International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 11, 2019, pp.-8595-8598.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

ASTROMETEOROLOGICAL RELATIONSHIP BETWEEN PLANET AZIMUTH AND CYCLONE EVENTS IN BAY OF BENGAL

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Received: June 02, 2019; Revised: June 10, 2019; Accepted: June 12, 2019; Published: June 15, 2019

Abstract: Astrometeorology is a great science gifted by our ancestors, provides opportunity to predict accurate weather in advance without time limit. In Tamil Nadu Agricultural University (TNAU), Astromet weather forecast rules for rain and wind speed were already defined. In continuation of Astromet research on rainfall and wind speed, identification of Astromet rules for the extreme weather events particularly Cyclone events had been taken up during 2018-19 at Agro climate Research Centre, TNAU, Coimbatore. Six hourly cyclone data observed from 1990 to 2016 over Bay of Bengal (BOB) were correlated with the ephemeris developed for the same period in Alcyone ephemeris calculator. The results of the study inferred that the cyclone events were concentred between the azimuth range of 61-120 and 240-300, irrespective of planet positions. The planets *viz*., Uranus, Mars, Saturn, Neptune and Jupiter had higher influence on cyclone events than other planets. In the above said azimuth, the Depression category events were highly influenced by the planets *viz*., Uranus (67.9%), Mars (66.4%), Saturn (66.1%), Neptune (65.9%), and Jupiter (65.3%). The Deep Depression category events were highly influenced by Jupiter (67.6%), Saturn (66.8%), Uranus (65.6%), and Mars (64.9%). The cyclone storm events were influenced by the planets *viz*., Neptune (70.1%), Saturn (69.4%), Uranus (68.6%), Moon (68.0%), and Jupiter (67.4%), whereas the influence on Severe Cyclonic Storm category was by the planets *viz*., Moon (74.6%), Uranus (71.0%), Saturn (68.4%), Mercury (66.8%), and Mars (66.3%) under the above said azimuth range. The earlier Astromet study also inferred the influence of Moon, Saturn and Neptune on rainfall events and Mercury, Mars, Uranus and Saturn on wind speed events under same azimuth. Since, the cyclone is a combination of wind and rainfall, these planets also have good influence on the cyclone events. The conclusion derived from the investigation is that the planets have good influence on cyclone events at varied levels. Most of the cyclone events (59 to 75%) were observed between the azimuth range of 61-120 and 241-300 degrees of cyclone influencing planet such as Saturn, Uranus, Moon, Mercury, and Venus.

Keywords: *Astrometeorology, Extreme weather events, Cyclone, Planet azimuth*

Citation: Sankar T., *et al*., (2019) Astrometeorological Relationship between Planet Azimuth and Cyclone Events in Bay of Bengal. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 11, pp.- 8595-8598.

Introduction

Indian agriculture is bestowed with varied climatic and monsoonal behaviours. Tamil Nadu is having still better climate with surrounding sea on all its three sides. Except few districts, Tamil Nadu receives major portion of its rainfall during North East Monsoon (NEM). Unlike South West Monsoon (SWM), the NEM is highly unpredictable, particularly characterized with cyclonic storms from Bay of Bengal (BOB). Tropical cyclones are the important rainmakers, provides over 25 percent of rainfall in India and Southeast Asia [1]. Indian sub-continent is the worst affected region of cyclone; nearly 10% of world's tropical cyclone occurs on its coastal line of 7516 km. An average of 370 million people is affected to cyclone annually in India [2]. On the other side, weather scientists are working continuously to provide accurate weather information and warnings to safeguard the life on earth and assets. Even after technological advancement, the numerical weather forecast accuracy is not increasing beyond 80 percent and searching for alternate method of weather forecasting. The integrating mechanism of both traditional and scientific weather forecasting system could help to understand the uncertainties and it serves a basis for decision making processes by farmers [3]. The astrometeorological rainfall prediction based on Panchangs at Varanasi had the accuracy of 75 to 78 percent [4]. According to Shankar *et al*., 2008 the mathematical science based astrological science could help to improve the weather prediction with more accuracy [5]. Astrometeorology is gifted by our ancestors, a glorious science during the past and followed by Indians from Vedic period onwards.

Planetaries movement and weather dealing science is well known as astrometeorology and it is still practiced today. Many village level Astrologers (Pandits) are still predicting highly accurate weather with planet movements. Nakshatra-charan wise rainfall prediction had the forecast accuracy varied between 42 to 73 percent for various zones of Gujarat [6]. Stars or planets movements are in well-defined path and hence, their influence on earth could also be predicted in advance for year together. Unlike other methods of weather forecasting, astrological method has no restrictions on time period. According to Arulprasad *et al*., (2016) the daily rainfall forecast through Astrometeorology showed the highest forecast accuracy of 74-87 percent. He noted that the integration of astrometeorology, numerical weather forecasting and probability methods increased the accuracy more than individual methods [7]. Astrometeorology based hourly rainfall and wind speed forecast rules were defined at Tamil Nadu Agricultural University (TNAU) during 2015-18 [7, 8, 9, 10]. In continuation of those studies, Astrometeorological relationship between planet azimuth and cyclone events in Bay of Bengal (BOB) was under taken at Agro Climate Research Centre, TNAU, Coimbatore and the results of individual planets azimuths on cyclone events are presented in this paper.

Material and Methods

Study Area

The Bay of Bengal (BOB) is located on northern part of Indian Ocean, south and eastern boundary of Tamil Nadu, Andrapradesh, Orissa and West Bengal.

Table-1 *Category wise cyclonic events used in this Astromet study*

SN	Weather systems	Wind speed km/hour
1.	Area of Low pressure	< 31
2.	System of Depression (D)	31 - 49
3.	Deep Depression (DD)	50 - 61
4.	Cyclonic storm (CS)	62 - 88
5.	Severe cyclonic storm (SCS)	89 - 117
6.	Very Severe cyclonic storm (VSCS)	118 - 166
7.	Extremely severe cyclonic storm (ESCS)	167 - 221
8.	Super cyclonic storm (SUCS)	> 222

Table-2 *Azimuth frequency (%) of cyclone events category D (1990 to 2014)*

Planets	61 – 90	91 – 120	61 – 120	241 – 270	271 - 300	241 - 300	All
Sun	18.1	16.4	34.5	9.5	9.6	19.1	53.6
Mercury	18.2	19.0	37.2	12.9	9.4	22.3	59.5
Venus	19.6	18.7	38.2	13.8	11.3	25.1	63.3
Moon	17.5	15.2	32.7	15.1	16.3	31.4	64.1
Mars	19.2	17.2	36.4	14.3	15.7	30.0	66.4
Jupiter	15.6	16.7	32.3	16.8	16.2	33.0	65.3
Saturn	19.1	14.5	33.6	14.4	18.1	32.5	66.1
Uranus	8.6	23.1	31.8	26.4	9.8	36.2	68.0
Neptune	4.6	25.6	30.2	30.8	4.9	35.7	65.9

Table-3 *Azimuth frequency (%) of cyclone events category DD (1990 to 2014)*

Planets	61 – 90	91 – 120	61 – 120	241 – 270	271 - 300	241 - 300	All
Sun	13.8	17.6	31.4	10.8	11.7	22.5	53.9
Mercury	15.0	19.4	34.4	16.9	11.1	28.0	62.5
Venus	14.5	21.0	35.5	14.9	12.5	27.4	62.9
Moon	16.8	15.9	32.7	14.1	15.6	29.7	62.3
Mars	20.5	15.5	35.9	11.5	17.5	29.0	64.9
Jupiter	14.6	19.7	34.3	20.2	13.2	33.3	67.6
Saturn	18.6	14.0	32.5	14.5	19.8	34.3	66.8
Uranus	7.7	21.8	29.6	26.0	10.0	36.1	65.6
Neptune	4.5	25.6	30.1	29.8	4.2	34.0	64.1

Table-4 *Azimuth frequency (%) of cyclone events category CS (1990 to 2014)*

Planets	61 – 90	91 – 120	61 – 120	241 – 270	271 - 300	241 - 300	All
Sun	11.4	18.7	30.1	17.3	9.4	26.6	56.7
Mercury	11.4	21.6	33.0	21.4	9.5	30.9	63.9
Venus	11.6	19.3	30.9	20.4	8.7	29.2	60.1
Moon	16.6	16.8	33.4	17.9	16.6	34.6	68.0
Mars	17.1	14.3	31.4	13.0	18.1	31.1	62.4
Jupiter	16.0	17.1	33.1	17.4	16.8	34.2	67.4
Saturn	18.4	13.8	32.2	16.8	20.4	37.2	69.4
Uranus	10.2	25.4	35.5	25.0	8.1	33.1	68.6
Neptune	2.4	33.4	35.8	32.2	2.1	34.3	70.1

Table- 5 *Azimuth frequency (%) of cyclone events category SCS (1990 to 2014)*

Planets	61 – 90	91 – 120	61 – 120	241 – 270	271 - 300	241 - 300	All
Sun	15.0	19.7	34.7	13.5	8.8	22.3	57.0
Mercury	10.9	28.0	38.9	18.7	9.3	28.0	66.8
Venus	11.9	23.8	35.8	16.6	9.3	25.9	61.7
Moon	21.2	16.6	37.8	15.6	21.3	36.8	74.6
Mars	18.7	18.1	36.8	18.1	11.4	29.5	66.3
Jupiter	16.6	12.4	29.0	14.5	15.0	29.5	58.6
Saturn	17.1	16.1	33.2	17.6	17.6	35.2	68.4
Uranus	9.9	25.9	35.8	26.4	8.8	35.2	71.0
Neptune	3.1	28.5	31.6	30.6	1.6	32.1	63.7

Table-6 *Azimuth frequency (%) of cyclone events category VSCS (1990 to 2014)*

Planets	61 – 90	91 – 120	61 – 120	241 – 270	271 - 300	241 - 300	All
Sun	9.5	16.9	26.5	15.9	11.6	27.5	54.0
Mercury	11.1	21.2	32.3	20.1	12.7	32.8	65.1
Venus	12.2	22.2	34.4	21.2	12.7	33.9	68.2
Moon	16.4	22.2	38.6	19.6	13.8	33.3	72.0
Mars	14.3	15.9	30.2	15.9	13.2	29.1	59.2
Jupiter	14.8	13.8	28.6	13.8	21.2	34.9	63.5
Saturn	13.2	18.0	31.2	18.5	19.0	37.6	68.8
Uranus	7.4	28.6	36.0	24.3	10.1	34.4	70.4
Neptune	3.7	32.3	36.0	30.7	2.7	33.3	69.3

Table- 7 *Azimuth frequency (%) of cyclone events category ESCS (1990 to 2014)*

Planets	61 – 90	91 – 120	61 – 120	241 – 270	271 - 300	241 - 300	All
Sun	13.8	20.7	34.5	15.5	9.5	25.0	59.5
Mercury	12.9	26.7	39.7	23.3	6.9	30.2	69.8
Venus	12.1	24.1	36.2	21.6	8.6	30.2	66.4
Moon	11.2	15.5	26.7	21.6	11.2	32.8	59.5
Mars	19.0	13.8	32.8	7.8	19.0	26.7	59.5
Jupiter	16.4	14.7	31.0	14.7	13.8	28.5	59.5
Saturn	19.0	20.7	39.7	19.8	13.8	33.6	73.3
Uranus	11.2	24.1	35.3	21.6	12.9	34.5	69.8
Neptune	3.5	26.7	30.2	24.1	5.2	29.3	59.5

The BOB is extended from 8 to 23°N and 78 to 95°E. It is about 1600 km wide and 1900 km long with a maximum depth of 4694 m. The BOB produces a greater number of cyclone events, which are major contributor for rainfall in Tamil Nadu.

Cyclone Data

Historical six hourly cyclone data was the basic data for this study. Totally, twenty seven years (1990 to 2016) of data with cyclone intensity and eye's location were downloaded from IMD website [11]. Based on the intensity of cyclone, the data were grouped in to eight categories *viz*., Low pressure (L), Depression (D), Deep Depression (DD), Cyclonic Storm (CS), Severe Cyclonic Storm (SCS), Very Severe Cyclonic Storm (VSCS), Extremely Severe Cyclonic Storm (ESCS) and Super Cyclonic Storm (SUCS) for the identification of category wise astrometeorological forecast rules and the same are depicted in [Table-1].

Ephemeris and azimuth

Positions of planets or Ephemeris were calculated from observer point's *i.e*, the angle between true north and planets, keeping the observer as origin. In this study, the location of the eye point of cyclone at every six hour was considered as observer point. Planetary position or ephemeris was calculated using Alcyone Ephemeris 4.3v calculator, which is more accurate and high speed calculator of astronomical ephemeris. Azimuth of individual planets at the time of cyclone events were grouped in to 12 azimuth frequencies *viz*., 0-30°, 31-60°, 61-90°, ...331°-360°. Based on this, the azimuth frequency that influence particular Cyclone category was calculated. The entire azimuth frequency calculation was performed in "TNAU Astromet soft". The formulae used for calculating the azimuth frequency was given below and expressed in percentage.

$$Azimuth\ frequency\ \% = \frac{\begin{array}{c}No.\ of\ times\ the\ planet\ positioned\\ in\ the\ same\ angle\ during\\ particular\ cyclone\ category\end{array}}{\begin{array}{c}Total\ number\ of\ cyclone\ events\\ in\ the\ particular\ category\end{array}}$$

Results

Results obtained from the study was grouped in to different category of cyclone events and discussed below. Each planet has displayed different influence on cyclone categories. In general, major influences of planets were concentrated in the azimuth ranged from 61 to 120 and 241 to 300 degrees. The other azimuth of planet's (1 to 60, 121 to 240, 300 – 360 degrees) had very less frequency (<5%) on all the cyclone categories and hence the major influencing azimuths (61 – 120 and 241 to 300 degrees) alone discussed below.

Individual planet azimuth and Cyclone events – Depression (D)

Results obtained for the influence of individual planet azimuth on cyclone event with category of D (Depression) were depicted in [Table-2]. In general, irrespective of planet, Cyclone – D category events were concentrated (53 – 68%) in the azimuth of 61 - 120 and 241 - 300 degrees. The highest to lowest number of depression events were occurred within these azimuths in the order *viz*., Uranus (67.9%), Mars (66.4%), Saturn (66.1%), Neptune (65.9%), Jupiter (65.3%), Moon (64.1%), Venus (63.4%), Mercury (59.5%) and Sun (53.6%).

Individual planet azimuth and Cyclone events – Deep Depression (DD)

Results obtained for the influence of individual planet azimuth on cyclone event with category of DD (Deep Depression) were depicted in [Table-3]. In general, irrespective of planet, Cyclone – DD category events were concentrated (53 – 68%) in the azimuth of 61 - 120 and 241 - 300 degrees. The highest to lowest number of depression events were occurred within these azimuths in the order *viz*., Jupiter (67.6%), Saturn (66.8%), Uranus (65.6%), Mars (64.9%), Neptune (64.1%), Venus (62.9%), Mercury (62.5%), Moon (62.3%), and Sun (53.9%).

Individual planet azimuth and Cyclone events – Cyclonic Storm (CS)

Results obtained for the influence of individual planet azimuth on cyclone event with category of CS (Cyclonic Storm) were depicted in [Table-4]. In general, irrespective of planet, Cyclone – CS category events were concentrated (56 – 70%) in the azimuth of 61 - 120 and 241 - 300 degrees. The highest to lowest number of depression events were occurred within these azimuths in the order *viz*., Neptune (70.1%), Saturn (69.4%), Uranus (68.6%), Moon (68.0%), Jupiter (67.4%), Mercury (63.9%), Mars (62.4%), Venus (60.1%) and Sun (56.7%).

Individual planet azimuth and Cyclone events-Severe Cyclonic Storm (SCS)

Results obtained for the influence of individual planet azimuth on cyclone event with category of SCS (Severe Cyclonic Storm) were depicted in [Table-5]. In general, irrespective of planet, Cyclone – SCS events were concentrated (57 – 75%) in the azimuth of 61 - 120 and 241 - 300 degrees. The highest to lowest number of depression events were occurred within these azimuths in the order *viz*., Moon (74.6%), Uranus (71.0%), Saturn (68.4%), Mercury (66.8%), Mars (66.3%), Neptune (63.7%), Venus (61.7%), Jupiter (58.6%) and Sun (57.0%).

Individual planet azimuth and Cyclone events-Very Severe Cyclonic Storm (VSCS)

Results obtained for the influence of individual planet azimuth on cyclone event with category of VSCS (Very Severe Cyclonic Storm) were depicted in [Table-7]. In general, irrespective of planet, Cyclone – VSCS events were concentrated (54 – 72%) in the azimuth of 61 - 120 and 241 - 300 degrees. The highest to lowest number of depression events were occurred within these azimuths in the order *viz*., Moon (72.0%), Uranus (70.4%), Neptune (69.3%), Saturn (68.8%), Venus (68.2%), Mercury (65.1%), Jupiter (63.5%), Mars (54.2%) and Sun (54.0%).

Individual planet azimuth and Cyclone event–Extremely Severe Cyclonic Storm (ESCS)

Results obtained for the influence of individual planet azimuth on cyclone event with category of ESCS (Extremely Severe Cyclonic Storm) were depicted in [Table-8]. In general, irrespective of planet, Cyclone – ESCS category events were concentrated (59 – 74%) in the azimuth of 61 - 120 and 241 - 300 degrees. The highest to lowest number of depression events were occurred within these azimuths in the order *viz*., Saturn (73.3%), Mercury (69.8%), Uranus (69.8%), Venus (66.4%), Jupiter (59.5%), Neptune (59.5%), Mars (59.5%), Moon (59.5%) and Sun (59.5%).

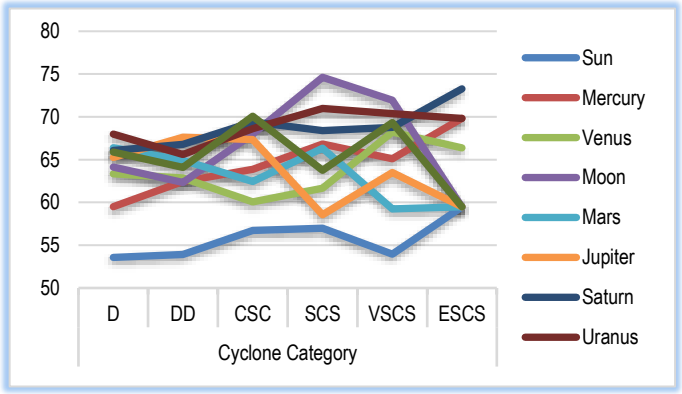

Fig-1 Influence of Individual Planet at Difference Stages of Cyclone

Discussion

The results clearly indicated the varied influence of individual planets and their azimuth on the cyclone categories. The influence of Mercury (Windy planet), the Saturn (Cool planet) and the Uranus had showed increasing trend of influence on cyclone category from Depression to ESCS, whereas the Jupiter and the Mars had showed decreasing trend of influence from Depression to ESCS in the azimuth range of 61 - 120 and 241 - 300 degrees [Fig-1]. Similar results had been obtained by Rathika *et al*., 2018 in astrometeorological study on wind speed that the Mercury, Venus, Moon, Jupiter and Uranus had good influence on wind speed at an increased trend from low to high wind speed in the azimuth ranged between 61 to 120 and 240 to 300 [10]. The influence of moon was increased from Depression to SCS and then decreased with further intensification of cyclone category ESCS, whereas the Venus showed just opposite influence to the Moon, decreased influence from Depression to SCS and then increased towards ESCS. Theo (2006) reported that the increase in moon activity would bring more number

of hurricanes [12]. Balamurali *et al.,* (2017) reported that the heavy rainfall event was highly influenced by Venus, Saturn and Neptune [9]. Most of results from this study have mutually supported the rainfall and wind speed astrometeorological forecast study done earlier at Tamil Nadu Agricultural University.

Conclusion

Astrometeorological investigation on Cyclone events could be concluded that the individual planets and their azimuth had good influence on the cyclone events at varied levels. Most of the cyclone events (59 to 75%) were observed between the azimuth range of 61 - 120 and 241 - 300 degrees of cyclone influencing planet such as Saturn, Uranus, Moon, Mercury, and Venus.

Application of research: Unique methodology for forecasting weather, based on planetary alignments. One reason for this study is that astrometeorology offers no mechanism to explain itself and another is that its methodology is complex and subject to modification depending on circumstances.

Research Category: Astrometeorology

Abbreviations

ACRC Agro Climate Research Centre
BOB Bay of Bengal
CS Cyclonic Storm
D Depression
DD Deep Depresion
ESCS Extremely Severe Cyclonic Storm
IMD India Meteorological Department
km/hr kilometre/ hour
NEM North East Monsoon
NCRMP National Cyclone Risk Mitigation Project
SWM South West Monsoon
SCS Severe Cyclonic Storm
SUCS Super Cyclonic Storm
VSCS Very Severe Cyclonic Storm

Acknowledgement / Funding: Authors are thankful to Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, India.

***Research guide or Chairperson**: Dr Ga Dheebakaran
University: Tamil Nadu Agricultural University, Coimbatore, 641003
Research Project Name: MSc thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore, 641003

Cultivar / Variety / Breed name: Nil

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Wada A. and Usui N. (2007) *Journal of Oceanography*, 63(3), 427-447.
[2] National Cyclone Risk Mitigation Project (NCRMP). Web: https://ncrmp.gov.in/cyclones-their-impact-in-india/
[3] Ngugi R. K. (2011) *International Journal of Current Research*, 3(11), 006-012.
[4] Mishra S., Dubey V., & Pandey R. (2002) *Asian Agri-History*, 6(1), 29-42.
[5] Shankar K.R., Maraty P., Murthy V., & Ramakrishna Y. (2008) *Director, Central Research Institute for Dryland Agriculture, Santoshnagar, Saidabad, Hyderabad, 59, Indigenous rain forecasting in Andhra Pradesh*, ISBN: 9788190436052.
[6] Varshneya M.C., Vaidya V.B., Vyas Pandey Shekh A.M. and Karande B.I. (2008) *Journal of Agrometeorology*, 10(2), 345-348.
[7] Arul Prasad S. (2016) *M.Sc Thesis at Agro Climate Research Centre, TNAU, Coimbatore* -03.
[8] Dheebakaran Ga., Arulprasad S., Kokilavani S., & Panneerselvam S. (2017) *Journal of Agrometeorology, 19, Special issue, 205*.
[9] Balamurali Dheebakaran Ga., Kokilavani S., & Panneerselvam S. (2017) *M.Sc Thesis at Agro Climate Research Centre, TNAU, Coimbatore*-03.
[10] Rathika K (2018) *M.Sc Thesis at Agro Climate Research Centre, TNAU, Coimbatore* – 03.
[11] India Meteorological Department (IMD) www.rsmcnewdelhi.imd.gov.in
[12] Theo (2006) http://theweatherforums.com/