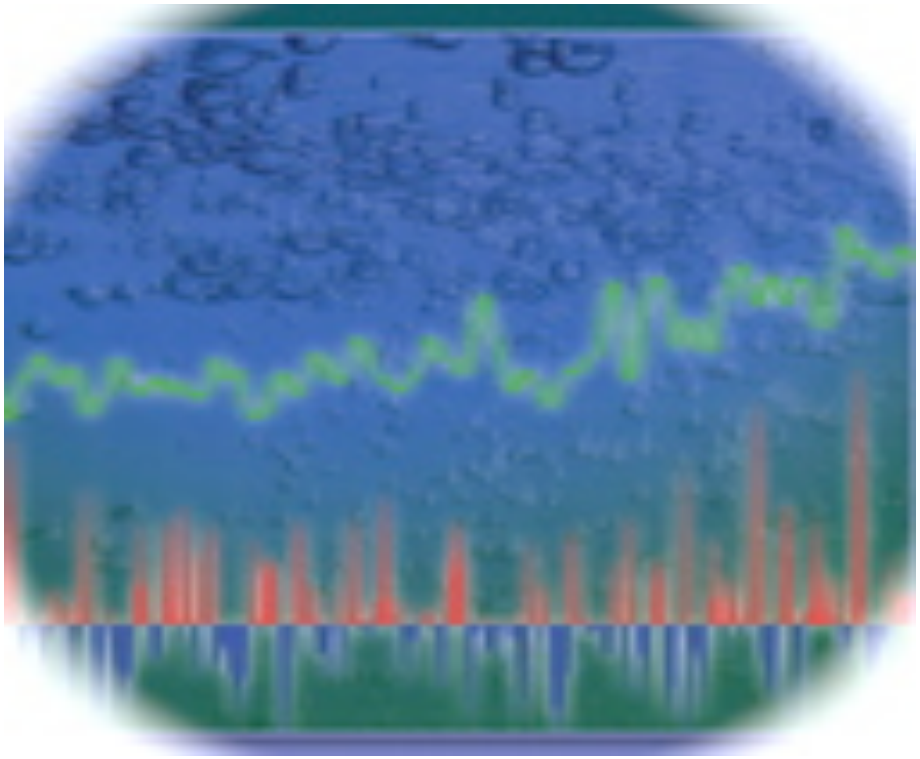
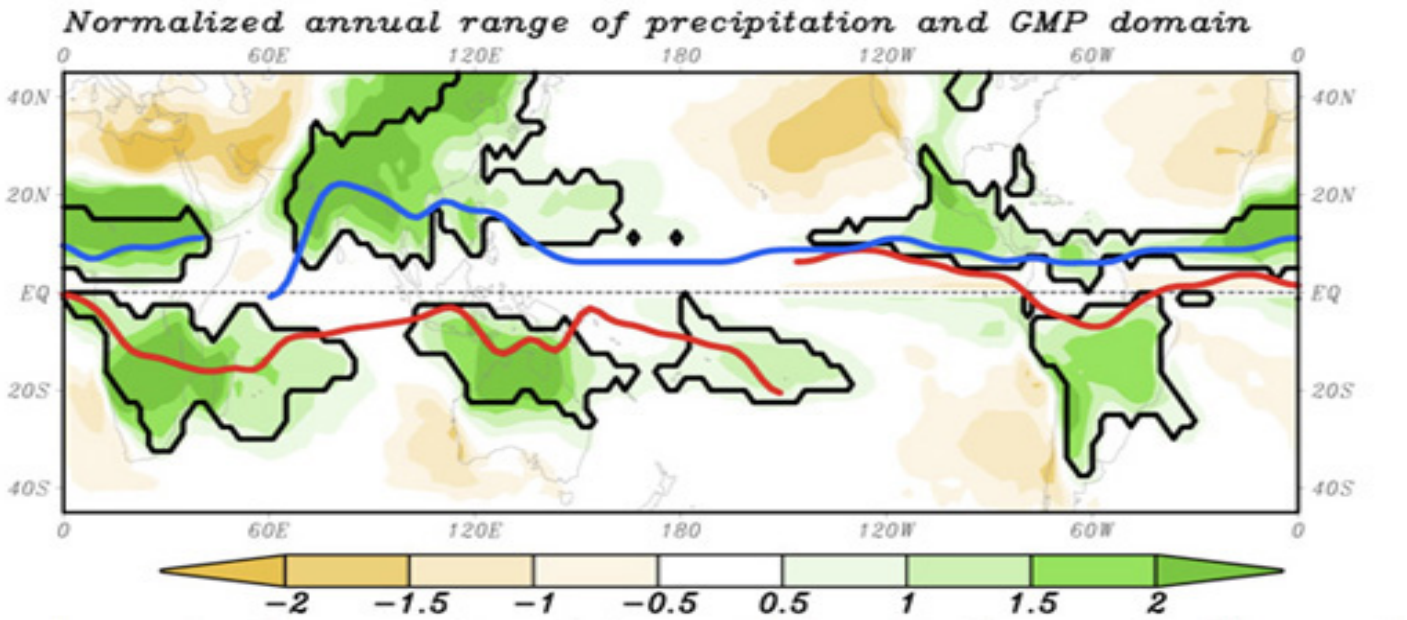
Climate Dynamics: Why Does Climate Vary?

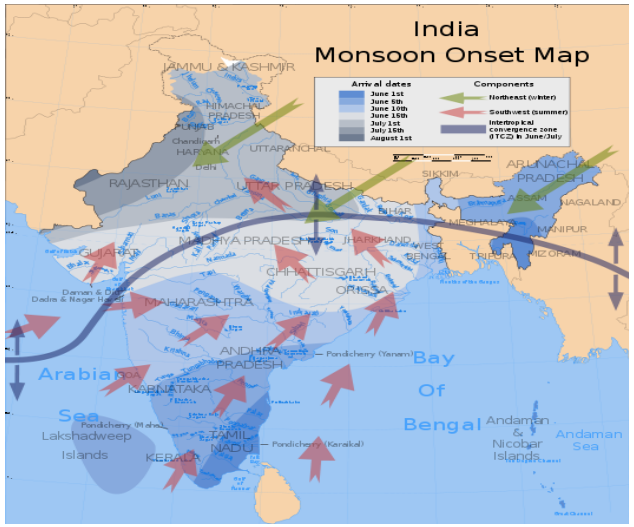


Monsoons: A Seasonal Dialogue Between the Land and the Adjacent Oceans

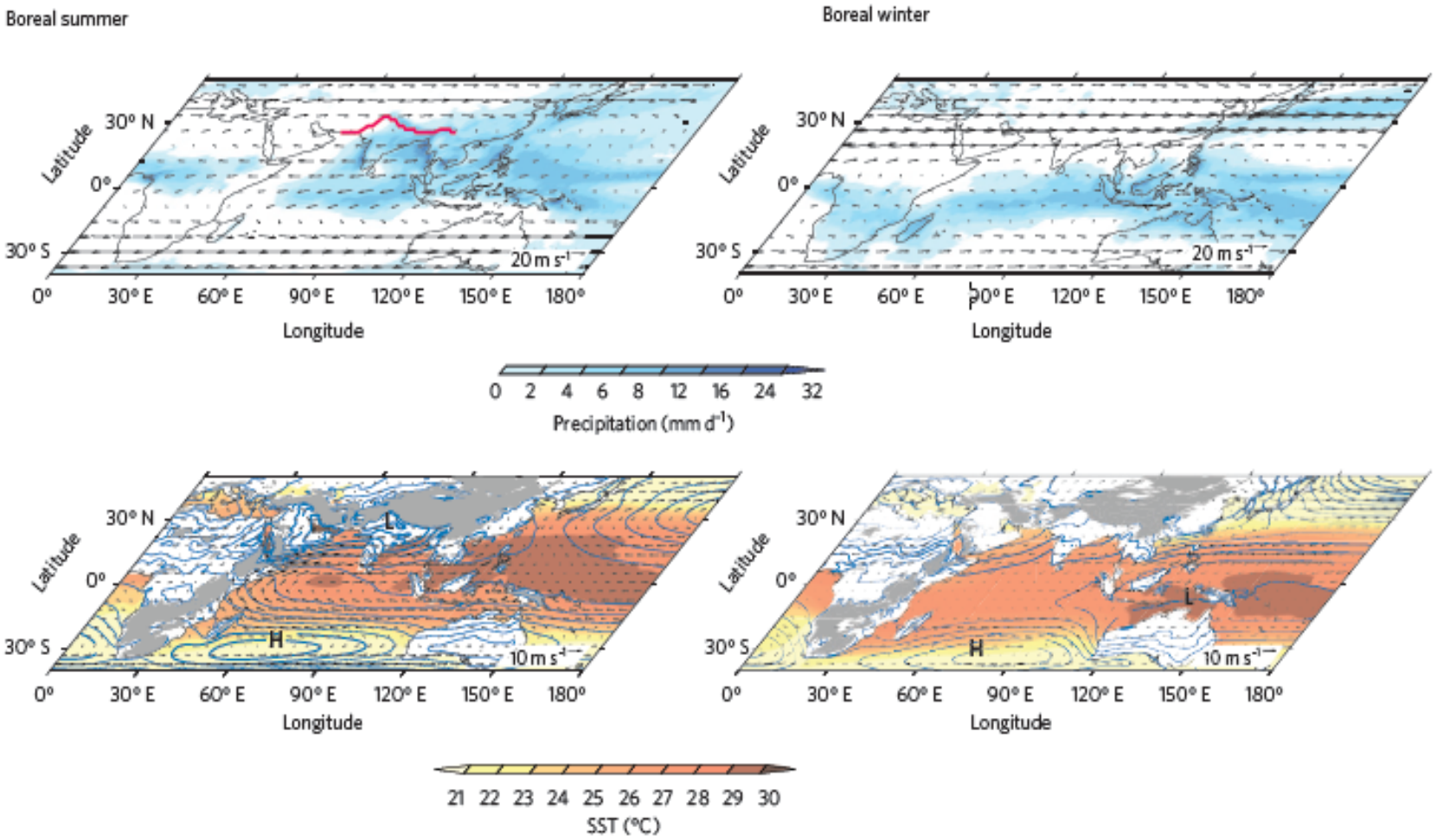
http://www.esrl.noaa.gov/psd/people/dezheng.sun/lectures/ATOC7500.html

The Monsoons

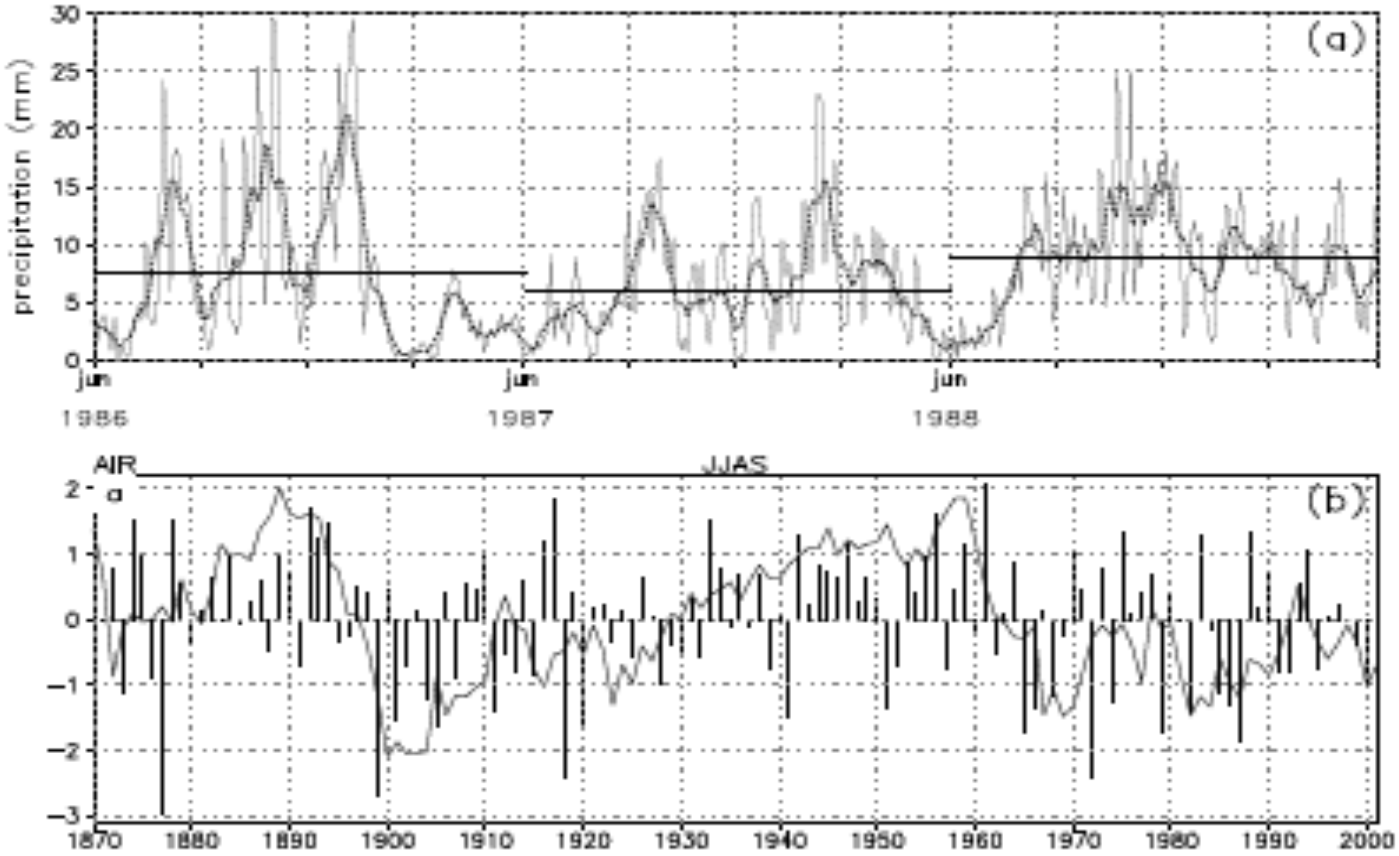




The South Asian Monsoon

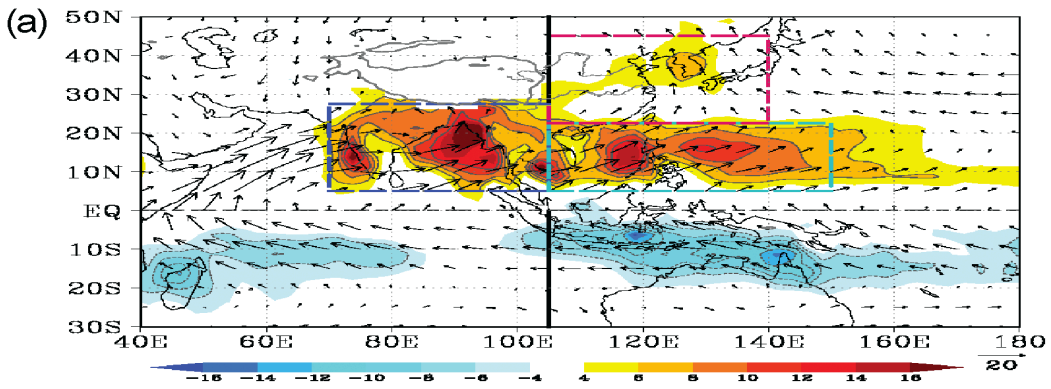


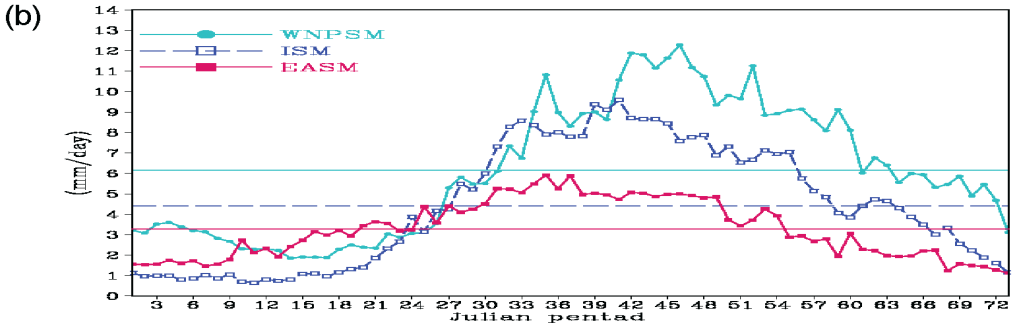
The South Asian Monsoon

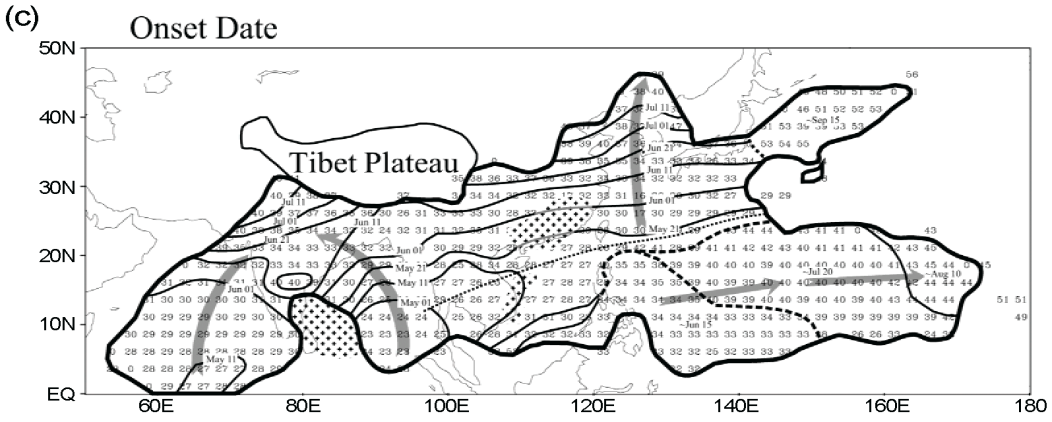


The Asian Monsoon Family:

IM,WNPM, EAM

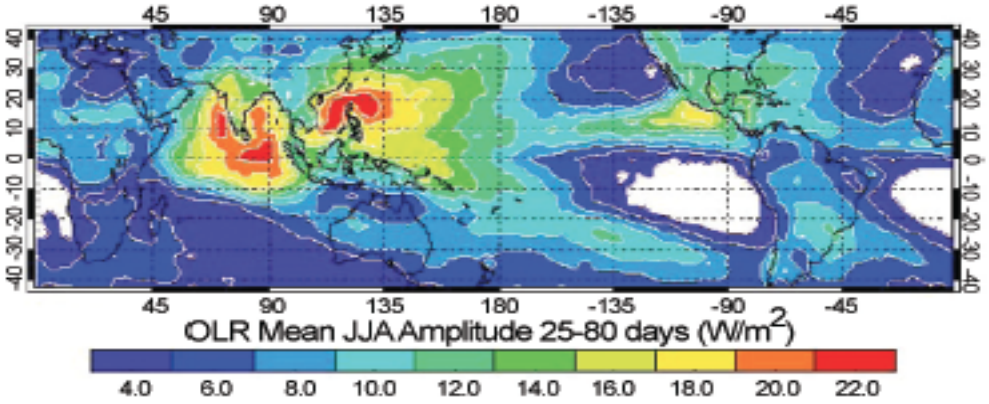


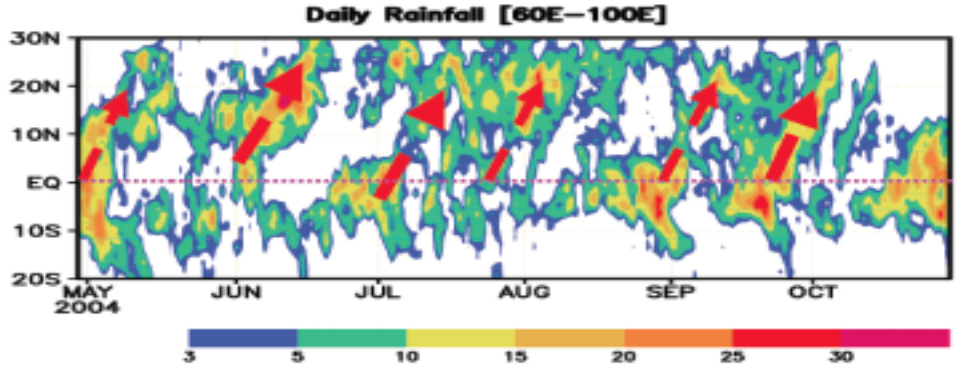




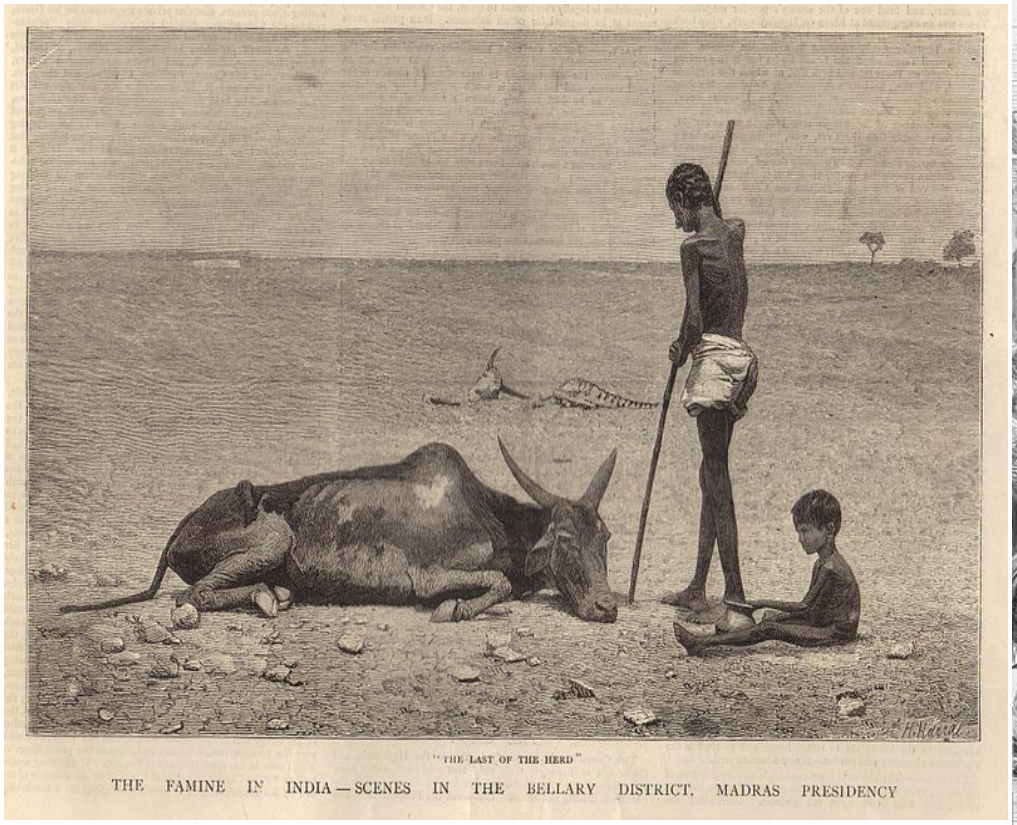
The Asian Monsoons

Intra-Seasonal Variability



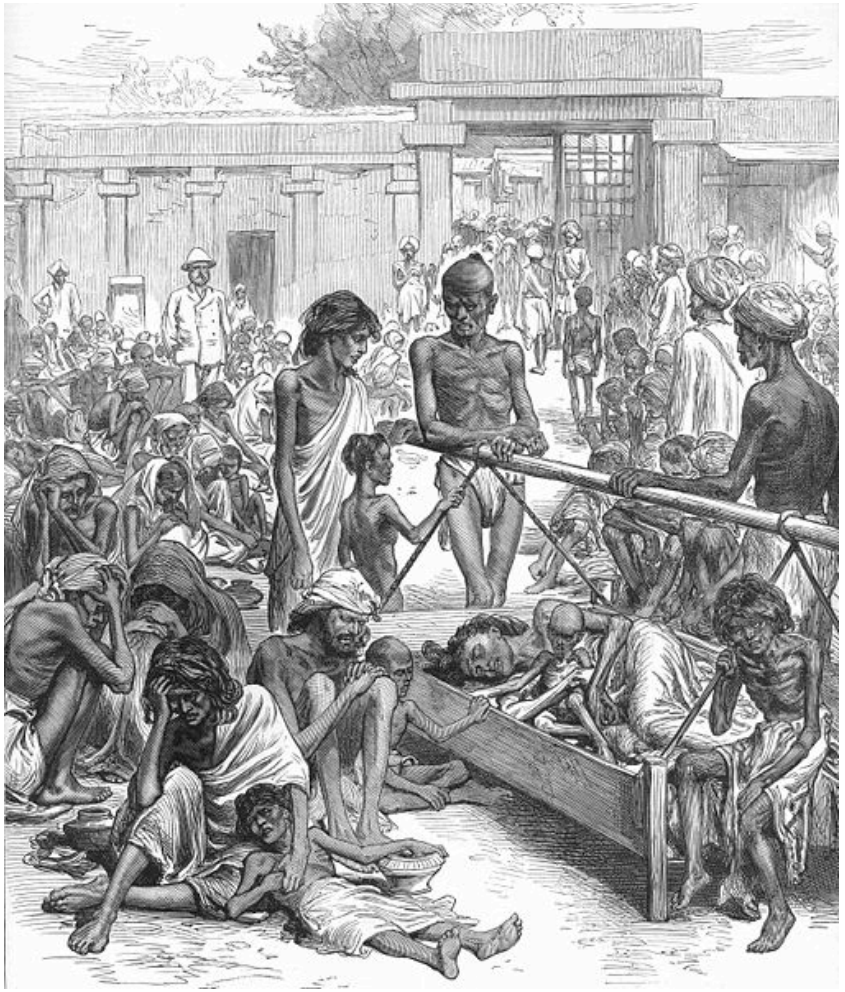


Great Famine of 1876–1878

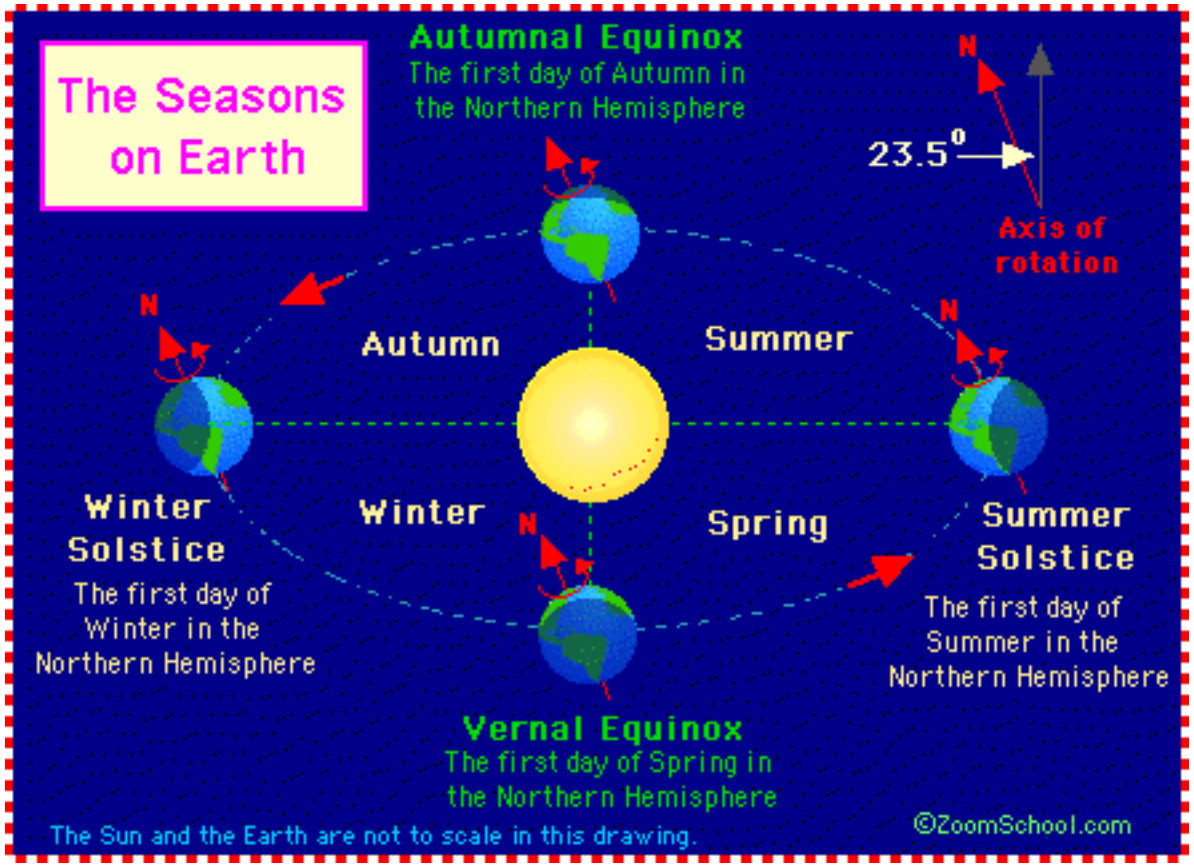


"THE LAST OF THE HERD"

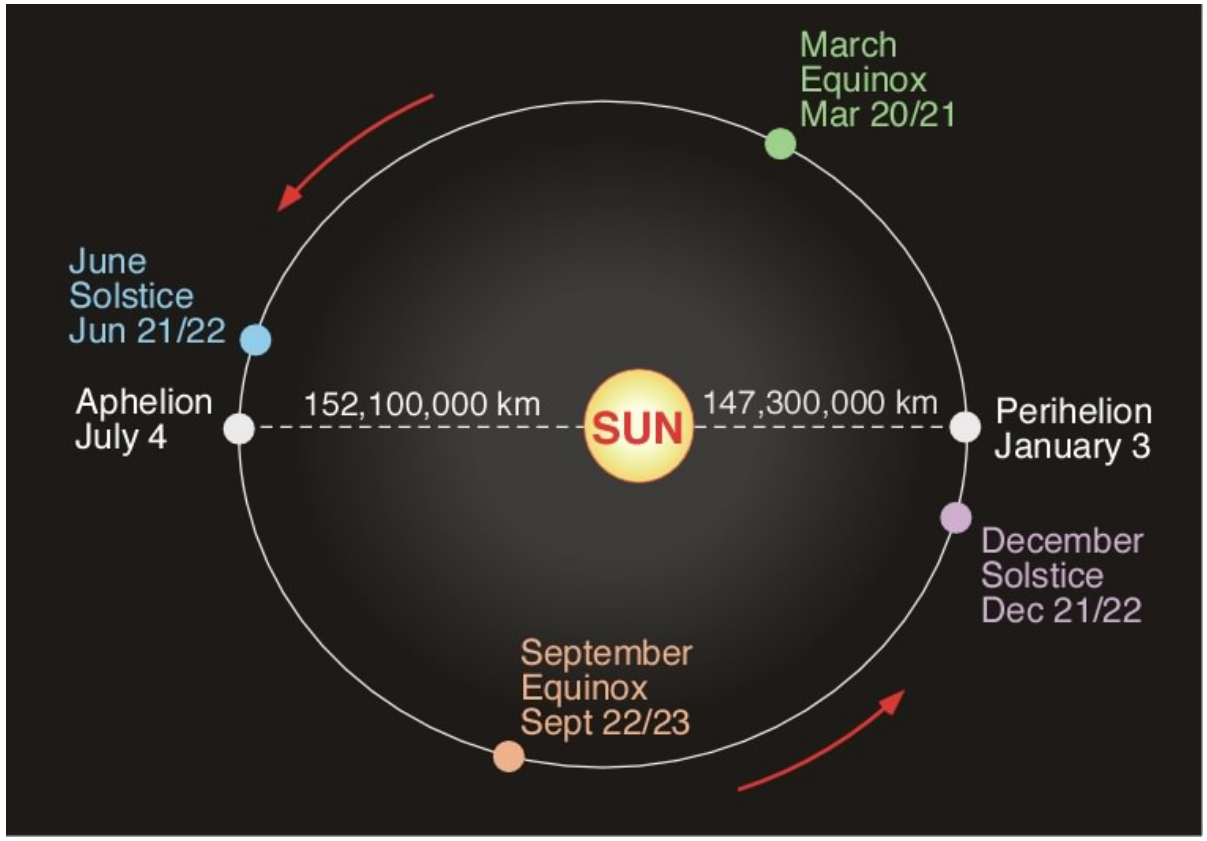
THE FAMINE IN INDIA — SCENES IN THE BELLARY DISTRICT, MADRAS PRESIDENCY



Why do we have seasons?

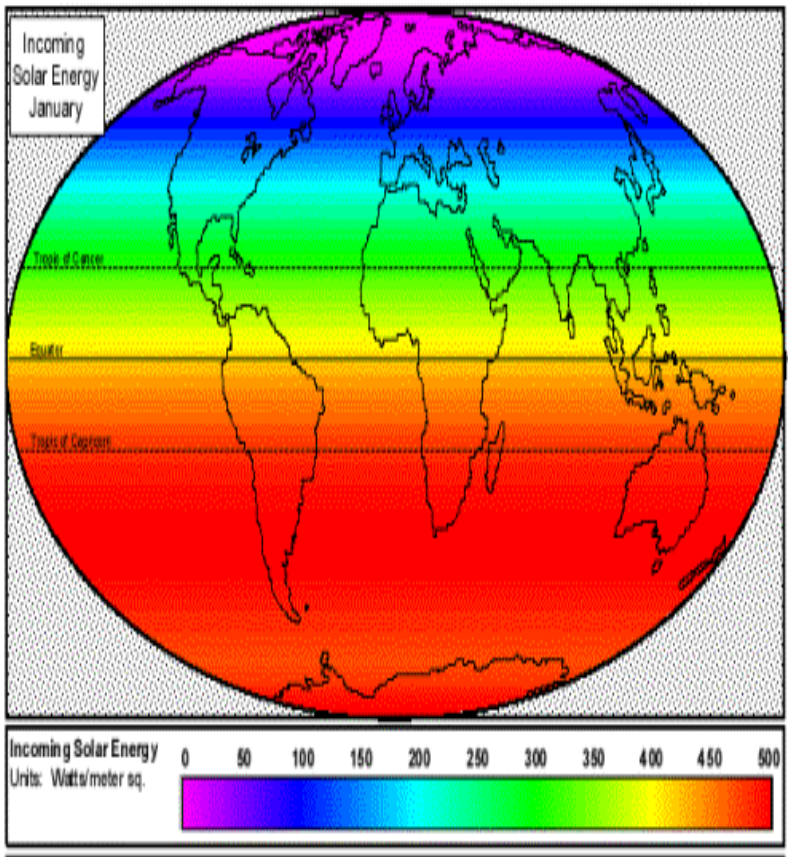


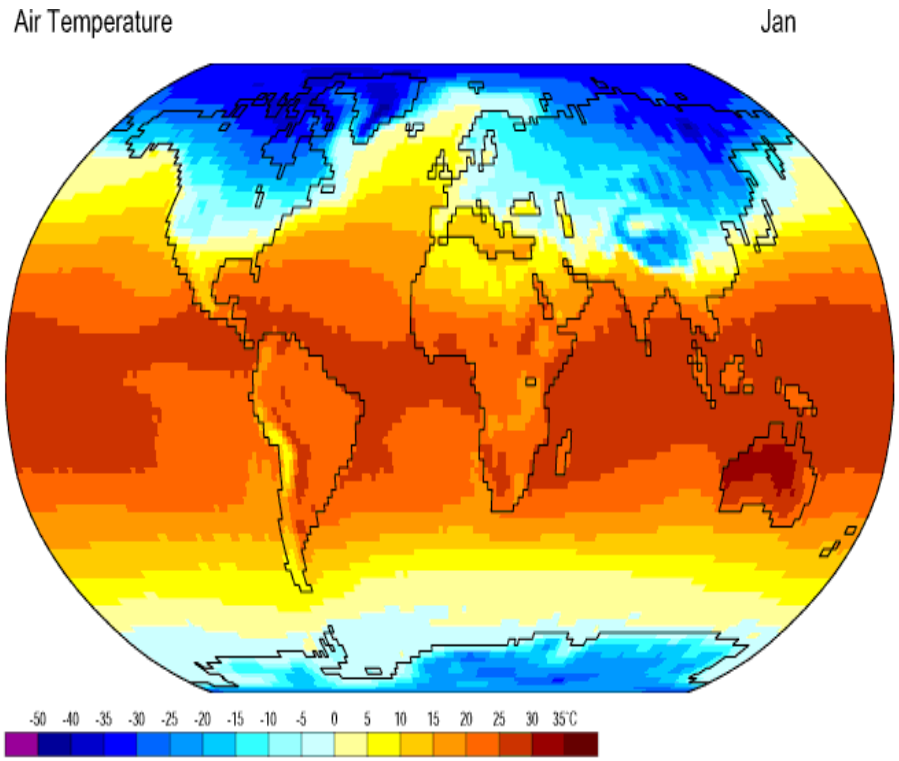
Some Numbers About The Earth's Orbit



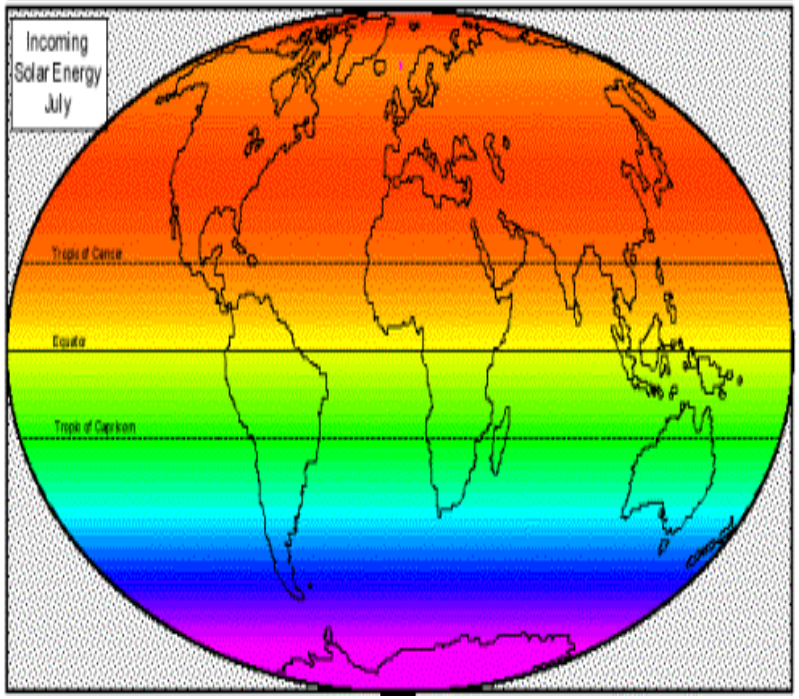
Farthest point:
152,100,000 km
Closest point:
147,300,000 km
Difference:
4,800,000 km
Sun's Radius:
695,500 km
Earth's Radius
6,400 km

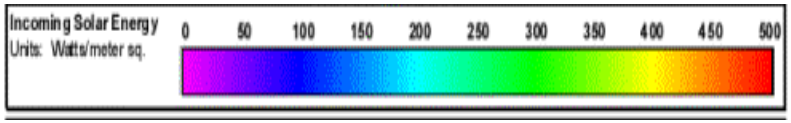
Why do we have seasons?

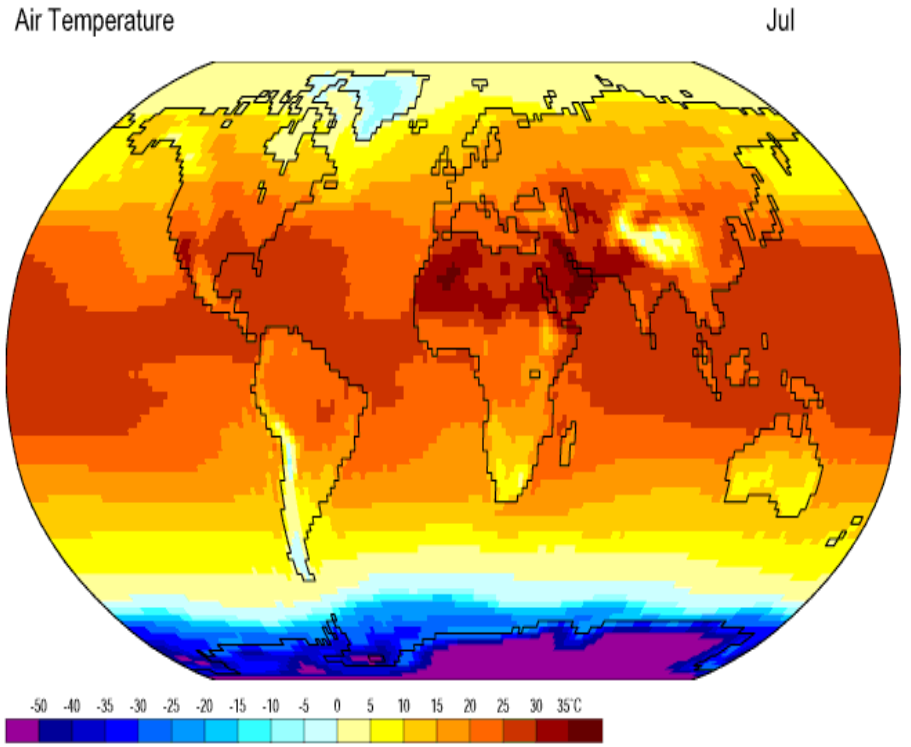




Why do we have seasons?





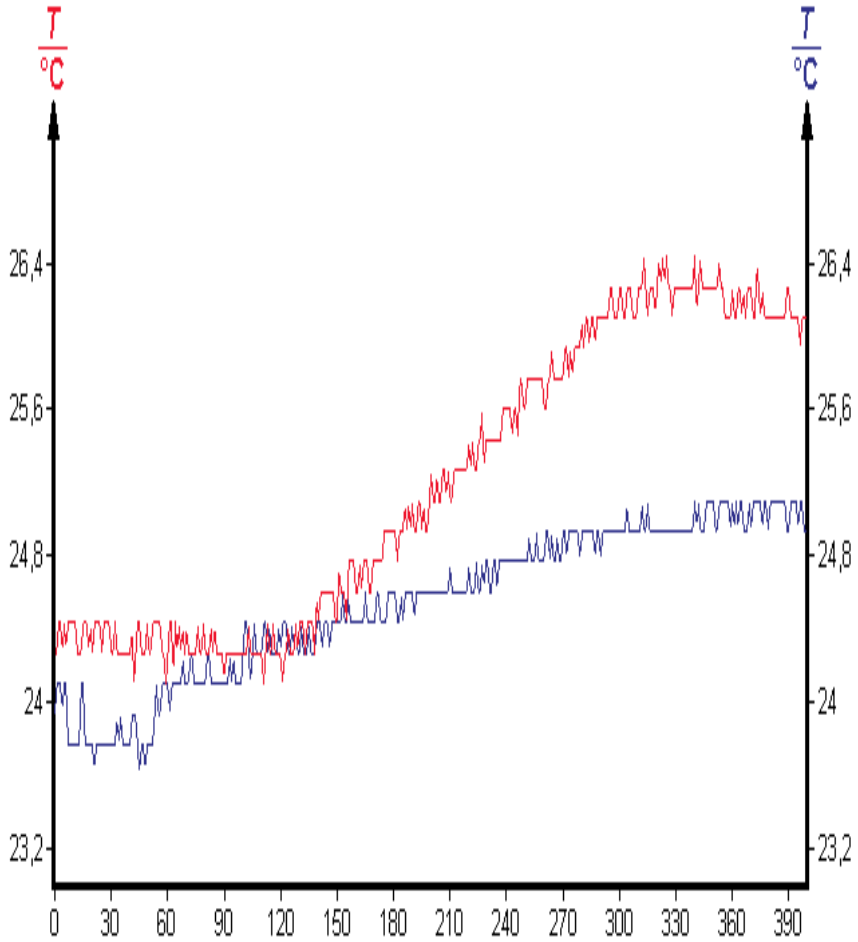


Data: NCEP/NCAR Reanalysis Project, 1959-1997 Climatologies

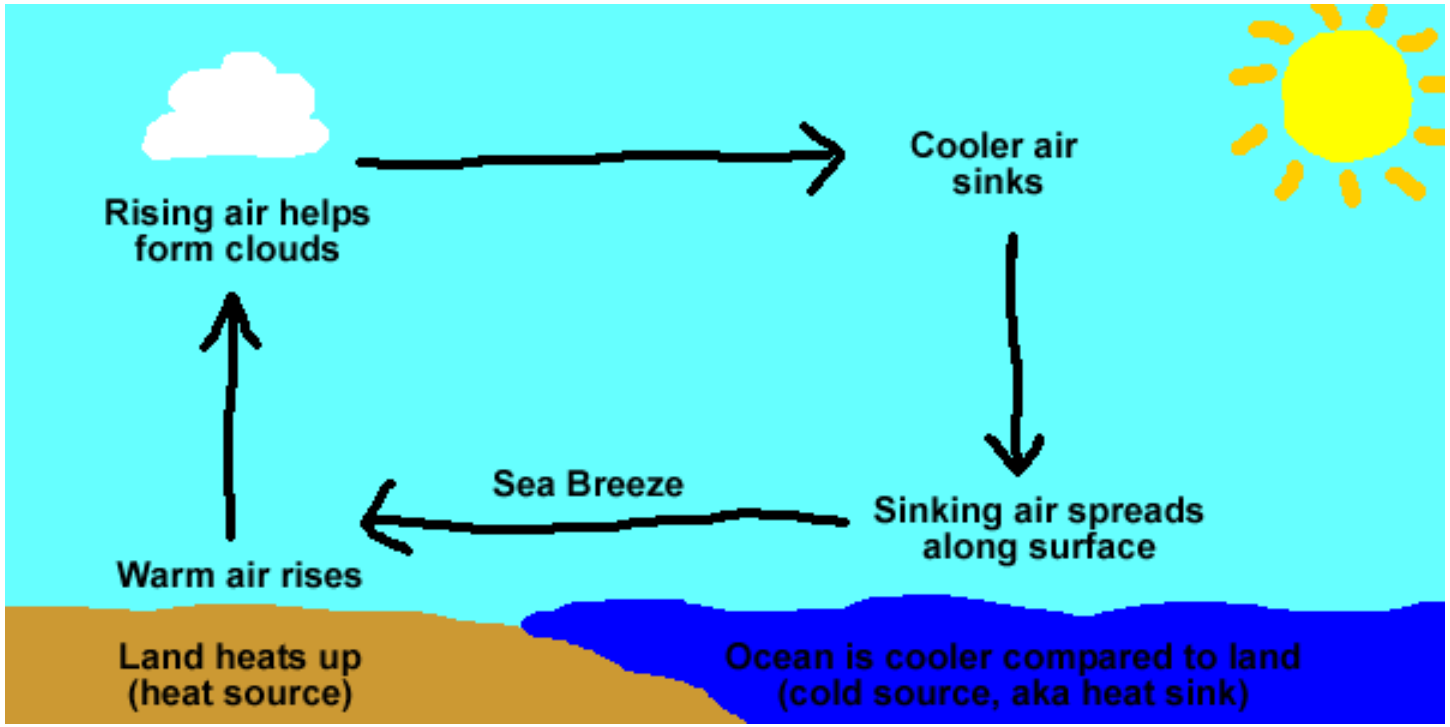
Land and Ocean Differences

MATERIAL	CONDITION	MASS DENSITY (r) ($kg\ m^{-3} \times 10^3$)	SPECIFIC HEAT (c) ($J\ kg^{-1}\ K^{-1} \times 10^3$)	THERMAL CONDUCTIVITY (k_g) ($W\ m^{-2}\ K^{-1}$)	THERMAL DIFFUSIVITY (v_g) ($m^2\ s^{-1} \times 10^{-6}$)
Air	20 Deg C, Still	0.0012	1.01	0.025	20.5
Water	20 Deg C, Still	1.00	4.19	0.57	0.14
Ice	0 Deg C, Pure	0.92	2.10	2.24	1.16
Snow	Fresh	0.10	2.09	0.08	0.38
Snow	Old	0.48	2.09	0.42	0.05
Sandy Soil	Fresh	1.60	0.80	0.30	0.24
Clay Soil	Dry	1.60	0.89	0.25	0.18
Peat Soil	Dry	0.30	1.92	0.06	0.10
Rock	Solid	2.70	0.75	2.90	1.43

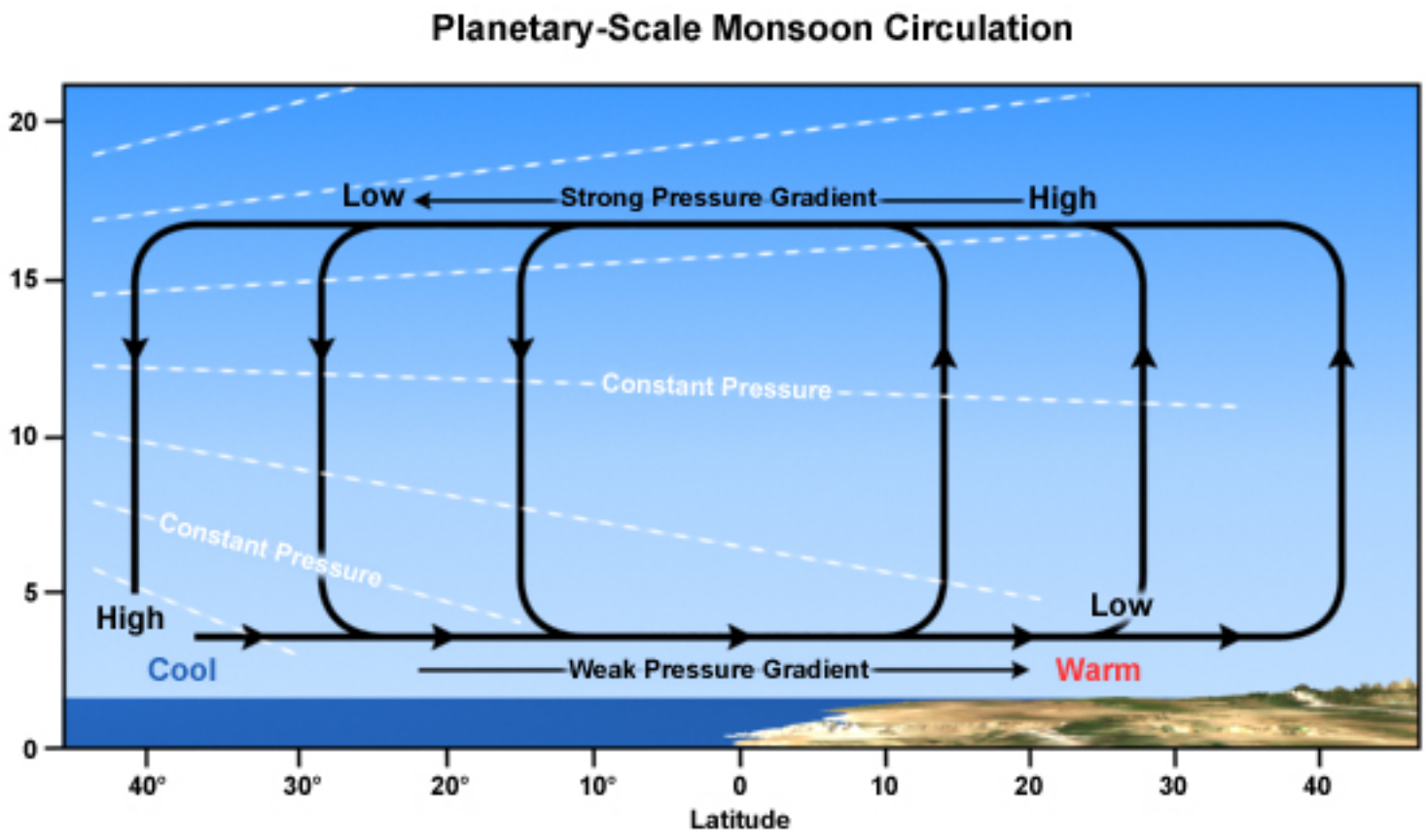
The Impact of Heat Capacity Difference On The Response of Heating



The Sea Breeze Model

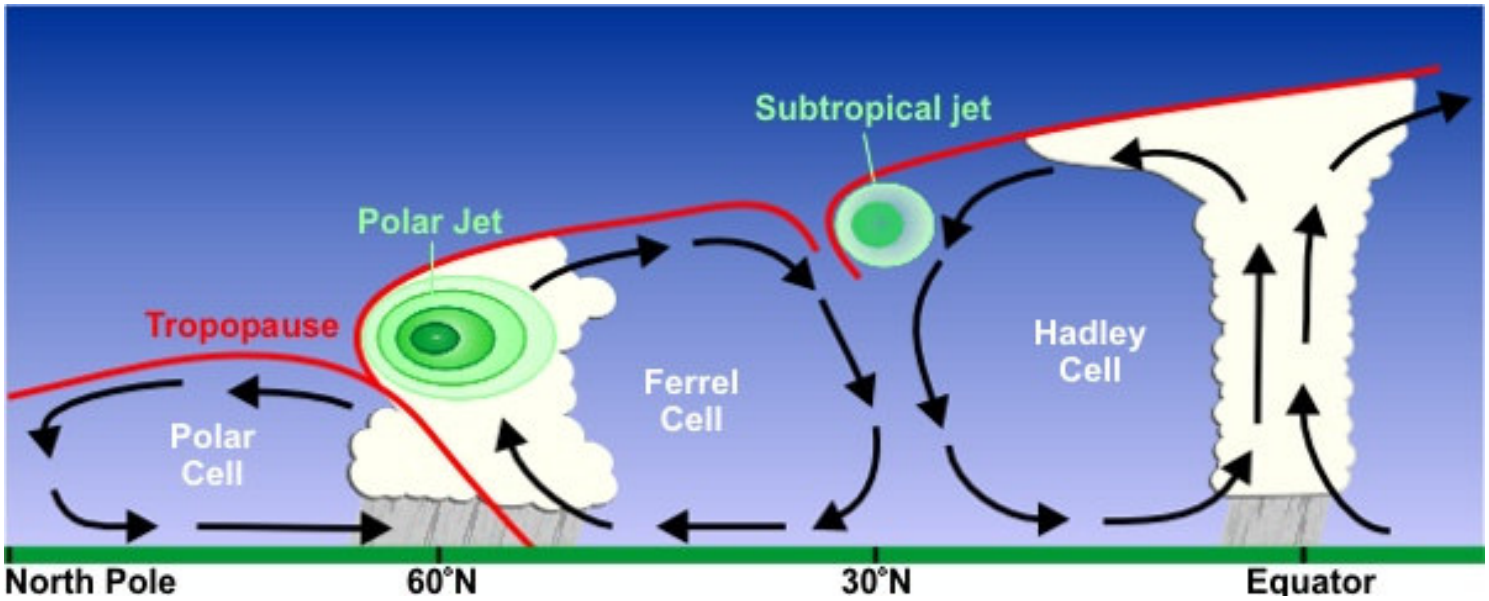


The First Model for SAM

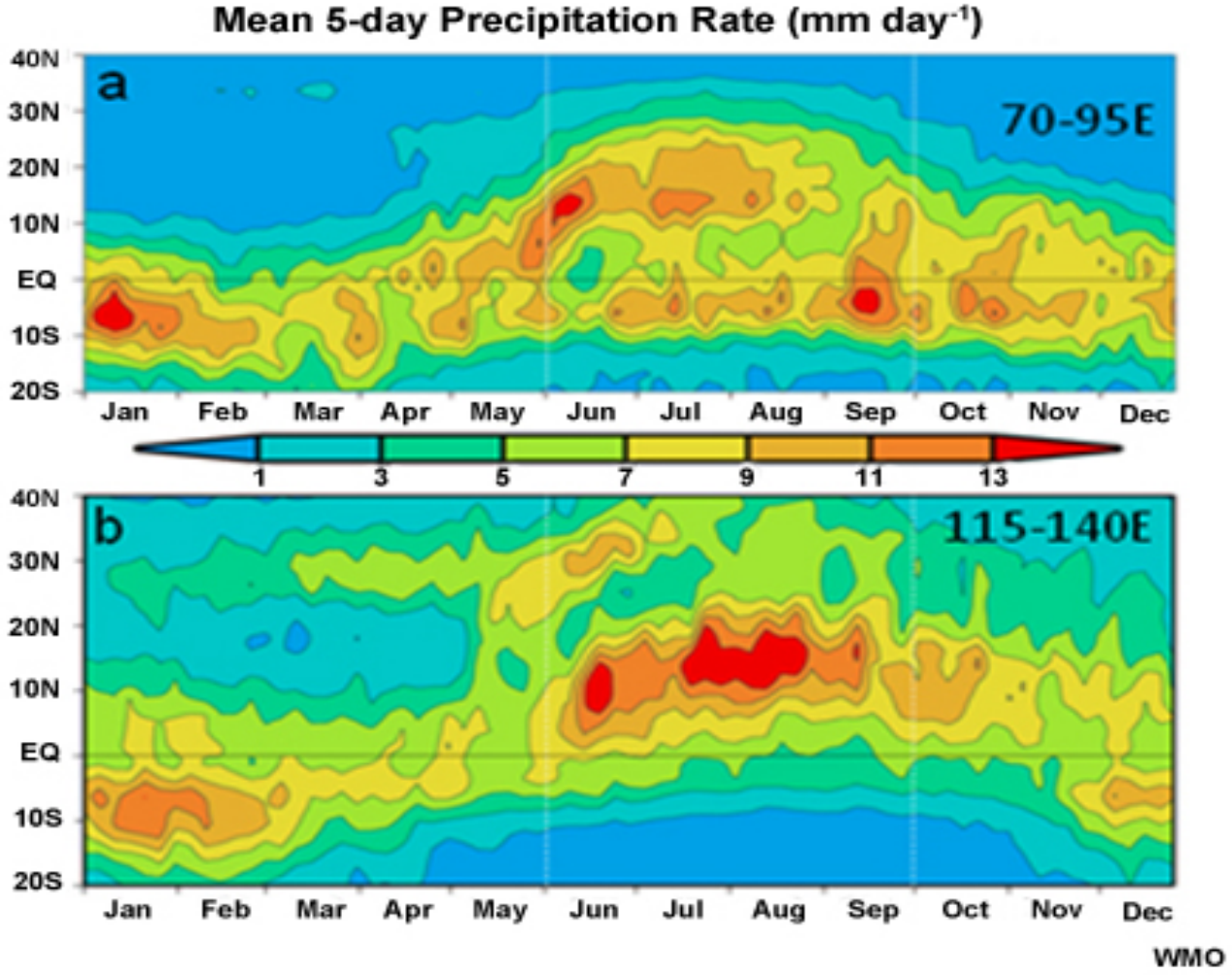


Webster (1987)

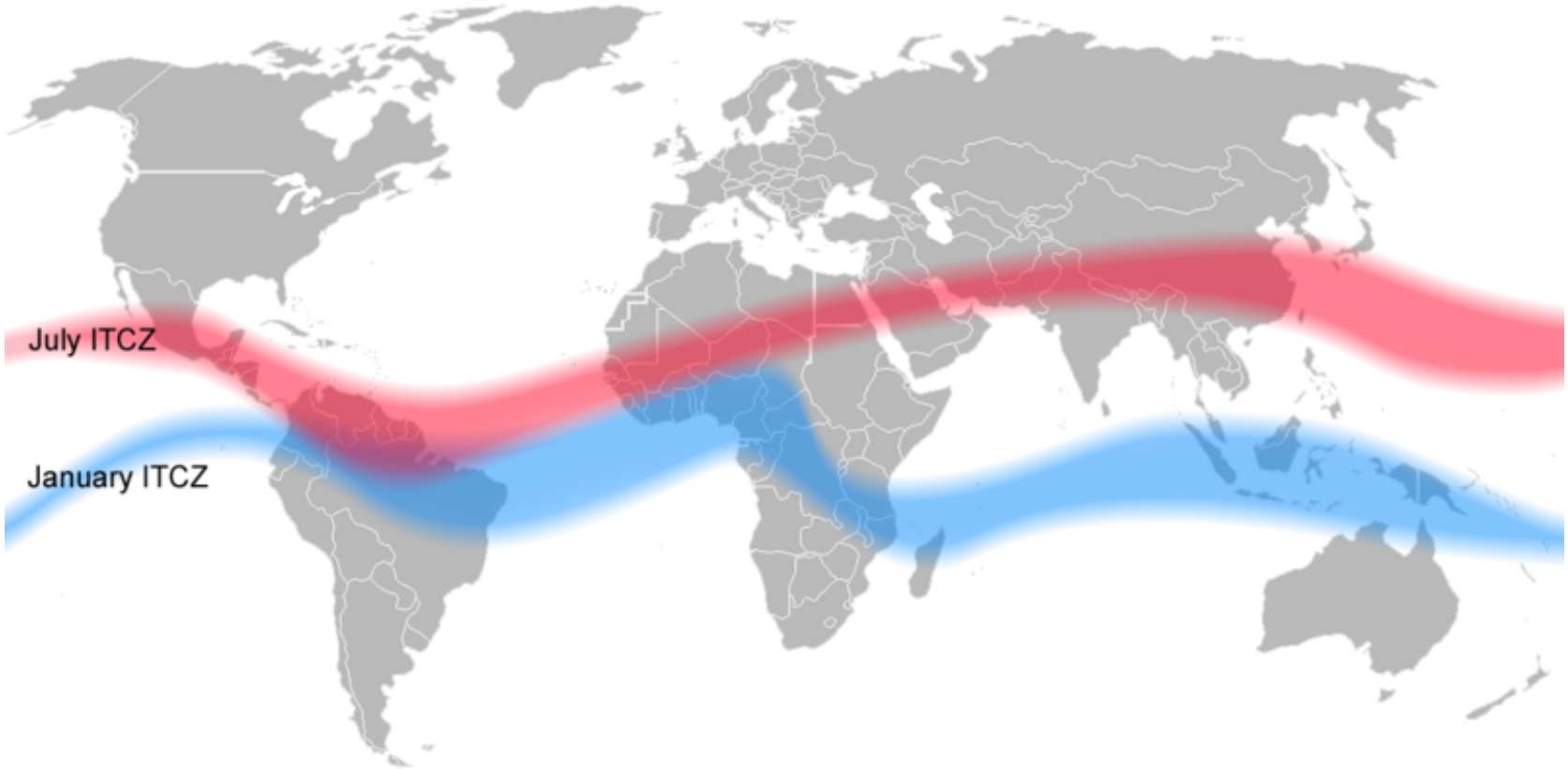
A Global Perspective:
The Seasonal Migration of the General Circulation



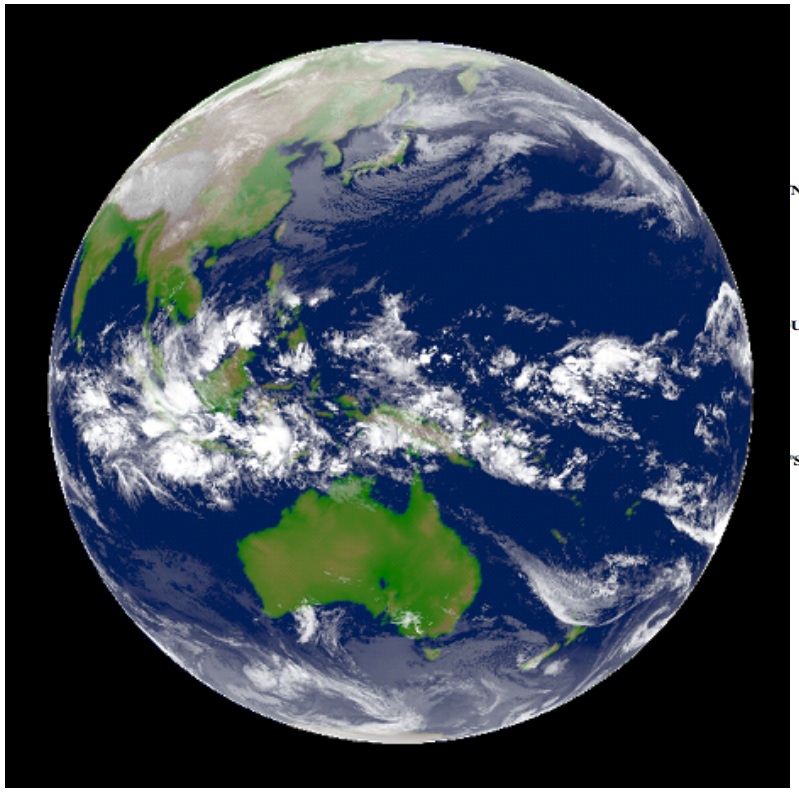
The Seasonal Migration of the ITCZ

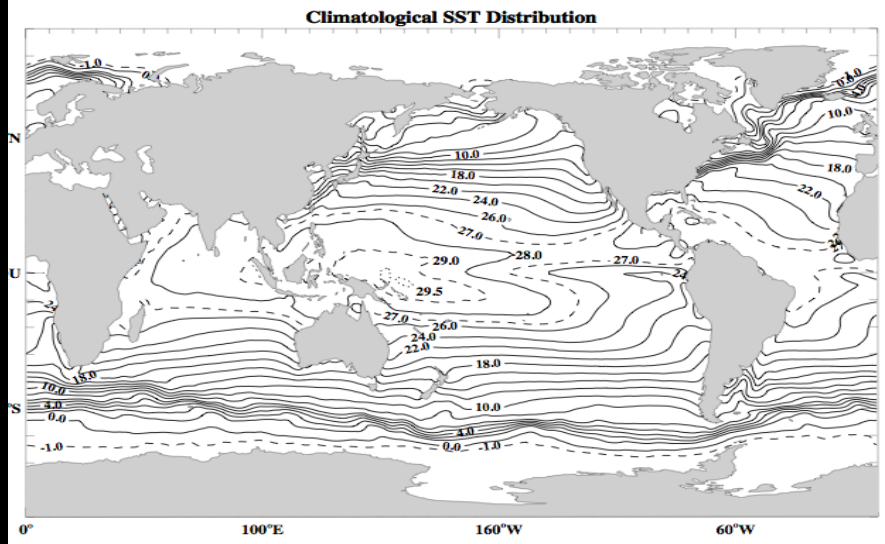


The Seasonal Migration of the ITCZ

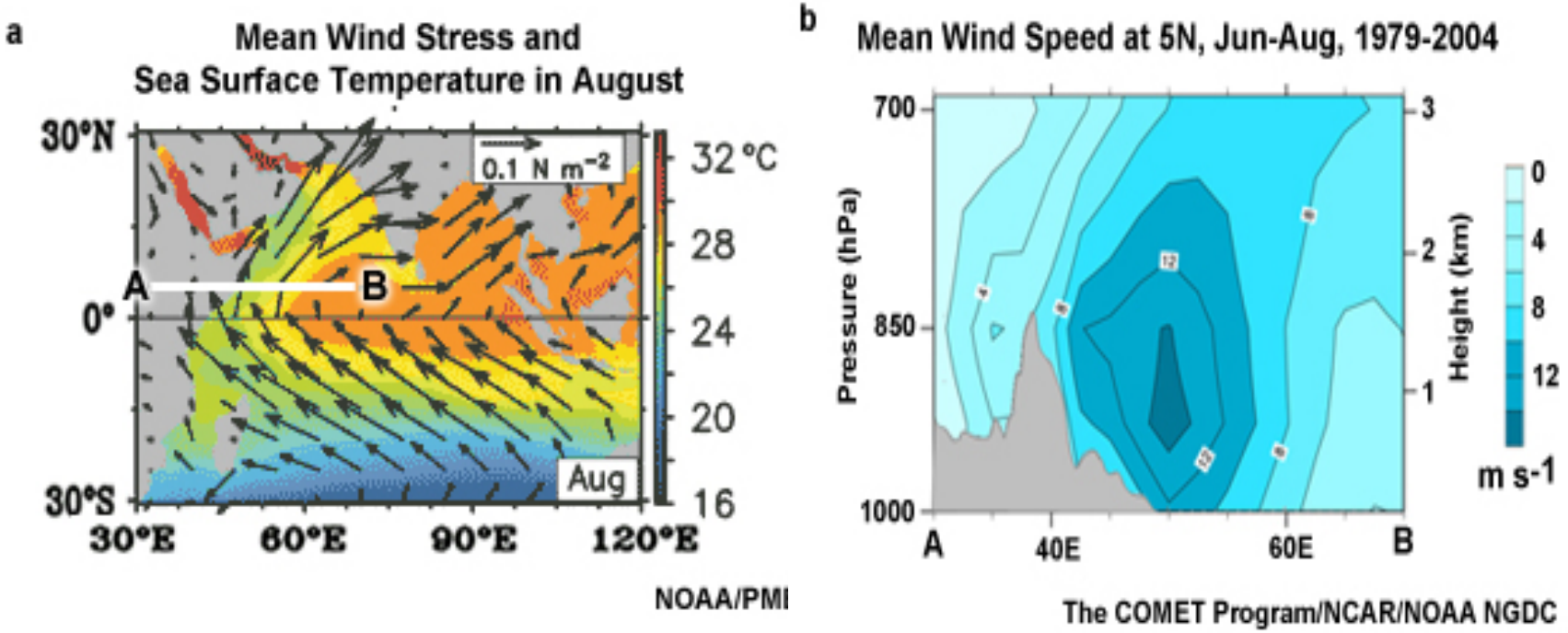


SST and Deep Convection Over Indian Oceans: The Moisture Factor

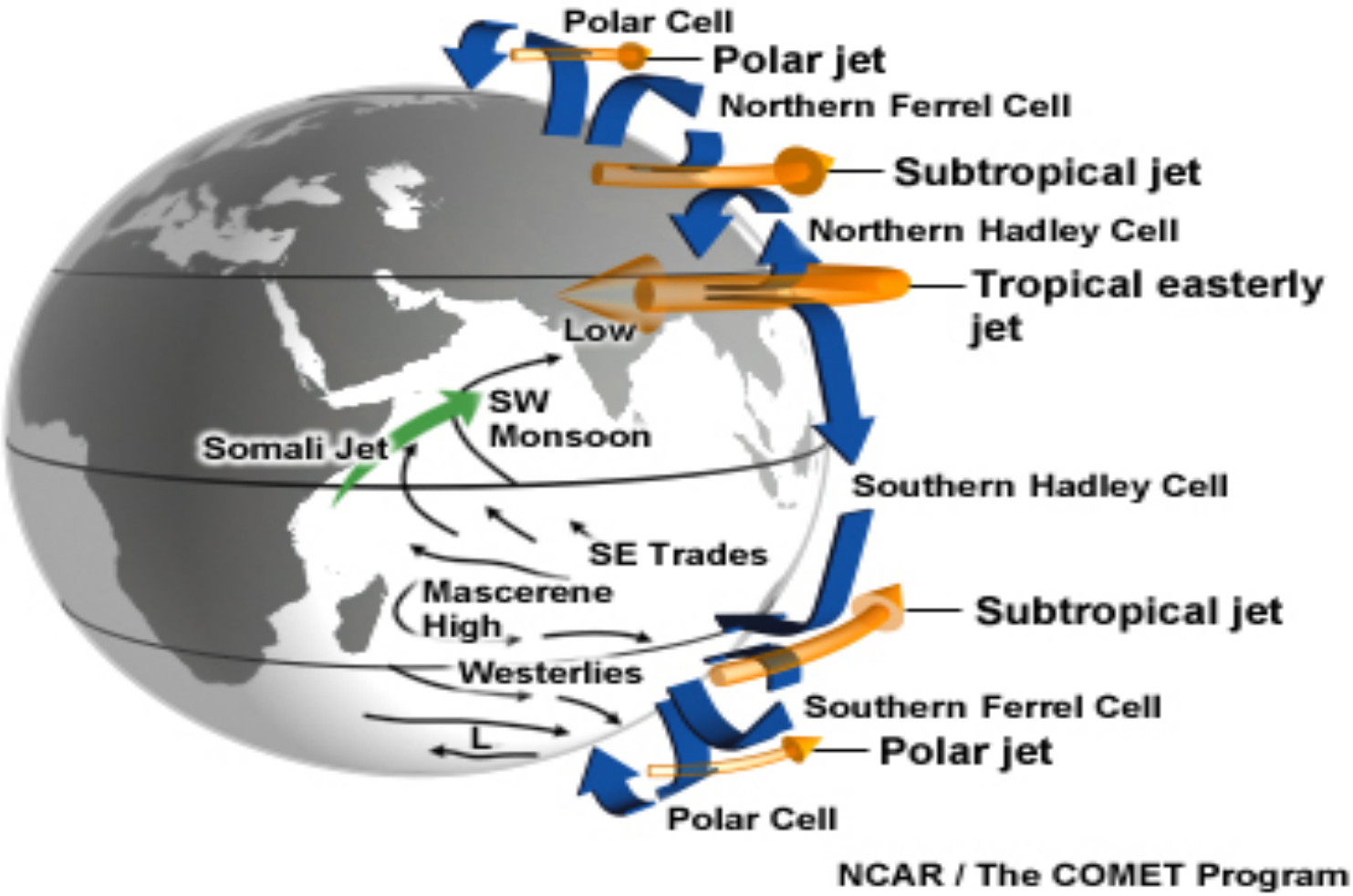




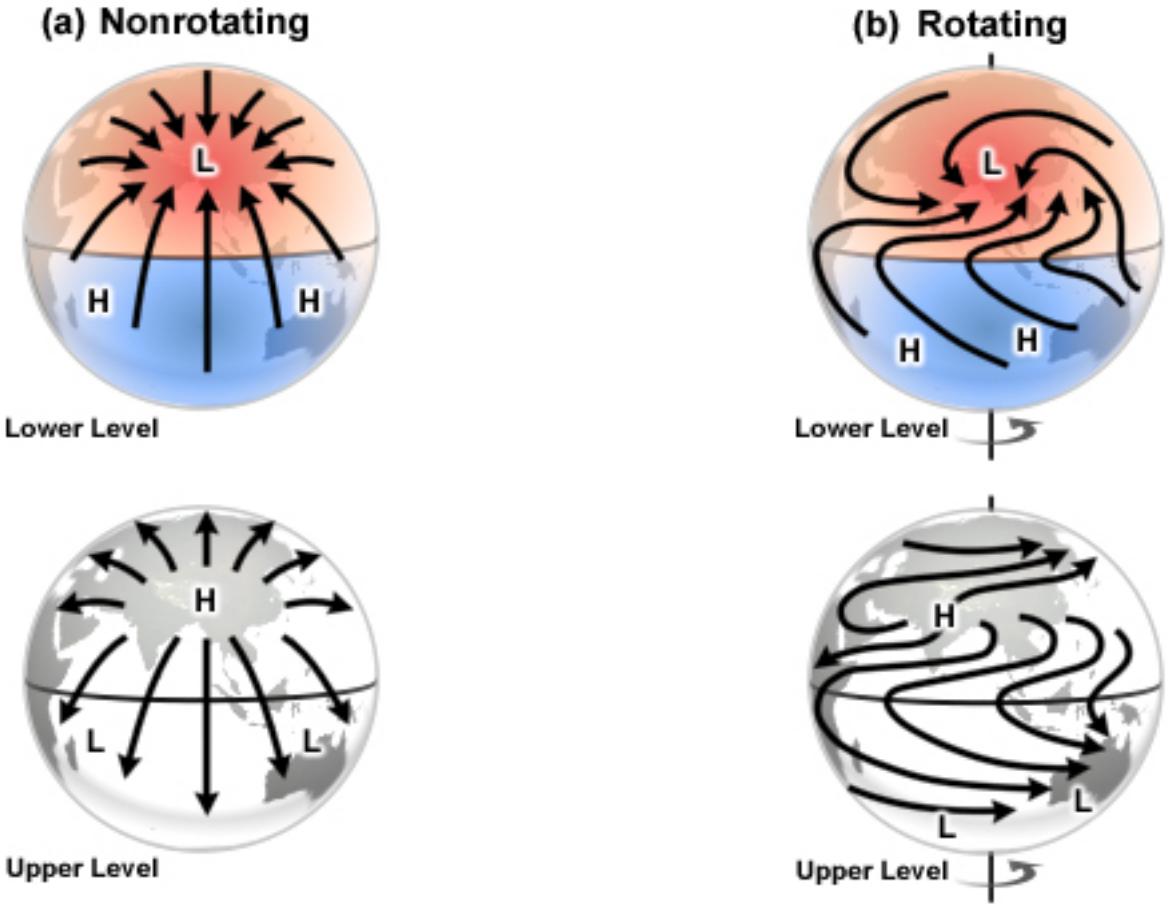
The Low-level Jet



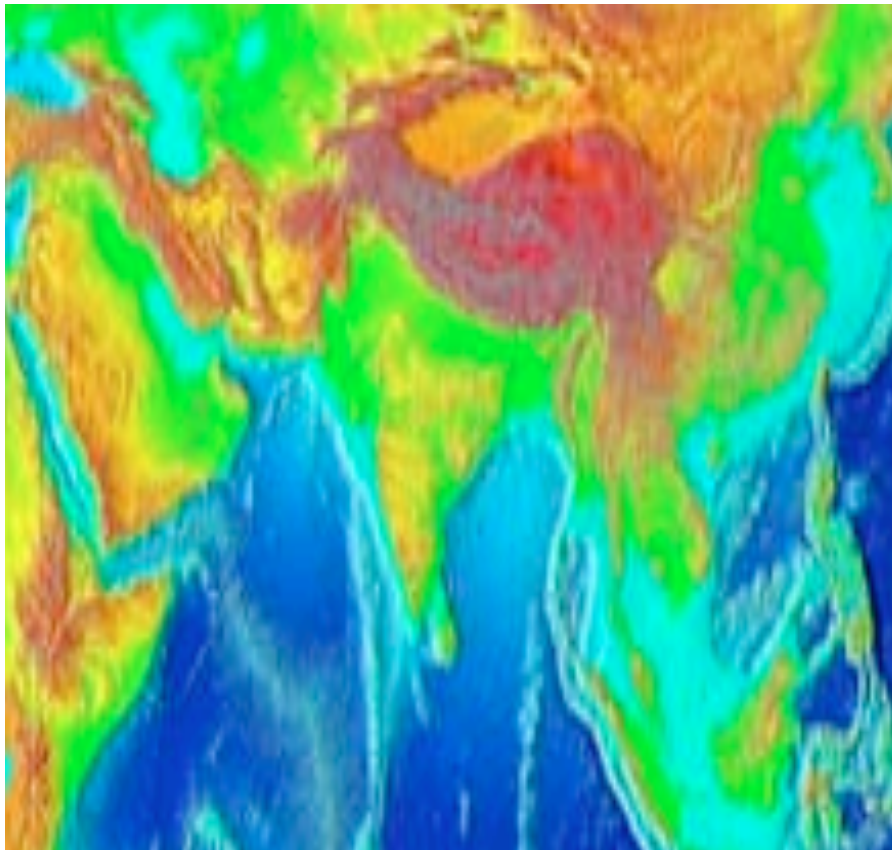
The Formation of the LLJ

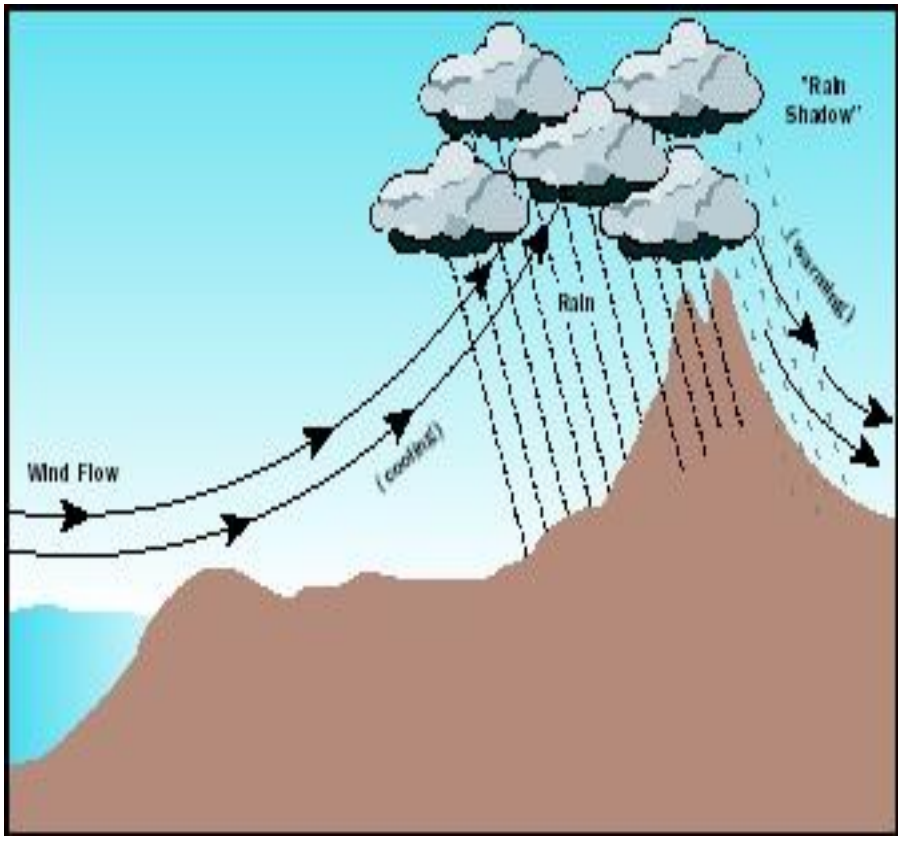


The Rotation Factor

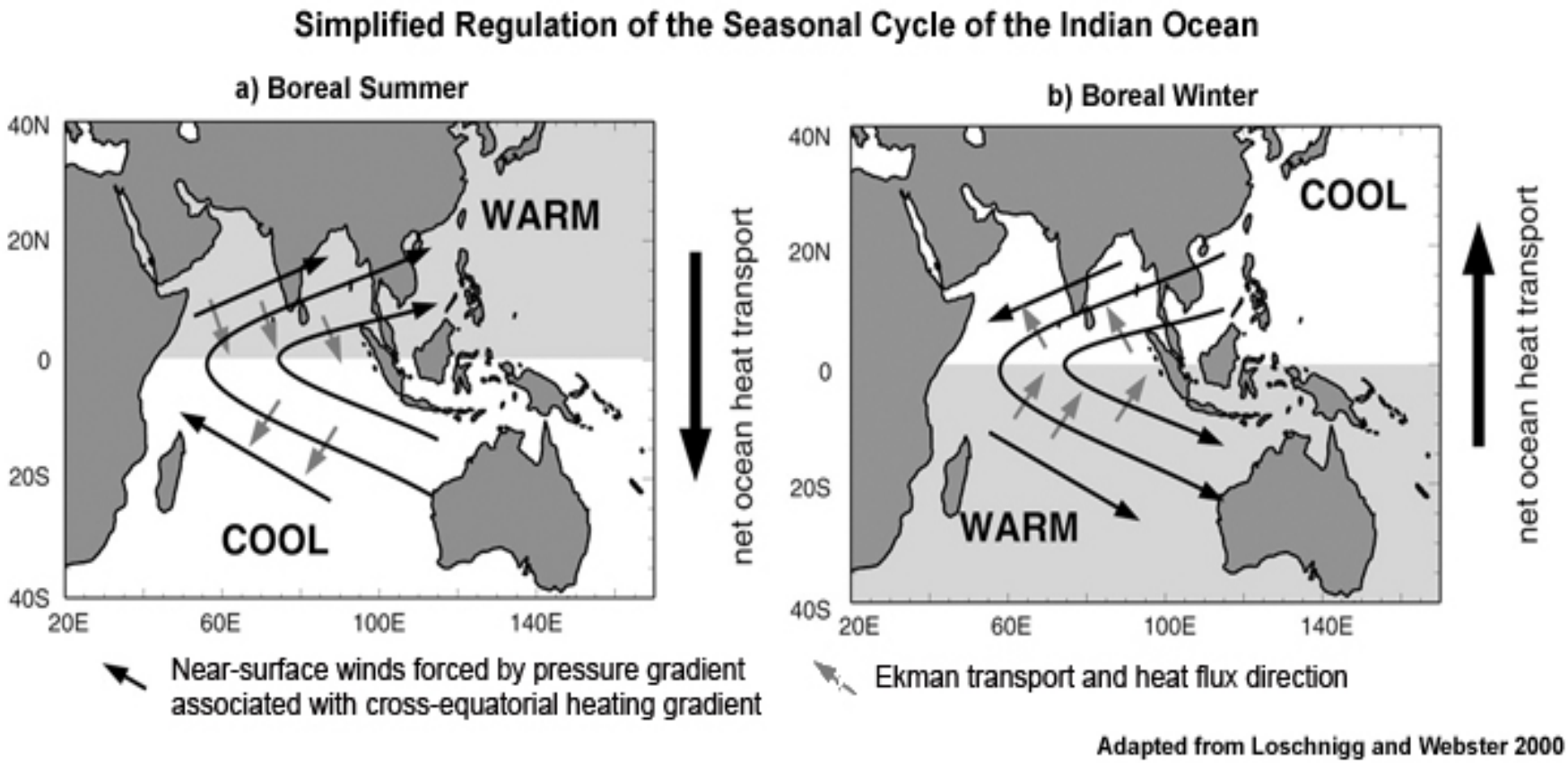


The Orographic Factor

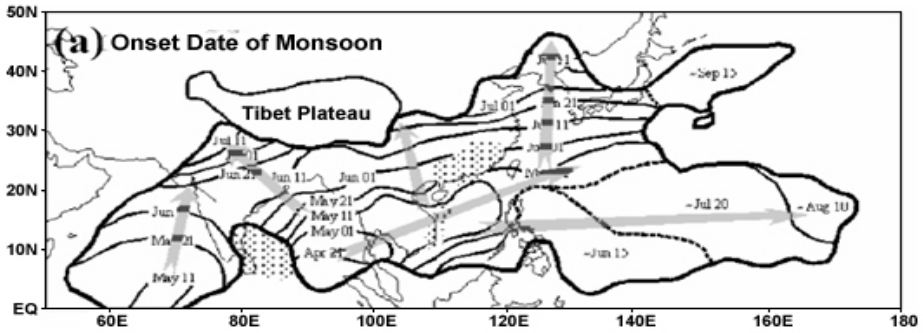


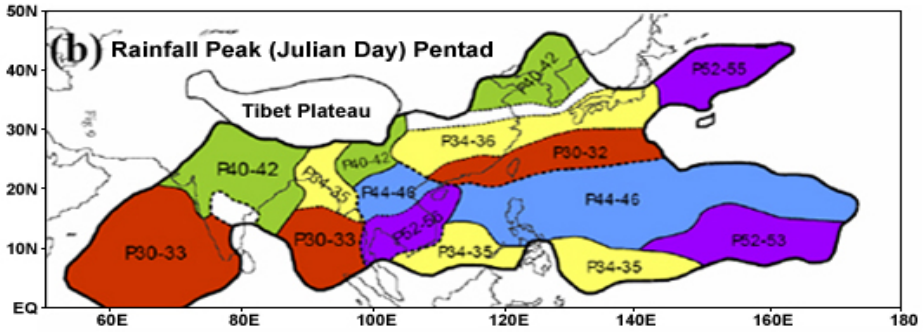


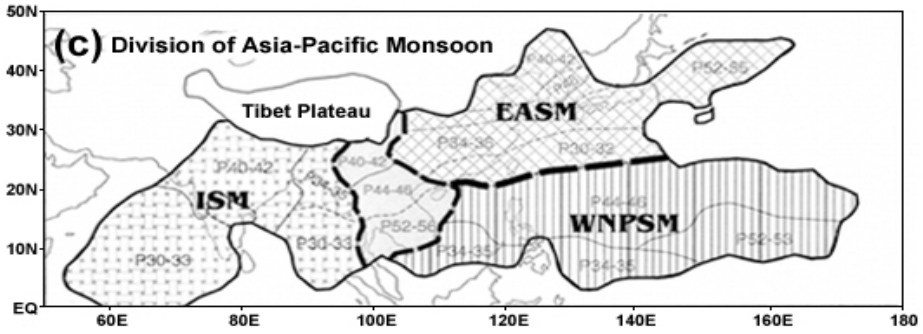
A role for upper ocean dynamics



Asian Monsoon Family

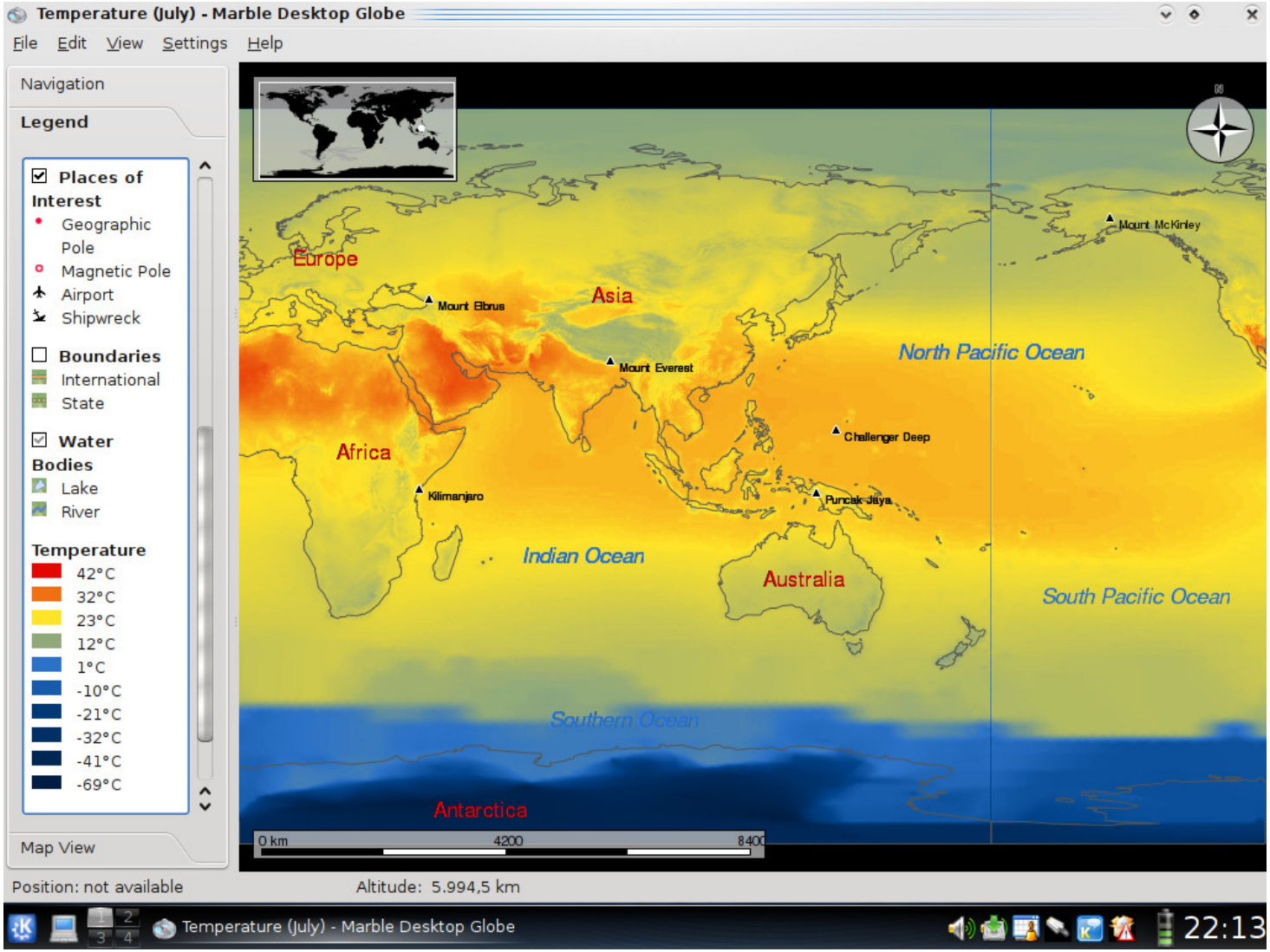




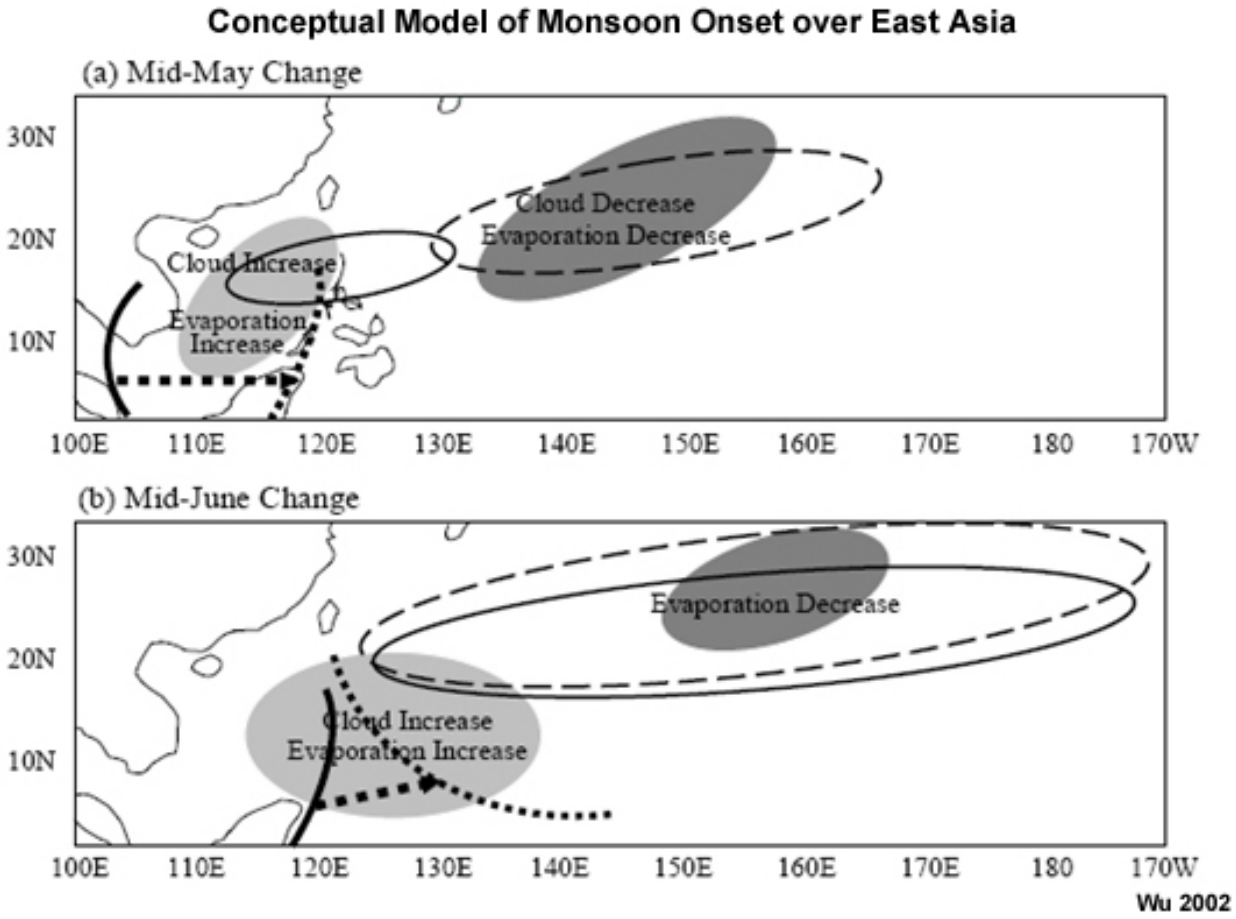


Wang and Lin 2002

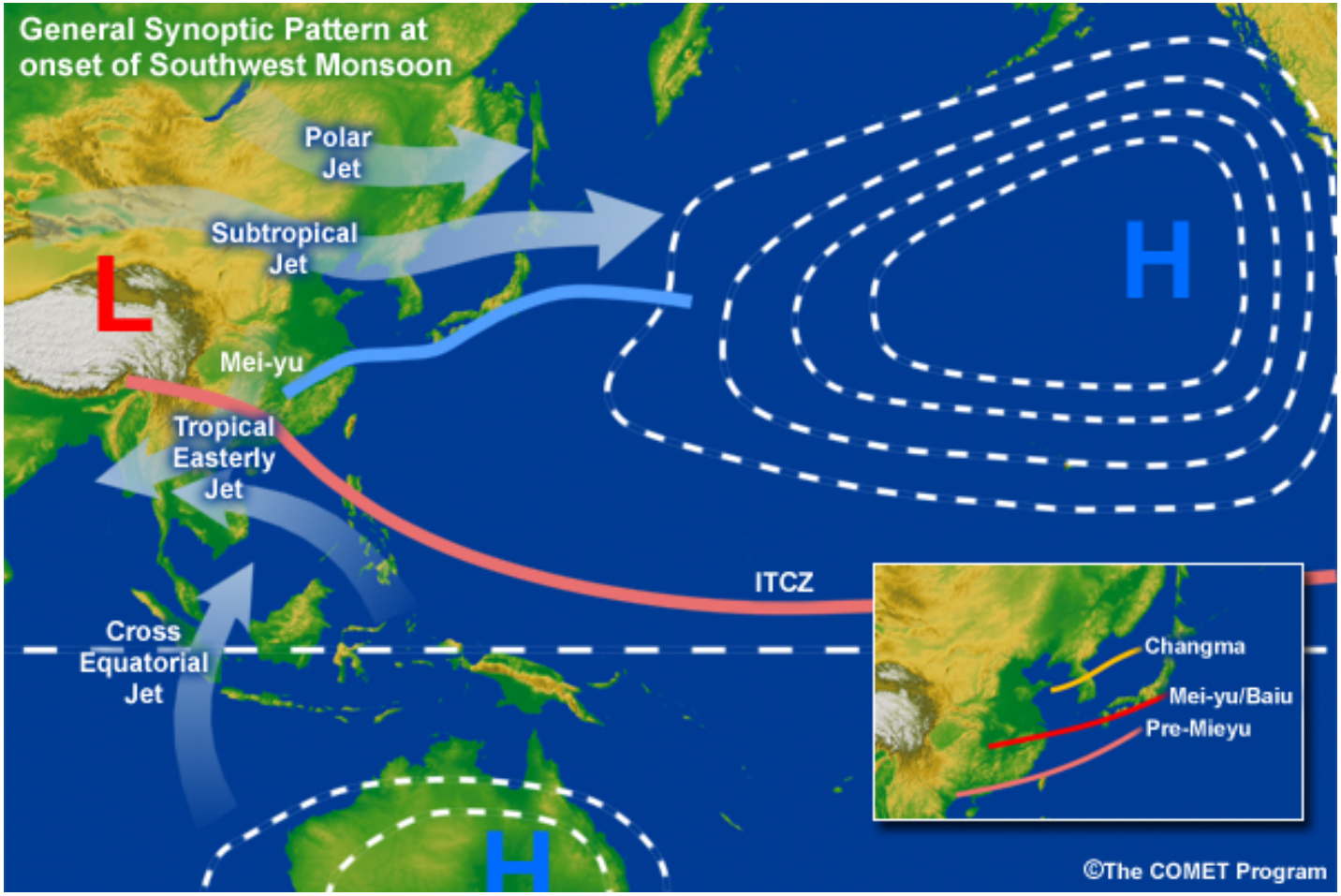
The East Asian Monsoon



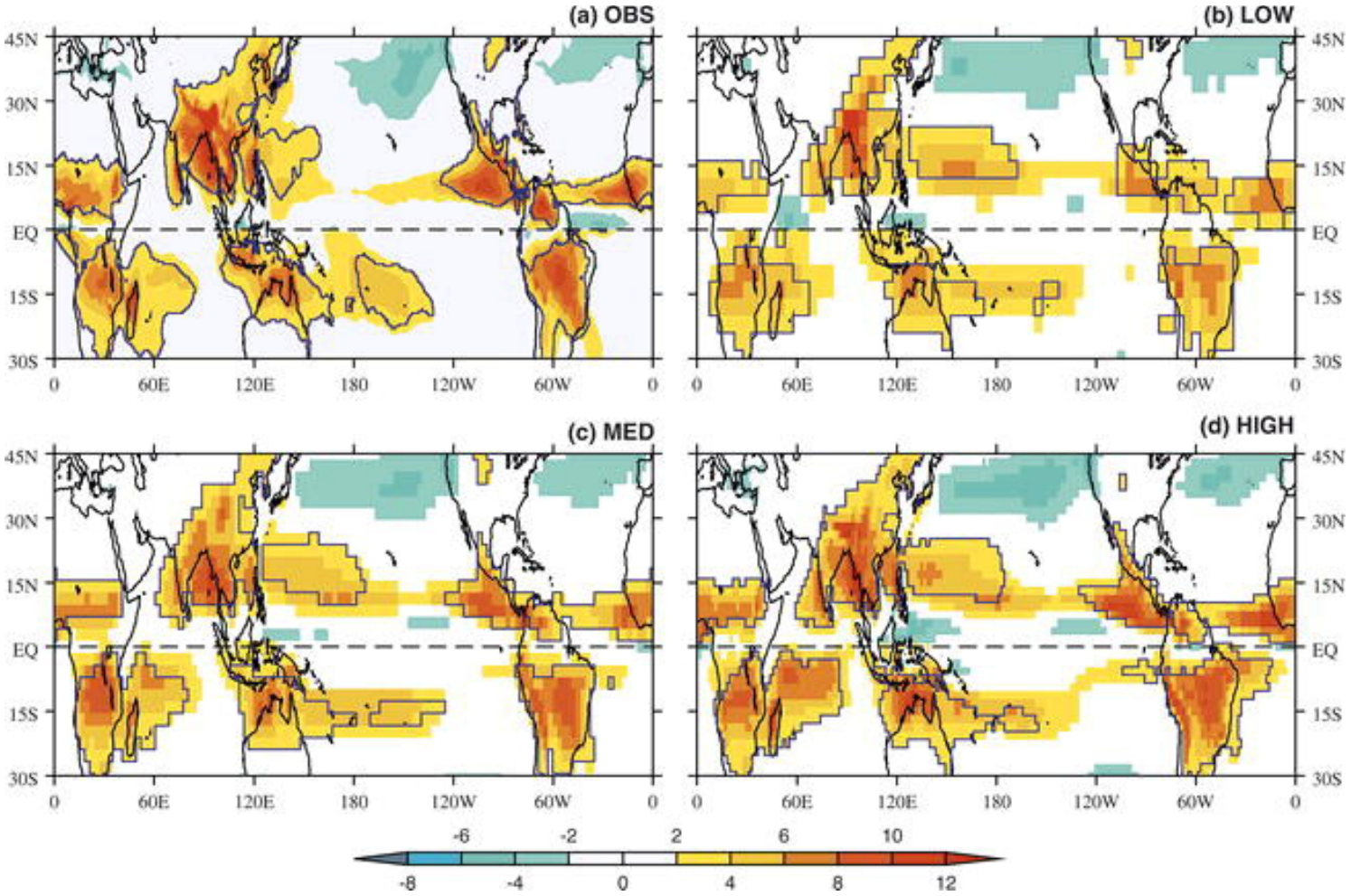
The East Asian Monsoon



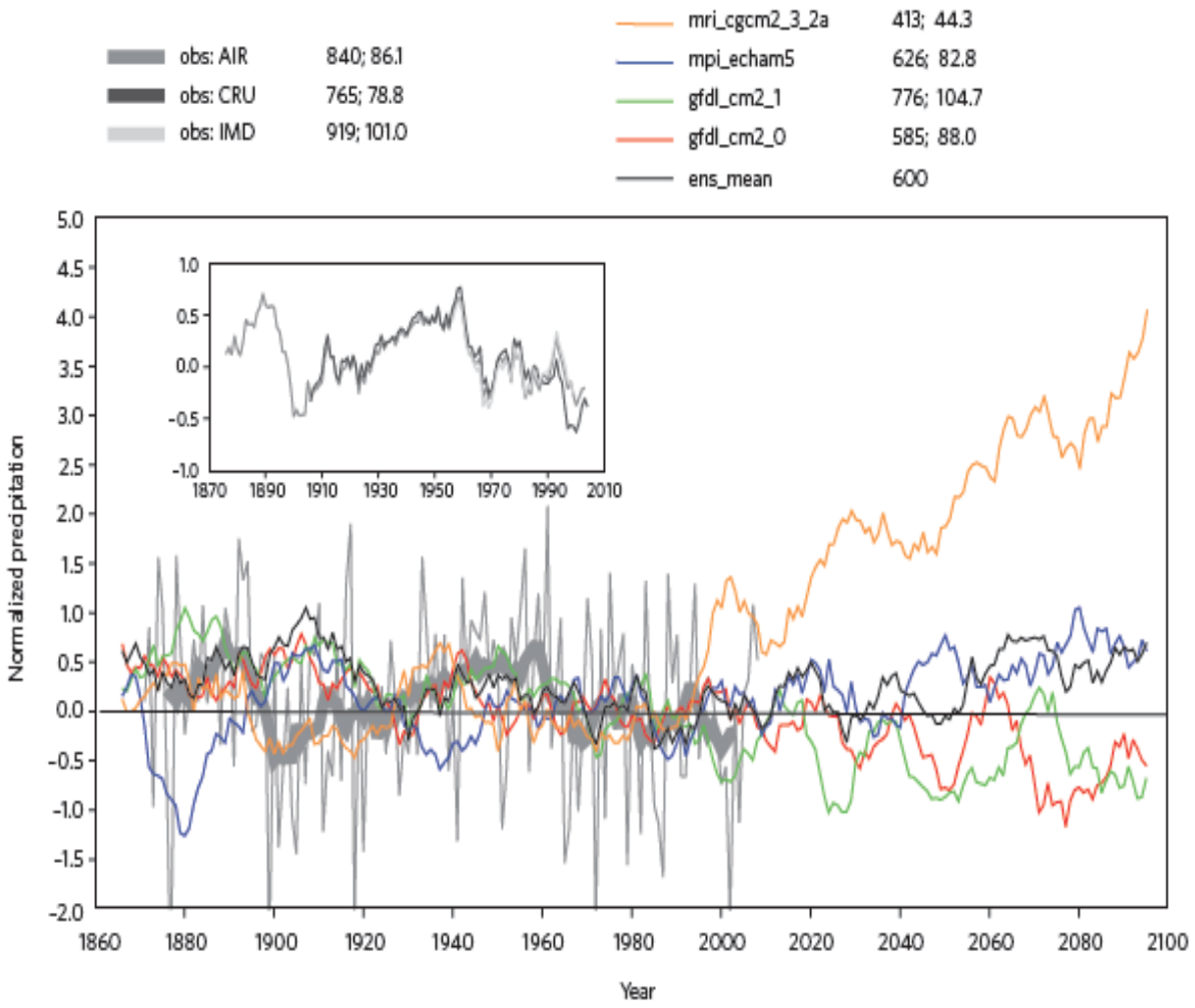
The East Asian Monsoon



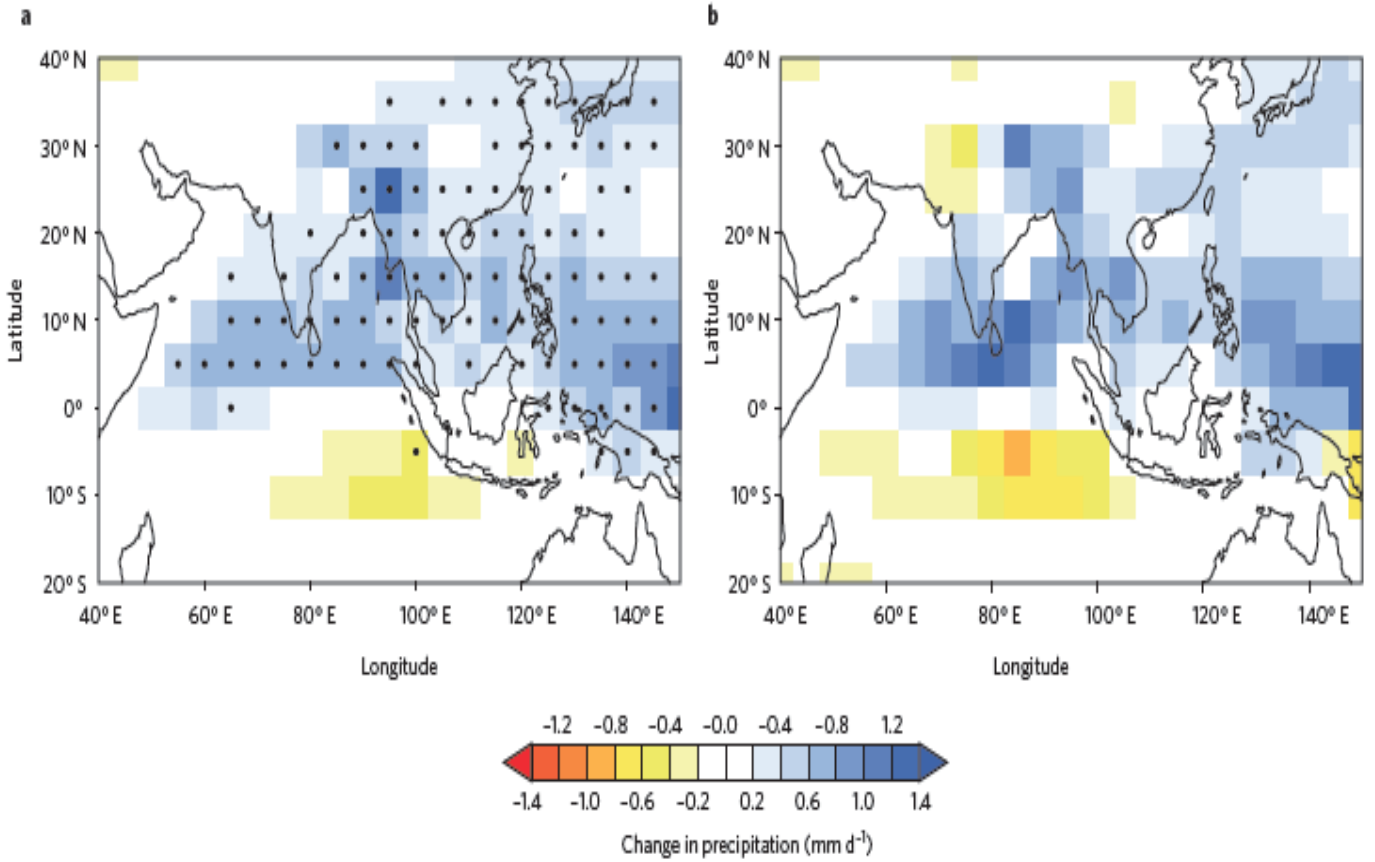
Monsoon in Climate Models



The Future of Monsoon



The Future of Monsoon



Homework

1. **What are the likely impacts of a decreasing Tibetan Plateau snowpack on the South Asian Monsoon? Why?**

2. **What are the likely major differences between the global monsoon system in the last ice age and that in the present climate? Why?**

Recommended Readings For The Next Lecture

Page 1—56 in El Nino, La Nina, and the Southern Oscillation by S. G. Philander