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The Influence of El Nino southern oscillation (ENSO) on the summer monsoon precipitation in Myanmar

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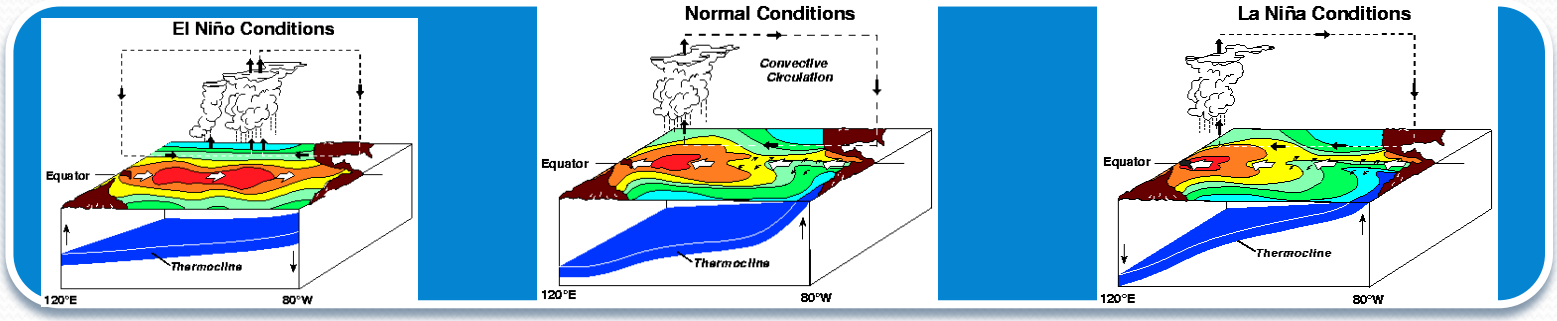
1.Introduction

- One of the most widely researched global teleconnections index is in the form of El Niño Southern oscillation (ENSO).
- ENSO is broadly defined as a disruption in ocean surface te… Pacific C… itation r…

There is an increased frequency of warm episodes of ENSO, which affect the precipitation regimes in the tropic and sub- tropic.



Hougton et at., 2001

1.Introduction

- Myanmar is located in the northwestern part of the Indochina Peninsula, between Latitude 09º 32'N and 28º 31'N and Longitude 92º10' E and 101º11'E.

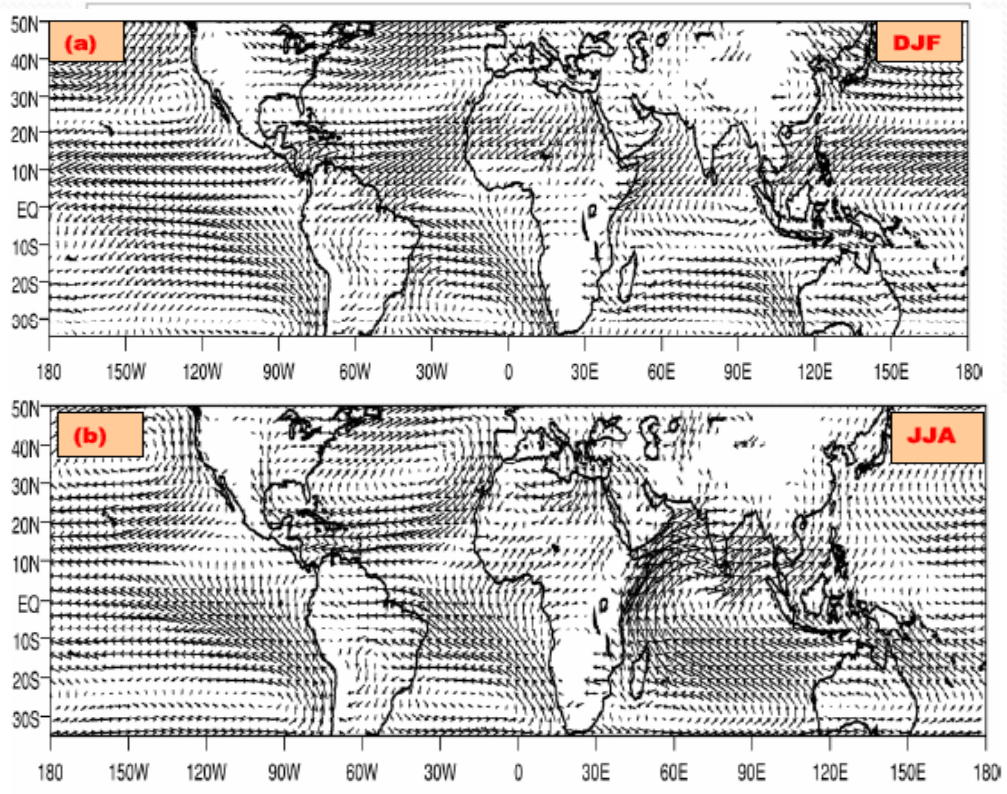


Fig 3. Climatological DJF 850 hpa wind and JJA 850 hpa wind . (After Goswami , 2004)

The most important feature in the climate of Myanmar is the alternations of seasons know as monsoon which normally starts in mid-May and last until mid-October. The wind during the northern winter season is northeasterly or easterly at the 850hPa level (Fig 3.a) and the southwest or westerly wind in the summer monsoon season (Fig 3.b)

2. Previous Studies: ENSO AND MONSOON

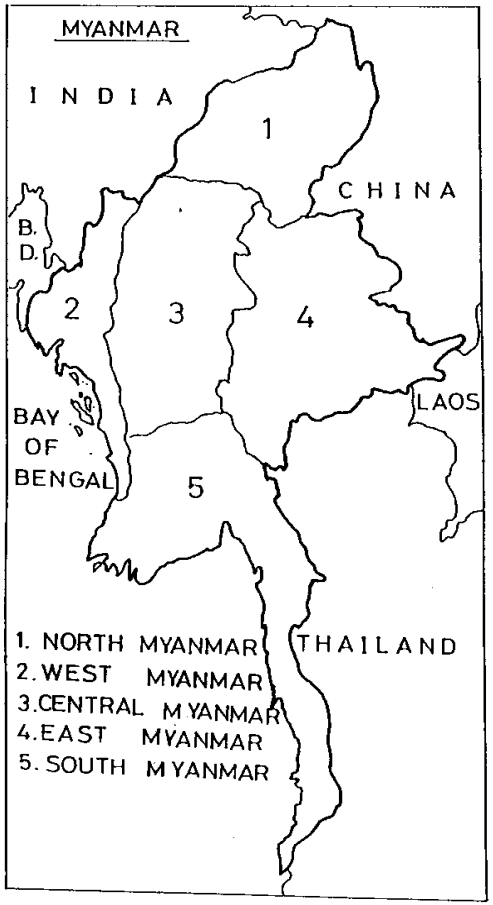
- The relationship between warm phase of ENSO and below average summer monsoon precipitation over the Indian subcontinent has been investigated in several previous research studies (Sikka and Gadgil, 1980; Rasmusson and Carpenter, 1982)

Mooley and Parthasarthy (1984) found that the deficient India summer Monsoon rainfall tends to occur in the year when an El Nino event develops

In general, not many studies exist on Myanmar's climatology.

2. Previous studies

- N.Sen Roy and kaur (20(ogy of monsoon rain in Myanmar, the result of th stence of five homogenous precipitation regions .
- Their study also indicat een warm phase of ENSO and below 10% average sum all regions has been investigated.
- During the period 1947-1 Niño. Both deficiency and excess rainfall have been does not have one to one relationship with the seas ıar.
- Lwin (2000) found that t ı the weather parameters such as annual temperatures, a Myanmar are evidence that starting from the mid 19
- There is still a need how ıer monsoon precipitation in Myanmar after 1970 and influence of ENSO on developing and decaying phase.
- In view of the importance of the monsoon climatology and relation with ENSO mechanisms, this study will examined the physical impact from El Niño/ La Niña to Myanmar climatological monsoon system.



3.Data and Methodology

- Daily precipitation data.
- Methodology

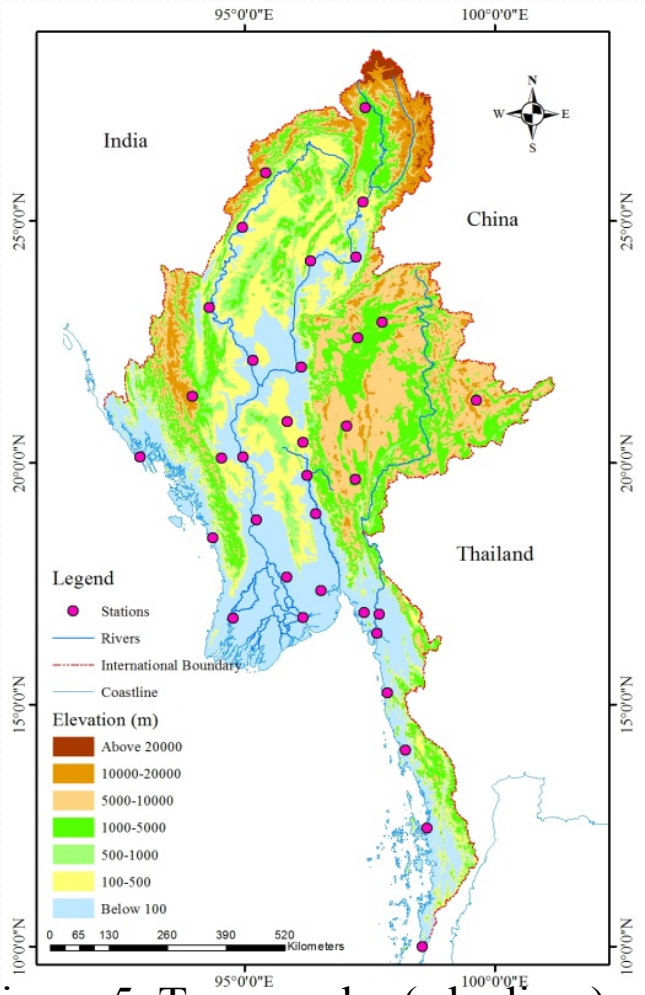


Figure 5. Topography (shading) of Myanmar and the 35 observation stations (red dots).

Rainfall is an essential meteorological parameter describing the monsoon climate.

Daily precipitation data were obtained from Department of Metrology and Hydrology (DMH) of Myanmar for the 30 year

Methodology

The cluster analysis based on Ward's method was applied for the seasonal variation patterns of daily mean precipitation data.

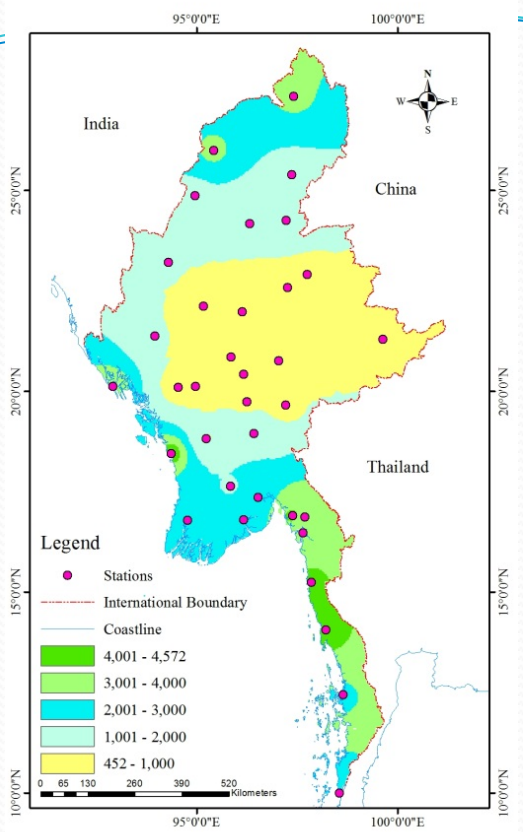
Data comprises monthly rainfall amounts for June to September. Seasonal rainfall percentage departures for entire southwest monsoon have also been worked out.

Objective

- The main purpose of this study is to clarify the regional difference of rainfall pattern in Myanmar.
- To reveal the impact of El Niño / La Niña to Myanmar.

I. **Cluster analysis**

Analysis: The climatology of monsoon rainfall in Myanmar



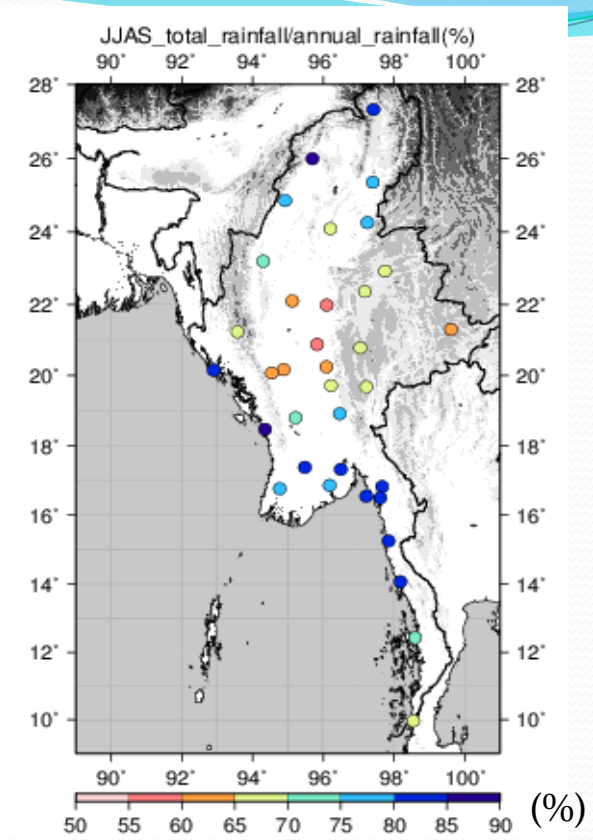


Figure 6. Distribution of JJAS seasonal mean rainfall (left) and its percentage to annual mean over Myanmar from (1971-2000) (right).

- According to above Figures the total rainfall accumulated within this monsoon period accounts for 85 to 90% of total annual rainfall for most of the country especially for the coastal areas.
- The stations located in northern , southern part of Myanmar and west coast has highest rainfall amount (3000-4500) mm (80-90%). However, the central part of Myanmar has lowest rainfall amount (450-1000) mm (60-65) % in rainy season.

4. Analysis and results

The Cluster analysis

The dendrogram of the cluster analysis

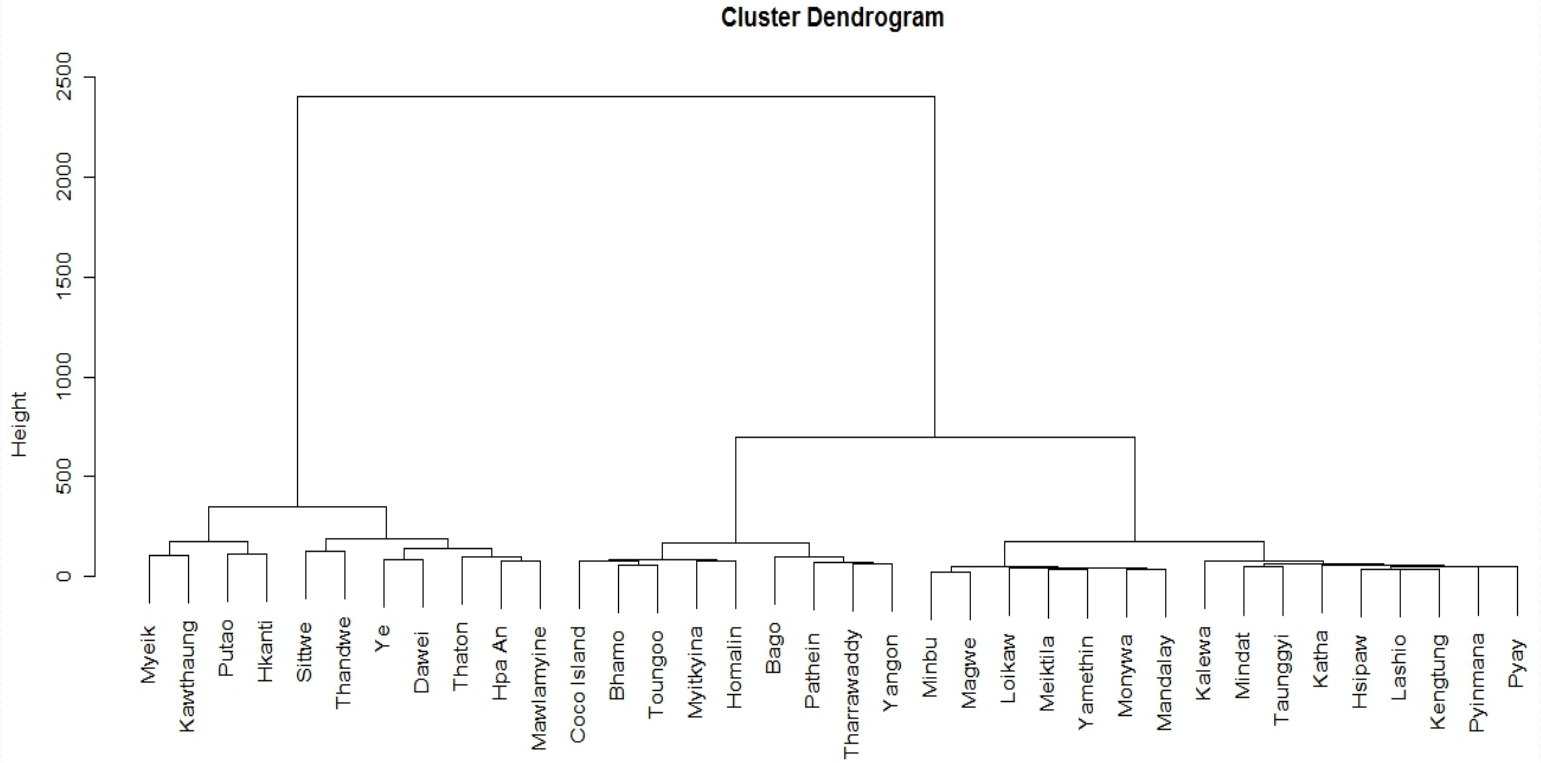


Figure 7. The dendrogram of the cluster analysis

The cluster analysis based on Ward's method was applied for the seasonal variation patterns of daily mean precipitation data.

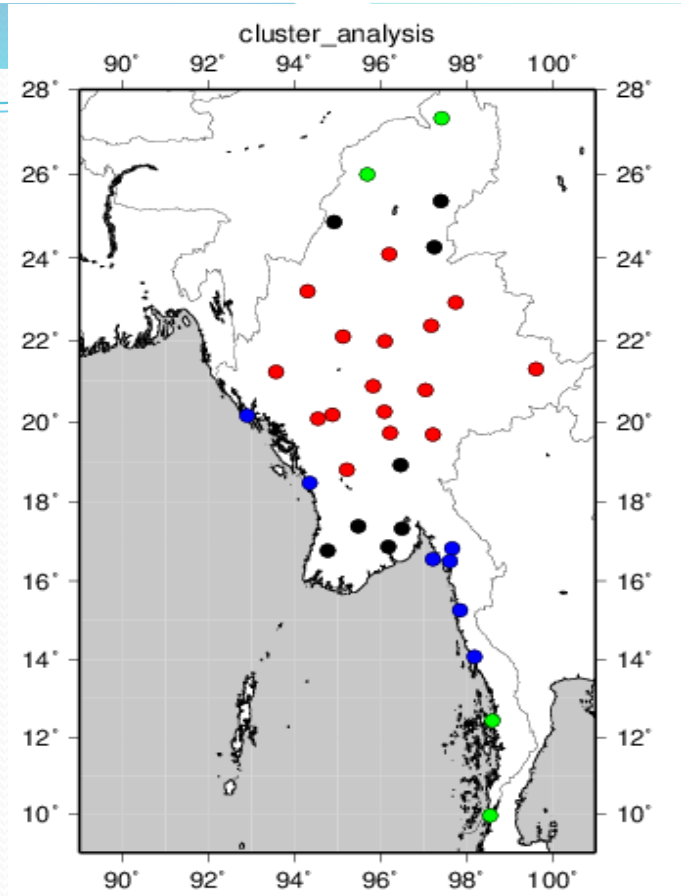


Figure 8 .The regional division of rainfall stations based on seasonal March of daily mean precipitation (dividing 35 stations into 4 groups)

The 35 rainfall stations dividing into 4 groups. Four types of rainfall pattern were identified. There are 4 stations in **Group 1**, 8 stations in **Group 2** , 16 stations station in **Group 3** and 7 stations in **Group 4.**

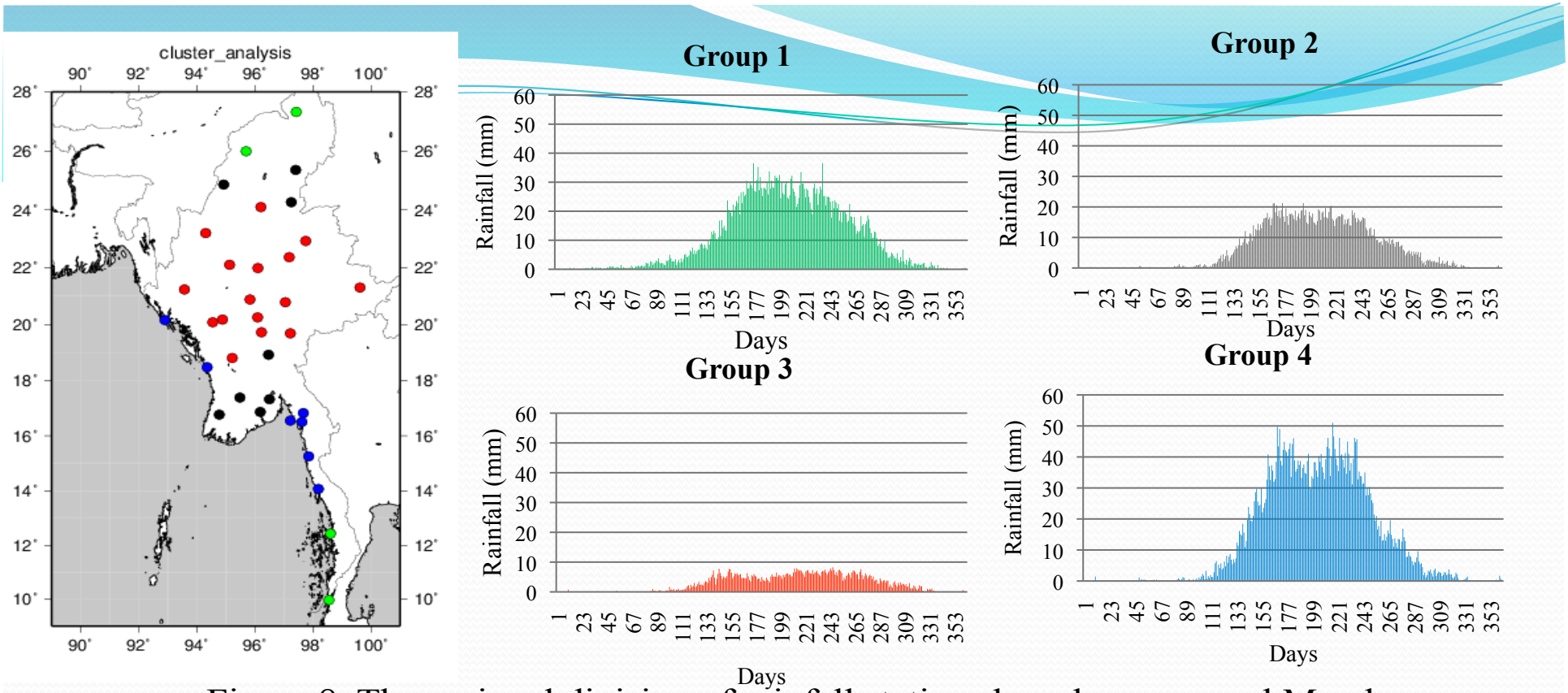


Figure 8. The regional division of rainfall stations based on seasonal March daily mean precipitation (dividing 35 stations into 4 groups) by Ward's method

Coastal Region is the most significant rainfall zone and highest peak during monsoon season because of near BOB and Andaman Sea. (Group 4) .The southernmost part and northernmost part are also comparatively heavy rainfall.(Group 1) .The Central region is relatively less rainfall area. (Group 3).

II. Influence of ENSO on the summer monsoon precipitation over Myanmar.

Table 1. Developing and Decaying years of El Niño and La Niña events . All ENSO events defined in this study are included within the definition of Trenberth (1997).

El Nino		La Nina	
Developing	Decaying	Developing	Decaying
1972	1973	-	1971
1982	1983	1973	1974
1986	1987	1975	1976
1991	1992	1984	1985
1994	1995	1988	1989
1997	1998	1998	2000

An ENSO developing year is defined as the year before the mature phase of ENSO and an ENSO decaying year is defined as the year after the mature phase of ENSO. The labels of years follow the notation of Rasmusson and Carpenter (1982). The Nino-3.4 (5°N–5°S, 170°–120°W) SST anomalies are used as an ENSO index. A mature phase of the warm event of ENSO (El Niño) is defined when the ENSO index averaged over winter is larger than 0.9C and a mature phase of the cold event of ENSO (La Niña) is defined when the ENSO index averaged over the same period is less than -0.9C.

Rainfall percentage departure for El Nino developing years.

1972 1982 1986 1991 1994 1996

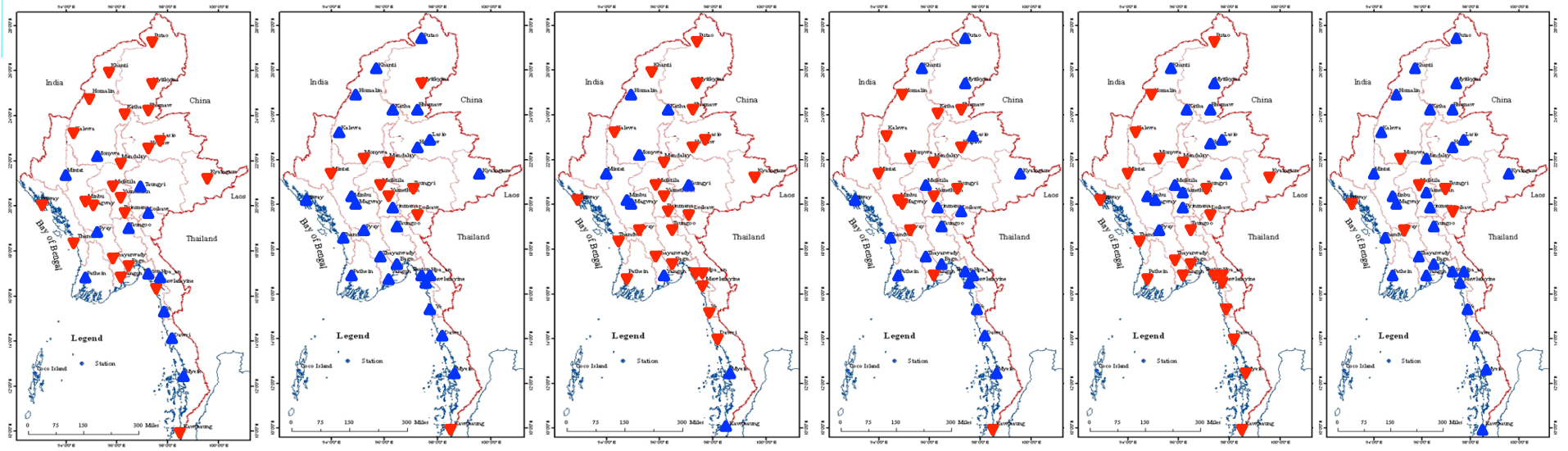


Figure 9. Distribution of JJAS rainfall percentage departure for El Niño developing years.

El Niño developing years	▲ excess rainfall (no: of station)	▼ below rainfall (no: of station)	Rf% Dep for whole country
1972	12	23	-12%
1982	26	9	5%
1986	10	25	-17%
1991	20	15	15%
1994	13	22	-32%
1996	29	6	20%

Rainfall percentage departure for El Nino decaying years.

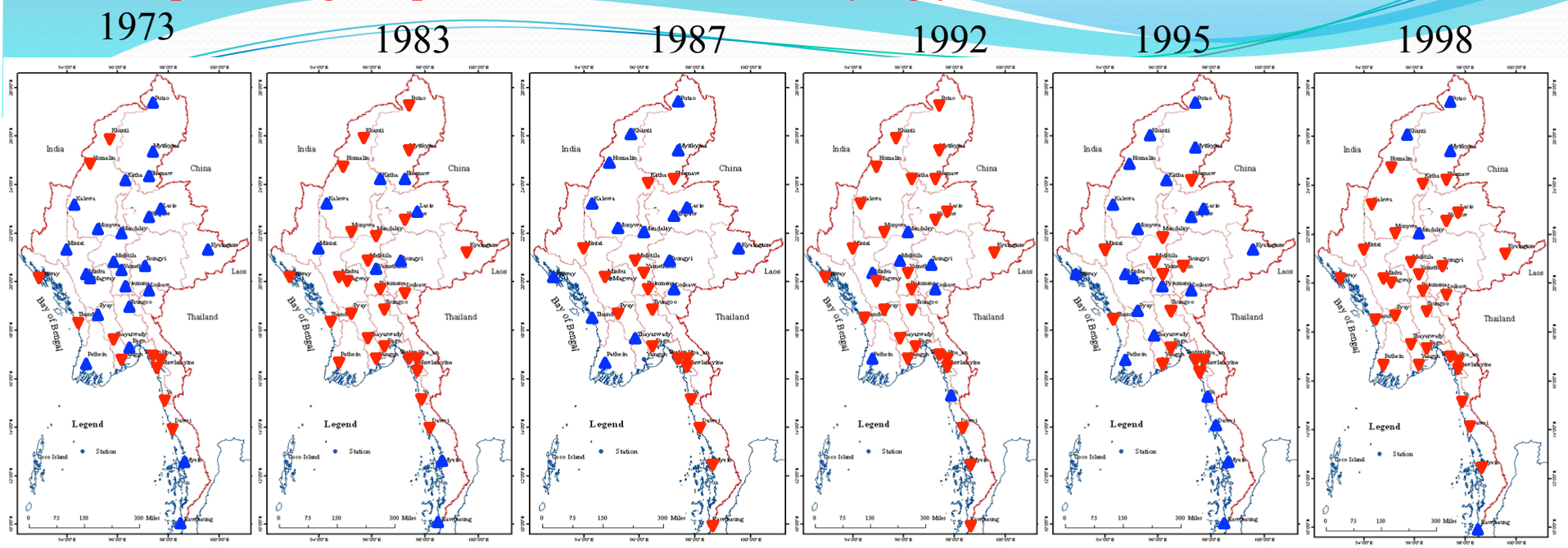


Figure 10. Distribution of JJAS rainfall percentage departure of El Niño decaying years.

El Niño decaying years	▲ excess rainfall (no: of station)	▼ below rainfall (no: of station)	Rf% Dep for whole country
1973	24	11	28%
1983	9	26	-80%
1987	18	17	-17%
1992	7	28	-52%
1995	22	13	-25%
1998	5	30	-78%

Rainfall percentage departure for La Niña developing years.

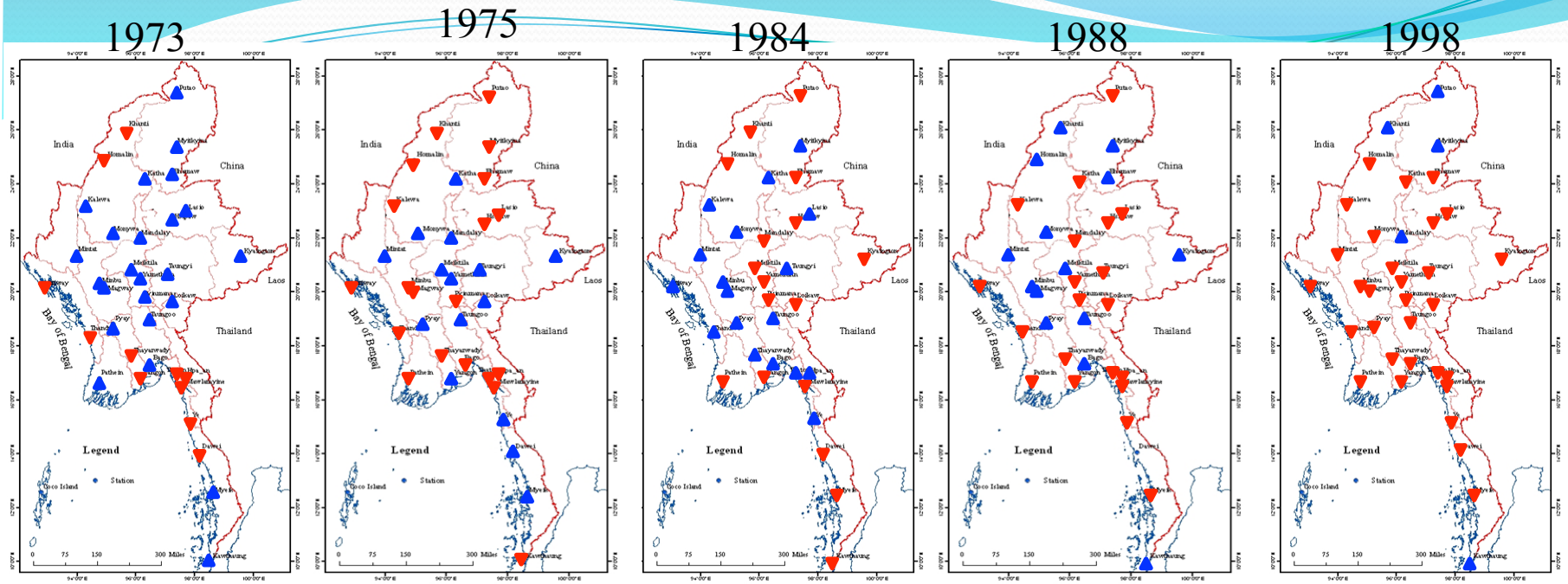


Figure 11. Distribution of JJAS rainfall percentage departure of La Niña developing years.

La Niña developing years	▲ excess rainfall (no: of station)	▼ below rainfall (no: of station)	Rf% Dep for whole country
1973	24	11	28%
1975	15	20	7%
1984	17	18	-4%
1988	15	20	-16%
1998	5	30	-78%

Rainfall percentage departure for La Niña decaying years.

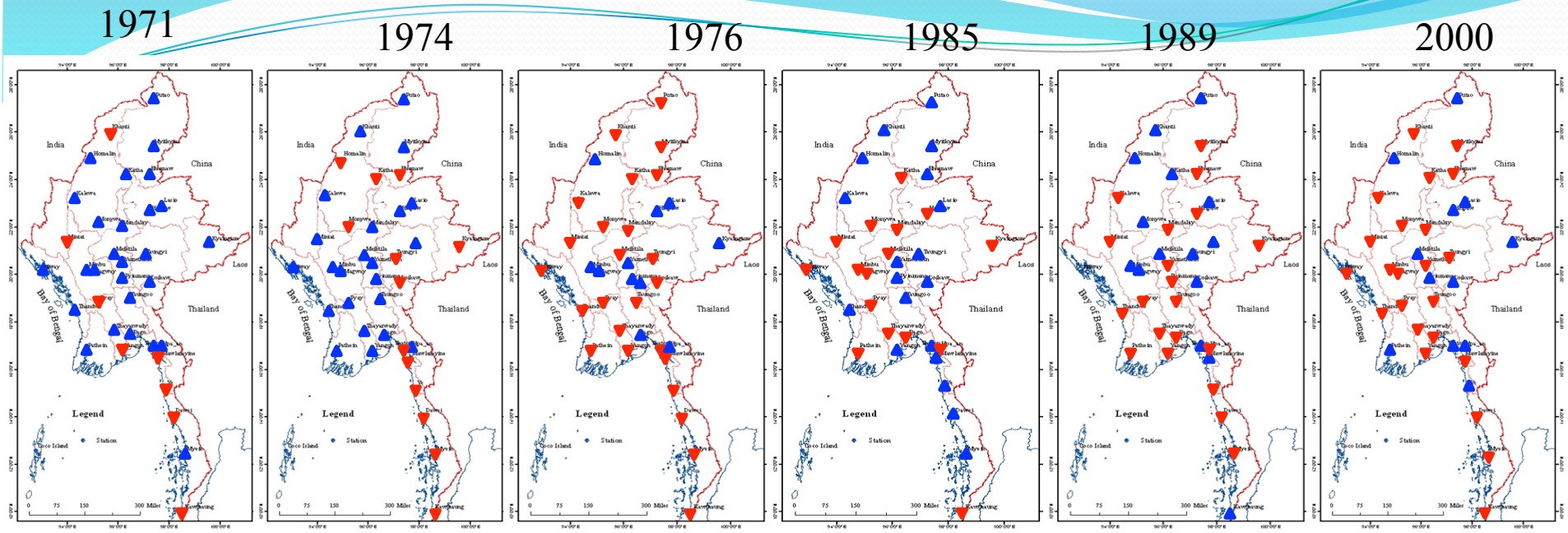


Figure 12. Distribution of JJAS rainfall percentage departure of La Niña decaying years.

La Niña decaying years	▲ excess rainfall (no: of station)	▼ below rainfall (no: of station)	Rf% Dep for whole country
1971	27	8	45%
1974	23	12	12%
1976	11	24	-21%
1985	19	16	8%
1989	14	21	-34%
2000	12	23	-60%

5. Discussion and conclusion

- During El Nino, La Niña developing and decaying years, both deficient and excess rainfall have been observed.
- So, ENSO does not have a one to one relationship with seasonal rainfall of Myanmar for El Nino developing year and La Niña developing and decaying years after 1970.
- To compare with India, also out of 17 El Niño years, between 1901 and 1996, only nine experienced deficient rainfall , while in other years, rainfall was either normal or excess, indicating that a weak correspondence between ENSO and seasonal rainfall (Pant and Kumar , 1997).

However,

All of the El Niño decaying years has deficient rainfall percentage departure except 1973 that is one of La Niña developing years. So, this is very interesting thing , ENSO is significantly influence over the seasonal rainfall of Myanmar especially in El Nino decaying years after 1970s to compare with the previous studies.

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