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*Review article*

# Monsoon rainfall forecasting of Saurashtra on astronomical basis*

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## ABSTRACT

An attempt has been made to explain the possible effect of planetary movements on monsoon rainfall. There is need to investigate in detail the effect of planetary movements, with other parameters of forecasting with open mind, which may help to develop a model based on planetary positions for gross indication of seasonal weather.

Weather forecasting in general and monsoon forecasting in particular can with some justification claim to be the oldest science. It grew as Man was taking his step towards civilization, forsaking the nomadic life of hunter and gatherer, for the more settled existence as a farmer. In the regular rhythm of solar system he perceived means of marking the passage of time. The establishment of an accurate calendar became essential so that Man could regulate sowing, planting and harvesting of his crops, and carry out other activities.

The ancients once upon a time regarded the Earth as the fixed centre of the universe. We know it to be otherwise, but this simple apparent concept of a celestial sphere provides a useful model even to-day, because we do appear to be at the center of a hollow star studded sphere that rotates around the earth once a day. And we can identify the positions of heavenly bodies in relation to that sphere.

### *Ancient science of rainfall prediction*

References are available in the old Indian literature, such as Rigved (> 5,000 year old) and the epic Shrimad Bhagwat about rainfall and weather. In the later period collective information on rainfall was given in Arth-Shastra by Kautilya (321-296 BC) Parashar Samhita (1st century AD) and Brihat

* This paper is published with a view to indicate the need for more work of research under on scientific evaluation of information on likely rainfall situations given in the traditional regional almanacs year after year for the past more than a century.

samhita by Varahmihir (505-587 AD), Meghmala, a Sanskrit text written in 800 AD is recognized as the first authentic script on meteorology. It is available in Asiatic Society Library Kolkata, India. Dr. A. K. Mukharjee a renowned meteorologist translated it into English in 1976. There is also a Gujarati translation of Meghmala.

The literature in local languages includes local folklores and songs relating to rainfall pattern. Among this, Bhadali Wakyo in Gujarat and Rajastan, Sahadev

Bhadali in Maharashtra and Bhadali Meghmala in Hindustani are well known. Certain information regarding rainfall forecasting was published in the Gazette of princely state of Vadodara. Such literature is available at College of Agriculture Junagadh Gujarat, and at the library of Agro-meteorological Division at India Meteorological Department, Pune.

***Astronomy in relation to weather:***

In Shrimad Bhagvat in Skund (section) V Chapter II, we found a reference of the association of Venus with rainfall. This planet has three motions, i. Fast ii. Stable iii. Slow.

In Brihat Samhita Shloka (verse) 21, Adhyaya (chapter) 28 mentions the effect of conjunction between i. Mercury and Venus ii. Mercury and Jupiter iii. Jupiter and Venus are said to be associated with good rain. In Bhadali Vakyo there is a reference of effect of Mars on break in monsoon. It quotes that if Mars is going ahead of Sun there will be less rain.

The various methods of rainfall forecasts, by farmers, forecast published in yearly Panchang (almanac), indications given in Brihat Samhita, Meghmala, Bhadali Vakyo etc. and weather forecasts issued on radio (since 1960) and television (since 1985) were scrutinized with the actual.

The following data and material were collected:

1) Daily data of rainfall and maximum and minimum temperature of a small town of Chorvad of Junagadh District of Gujarat from 1951 to 1989.

2) Daily rainfall data of 16 rain gauge stations under Rajkot irrigation circle from 1979 to 1990.

3) Daily rainfall data of 69/73 Taluka Head Quarters of Saurashtra Region of Gujarat from 1966 to 1999.

4) Yearly Panchangs (almanac) from 1964 to date.

The primitive forecast for probable rainy or cloudy days were prepared and published in newspapers from 1986.

***Astro-meterological research project (AMRP)***

With the above background an Astro-meteorological Research Project (AMRP) was chalked out. The years for initial study were selected on the basis of rainfall data of Rajkot (which included 16 rain gauge stations of Rajkot irrigation circle) from 1979-1990. and four criteria : (1) Normal rainfall (? 10% of normal; (2) High rainfall (+25% of normal; (3) Heaviest rainfall (+50% of normal); (4) Scarcity year ( < 75% of normal.) During 4 case years, the days of : (1) Heaviest rainfall (> 125 mm.); (ii) Moderate rainfall (51-124 mm); (iii) Medium rainfall (11-50 mm); Low rainfall (1-10 mm.); (v) No rainfall (0 mm) were selected. So from four years with five rainfall dates there were in all 20 cases for detailed study. In addition to these 20 cases (4 years x 5 conditions); flood events were also considered separately. For each date the planetary chart (Kundli) at 5.30 IST (00 GMT) was prepared. Then certain inferences were drawn which might have effect on the occurrence of that event. Thus, some planetary angles and movements were identified for forecasting the relevant rainy day for subsequent years. From 1992, daily planetary charts were prepared well in advance and finally daily forecast for whole monsoon (1st June to 15th October) was prepared by the end of April

In continuation to this, study was concentrated on following since 1993.

1. To prepare daily monsoon forecast (from 1st June to 15th October) every year, by themonth of April.

2. To compare the actual rainfall with predicted rainfall.

3. To tabulate the rainfall data from 1966-99 [work is completed]

4. To prepare daily planetary position of 5.30 IST, to insert the data of the rainfall from 1966 to 1999.

(a) Work is completed for the year 1966 to 1978.

(b) The remaining work is under progress. .

5. To identify various combinations of planetary movements this might

**Table 1:** Verification of rainfall forecast on Yes/No basis Saurashtra

| Year | Date of issue of forecast | Accuracy % |
|---|---|---|
| 1993 | 30.04.1993 | Not Verified |
| 1994 | 20.04.1994 | 61 |
| 1995 | 20.03.1995 | 50 |
| 1996 | 09.04.1996 | 73 |
| 1997 | 08.04.1997 | 71 |
| 1998 | 29.03.1998 | 68 |
| 1999 | 01.05.1999 | 80 |
| 2000 | 05.05.2000 | 45 |
| 2001 | 08.04.2001 | 75 |
| 2002 | 08.03.2002 | 69 |
| 2003 | 28.03.2003 | 52 |
| Average of 11 years | | 64 |

have similar effects during this study.

6. To apply such findings for future forecast & validate the same.

7. Finally to develop a model for forecasting Monsoon Rainfall of Saurashtra.

***Dissemination and verification of forecast***

The forecasts are being published in Saurashtra in Gujarati daily newspaper, viz;, Akila, Fulchab, Sandesh, Gujarat Samachar etc. and magazines viz. Umiya Parivar, Krishividyan etc., in the month of April/ May since 1993. It is interesting to note that this forecast includes (i) onset of Monsoon (ii) dry spell (iii) wet spell and iv) withdrawal of Monsoon.

According to information collected from the Physical Research Laboratory (Ahmedabad) and Nehru Planetarium (Mumbai) the fundamental structure of our solar system is shown in Table 2

**Table 2 :** The Fundamental structure of the Solar System

| Planet | Mean distance from Sun($x10^6$Km) | Equatorial diameter(Km) | Density (Water=1) | Circle Sun in Period |
|---|---|---|---|---|
| Mercury | 58 | 4,878 | 5.40 | 88 days |
| Venus | 108 | 12,104 | 5.20 | 224.7 days |
| Earth | 150 | 12,756 | 5.52 | 365.25 days |
| Mars | 228 | 6,794 | 3.95 | 687 days |
| Jupiter | 778 | 1,42,800 | 1.34 | 11.9 years |
| Saturn | 1427 | 1,20,000 | 0.70 | 29.5 years |
| Uranus | 2870 | 52,000 | 1.58 | 84 years |
| Neptune | 4497 | 48,400 | 2.30 | 164.8 years |
| Pluto | 5900 | 2,200 | ? | 247.7 years |
| Sun (Star) | - | 13,92,000 | Spin on axis | 25.4 days |

**Table 3. :** Observed and predicted dates of law temperature (It was predicted on 10-12-95)

| Prediction | Actual (Date) |
|---|---|
| 15, 16, 17 January will be cooler | 15.4° C (15), 15.9° C (16) 12.1° (C) (17) |
| 18, 19, 20 January will **be coldest** | 9.6° C (18) **7.3° C (19)** 8.5° (C) (20) |
| 21, 22, 23 January will be cooler | 8.0° C (21) 9.8 C (22) 10.6° (C) (23) |

The cold wave, cyclone etc., are also the part of the weather phenomena, hence some occasional work on temperature variation, cyclone etc. was carried out to verify the concept of the effect of planetary movements on weather.

***Cyclone prediction:***

On 23rd June 1997 there was heavy downpour in Surendranagar and Mahesana districts of Gujrat.

On 8th and 9th June, 1998 there was cyclone and wide spread rain in Junagadh, Porbander and Jamnagar

**Table 4 :** Planetary position during heavy rain and cyclone in Gujrat and Andhra Pradesh in India

| | 23.6.1997 | | 8.6.1998 | | 9.6.1998 | | 5.11.1996 | |
|---|---|---|---|---|---|---|---|---|
| **Planet** | **Degree[2]** | **Decl[3]** | **Degree[2]** | **Decl.[3]** | **Dege[2]** | **Decl[3]** | **Dege[2]** | **Decl.[3]** |
| **Sun** | **67.52** | **N 23.26** | **53.17** | **N 22.48** | **54.15** | **N 22.54** | **199.09** | **S 15.42** |
| **Moon** | 277.17 | S 16.03 | 208.18 | S 13.33 | 220.33 | S 16.05 | 127.19 | N 08.13 |
| **Mars** | 155.54 | S 00.21 | 46.45 | N 22.20 | 47.27 | N 22.26 | 129.26 | N 11.53 |
| **Mercury** | **64.25** | **N 24.10** | **50.28** | **N 22.58** | **52.50** | **N 23.00** | **201.00** | **S 16.15** |
| **Jupiter** | R297.57 | S 15.03 | 331.51 | S 02.49 | 331.58 | S 02.46 | 259.45 | S 23.07 |
| **Venus** | 87.16 | N 22.54 | 16.48 | N 13.03 | 17.59 | N 13.29 | 164.11 | S 01.36 |
| **Saturn** | 355.20 | N 05.15 | 6.08 | N 09.15 | 6.14 | N 09.17 | 337.38 | S 20.34 |

1. N North; S South; and R = Retrograde
2. Degree(°) Longitude
3. Decl. is declination (°) Angle subtended by planet with equator.

district and havoc at Kandla in Kutch, Gujrat.

On 5th November, 1996 there was devastating cyclone in Andhra Pradesh. The planetary chart was prepared for these days to find out whether any similar co-relation had occurred (Table 4).

It was observed that position of Mercury with sun was very near in degree and declination see (Table 4).

While preparing charts for 1999 monsoon, some indications were observed which were somewhat similar to above and a deep study of Sun/ Mercury movement from 15th to 31st May was undertaken and the following forecast was issued one month in advance i. e. on 18-4-1999.

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**Warning for cyclone**

The study of weather for Saurashtra Region since last decade reveals the possibility of cyclone during 24-28 May 1999.

1. A low pressure belt may occur created between 18 and 21 May, 1999 in the Arabian Sea.
2. It may become Deep Depression between 22 and 24 May, 1999.
3. The cyclone may hit Saurashtra Region between 24 and 28 May 1999.
4. Then it may weaken.

**By Dhansukh Shah, Pune dated 18 April 1999**

The prediction of cyclone came true. The track of the cyclone was published on the cover page of the news letter of Indian meteorological society, Pune Chapter.

It is observed that the changes in daily weather are associated with the various declinations of other planets.

The work so far carried out indicates strong co-relation between the planetary positions and weather. The following are some of the eye-catching observations.

1. Certain positions of Sun/Mercury and Sun/Saturn/Mercury have effects on cyclone appearance.
2. The declination of Mercury in the end of May to June seems to determine onset of Monsoon in Saurashtra region. The position of Mercury determines cloud formation in the Arabian Sea.
3. Venus has effect on cloud formation in Bay of Bengal during monsoon season.
4. If Mars is going ahead of Sun, Mercury and Venus continuously in June and July the monsoon is delayed hence less rain or draught can be anticipated in Saurashtra region. The examples are the years of 1972, 1974, 1985, 1987, and 1991.

   Such position of Mars was used for prediction of monsoon of 2002.
5. Jupiter and Saturn when they are in conjunction or opposition in degree

and declination for a long period cooling effect on weather is observed as under.

(a) If this occurs in Nov., Dec., Jan. cold wave is possible.

(b) If this occurs in April/May monsoon cycle is disturbed and possibility of less rain during monsoon.

(c) If this occurs in July, August there is possibility of (I) widespread (ii) satisfactory and (iii) some time prolonged wet spells during monsoon.

(d) If this occurs in June the effect is yet to be examined.

It is hoped that, after scrutinizing the rainfall data with planetary positions from remaining period of 1979 to 2004, some model may emerge so that may prove useful.

## REFERENCES

Shrimad Bhagvat Piyush Part/Vol. II (Gujrati).1982. First edition, edited by Kardam rushi Krishnashankar Shastri. Published by Shrikrishnanidhi, 302 Relief shopping centre, near GPO Ahmedabad-380001.pp.302.

Varahmihir's Brihat Samhita (Gujrati).1984. First edition, edited by Shailendra Thakur, published by Pravin Pustak Bhandar, Labh chambers, Dhebar road, Rajkot-360001. pp. 219.

Bhadali vakyo (Gujrati). 6th edition.1986. Edited by Jethalal Narayan Trivedi. Published by Sastu sahitya vardhak karyalaya, Bhadra, Ahmedabad-380002. pp.54.