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Village Information Systems - Prediction of weather for the benefit of farmers

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Abstract: The main objective of this research is to provide weather information for decision-making based on capabilities of Village Information Systems (VIS). Using these facilities, the volunteers are able to create query, print personal documents, weather data and important agricultural interactive maps for the benefit of villagers. 19 VIS [9 in Nellore and 10 in Kadapa districts of Andhra Pradesh, India] are established to monitor two (wet over Nellore and dry over Kadapa region) divergent climatic zones in a very close range of about 150 km with a distinctive and varying weather characteristics such as temperature, humidity, pressure, rainfall and etc. and for which two Automatic Weather Stations (AWS) were operated for 16-months (October 2009 to February 2011), the reliability of the Kiosks services are found to be around 90%. The data of the VIS have been tested for Disaster preparedness management scheme to minimize the adverse effects of natural disasters/hazards, for example, tropical cyclone, JAL formed in the Bay of Bengal (BoB) from 4 to 7 November 2010. Normally, the coastline districts of Andhra Pradesh are affected by cyclones and floods, whereas JAL cyclone caused heavy rainfall over the Rayalaseema region also. To provide accurate weather forecast information AQUA satellite Outgoing Long wave Radiation (OLR), Constellation Observing System for Meteorology Ionosphere and Climate (COSMIC), Chennai S-band Doppler Radar images, YVU-Kadapa Micro Rain Radar (MRR), Parsivel disdrometer, Radiosonde, Kadapa and Nellore Automatic Weather station data are also utilized.

Keywords: Meteorological parameters, Village Information System, AWS, JAL cyclone and Weather Research Forecasting(WRF).

I. INTRODUCTION

The rural areas in India cannot be compared with its urban areas, where needs and service requirements are at a very different level. With poor existing infrastructure in the rural areas, the delivery of services of essential requirements becomes in itself a formidable task in the 6,40,000 villages spread out in every type of agro-climatic zones. Kadapa district is located in the semi - arid zone and often experiences drought, which receives scanty rainfall with annual average rainfall much below the National average. This is a backward district with diverse socioeconomic problems like lowest literacy rate, migrations, extreme poverty, etc. The ground water level is at 600-900 feet below the earth's surface in many areas of Andhra Pradesh, more especially, in Kadapa, Chittoor and Anantapur districts. Over Kadapa district, the ground water level never reaches to expected levels even in the monsoon seasons due to scanty rainfall and poor seepage conditions. Under these conditions, only drought prone plant species alone survive resulting in the decrease of forest cover. In summer, the maximum temperature reaches ~46^{0}C and above. These semi-arid conditions result in desertification. Many predict that total desertification is not very far.

The Nellore district climate is savanna (tropical wet and dry) region. The tropical wet and dry climate is characterized by persistently high temperature in the coolest month and dry winter. Further, another feature of this climate is the long dry period that spreads over winter and early summer. The Mean monthly temperature is above 18^{0}C during the winter season. In the summer before the onset of rains is very hot, particularly in the interior low level areas where in the month of May maximum temperature may increase up to 46^{0}C and sometimes even up to 48^{0}C. Nellore District is located in the east coast of India at least couple of cyclones may affect this region every year.

Hence it necessary to uplift the lifestyle of unprivileged people from the Kadapa and Nellore district village community and bring them in the main stream of development by providing necessary support. Weather is a vital factor to the success of agriculture, research and education, routine life, and many other activities around the world. To increase the productivity of farming, it is essential to know the light, temperature, moisture, sunshine, radiation level, rainfall and other conditions. The data is deemed essential as solar radiation and temperature have a direct impact on ambient humidity and affects the quality of crop, so measurements of these conditions are crucial. Considering the emerging requirement of the society under dynamical changing climatic conditions reliable weather forecast is inevitable. For agricultural needs agro-meteorological data is required for good yield of food grains during Kharif and Rabi seasons. For every day divergent weather conditions in dry and wet regions like Kadapa and Nellore district collection of 1-min data of temperature, pressure, humidity, wind speed wind direction and rainfall is required. Thus the need of the hour is Village Information System which can provide the above crucial information for the village community. Several parameters need to be taken into consideration while creating a village information system (VIS) but due to constraint of time it was not possible. Political aspects, financial aspects and demographic aspects all work together in building a well-developed village. The scope and objectives of the information system at the village level are as follows:

A. To operate and maintain 19-Village Information Systems – Kiosks for theunderstanding of natural disasters (thunderstorms, cyclones, monsoon, heavy precipitation).
B. Forecasting of meteorological (Temperature, Pressure, Humidity (%), wind speed/direction, rainfall) parameters using WRF model and Artificial Neural Networks. This data instantly disseminated to the VIS through e-mail and SMS to villagers.
C. Providing information on Natural Resources, Socio- Economic and Infrastructure facilities (Health, Education, etc.), Crop Suitability, Market Facilities, etc., to the common citizen residing around 19-VIS.
D. Development of long-term strategies for natural resources development and disaster management plans through community participation.

II. TOPOGRAPHY, CLIMATOLOGY AND LOCATION OF VILLAGE INFORMATION SYSTEMS

Village Information Systems (VIS) project was sponsored by Natural Resources Data Management Systems (NRDMS) Division of Department of Science & Technology (DST), Govt. of India during the year 2006 and was executed and installed by APCOST in association with Andhra Pradesh State Remote Sensing Applications Centre (APSRAC), Hyderabad. 19 VIS locations [9 in Nellore and 10 in Kadapa districts of Andhra Pradesh, India] were selected representing the two divergent climatic zones i.e. savanna and semi-arid. The details of locations of VIS are shown in the figure 1.

We have purchased two prototype, low-cost Automatic Weather stations (AWS) DAVIS Vantage Pro2 Plus which were installed at Mypad, Indukurupeta Mandal, Nellore District and at Inagaluru, Thondur Mandal, Kadapa District. The two Automatic Weather Stations (AWS) collects 1-min air temperature (AT), atmospheric pressure (P), relative humidity (RH), wind direction (WD), wind speed (WS) and rain fall (RF) round the clock. The weather parameter data were stored in a data logger and also sent simultaneously into a Village Inforamtion System (VIS) kiosk also.

The Nellore district lies between $13^o30'$ and $15^o06'$ of Northern latitude and $70^o05'$ and $80^o15'$ of Eastern latitude. Nellore's total land area is 13,076 square kilometers (8,761) sq. miles. It is bordered by the Bay of Bengal to the east, the state of Tamil Nadu to the South, the district of Kadapa, and the district of Prakasam to the north.

The eastern side consists of an area of low lying land extending from the base of the Eastern Ghats to the sea. The west side of the district is separated from Kadapa district by Veligonda hills. The district is split by the River Pennar and is located on both south and north banks of it. The district is broadly divided in to 2 natural divisions from North to South. The eastern Half of the District adjoins coastal belt is fairly fertile and the western half of the district has low elevation towards west with large track of low shrub jungles diversified with rocky will stony plains.

Geographically, YSR (formerly known as Cuddapah and Kadapa) district is situated within $13^o43'$ and $15^o14'$ of the northern latitude and $77^o55'$& $79^o29'$ of the eastern longitude. The district spreads northwards beneath the Western slopes of the Eastern Ghats mountain range as a rough parallelogram, dented deeply in its Southern, Western and Northern boundaries.

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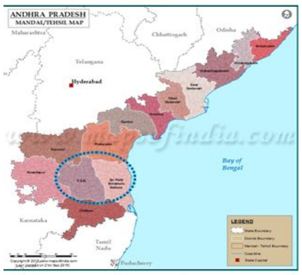

(a) NELLORE (District)

Sl. No	LOCATION OF VIS KIOSK(lat, long)	MANDAL
1.	Venkanapalem (14°29.92', 80°9.42')	Indukurupeta
2.	Mypadu (14°30.36', 80°10.36')	Indukurupeta
3.	Gangapatnam (14°31.55', 80°10.40')	Indukurupeta
4.	Kudithipalem (14°34.14', 80°11.21')	Indukurupeta
5.	Utukuru (14°34.63', 80°8.78')	Vidavaluru
6.	Dandigunta (14°38.12', 80°8.63')	Vidavaluru
7.	East Gogulapalli (14°42.14', 80°6.35')	Allur
8.	Iskapalle (14°44.28', 80°7.13')	Allur
9.	Juvvaladinne (14°45.02', 80°4.95')	Bogole

(b) KADAPA (District)

Sl. No	LOCATION OF VIS KIOSK(lat, long)	MANDAL
1.	Kamasamudram (14°35.3', 78°6.3'))	Lingala
2.	Bhadrampalle (14°36.05', 78°15.13')	Thondur
3.	Tonduru (14°34.7', 78°17.5')	Thondur
4.	Inagaluru (14°33.17', 78°16.15')	Thondur
5.	Telluru (14°31.47', 78°15.58')	Thondur
6.	Maduru (14°31.15', 78°13.73')	Thondur
7.	Saidapuram (14°31.1', 78°15.6)	Thondur
8.	Ankalammaguduru (14°34.54', 78°11.05')	Simhadripuram
9.	Lomada (14°33.8', 78°15.5')	Simhadripuram
10	Balpanuru (14°32.22', 78°12.00')	Simhadripuram

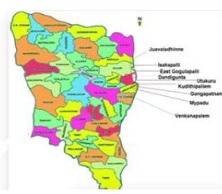

Fig.1 Location of Village Information Systems over Nellore and Kadapa districts.

It is surrounded by Kurnool district on the North, Chittoor district on the South Nellore district and Prakasam district on the East and Anantapur District on the West. The total geographical area of the Kadapa district is 15,379 sq. Kms. The climate around Andhra Pradesh is warm, humid, or hot according to the season and the location of the area. The climate in Kadapa and Nellore is outlined in Table 1. The seasons are classified as pre-monsoon (March, April and May), monsoon (June, July, August and September), post-monsoon (October and November) and winter (December, January and February). Kadapa and Nellore receive rainfall from the SW monsoon as well as the NE monsoon. The SW monsoon begins from June and lasts till September, while the NE monsoon occurs in late October-early December. This region receives heavy rains during the NE monsoon also and subject to cyclonic conditions, which cause enormous damages to residential accommodation and standing crops. Note that in January to April, a dry season at Nellore and Kadapa, there is little rain.

The districts of Nellore and Kadapa possess these peculiar conditions and hence, 19-Village Information Systems (VIS) are established to understand semi- arid and coastal region weather systems and also provide micro-level digital information on Natural Resources, Socioeconomic and Infrastructure Facilities (Health, Education, etc.,), Crop Suitability, Market Facilities, etc., to the common citizen. In addition, every day, we disseminate meteorological forecast data to the VIS through e-mail/SMS.

TABLE 1: CLIMATE AT KADAPA AND NELLORE

Climate	Month
Pre-monsoon	March, April and May
Summer/South-West monsoon	June, July, August and September
Post- /North-East monsoon	October, November and early December
Winter	Late December, January and February

III.DISSIMINATION OF WEATHER INFORMATION TO VILLAGE INFORMATION SYSTEM

The Indian subcontinent is highly prone to natural disasters and has been repeatedly subjected to cyclones, floods, tornados (north-eastern region), droughts, erosion, epidemics, etc. However, Southern India is particularly affected by cyclonic storms that come from the Bay of Bengal and which are normally accompanied by a tidal surge. The low-lying coastal area and offshoreislands'people are particularly affected mainly along east-coast in the high risk area for the cyclonic water surge. The Cyclone Preparedness Program (CPP) for Nellore and Kadapa district is developed based on VIS data and also observations from Satellite, Doppler Radar and surface meteorological parameters. For diagnosis of weather and precipitation as rain, hail and snow as well as wind and turbulence that have an impact on human activity and agriculture the following scheme as shown in figure 2 is utilized.

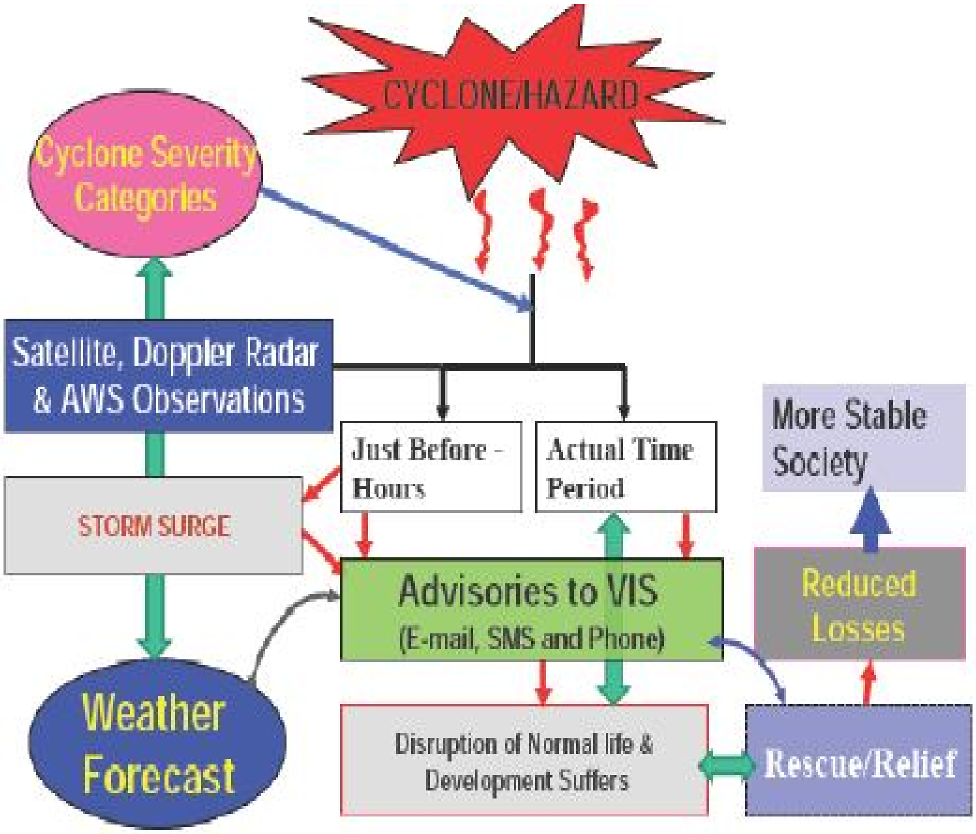

Fig. 2: Cyclone disaster preparedness program developed by the Department of Physics, Yogi Vemana University for Nellore and Kadapa districts based on meteorological observations.

Indian Space Research Organization (ISRO) is supporting Semi-arid zonal Atmospheric Research Centre (SARC) at Yogi Vemana University, Kadapa. At SARC, several ground based in-situ and remote sensing meteorological instruments are working round the clock. Apart from these, a High Performance Computating (HPC) facility shown in figure 3 is established to predict and also understand convection processes (updraft and downdraft) those influences the mesoscale convective cloud systems during SW and NE monsoon seasons in this region by using the forecast models. However, in the present study, Weather Research and Forecasting (WRF)-Advanced Research WRF (ARW)[11] is utilized to understand associated meteorological characteristic features, and improve the accuracy of such forecasts.

A. Simulation of JAL Cyclone at 27 km resolution

In the present study, non-hydrostatic, fully compressible Advanced Research Weather Research Forecast (WRF-ARW) model version 3.4, developed by the National Center for Atmospheric Research (NCAR) [1] is used to get vertical profile information (radar reflectivity and vertical wind) of a JAL cyclone over Kadapa. WRF model uses terrain-following hydrostatic pressure coordinates with 27 vertical levels. Model domain and the resolution used in the present analysis are provided in Table 2. The horizontal resolutions used are 27 km, 9 km and 3 km shown in figure 4.

Fig. 3: High Performance Computational (HPC) facility at SARC – Computer (Terminal) room and HPC installed on a rock in a A/C insulated room.

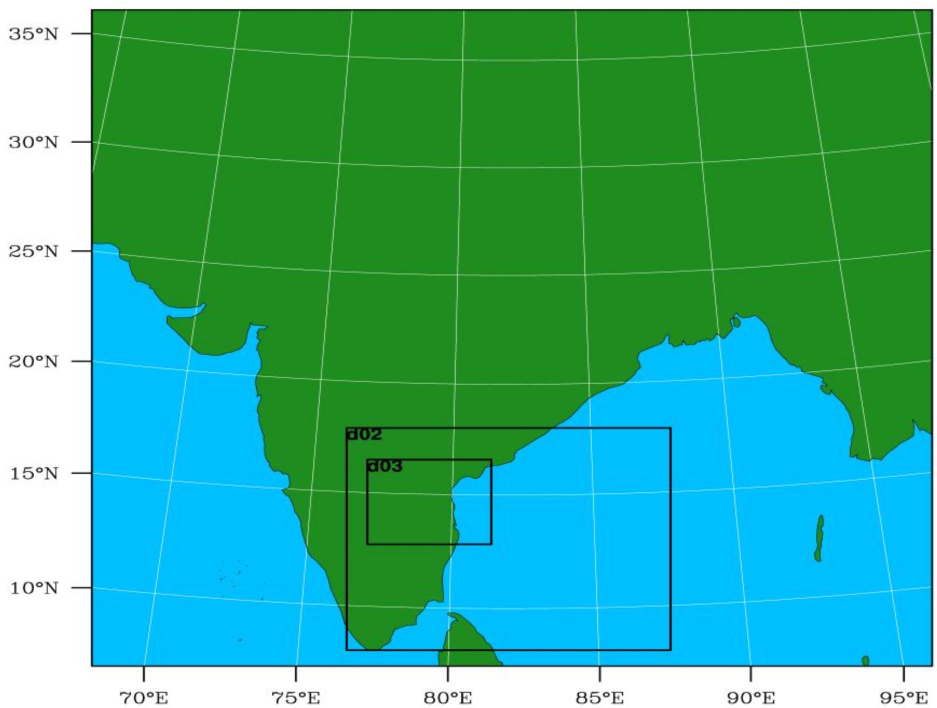

Fig.4: Cyclone Preparedness Programme (CPP) forecasting domains. In 3 domains [horizontal resolution of 27 km, 9 km (D02) and 3 km (D03)],Kadapa and Nellore all Village Information Systems are operated.

The National Centre for Environmental Prediction Final Analysis (NCEP-FNL) data from Global Data Assimilation System (GDAS) available at 6 h intervals and at 1° ×1° resolutions are used for initial and boundary conditions for the three cyclones[2]. In the present study, microphysical scheme of ThompsonYonsei University (YSU) ,planetary boundary layer (PBL) scheme of Hong, Kain-Fritsch Cumulus parameterization scheme , Dudhia shortwave scheme for shortwave radiation and Radiative Transfer Model (RTM) [3-6] for thelong-wave radiation have been used at 27 km resolution by following Osuri, Srinivas , and Reddy schemes [7-10].The infrared cloud coverage images (obtained from the Kalpana satellite) of JALcyclone are depicted in figure 5 and Table 3 shows JAL cyclone propagation and its intensity.

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Table 2: Model Configuration And Parameterization Schemes Used In The Wrf Model

Model	NCAR Mesoscale model WRF
Dynamics	Non-hydrostatic with 3-D Coriolis force
Grid size/ Horizontal grid resolution	Domain1:(123×135)×27/ (193×151)×27 Domain2:(193×151)×27/ 9 km×9 km Domain1:(154×139)×27/ 3 km×3 km
Data	NCEP Final Analyses (FNL) data
Horizontal grid system	Arakawa-C grid
Vertical coordinates	Terrain-following hydrostatic pressure vertical co-ordinate with 51 vertical levels
Micro physics	1. Lin et al. 2. Ferrier (new Eta) 3. WSM6-class Scheme graupel scheme 4. Thompson
Long wave radiation scheme	Rapid Radiative Transport Model (RRTM) scheme
Short wave radiation scheme	Dudhia scheme
Land surface scheme	Noah land surface model
Planetary Boundary Layer (PBL) scheme	Yonsei University scheme (YSU)
Cumulus parameterization scheme	1. Kain- Fritsch (new Eta) scheme 2. Betts-Miller-Janjic 3. Grell-Devenyi ensemble 4. New Grell Scheme (NG)
Diffusion option	Simple diffusion

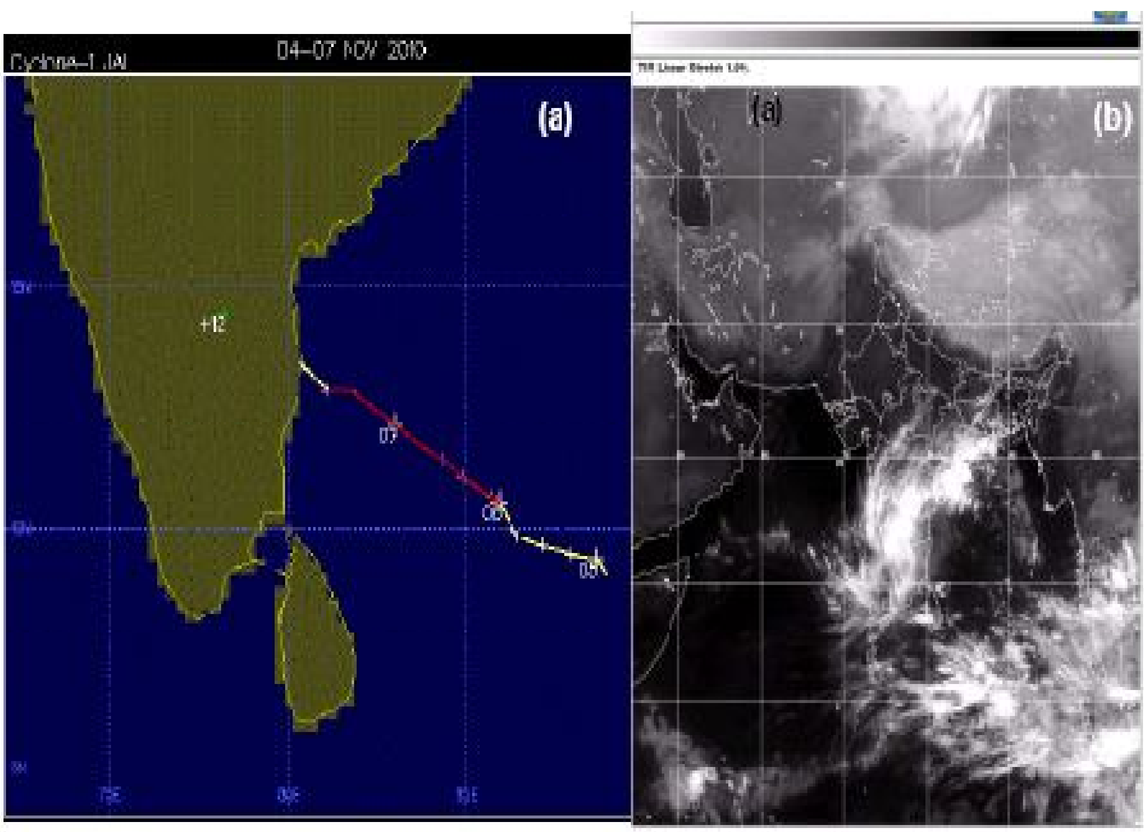

Fig 5: (a) Track of JAL cyclone observed from 5th November to 8th November 2010. (b) Kalpana satellite image for cyclonic day on 7th November 2010.

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Table 3: Propagation And Intensity Of Jal Cyclone

Advisory Number	Latitude (deg.N)	Longitude (deg.E)	Date and Time	Wind speed (Knots)	Status
1	9.00	88.90	11/04/18Z	35	TROPICAL STORM
2	9.30	88.60	11/05/00Z	45	TROPICAL STORM
3	9.40	87.90	11/05/06Z	45	TROPICAL STORM
4	9.60	87.10	11/05/12Z	45	TROPICAL STORM
5	9.80	86.40	11/05/18Z	55	TROPICAL STORM
6	10.50	85.90	11/06/00Z	65	Cyclone-1
7	10.60	85.70	11/06/06Z	65	Cyclone-1
8	11.00	84.90	11/06/12Z	65	Cyclone-1
9	11.40	84.30	11/06/18Z	70	Cyclone-1
10	12.10	83.00	11/07/00Z	70	Cyclone-1
11	12.80	81.80	11/07/06Z	65	Cyclone-1
12	12.80	80.10	11/07/12Z	50	TROPICAL STORM
13	13.40	80.40	11/07/18Z	35	TROPICAL STORM
+12	14.40	78.20	11/08/06Z	25	TROPICAL DEPRESSION

As shown in figure 6, the JAL cyclone was formed as a depression over southeast Bay of Bengal (BoB) near 8° N and 92° E at 00:00 UTC on 4th November 2010. The depression was intensified to deep depression on 5th November 2010 at 00:00 UTC and developed into a cyclonic storm, JAL, at 06:00 UTC with its centre near 9° N and 87.5°E, at about 900 km southeast of Chennai. The cyclonic storm JAL moved ahead in the direction of west, north westwards over southeast BOB and then enhanced to severe cyclonic storm during the early hours of 6th November 2010. The severe cyclonic storm intensity persisted up to 03:00 UTC on 7thNovember 2010 and then weakened to cyclonic storm with its center near 12.5° N and 82.5° E over southwest BoB at 06:00 UTC on 7thNovember at about 250 km east-south-west of Chennai. With further weakened intensity to deep depression, it crossed near north TamilNadu-south Andhra Pradesh coast, close to the north of Chennai near13.3° N and 80.3° E around 16:00 UTC on 7th November 2010. Over the inland region, it continued to move west-north westwards as a depression at 03:00 UTC, and to a well-marked low-pressure area over Rayalaseema and adjoining south interior Karnataka at 06:00 UTC on8th November 2010. JAL cyclone microwave, satellite images (85–91 GHz) from SSM/I, SSMIS, TMI, and NOAA-16 obtained from the NARL website are depicted in figure 6.

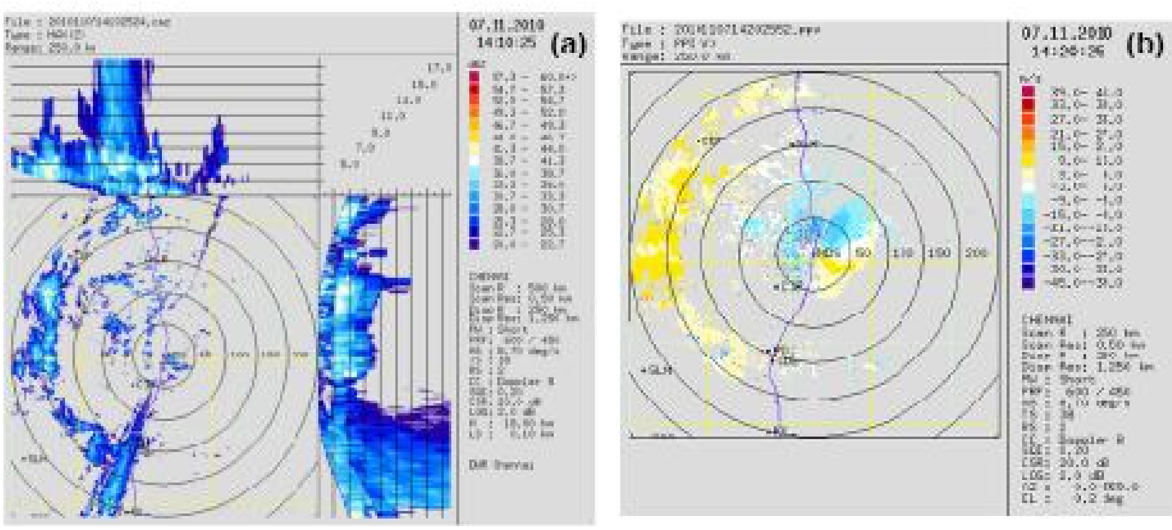

Fig.6: Chennai Doppler Weather Radar observation of JAL Cyclone on 07 November 2010 covering Kadapa and Nellore District. (a) Radar reflectivity (dBZ) and (b)Doppler Velocity snap shot on 7 Nov. 2010 at 14:10:25 hrs LT.

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Color contour on the satellite image of Fig. 7 represents black-body brightness temperature (TB) caused by scattering from precipitation-size ice hydrometeors. TB is used as a proxy for strong (TB < 230 K) or weak convection (230 < TB < 270 K). Very cold brightness temperature (colder than 230 K) is an indication of enhanced convection and larger amounts of frozen hydromeoteors that would be indicative of storm intensification.

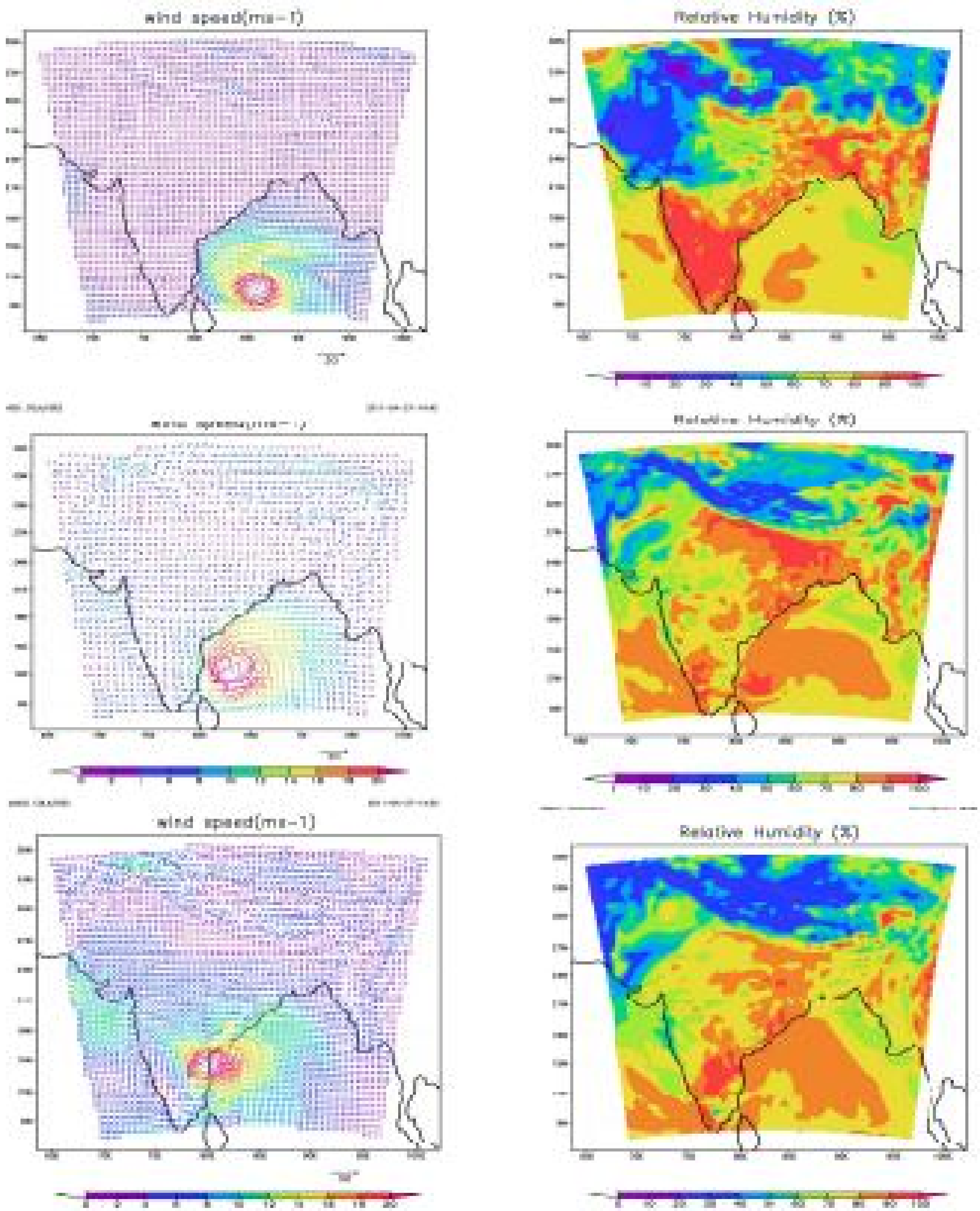

Fig.7: Forecasting of JAL Cyclone winds and humidity

IV. VALIDATIONUSING VIS AWS DATA

To validate the model results, the meteorological parameters like sea level pressure (slp), temperature and relative humidity are compared with the observed parameters. For this, simulation of *JAL* cyclone is carried out using different microphysical parameterization schemes with and without CP schemes in WRF model using Exp-D3I3 at 3 km resolution.

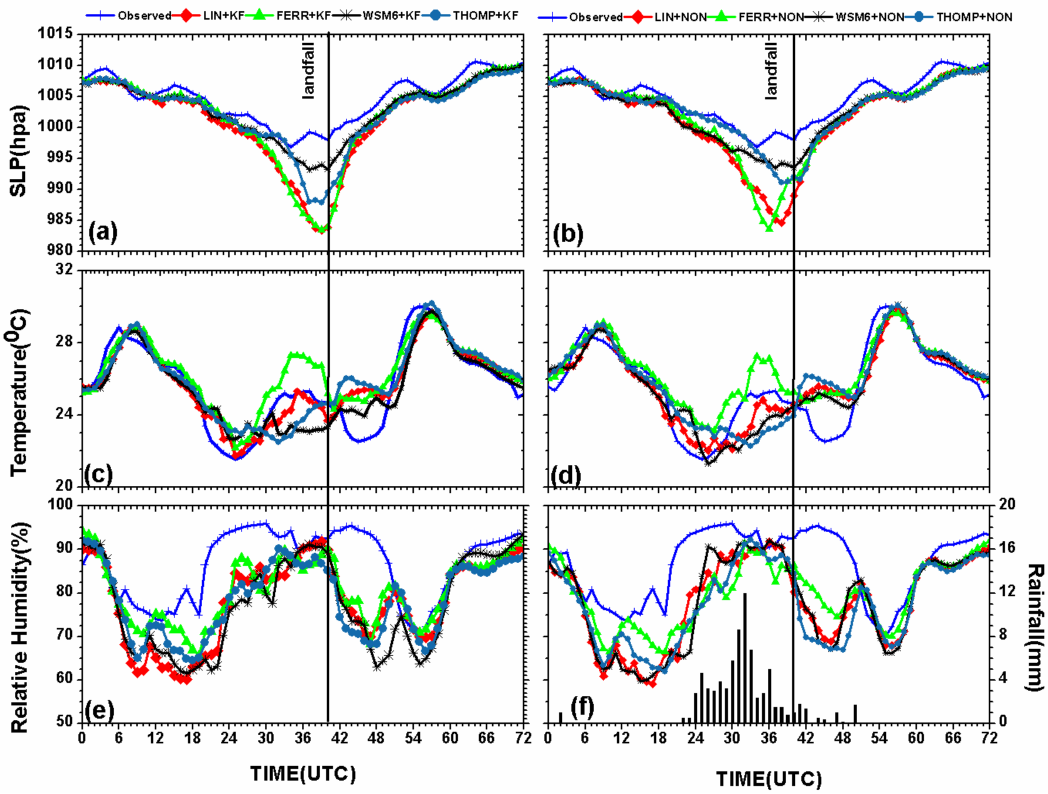

Fig.8: Observed and simulated (a) slp (hPa); (b) temperature (^{o}C) and (c) relative humidity (%) of the cyclone using 4 MP schemes (LIN, FERR, WSM6 and THOMP) with KF CP scheme at 00UTC 06 November, 2010 to 00 UTC 09 November, 2010 in the Oceanic region; (d), (e) & (f) same as in (a), (b) & (c) without CP scheme. Vertical bars represent the observed rainfall (mm).

Figure 8 shows the meteorological parameters (slp, temperature, relative humidity and rainfall) observed using Automatic Weather Station (AWS) and meteorological parameters (slp, temperature and relative humidity) simulated in Exp-D3I3 between 00 UTC 06 November, 2010 (before landfall) and 00 UTC 09 November, 2010 (after landfall) over Oceanic region using different MP schemes with KF CP scheme and without any CP schemes. Figure 8(a) shows the observed pressure and slp predicted in Exp-D3I3 in the Oceanic region. During the landfall, observed slp decreases and it increased after landfall. The observed slp and the slp predicted by all the schemes remain the same up to 03 UTC 07 November, 2010 and after 00 UTC 08 November, 2010. Whereas the predicted slp varied much compared to the observed slp during the landfall of the cyclone. The variation is maximum for FERR and LIN and is minimum for WSM6 MP scheme. Even in the same experiment without any CP scheme Figure 8(b) also shows the same behaviour before and after landfall of the cyclone. But during the landfall of the cyclone, the slp decreased considerably compared to the same experiment with CP scheme. Figure 8(c) shows the observed temperature and temperature simulated in Exp-D3I3 over Oceanic region. Observed temperature increases first and then decreases until 03 UTC 07 November, 2010. After this the temperature increases slightly and remains constant up to landfall of the cyclone. After landfall, the temperature decreases (00 UTC 08 November, 2010) and again increases following the diurnal pattern. The predicted temperature followed the observed temperature before 03 UTC 07 November, 2010 and after 00 UTC 08 November, 2010. The temperature simulated in Exp-D3I3 without CP scheme Figure 8(d) also shows the same pattern as in Exp-D3I3 with CP scheme. Figure 8(e) shows the observed and simulated relative humidity for Exp-D3I3 in the Oceanic region. The observed relative humidity increased before landfall and decreased during landfall and again increased after landfall. In this case the relative humidity predicted in all the MP schemes deviated more compared to the observed relative humidity. Also, relative humidity simulated in Exp-D3I3 without CP scheme figure 8(f) shows similar behaviour as in Exp-D3I3 with CP scheme.

Figure 9 shows the comparison of observed and simulated meteorological parameters in Exp-D3I3 between 00 UTC 06 November, 2010 and 00 UTC 09 November, 2010 over in-land and semi-arid region using different MP schemes without any CP schemes. Figure 9(a) shows the observed and simulated slp using Exp-D3I3 without any CP scheme in the in-land region. The slp predicted in the in-land region shows higher values compared to the oceanic region. The simulated slp decreased 6-hours before the dissipation of the cyclone in Exp-D3I3. All the schemes deviated from the observed slp between landfall and dissipation time and followed well in the remaining time. The variation is maximum for FERR and LIN and is minimum for THOMP MP scheme. Figure 9(b) shows the observed and simulated temperature in Exp-D3I3 in the in-land region. During 07 November, 2010, the temperature remains constant throughout the day and increases after the dissipation of the cyclone. The FERR scheme deviated from observed temperature between landfall and dissipation time, whereas the remaining schemes deviated during the dissipation time. Figure 9(c) shows the observed and simulated relative humidity for Exp-D3I3 in the in-land region. The simulated relative humidity deviated a little compared to the observed relative humidity.

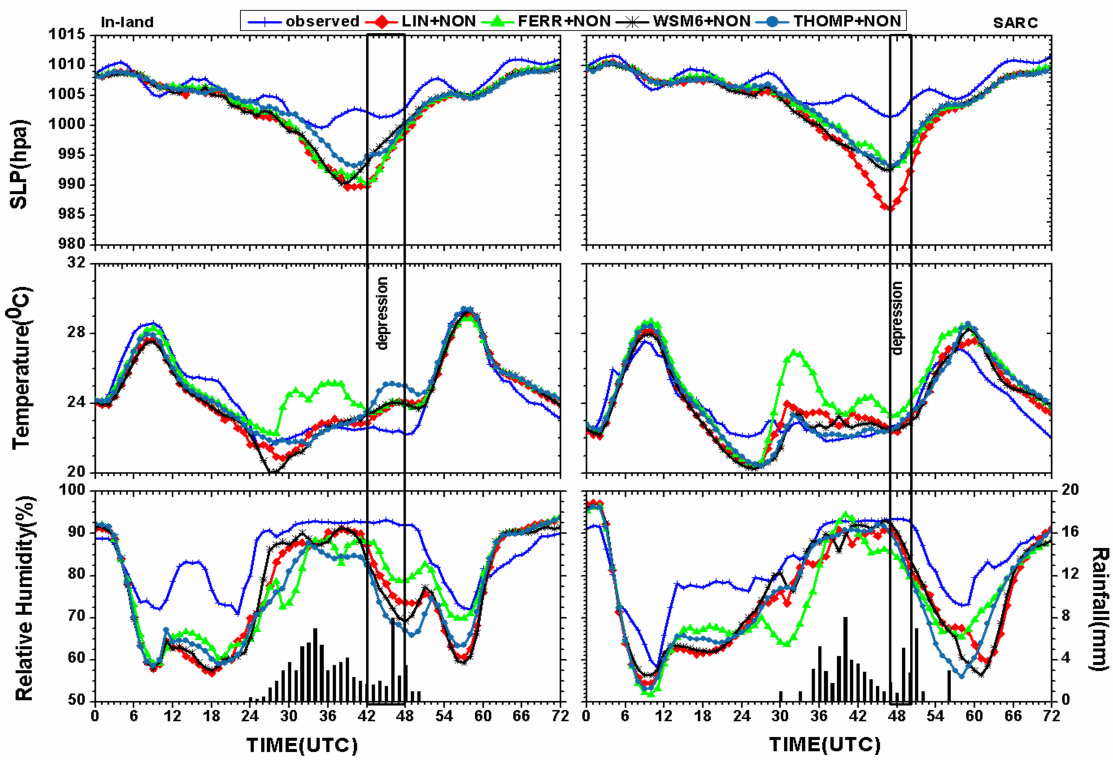

Fig.9: Observed and simulated (a) slp (hPa); (b) temperature (^{o}C) and (c) relative humidity (%) of the cyclone using 4 MP schemes (LIN, FERR, WSM6 and THOMP) without CP scheme at 00UTC 06 November, 2010 to 00 UTC 09 November, 2010 in the inland region; (d), (e) & (f) same as in (a), (b) & (c) in the semi-arid region. Vertical bars represent the observed rainfall (mm).

Figure 9(d) shows the observed and simulated slp using Exp-D3I3 without any CP scheme in the semi-arid region. The observed slp decreases during the landfall of the cyclone and then increases after landfall. Again the slp decreases during the dissipation of the cyclone and increases afterwards. The decrement in the slp is more during dissipation compared to landfall time. All the schemes deviated from the observed slp between landfall and dissipation time and followed well in the remaining time. The variation is maximum for LIN MP scheme. Figure 9(e) shows the observed and simulated temperature in Exp-D3I3 in the semi-arid region. During 07 November, 2010, the temperature remains constant throughout the day and increases after the dissipation of the cyclone. The temperature increases slightly before landfall and then decreases during landfall. All the schemes deviated between landfall and dissipation time. Figure 9(f)shows the observed and simulated relative humidity for Exp-D3I3 in the semi-arid region. The simulated relative humidity deviated from the observed relative humidity.

As the cyclone approaches, the slp increased in the inland and semi-arid regions. However, during the dissipation of cyclone, the observed temperature remains the same throughout the day in both inland and semi-arid regions, whereas in the oceanic region it varies during the landfall of the cyclone. The observed rainfall is maximum over the oceanic region (83 mm) compared to inland (79 mm) and semi-arid (65 mm) regions. The relative humidity increased before the landfall of the cyclone in both oceanic and inland region. However, in semi-arid region, relative humidity increased during dissipation of the cyclone. After dissipation the relative humidity decreases in all the regions at the same time.

V. CONCLUSION

During the trial runs of the VIS project from Feb'2010 to Feb'2011, It is found that the VIS is proving to be a useful tool in generating weather data, which could be integrated with the regional, state and national weather information for weather forecasting purposes. The VIS data is useful in generating forecast of meteorological parameters over Rayalaseema region using High Performance Computational (HPC) Facility at Yogi Vemana University, Kadapa.

VI. ACKNOWLEDGMENT

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REFERENCES

[1] Kanamitsu M, Description of the NMC global data assimilation and forecast system, Weather Forecast (USA), 4(1989) pp 335-342.
[2] Skamarock, W. C., et al. (2008), A description of the advanced researchWRF version 3, NCAR Tech. Note TN-475+STR, 113 pp., NCAR, Boulder, Colo.
[3] Thompson G, Rasmussen R M & Manning K, Explicit forecast of winter precipitation using an improved bulk microphysical scheme, Part I: Description and sensitivity analysis, Mon Weather Rev (USA) , 132 (2004) pp 519-542.
[4] Hong S –Y, Dudhia J & Chen S -H, A revised approach to ice microphysical processes for the bulk parameterizations of clouds and precipitations, Mon Weather Rev (USA) , 132 (2004) pp 103-120.
[5] Kain J S & Fritsch J M, Convective parameterization for mesoscale models: The Kain-Fritsch scheme, The representation of cumulus convection in numerical models, Am Meteorol Soc Meteorol Monogr (USA) , 46 (1993) pp 165-170.
[6] Dudhia, J., 1989: Numerical study of convection observed during the winter monsoon experiment using a mesoscale two-dimensional model.J Atmos. Sci., 46, 3077–3107.
[7] Malwer E J, Taubman S J, Brown P D, Iacono M J & Clough S A, Radiative transfer for inhomogeneous atmosphere: RRTM, a validated correlated-k model for the long wave, J Geophys Res (USA) , 102 (D14) (1997) pp 16, 663-16, 682.
[8] Osuri, K. K., U. C. Mohanty, A. Routray, A. K. Makarand, and M. Mohapatra, 2012a: Sensitivity of physical parameterization schemes of WRF model for the simulation of Indian seas tropical cyclones. Nat. Hazards, 63,1337–1359.
[9] Srinivas CV,BhaskarRaoDV,Yesubabu V,Baskaran R,Venkatraman B (2013) Tropical cyclone predictions over the Bay of Bengal using the high – resolution Advanced Research Weather Research andForecasting (ARW) model. QJR MeteorolSoc 139(676):1810 – 1825
[10] Reddy M V et al 2014 Effect of cumulus and microphysical parameterizations on the JAL cyclone prediction Indian Journal of Radio & Space Physics Vol 43, February 2014, pp 103-123.
[11] Hu, X. M., J. W. Nielsen-Gammon, and F. Zhang (2010), Evaluation of three planetary boundary layer schemes in the WRF model, J. Appl. Meteorol. Climatol., 49(9), 1831–1844.
[12] SrikanthMadala et al Performance evaluation of PBL and cumulus parameterization schemes of WRF ARW model in simulating severe thunderstorm events over Gadanki MST radar facility — Case study Atmospheric ResearchVolume 139, 15 March 2014, Pages 1-17.