Volume 4, Issue 10, October 2014 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

Application of Geo-Informatics for Assessment and Monitoring of Hails Storm Affected Area

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Abstract: ***The weather linked extreme disastrous events such as storms, high winds, heat and cold waves, heat stress and cyclone are becoming more pronounced and recurring to same areas with regular interval. Extent of affected areas increases in recent years. The damages associated with unseasonal storm directly impairment the agriculture produce, fixed possessions and livelihood by means of falling hailstone, high winds and torrential rains, which also alter the socio-economic status of affected areas. For immediate assessment of affected areas Government agencies needs quick, accurate and reliable technology results for the release of aids and performing relief operation in the affected areas. The continuous monitoring capability of geo-stationary meteorological satellites provides the real time data of dynamic weather events. The METEOSAT provides six hourly data as the free public domain, which helps in continuous monitoring and assessment of natural weather calamities. The infrared and water vapor band of METEOSAT were useful for demarcation of affected area.***

The present study was carried out for the Eastern districts of the Vidharbha region of the Maharashtra (India). In this study freely available METEOSAT images were used from free domain. These METEOSAT images were processed in Arc Map 9.2 and ERDAS IMAGINE software. Six hours images were taken for the monitoring of the area and overlay operation was carried out using Arc-GIS 9.2. From analysis it is resulted that Armori and DhanoraTahsil of Gadchiroli district were affected by storm.

This kind of work is helpful for decision makers, corporates and insurance sector persons. The multisource coupled data analysis especially of optical satellite remote sensing data of suitable resolution will be help to depict the precise damage assessment occurred in agriculture and allied industries.

Keywords— Geo-informatics, Crop Insurance, Meteosat, and Storm

I. INTRODUCTION

The climate of India is dominated by the summer monsoon (June to September). The entire year is, however, divided into four season: (i) Winter (December to February) (ii) Pre-monsoon or Hot Weather season (March-May) (iii) Southwest or Summer Monsoon season (June - September) (iv) Post monsoon season (October - November). Year to year deviations in the weather and occurrence of climatic anomalies / extremes in respect of these four seasons (U.S.De *et. al*. 2005)

(i) Cold wave, Fog, Snowstorms and Avalanches
(ii) Hailstorm, Thunderstorm, Dust storms and Heat wave
(iii) Tropical cyclones, Tidal waves, Heavy rain, Floods, Landslides and Droughts
(iv) Rains from northeast or return monsoon.

Hailstorm may refer to any storm that produces hailstones that fall to the ground. It is usually used when the amount or size of the hail is considered significant generally bigger than the size Pea or Peanut. Over Indian continent, temperature regime start transforming from south to north from mid of January; which push the cold winter northward, the frontal zone of hot and cold winds widen the scope for developments of storms at the juncture of fronts. This condition begins from middle of February over central and southern India and last long up to the end of winter season followed by intermittent storm events up to the commencement of monsoon season. Normally, occurrence of storms over any area is in the evening hours and persists for short duration. It complete life cycle within span of 3-4 hours with stormy winds, rainfall and hailstones of varied size. The short time span needs much attention to monitor and forecast of such events is bigger challenge in Indian subcontinent. Subsequently; confirmations and assessments of affected area is tricky job for different Government line department and officials.

The damages associated with short nature weather events directly hit the agriculture produce and indirectly to fixed possessions, livelihood by means of hailstone, high winds and torrential rains, which also alter the socio-economic status of affected areas. Normally, all the major winter crops were in crucial growth phases and majority of short duration variety of important winter crops touches the maturity phase from the middle of February month to March. These extreme events put agro based industries in heavy losses in terms of quality degradations and low food grain production.

Some of the historic reviews focused on the extreme events in several part of country. During February 2007, most parts of the state of the Rajasthan state in NW India were badly hit by hailstorm and authorities announced a relief package of US $ 3.78 millions for the hailstorm-affected farmers. (Jyoti Bhardwaj *et.al*. 2007).The hailstorm frequencies

are highest in the Assam valley, followed by hills of Uttar Pradesh now known as Uttaranchal, South Bihar (now known as Jharkhand) and Vidarbha in the eastern parts of Maharashtra (Philip and Daniel 1976).

Crop insurance is important tool; by which farmers can stabilize farm income, investment and produce/product against crop losses due to natural weather calamities and secure livelihood this support the farmers to initiate production activity after bad agriculture year. In recent years crop insurance sector is playing vital role in the stable growth of agriculture sector and recovering the losses in abnormal weather events and providing security for expansion of agriculture and agro-industry in broader sense.

E-Governance or Electronic Government is a diffused neologism used to refer to the use of information and communication technology to provide and improve government services, transactions and interactions with citizens, businesses, and other arms of government. (Wikipedia). The advancement in information technology with easy availability and access to internet or web world shrink the route between source and final user. This techno based dissemination of information widens the scope for day to day activity monitoring over the various administrative setup of Government.

II. STUDY AREA

Eastern Vidarbha comprises of four major districts of Maharashtra state of India namely Bhandara, Gondia, Chandrapur and Gadchiroli. The Bhandara and Gondia share northern boundary with Madhya Pradesh, while Eastern Gondia with Chattisgarh state. Similarly, Southern boundary of Chandrapur and Gadchiroli touches Andra Pradesh and eastern Gadchroli with Chattisgarh states. The north south extension of study area is in between 18°40'23.876" N 21°37'42.822" N that of east west range from 78°48'0.941" E to 80°54'0.262" E.

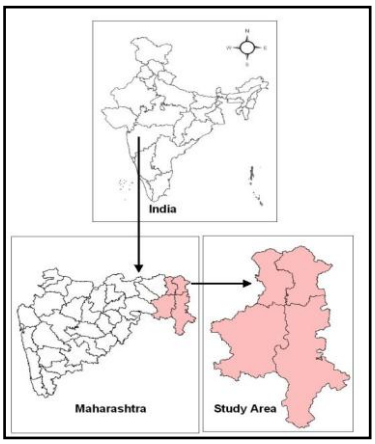

Fig.1: Location map of the study area.

III. MATERIAL AND METHOD

The required open source Meteosat-7 data had been downloaded from the website www.sat.dundee.ac.ukwhich is available in three different bands viz. Visible, Infrared (IR) and Water vapor (WV) at six hours interval in JPEG format. The acquisitions time of data is 00:00, 06:00, 12:00 and 18:00 UTC hours, which is equal to 05:30, 11:30, 17:30 and 23:30 hours IST respectively. The globally this open source data available in eight sectors for download purpose, Indian sub-continent covered in South-Asian Sector. The infrared and water vapor band images were used for this study.

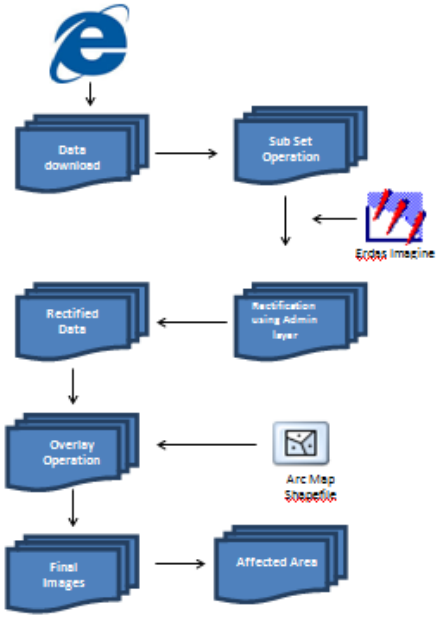

Fig.2: Methodology flowchart of the study

Data Sub-setting and Rectification:

The Meteosat-7 data was subset and rectified using Erdas Imagine Software. The vector data of India with all administrative state boundaries was used to create a base rectified image of Meteosat-7. The base image was further used for rectification. The overlay operation with state, district and tahsil boundaries was carried out using Arc Map 9.2 software with LLC projection. Fig. 2 shows the methodology adopted for this study.

IV. RESULT AND CONCLUSION

The WV channel detects thermal radiation from the water vapor in the middle layer of the atmosphere. During winter and summer seasons, major part of Indian landmass and ocean is warm and start progressive heating from February onward, such warm/hot areas were appeared in gray to dark black pixel as per the degree of hotness in IR band that of water vapor bands shows dry areas in shades gray to black and most in white color in jpeg format.

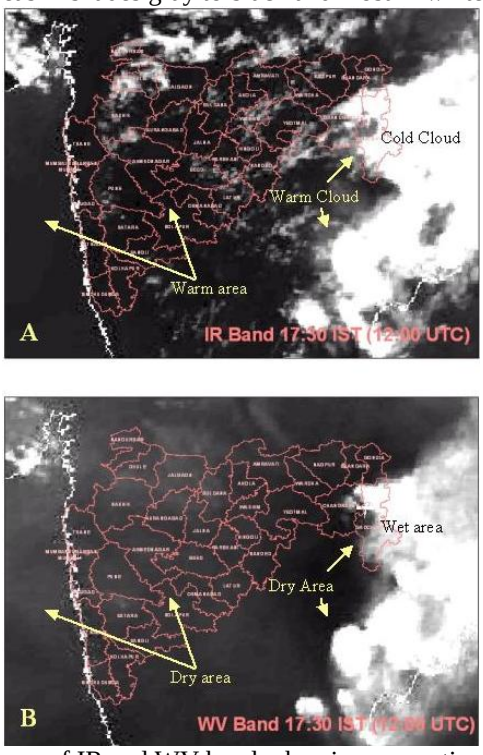

Fig.3: Comparative images of IR and WV bands showing properties of cloud and moisture.

The overly procedure was carried out for all six hourly IR and WV images acquired on 05th April 2008. The extent of cloud cover and moisture spread in IR and WV bands respectively over Maharashtra state and adjoining areas at 00:00, 06:00, 12:00 and 18:00 UTC hours depicted in Fig. 3 and 4.

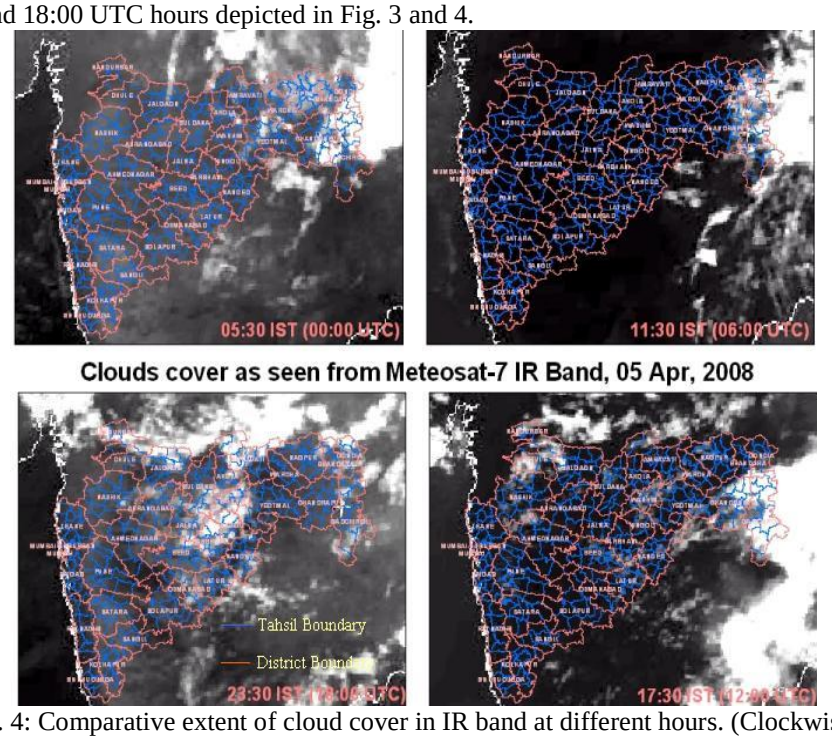

Fig. 4: Comparative extent of cloud cover in IR band at different hours. (Clockwise)

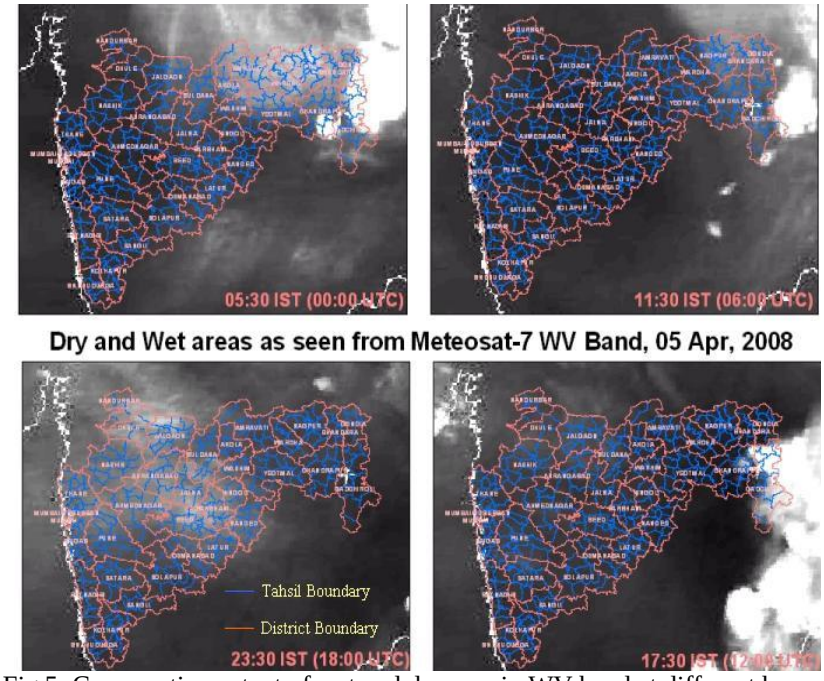

Fig.5: Comparative extent of wet and dry area in WV band at different hours.

The synoptic view of cloud cover over Maharashtra and adjoining area show a clump of warm and cold clouds gathering above eastern part (00: 00 UTC hours) which move further eastward in next six hours (06:00 UTC hours). The 12.00 UTC image shows dense cloud over Chandrapur, Gadchiroli and southern parts Gondia in east and border areas of Dhule, Nandurbar and Nasik districts in west Maharashtra. In another six hours, a strip of warm and cold cloud cover stretches along the northern boundary of state, small cloud extend noticed over the entire Washim, northern Parbhani and Hingoli, southern Buldana and Beed along few patches over Osmanabad districts.

The extent of wet areas as bright white patch over Maharashtra state observe in images of 00:00, and 12:00 UTC mainly in eastern part, fair spread over west Vidarbh and sparse moisture extended in NW-SE direction above central part of state at 18:00 UTC hours, remaining area was completely dry as it appear in black. The image of 12:00 UTC was important for storm demarcation; it shows the strong activity over N-NE region of study area and fair extent of moisture in eastern and southern part of Gadchiroli district.

The tahsil overlay resulted that the Armori and Dhanora were intensely affected, along with south part of Kurheda and south part of Korchi, east part of Etapalli tahsils of Gadchiroli district along with adjoining north part of Bhrampuritahsil of Chandrapur district.

V. CONCLUSION

The repetitive coverage of optical sensors and continuous scanning ability of weather satellite facilitate round the clock monitoring and quick analysis of affected hail storm affected areas. The synoptic presentation of study area helps the Government officials for better decision-making and implementations of various schemes for society within the given frame of time. The present study shows very good and real time results for monitoring and assessment of hails storm affected area. Government agencies and policy makes can adopt such methodology for handling real time cases.

ACKNOWLEDGMENT

Authors are thankful to the Director, Maharashtra Remote Sensing Application Centre, Nagpur for providing necessary facility for this study.

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