

CONTRIBUTION TO WEATHER SCIENCE IN ANCIENT INDIA.
V—PRINCIPLES OF FORECASTING RAINFALL IN ANCIENT INDIA
(LONG RANGE)

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The post-Vedic scholars evolved several techniques of long range forecasting of rainfall based on observation of winds, clouds, sky conditions, etc. on selected days characterised by the relative position of the sun and the moon with respect to the stars as well as the position of planets with respect to sun, moon and stars. A survey of these techniques is made in this paper.

INTRODUCTION

In an earlier paper,¹ we have seen the essential features of the conceptual model of the post-Vedic scholars. The year to year variations of the weather occurrences as well as extremes of weather like floods and droughts did affect them and they were naturally compelled to study more deeply the causes of such variations. After careful observation of the day to day weather over a prolonged period, their natural tendency was to correlate certain weather disturbances during the western disturbances period as well as the period immediately following it (periods of formation and growth of the rain foetuses), with the quantity of rainfall, its intensity and time of occurrence during the rainy or monsoon season. These constituted the first steps in the formulation of rules of forecasting rainfall on the long range in ancient India. Careful observation of the conditions of sky, wind temperature, halos round the sun and the moon and even behaviour of animals, birds, etc., as well as plants and trees, some hours or even one or more days prior to the occurrence of heavy or moderate rainfall in a place also enabled them to formulate rules for forecasting rainfall on short and medium range (which we shall discuss in a subsequent paper).

LONG RANGE FORECASTING

There were three broad approaches possible for the post-Vedic scholars in this field. They were the following :

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1. To work within the framework of the concepts handed over to them by the Vedic scholars and improved by them, *viz.*,
 - (a) Rainfall is essentially a *yajña* process in which both sun and *soma* play important roles.
 - (b) By virtue of being a *pratikṛti* of *soma* of the upper regions, the moon has an influence on the rainfall process. (In fact, the moon was imagined to have the ability of extracting the *soma* of the upper heavens and stars and thus acquire all the essential functions of *soma* that resides in the midst of stars.²)
 - (c) The period that elapses between formation of rain foetuses and rainfall delivery is 195 days.

In other words, the formulation of the rainfall forecasts on the long range can be based on observations of winds, clouds, rain, sky conditions, *etc.* on selected days characterised by the relative positions of the moon and the sun with respect to the stars in all the months prior to the commencement of monsoon rainfall.

2. To assume that eclipses of the sun and the moon, comets, the relative position of various planets with respect to the sun and the moon, *etc.* do influence rainfall and formulate the forecasting rules accordingly. The idea of rainfall cycles perhaps has its origin here.
3. To interpret certain shapes of clouds, state and colour of the sky, fall of meteors, unseasonal winds, abnormal weather conditions, *etc.* as indicative of oncoming extremes of weather and forecast the same accordingly.

Before we proceed further, it is pertinent to point out at this stage that we are dealing with an extremely difficult subject from the scientists' point of view. While the natural tendency of any scientist will be to dismiss these concepts as not conforming to any scientific standards and, therefore, not worth going into, a scientist tracing the historical development has necessarily to probe deeply into them and see on what framework or on what basic concepts such a large number of detailed thumb rules of forecasting rainfall were developed. To understand these, we have to go into some basic principles of astronomy as known to our ancients.

From the very ancient times man has wondered at the complexity of the objects he observed in the sky, night after night and day after day, and their motions. Their varied nature, brightness, and colour enabled him to identify certain principal stars in addition to sun, moon and the planets. Then gradually the regular motion of the sun and the moon and their daily shift in the background of the stars was understood and could also be mapped. The following facts known to our ancients are relevant to us.

1. The sun slides back with respect to the stars and completes one round in a year. (The annual motion of the earth round the sun was most probably not known to them clearly).
2. The sun moves through the 27 asterisms of the Indian system during the above period and stays in each for a period of a little over 13 days.
3. The moon stays in each asterism for one day, and completes one round of the heavens in 27.3 days.
4. The apparent north south motion of the moon during a lunar month is as much as the north south motion of the sun during a year. The annual path of the sun in the celestial sphere is more or less followed by the moon also with a deviation of 5 degrees north and south.
5. The apparent path of the moon in the sky is zig zag (the concept of *Rāsa Kṛīḍā* of Lord Kṛṣṇa has its origin here*)
6. In the winter period Kārttika to Māgha, the moon moves from south to north in *śukla pakṣa* and from north to south in *kṛṣṇa pakṣa*.⁺
7. In the summer months of Caitra to Āṣāḍha, the moon moves from north to south in the *śukla pakṣa* and south to north in the *kṛṣṇa pakṣa*. Phālguna and Bhādrapadā are transition months.
8. The asterisms, according to our ancients, are distributed in the zodiac in a belt of 48° with a spread of 24° on either side of the celestial equator. The planets also move within this belt. Initially, they had 28 asterisms. Later, Abhijit, which was assumed to be located partly in Uttarāṣāḍha and partly in Śravaṇa was dropped leaving 27 asterisms covering the zodiac. In order to identify the *nakṣatras*, the ancients first developed the idea of groups of stars having shapes of animals, birds, men, etc. In each group they identified one bright star which was called *yoga tārā*. The asterisms Aśvinī, Bharanī, etc. were located with the help of these *yoga tārās* which were referred to by the same names. In order to facilitate the location of these stars, the astronomers then developed the idea of separate paths in the celestial sphere in which these stars are distributed. They imagined three broad belts parallel to the celestial equator and these were named Irāvata, Jaradgava and Vaiśvānara. Vaiśvānara is on the southern side of the equator, Irāvata on the northern side and Jaradgava in the

* *Aṅganāmaṅganāmantare Mādhavo Mādhavaṃ Mādhavaṃ Cāntareṅgaṅganā. Ithamā kalpīte Maṅḍale Madhyagasaṅjagau Veṇuna Devakī Nandanah.—Līlāsūka.*

⁺One should always keep in mind the precession effects on seasons. The months refer to lunar months (Amānta)

middle. Each of these three broad belts was further subdivided into three secondary belts (*vīthis*), so that there were a total of nine *vīthis*, three on the northern side, three on the southern side and three in the middle. These nine *vīthis* from north to south have the following names :

- (1) *Nāga*, (2) *Gaja*, (3) *Irāvata* on the northern side ; (4) *Vṛṣa*, (5) *Go*, (6) *Jaradgava* in the middle ; (7) *Mrga*, (8) *Aja*, (9) *Vaiśvānara* on the southern side.

It is interesting to note that for a man located outside these belts in the northern hemisphere, the span of these belts above the horizon would appear smaller and smaller as one proceeds southwards and the names of the belts are quite suggestive of this diminution. In fact, the seven horses which the sun rides on are nothing but the seven tracks of the sun, three on the southern side, three on the northern side and one in the middle (along the celestial equator). They are incorporated in the Vedas as seven metres (*chandās*), *Gāyatrī* (24 syllables) being associated with the southern-most track and *Jaḡatī* (48 syllables) being associated with the northern-most track. *Bṛḡhatī* (36 syllables) is the track along the celestial equator. The movement of the moon across the sky is not only associated with one *yoga tāṛā* every day but also with each of these belts. In other words, the *nakṣatras* are distributed in the nine *vīthis*, three in each :

Bharaṇī, Kṛttikā, Svātī	<i>Nāga vīthi</i> (northernmost)
Rohiṇī, Mṛgaśīrṣa, Ārdṛā	<i>Gaja vīthi</i>
Punarvasu, Puṣyā, Āśleṣa	<i>Irāvata vīthi</i>
Maghā, Pūrvaphalgunī, Uttaraphalgunī	<i>Vṛṣa vīthi</i>
Purva Bhādrapadā, Uttara- bhādrapadā, Revatī, Aśvinī	<i>Go vīthi</i>
Śravaṇa, Dhaniṣṭhā and Śatabhiṣaj	<i>Jaradgava vīthi</i>
Anurādhā, Jyēṣṭhā, Mula	<i>Mrga vīthi</i>
Hasta, Citrā, Viśākhā	<i>Aja vīthi</i>
Pūrvāṣāḍha and Uttarāṣāḍha	<i>Vaiśvānara vīthi</i> (southernmost)

There will be some differences from author to author in the above distribution, but we shall not bother about the reasons for these just now.

With the above information, we shall now revert back to our subject.

We have already seen the importance of *soma* for rainfall as understood by the Vedic seers and endorsed by the post-Vedic scholars. *Soma* is the fertilising agent, which mixes with water and comes down as rain. The post-Vedic scholars used this idea to formulate their improved model of rainfall process. During the western disturbances period, it was conceived that the formation of rain foetuses

takes place as a result of the injection of *soma* from the north—a process of fertilisation (*somo vai retodhāh*). That is why during this period a soft wind from the north is considered as a favourable symptom. The northern region is the abode of *soma* (snow) and the south the seat of *agni*, so that the southward movement of *soma* and the northward movement of *agni* are essential for the functioning of the cycle of *ṛtus* or seasons which are caused by the interaction of *soma* and *agni*. To put in a more direct way, the western disturbance activity pushing *agni* (sun) to the south, and the northward movement of the sun pushing *soma* (snow) to the north are essential for the occurrence of monsoon rains. This will automatically mean existence of *soma* in the north or its restoration to the northern region by some process and the existence of *agni* in the south or its restoration to the south are most conducive for the orderly functioning of the seasons and more particularly the rainfall cycle which is the principal cause of origin and maintenance of life on earth. Keeping in mind the above ideas, the post-Vedic scholars believed that whenever the moon moves in a northerly track or is restored to a northerly track, conditions are favourable for the formation of healthy rain foetuses and whenever he moves in a southerly track with sun (*agni*) on its northern side, or whenever a condition of *soma* being overpowered by *agni* is created, it favours abortion of rain foetuses if the foetuses are not fully developed, and a healthy delivery of rainfall if the foetuses have gone through their full period of growth. With this basic hypothesis they made careful observations of sky and weather conditions as well as the position of sun and moon with respect to the stars and related the nature and distribution of rainfall during the delivery period to certain favourable and unfavourable sky conditions and corresponding position of sun and moon during the periods of formation and growth. When once a start is made in this direction, the natural tendency will be to go into elaborations and bring in the influence of *nakṣatras* and planets on rainfall process after attributing the quality of *soma* or *agni* or related qualities to them especially when they have been taught by the Vedic seers that *agni* and *soma* are the two basic things which have given rise to everything that we witness in this universe. Thus a new talent was developed for which the Vedic seers had shown the way. Though initially this art of rainfall forecasting was practised by a few experts like Garga, Parāśara, Nārada, Devala, Vaśiṣṭha, Bhṛgu, Druhina, Ṛṣiputra, Kāśyapa, Varāhamihira, etc. later in the light of careful observations covering more regions, the number of experts increased and naturally the thumb rules also increased in number. In some recent books on this subject, many hundreds of such rules have been collected from ancient literature and presented.³ Many of these have been handed down the generations and they have been incorporated in local proverbs or sayings.

The examination of the scientific validity of the above thumb rules is a time-consuming investigation, the result of which may be most disappointing. But

in the opinion of the author, in this process, one gets greater insight into the ramifications of the mind of our ancients. However, the very magnitude of the work involved repels anyone from attempting the same. We, therefore, propose to present a selected number of these thumb rules. In a subsequent paper, we shall analyse their evolution and also present a new approach to examine their scientific validity.

It will not be out of place here to point out that, in the opinion of the author, most probably the subject of Astrology which aims at the prediction of the future of a person's life history, had its origin in the basic principles which according to our ancients govern the prediction of the nature and distribution of rainfall especially since they conceived that rainfall also has to go through the three stages of conception, growth and delivery, just like a man and further the influence of sun, moon and stars and planets on both was assumed to be more or less similar. It is quite interesting to note also that the science of weather was always dealt with by them in texts which deal with Astrology though in a separate section.

Before we state the thumb rules, some general remarks on Indian weather may be of help for a correct appreciation of their implications. The Vedic seers as well as the post-Vedic scholars should have been well aware of the striking difference in the nature and rainfall potential of the western disturbances and the monsoon. Especially, the bang characterised by dark clouds, lightning, thunder, wind, and torrential rain which ushers in the monsoon over northwest India sustaining all forms of life, and its prolonged presence with breaks, was compared by them with the fleeting type of western disturbance activity with occasional light rain from thinly overcast sky, occasional lightning, thunder, mist, fog and winds which are sometimes pleasant when they are from north or northeast behind a moving disturbance on a clear sunny day, and then the concepts of formation of rain foetuses, their growth and delivery were developed. Naturally, when once western disturbance activity was considered as the beginning of the rainfall cycle, its nature and features should be indicative of the nature and features of the end product, *viz.*, the monsoon rainfall.

By carefully observing the weather and sky conditions day after day for a prolonged period, it should have been easy for the post-Vedic scholars to recognize the following features of the weather patterns during the various months.

The monsoon completely withdraws from Northwest India in the beginning of the month of Kārttika (October-November). The days are characterised by clear skies in the region and temperatures show a falling trend especially in the nights.

In the month of Mārgaśīra (November-December) the western disturbance activity slowly picks up and we get one or two disturbances, which normally are

mild to moderate. The anticyclone at the lower levels over Northwest Pakistan and adjoining Iran begins to build up. Because of the prolonged absence of rain, haze in the sky increases. The temperatures have not yet fallen appreciably. In the month of Pauṣa (December-January) frequency of western disturbance increases and temperatures fall sharply. The plains sometimes get appreciable rain and behind the disturbances the sky clears and haze decreases.

In the month of Māgha (January-February), the western disturbance activity reaches a peak, sometimes giving rise to thick fog or frost, especially whenever the skies clear in the night after the passage of a western disturbance. The foggy conditions during the day keeps the maximum of the day temperatures the lowest of the year.

In the month of Phālguna (February-March) westerlies assert themselves in the region. Haze which cleared during peak western disturbance activity again increases.

In the month of Caitra (March-April) westerlies continue, temperatures slowly build up and the first thunderstorms occur and decrease the haze.

In the month of Vaiśākha (April-May) the temperatures increase, skies are clear except when there are thunderstorms which gain in strength as summer advances.

One of the interesting observations of the ancients was that too much rain during the period of initial growth of the rain foetuses results in poor rainfall at the time of delivery. They imagined that rain foetuses are destroyed (*garbhasrāva*) if there is too much rain during the time of their early growth period. It was till very recently believed that too much western disturbance activity affects the monsoon rainfall of the subsequent season. In fact, the very first forecast of monsoon rainfall issued by Blanford, the first chief of the India Meteorological Department, after the successive famines of 1876 and 1877 was based on the negative correlation between winter snow fall and subsequent monsoon rainfall and it proved to be correct at that time though we know now that it is very very rare that the monsoon will fail successively for three seasons.

It was also believed by our ancients that hotter the conditions are in the month of Vaiśākha and Jyaiṣṭha (May-June), the better will be the performance of the monsoon. This was also the view of the meteorologists in the early stages of development of forecasting techniques.

THUMB RULES FOR LONG RANGE FORECASTING

We shall now proceed to state the thumb rules which we have selected for presentation :

1. Rain foetuses that develop when the moon is in any of the asterisms Pūrvabhādrapadā, Uttarabhādrapadā, Pūrvāṣāḍhā, Uttarāṣāḍhā, and Rohiṇī in any season will yield plenty of rain. Those that are formed in Śatabhiṣaj, Āśleṣa, Ārdrā, Svātī or Maghā prove fertile and rains for many days. If they go through their full period of growth without any impediments, they will give rain as given below according to the month in which they form :

<i>Month of formation of foetus</i>	<i>Duration of rainfall (at the time of delivery)</i>
Mārgaśira	8 days
Pauṣa	6 days
Māgha	16 days
Phālguna	24 days
Caitra	3 days
Vaiśākha	3 days

2. The following symptoms favour healthy growth of the rain foetuses in the various months as shown below :

- i. Absence of severe cold conditions in Mārgaśira.
- ii. Heavy snow fall in Pauṣa.
- iii. Sky reddish near horizon during mornings and evenings both in Mārgaśira and Pauṣa.
- iv. Sun and moon appearing dim because of thick fog or mist and severe cold conditions in Māgha. Sunrise and sunset hidden by fog or low clouds (formed as a result of lifting) in the same month.
- v. Rough and strong winds, appearance of clouds, incomplete halo round the sun, coppery colour of the sun in the month of Phālguna.
- vi. Winds, clouds, rain and halos in the month of Caitra.
- vii. Wind, rain, white clouds, lightning and thunder in the month of Vaiśākha.

If all the above conditions are present in the respective months and if there are no adverse symptoms in any of the months, the monsoon rains will be very good.

3. If the formation of rain embryo in any month is accompanied by all the five lakṣaṇas viz., wind, clouds, light rain, lightning, and thunder it will rain (at

the end of 195 days) over a span of 100 yojanas,* and it will be over a span of 50 yojanas if three are present, and over a span of 25 yojanas if one or two only are present. The quantity of rainfall will be 3 *ādḥakas* if wind alone is present, 6 *ādḥakas* for lightning alone, 9 *ādḥakas* for clouds, 12 *ādḥakas* for thunder. If all are present it will yield 5 *dronas* (20 *ādḥakas*).

4. If at the time of formation of rain foetuses sun and moon are in conjunction with *saumya* (having the qualities of *soma*, planets like Jupiter or Venus, the monsoon rainfall will be very good. If on the other hand, in conjunction with *āgneya* or *vāyavya grahas* like Mars and Saturn, it results in occurrence of hailstorms. Hailstorms will also occur if at the time of delivery the moon or sun is associated with the above planets and rainfall occurrence is delayed.

5. If at the time of formation of rain foetuses, the moon entering the asterisms *Kṛttikā*, *Rohiṇī*, *Mrgaśīrṣa*, *Maghā*, *Citrā*, *Viśākhā*, *Anurādhā*, *Jyesthā*, *Mūla*, *Pūrvāṣāḍha*, *Uttarāṣāḍha*, makes her exit on the northern side then it is very auspicious and portends good rainfall and prosperity. If she makes her exist on the opposite side (south) it portends bad times.

6. If there is rain on the 2nd, 3rd, 9th, 11th, 12th, and 13th days of the bright half of the month of *Kārttika*, there will be very good rainfall during the subsequent monsoon season. The 11th and 12th days mentioned above are named *abhradhruva* and are usually characterised by sun in *Svātī* or *Viśākhā* and moon in *Aśvinī* or *Revatī*. If these days are cloudy then there will be plenty of rains in the month of *Āṣāḍha*. If these days are clear, the monsoon rains will be poor.

7. If on the *Pūrṇimā* day of the month *Kārttika*, the moon stays in the asterism *Kṛttikā* for the whole period of 24 hours commencing from sunrise, there will be good rainfall in the subsequent monsoon season. If the asterism is *Rohiṇī* on that day the rainfall will be poor. If the asterism is *Bharanī* on the other hand, there will be good monsoon in some places and it will be poor in some other places.

8. The eleven days commencing from the 2nd day of the bright half of *Mārgaśīra* are extremely favourable for formation of rain foetuses. (The moon will invariably traverse the asterisms *Mūla* to *Bharanī* during these days and these asterisms are imagined to be favourable for conception). If on any of these days there is rain or cloudiness, there will be good monsoon rainfall during the subsequent rainy season.

9. If on the 10th day of the bright half of *Mārgaśīra* there is northerly wind throughout the day (sunrise to sunrise) it may be taken that conception has taken place.

*We shall be dealing with units and measurements in a subsequent paper.

10. If on the 12th day of the bright half and on the new moon day in Mārgaśīra there is rain, the subsequent monsoon rainfall will be good.

11. The nine days commencing from the 4th day of the dark half of Mārgaśīra are most favourable for conception. If the symptoms (five lakṣaṇas) are present in these days, there will be surely rain in the bright half of Āṣāḍha.

12. If there is wind from the east on the 8th day of dark half of Mārgaśīra, there will be prosperity in the region. Wind from other directions on this day brings distress condition.

13. If there is wind from all directions on the 12th and 13th, 14th and 15th (Amāvasyā) days of the dark half of the month of Mārgaśīra, there will be good rain in the month of Āṣāḍha.

14. If the asterism on the Amāvasyā day of dark half of Mārgaśīra is Mūla, the prices of foodgrains will come down and if it is Jyēṣṭhā, foodgrains will become dear.

15. If the formation of rain foetuses takes place in the first ten days of the bright half of Pauṣa, there will be good monsoon rainfall in the region if no miscarriage of the rain foetuses takes place in the month of Caitra (*i.e.* if too much rain does not occur in the month of Caitra).

16. If there is cloudiness during the sun's stay in the asterism Pūrvāṣāḍha (for 13 days) in the month of Pauṣa, then there will be rain almost daily during the period when the sun moves through the asterism Ārdrā to Mūla (*i.e.* during the monsoon season).

17. If in the month of Pauṣa, there are no indications of conception, in all probability the monsoon will be a failure.

18. If in the month of Pauṣa, when moon passes through Pūrvabhādrapadā, there is halo round the moon and the day is accompanied by rains, lightning and thunder, the subsequent monsoon rains will be very good.

19. If on the fifth day of the bright half of Pauṣa there is snowfall, the subsequent monsoon rains will be very good.

20. If on the eleventh day of the bright half of Pauṣa lightning, cloudiness and snowfall occur and if the moon is in the asterism Rohinī on that day, the subsequent monsoon rains will be very good.

21. If lightning is seen on the fourteenth day of the bright half of Pauṣa, it is an auspicious sign and there will be plenty of rain in the dark half of Āṣāḍha.

22. The moon's presence in the asterism Svāti on the seventh day of the dark half of Pauṣa is indicative of prosperity. If on this day there is cloudiness, the monsoon rains will be moderate, and if there is rain on that day, the monsoon rains will be very good.

23. If on the eighth day of the dark half of Pauṣa there is no rain, there will be spell of heavy rain when the sun traverses the asterism Ārdrā.

24. If in the month of Māgha, the five symptoms of conception are noticed with wind from east or north when the moon traverses the asterism Mūla to Bharanī, there will be rain when the sun moves through Ārdrā to Viśākhā i.e. if the symptoms occur when the moon is in Mūla, there will be rain when the sun moves through Ārdrā. If they occur when the moon is in Pūrvāṣāḍha, there will be rain when the sun moves through Punarvasu, etc.

25. If there is rain on the seventh day of the bright half of Māgha, there will be a spell of heavy rain in the month of Āṣāḍha. If, on the other hand, there is no rain on the seventh day but rain on the eighth day, there will be no rain in Āṣāḍha but it will rain in Śrāvaṇa.

26. If cloudiness prevails for eight days commencing from the seventh day of the bright half of Māgha, there will be more than normal rain in the subsequent monsoon season. If there is no cloudiness on the above days, the monsoon will be poor.

27. If there is strong breeze, lightning and cloudiness on the ninth, tenth and eleventh days of the dark half of Māgha, the monsoon rains will be more than normal.

28. If during the month of Phālguna, there is cloudiness on many days without rain, it indicates healthy condition of the rain foetuses and the subsequent rainy season will yield ample rainfall.

29. On the Pūrṇimā day (Holi) of Phālguna month, if there is wind from the east, it will give above-normal monsoon rainfall, if it is from north, crops prosper, if it is from west, moderate rainfall will occur during the subsequent monsoon season and if it is from south, there will be distress condition in the region.

30. If on the second day of the dark half of Phālguna, there are no clouds or lightning and if there is wind from all directions there will be good rain in the months of Śrāvaṇa and Bhādrapadā.

31. If on the fifth, ninth, and thirteenth days of the dark half of Phālguna lightning occurs and if there are symptoms of conception, the monsoon rains will be affected.

32. If there is rain in the month of Caitra when the sun moves through the asterism Revatī, and if there is no rain in the subsequent ten days it is to be taken that miscarriage of the rain foetuses has taken place and therefore the monsoon rainfall will be poor.

33. If rain occurs during the period from the first to the eighth day of the bright half of the month of Caitra and if there is lightning on the ninth day, the monsoon will be poor in that region.

34. If during the bright half of Caitra; wind from the west and south blows continuously for two days, the subsequent monsoon will be a failure.

35. If there is rain or lightning or even thunder on the fifth, seventh and thirteenth days of the bright half of the month of Caitra, there will be total failure of the subsequent monsoon.

36. If on the second, third, fourth and fifth days of the dark half of Caitra there is rain with wind from the east, the monsoon rainfall will be poor.

37. Wind from the south without rain, during the period when the moon moves from Mūla to Bharanī in the dark half of Caitra, is indicative of good monsoon rainfall in the year.

38. The third day of the bright half of Vaiśākha is called Akṣaya Tṛtīyā and events on that day have great importance in forecasting future events. The direction of the wind on that day bears a relation to the performance of monsoon. Wind from west favours good monsoon performance.

39. If there is rain on the eleventh, twelfth and thirteenth days of the bright half of Vaiśākha, it foretells distress conditions later. If there is no rain, there will be prosperity.

40. Thunderstorms in Vaiśākha are indicative of good monsoon later.

41. The events in the month of Jyaiṣṭha are important for determining the rainfall of the ensuing monsoon season.

42. Thunder in the bright half of Jyaiṣṭha destroys the rain foetuses. Frequent occurrence of thunder results in poor rains in the months of Śrāvaṇa and Bhādrapadā.

43. If there is cloudiness on the day when the moon is in the asterism Rohiṇī in the bright half of Jyaiṣṭha, monsoon will be good and if there is no cloudiness it will be bad.

44. The conjunction of the sun and the moon in the star Rohiṇī is extremely bad. There will be distress conditions in the region.

45. If the moon is in the asterism Ārdrā on the third day of the bright half of Jyaiṣṭha and if there is rain, the subsequent monsoon will be a failure.

46. Wind from east, north and west on the fifth day of the bright half of Jyaiṣṭha portends prosperity but the wind from the north is conducive to locust attack.

47. The examination of wind direction on four days commencing from the eighth day of the bright half of Jyaiṣṭha is important for forecasting purposes. If winds are light and pleasant, they foretell prosperous conditions. If on these days lightning and halo around the sun and the moon also occur, they augur a good period ahead.

48. If there are no clouds on the nine days commencing from the day the moon is in Ārdrā in the bright half of Jyaiṣṭha, there will be good rainfall later. If clouds appear, the monsoon will be poor. Also if rain occurs when moon moves through Svātī, Viśākhā, Anurādhā and Jyeṣṭhā, it portends total failure of monsoon.

49. Forecast of the quantities of rainfall during the monsoon season is based on observations during the 27 day period commencing from Pūrṇimā day of the bright half of Jyaiṣṭha which invariably coincides with moon's position in the asterism Jyeṣṭhā. There is a tendency for rainfall to follow a 27 day cycle during the monsoon season *i.e.* if it occurs when the moon is in a particular asterism it will again occur when the moon returns to the same asterism after about 27 days. The following table shows the expected quantity of rainfall during the season if the initial showers occur when the moon is in the various asterisms shown on the left side.

<i>Name of the Asterism</i>	<i>Expected quantity of rainfall for the season</i>
1. Dhaniṣṭhā, Revatī, Citrā, Hasta, Pūrvāṣādhā and Mṛgaśīrṣa	16 droṇas
2. Svātī, Jyeṣṭhā and Śatabhiṣaj	4 droṇas
3. Maghā, Anurādhā, Bharanī, Śravaṇa and Mūla	14 droṇas
4. Uttarāṣādhā, Punarvasu and Viśākhā	20 droṇas
5. Kṛttikā	10 droṇas
6. Uttarabhādrapadā, Rohinī, Pūrvaphalgunī and Uttara- phalgunī	25 droṇas
7. Āśleṣa	13 droṇas
8. Puṣya and Pūrvabhādrapadā	15 droṇas
9. Ārdrā	18 droṇas
10. Aśvinī	12 droṇas

The above forecasts are valid only if unfavourable situations do not develop during the period.

50. If on the third day of bright half of Āṣāḍha easterlies prevail and clouds move from east to west, there will be good rainfall in the month of Bhādrapadā.

51. If on the second day of the bright half of Āṣāḍha the first showers occur, on the third day easterlies appear giving rise to dark and large clouds, on the fourth day wind from the south and clouds from the east appear and on the fifth day northerlies blow and give rise to high clouds, then in that year there will be good rains for four months commencing from Śrāvaṇa.

52. The total amount of clouds that appear on the four days commencing from the fifth day of the bright half of Āṣāḍha is a measure of the quantity of rainfall during the ensuing entire monsoon season.

53. A clear sky on the Pūrṇimā day of Āṣāḍha is indicative of distress conditions due to poor monsoon.

54. If there is lunar eclipse on Āṣāḍha Pūrṇimā day, things will become very dear in the next four and a half month.

55. If there is rain on the fifth day of dark half of Āṣāḍha, the ensuing monsoon will be good.

56. If at the times of dawn and sunset the clouds look yellow in colour on the fourth, fifth and sixth days of the bright half of Āṣāḍha they eventually become dark and bring rains.

57. If the sun is in the constellation Siṃha in the bright half of Śrāvaṇa, there is generally a break in monsoon rains and rainfall is confined to sea coast areas.

58. If clouds appear on the west on the first, seventh, twelfth, thirteenth and Pūrṇimā days of Bhādrapadā they portend good rainfall.

The following seven rules (59-65) cover a wider range of observation.

59. If it is not very cold in the month of Māgha, no winds in Phālguna, no clouds in Caitra, hailstorms in Vaiśākha and very hot weather in the month of Jyaiṣṭha, there will be scanty rain during the monsoon season.

60. If there are no clouds in Māgha, if it rains in Caitra and there is no thunder on Akṣaya Tṛtīyā day (Vaiśākha Śukla Tṛtīyā) then there will be scanty rain in the rainy season.

61. If it is warm in Māgha, subnormal temperatures in Jyaiṣṭha and cool breeze in the month of Śrāvaṇa, there will be scanty rain in the rainy season.

62. If there is no lightning in the month of Caitra, some rain occurs in the beginning of Vaiśākha, very hot in Jyaiṣṭha there will be very good rainfall in the rainy season.

63. Cold conditions in Caitra, hailstorms in Vaiśākha and clear skies in Jyaiṣṭha foretell good monsoon rains.

64. If it is warm in Pauṣa and cold in Vaiśākha there will be some rains in Āṣāḍha and no rains in Śrāvaṇa and Bhādrapadā.

65. Some rains when the sun enters Kṛttikā, hot weather when the sun is in Rohiṇī, no winds when the sun enters Mṛgaśīrṣa and appearance of winds when he leaves it, some showers and light wind when the sun is in Ārdrā and absence of wind when the sun is in Punarvasu are all indicative of prosperous conditions.

66. Clear sky and hot weather when sun moves through the asterism Rohiṇī is indicative of good rainfall during the subsequent monsoon season.

67. Jupiter, Venus, moon and Mercury are auspicious planets. Saturn, Mars and sun are ferocious planets. Venus always favours (aids) rainfall. Mars acts against rainfall. Principally, these two determine the rainfall at a place. The other planets aid either of them. By nature Mercury and Saturn produce winds, Venus and Jupiter produce water (rain) and Mars and sun produce heat.

68. Saturn moving through the asterisms Hasta, Svātī, Bharanī, Ārdrā, Śrāvaṇa, and Pūrvaphalgunī brings rains but produces scanty rain when moving through Āśleṣa, Śatabhiṣaj, Jyēṣṭhā, and drought when moving through Mūla, Revatī and Uttarabhādrapadā. It stops rain when moving through Citrā, Viśākhā Anurādhā, Pūrvāṣāḍhā, Dhanīṣṭhā, Punarvasu, Maghā and Puṣyā.*

69. Jupiter moving through Bhādrapadā, Āśleṣa, Puṣyā, and Punarvasu brings in drought, moving through Kṛttikā, Rohiṇī, Viśākhā and Anurādhā brings in moderate rain, and moving through Maghā, Phalgunī, Hasta, Mṛgaśīrṣa and Ārdrā brings in good rains. (Again this represents one school only).

70. Venus moving in the northern vīthis (saumyavīthis) produces lot of rains and moving in the southern vīthis (āgneya vīthis) destroys crops.

71. During the rainy season if Mars moves ahead of the sun, there will be drought, if Venus is ahead of the sun there will be rains, if Jupiter is ahead of the sun, the weather will be hot and if Mercury is ahead of the sun, winds will occur.

72. Conjunctions of the sun and Mars, Saturn and Mars, Jupiter and Mars result in drought. Conjunctions of Mercury and Venus and Jupiter and Mercury give rains.

73. Venus, Mercury and Jupiter in conjunction and uninfluenced by other planets is indicative of abnormally heavy rain.

* This represents only one school. There are other schools which differ from this.

74. Equal volumes of water from well, tank and river at a place are weighed on the Āṣāḍha Pūrṇimā day. If well water is the most dense, it indicates scanty rain in the ensuing rainy season. If the river water is the most dense, it is indicative of moderate rain and if the tank water is so, it is indicative of very good rains.

75. Four pots filled with water are placed in the four directions beginning with north and are named after the months beginning with Śrāvaṇa in the dextral order on the day the moon passes through the asterism Rohiṇī in the dark half of Āṣāḍha. The amount of rain in the various months will have to be guessed from the quantity of water left in the pots at the end of fifteen days.

Many of the above rules have been taken out from the collection presented by Madhusudan Ojha. Some of these have been extracted directly from the original texts. Madhusudan Ojha, a noted scholar of Jaipur, has presented in an orderly way hundreds of these rules in his book *Kādambinī*³ after collecting them from many original texts. The author has verified many of them with the original texts available to him. We shall take up the discussion of these rules in a subsequent paper.

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(iii) Dhuniram Tripathi, *Prācyabhāratīyam Rtuviññānam*, Saraswati Bhavan Studies, Vol. XIX, Varanasi, 1971 ; Many quotations from original texts are found in this thesis.