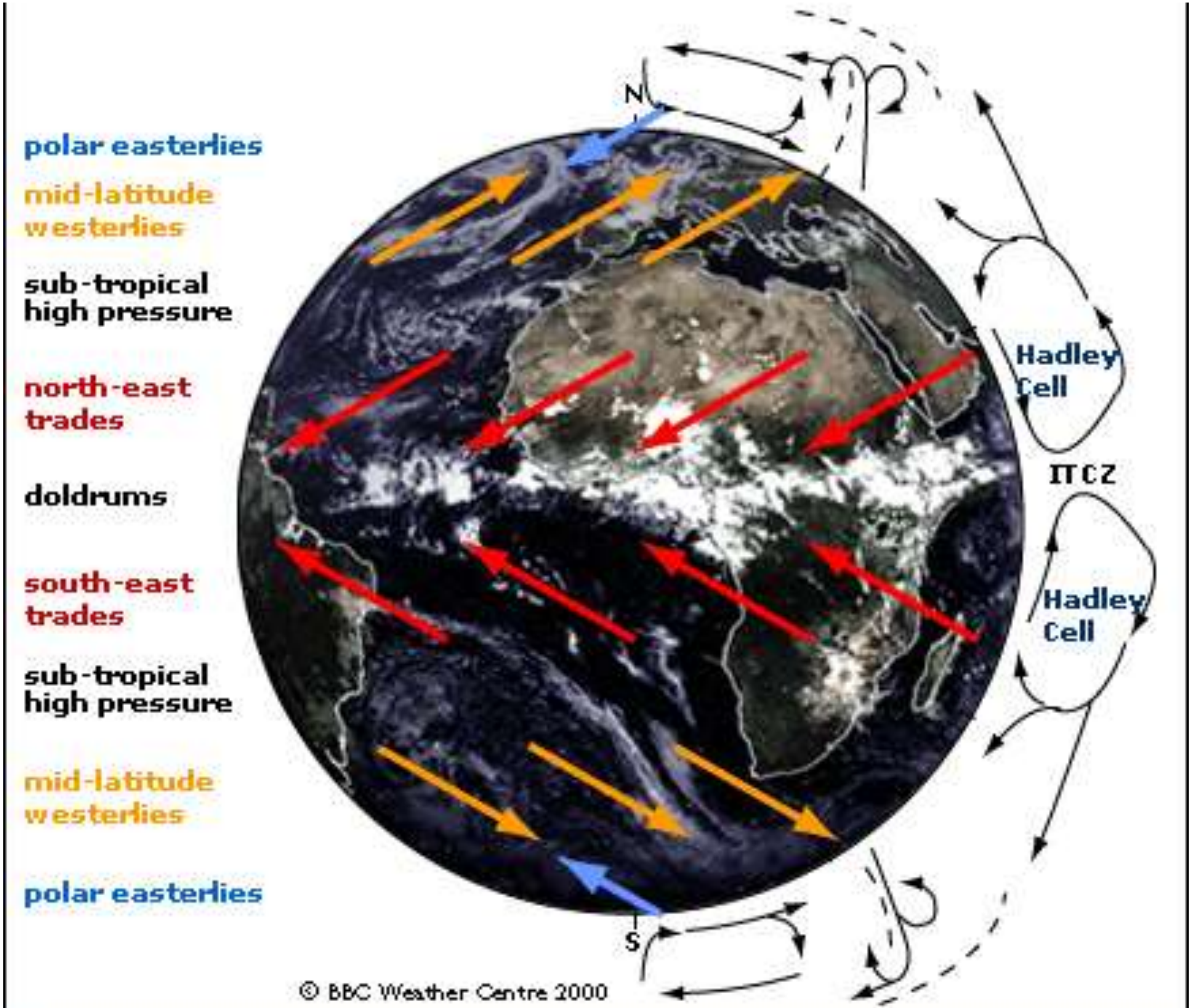
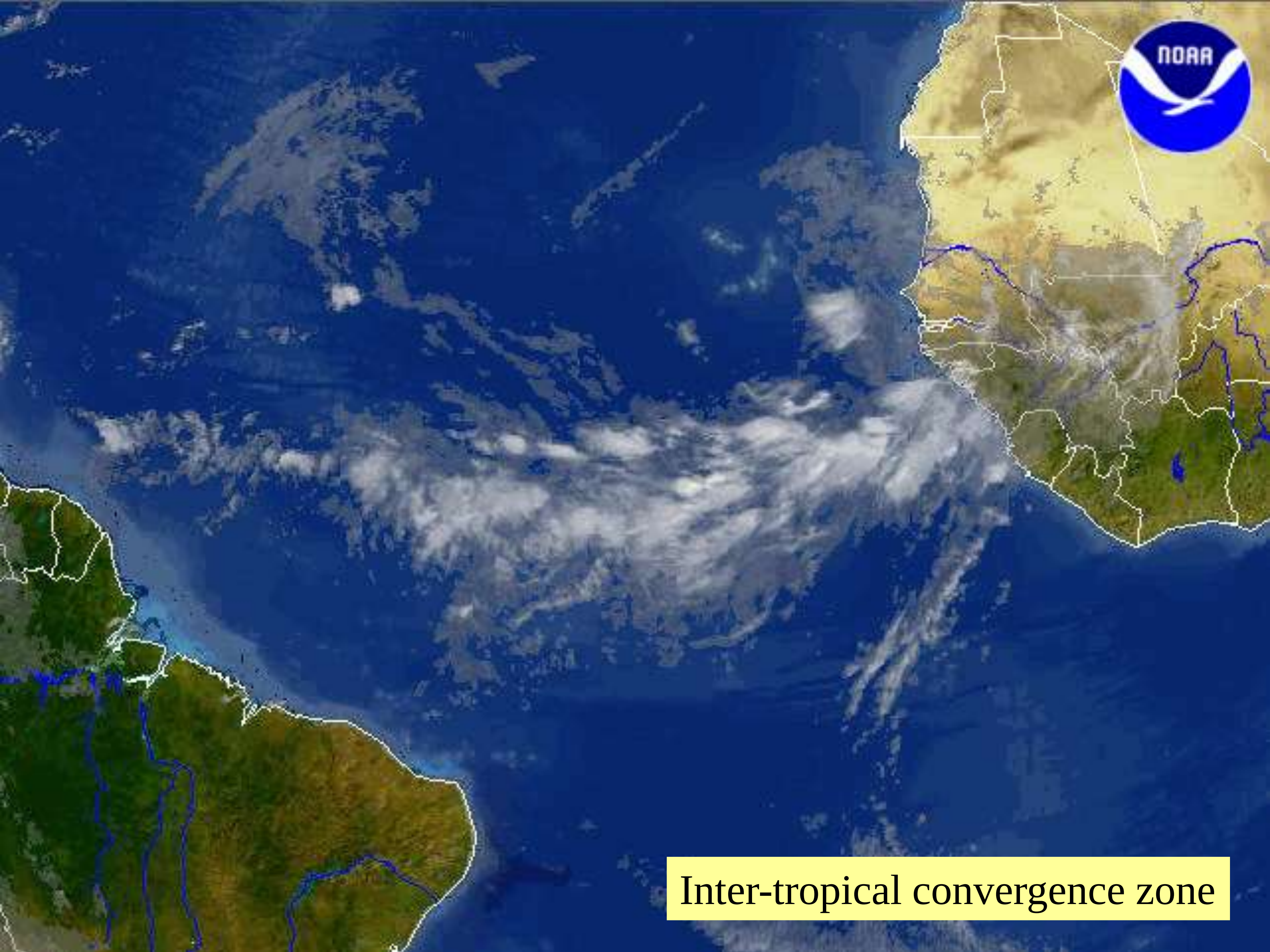
No of days x daily mean temperature – base temperature 5°C



Global View of General Circulation of the globe



Inter-tropical convergence zone

Movement of ITCZ

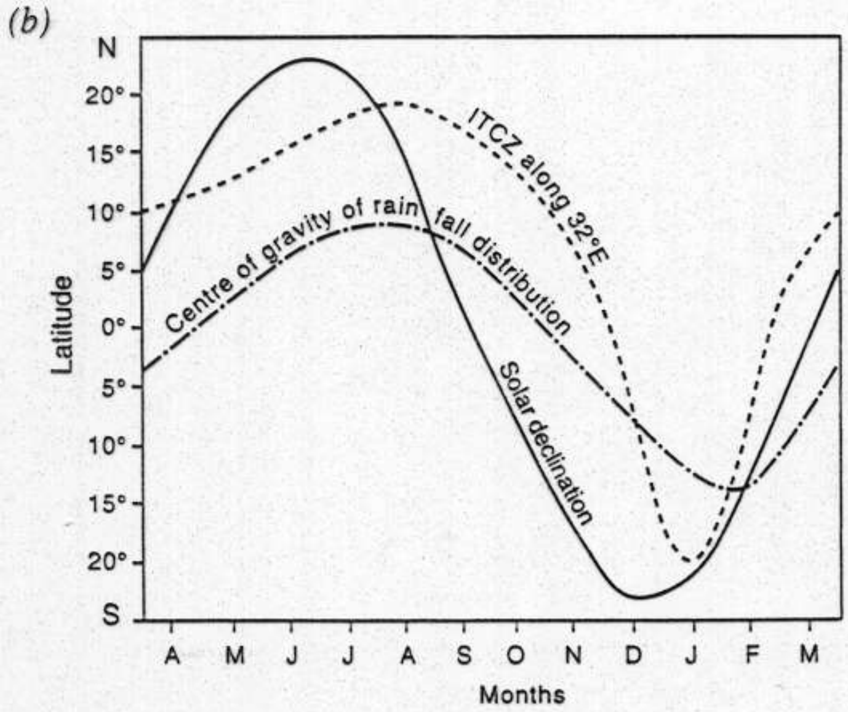


Fig. 4.11. Latitudinal distribution and seasonal movement of the inter-tropical convergence zone (ITCZ), (*a*) at all longitudes (H = high pressure), (*b*) at longitude 32° E, with associated shifts over latitude of solar zenithal position (declination) and distribution of rainfall. Modified from Dhonneur (1985) and Griffiths (1972*a*).

Latitudinal profile of radiation

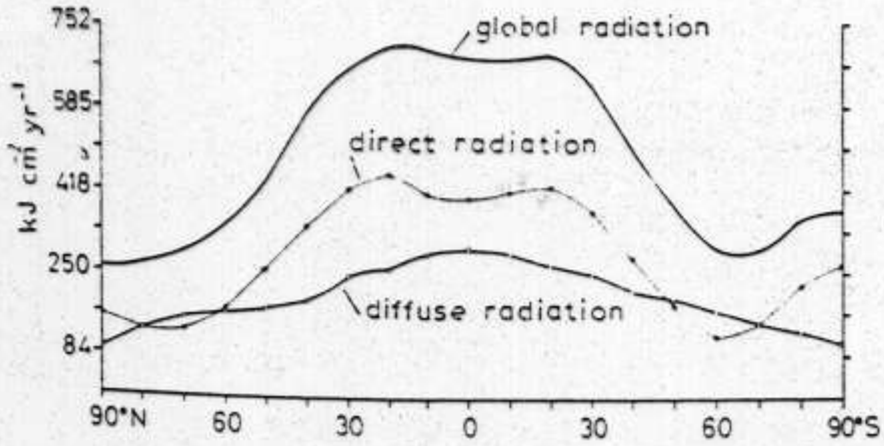
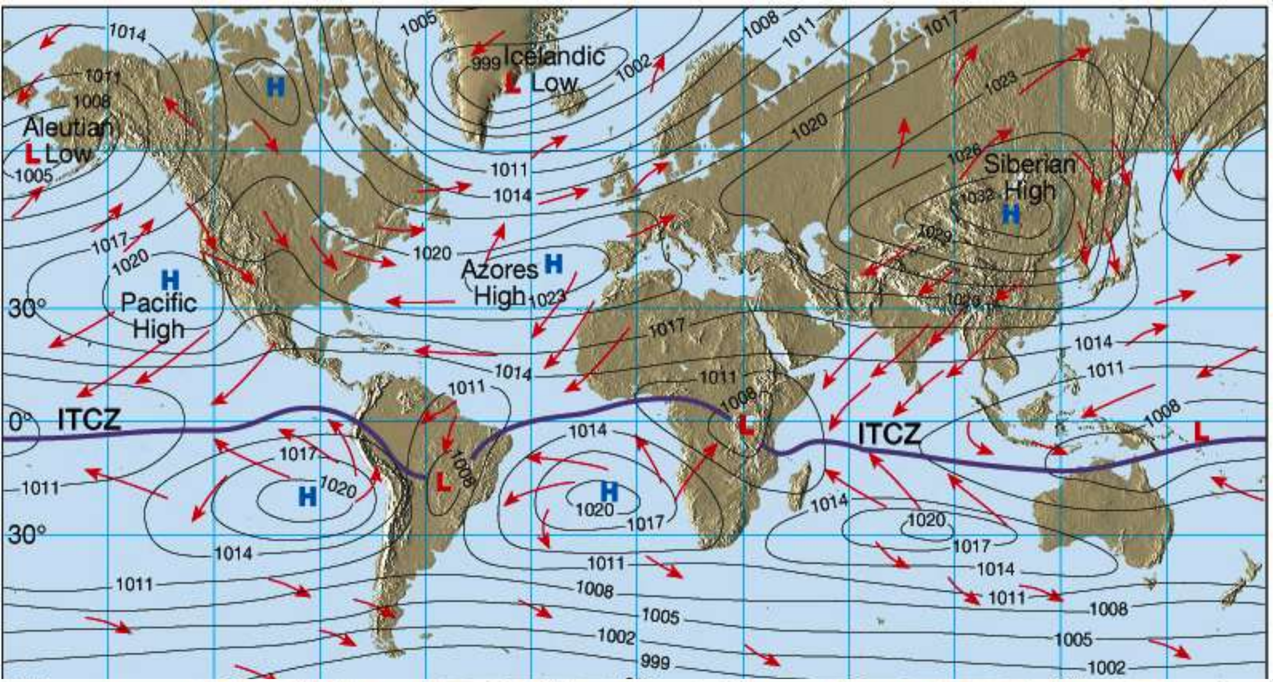


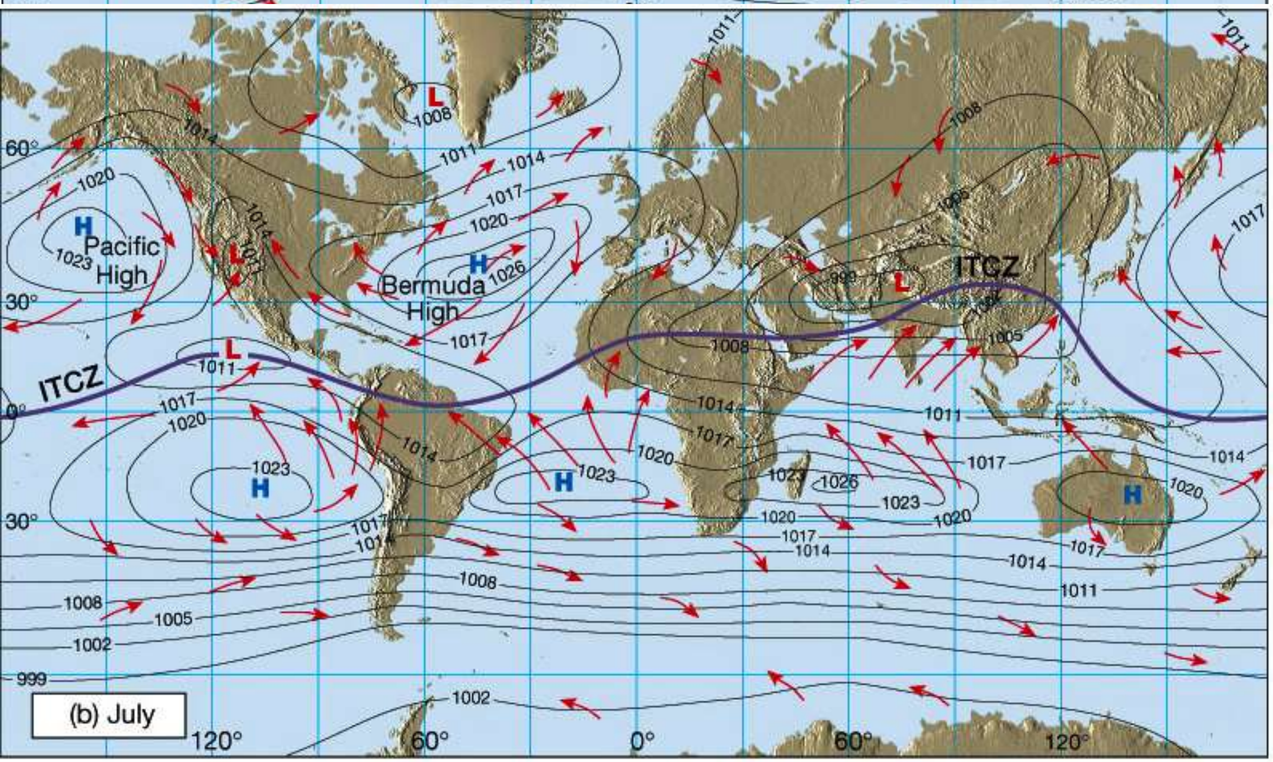
Fig. 2.4. Latitudinal profile of annual sum of global radiation ($kJ^{-2}yr^{-1}$) and its components. (After Sellers, 1965.)



January

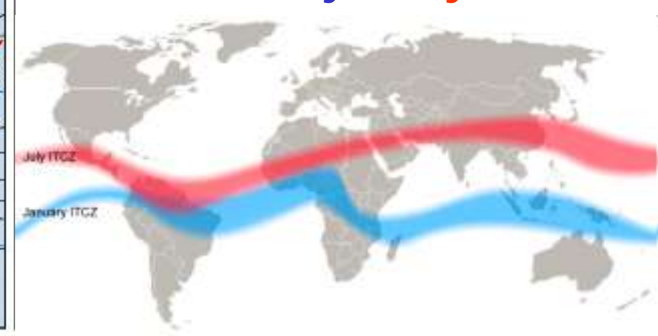
http://www2.palomar.edu/users/pdeen/animations/23_weatherpat.swf

---- ITCZ

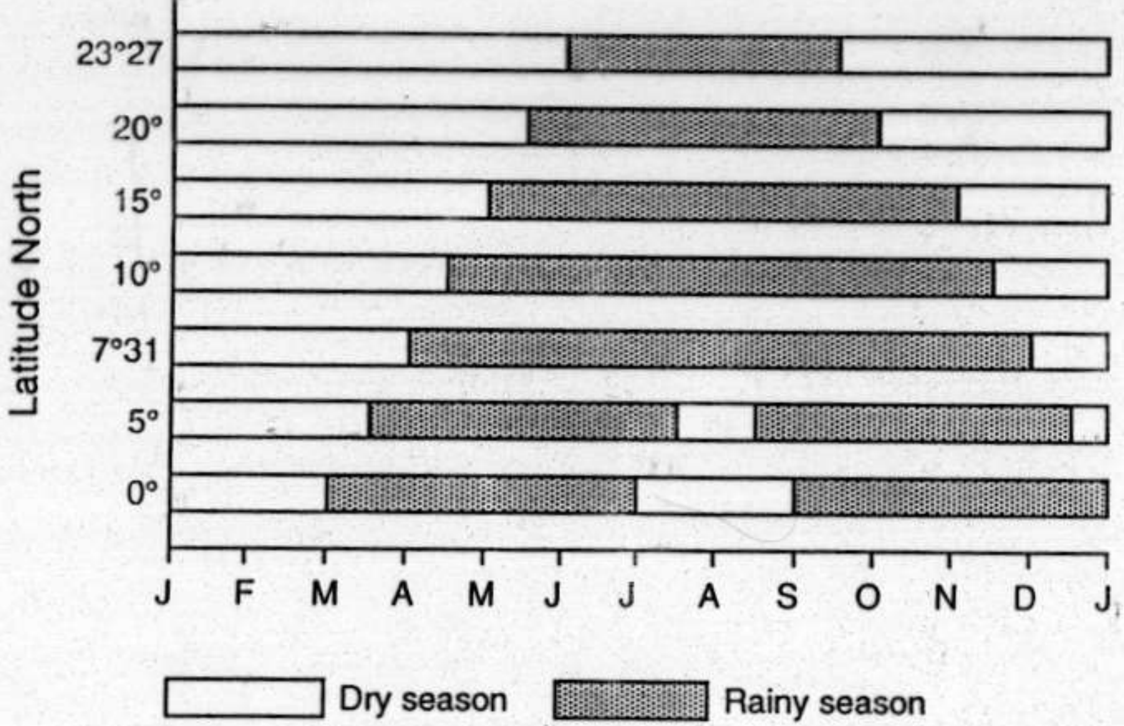


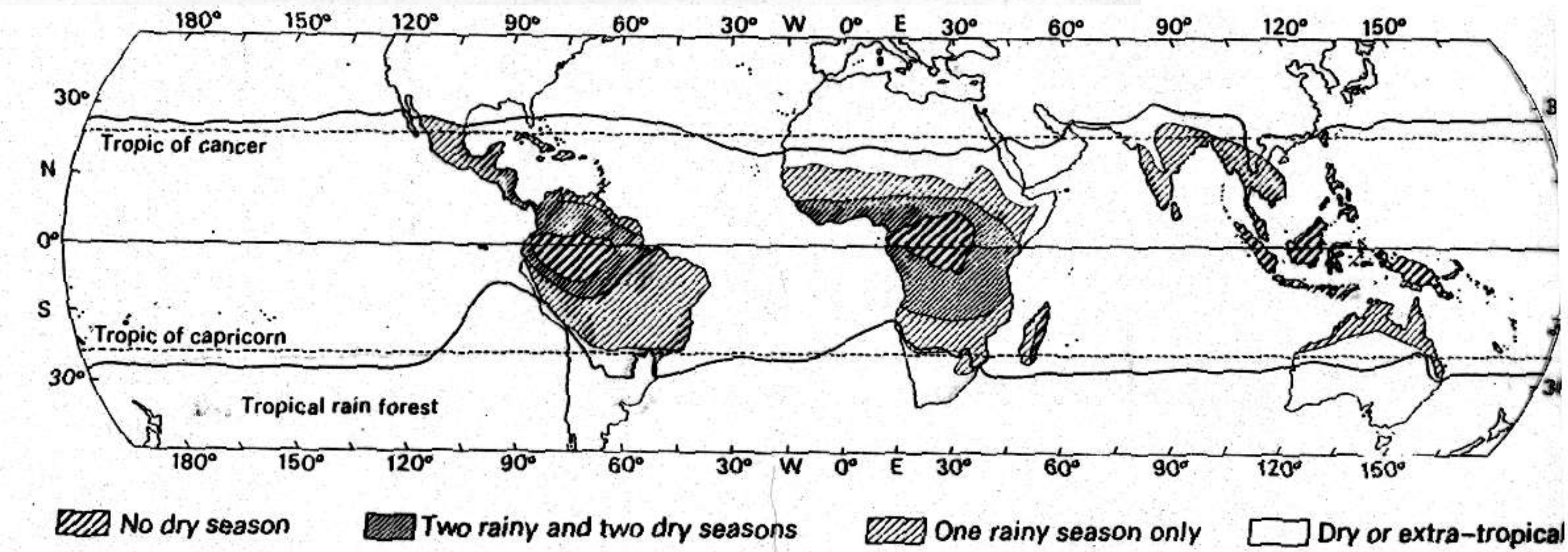
July

January July

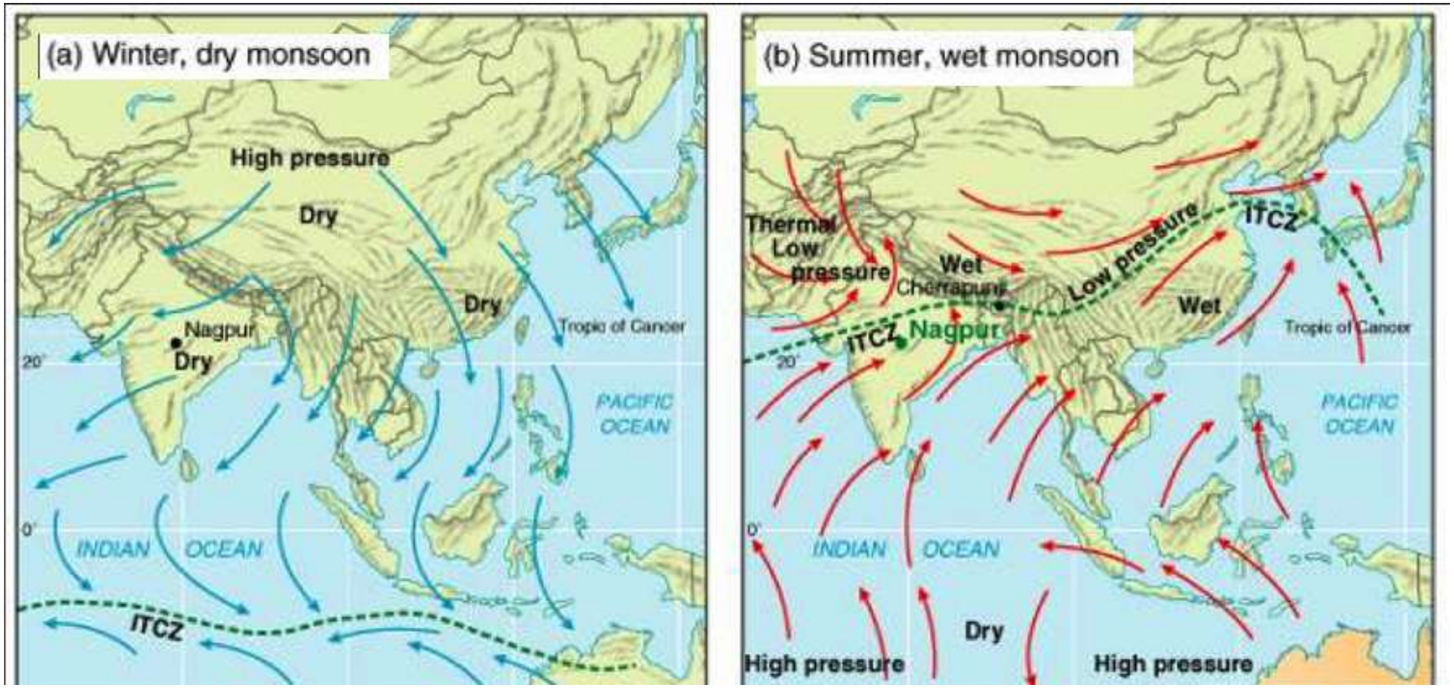


Rain seasons: one or two

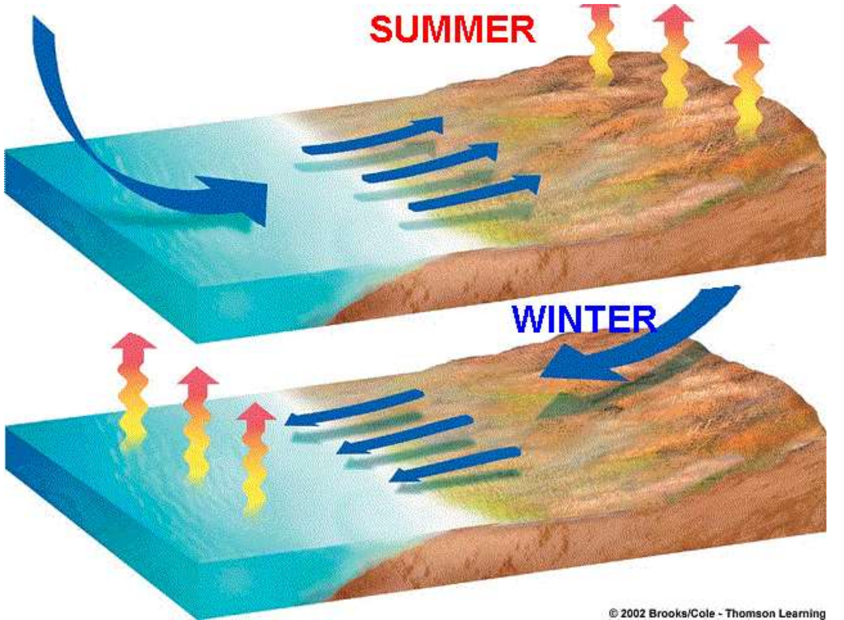




Monsoon

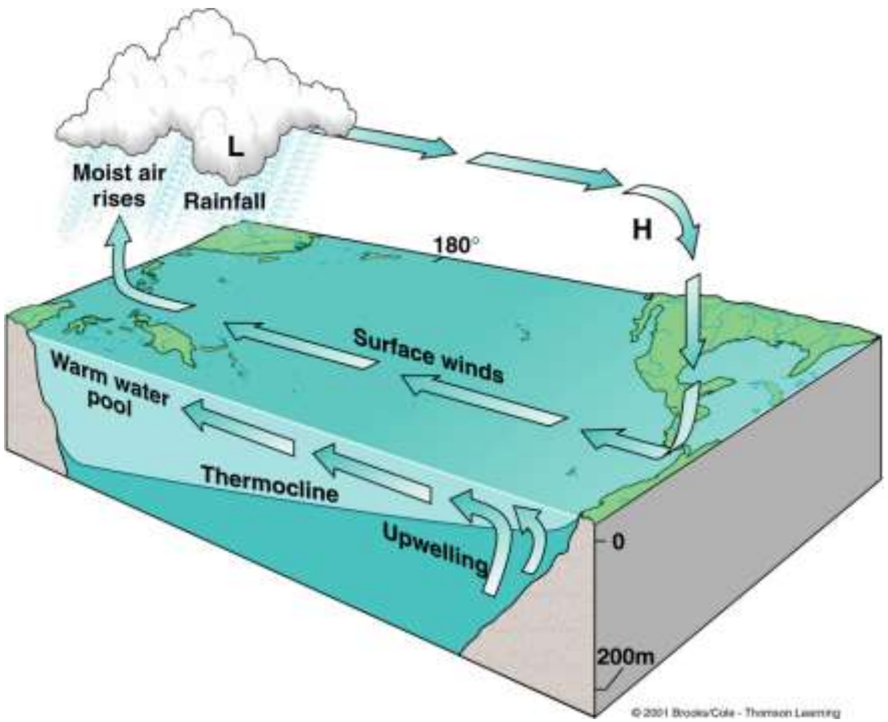


Dana Ellyn: Monsoon season

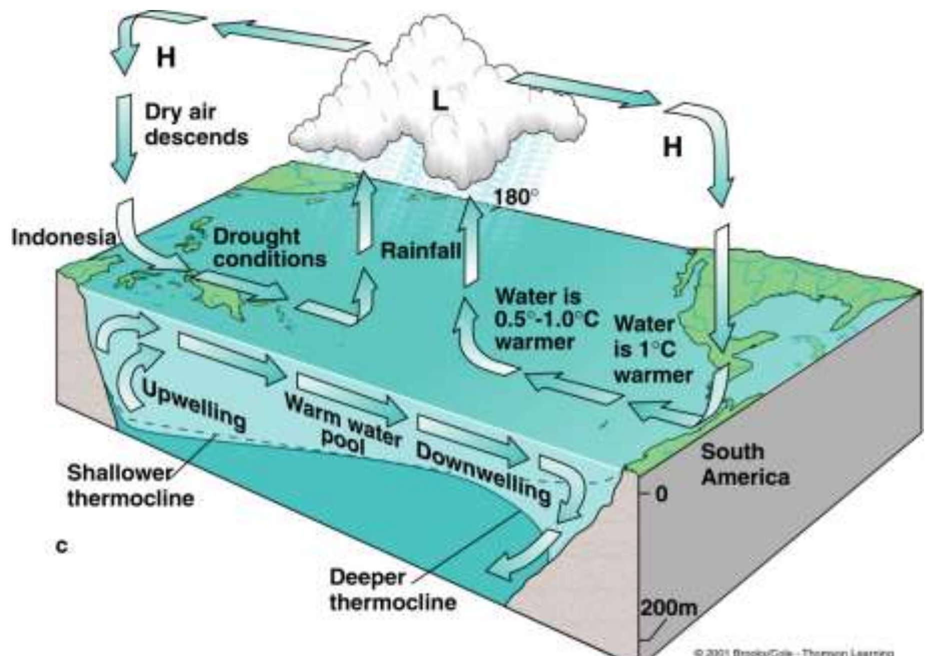


El Nino

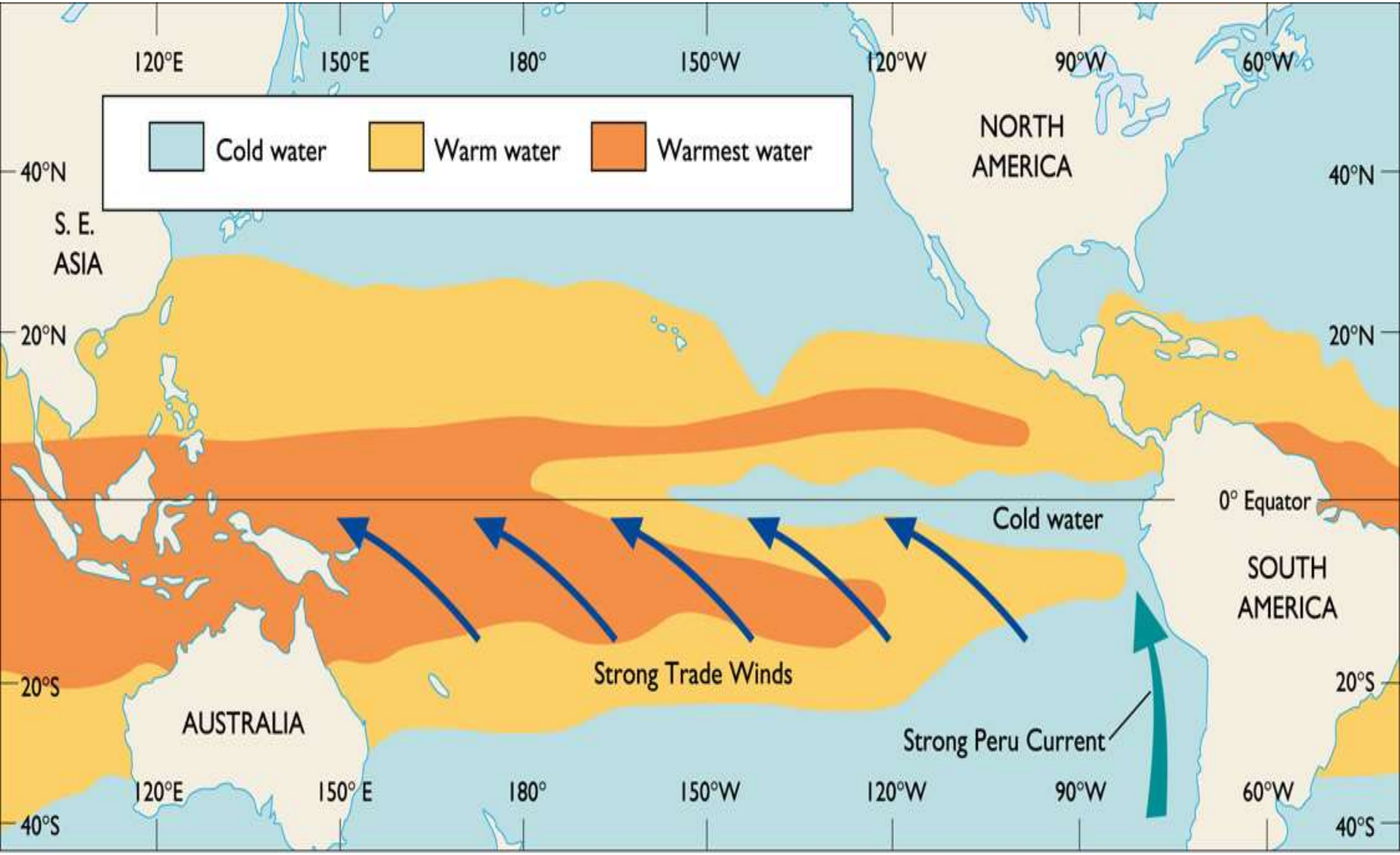
Normal Pacific circulation



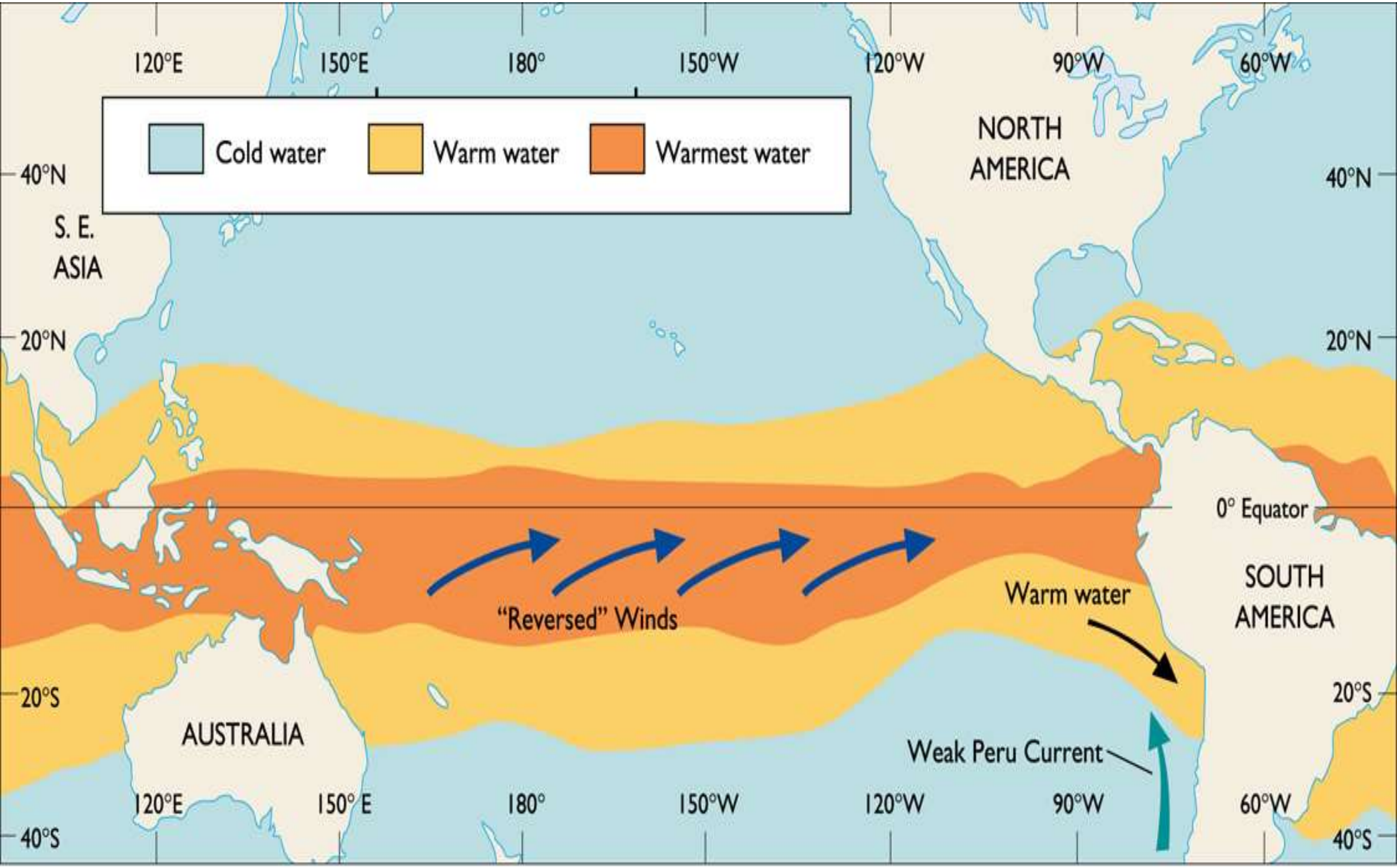
El Nino event



http://www.bom.gov.au/climate/ahead/model-summary.shtml

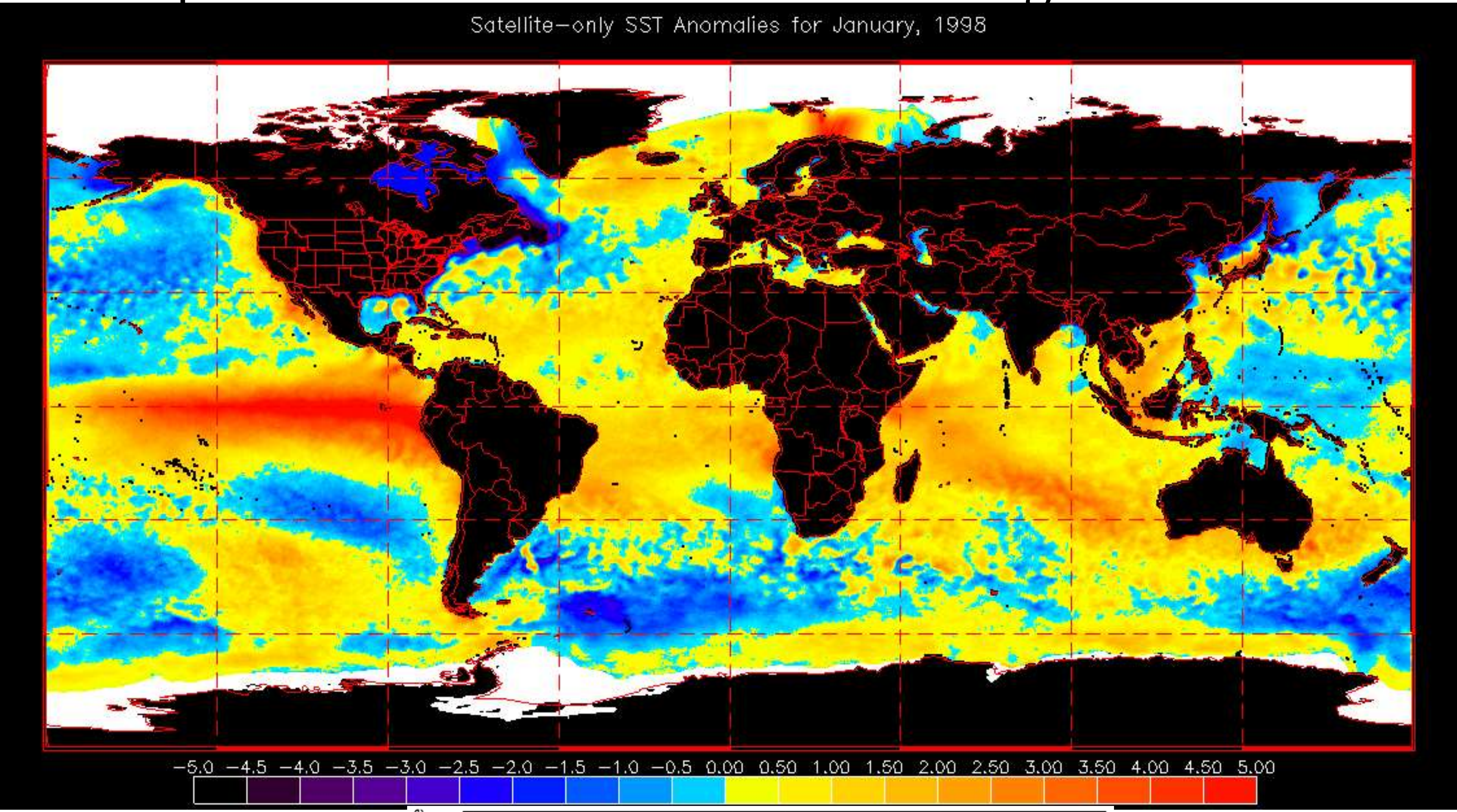


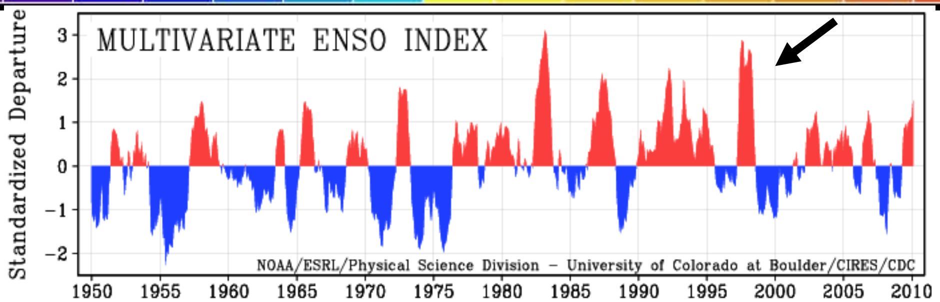
(a) NORMAL OCEANOGRAPHIC CONDITIONS



(b) EL NIÑO CONDITIONS

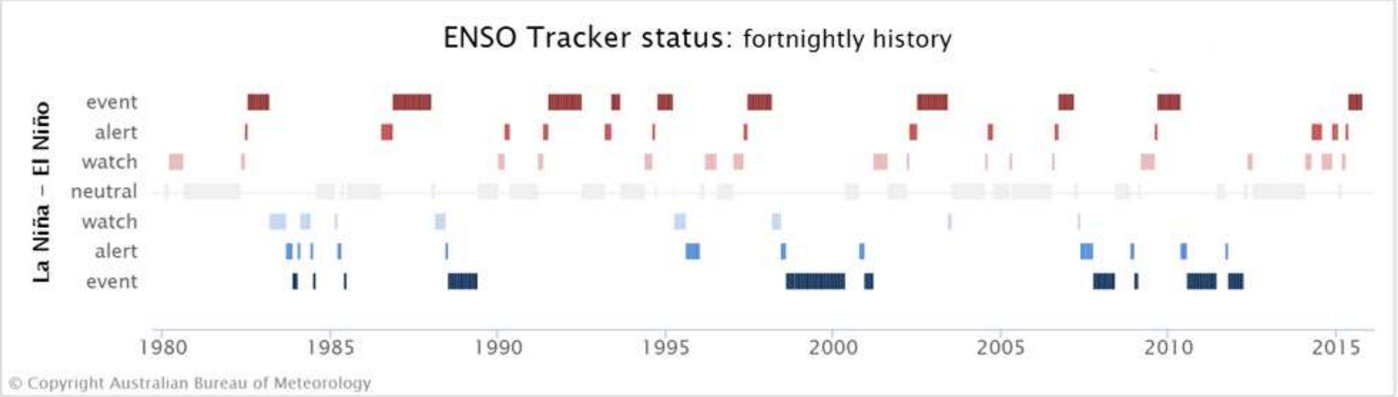
Temperature anomalies in Jan 98 - a strong El Nino event

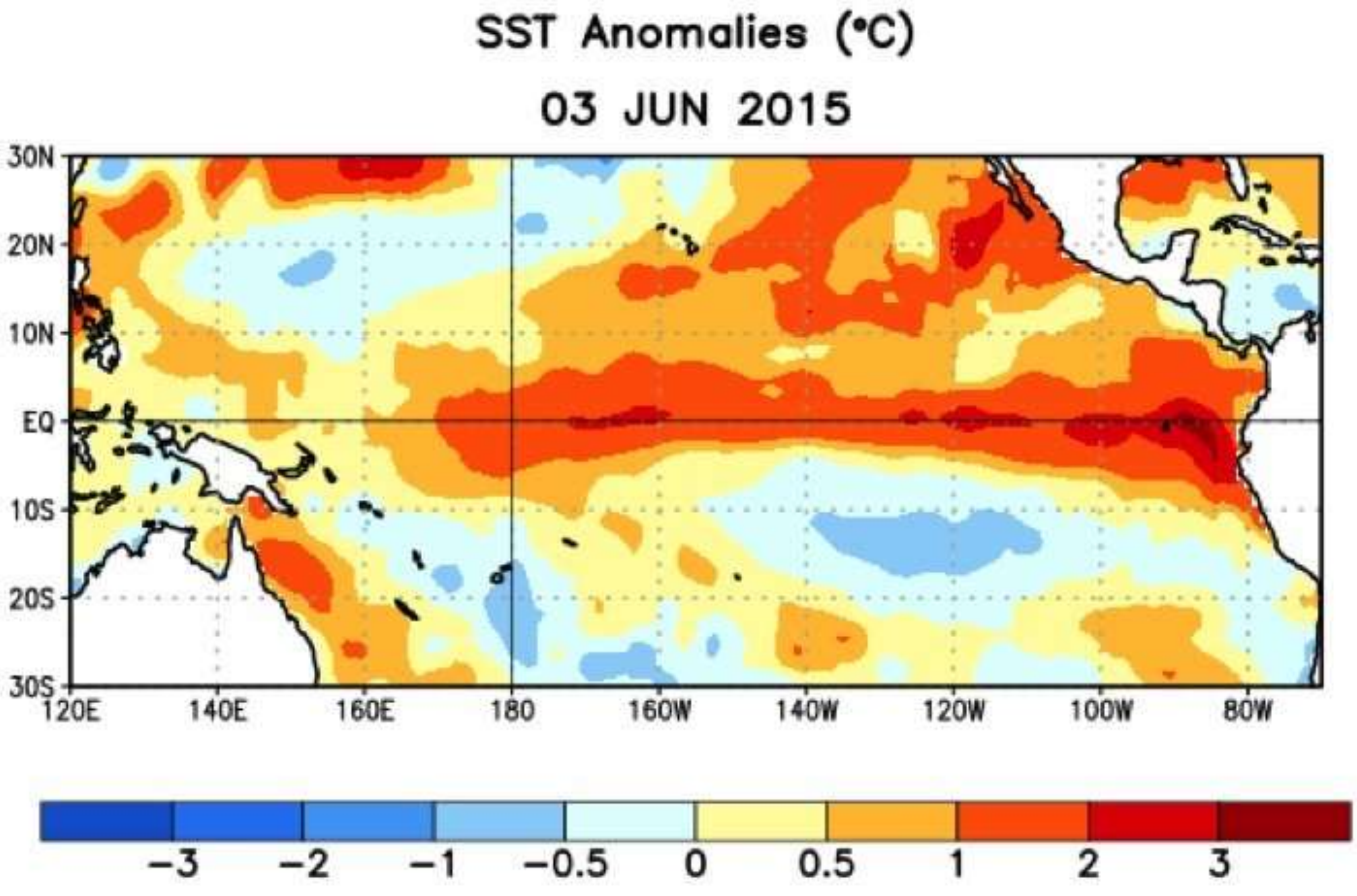




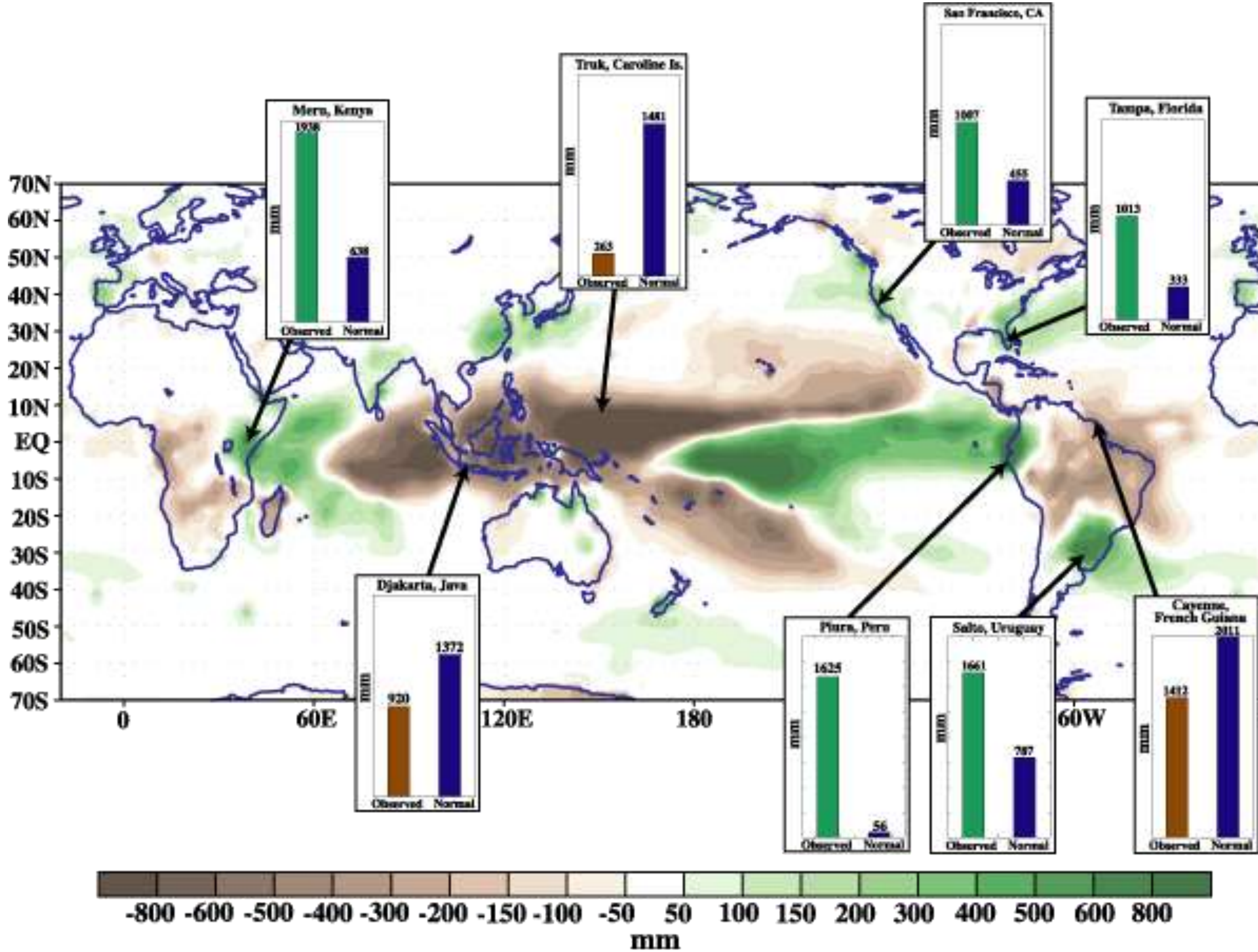
El Nino 2015

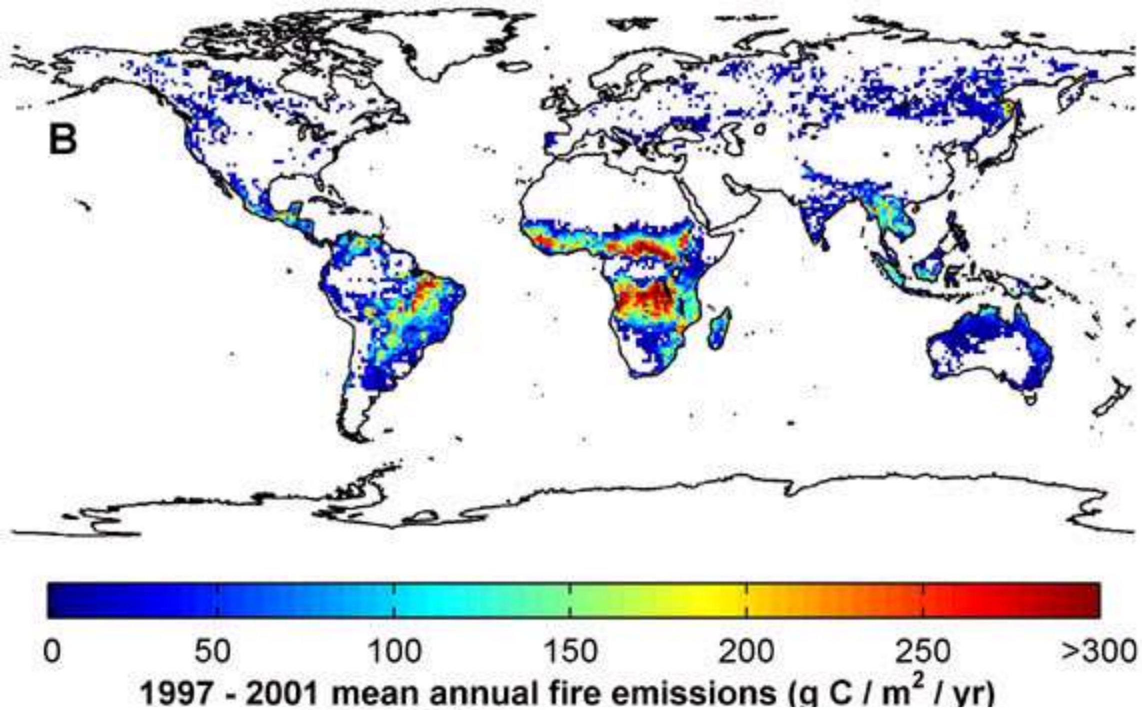
Fortnightly ENSO Tracker values



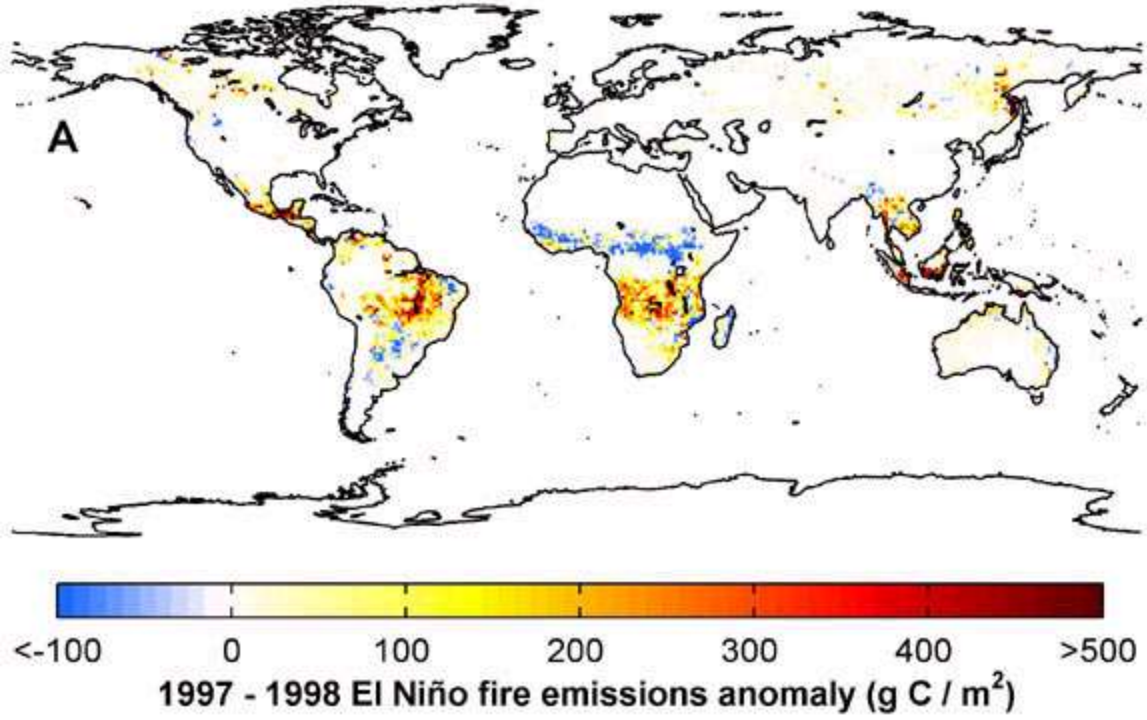


Rainfall deficit/surplus during a strong El Nino event in 1997





El Nino fires



Variability in temperature and rainfall (Borneo lowlands)

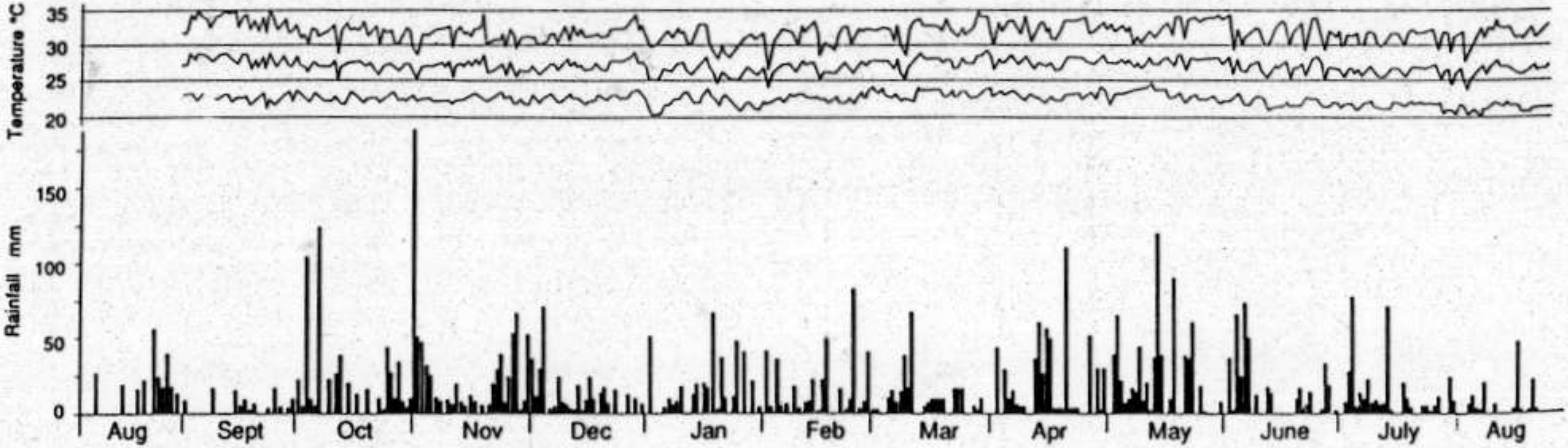


Fig. 7.3 Daily maximum, minimum and mean temperatures and daily rainfall at Long Pala, Gunung Mulu, Sarawak, during 1977–78. After Walsh (1982a).

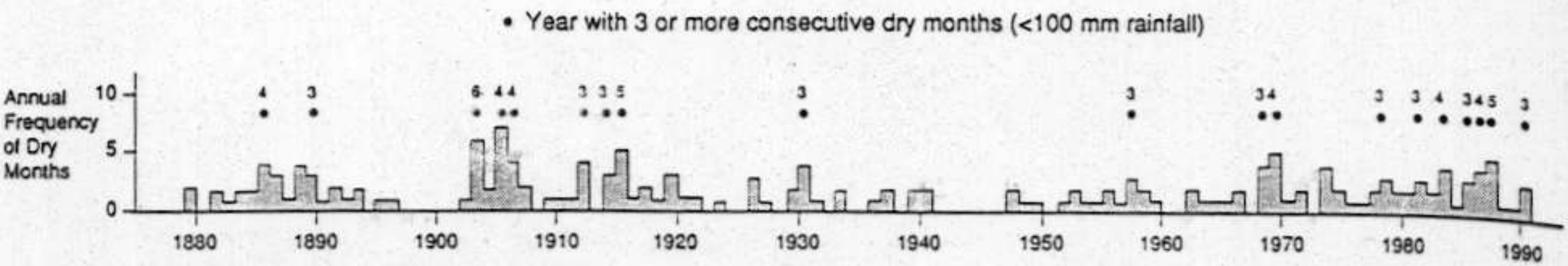
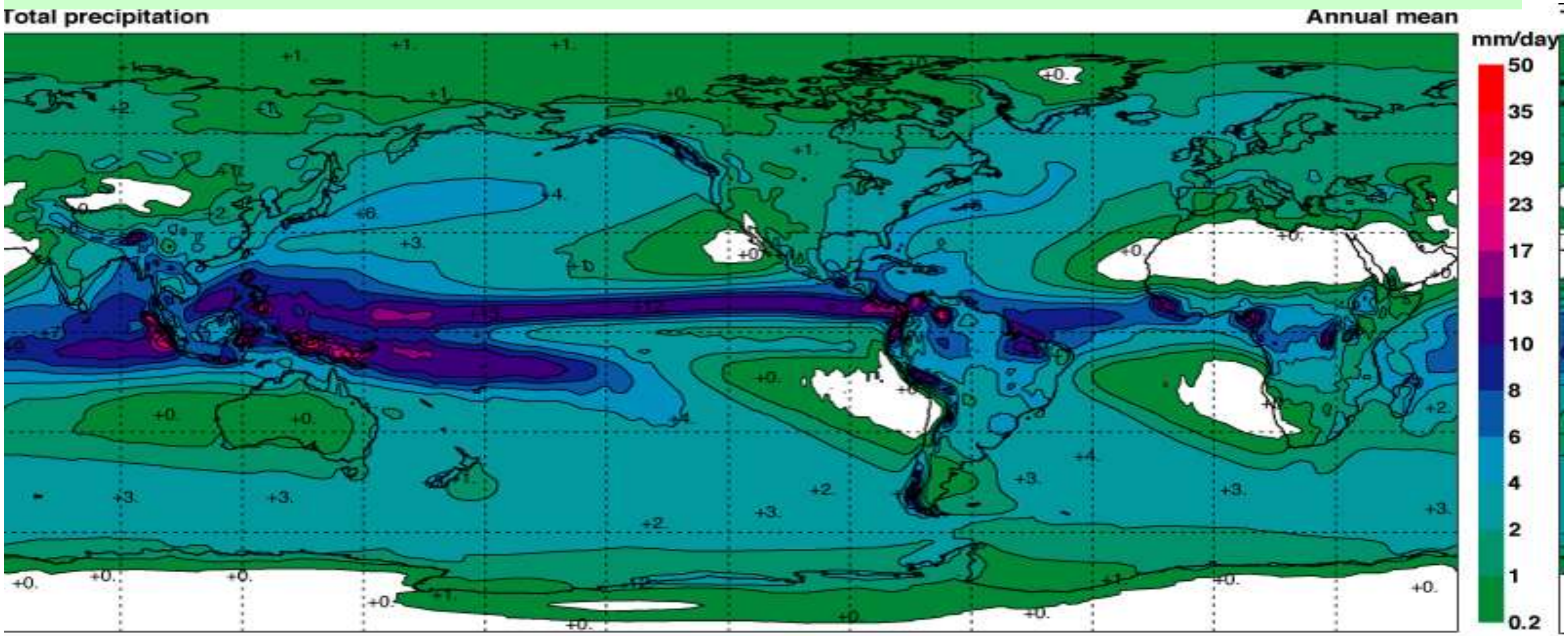
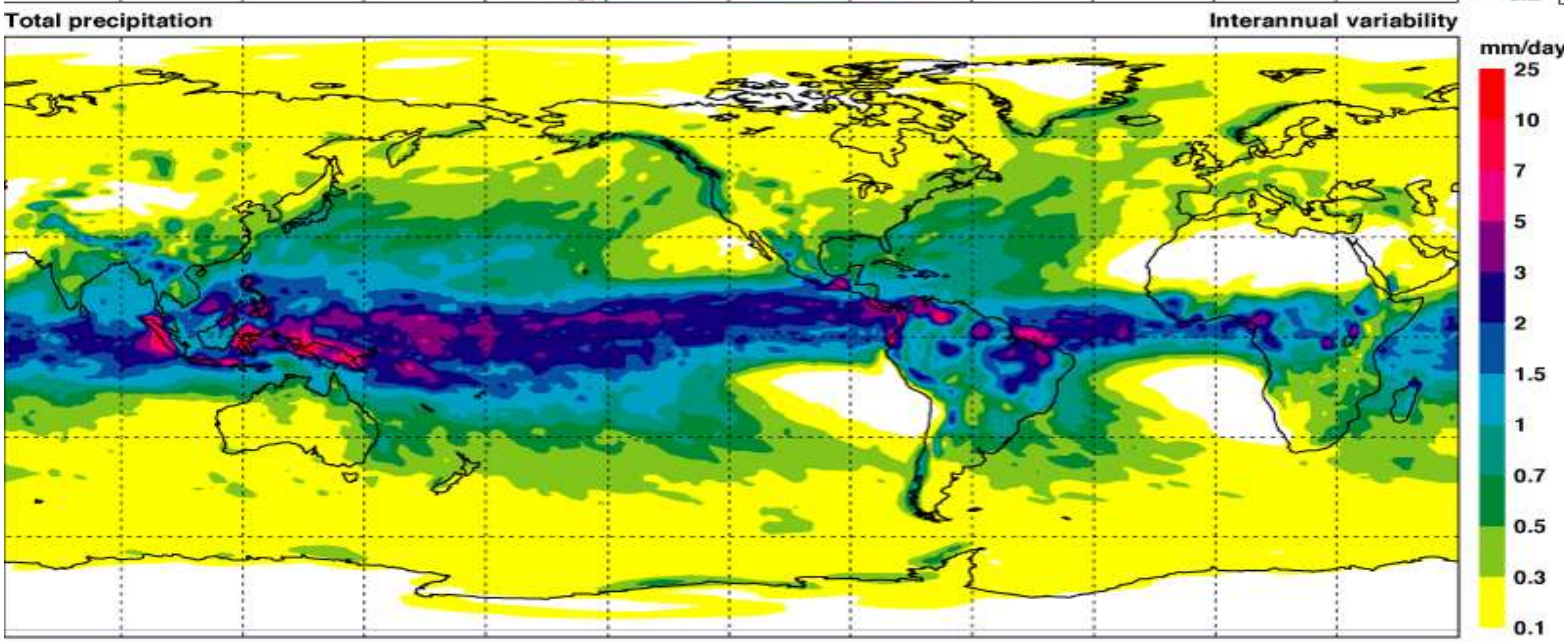


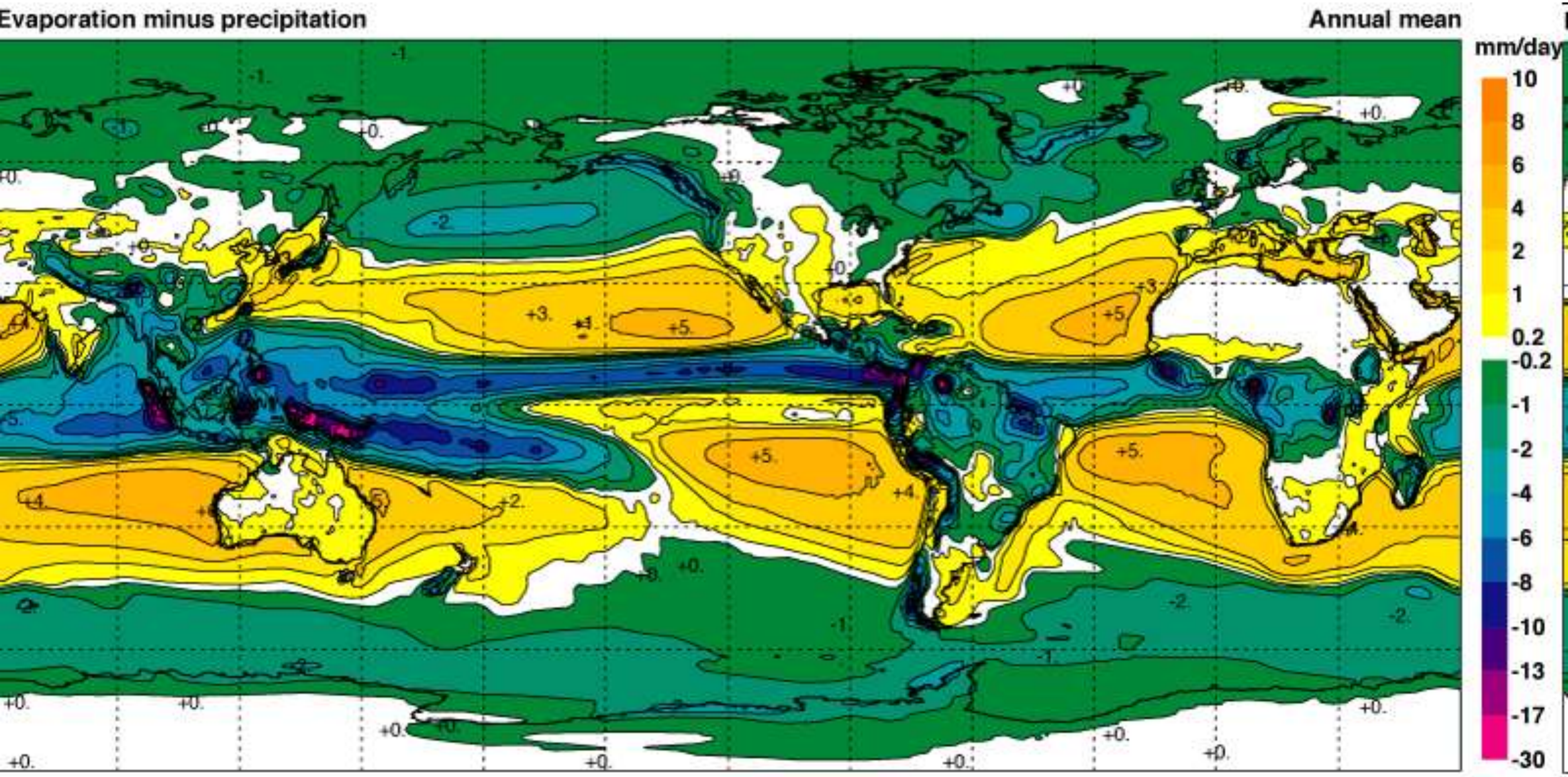
Fig. 7.15 Major droughts and annual frequency of dry months (<100 mm rain) at Sandakan, Sabah, 1879–1990. There are no data for the years 1897–1901 and 1941–46.

Latitudinal gradients in the amount and variability of rainfall

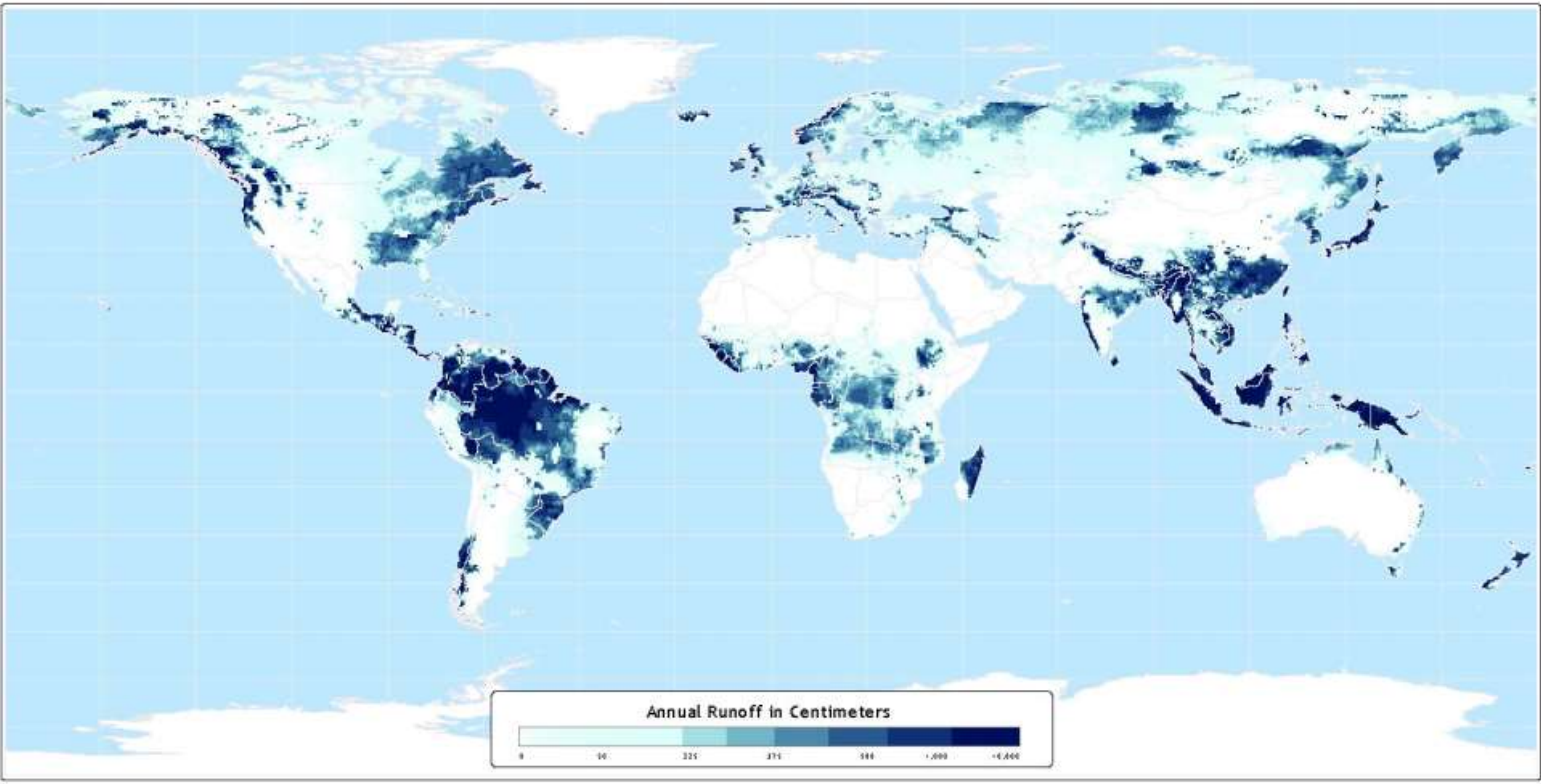




Evaporation minus precipitation: water surplus or deficiency



Annual Runoff



Data taken from: UNH-GRDC Composite Runoff Fields v1.0

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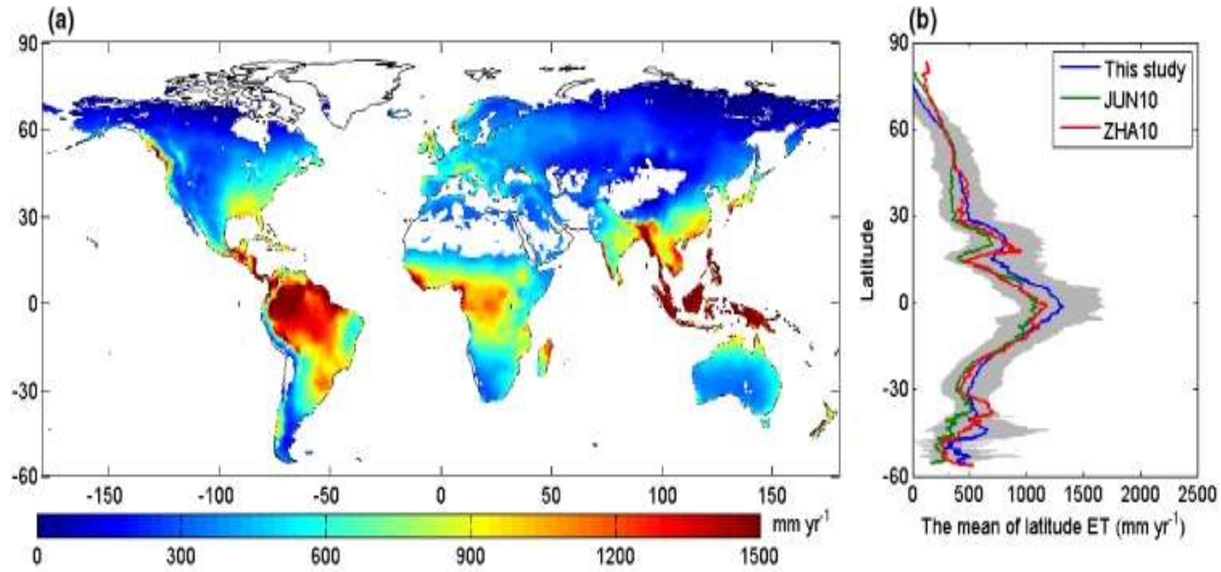
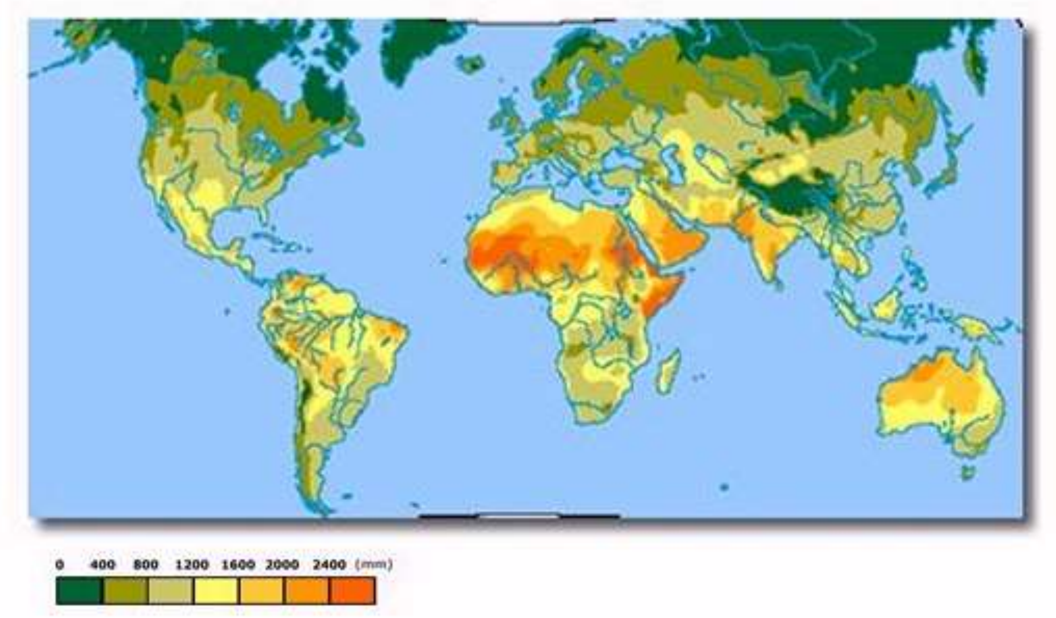
Mean annual **potential** evapotranspiration

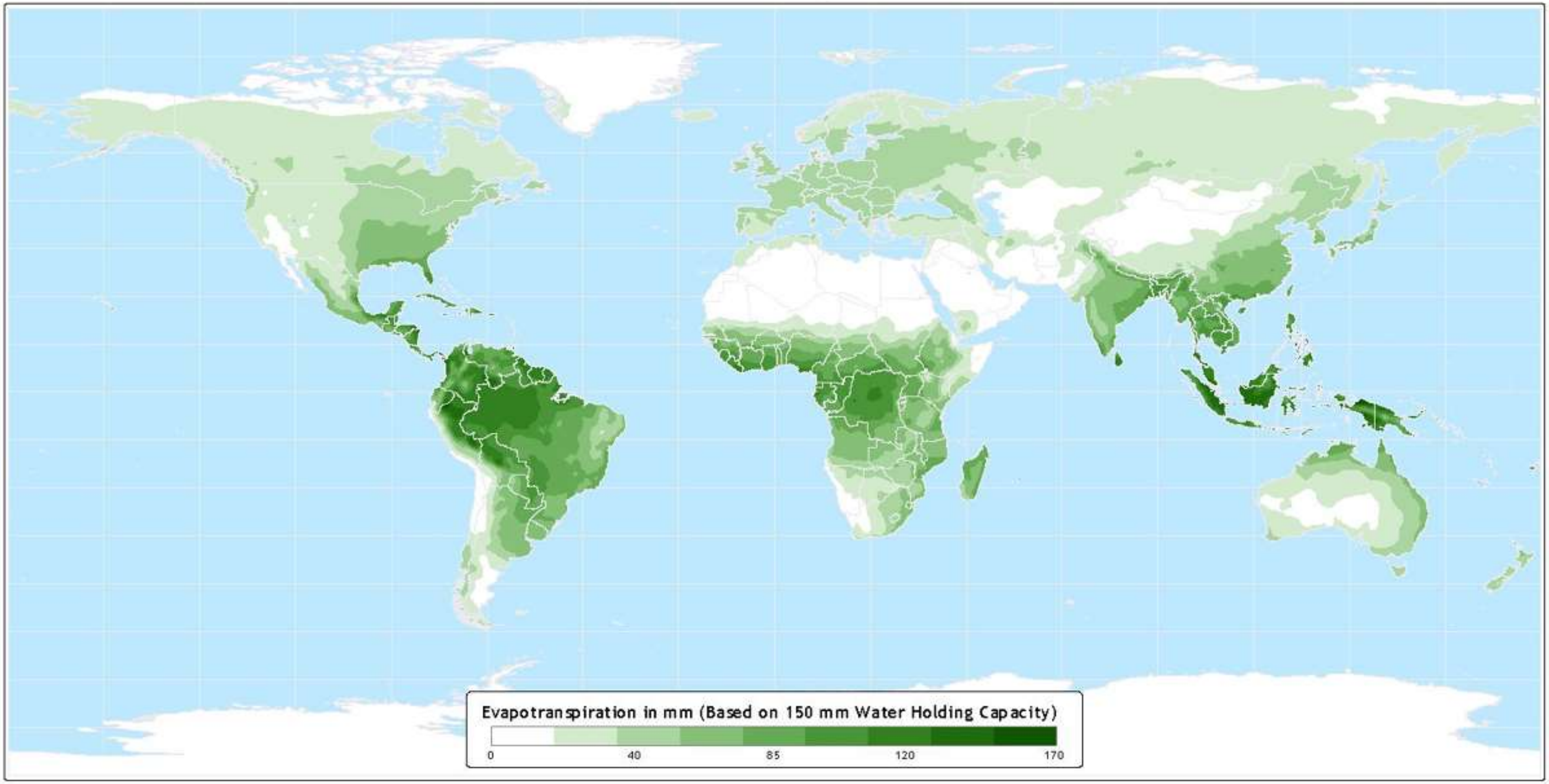


Mean annual **actual** evapotranspiration [1982-2009]



Zhenzhong Zeng *et al* 2012 *Environ. Res. Lett.* **7** 014026

Evapotranspiration



Data taken from: Willmott and Matsuura (2001)

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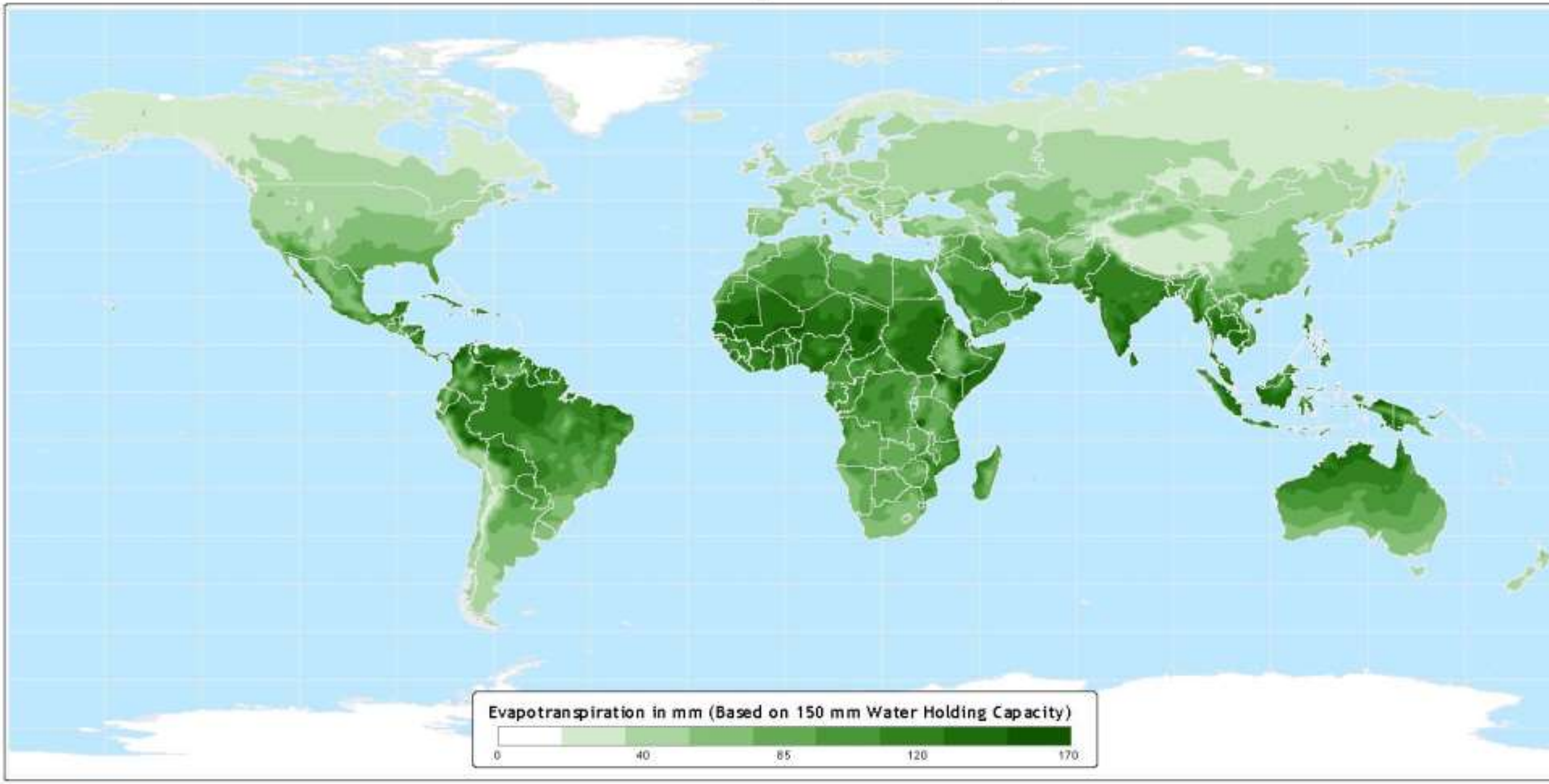
Potential Evapotranspiration



Data taken from: Willmott and Matsuura (2001)

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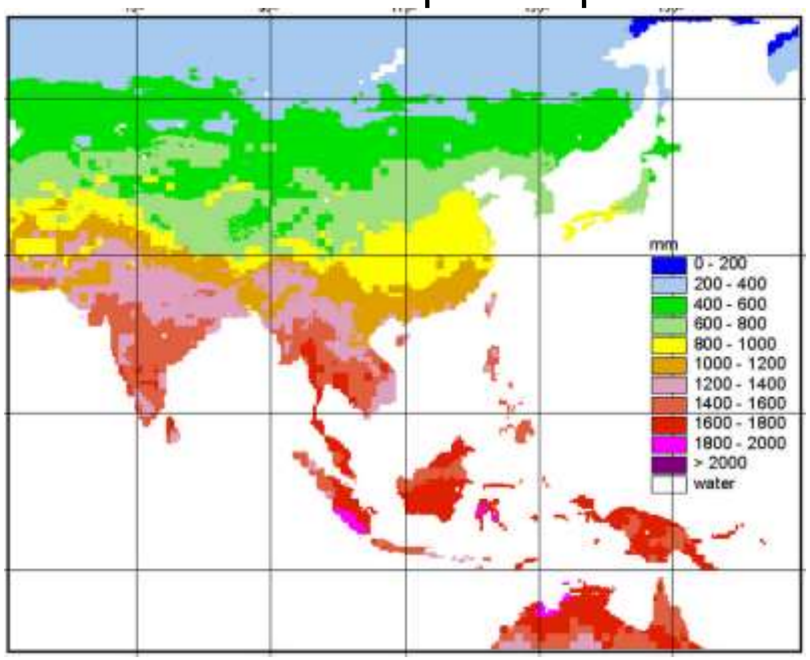
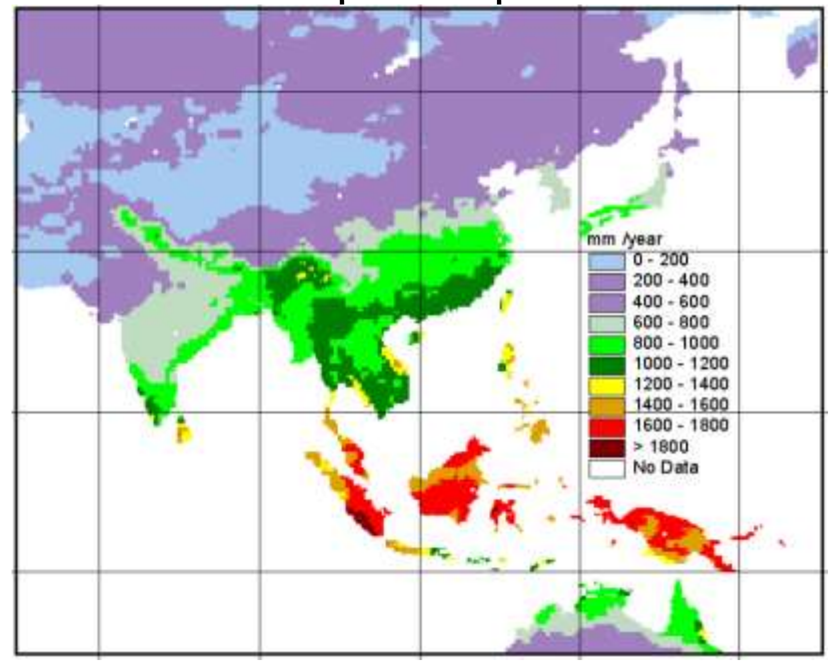
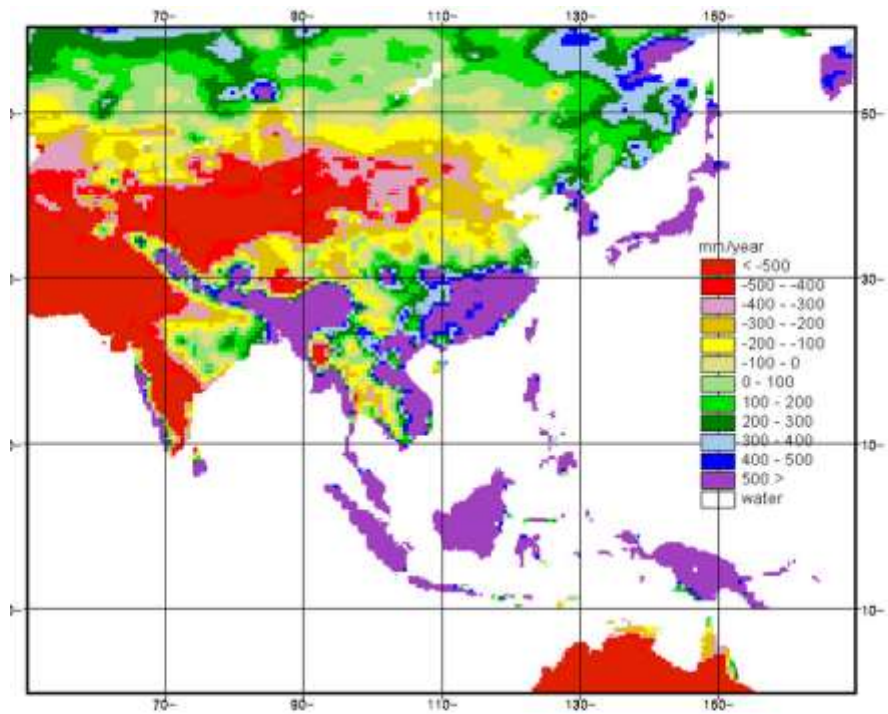
Potential evapotranspiration

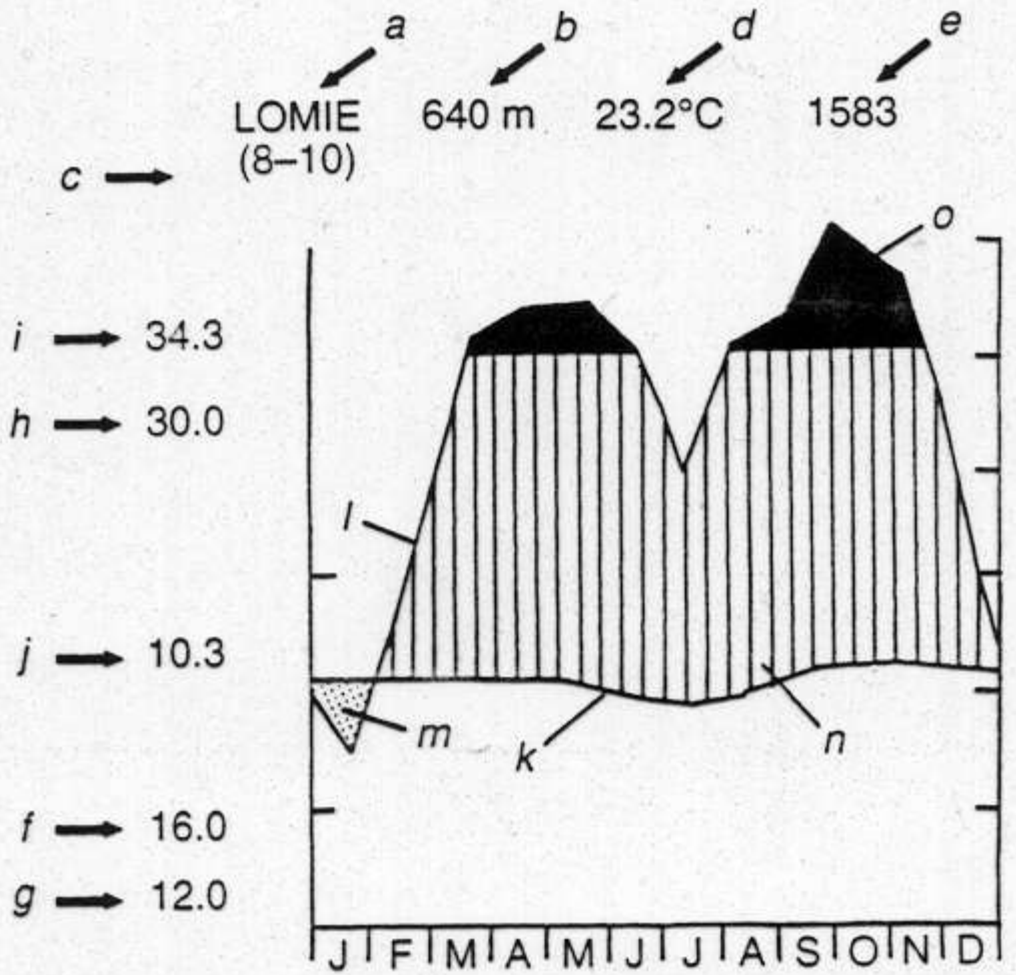


Actual evapotranspiration





Water surplus/deficit



Walter climate diagram: generic

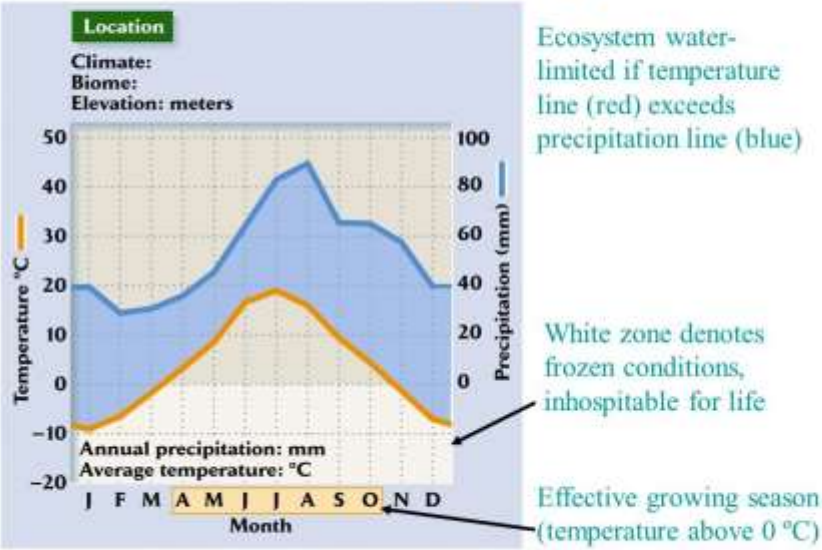
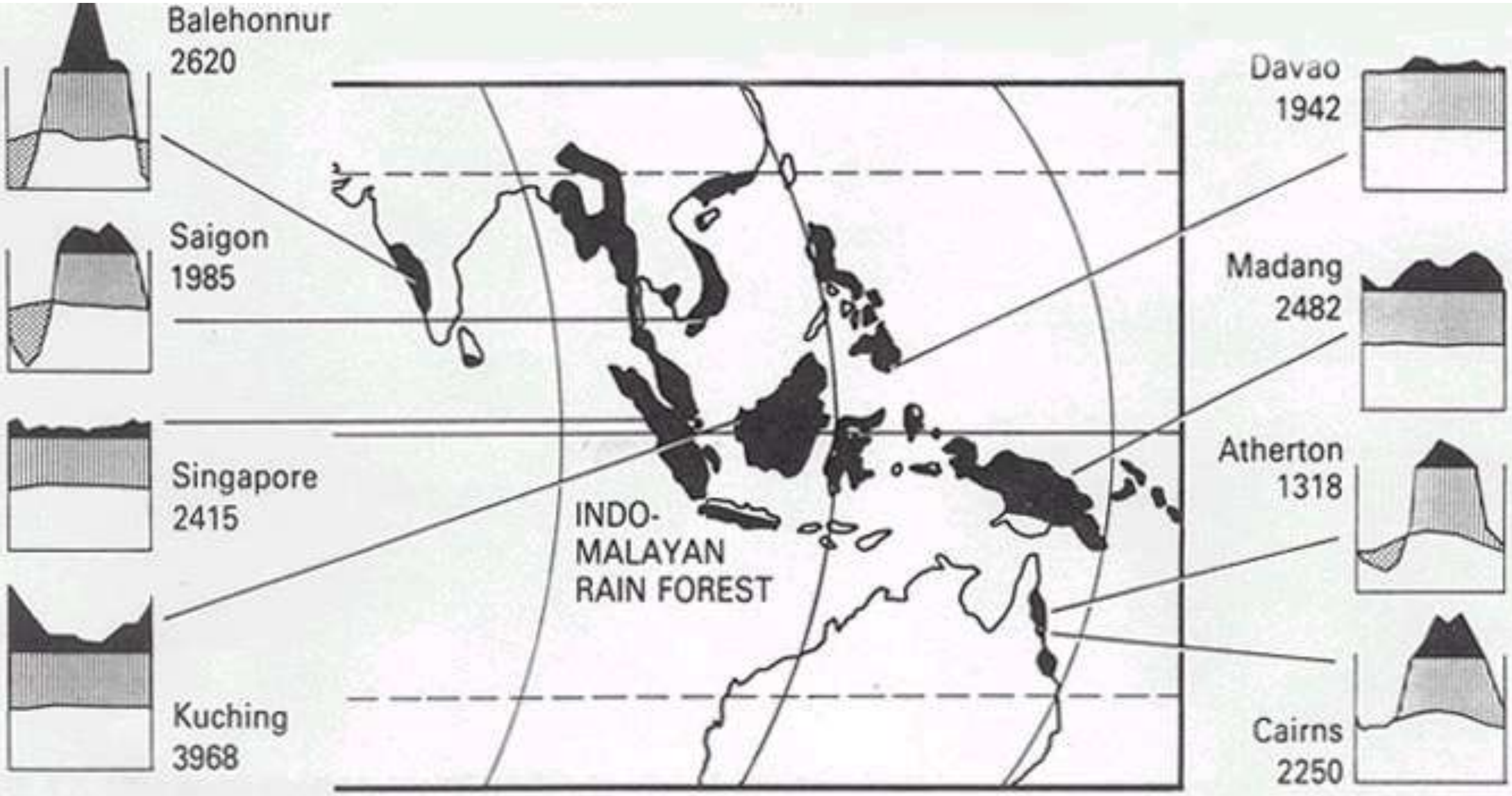
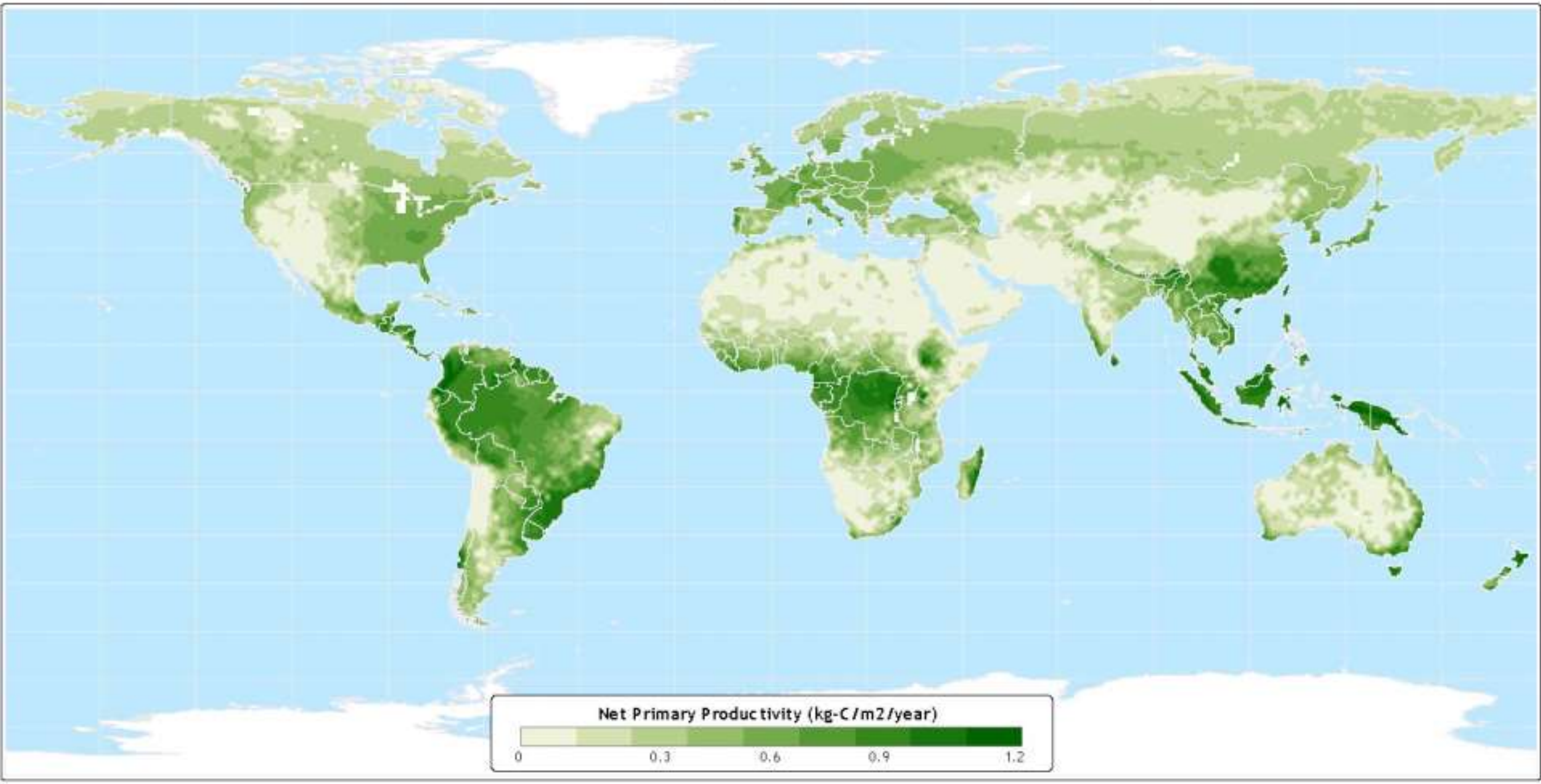


Figure 1.8 Example of a climate diagram for Lomie in Cameroon. The symbols and figures on the diagram have the following meaning: (a) station name; (b) station altitude; (c) number of years of observations (first figure: temperature; second figure: rainfall); (d) mean annual temperature; (e) mean annual rainfall mm; (f) mean daily minimum of coldest month; (g) lowest temperature recorded; (h) mean daily maximum of warmest month; (i) maximum temperature recorded; (j) mean daily temperature range; (k) graph of monthly mean temperatures (scale divisions are 10 °C); (l) graph of monthly mean rainfall (scale divisions are 20 mm); (m) drought period; (n) humid period; (o) monthly rainfall greater than 100 mm (scale 1/10 that of rainfall) (after Walter 1971 with kind permission from Gustav Fischer Verlag, Stuttgart 1991 © Spektrum Akademischer Verlag,



2.1. Tropical rain forest, distribution and climate. (After White 1983; Whitmore 1984*a*; Walter and Lieth 1967.) The Climate Diagrams show dry periods as dotted and rainy periods as hatched (or where monthly rainfall exceeds 100 mm shown black at 1/10 scale). Long-term mean annual rainfall (mm) is shown in figures. Dry periods which occur irregularly scattered through the year do not show up on these diagrams because they are based on long-term means.

Net Primary Productivity



Data taken from: IBIS Simulation
(Kucharik, et al. 2000)
(Foley, et al. 1996)

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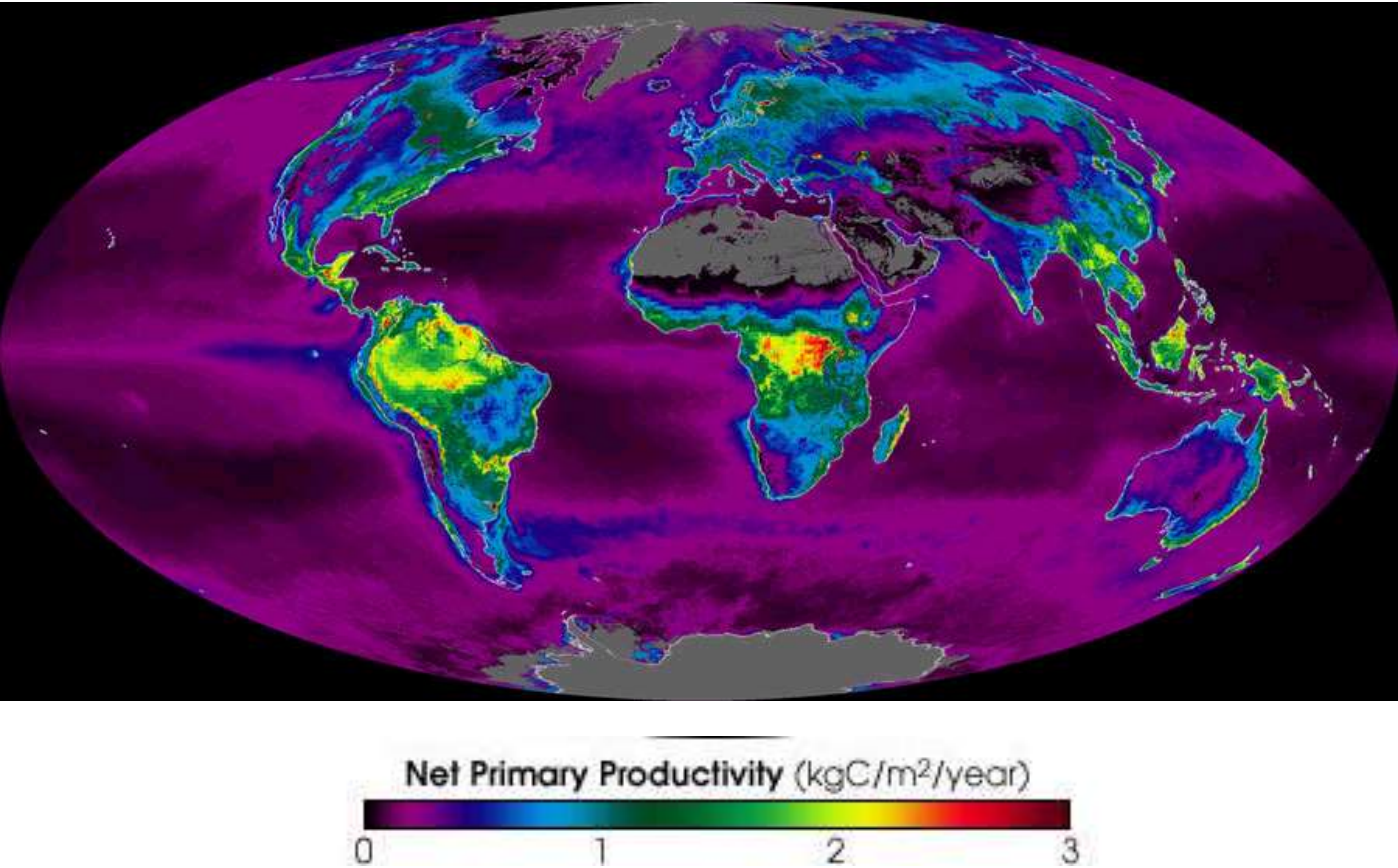
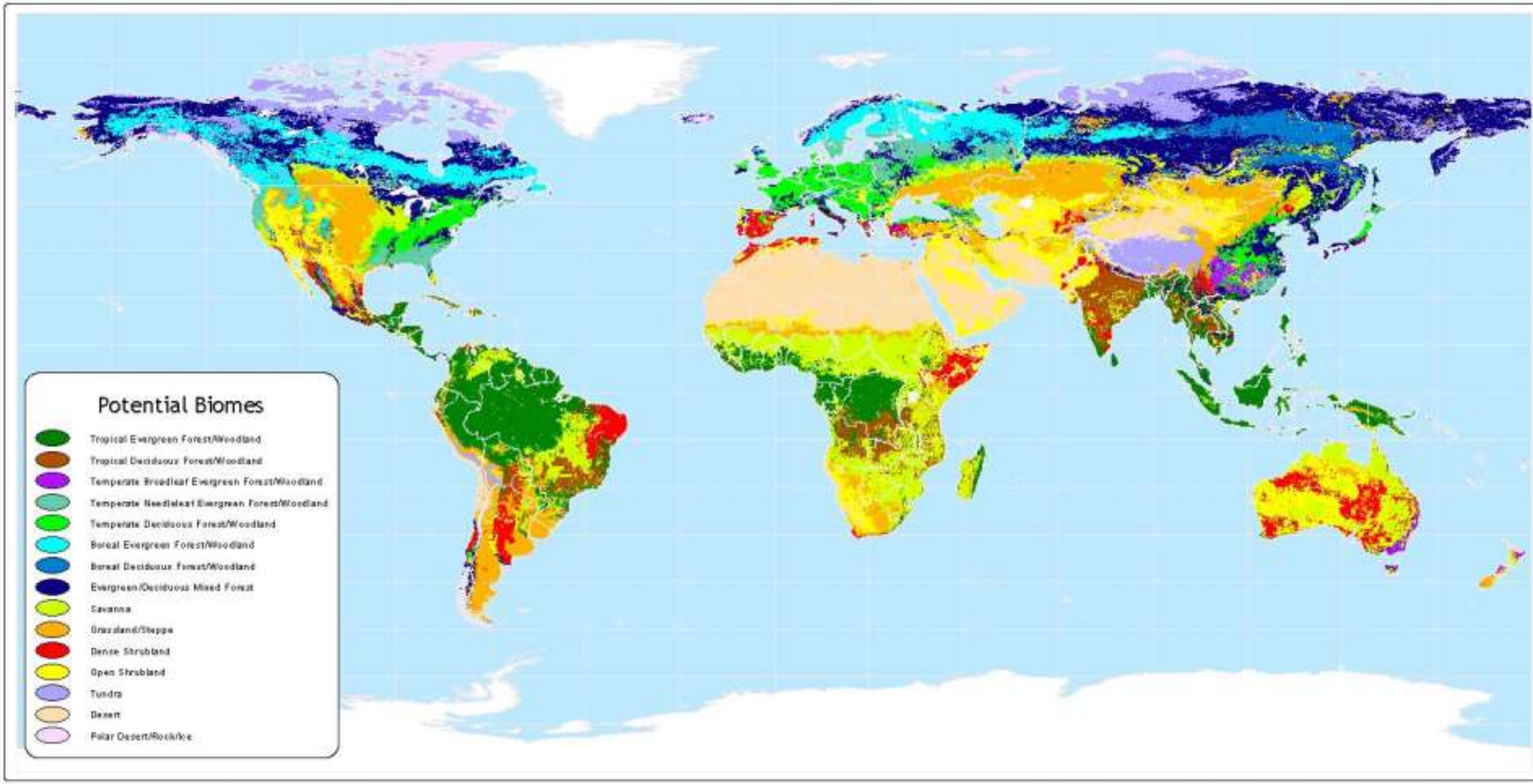
Global NPP - Net Primary Productivity



Productivity of world ecosystems

habitat	net PP g/m^2	Area (ha x 10^8)	World NPP	biomass kg/m	world biomass bill. ton
tropical rain forest	**1800**	24.5	**44.1**	**45**	**765**
temperate forest	1250	12.0	**15.0**	**65**	**386**
savanna	700	15.0	10.5	4	60
temp. grassland	500	9.0	4.5	1.6	14
desert	70	18.0	1.3	0.7	13
cultivated land	650	14.0	9.1	1	14
swamp and marsh	**2500**	2.0	5.0	15	30
lake and stream	500	2.0	1.0	.02	.05
Total Continent	**773**	**149**	**115.0**	**12.3**	**1837**
continental shelf	360	26.6	9.6	0.01	0.27
open ocean	125	332	**41.5**	.003	1.0
algal beds and reefs	2500	0.6	1.6	2	1.2
Total Marine	**152**	**361**	**55.0**	**0.01**	**3.9**

Potential Vegetation



Data taken from: Ramankutty and Foley 1999

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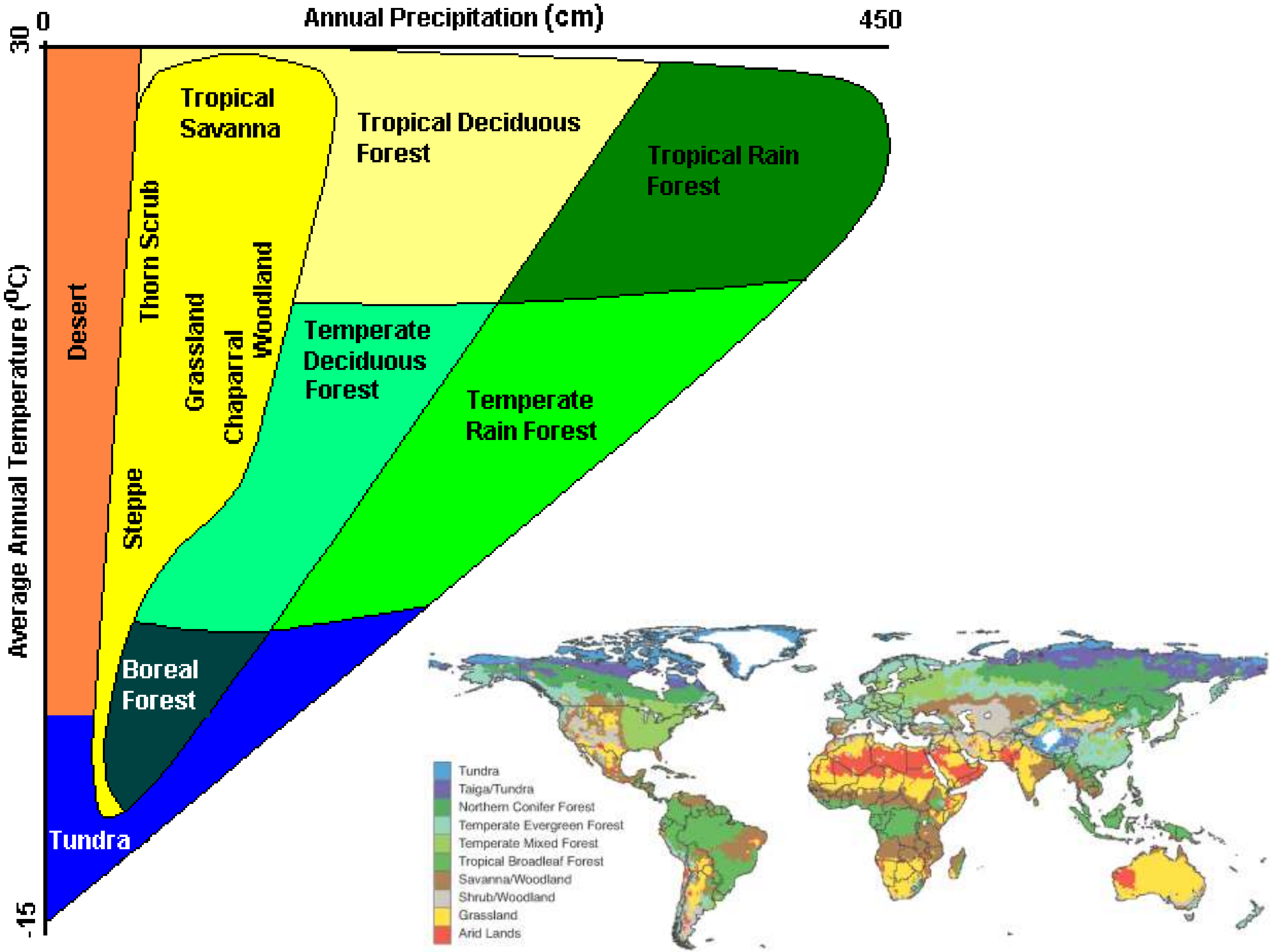
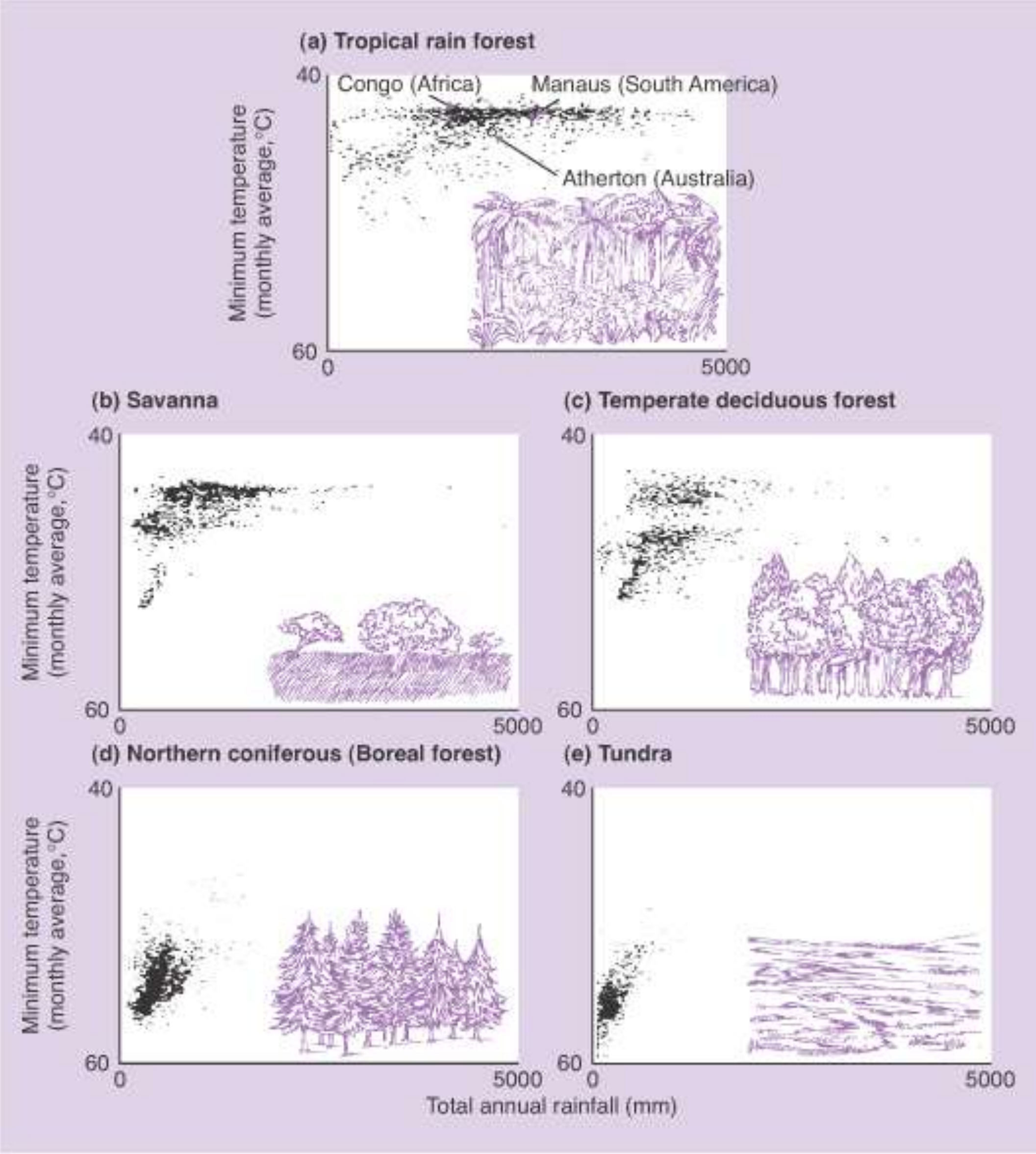
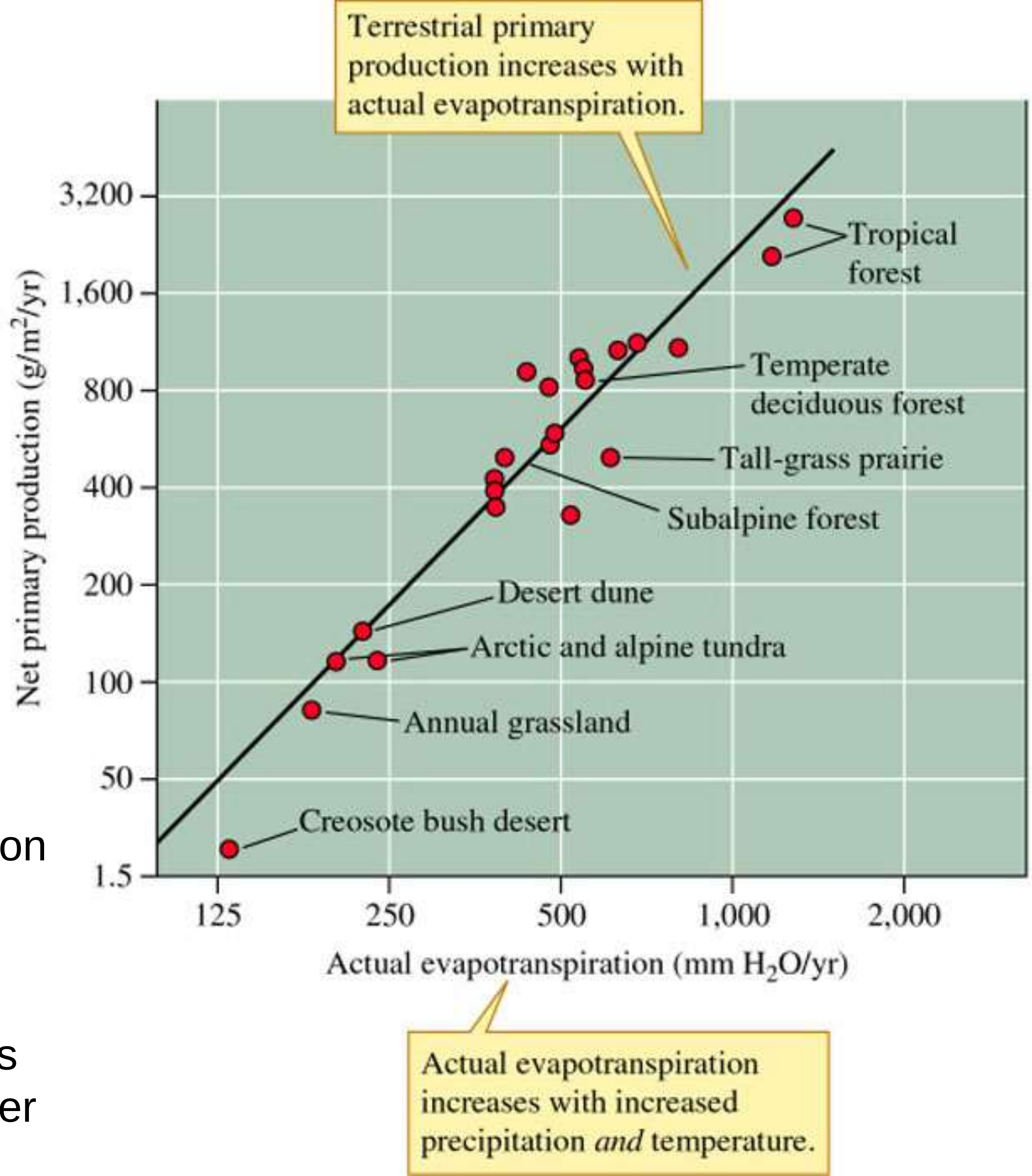

Annual Precipitation (cm)
0
450
30
-15
Average Annual Temperature (°C)
Desert
Thorn Scrub
Tropical Savanna
Grassland
Chaparral
Woodland
Steppe
Tropical Deciduous Forest
Tropical Rain Forest
Temperate Deciduous Forest
Temperate Rain Forest
Boreal Forest
Tundra
Tundra
Taiga/Tundra
Northern Conifer Forest
Temperate Evergreen Forest
Temperate Mixed Forest
Tropical Broadleaf Forest
Savanna/Woodland
Shrub/Woodland
Grassland
Arid Lands

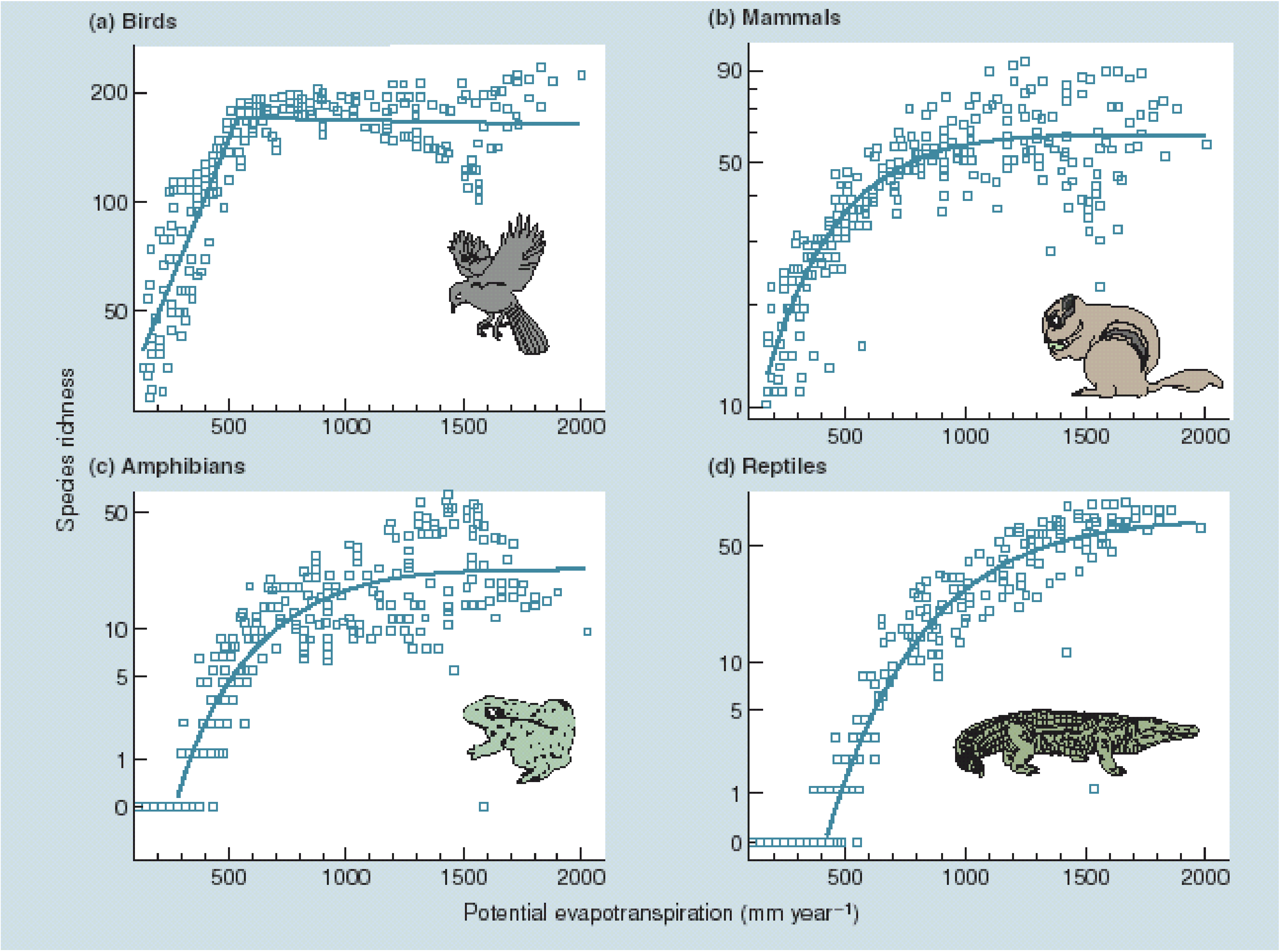


(a) Tropical rain forest
Congo (Africa)
Manaus (South America)
Atherton (Australia)
Minimum temperature (monthly average, °C)
40
60
0
5000
(b) Savanna
(c) Temperate deciduous forest
(d) Northern coniferous (Boreal forest)
(e) Tundra
Total annual rainfall (mm)



Actual Evapotranspiration is a good predictor of terrestrial net primary production as it combines the influences of temperature and water

Potential evapotranspiration - the best predictor of species richness



Hurricanes:
a common tropical
disturbance

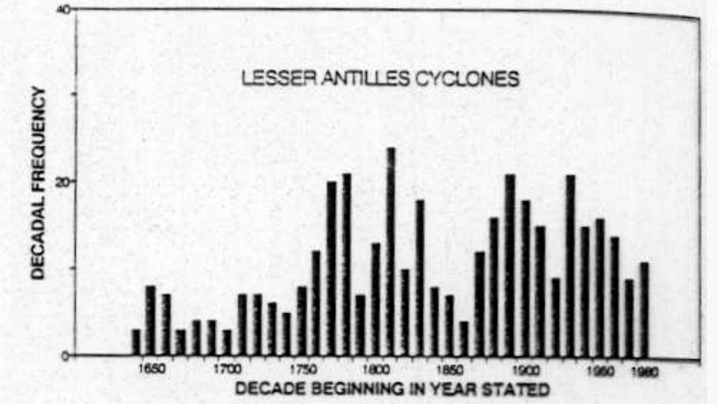
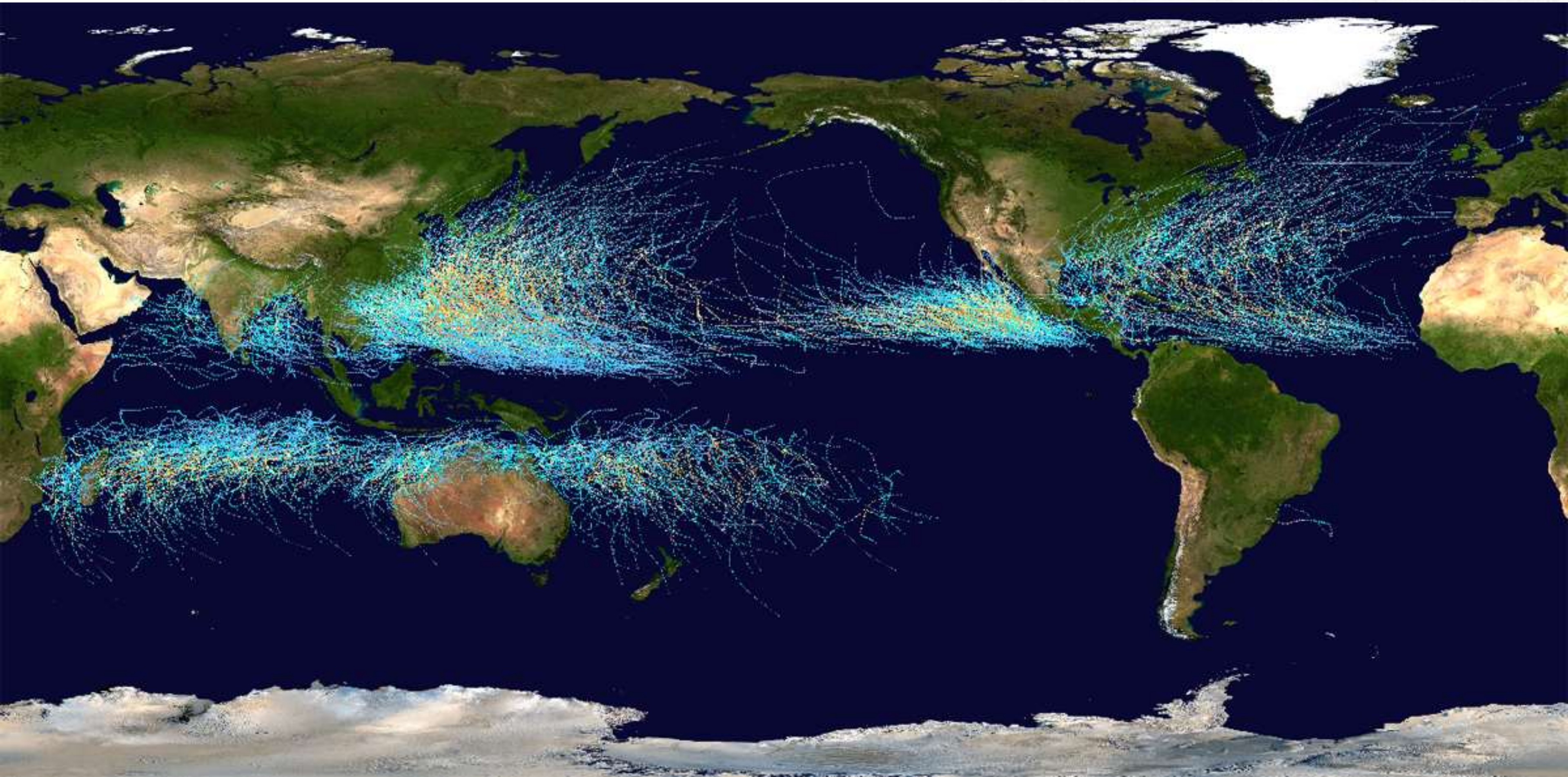
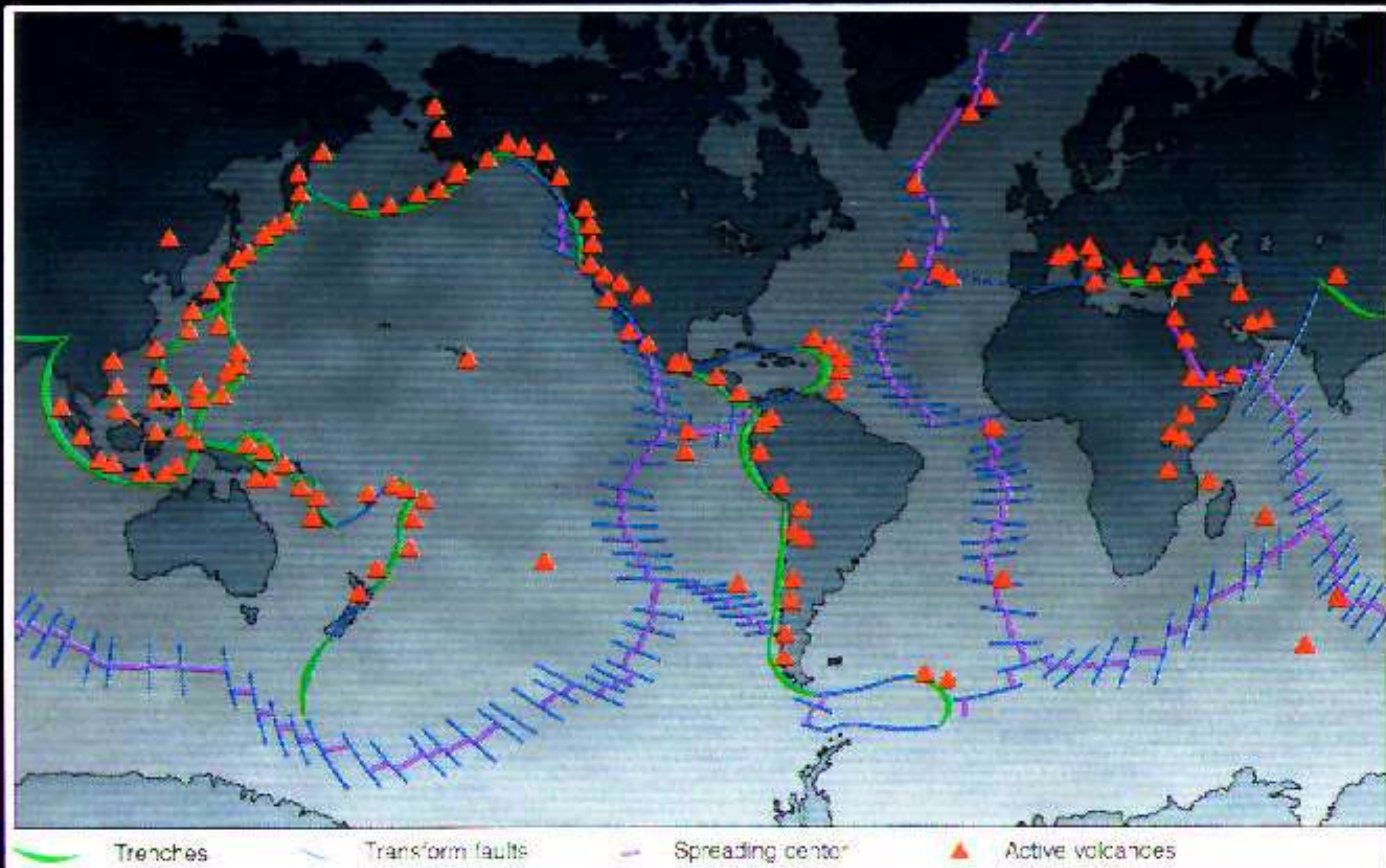
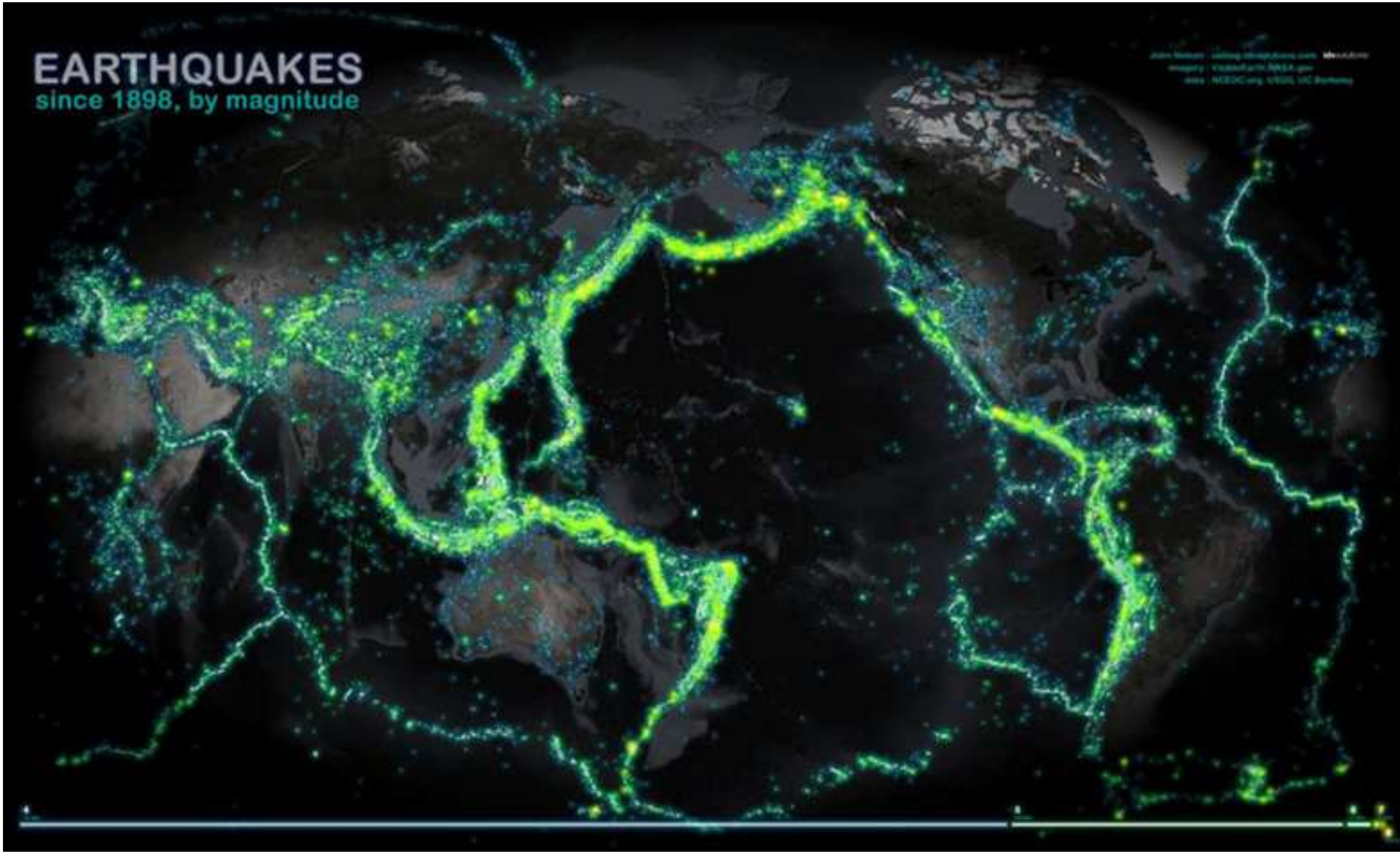


Fig. 7.16 Changes in cyclone frequency in the Lesser Antilles during the period 1640–1989. After Walsh & Reading (1991).



Centers of volcanic activity




EARTHQUAKES
since 1898, by magnitude