RJC
Estd. 2008

RASĀYAN *J. Chem.*
Vol. 8 | No.1 |56-58 | January - March | 2015
ISSN: 0974-1496 | e-ISSN: 0976-0083 | CODEN: RJCABP
http://www.rasayanjournal.com
http://www.rasayanjournal.co.in

RAIN PREDICTION USING ENVIRONMENTAL DATA

S. Meganathan, T.R. Sivaramakrishnan, R. Bala Krishnan and N. Rajesh Kumar

SASTRA University, Srinivasa Ramanujan Centre, Kumbakonam, Tamilnadu, India
*E-mail: vsmnathan@gmail.com

ABSTRACT

Satellite is a remote sensing tool for observations in meteorological fields. Prediction of rain occurrence of a specific location, called 'spot rainfall forecast' is gaining importance in meteorological service. A method of forecast of rainy day using only satellite images for a few sample stations in south India by data mining technique was tried and the results are presented here.

Keywords: Pattern classification, Satellite images, Weather prediction

INTRODUCTION

Station specific forecast of weather is gaining importance nowadays as many activities like sports, national events, industry, cultural affairs and similar activities require the same. Recently Sivaramakrishnan and Meganathan[1-3] have suggested some methods of spot forecasting using 'in situ' data only. Data mining has been found to be a successful tool[4-10] in this regard. They have used ground based instrumental observations. However remote sensing tools like radar and satellite are liberally used in meteorological data recording and the data was found to be useful in understanding weather systems and climatology.[11-14] Satellites observe the presence or otherwise of the clouds over any location and get a bird's eye view of clouds. Besides other details like cloud motion vectors, quantitative precipitation estimate, vertical profile of temperature and humidity are also derived nowadays. Hence satellite imagery is found to have many applications in weather forecasting.

EXPERIMENTAL

During Northeast (NE) monsoon season of October, November and December convective clouds form over the Bay of Bengal and drift over the east coast of peninsular India giving good amount of rainfall[16] in Tamilnadu State. The potential of satellite imagery for rainfall estimate can be used using the intensity scale. Indian satellite KALPANA-1 send regular cloud pictures at certain predetermined intervals. The pictures received at 4, 9 and 12 hrs IST called early morning, morning and noon respectively during the season in 2013 have been taken as the input for analysis. Because it is the experience of operational forecasters that rainfall[17-18] in this area during the season is dominantly during early morning and forenoon hours[15]. The test sites selected are Chennai[19-20] (Lat 13° 11' N | Long 80° 11' E), Nagapattinam (Lat 10° 46' N | Long 79° 50' E), Kanyakumari (Lat 8° N | Long 77° E) and Pamban (Lat 9° 17' N | Long 79° 12' E). These sites are along east coast. As a sample inland site Tiruchirappalli (Lat 10° 46' N | Long 78° 43' E) was considered. The locations are shown in Figure-1 and sample satellite imagery in Figure-2.

Occurrence of rain was also considered on all these sites and the digital image of clouds in the said three timings (4am, 9am, and 12 Noon) was considered. The satellite image is a Joint Picture Expert Group (JPEG) type with dimension of 1024 × 1024 and its size is 1.12 Mbytes. Now identify the latitude and longitude of image to locate the specific sites. The image is cropped. The cropped image is a portable graphics network (.png) type with dimension of 100 × 100 and its intensity 8 dpi. The cropped image covers about 25 sq. Kms (5 ×5) over the station. The cropped images of three sample stations shown in Figure-3. By using SciLab 5.4.1 tool the cropped image is converted into pixel intensities. The intensity

value ranges from 0 to 255. Based on the threshold value the algorithm indicates the possibility of the rainy day or non rainy day.

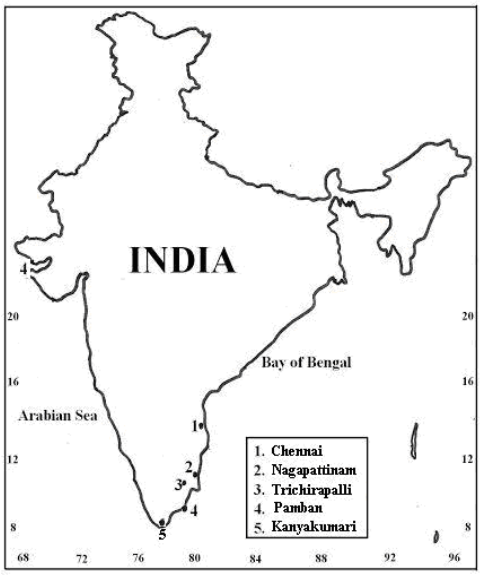

Fig.-1: Station locations under study

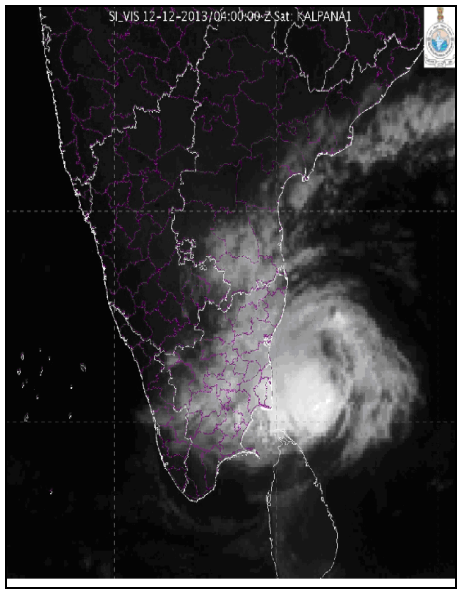

Fig.-2. Input image from the satellite KALPANA-1

(a)Nagapattinam (b)Tiruchirappalli (c)Pamban

Fig.-3: Cropped image for sample stations

Algorithm for rainy day prediction using Satellite Images (ARDPSI)

The proposed procedure for the rainy day prediction using satellite image finds the occurrence and non-occurrence of the wet day with the parameters location, time and intensity values of the cropped image. The proposed algorithm demonstrates the prediction techniques for pattern classification and weather prediction. This mechanism identifies the source image from the "South India sector of satellite KALPANA-1" and crop the image according to latitude and longitude. This operation identifies circumstance of the local station around 25 square kms approximately. The algorithm for rainy day prediction using satellite images (Figure- 4) finalizes the density parameter and compares the density values of cropped image with density parameter to declare the occurrence of rainy day.

RESULTS AND DISCUSSION

After applying ARDPSI procedure the wet day (rainy day) and dry day (non rainy day) actually occurred were compared with predicted wet and dry days. The results are shown in Table-1. It is seen that success rate percentage is reasonably good. Compared to results using noon satellite imagery, prediction using early morning and morning images are high. Prediction based on previous day's imagery is also satisfactory (60% or more).

CONCLUSION

The implementation offers a pattern classification image technique for rainy day prediction using satellite images during October, November and December for this part of the country. The method is useful for locations where there is no meteorological observatory. The point to note here is that the satellite imagery is easily available in 'internet' and hence no investment towards collection of data or equipment is needed. This methodology may work for regions where cloud formation and growth mechanisms are similar.

Table-1: Success rate of wet / dry day prediction on Northeast monsoon

Station Name	Wet / dry day prediction					
	Early Morning (4 am)	Morning (9 am)	Noon (12 00)	24 hour Early Morning	24 hour Morning	24 hour Noon
Chennai	72.22%	60.69%	59.98%	59.55%	59.25%	63.01%
Kanyakumari	73.33%	75.61%	65.75%	71.91%	67.90%	68.49%
Nagapattinam	75.56%	73.10%	64.38%	61.79%	66.67%	63.01%
Pamban	67.78%	65.85%	64.01%	61.10%	62.96%	57.53%
Trichy	77.17%	73.17%	68.49%	71.43%	65.43%	70.27%

Input:

1. Satellite Image (SI)
2. Stations
3. Longitude and Latitude
4. Density Parameter (DP)

Output:

1. Predictive Occurrence (PO)

Algorithm

Step 1: Identify the Satellite Image SI.
Step 2: Apply the Longitude and Latitude on the SI to identify the station.
Step 3: Locate the station at deeper level around 5 square kms.
Step 4: Crop the SI with respect to the station.
Step 5: Generate the intensity values from the cropped image.
Step 6: Apply the DP on the intensity values to obtain the PO value.
Step 7: The PO value offers the predictive result that may either be a rainy or Sunny day.

Fig.-4: Algorithm for Rainy Day Prediction using Satellite Images (ARDPSI)

REFERENCES

1. S. Meganathan, T.R. Sivaramakrishnan, *Mausam*., **66**, 33(2015).
2. S. Meganathan, T.R. Sivaramakrishnan, *Res. J. of App. Sci., Eng. and Tech.,* **5**, 3692 (2013).
3. S. Meganathan, T.R. Sivaramakrishnan, *J. of Theo. and App. Inf. Tech.*, **34**, 173 (2011).
4. S. Meganathan, T.R. Sivaramakrishnan, *Res. J. of App. Sci., Eng. and Tech.,* **35**, 169 (2012).
5. T.R. Sivaramakrishnan, S. Meganathan, *Archives Des Sciences*., **65**, 8 (2012).
6. T.R. Sivaramakrishnan, S. Meganathan, *Res. J. of App. Sci., Eng. and Tech.,* **4**, 1899 (2012).
7. B. Yubin Yanga, Hui Linb, Zhongyang Guob, Jixii Jiangc, *Comp. & Geosciences*., **33**, 20 (2007).
8. C. Vaduva, D. Faur, Gavat I, *8th Int. Conf. On Comm.,* 5509002, 173 (2010).
9. Muhammad Shahbaz, Aziz Guergachi, Aneela Noreen, and Muhammad Shaheen, *Proc. of the World Cong. on Eng*., **1**, 406 (2012).
10. Chengjun Guo., Yunlong Teng, *Lect. Not. In Com. Sci.,* **6677**, 416 (2011).
11. S. Raghavan, T.R. Sivaramakrishnan, B. Ramakrishnan, J. *Atmos. Sci.*, **40**, 428 (1983).
12. T.R. Sivaramakrishnan, B. Ramakrishnan and V. Ramasamy, *Mausam.* **36**, 120 (1985).
13. S.R. Kalsi, *India Meteorological Department*, (2002).
14. D.K. Mishra, S.R. Kalsi and R.K. Jain, *Mausam.* **39**, 19 (1988).
15. T.R. Sivaramakrishnan, K. Prakasam, *Vayumandal*., **22**, 116 (1992).
16. R. Varahasamy, *Rasayan J.Chem*., **7(3)**, 264 (2014).
17. M. Harish, *Rasayan J.Chem*., **3(4)**, 705 (2010).
18. A. Begum, S. Harikrishna and I. Khan, *Rasayan J.Chem*., **1(4)**, 856 (2008).
19. N.R. Prasad and J.M. Patil, *Rasayan J.Chem*., **1(4)**, 943 (2008).
20. N. Raman and D. Sathiyanarayanan, *Rasayan J.Chem*., **3(3)**, 539 (2010).

[RJC-1198/2015]