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RESEARCH ARTICLE

EXTRATERRESTRIAL INFLUENCE ON INDIAN RAINFALL DURING THR PERIOD 1950-2012

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ABSTRACT

During the Year 1950 to 2015 AD a study has undertaken the data for the investigation on the correlation amongst the rainfall, sunspots and El-nino & La-nina in the north-western part of India (specifically in the city of Ahmadabad). Average sunspots, rainfall, El-nino & La-nina data have been computed and tried to find inter dependence in context of Solar influence apart from the anthropogenic activities. We could find a genuine dependency with new feature of occurrence of two peaks of maximum rainfall during the maxima and minima of Sunspots, which was interesting to understand in the light of new discovered phenomenon known as El-nino and La-nina in the second half of the twentieth century. Except very few exceptions the draught and maximum rainfall (double peak) was in consonance with the occurrence of El-nino and La-nina.

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INTRODUCTION

Galileo was the first person to discover low temperature dark spots on the sun which we call today Sunspots. These are short-term phenomena on the photosphere of the sun that appear visibly as dark due to low temperature as compared to surrounding regions. Sun is constantly active (Weber W. 2010) but sometimes releasing sudden amounts of energy and displaying different kinds of solar activity. These patterns of activity are assumed to be driven by the surface embedded bands of magnetism of the Sun. The Solar activity is periodic phenomena and is called solar cycle. It is associated with the number of sunspots and exhibits after every 11years. Solar activity and galactic cosmic radiation affect the atmospheric activity coupled with rain shower. It is generally seen that this extra terrestrial perturbation during solar cycle i perhaps may be quite effective through the monsoon cloud and aerosols interaction in lower earth atmosphere. During interaction, the lower atmosphere is charged by the primary cosmic rays with the various secondary charges (muons, pions, neutrons, electrons, positrons, and light nuclei) and the short wave length atmospheric florescent radiation ranging from gamma, x-rays to UV radiations. The charged atmosphere concurrent with monsoon undergo a typical interaction sometimes called nucleation. Around these charge centers condensation starts and when sufficient mass is procured in the form water droplets than under gravity, they are accelerated down the earth. Such critical process of nucleation once if started then rain shower occurs. However this mechanism justifies the heavy rainfall during the solar and Galactic Cosmic activities. This helps us to investigate the extra terrestrial perturbation on monsoon activity on the earth. In the earlier study (Mahaveer *et al.*, 2015), a systematic dependence between Sunspots number and annual rainfall has been investigated and It is found that heavy rainfall (i.e. above average) occurred during the maximum and minima (Lockwood, 2010) of Sun spots number in each solar activity cycle of 11 years.. The high percentage of intruded pollutants of course disturbed over the entire cycle of seasons on the globe by changing extreme condition of all types of weather and climate. Extreme effect is observed in the form of El-nino and La-nina in off the coast of South America, with the appearance of unusual warm water in the Pacific Ocean. The term has significantly chosen due to its flow during the month of December. It is generally warmer than average waters in the eastern equatorial Pacific affects weather in the earth. This refers to the large scale ocean environment climate amalgamation to a periodic warming in sea surface temperatures across the central and east central Equatorial Pacific. Globally averaged temperatures often rise by a few tenths of a degree Fahrenheit during the latter stages of a strong El-nino event and the same global temperatures can drop by

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similar amount during a La-nina event. In order to examine the influence of El-nino and La-nina on climatic change (rainfall), we attempted the present study contemplating extraterrestrial perturbation and anthropogenic activities.

Data Analysis

We have taken the Sunspot number data from Physics Research Laboratory, Ahmadabad and have compiled a homogeneous set of rainfall data for Ahmadabad city situated in western part of India. For the years 1950-2012, the rainfall data (in mm) is available in monthly and annual series. In the present analysis we have used the annual (averaged for the period of 12 months) rainfall data. The 11years sun spots activity cycle becomes effective for five and half year's periods for solar activity maxima and minima, which cause more annual rainfall including both seasonal and non-seasonal rainfall. In order to understand the solar and Galactic Cosmic radiation effect on rainfall we synoptically combined the annual rainfall data including winter, summer and rainy season. In table 1 we present the data computed between Sunspots and rainfall activity. The fourth and fifth column are related to data of new phenomenon known as La-nina and El-nino and we obtained from web sides representing their temperatures. There is no La-nina and El-nino in pre-industrialization period but it is well recorded alternatively either El-lino or La-nina in industrialization era. In the beginning of industrialization (from 1950-1976) temp difference is less, in Pacific so there were few La-nina and El-nino but its number is large in decade of eighties and beyond due to high temperature difference records.

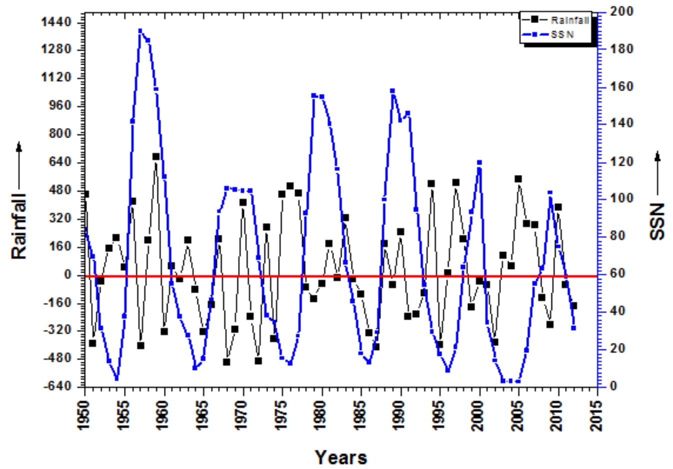

Fig. 1. Plot of rainfall, SSN as a function of year from 1950-2012 (yearly) at Ahmadabad City, India

DISCUSSION

The present study is carried out the second half century 1950-2012 which is also known as industrial era. We plotted SSN and rainfall data over this period and found some typical results besides what Mahaveer *et al* (2015) observed in pre-industrial era. Fig – 1 show that in the first solar cycle in the industrial era between 1954- 64 there is maximum rainfall with two peaks. First peak is at 1956 with average rainfall of +418.1mm and another is 1959 but a situation like a draught in the year 1957 with minimum rainfall. This draught situation contradicts our findings of Mahaveer *et al* (2015) and we try to understand this contradiction by a new phenomenon of either El-nino or La-nina. The presence of observed La-nina in the year 1956 (Fig-2) and El-nino in the year 1958 (Fig-3) may be co-related for this double peak. For another Solar cycle in the year 1964 - 1975 again we found two peaks for maximum rain in 1967 and 1970 with the average rainfall of +206.3mm and +411.5mm. and a draught in the year 1968 with the average rainfall of -496.2mm. To explain double peaks we find El-nino in the year 1966 and 1969 (Fig-3) with the temp of 0.019F and 0.125F and one La- nina corresponding to draught in the year 1968 (Fig-2) with the temp of 0.022F. Next cycle of the year 1976 -86 we observed the two peaks for maximum in 1981with the aver and these two peaks were on the year when La-nina and El-nino occurred on 1977 (Fig-2) and 1983 (Fig-3) respectively but there was one deep in the 1980 but it cannot be said as a draught reason because rainfall was just below average.

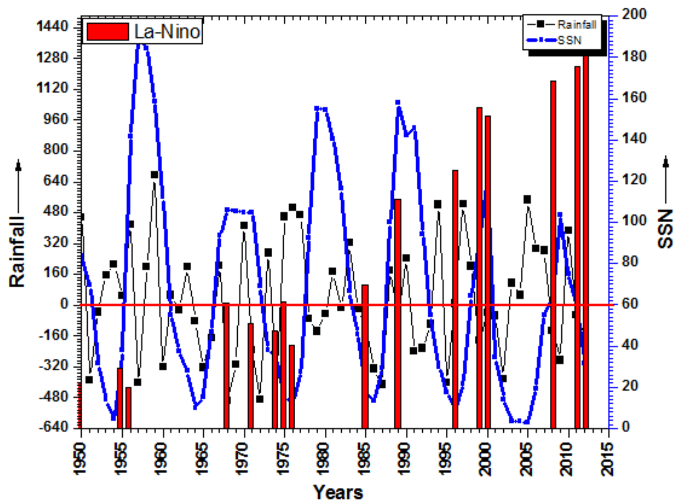

Fig. 2. Plot of rainfall, SSN with La-Nina as function of year from 1950-2012 (yearly)

The height of la-nina bars represents the tempratures in degree farenheit as shown in last two column of Table-1.

Last cycle from 2005-15 we have only one peak in 2010 with 388.5mm which corresponds to El-nino of 0.65F (Fig-3).

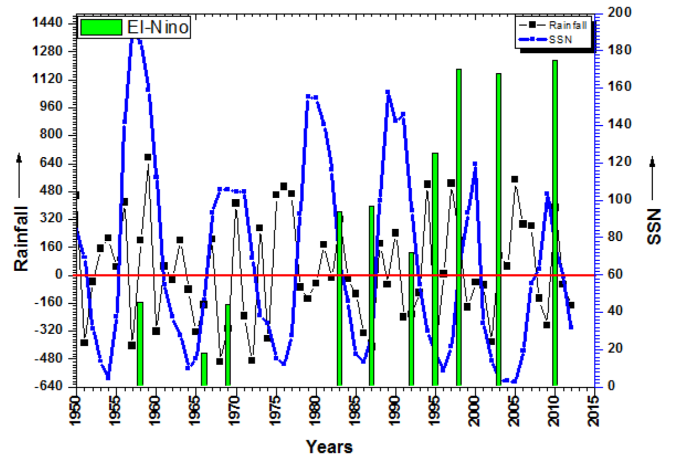

Fig. 3. Plot of rainfall, SSN with El-Nino as the function of year from 1950-2012 (yearly)

Table 1. Data of Rainfall, Rainfall relative to Average, Sun spot Number (SSN), El-nino & La-nina (˚F) (Average Rainfall at Ahmadabad city is 780mm) (Minus sign in Rainfall data indicates the scarcity in rain prone to Draught)

Year	Rainfall(mm)	Rainfall wrt Average	SSN	El-Nino(˚F)	La-Nino(˚F)	Year	Rainfall (mm)	Rainfall wrt Average	SSN	El-Nino(˚F)	La-Nino(˚F)
1950	1237.1	457.1	83.93		-0.15	1982	765.3	-14.7	116.3		
1951	392	-388	69.43			1983	1102.7	322.7	66.64	0.325	
1952	743	-37	31.41			1984	760.5	-19.5	45.85		
1953	934.5	154.5	13.85			1985	674.2	-105.8	17.94		0.0625
1954	992.8	212.8	4.41			1986	449.3	-330.7	13.4		
1955	827.5	47.5	37.95		-0.12	1987	369.6	-410.4	29.23	0.335	
1956	1198.1	418.1	141.71		-0.162	1988	960	180	100		
1957	376.2	-403.8	189.86			1989	727.6	-52.4	157.8		0.25
1958	979.1	199.1	184.59	0.13		1990	1023.4	243.4	142.3		
1959	1453.2	673.2	158.75			1991	541.1	-238.9	145.8		
1960	458.4	-321.6	112.28			1992	555.6	-224.4	94.48	0.237	
1961	831.3	51.3	55.15			1993	680.6	-99.4	54.73		
1962	756.3	-23.7	37.6			1994	1300.9	520.9	29.87		
1963	980	200	27.89			1995	379.5	-400.5	17.5	0.45	
1964	698	-82	10.2			1996	787.8	7.8	8.63		0.3125
1965	457.1	-322.9	15.07			1997	1306	526	21.48		
1966	609.2	-170.8	46.88	0.019		1998	983.2	203.2	64.21	0.63	
1967	986.3	206.3	93.67			1999	598	-182	93.18		0.45
1968	283.8	-496.2	105.89		0.022	2000	742.6	-37.4	119.5		0.43
1969	473.1	-306.9	105.56	0.125		2001	725.1	-54.9	34.37		
1970	1191.5	411.5	104.69			2002	397.8	-382.2	14.33		
1971	547.4	-232.6	104.69		-0.023	2003	893.2	113.2	3.45	0.621	
1972	288.4	-491.6	68.93			2004	830.9	50.9	3.33		
1973	1050.9	270.9	38.15			2005	1327.6	547.6	3.04		
1974	416.9	-363.1	34.41		-0.037	2006	1072.5	292.5	19.56		
1975	1238	458	15.46		0.025	2007	1063.4	283.4	55.21		
1976	1286.8	506.8	12.55		-0.07	2008	648.9	-131.1	63.45		0.506
1977	1248	468	27.48			2009	493.7	-286.3	103.7		
1978	711.4	-68.6	92.66			2010	1168.5	388.5	74.9	0.65	
1979	645	-135	155.28			2011	727.9	-52.1	58.95		0.54
1980	733.4	-46.6	154.65			2012	607.6	-172.4	31.72		0.57
1981	955.7	175.7	140.45								

The height of el-nino bars represents the tempratures in degree as shown in last two column of Table-1. On the next solar cycle during 1986-96 there were two peaks one is on 1988 with the rainfall +180mm and another in 1990 with +243.4mm rainfall. The draught in the year 1989 with average rainfall -52.4mm which is justify by the La-nina of 0.25F (Fig-2) and the two peaks may be justified by the two El-nino of 0.335F and 0.237F (Fig-3). The fifth cycle of solar activity (1996-2005) is an exception without any two peaks although there were consecutive two La- Nina 0.43F,0.45F in the year 1999, and 2000 (Fig2) respectively and two other El-nino of 0.63F and 0.621F in the year 1998 and 2003(Fig-3).

The presence of this group of El-nino and La-nina disturb the solar cycle to have the two peaks. On the other hand Solar minima of 1964 has got two peaks in the year 1961with the average rainfall +51mm and 1963 with +200mm rainfall but there is no El-nino and La-nina in this period. Here the peak is not so appreciable because of fact that it is very close to the average rainfall so it cannot be regarded as draught (-23.7mm), it is justify that during Solar minima we get max rainfall in absence of observed La-nina and El-nino. In the second Solar minima at 1976 there were two distinct peaks in the year 1973 with the average rainfall +270.9mm and 1976 with +506.8mm rainfall. These are attributed to the consecutive La-nina in year 1974 (Fig-2) with -0.037˚F brought the rainfall down to-363.1mm which is in any case is draught. The third solar minima of 1986 there is a exception that is although there is a La-nina of0.0625˚F occurred in 1985 (Fig-2) but still there is no double peaks except draught of -105.8mm rainfall. In the fourth Solar minima 1996 there is two clear peaks occurred in the year 1994 with average rainfall +520mm and in 1997 of +526mm rainfall. Here there is also one deep in the year 1995 of average rainfall -400.5mm which is a draught. Here is a El-nino of 0.45˚F in 1995 (Fig-3) and La-nina of +0.3125˚F in the year 1996 (Fig-2) convince the observed fact. The last minima of the Solar activity is on 2005.There is also two peaks occurred in the year 2003 and 2005 with the average rainfall +113.2mm and +547.6mm . In 2004 there is a small declivity of average rainfall of +0.9mmwhich may be due to the observed one El-nino of 0.621˚F in 2003 (Fig-3).

Conclusion

It was very surprising to note that the occurrence of La-nina and El-nino as well as the two peaks of maximum rainfall with draught below average rainfall of above -400 mm except two exceptions were in strong correlation with Solar cycle and require more data to analyze in near future to establish this fact. The exact scientific reason for this pattern is still yet not known. Still more rigorous data analysis is needed at small and large scale climate change in the Pacific Ocean.

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