Variability on the Hydro-climatology of Nepal Himalaya

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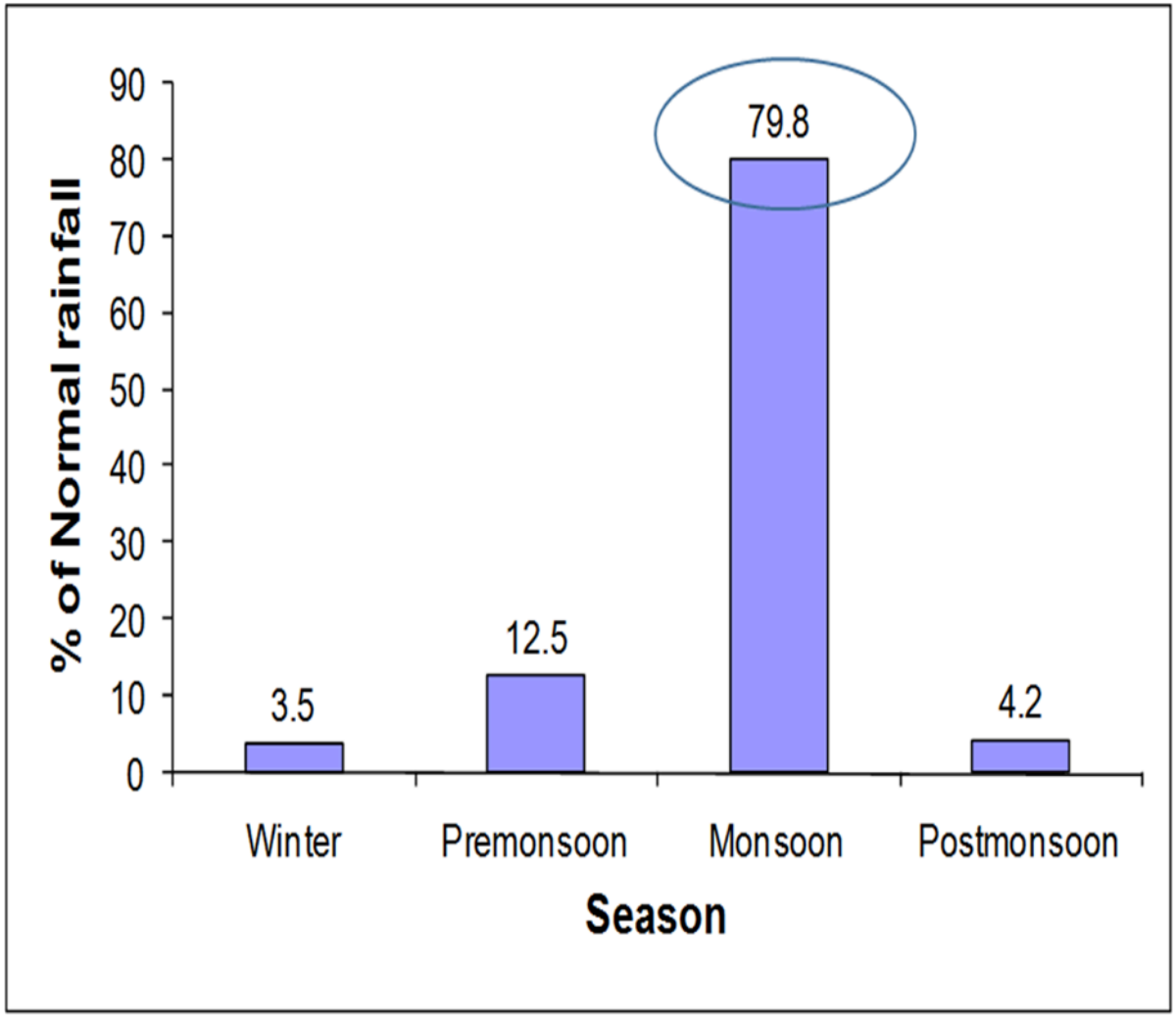
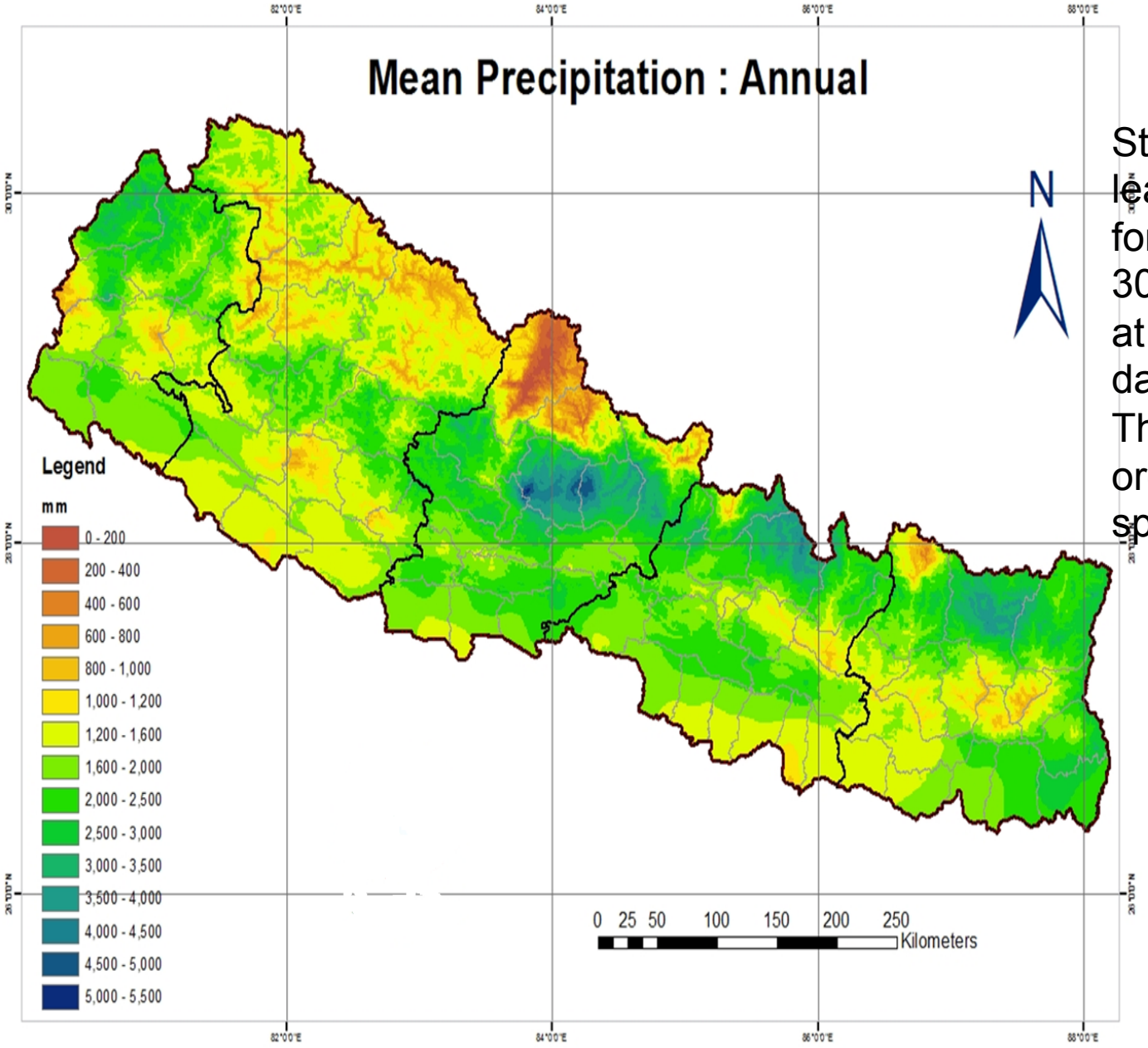
Seasonal distribution of precipitation



Spatial Analysis (based on data from 374 stations)



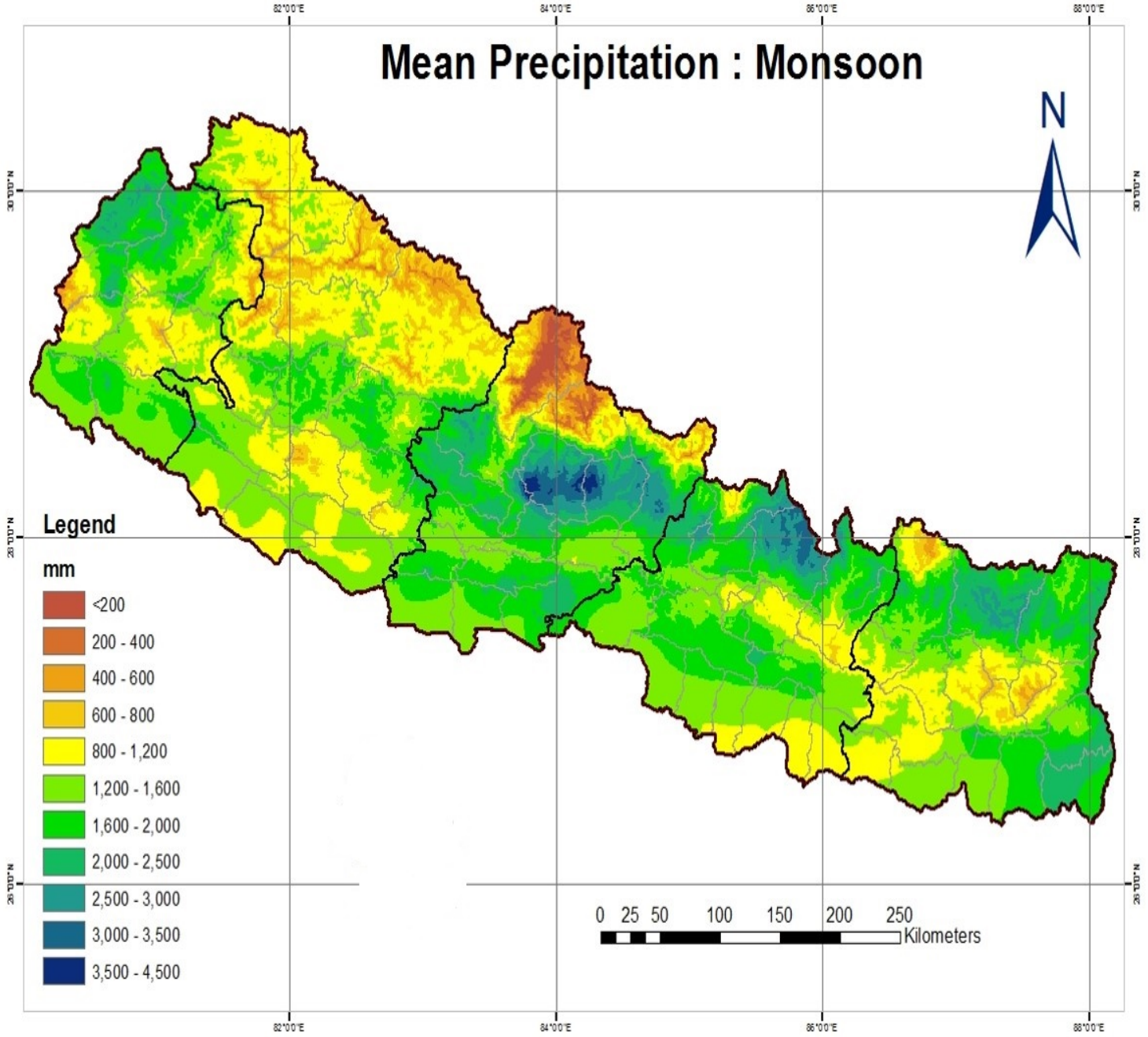
Stations with at least 10 years data for low and above 3000m stations with at least 5 years data

This is done in order to have good spatial coverage

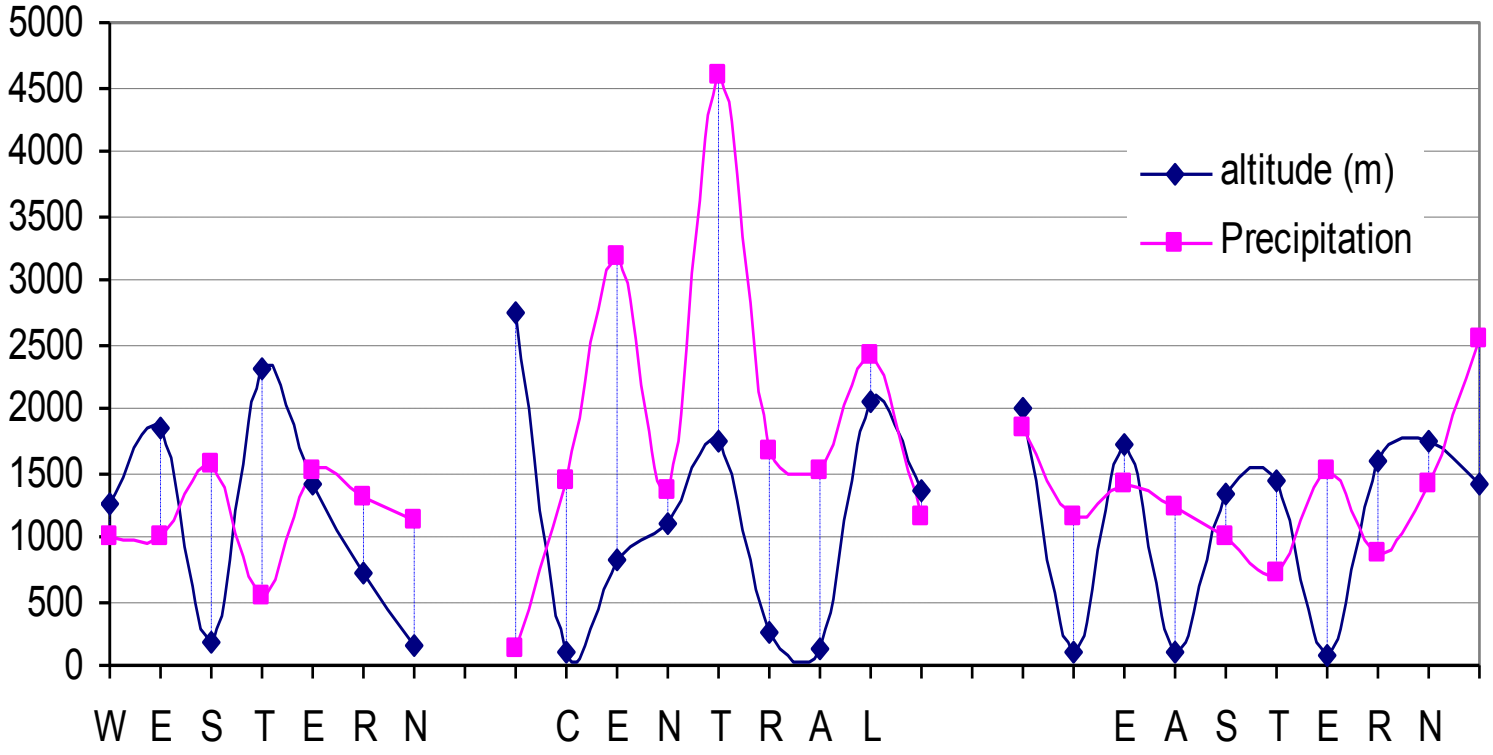
- highest annual precipitation in Lumle mean annual precipitation of about 5500mm.

- The lowest precipitation site is recorded in Upper Mustang Dhiee, Lomanthang area of Mustang less than 150mm.

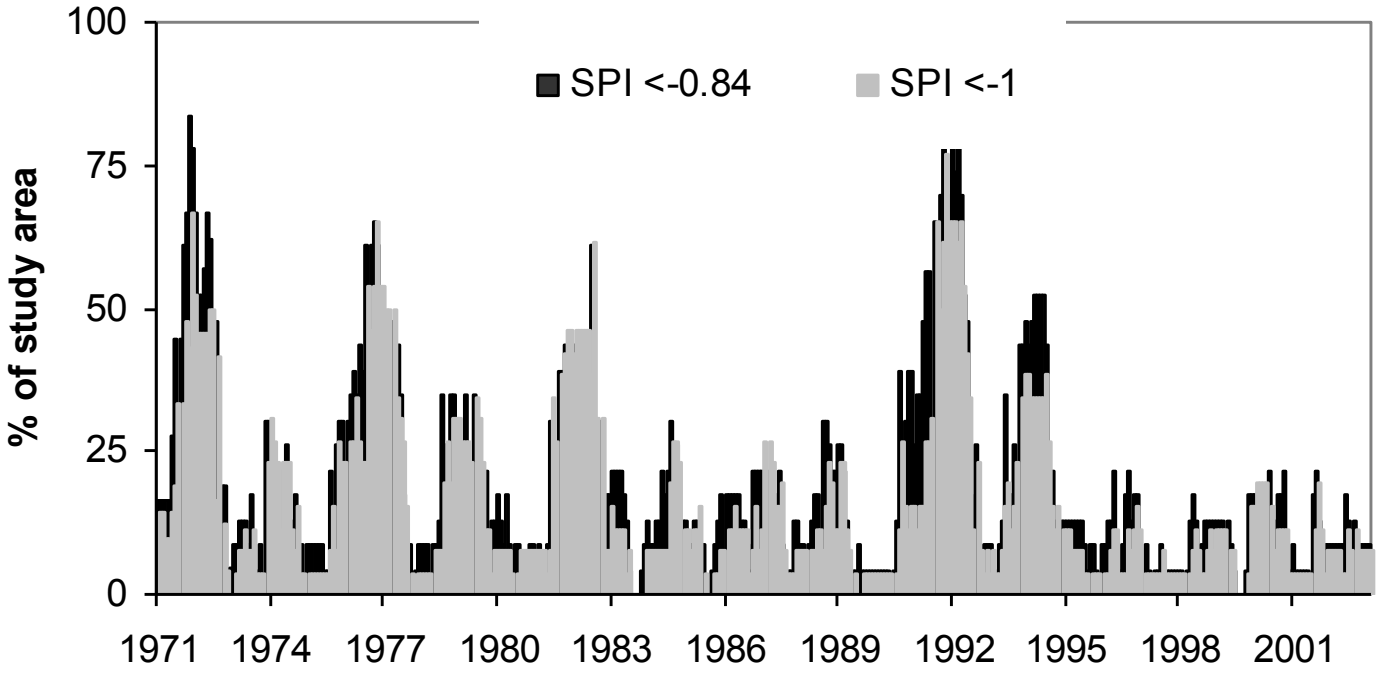
- The three highest precipitation pocket areas - southern slope of Makalu range in eastern development region, Southern slope of langtang range in central development region and south of the Annapurna range in western development region


Mean Precipitation : Monsoon
N
82°0'0"E
84°0'0"E
86°0'0"E
88°0'0"E
30°0'0"N
28°0'0"N
26°0'0"N
Legend
mm
<200
200 - 400
400 - 600
600 - 800
800 - 1,200
1,200 - 1,600
1,600 - 2,000
2,000 - 2,500
2,500 - 3,000
3,000 - 3,500
3,500 - 4,500
0 25 50 100 150 200 250
Kilometers

Altitudinal variation of summer monsoon rainfall

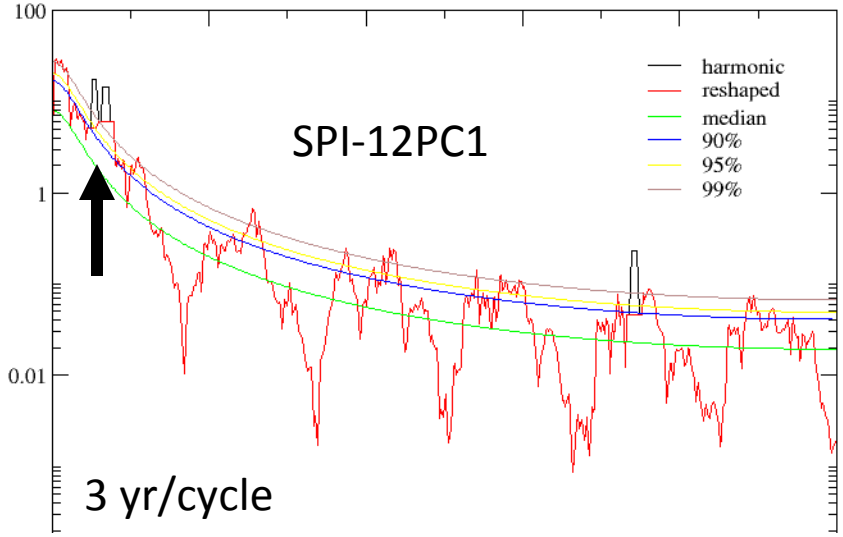


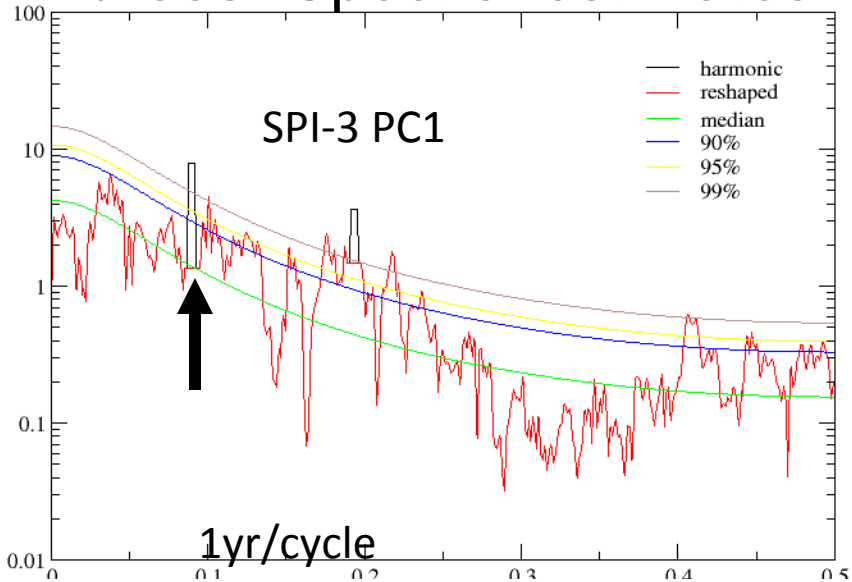
Arial extension of drought

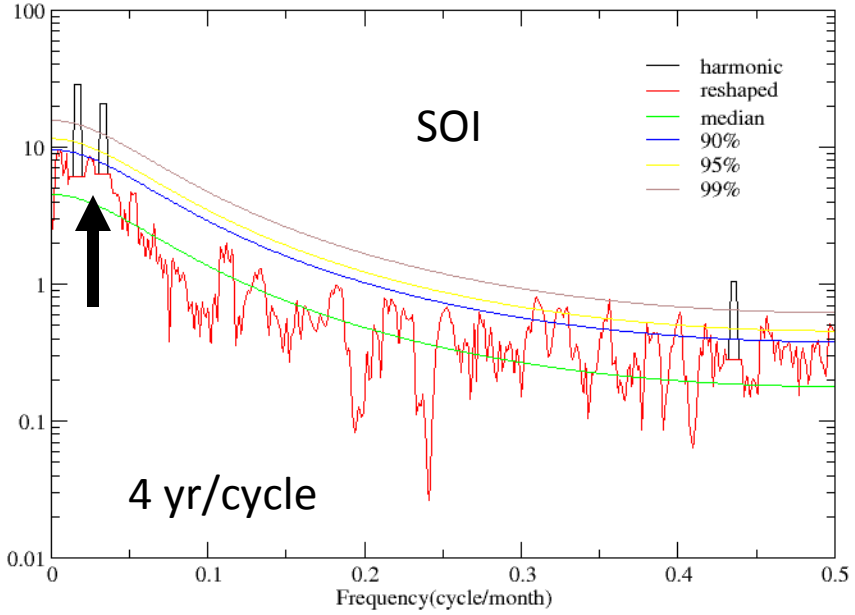


In 33-years average 10%, 6% and 5% of area were covered by moderate, severe and extreme drought respectively.

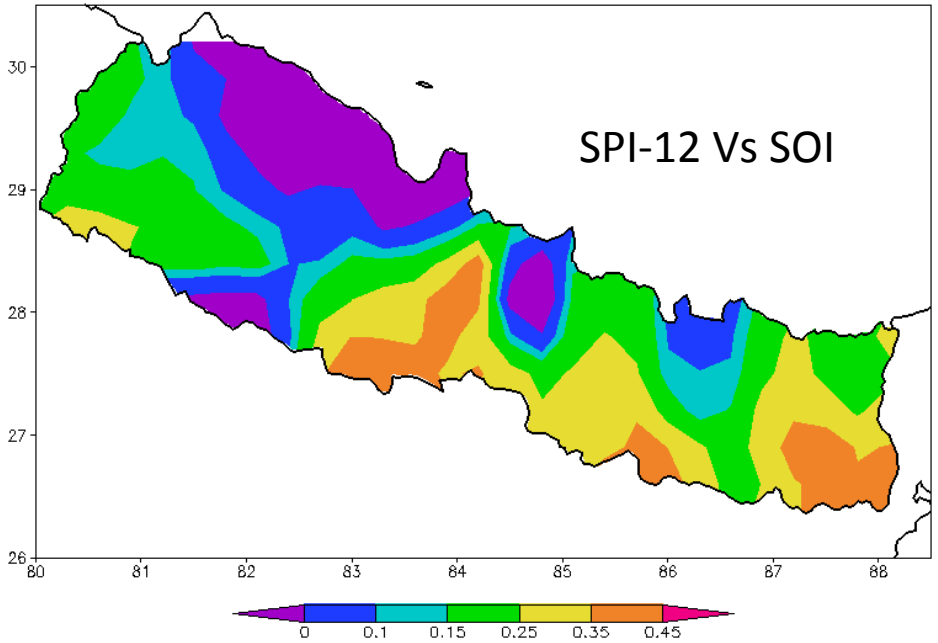
Links with the Climate indices- Spectral estimates





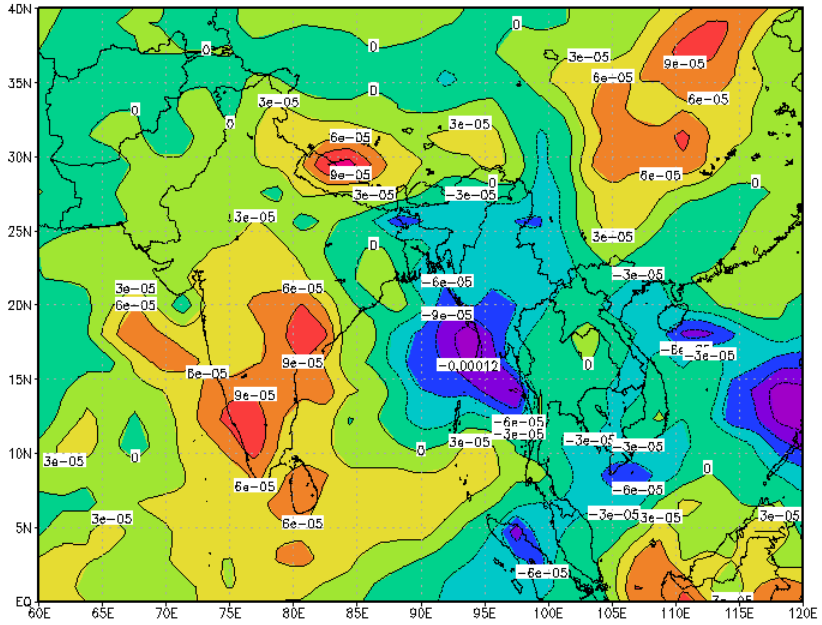


Correlation

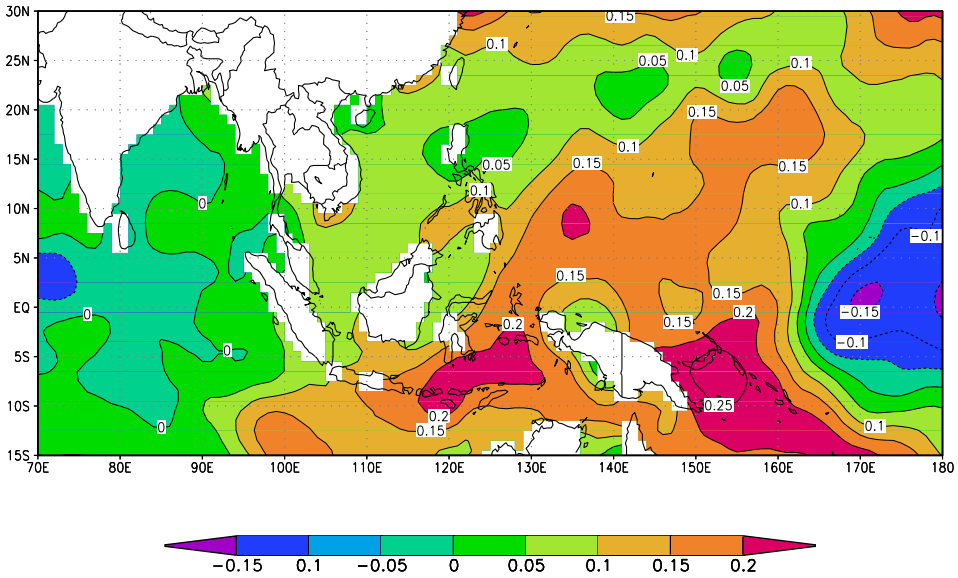


Large-scale circulations

SOI composite (difference) on precipitation rate



Regressed SST on Summer Rain (SR)



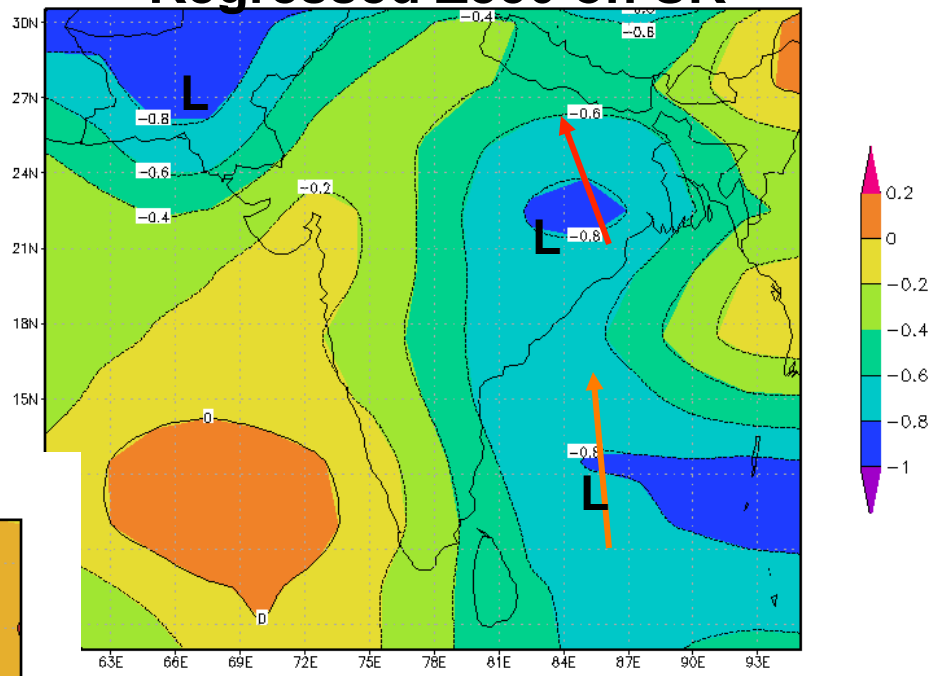
Increase precipitation over continent than in Ocean in the cold phase of ENSO.

Weak anomaly of SST in BOB while stronger positive anomaly in Pacific, A typical La Nina pattern.

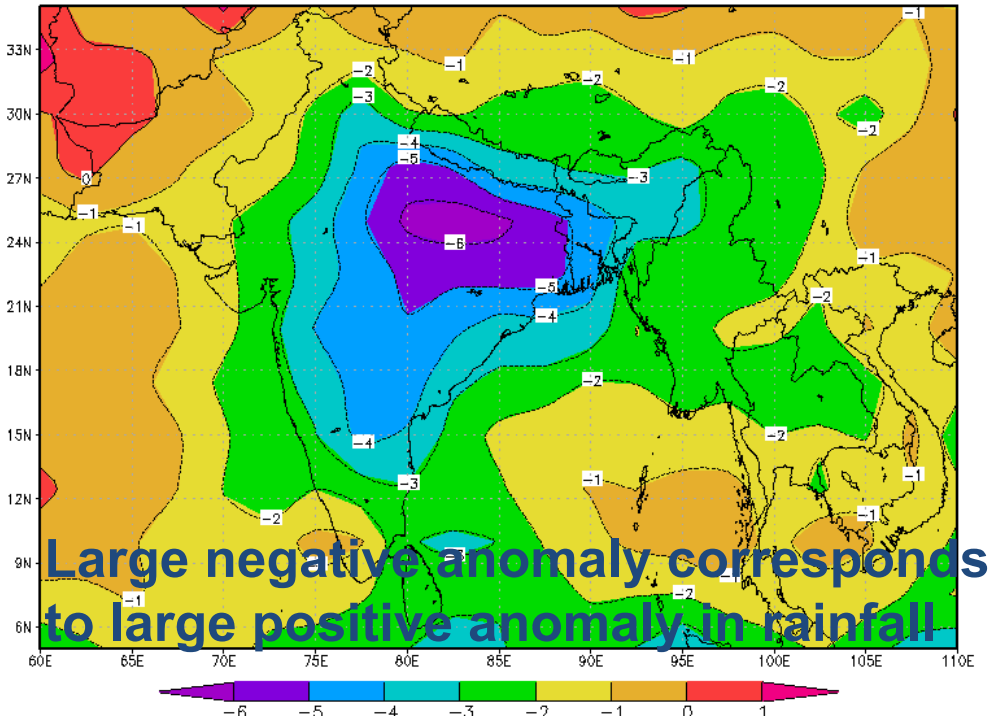
Process around north BOB

Geopotetial height (Z850) shows the extended low pressure trough from Bay of Bengal up to Pakistan.

Regressed Z850 on SR



Regressed OLR on SR

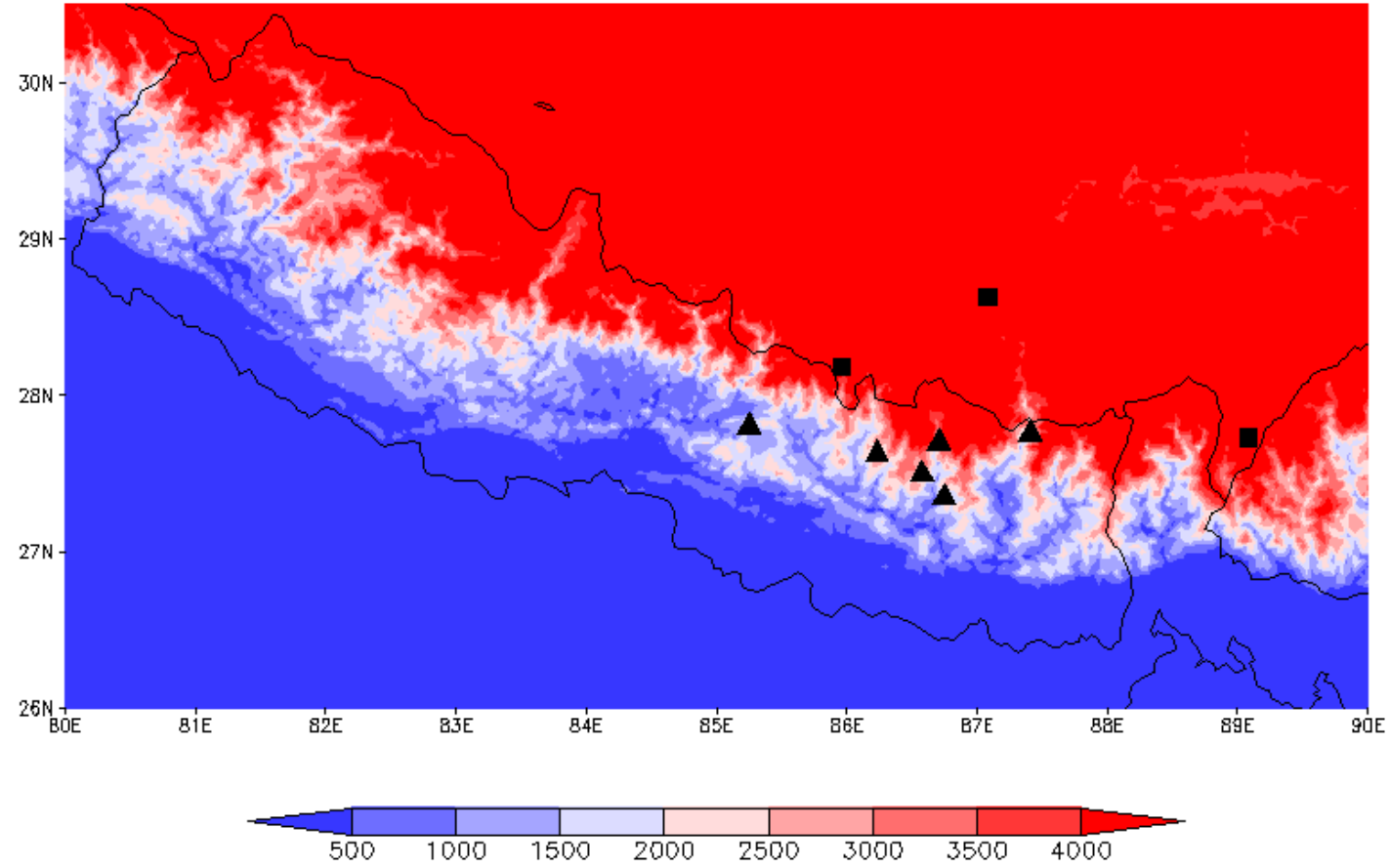


Large negative anomaly corresponds to large positive anomaly in rainfall

When convective system approach Southern Nepal (northern India) with additional moisture, Nepal/ Himalaya region is activated as background condition for monsoon progression.

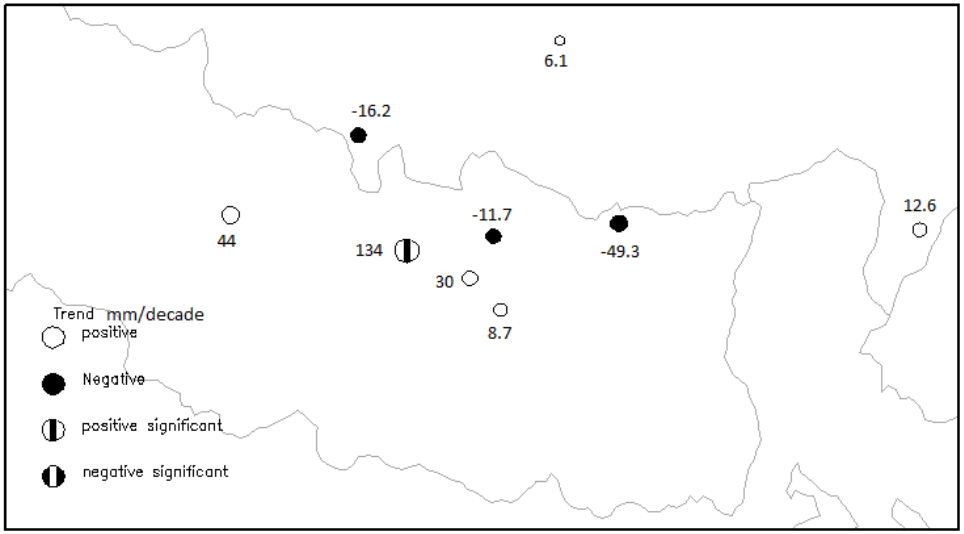
Northern and Southern Slope

All the stations are above 2000 m sea level



Precipitation total and intensity

Annual total wet day Precipitation

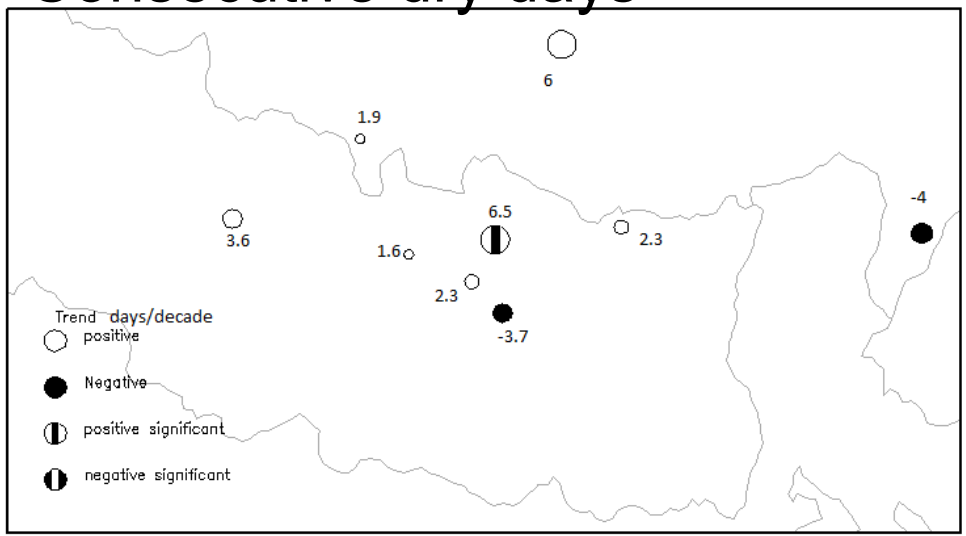


The spatial patterns at most stations showed increasing trends, ranging from −40 mm to 180 mm *per* decade

Jiri reported an increasing trend with a statistically significant value at the 5% level.

Individual stations indicated positive or negative trends across the region, but overall the trend was not statistically significant (Tibet)

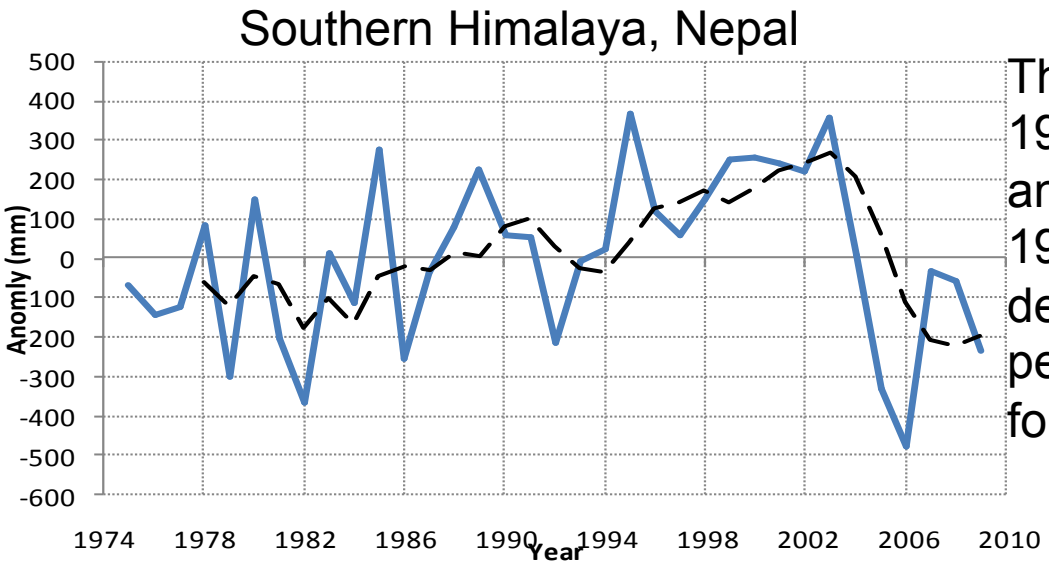
Consecutive dry days



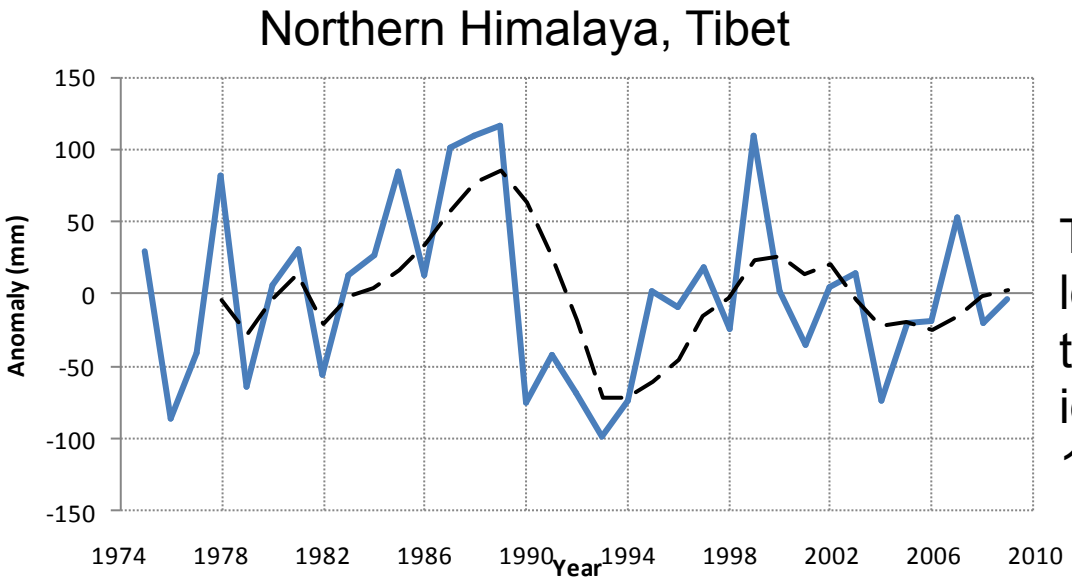
Most of the stations showed a positive trend over the region, but only one station (Chourikharka) evinced a statistically significant value.

Tibet:: Spatial patterns in trends ranged from -4 to 19 days *per* decade.

PRCPTOT



The time series indicated that the years 1982 and 2006 had the lowest anomalies in PRCPTOT, while the years 1995 and 2003 had the highest. The decadal rising pattern over the decadal period 1994-2003 was observed using a four year running mean.

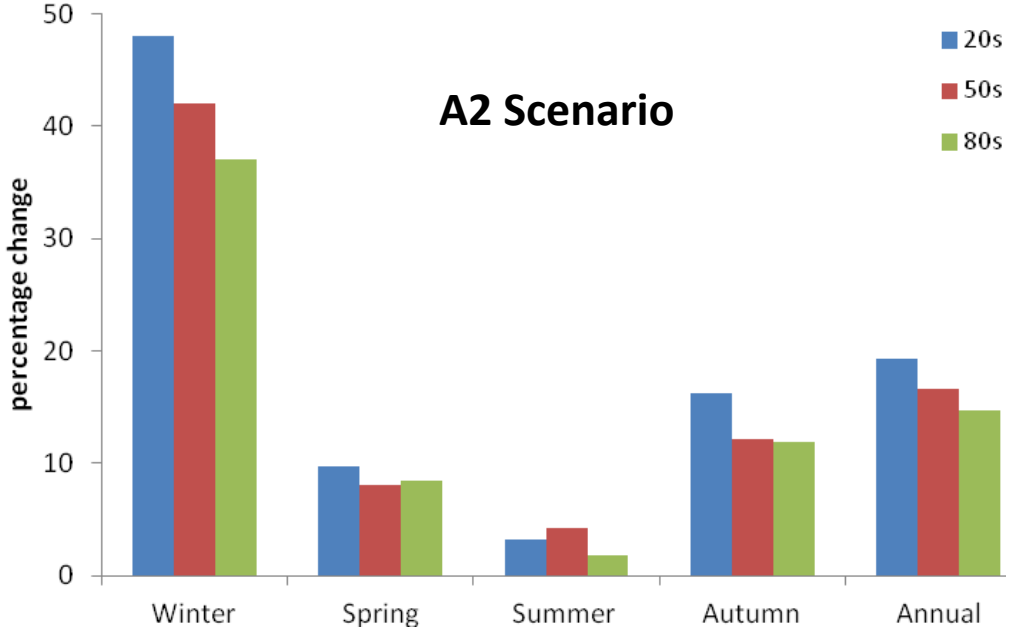


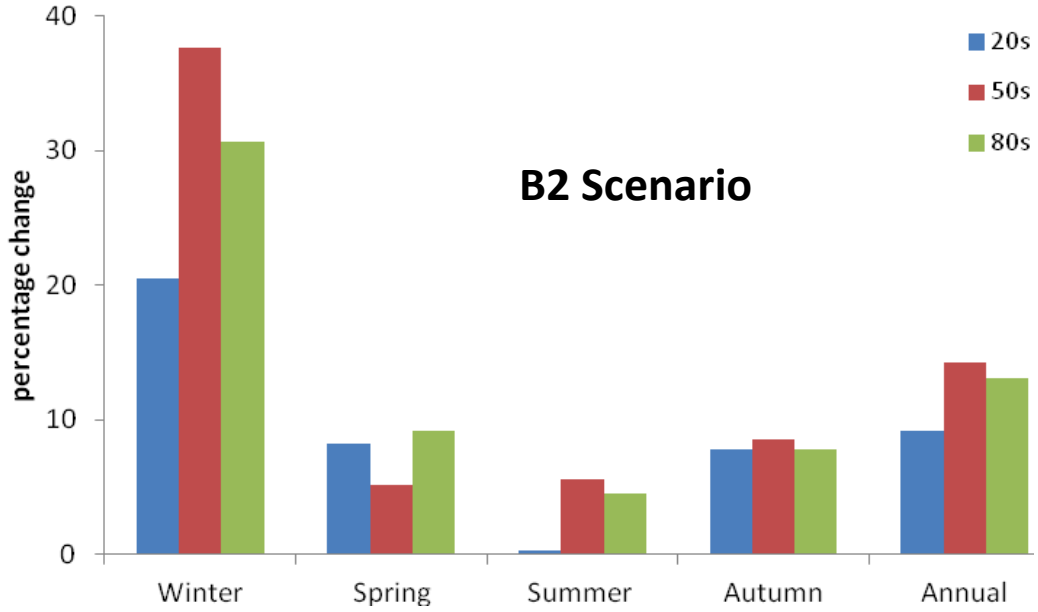
The years 1976 and 1993 had the lowest anomalies, and 1988 and 1989 the highest. Running mean time series identified a decadal rising pattern from 1980-1990.

Trends/ decade

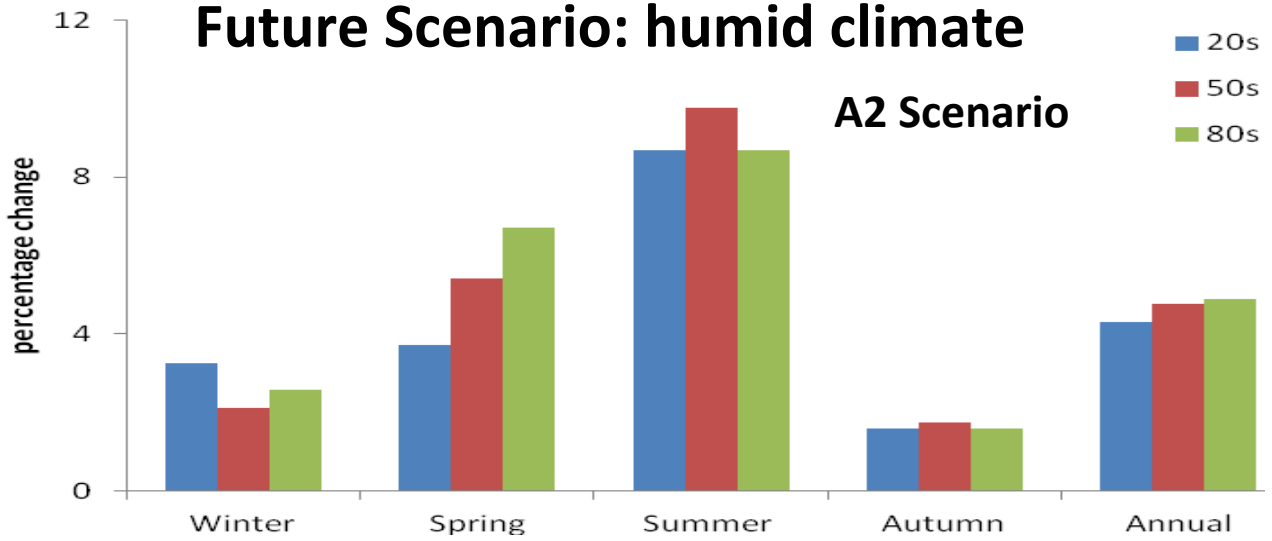
Index	Unit	Southern Himalaya	Northern Himalaya
CDD	Day	4.2 (-1.1 to 9.1)	0.9 (-6.6 to 8.5)
CWD	Day	4.7 (1.8 to 7.3)	-0.4 (-1.1 to 3.3)
PRCPTOT	mm	41 (-20 to 101)	-3.7 (-19.4 to 20.2)
R10	Day	1.17 (-0.21 to 3.90)	-0.07 (-0.8 to 0.6)
R20	Day	0.73 (-0.71 to 2.60)	-0.18 (-0.30 to 0.40)
Rnn	Day	0.6 (-0.7 to 1.9)	-0.1 (-0.2 to 0.3)
R95p	mm	2 (-1.5 to 6.7)	-0.9 (-15.2 to16.2)
RX1	mm	-1.7 (-6.1 to 2.8)	-1.5 (-5.1 to 4.2)
RX5	mm	3.9 (-3.2 to 13.2)	-0.12 (-4.40 to 8.20)
SDII	mm/day	-0.13 (-0.72 to 0.44)	0.04 (-0.09 to 0.37)

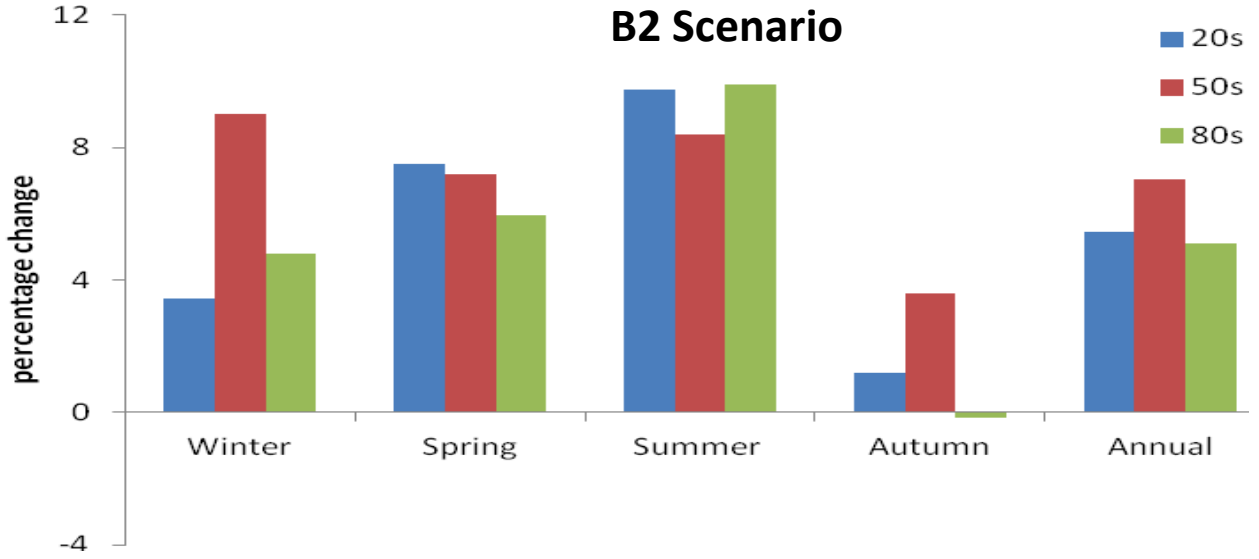
Future Scenario (H3A2 and H3B2) at Arid climate



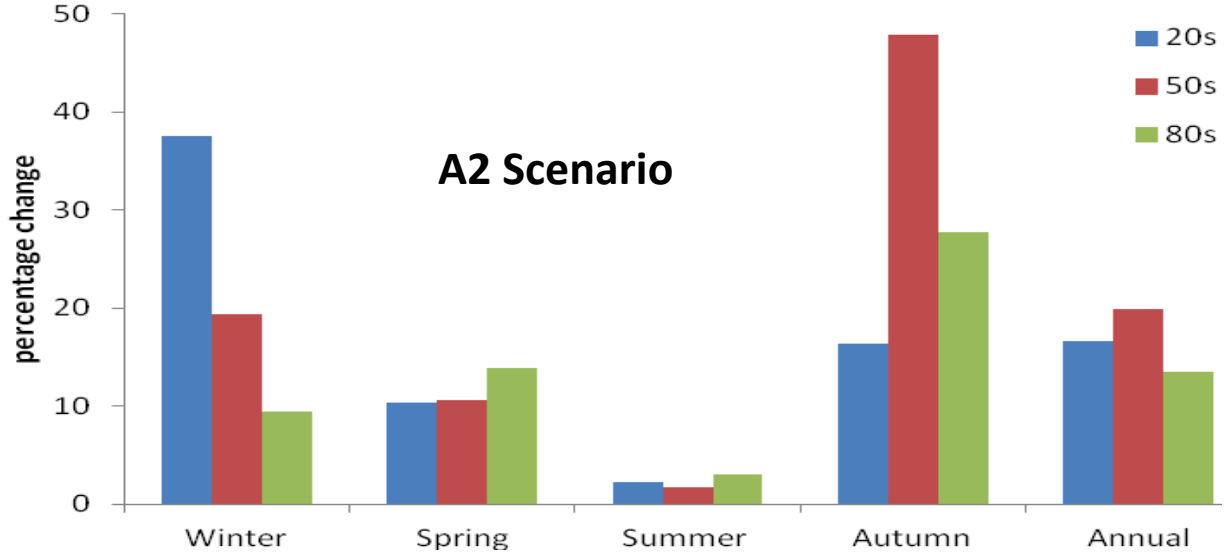


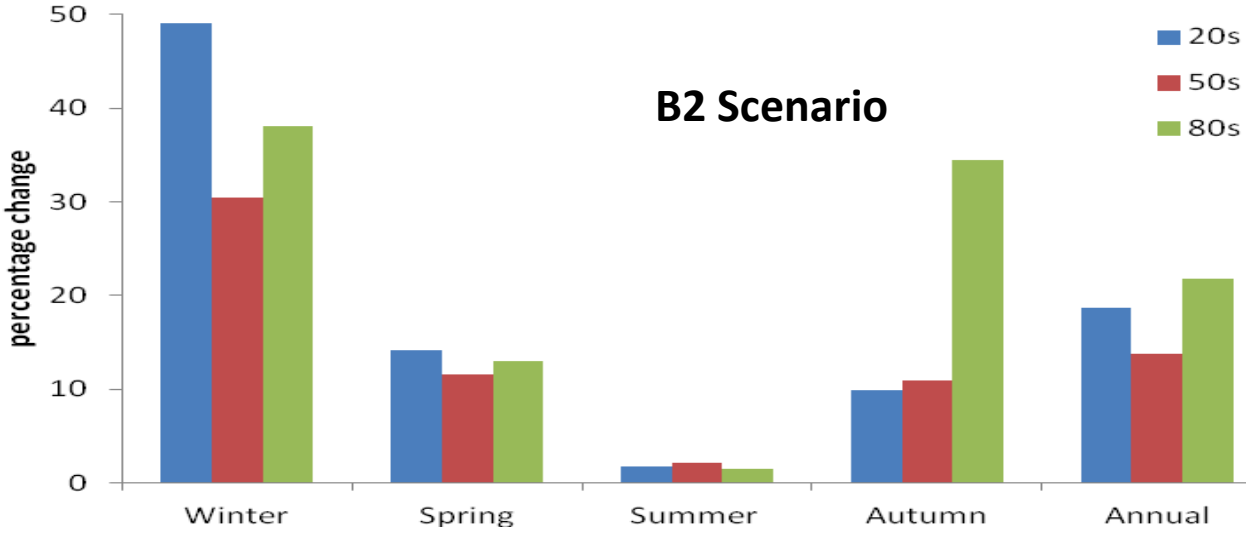
Future Scenario: humid climate





Future Scenario: sub humid climate





Summary

- Synoptic pattern is pushed by low pressure system and governs the precipitable water associating with convection inside Nepal. Moreover moisture flux from the BOB basically determines the precipitation around Nepal, while synoptic depression occasionally controls the high and low rain events.
- Most precipitation indices appeared to exhibit increasing trends over the southern slopes of the central Himalaya. The time series indicated the year post 2003 decline seems to be sharper in the extreme indices than in the means
- On the northern slopes of the central Himalaya, all indices (except for the CDD and SDII indices) exhibited negative trends, but these trends were weaker than for the southern slopes
- Within three different climatic regions, increase in precipitation reaches to 13.75% and 11.68% for the H3A2 and H3B2 in 2050s. For the 2080s there would be increase of 8.28% and 13.30% under H3A2 and H3B2 respectively.

Thank you