# Examining the Interaction of the Indian Summer Monsoon with Double ITCZs via an Automated Feature Detection Scheme

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*University of Washington*

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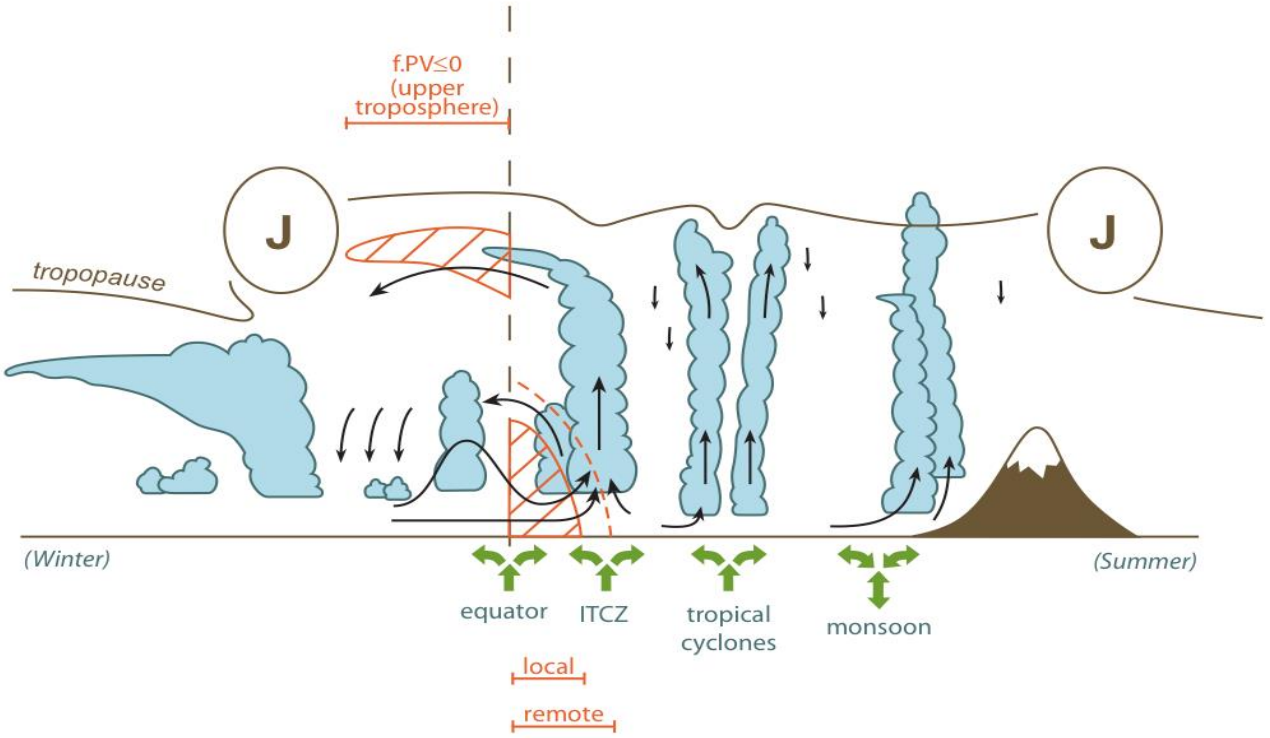
# Indian Ocean Convection



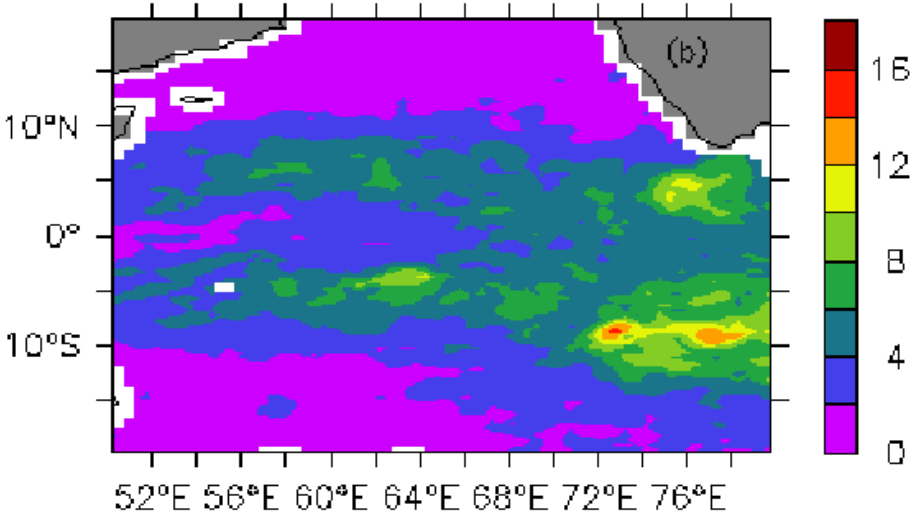
# Motivation

- Relation of DITCZs with annual monsoon
- Tendency of GCM to over-predict DITCZs
- Dynamics are poorly understood
- Application of algorithm to DITCZs in other ocean basins

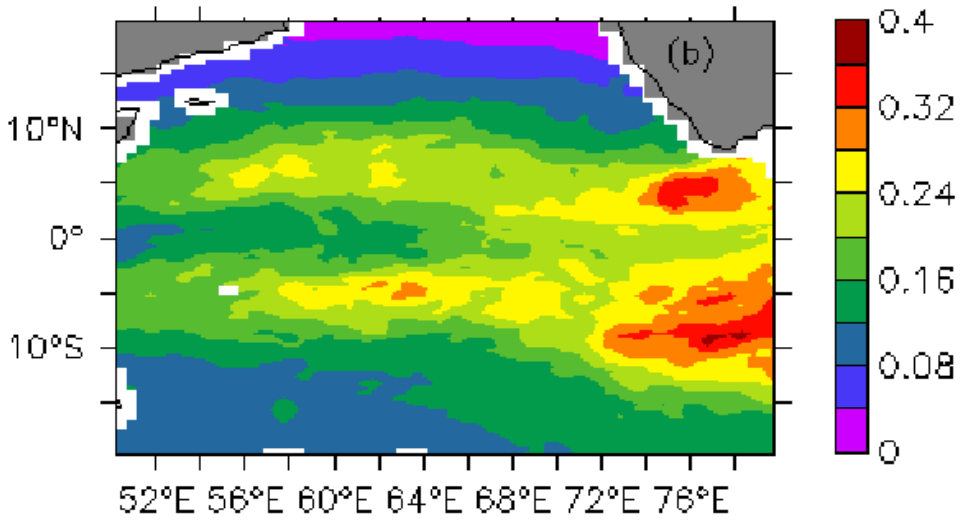
# DITCZs in RS Data

**Climatological 18-year Mean: Nov 16-30 1988-2005**

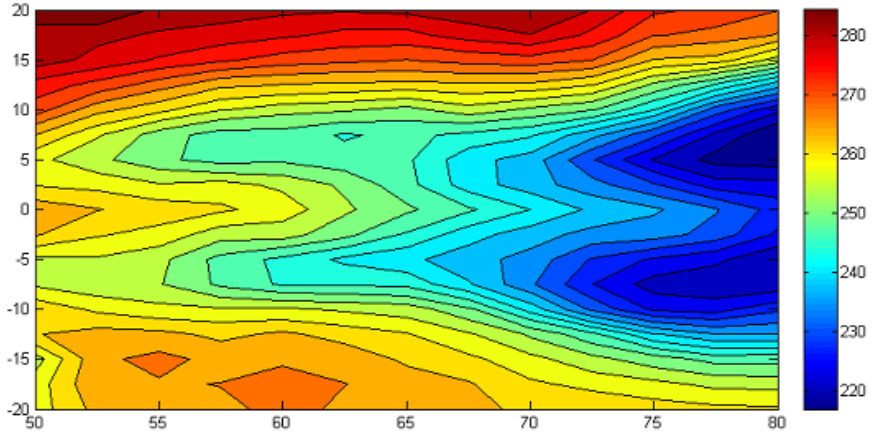
Rainfall: mm/day



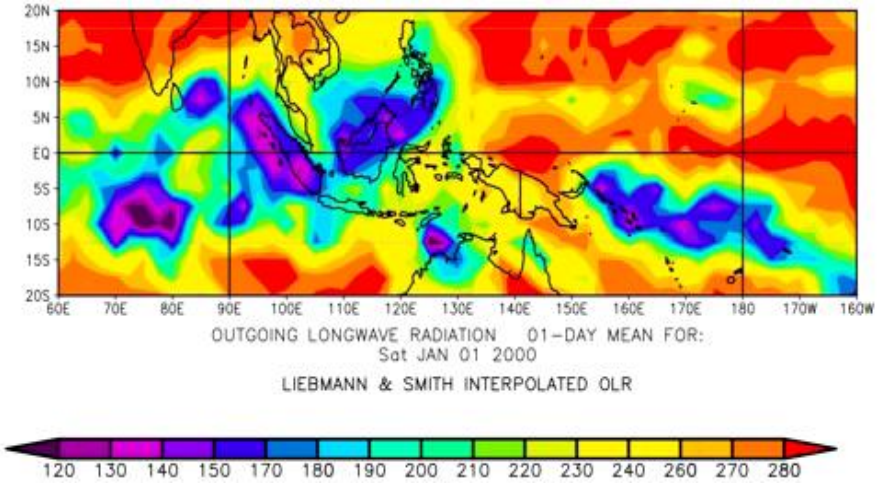

Cloud Liquid Water: Kg/m^2

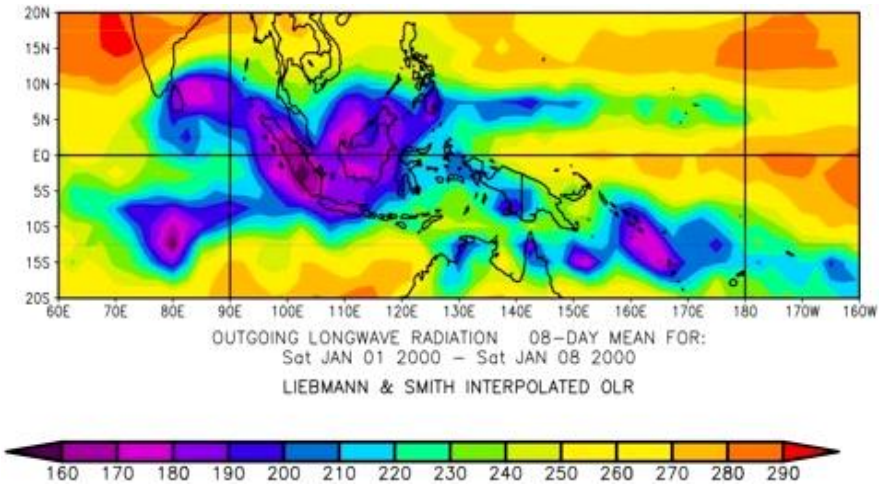


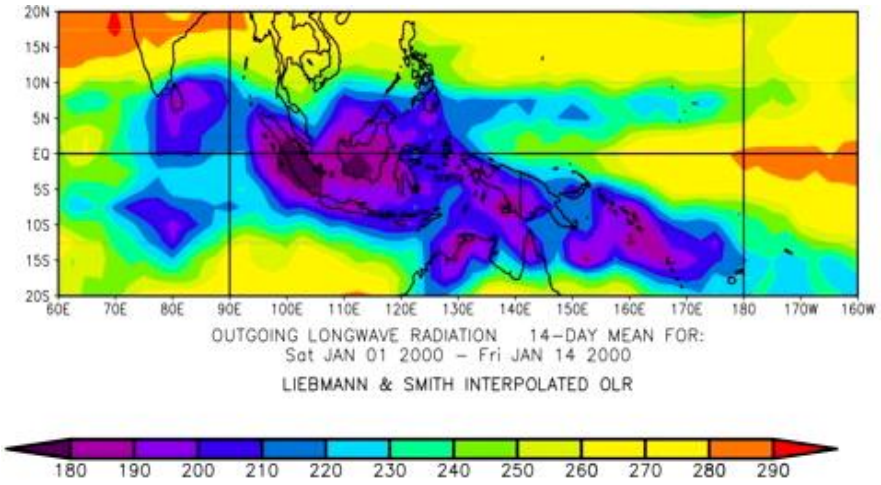

OLR: W/m^2



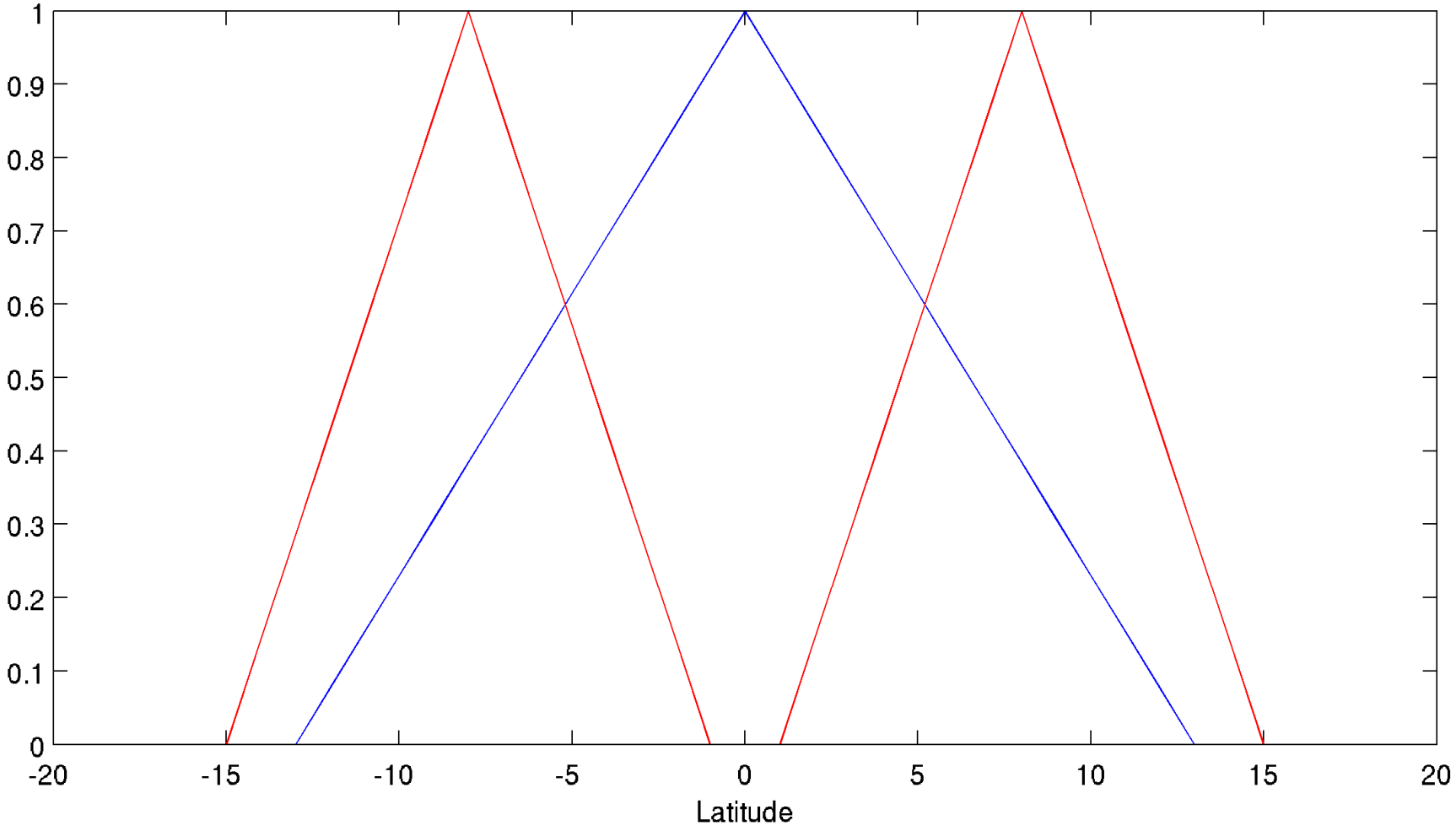
# The ITCZ in OLR Multi-Day Means



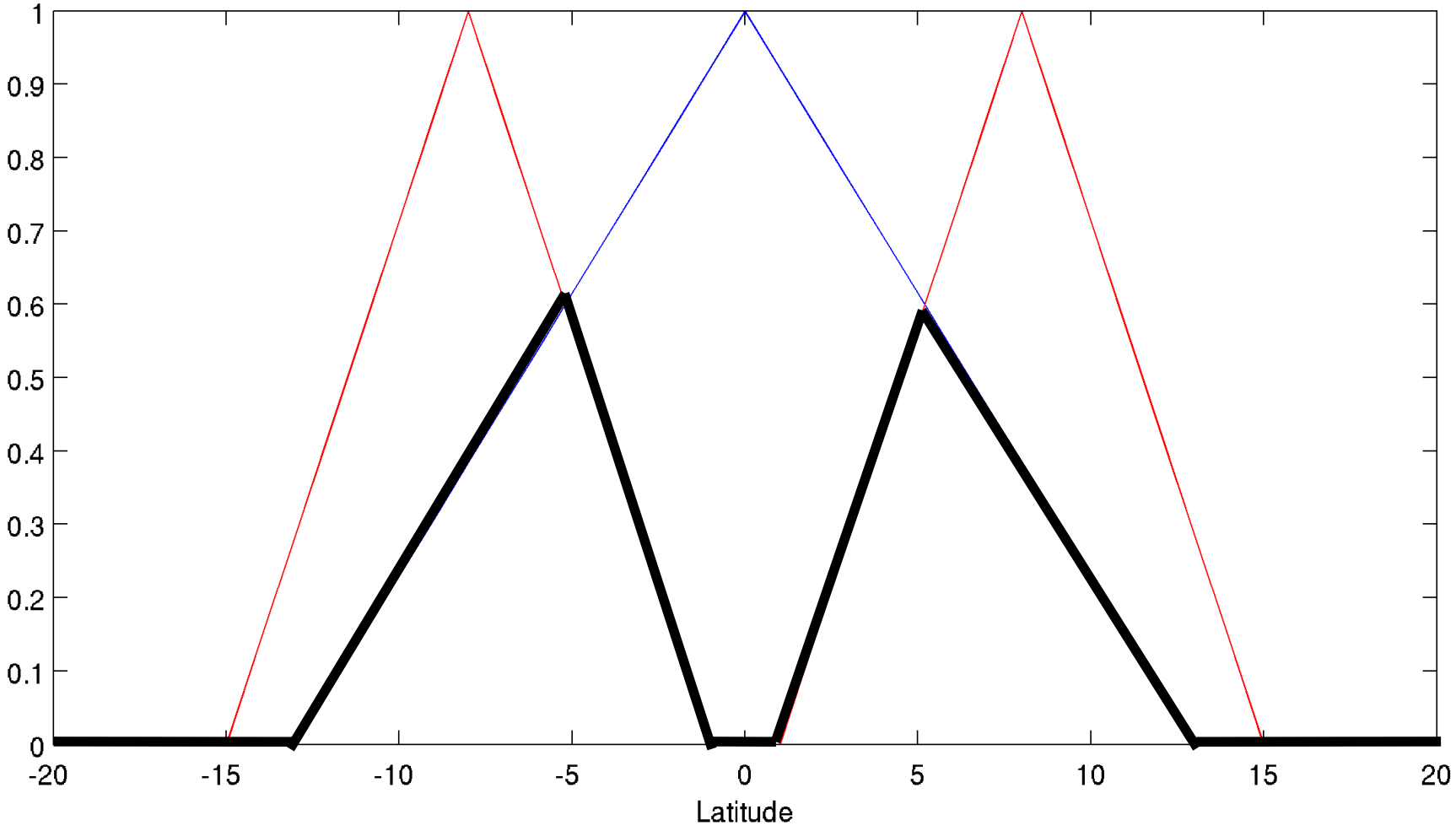



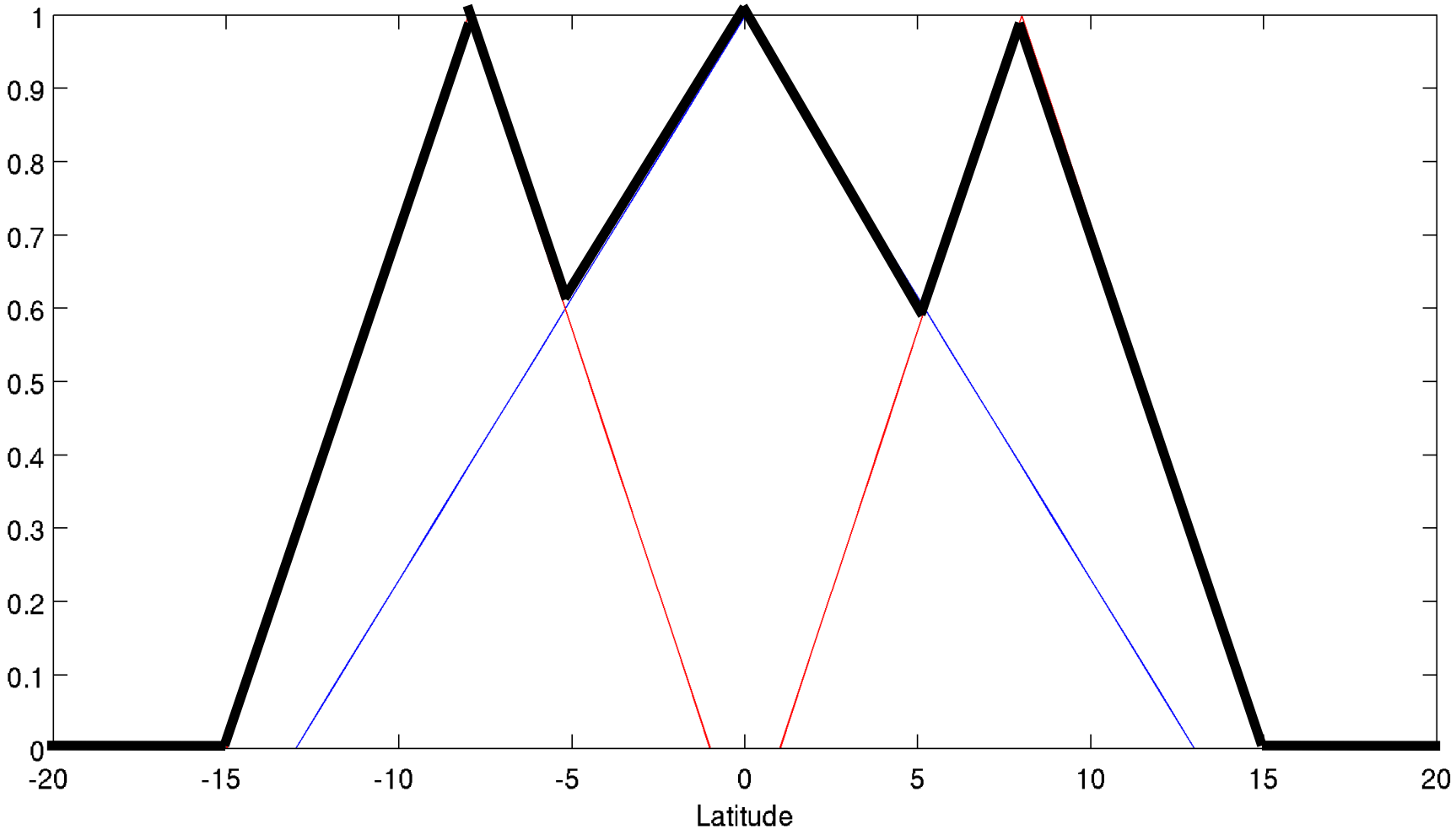
# Fuzzy Method



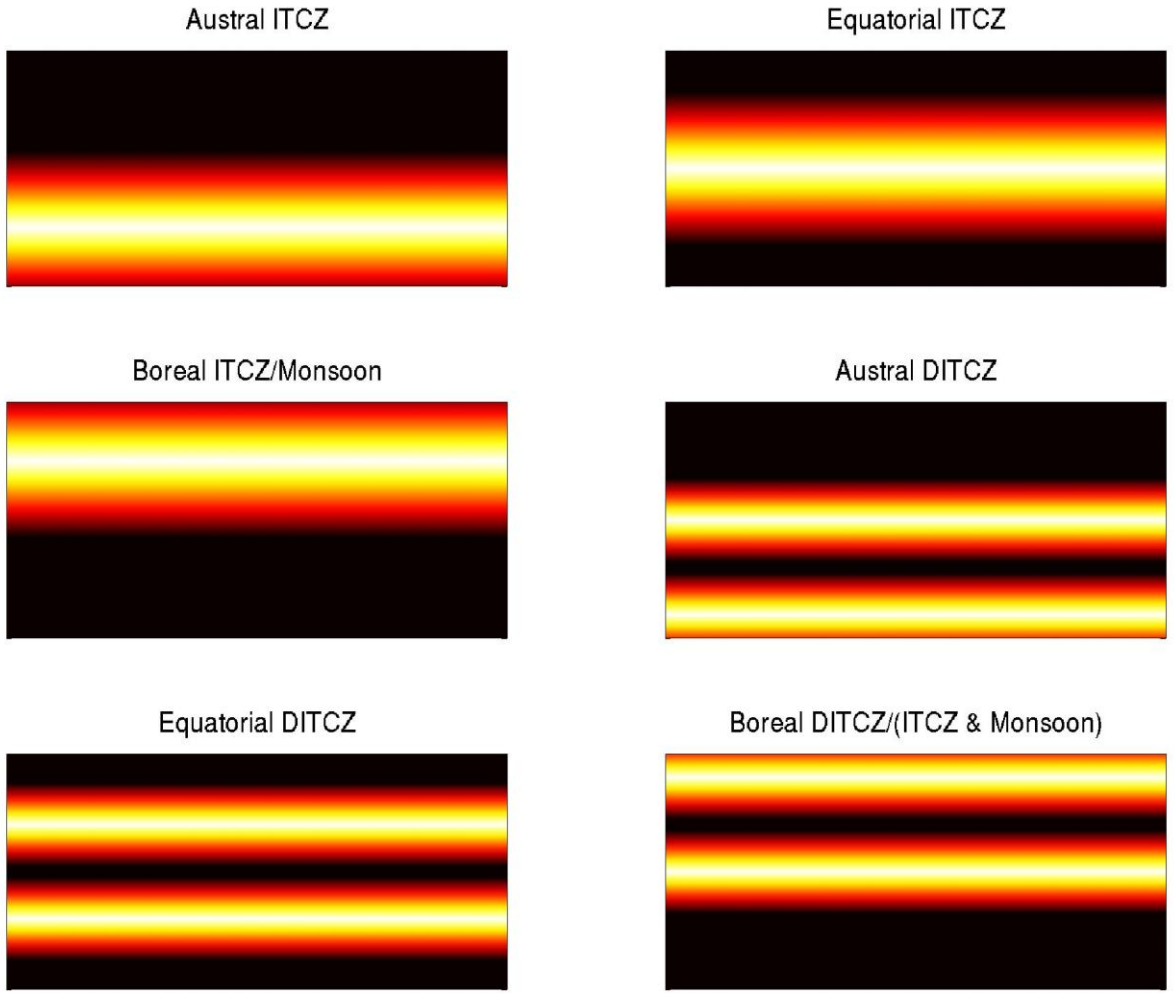
# Fuzzy AND



# Fuzzy OR



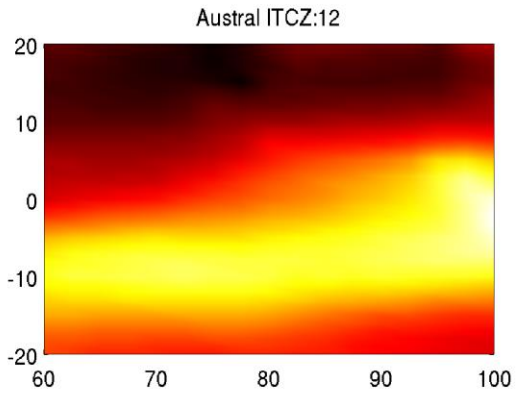
# Fuzzy Filters

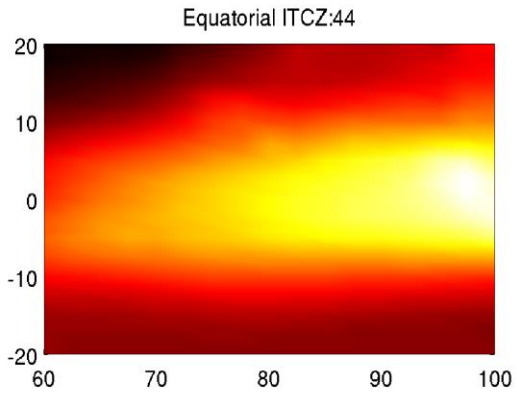



$$\Sigma \min(OLR,Filter) / \Sigma \max(OLR,Filter)$$

# Fuzzy Classification: Results

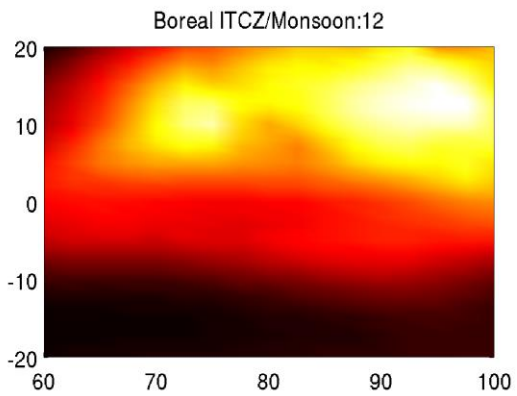
12%

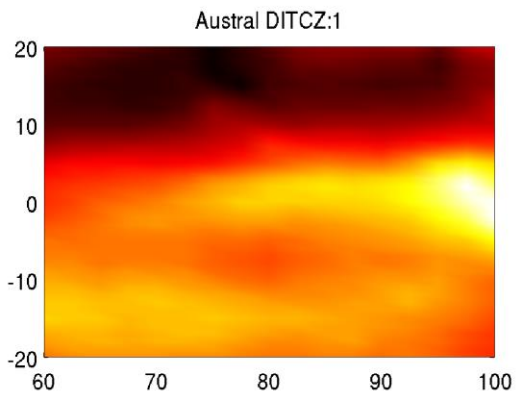



44%

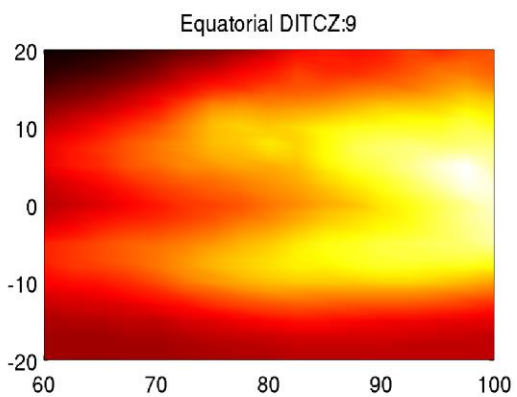
12%

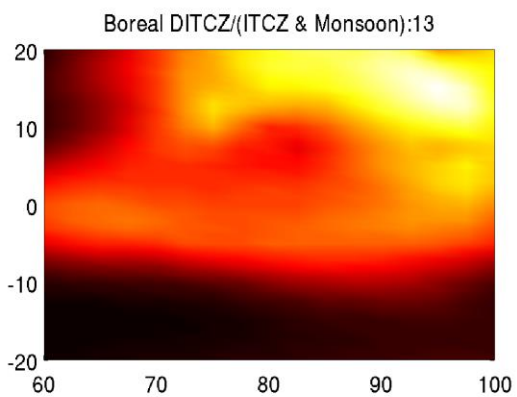



1%

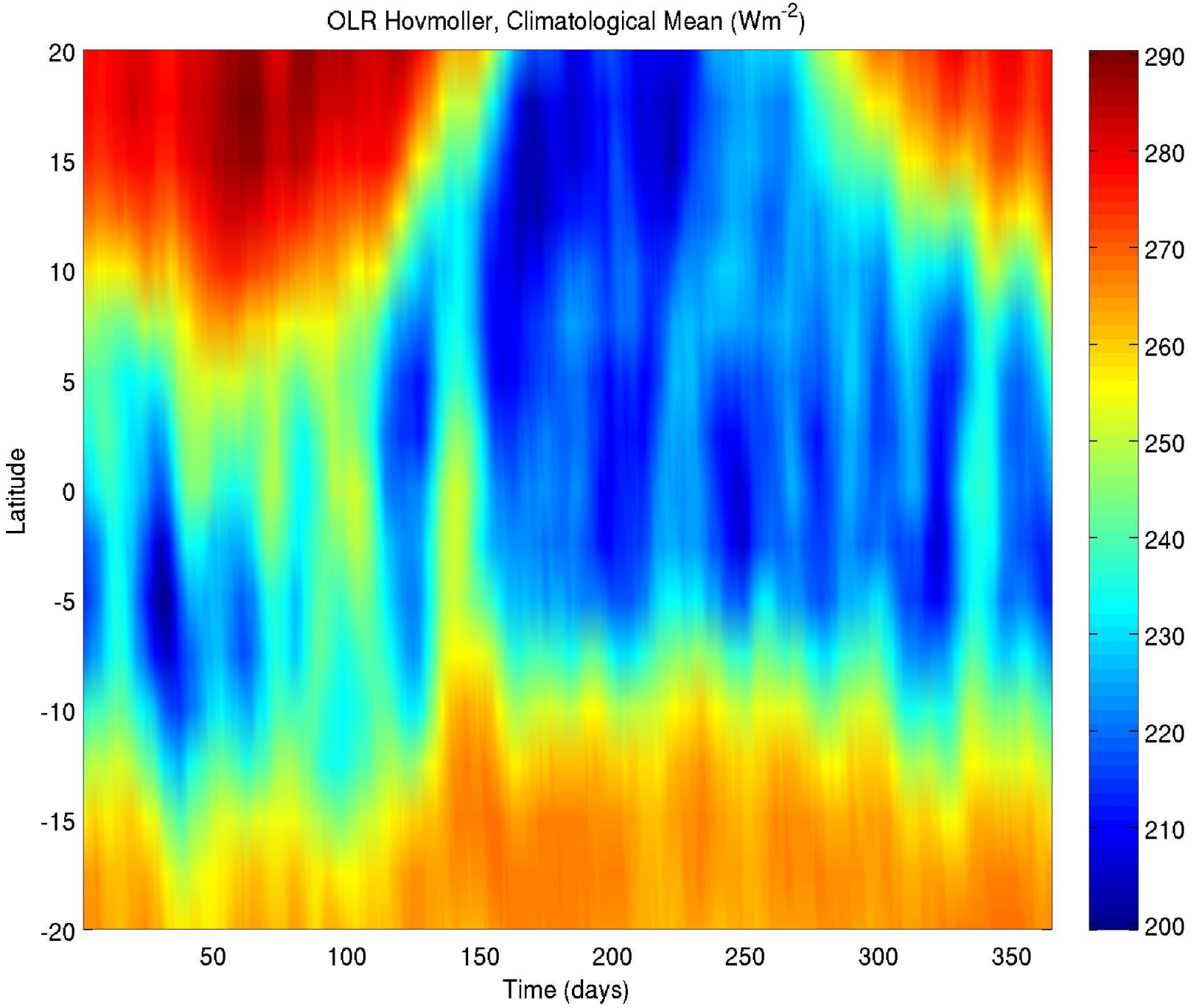
9%




13%

# Climatological Monsoon Season OLR



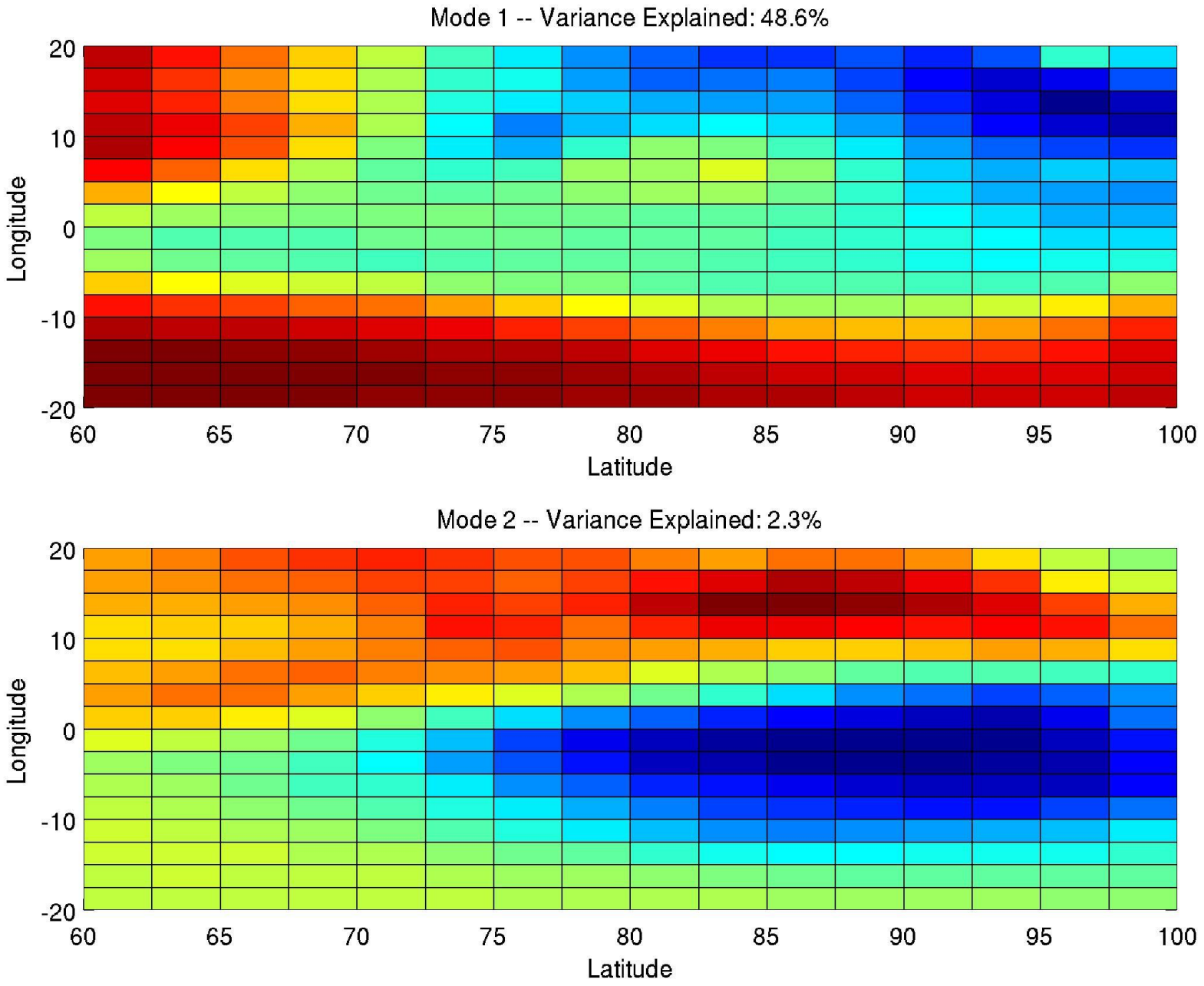
# Precipitation Monsoon Break Index

**A new criterion for identifying breaks in monsoon conditions over the Indian subcontinent**

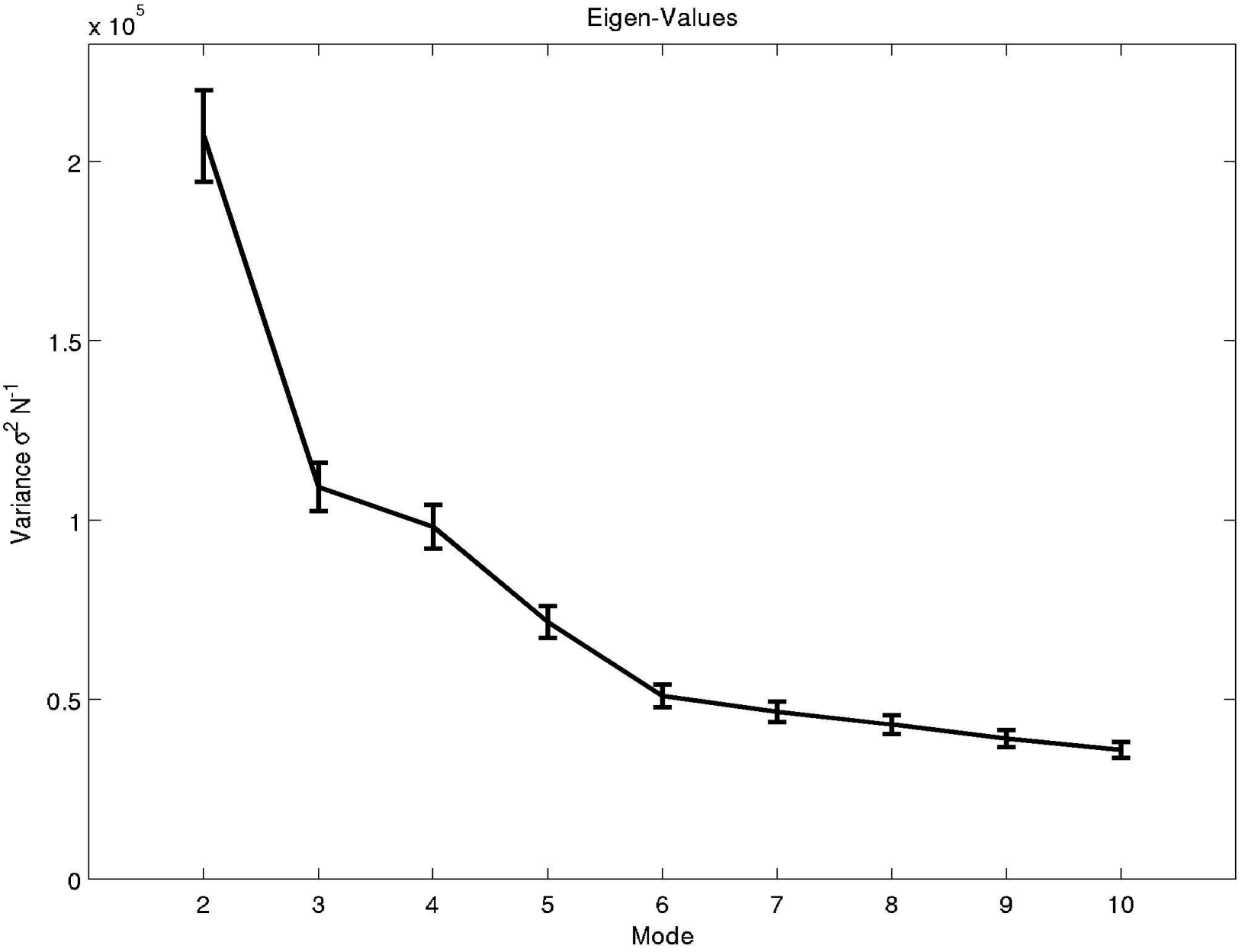
M. R. Ramesh Kumar and Uma R. Prabhu Dessai
Physical Oceanography Division,
National Institute of Oceanography,
Dona Paula ,Goa – 403004 , India.

for identifying the breaks, we have catalogued them for the period 1901 to 2002. We refer to a situation as a break, if the all India rainfall is less than 9 mm/day and the condition persists for a minimum of three days and if it occurs in the mid monsoon months of July and August. The majority of the

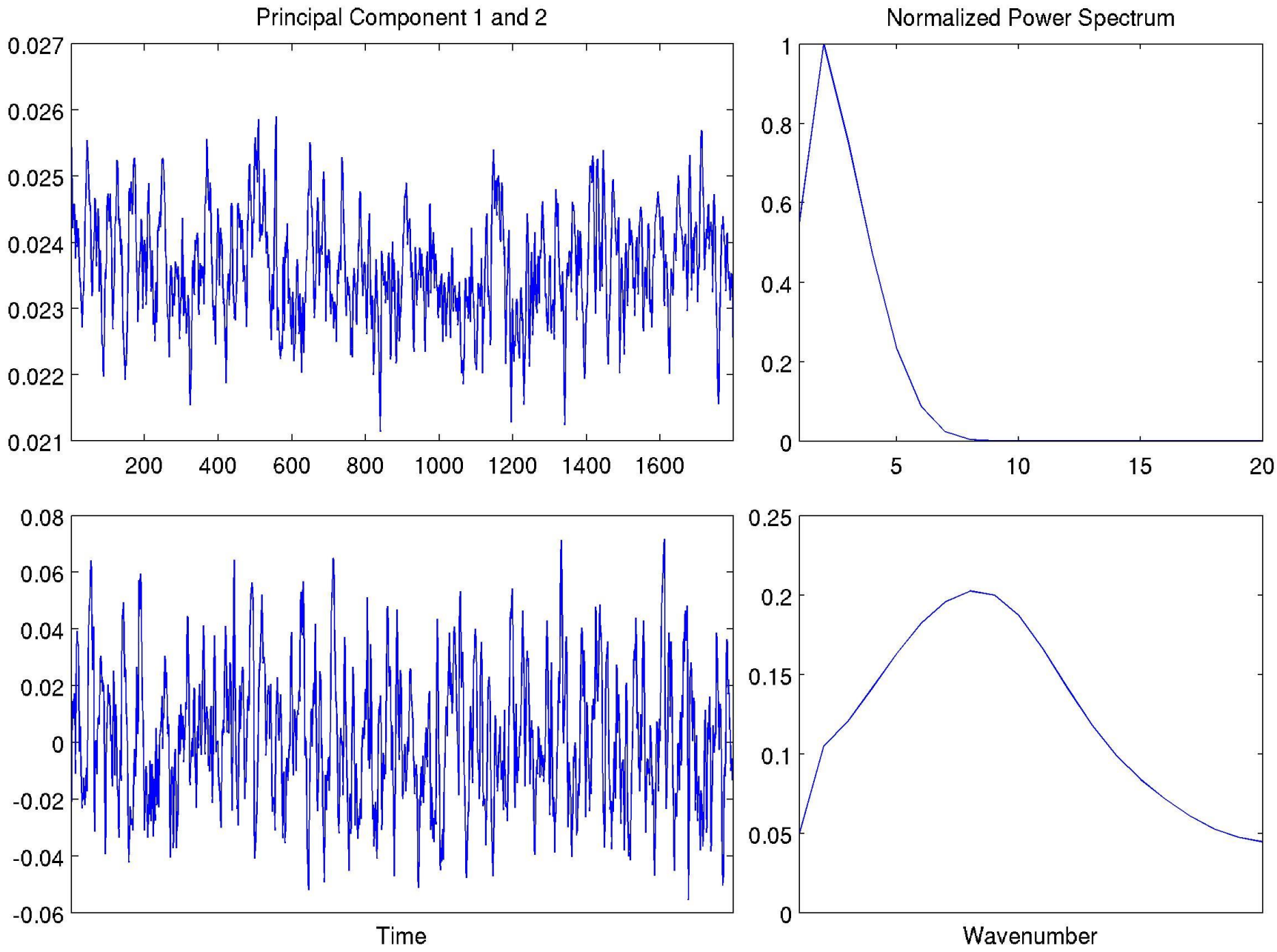
# SVD: EOFs


Mode 1 -- Variance Explained: 48.6%
Longitude
Latitude
20
10
0
-10
-20
60
65
70
75
80
85
90
95
100
Mode 2 -- Variance Explained: 2.3%
Longitude
Latitude
20
10
0
-10
-20
60
65
70
75
80
85
90
95
100

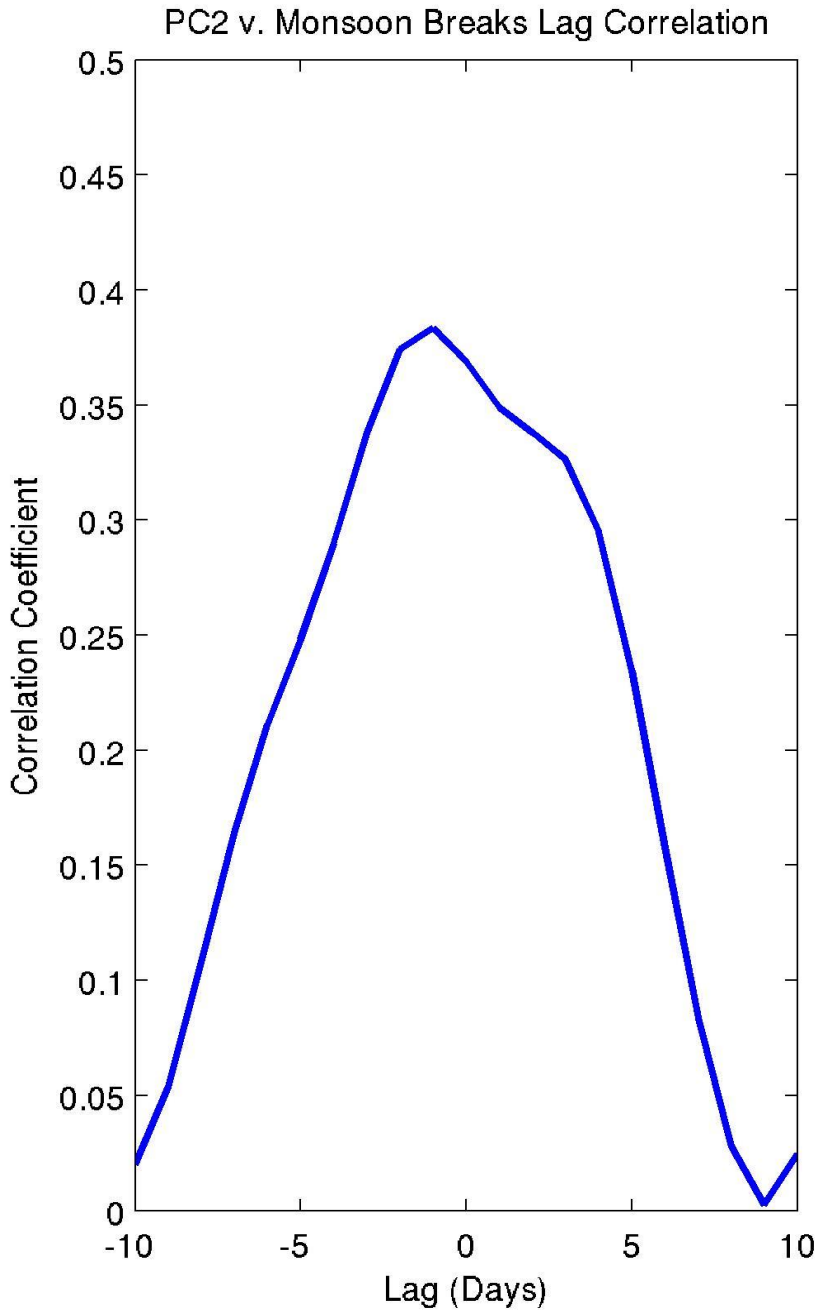
# SVD: Singular Values

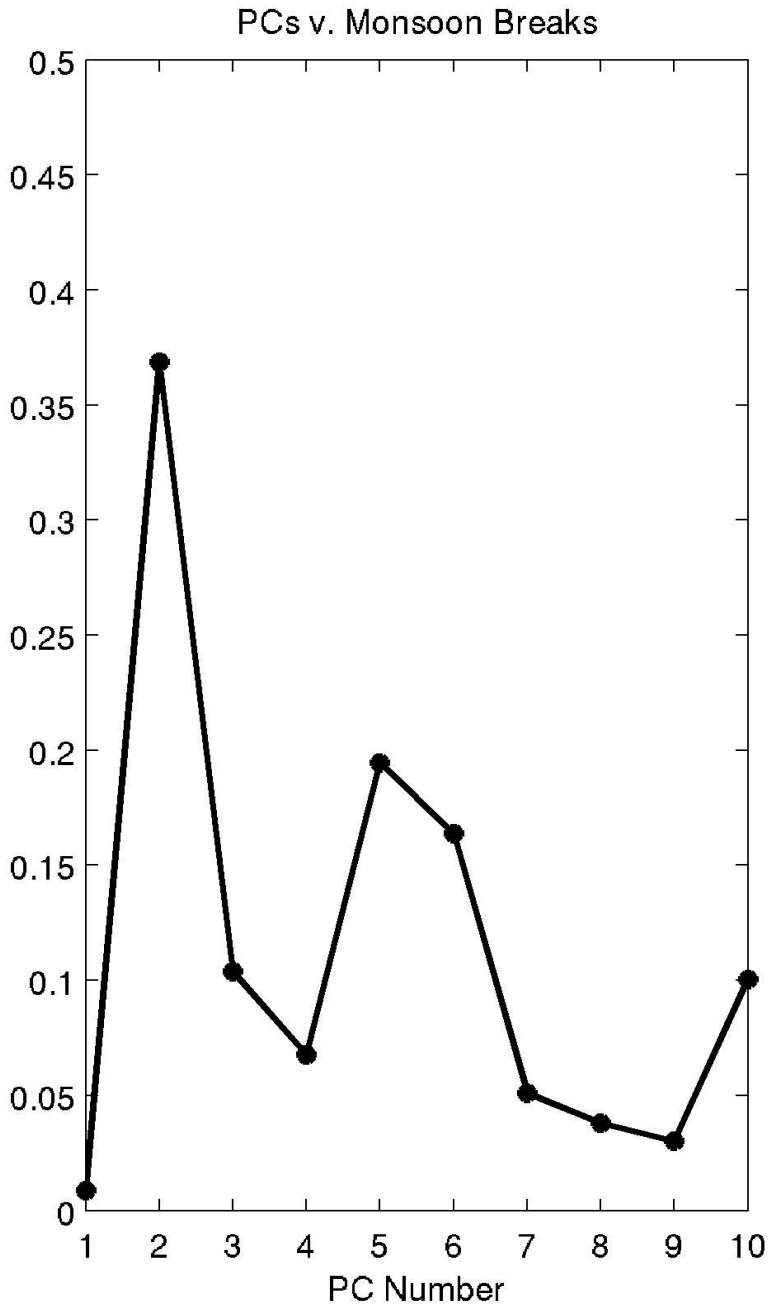


# SVD: PCs

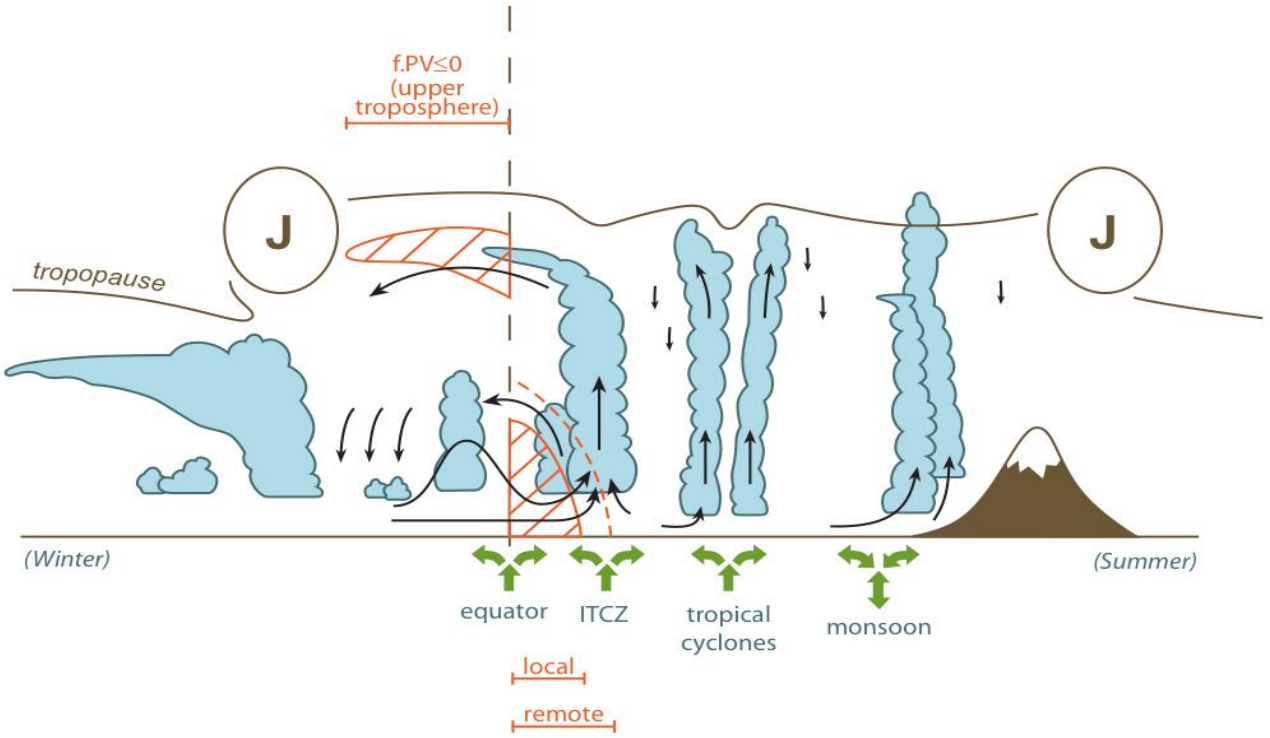

Principal Component 1 and 2
0.027
0.026
0.025
0.024
0.023
0.022
0.021
200
400
600
800
1000
1200
1400
1600
Normalized Power Spectrum
1
0.8
0.6
0.4
0.2
0
5
10
15
20
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
Time
0.25
0.2
0.15
0.1
0.05
0
Wavenumber

# SVD: Lag Correlations



# Thank you!


f.PV≤0
(upper
troposphere)
J
J
tropopause
(Winter)
(Summer)
equator
ITCZ
tropical
cyclones
monsoon
local
remote