

Onset Variation of Northeast Monsoon and Successive Rainfall over Tamilnadu

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Abstract

The onset of monsoon plays an important role in agriculture and economy. The northeast monsoon onset dates changes every year; the climatological monsoon onset date is 20th October. In this paper, we analysed the monsoon onset dates in relation to rainfall variations during 1971 to 2016. With respect to the onset dates there's a version of monsoon rainfall in monsoon months (OND) and also with the average seasonal rainfall. In this study period we identified that delayed onset resulted in rainfall deficit and early onset provided above average rainfall in most years, but some years the monsoon onset did not affect the rainfall pattern. As it's far widely known, the worldwide phenomena like El Nino/La Nina also affecting the delay or improve in the monsoon onset and also in subsequent rainfall. Detailed discussions approximately the onset dates and the outcomes rainfall in the course of the monsoon months are given.

Keywords: Monsoon Onset, NEM, El Nino/La Nina

I. INTRODUCTION

The first meaning of monsoon becomes solely based on the every year inversion of surface winds(Ramage, 1972). Be that as it may, the meteorological thrust and useful significance of rainfall makes it attractive to characterize monsoons as far as rainfall qualities (Wang and Linho, 2002).

In spite of the truth that, there is no precise meaning of the onset of the monsoon, Indian meteorologists robotically distinguish the date of onset over the Kerala coast depending on a sharp increment and trademark persistency of the precipitation (Ananthakrishnan et al., 1968). Notwithstanding the significance of the quality of the general monsoon in a specific year, guaging of the onset and the sub occasional changeability (dynamic/break periods) are of huge importance for the Indian economy. A late or early onset of the monsoon and break periods in the monsoon rainfall may affect farming, regardless of whether the mean precipitation in the monsoon season all in all is ordinary. Subsequently, understanding the dynamical components of the monsoon contrast on time scales extending from weeks to months is an issue of impressive significance (Raju et al., 2005)

A total of 46 years has been considered for the study starting from 1971 to 2016. The seasonal rainfall and annual rainfall data is used from 1971-2014 based on 306 stations and for the years 2015-2016 based on IMD Sub divisional rainfall. In this study the early onset of monsoon is assumed as positive and whereas delayed onset is negative.

Our nation's major portion of yearly rainfall is acknowledged amid the second 50% of the year (June to December).This period comprises of two fundamental monsoon seasons Southwest Monsoon (SWM) and Northeast Monsoon (NEM) Seasons, of these two seasons SWM is in charge of over 70% of yearly rainfall in India. Anyway rainfall got amid NEM is likewise vital, especially for south Peninsular India. The India Meteorological Department (IMD) alludes toward the southwest or summer storm amid June to September and the north east or winter monsoon amid October to December. The inconstancy of these two monsoons assumes an essential job in agriculture, flood control and numerous different divisions in water resources in south India.

The north east monsoon is dry, stable and has less vertical degree contrasted with the southwest monsoon. This season is additionally named the

withdrawing (north east) monsoon season or the post-monsoon season in which the zone of highest rainfall moves to southern India, Sri Lanka and the neighboring ocean. During the north east monsoon season, the nation gets about 11% of its yearly rainfall, while numerous region over the south landmass get 30–60% of their yearly rainfall. (Rajeevan et al, 2012). The precipitation got during NEM is higher along the coastal regions and diminishes as it arrives at inside land areas.

The SWM has undergone extensive research in various aspects, whereas the NEM has received less importance comparatively. Some of the NEM related studies are (Rajeevan et al, 2012), (Raj 2003), (Dheebakaran et al 2015), (Kripalani and Pankaj Kumar 2004).

The date of onset of the northeast monsoon over Tamilnadu is a crucial date in the meteorological calendar of India as it marks the beginning of the rainy season for the country.

The Monsoon onset is taken as the principal day of the change from light to substantial rain spell classification with the provision that the average daily rainfall amid the initial 5 days after the progress ought not to be less than 10 mm. (Ananthakrishnan et al., 1988)

The rainfall occurring amid NEM is due to the accompanying physical activities, which includes an association of a trough of low, easterly waves, low-pressure area, depression and cyclonic storm over the Bay of Bengal (Dheebakaran et al., 2015).

(Kripalani et al., 2004) studied about the influence of the NEM variability with the Indian Ocean Dipole Mode.

II. DATA AND METHODOLOGY

The onset dates have been acquired from the Indian Meteorological Department (IMD) for this study. The climatological date of onset of Southwest Monsoon and Northeast Monsoon are June 1st and October 20th respectively. These dates were taken as benchmark dates to verify the advance or delay of the monsoon onset date, to determine the variation of the onset. The rainfall information was acquired from

IITM month-to-month rainfall records and the anomalies of rainfall with monsoon onset dates are shown.

III. Results and Discussion

In this paper, the features of the difference of northeast monsoon rainfall over India have been analyzed. The perusal divulges that there are visible types of variety over the land and seas. Over the land, rainfall tops during the late night/early night while over the seas an early morning rainfall top is noticed. The time series of Southwest monsoon, Northeast monsoon and annual rainfall for Tamilnadu for a period of 45 years from 1971 to 2016 is presented.

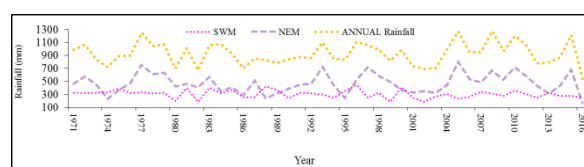


Fig 1: Time series of the SWM, NEM and annual rainfall of Tamilnadu for the period of 1971-2016.

Table I Northeast Monsoon Onset dates as published by IMD

Year	NEM Onset	Year	NEM Onset	Year	NEM Onset	Year	NEM Onset	NEM Onset
1971	Oct 17	1981	Oct 23	1991	Oct 20	2001	Oct 16	Oct 25
1972	Oct 21	1982	Oct 18	1992	Nov 02	2002	Oct 25	Oct 19
1973	Oct 18	1983	Oct 24	1993	Oct 21	2003	Oct 19	Oct 22
1974	Nov 6	1984	Nov 4	1994	Oct 18	2004	Oct 18	Oct 18
1975	Oct 25	1985	Oct 25	1995	Oct 23	2005	Oct 12	Oct 28
1976	Oct 15	1986	Oct 26	1996	Oct 11	2006	Oct 19	Oct 30
Year	NEM Onset	Year	NEM Onset	Year	NEM Onset	Year	NEM Onset	
1977	Oct 7	1987	Oct 20	1997	Oct 13	2007	Oct 14	
1978	Oct 20	1988	Nov 3	1998	Oct 28	2008	Oct 12	
1979	Oct 22	1989	Oct 27	1999	Oct 21	2009	Oct 29	
1980	Oct 11	1990	Oct 19	2000	Nov 2	2010	Oct 29	

Table II Southwest Monsoon Onset dates as published by IMD

Year	SW M Onset	Year	SW M Onset	Year	SW M Onset	Year	SW M Onset	Year	SW M Onset
1971	27 May	1981	30 May	1991	2Jun	2001	23 May	2011	29 May
1972	18 Jun	1982	30 May	1992	5Jun	2002	29 May	2012	June 5
1973	4Jun	1983	13Jun	1993	27 May	2003	8 Jun	2013	June 1
1974	26 May	1984	31 May	1994	28 May	2004	18 May	2014	June 6
1975	31 May	1985	28 May	1995	8Jun	2005	June 7	2015	June 5
1976	31 May	1986	4Jun	1996	3Jun	2006	May 26	2016	June 8
1977	30 May	1987	2Jun	1997	9Jun	2007	May 28		
1978	28 May	1988	26 May	1998	2Jun	2008	31 May		
1979	11Jun	1989	3Jun	1999	25 May	2009	May 23		
1980	1Jun	1990	19 May	2000	1Jun	2010	31 May		

1972	17	1
1973	3	-2
1974	-6	17
1975	-1	5
1976	-1	-5
1977	-2	-13
1978	-4	0
1979	10	2
1980	0	9
1981	-2	3
1982	-2	-2
1983	12	4
1984	-1	15
1985	-4	5
1986	3	6
1987	1	0
1988	-6	14
1989	2	7
1990	-13	-1

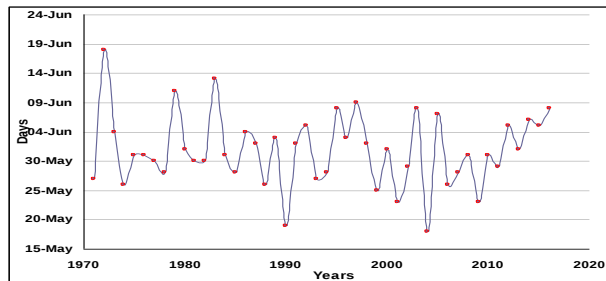


Fig 2: Time series of the SWM rainfall of TamilNadu For a period of 1971-2016

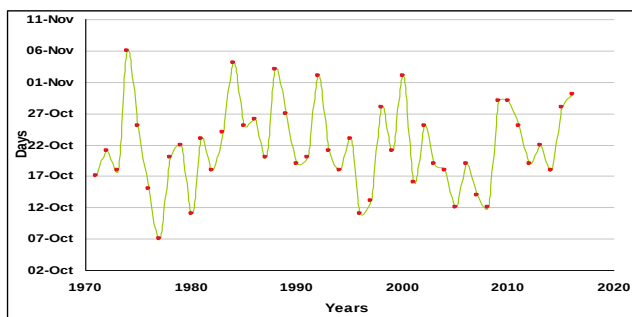


Figure 3: Time series of the NEM rainfall of Tamilnadu for the period of 1971-2016.

Table III Onset date variation of Southwest and Northeast Monsoon from climatological date

YEAR	SWM	NEM
1971	-5	-3

Table IV: Rainfall observed during SWM and NEM as per IMD

YEAR	SWM	NEM
1971	328.5	463.7
1972	320.9	573.3
1973	329.3	447.9
1974	333.8	233.4
1975	391.2	364.6
1976	321	471.9
1977	332.3	750.8
1978	315.1	611.8
1979	329	629.3
1980	198.2	418.2
1981	398.1	466.7
1982	185.2	405
1983	401.5	569.6
1984	322.2	352.8
1985	370.3	405.9
1986	255.3	289
1987	255	515.6
1988	421.2	234.9
1989	368.5	311.9

1990	242.4	388.5
1991	325.4	446.8
1992	319.8	461.9
1993	298.6	727
1994	248.2	436.9
1995	351	245.2
1996	446.4	520.5
1997	245.4	716.3
1998	322.5	584.7
1999	183.9	490.9
2000	413	367.6
2001	249.8	331.8
2002	186.4	353.6
2003	269.8	321
2004	302	439.6
2005	232.3	802
2006	259.3	534.6
2007	340.8	485.5
2008	309.1	670.4
2009	274.8	529.5
2010	362.1	719.3
2011	302.3	586.3
2012	249.3	428.4
2013	326.7	317.2
2014	276.6	432.2
2015	280	685.1
2016	246.1	169.1

III. RESULTS AND DISCUSSION

The study arrive the following important findings

- The onset date variation has influence in the amount of rainfall received in the particular year.
- The delayed onset has deficit rainfall and early onset has above normal rainfall for most of the years, though some years this trend has not satisfied.
- There is no correlation between deviation of onset date and NEM rainfall anomaly.

IV. CONCLUSION

The northeast monsoon onset date and rainfall pattern correlated during the monsoon is suggested for further studies considering the influeceof El nino and La nina in the amount of rainfall received, number of rainy days and the sea surface temperature effects in the rainfall quantum.

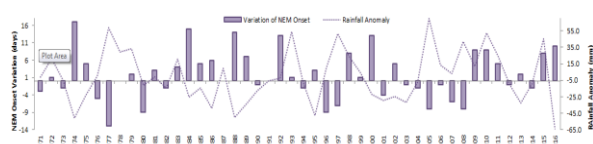


Fig 4: Variation of onset dates with the Northeast Monsoon anomalies

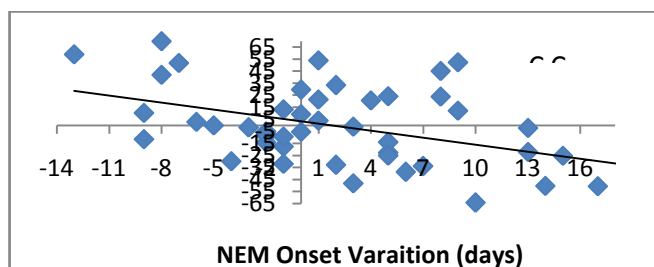


Fig 5: Correlation between deviation of onset date and NEM rainfall anomaly