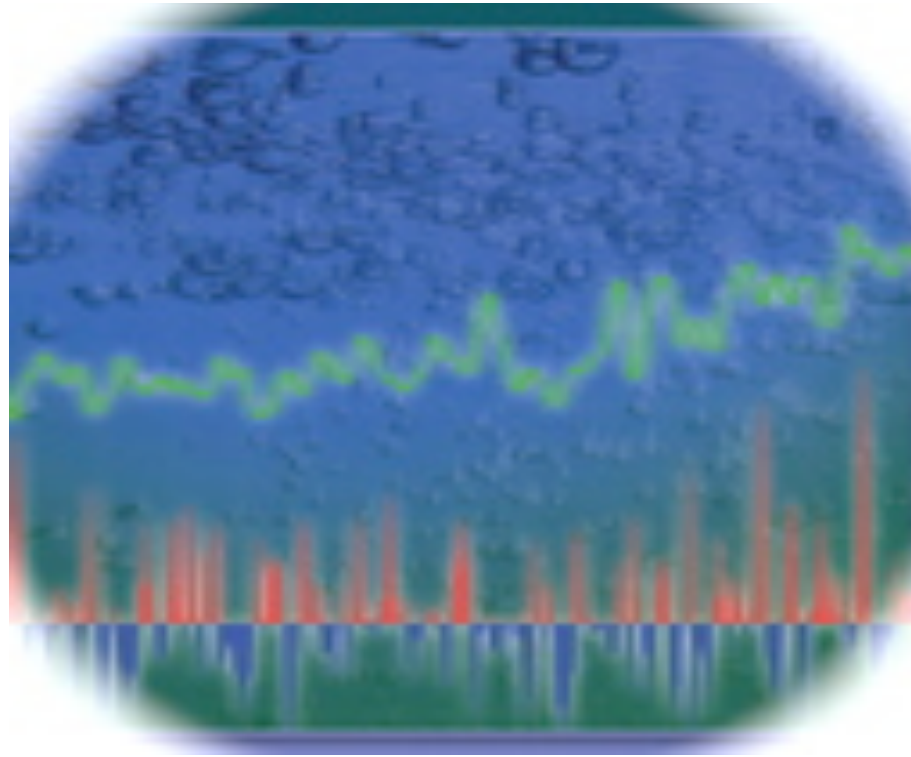


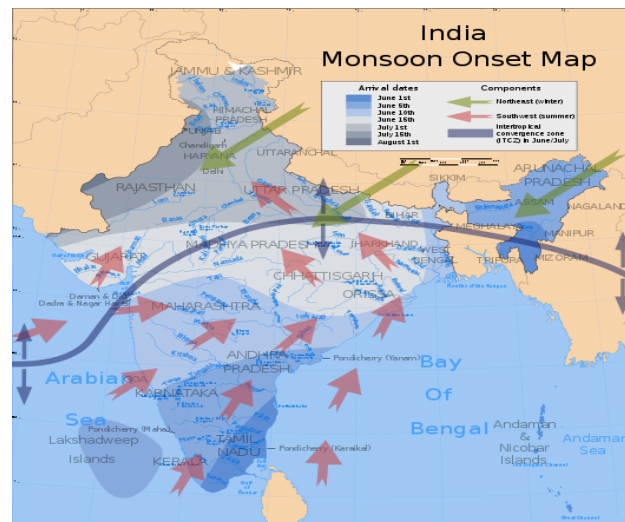
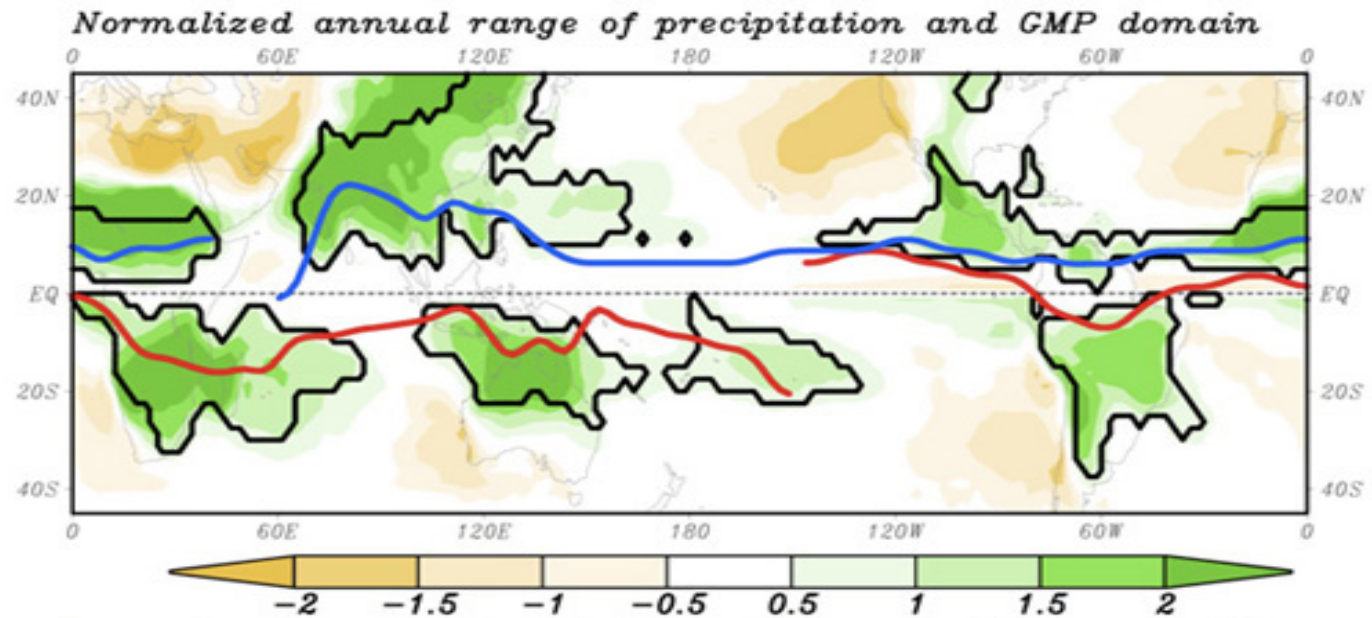
Climate Dynamics: Why Does Climate Vary?



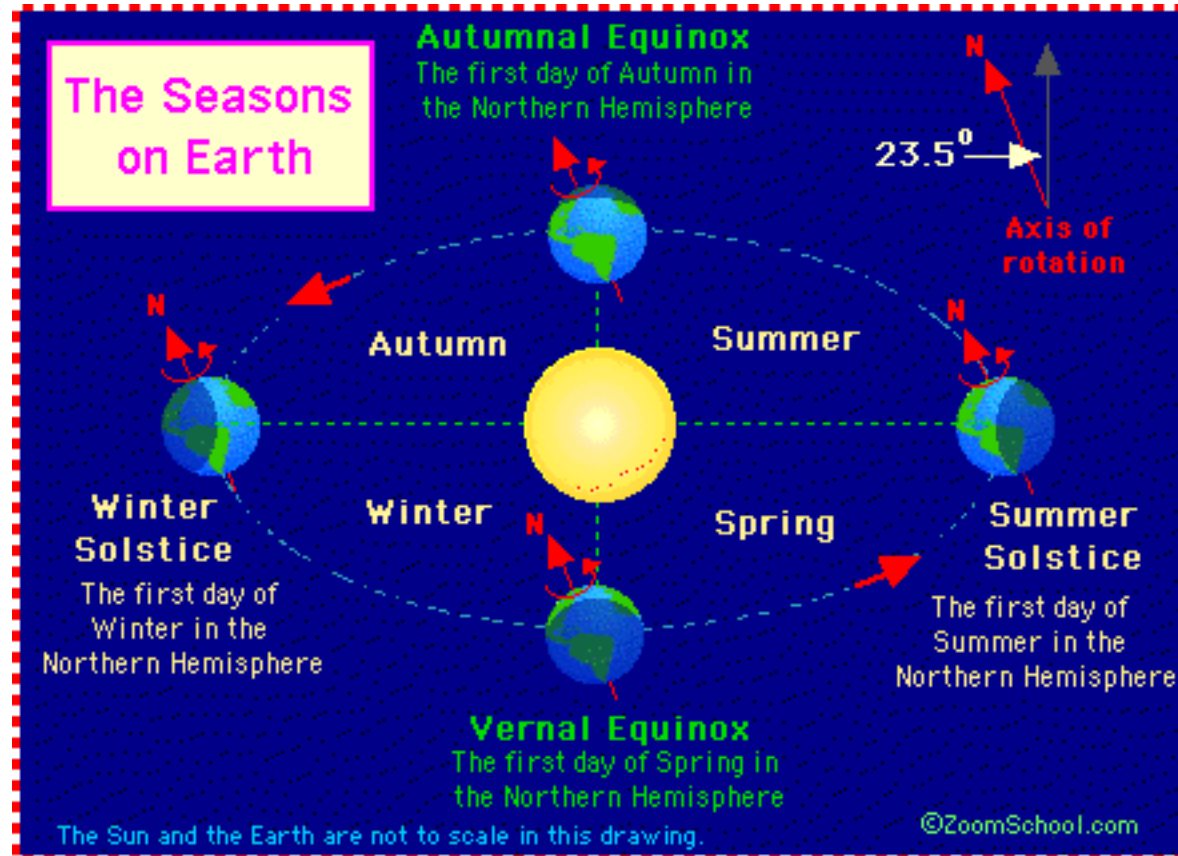
Monsoons: A Seasonal Dialogue Between the Land and the Adjacent Oceans

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

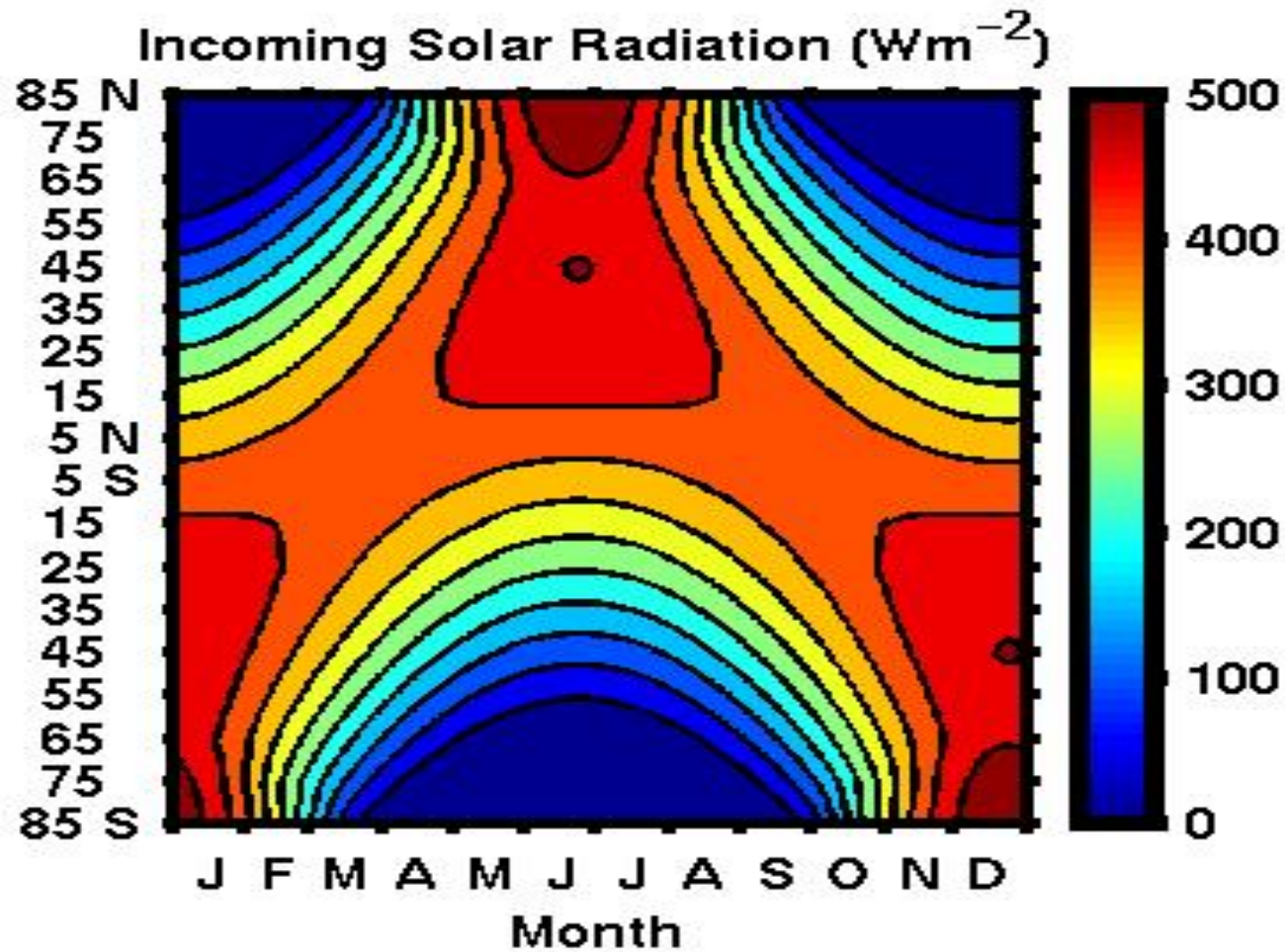
The Monsoons



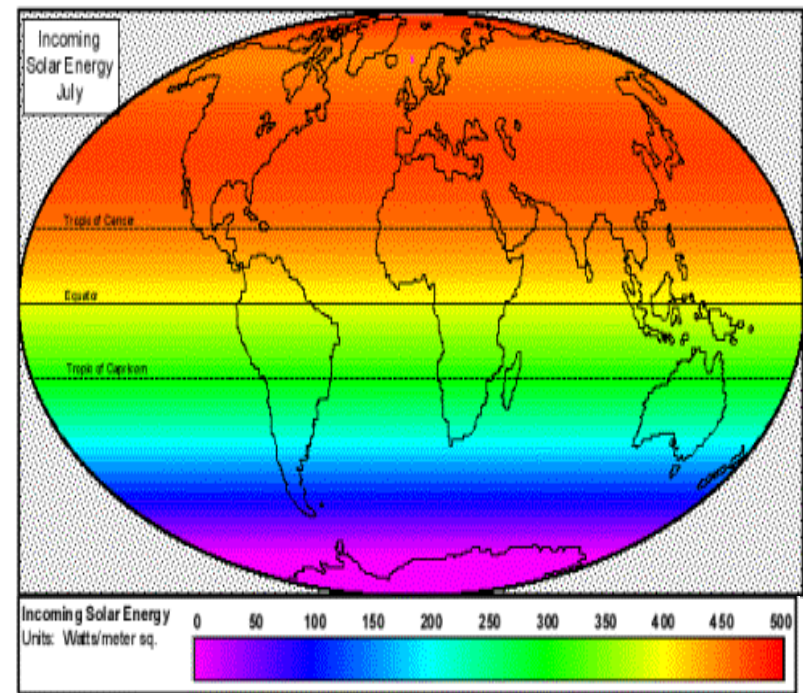
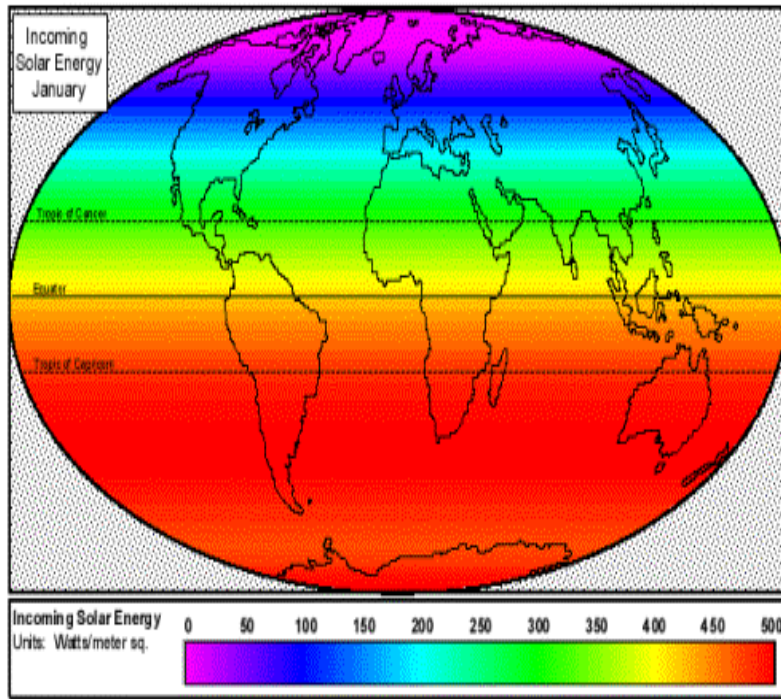
Why do we have seasons?



Why do we have seasons?



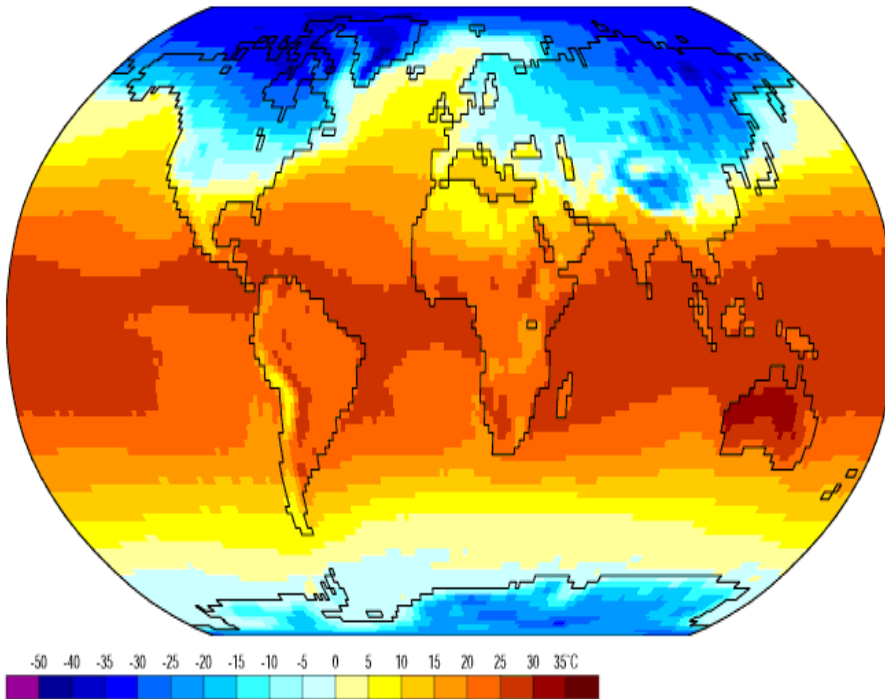
Why do we have seasons?



Why do we have seasons?

Air Temperature

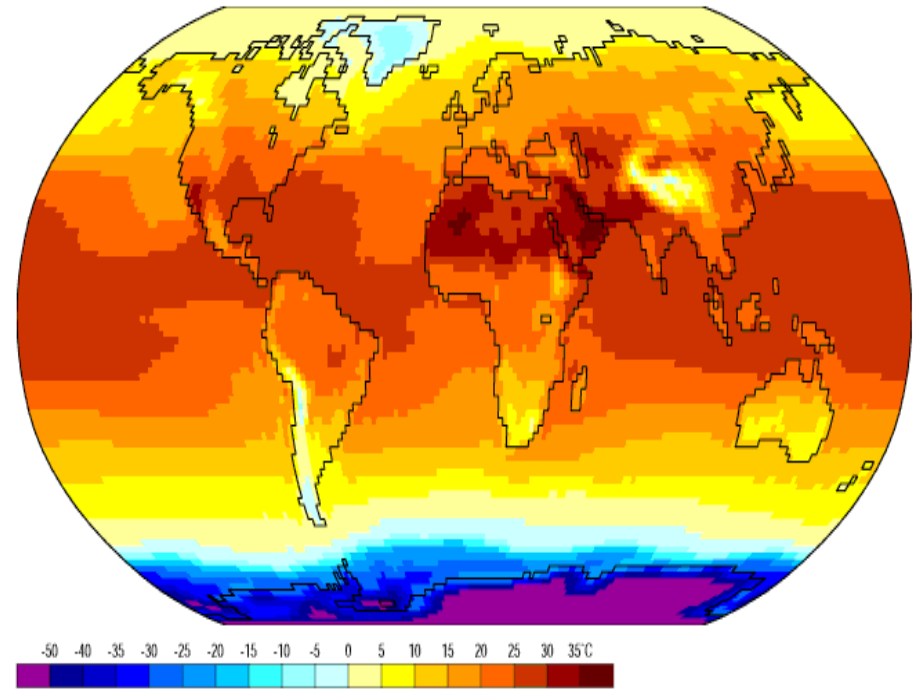
Jan



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

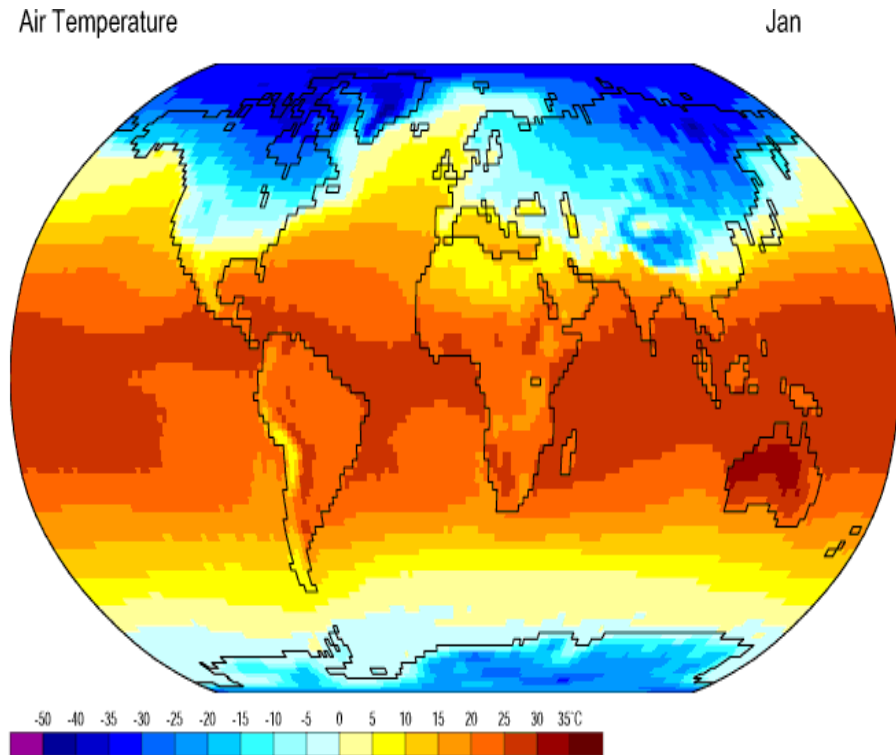
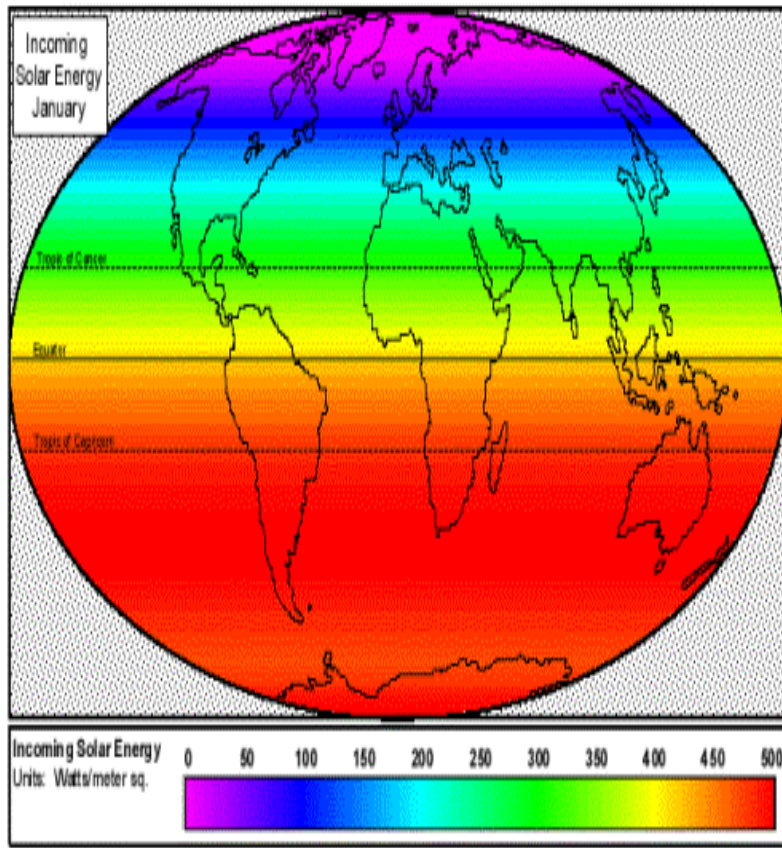
Air Temperature

Jul



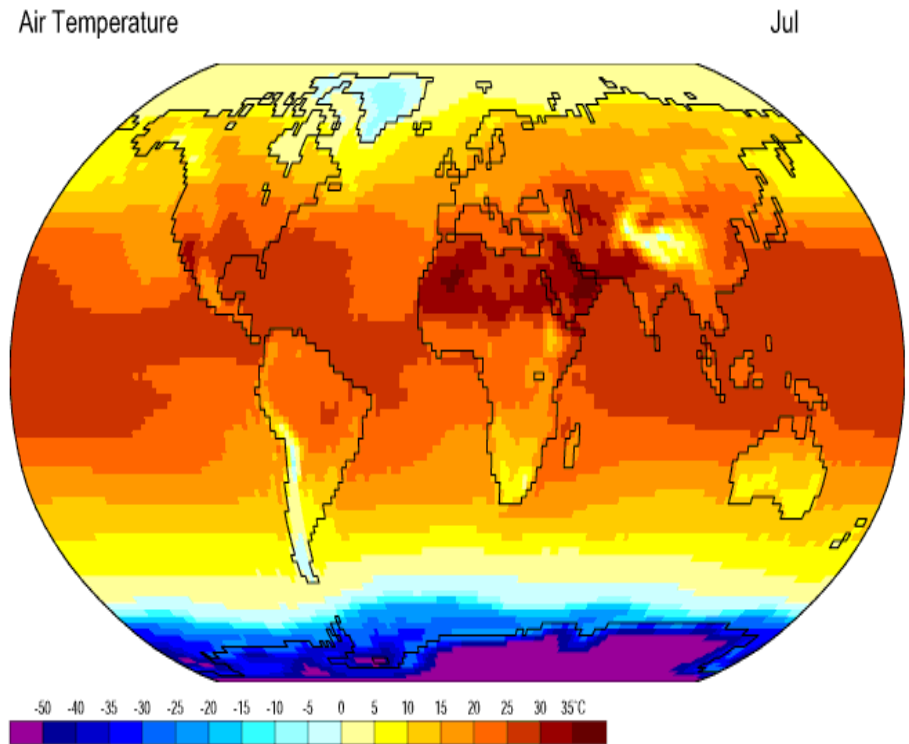
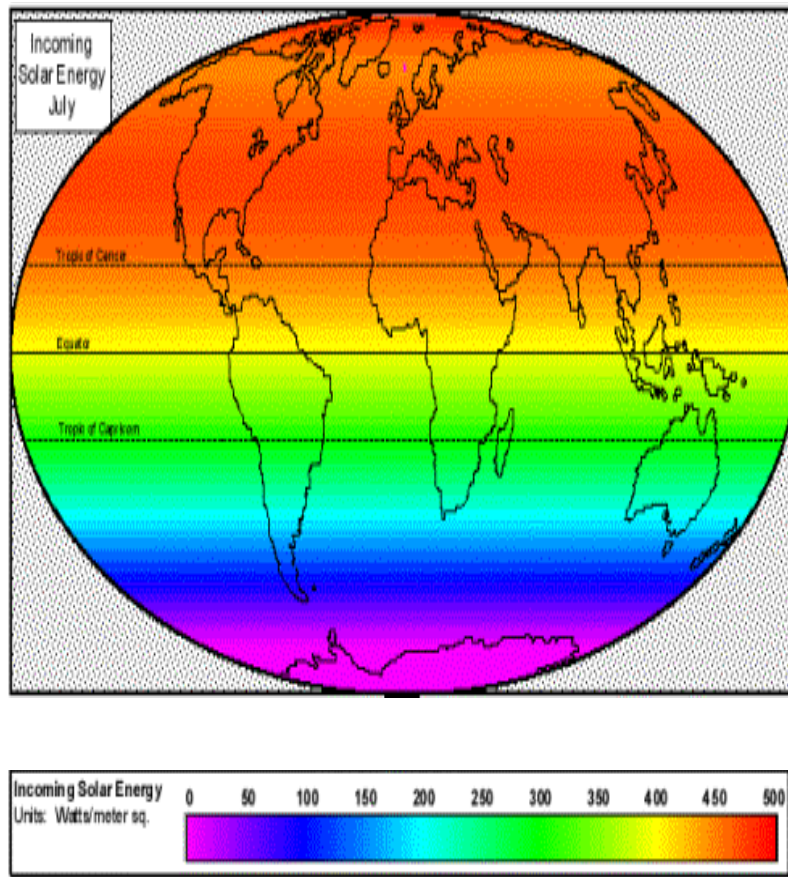
Data: NCEP/NCAR Reanalysis Project, 1959-1997 Climatologies

Why do we have seasons?



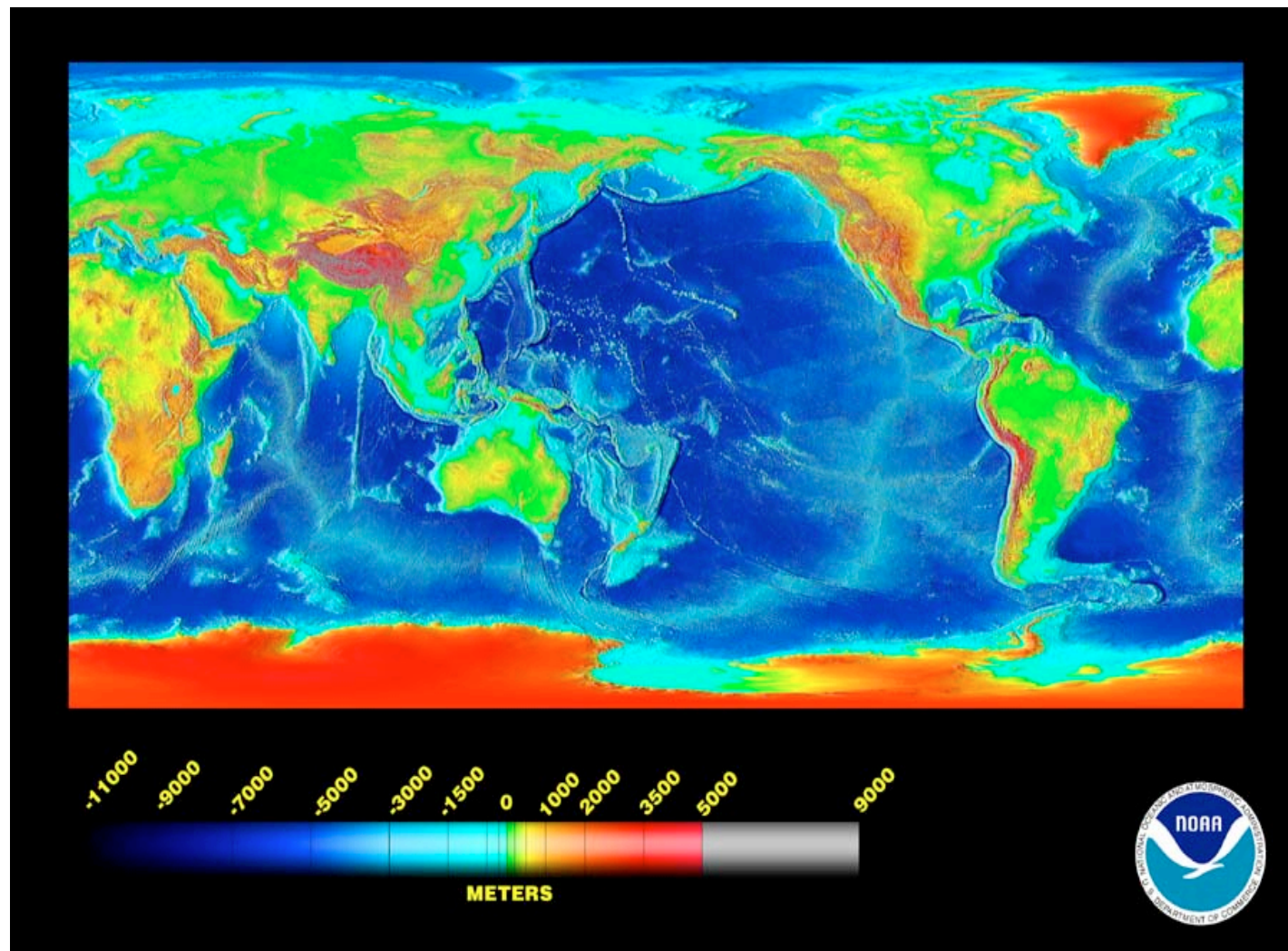
Data: NCEP/NCAR Reanalysis Project, 1959-1997 Climatologies

Why do we have seasons?

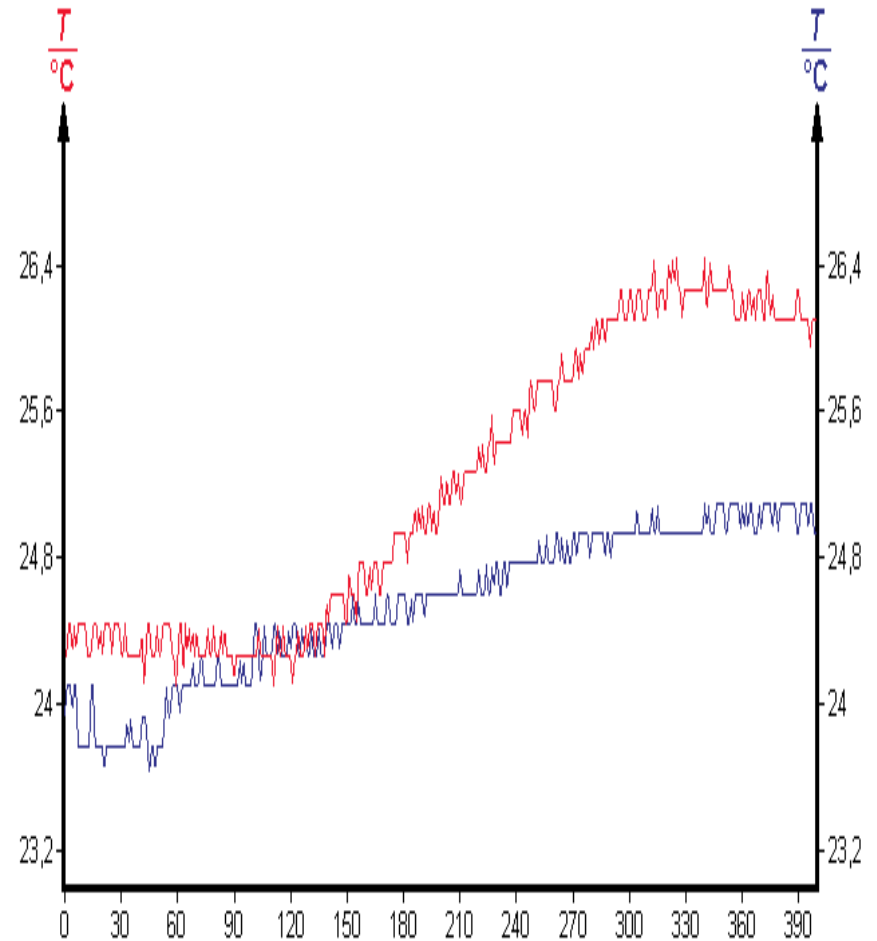


Data: NCEP/NCAR Reanalysis Project, 1959-1997 Climatologies

Topography of SAM region



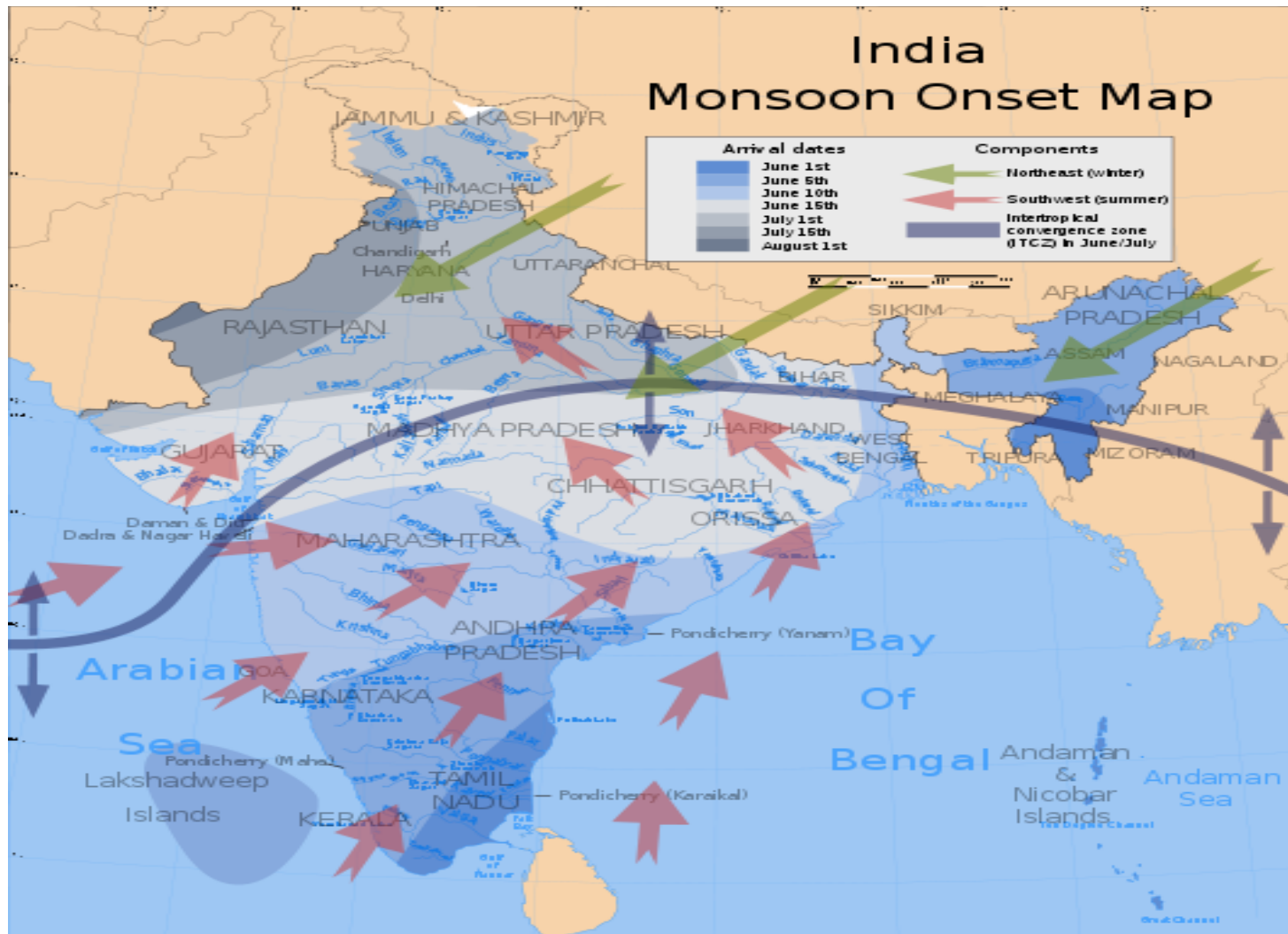
The Impact of Heat Capacity Difference On The Response of Heating



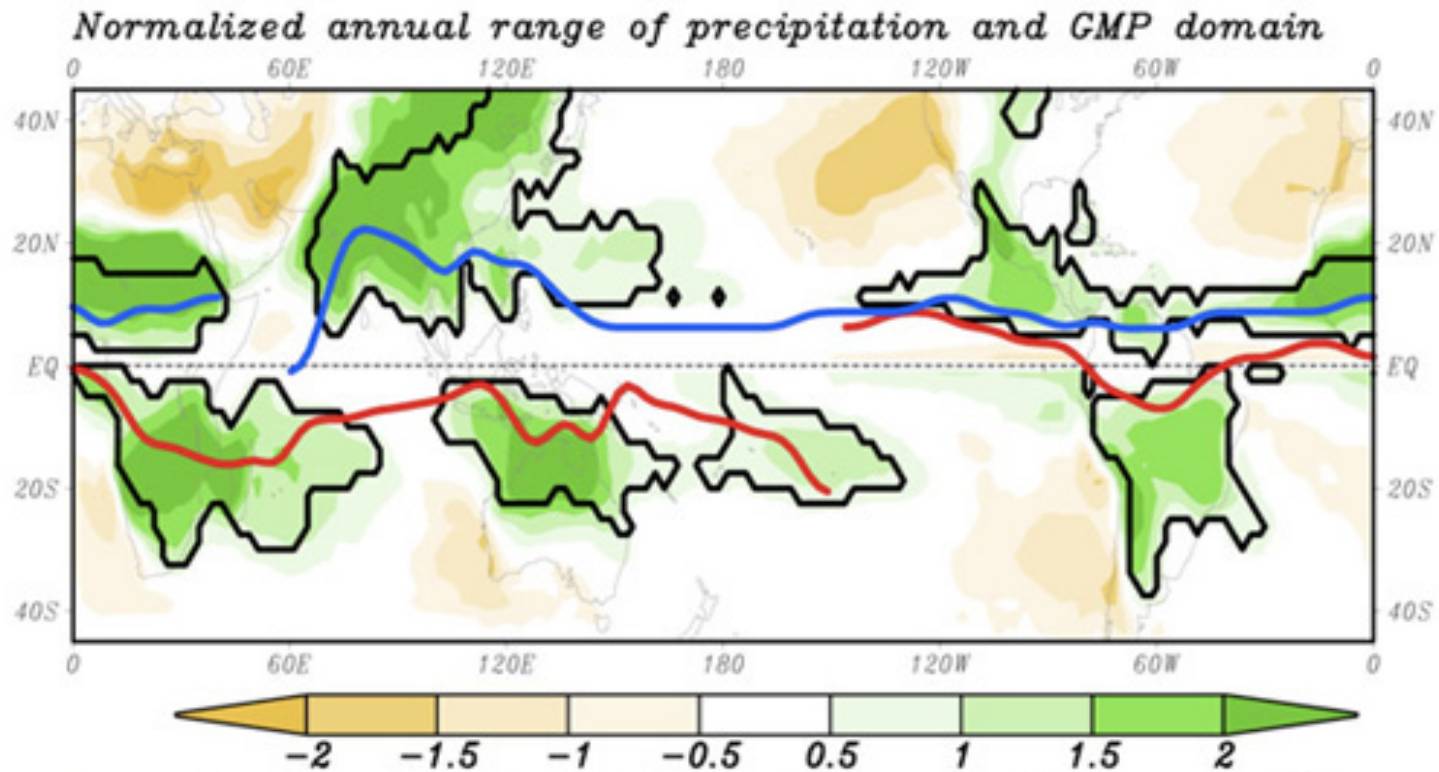
Why do we have seasons?

MATERIAL	CONDITION	MASS DENSITY (ρ) ($\text{kg m}^{-3} \times 10^3$)	SPECIFIC HEAT (c) ($\text{J kg}^{-1} \text{K}^{-1} \times 10^3$)	THERMAL CONDUCTIVITY (k_g) ($\text{W m}^{-2} \text{K}^{-1}$)	THERMAL DIFFUSIVITY (α_g) ($\text{m}^2 \text{s}^{-1} \times 10^{-6}$)
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

What Is Monsoon?



What Is Monsoon?

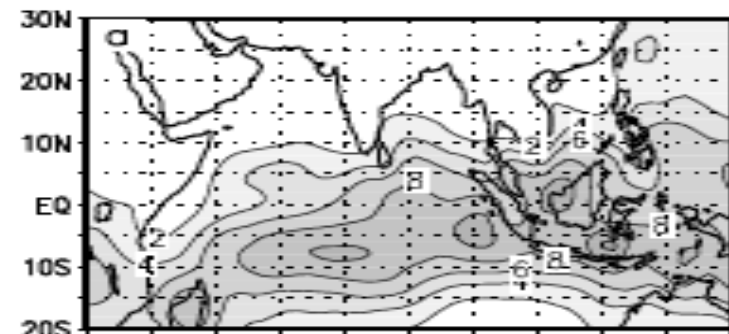
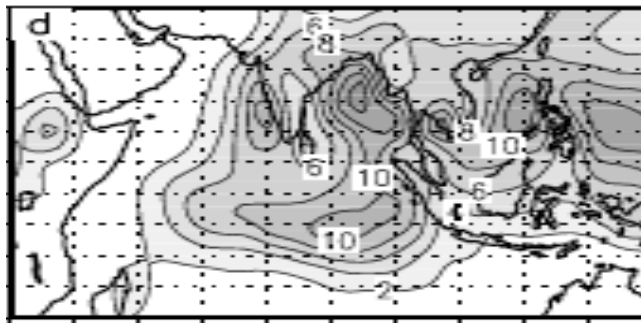


The South Asian Monsoon

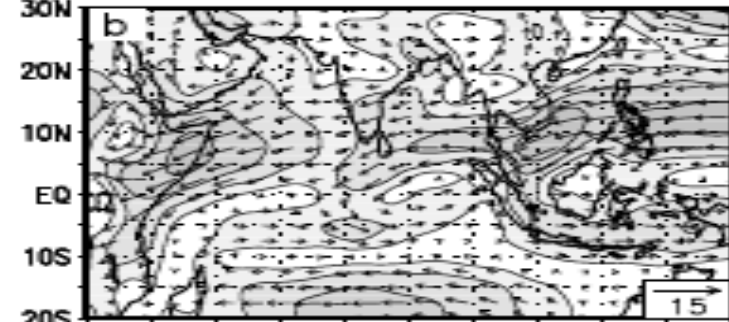
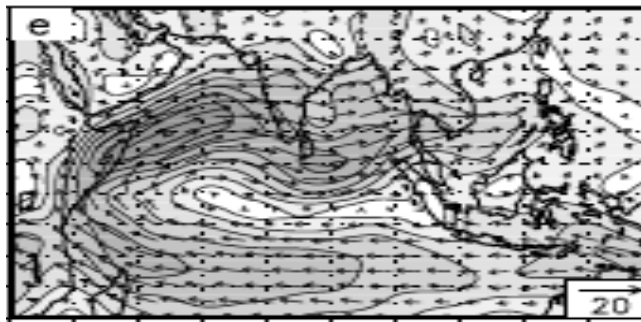
Boreal Summer

Boreal Winter

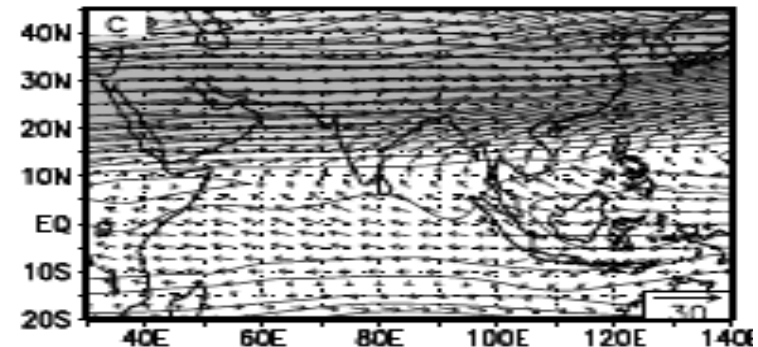
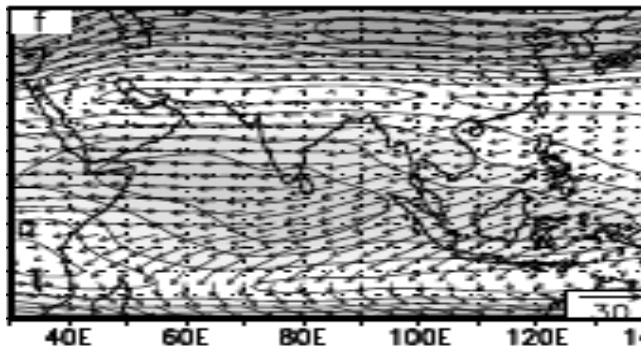
Precipitation



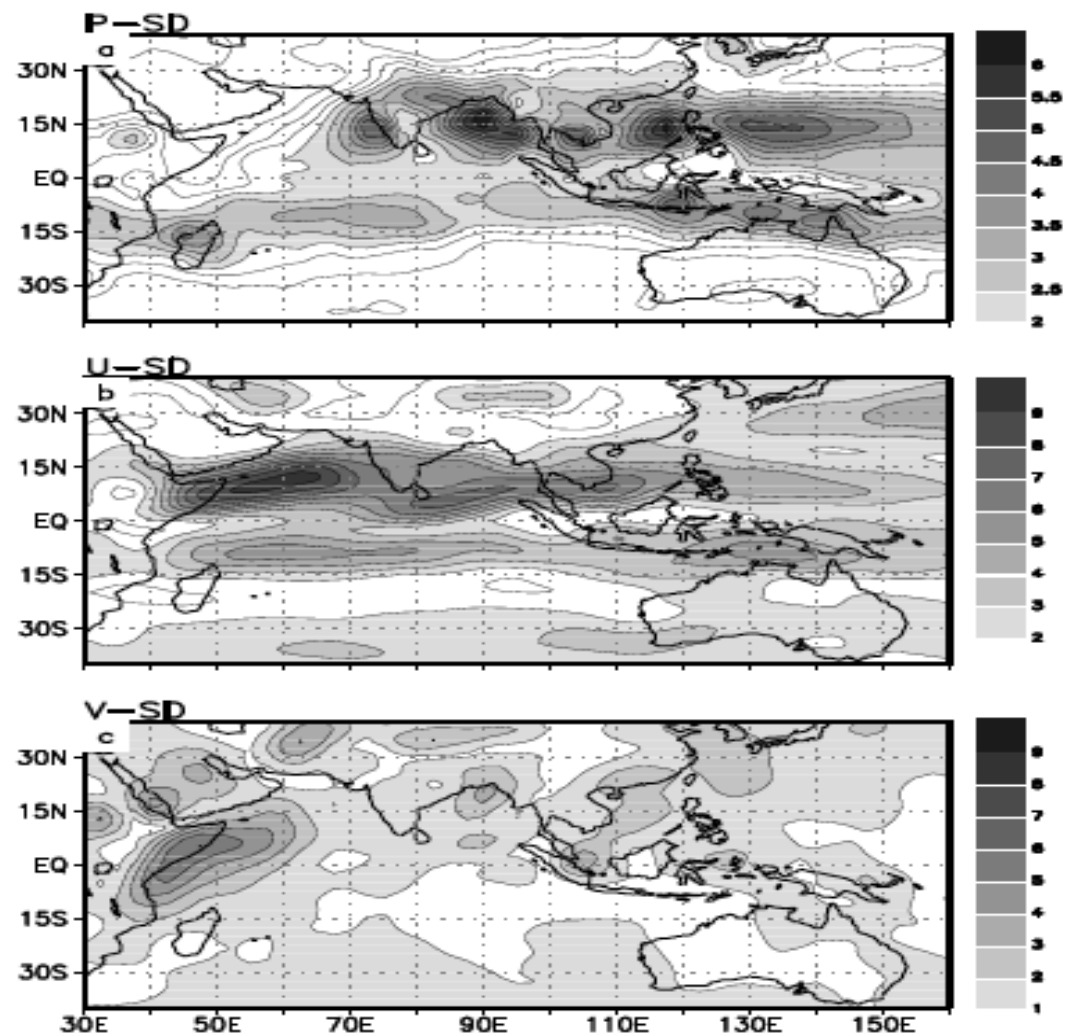
850hpa
winds



200hpa
winds

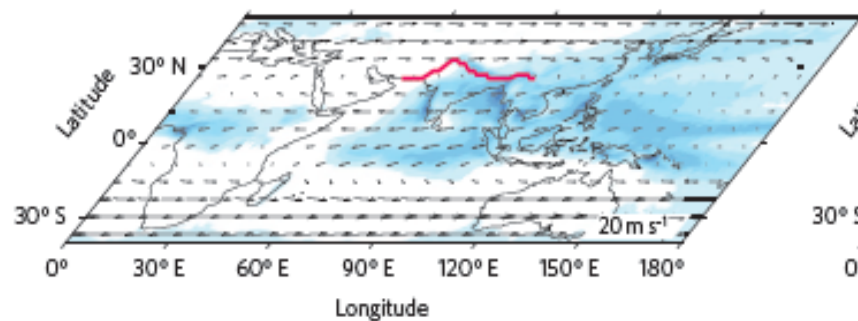


The South Asian Monsoon

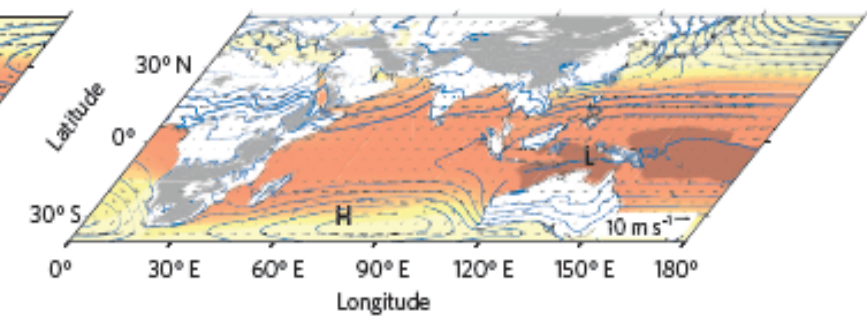
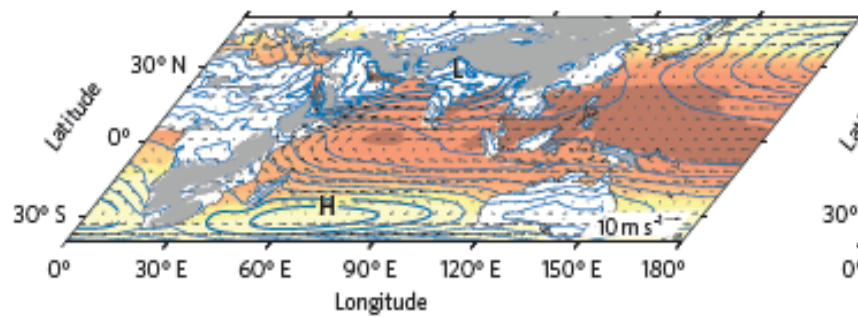
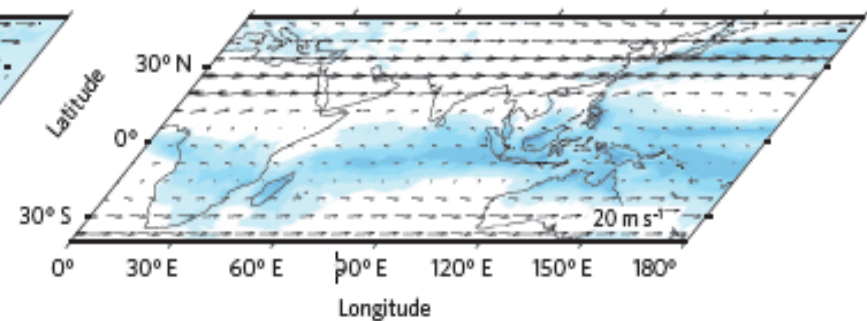


The South Asian Monsoon

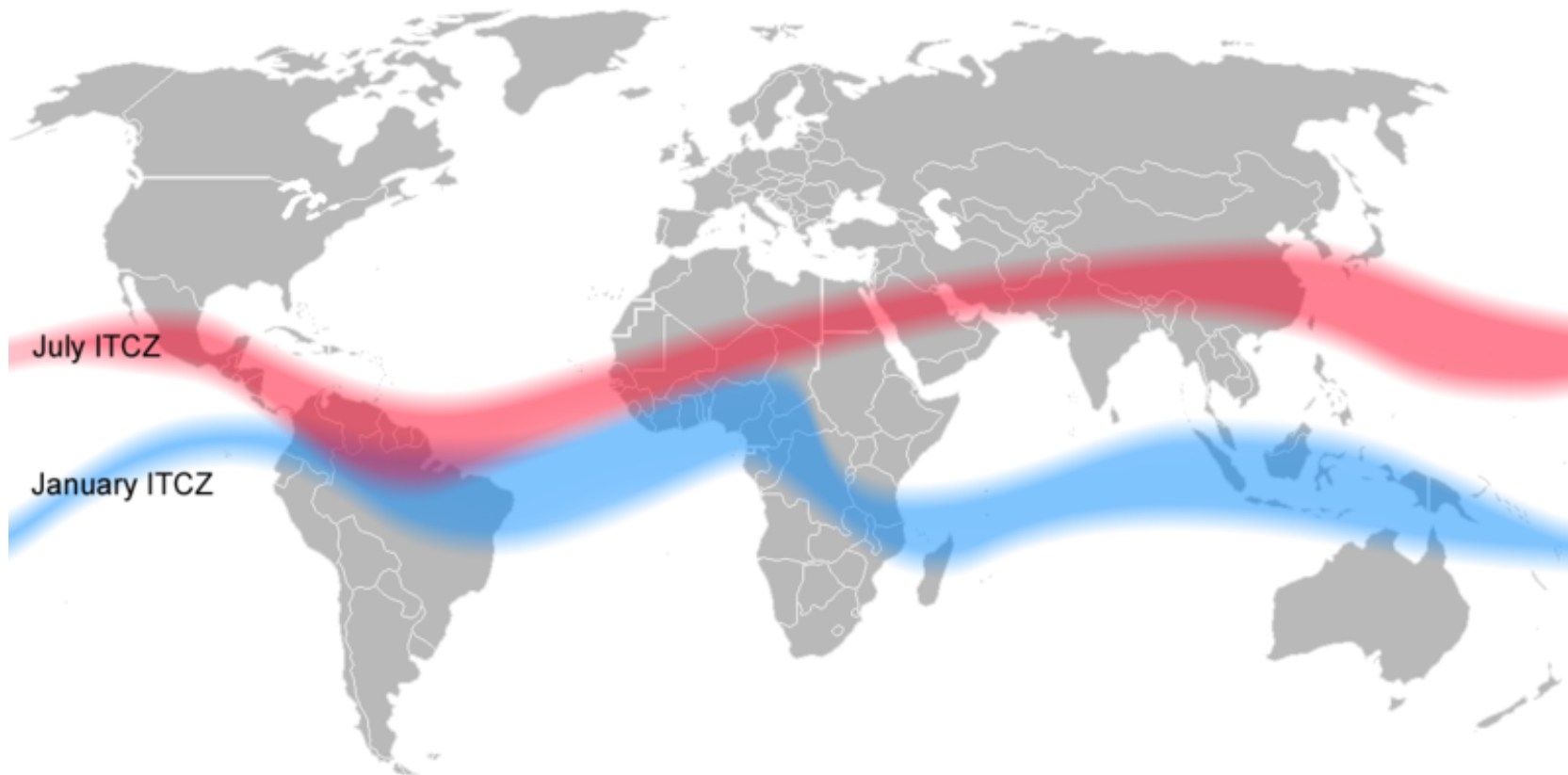
Boreal summer



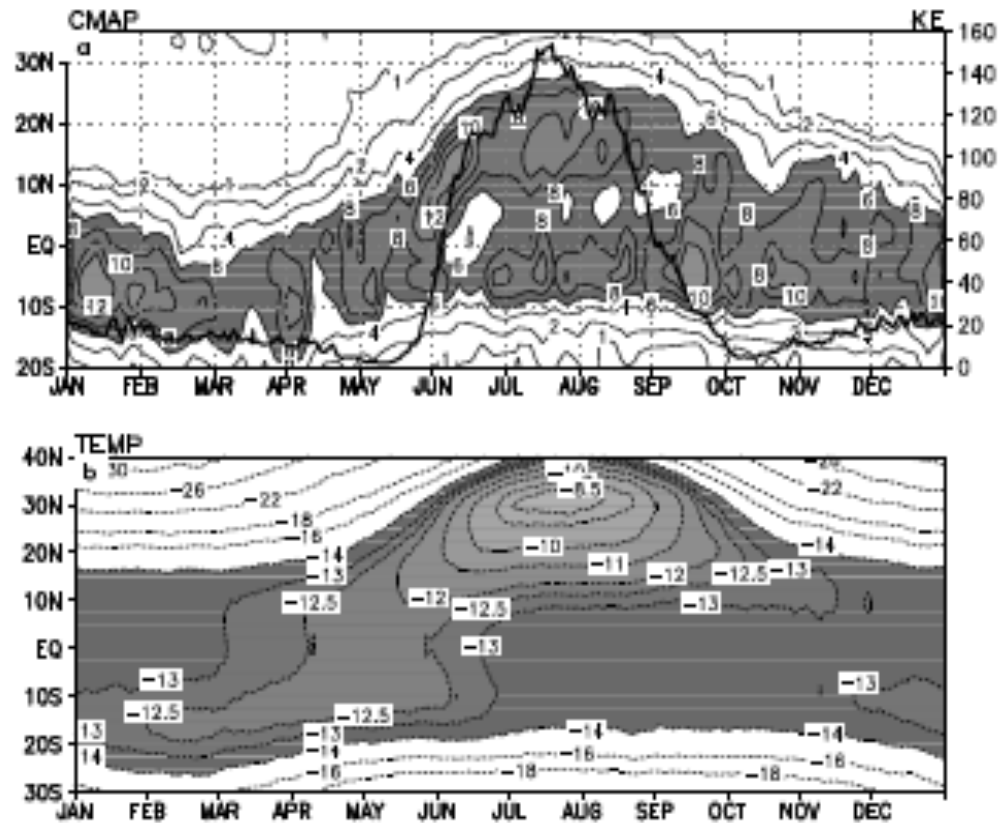
Boreal winter



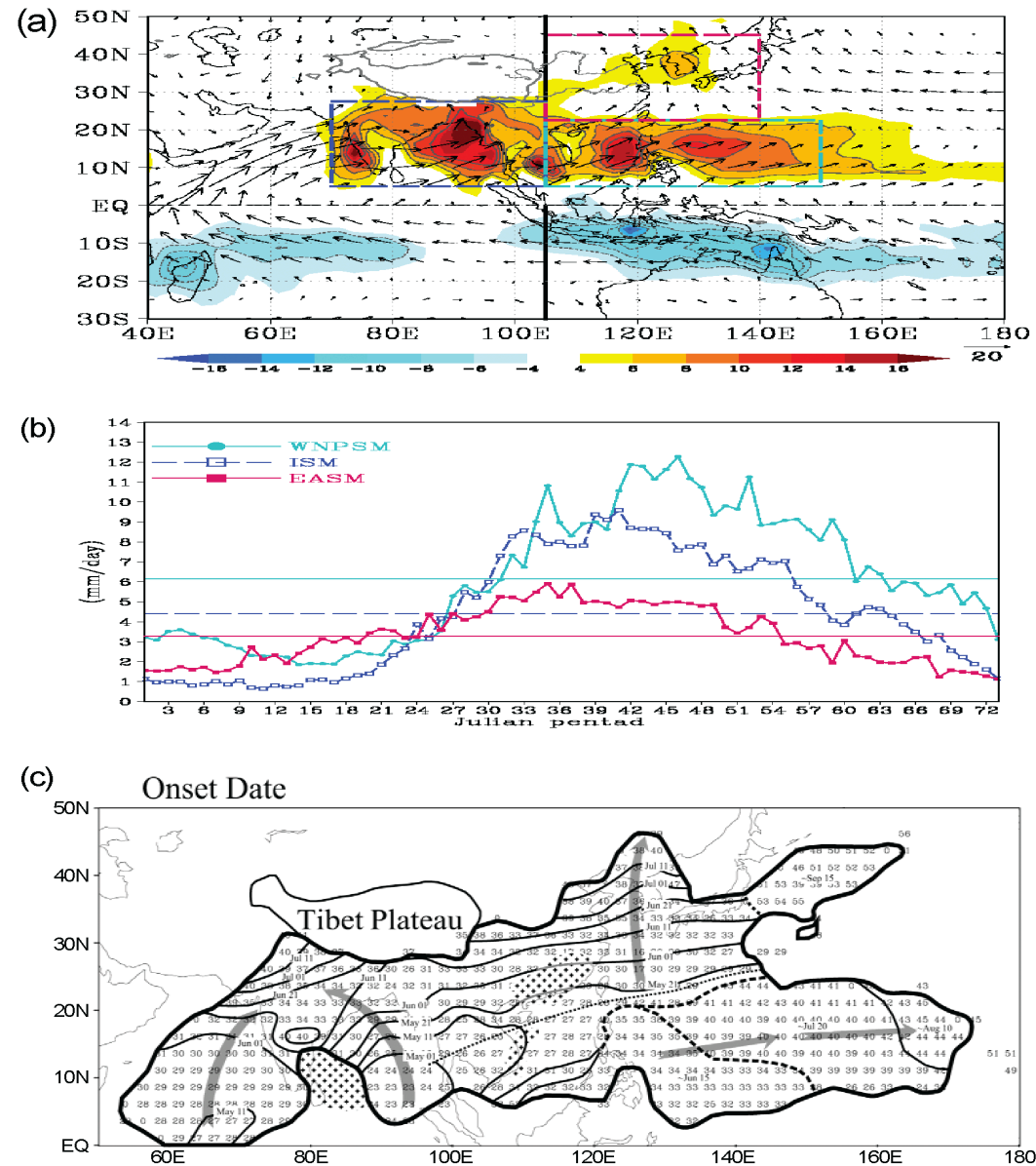
The Seasonal Migration of the ITCZ



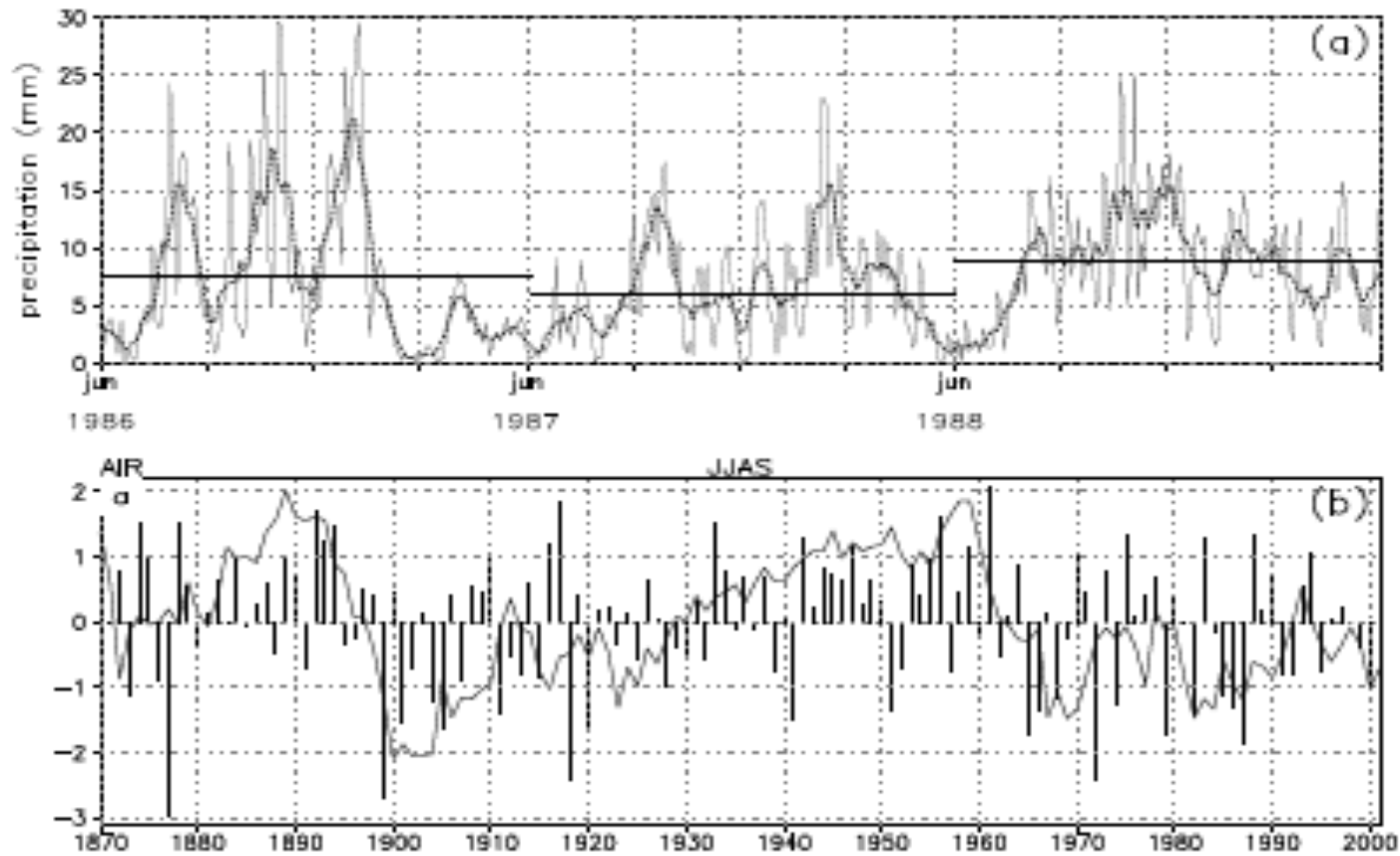
The South Asian Monsoon



The Asian Monsoon Family: IM, WNPM, EAM

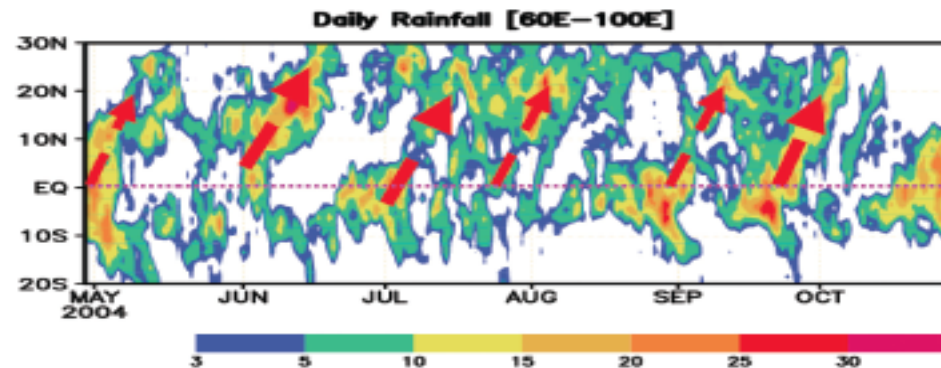
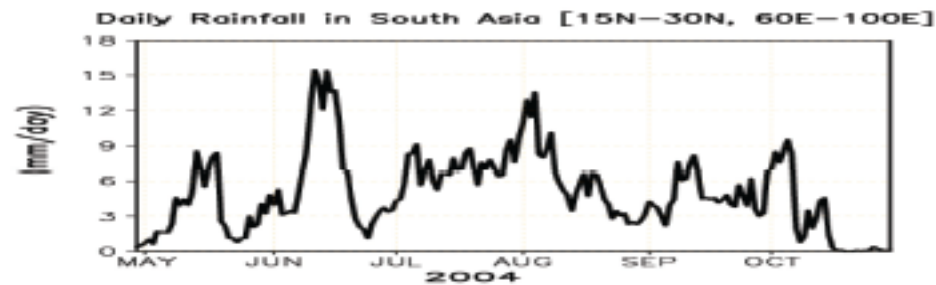
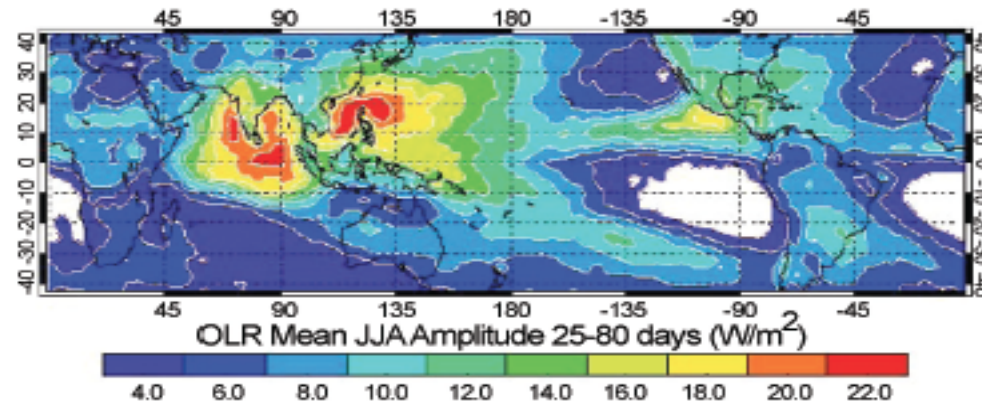


The South Asian Monsoon



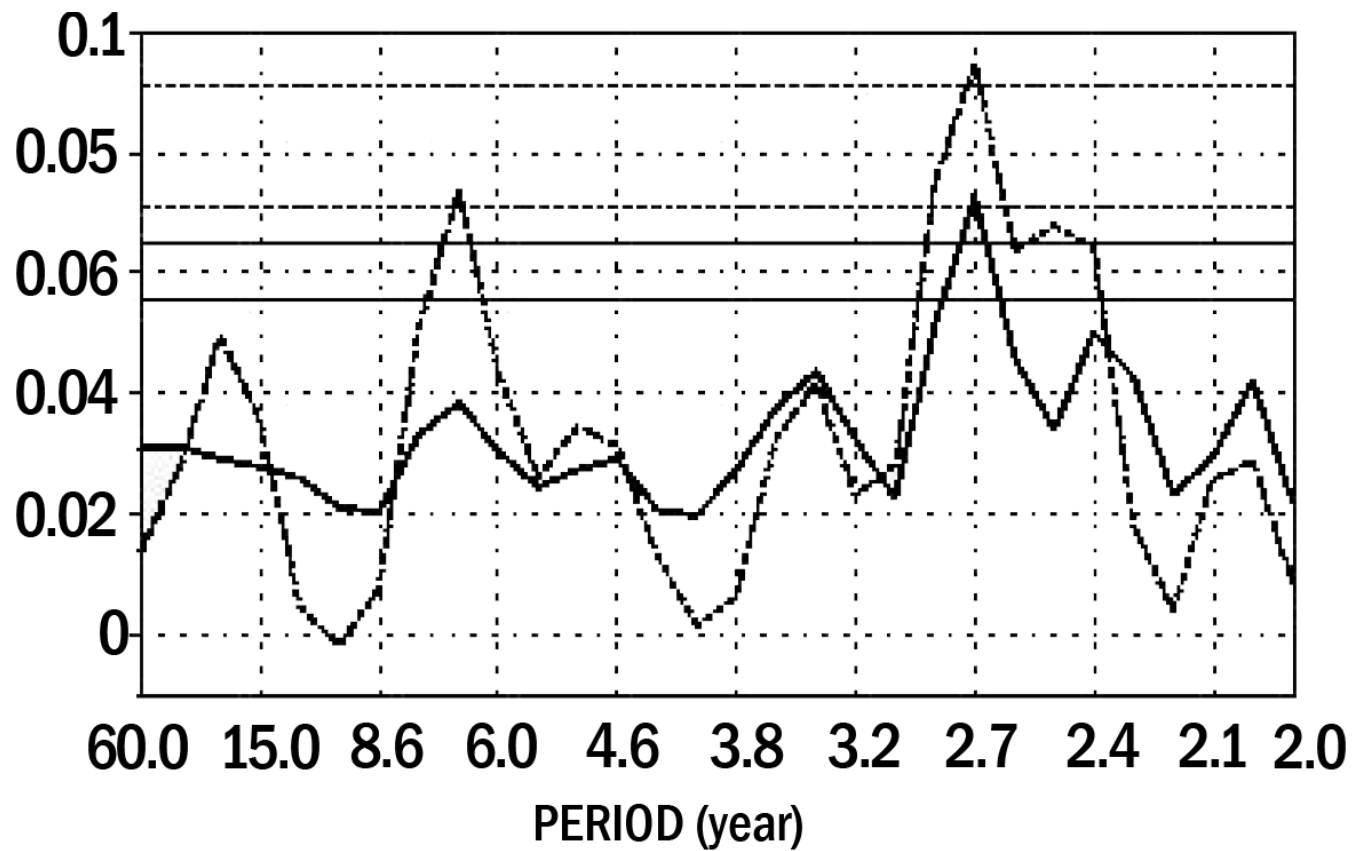
The Asian Monsoons

Intra-Seasonal Variability



The South Asian Monsoon

Intra-Seasonal Variability



Recommended Readings For The Next Lecture

Turner, A. and H. Annamalai, 2012: Climate change and the South Asian summer monsoon. *Nature Climate Change*, Vol. 189, page 587-595 .

Li, T. 2011: Monsoon Climate Variability. In *Climate Dynamics: Why Does Climate Vary*. Sun, D.-Z. and F. Bryan (Eds).