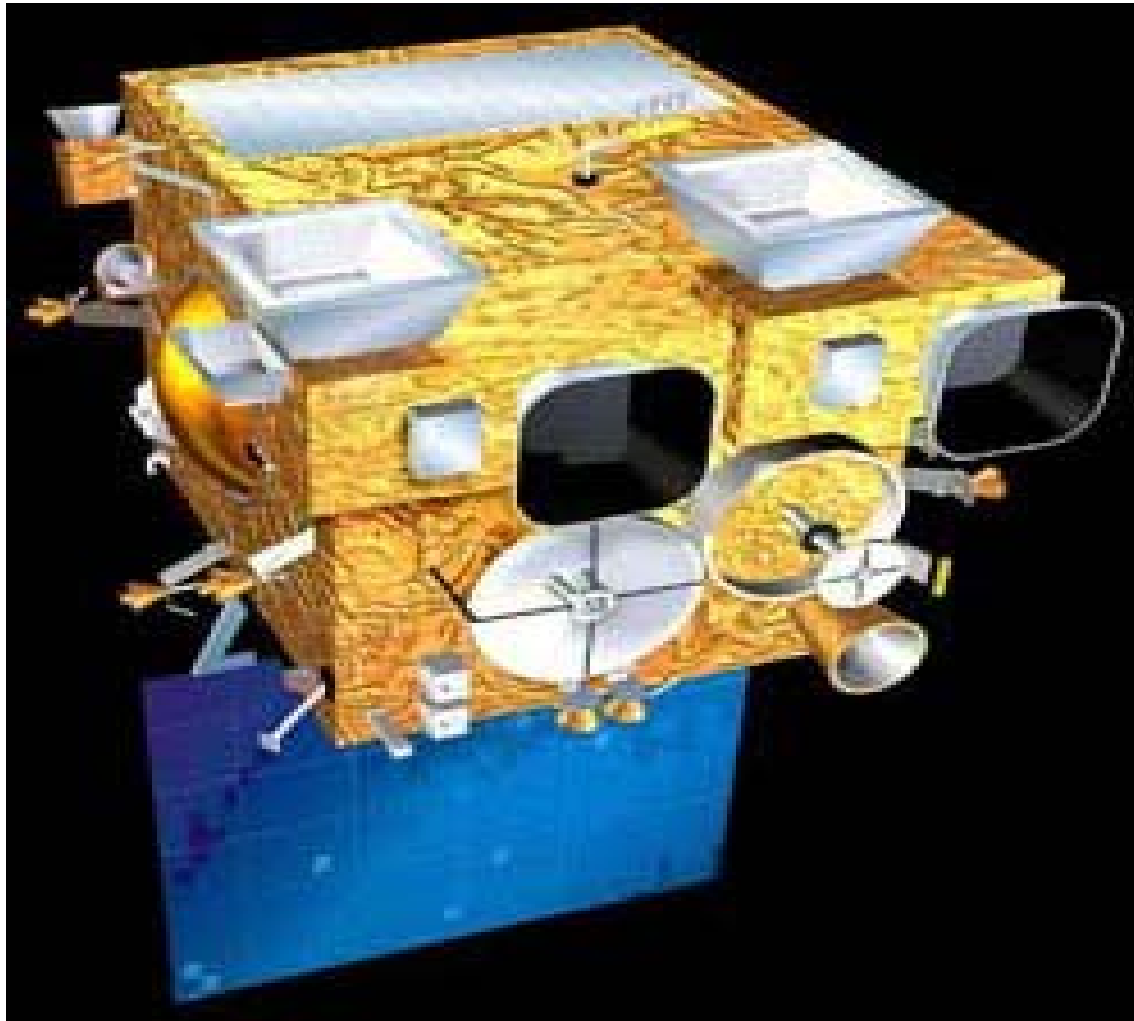


Coordination Group for Meteorological Satellites - CGMS



CGMS-44-IMD –AGENCY-REPORT

Coordination Group for
Meteorological Satellites

6/8/2016

Agency, version?, Date 2014? [update filed in the slide master]

IMD



Brief History of INSAT Satellites

- ❖ Satellite Meteorology in IMD started in 1982 with the launch of INSAT-1A which was a multipurpose satellite meant for services to Meteorology, Doordarshan and Communication. Before that, Indian meteorologists were using analog imageries received from U.S. Polar orbiting satellites series of TIROS-N.
- INSAT-1A – 10 April 1982 Two Channel VHRR
- INSAT-1B – 30 August, 1983
- INSAT-1C – 21 July 1988
- INSAT-1D – 12 June, 1990
- INSAT-2A – 10 July, 1992
- INSAT-2B – 23 July, 1993
- INSAT-2E – 03 April 1999, KALPANA-1 – 12 Sept. 2002, INSAT-3A – 10
- INSAT-3D – 26 July, 2013 --- 6 channel Imager and 19 channel Sounder

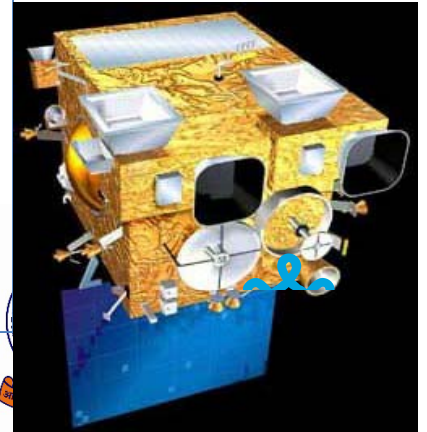
Current Indian Geo stationary Meteorological satellites

At present the following three INSAT satellites are in operation

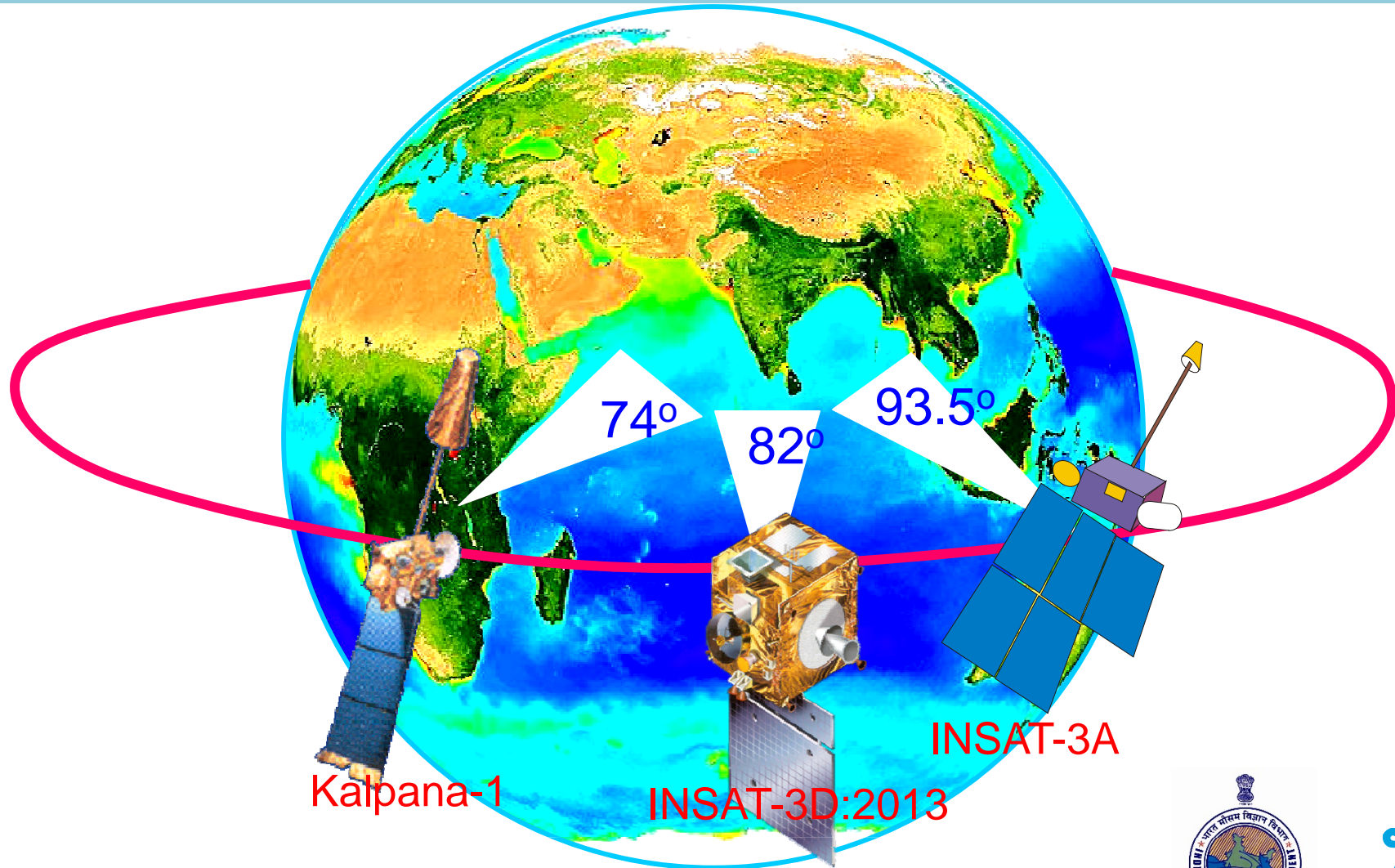
Kalpana -1(METSAT) is a meteorological satellite which was launched in September 2002. It is located at 74° east. For meteorological observation, METSAT carries a Very High Resolution Radiometer (VHRR) capable of imaging the Earth in the visible, thermal infrared and water vapor bands. It also carries a Data Relay Transponder (DRT) for collecting data from unattended meteorological platforms.

INSAT-3A is a geostationary satellite which was launched in April 2003. It is located at 93.5° east longitude in the geostationary orbit. INSAT-3A is the first satellite in the INSAT-3 series. INSAT-3A is a multipurpose satellite for providing telecommunications, television broadcasting, meteorological (VHRR, CCD, DRT) and search & rescue services.

INSAT-3D is India's advanced weather satellite and was launched in the early hours of July 26, 2013 from Kourou, French Guiana, and has successfully been placed in Geosynchronous orbit. It is a dedicated meteorological satellite and carries four payloads: Imager (Six Channels), Sounder (Nineteen Channels), Data Relay Transponder (DRT) & Satellite Aided Search and Rescue (SAS & R)



Current Indian Geostationary Meteorological Satellites



Coordination Group for
Meteorological Satellites

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Agency, version?, Date 2014? [update filed in the slide master]

IMD



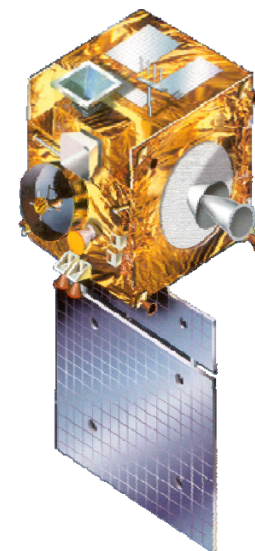
Coordination Group for Meteorological Satellites - CGMS

INSAT-3A and Kalpana-1

	(2003)	(2002)
Location	: INSAT 3A : 93.5°E	Kalpana-1 : 74°E
Payloads	:(i) VHRR and CCD camera in INSAT -3A (ii) VHRR in Kalpana-1	



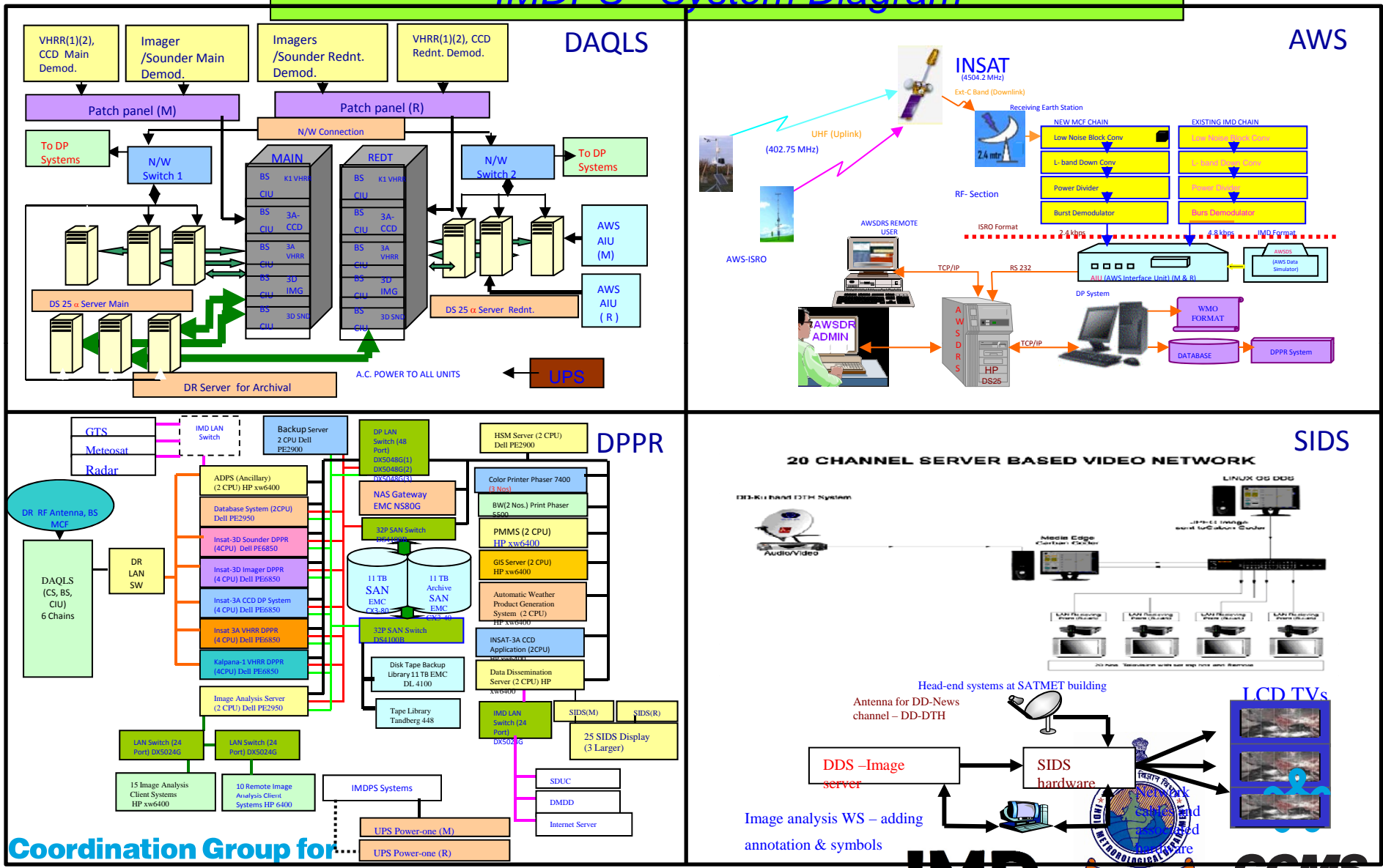
- VHRR Bands (μm)
 - Visible : 0.55 – 0.75
 - Water vapour : 5.70 – 7.10
 - Thermal Infra Red : 10.5 – 12.5
- Resolution (km) : 2 X 2 for Visible
8 X 8 for WV & TIR
- CCD Camera Bands (μm)
 - Visible : 0.62 – 0.68
 - Near Infra Red : 0.77 – 0.86
 - Short Wave Infra Red : 1.55 – 1.69
- Resolution (km) : 1 X 1 for all bands



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IMDPS System Diagram



Coordination Group for Meteorological Satellites

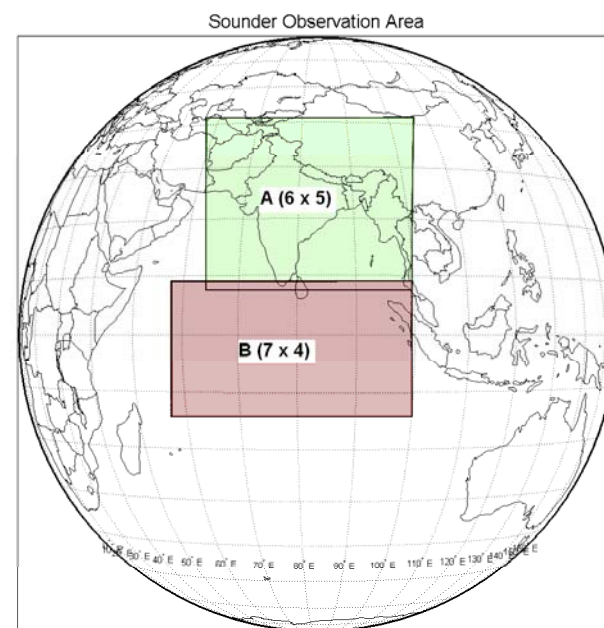
IMD CGMS

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The present system was installed in 2008-09.

Used for processing and dissemination of data from all the three currently operational Geostationary satellites(Kalpana-1, INSAT-3A & INSAT-3D).

INSAT Series	Temporal Resolution
K1-VHRR	Half Hourly(0015 & 0045 UTC)
3A -VHRR	Hourly
3A- CCD	3,5,6,7,9,11 UTC
3D -Imager (6 Channel)	½ hourly (0000 & 0030 UTC)
3D -Sounder (19 Channel)	Hourly (Five times Region-A and sixth times region-B)



**Coordination Group for
Meteorological Satellites**

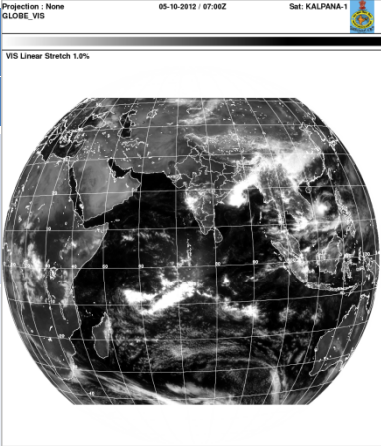
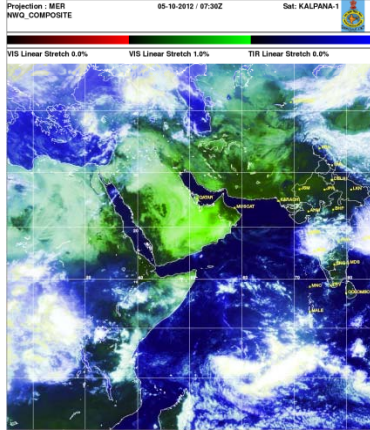
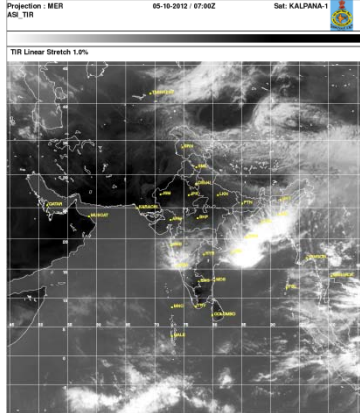
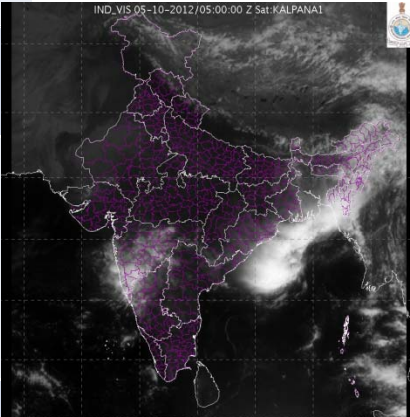
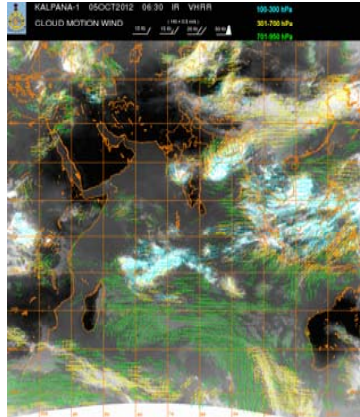
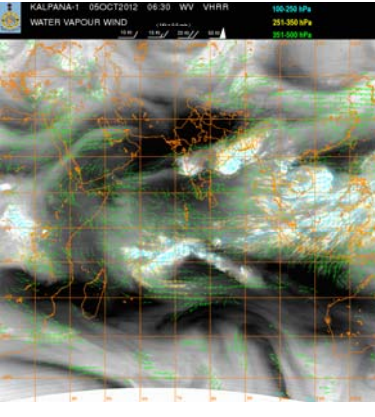
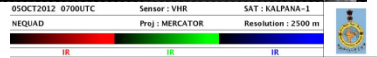
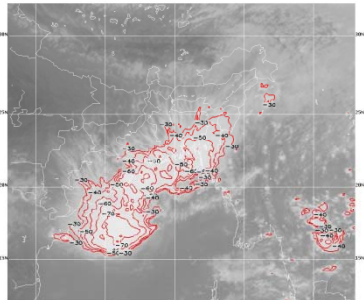
IMD



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Kalpana-1 Satellite derived imageries

Name of Imageries	K1 VHRR	
Full Disc (VIS,IR,WV,Colour composite)	Half hourly	  
Sectors-Asiamer/NE/NW(VI S,IR,WV,Colour composite)	Half hourly	
Enhanced Images(IR,VIS)	Half hourly	  
Sectors with District boundaires-India/NE/NW/SI(VI S,IR)	Hourly	
Average images of IR/WV	Daily	
CMV/WVW	Half hourly	
CTT, CTT below-40deg	Hourly	

Coordination Group for Meteorological Satellites

6/8/2016

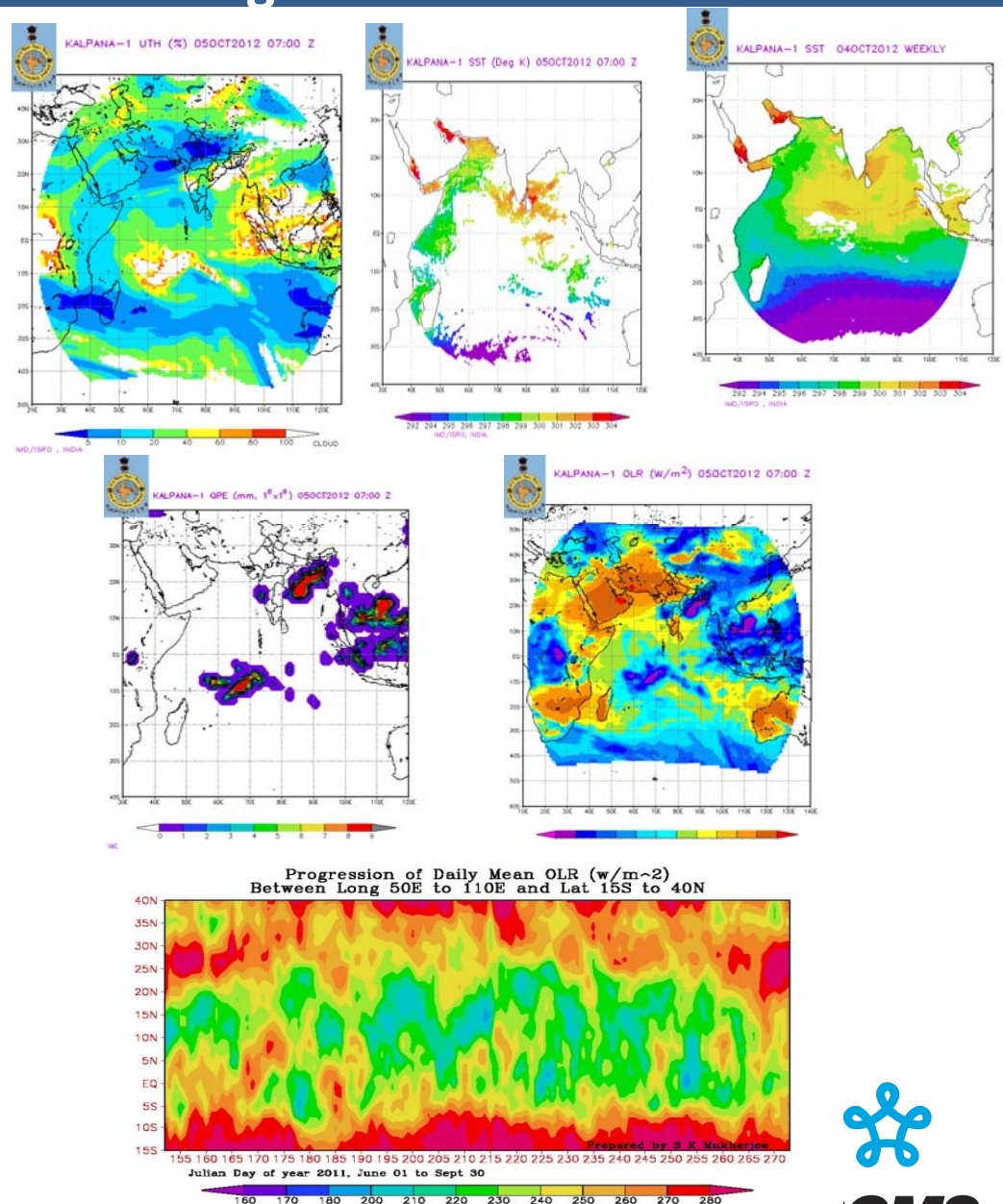
Agency, version?, Date 2014? [update filed in the slide master]

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Products	Kalpana-1 VHRR
UTH	Half Hourly, Daily, Weekly and Monthly
SST	Half Hourly, Daily, Weekly and Monthly
OLR	Half Hourly, Daily, Weekly, Monthly and Seasonal
QPE	Half Hourly, Daily, Weekly, Monthly and Seasonal
Latitude/time OLR hovmoeller	Daily
Animated Images for last three Hours	Half hourly
Animated Images with CTT of Current and Previous day based on 06 UTC	Daily



Coordination Group for Meteorological Satellites

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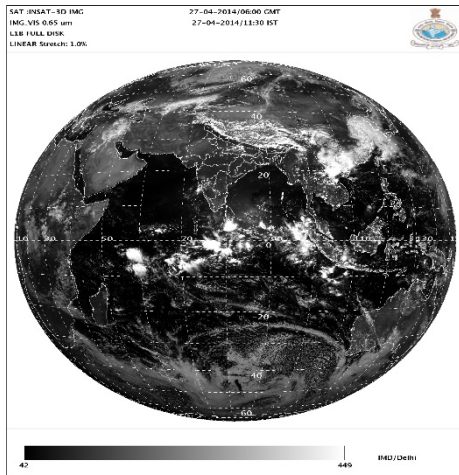


Coordination Group for Meteorological Satellites - CGMS

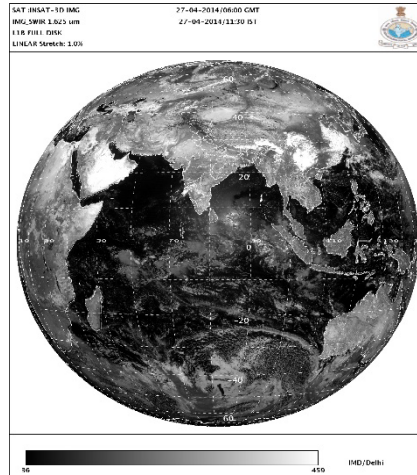
List of Geo-physical Parameters of INSAT 3A

Sl. No.	Sensor	Geo-Physical Parameters
1	INSAT-3A CCD	Normalized Differential Vegetative Index (NDVI)
		Aerosol Optical Depth
2	INSAT-3A VHRR	Outgoing Long-Wave Radiation (OLR)
		Quantitative Precipitation Estimate (QPE)
		Sea surface Temperature (SST)
		Upper Tropospheric Humidity(UTH)

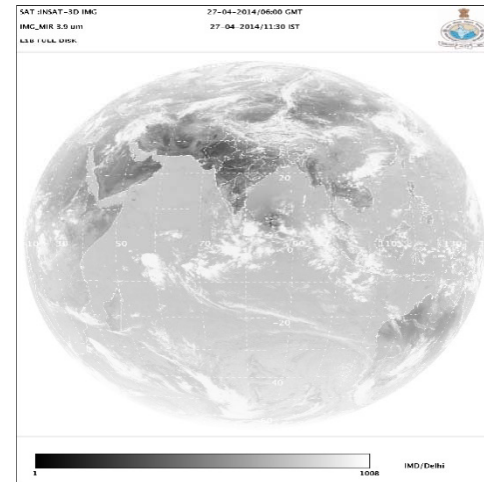
INSAT-3D Imager Standard Products



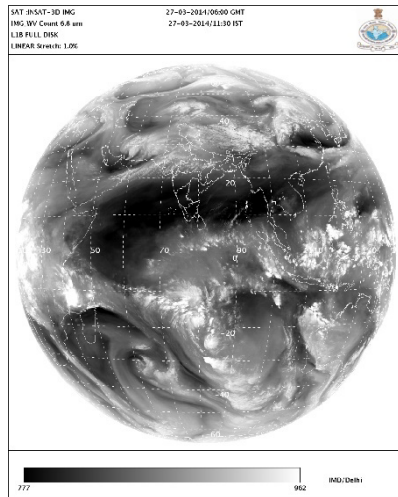
VIS (0.55-0.75µm)



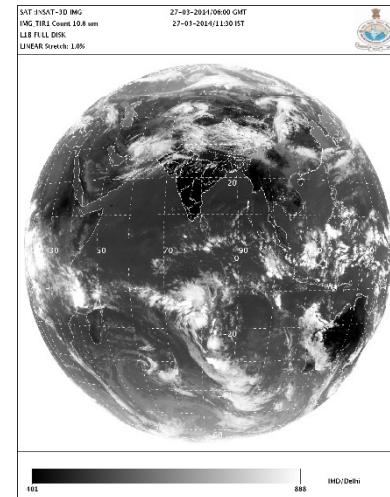
SWIR(1.55-1.70µm)



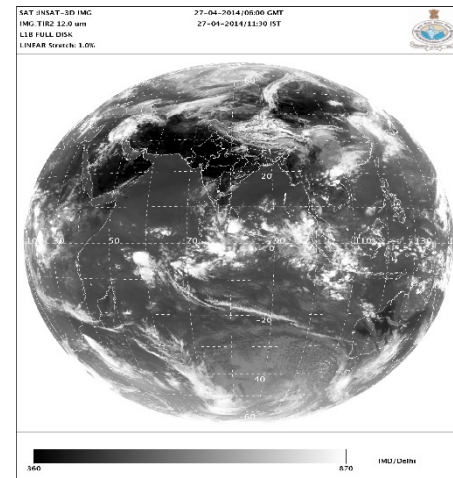
MIR(3.80-4.00µm)



WV(6.50-7.10µm)



TIR-1(10.30-11.30µm)



TIR-2(11.50-12.50µm)

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INSAT-3D Imager Products types and formats .

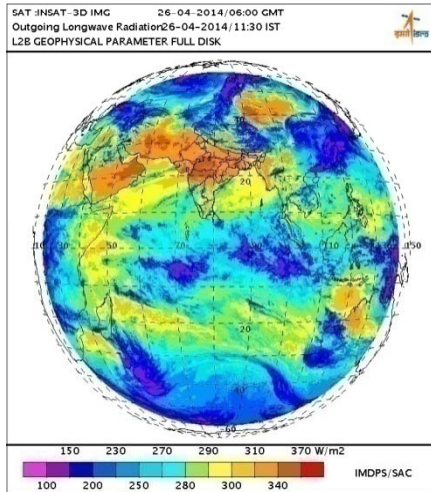
Geo-Physical Parameters						
1	Outgoing long wave radiations	L2B/L3B	OLR	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	WV, TIR-1, TIR -2
2	Rainfall using Hydro Estimator	L2B/L3B	HEM	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	TIR-1, TIR- 2
3	FOG	L2C/L3C	FOG	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	SWIR, MIR, TIR-1, TIR-2
4	SNOW	L2C/L3C	SNW	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	VIS, SWIR, TIR – 1, TIR –2
5	Cloud Mask	L2B/L3B	CMK	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	MIR, TIR-1, TIR-2
6	Upper Troposphere Humidity	L2B/L3B	UTH	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	WV, TIR-1, TIR –2
7	Sea Surface Temperature	L2B/L3B	SST	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	MIR,TIR -1,TIR -2
8	Land Surface Temperature	L2B/L3B	LST	HDF	Per Pixel(Half hourly ,Daily, Weekly & Monthly)	TIR -1,TIR -2
9	INSOLATION	L2B/L3B	INS	HDF	Per Pixel(Half hourly ,Daily, Weekly, Monthly and Yearly)	TIR -1,TIR -2

Coordination Group for Meteorological Satellites - CGMS

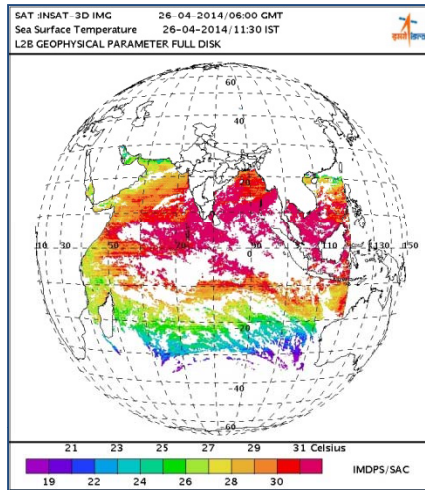
INSAT-3D Imager Products types and formats Cont .

Geo-Physical Parameters (Point)						
1	FIRE	L2P	FIR	KML	Point	MIR , TIR -1
2	SMOKE	L2P	SMK	KML	Point	VIS, MIR, TIR 1, TIR -2
3	Atmospheric Motion Vectors(VIS/MIR, TIR, WV)	L2P	AMV	HDF	(Point)	VIS, TIR-1, TIR -2 & WV
Geo-Physical Parameters (Gridded)						
1	INSAT Multi-Spectral Rainfall Algorithm (IMSRA)	L2G	IMR	HDF	0.1 deg x0.1 deg (Half hourly ,Daily, Weekly & Monthly)	TIR-1, TIR- 2
2	Quantitative Precipitation Estimation	L2G	QPE	HDF	1 deg x 1 deg (Half hourly ,Daily, Weekly & Monthly)	TIR-1, TIR- 2
3	Aerosol Optical Depth	L2G	AOD	HDF	0.1 deg x 0.1 deg	VIS, TIR -1, TIR -2

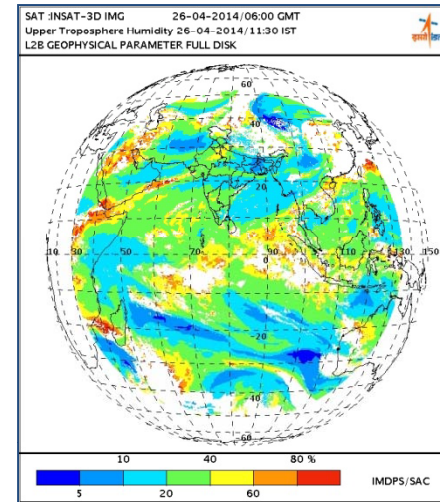
INSAT-3D Imager Geo-Physical Parameters (L2)



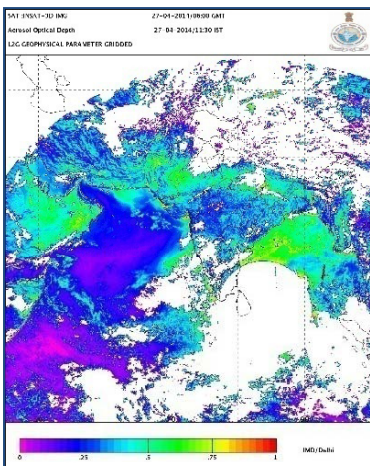
OLR



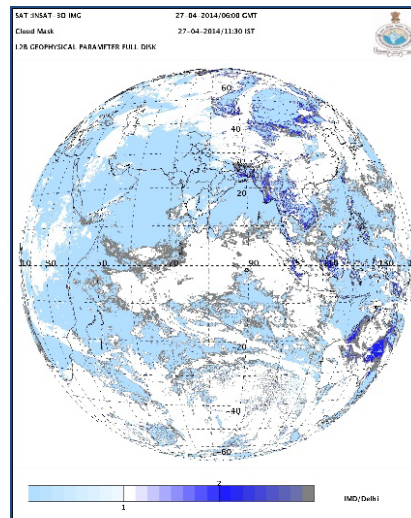
SST



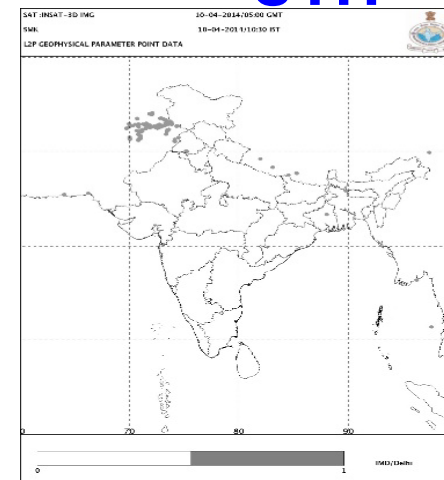
UTH



AOD



CMK



Smoke

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6/8/2016

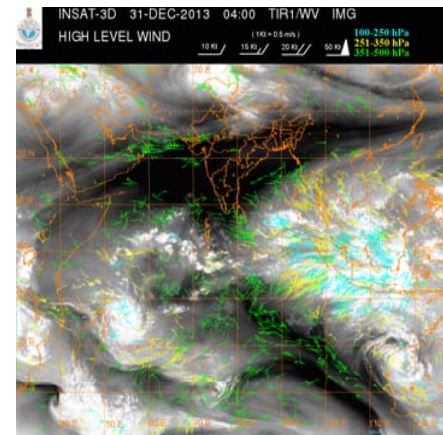
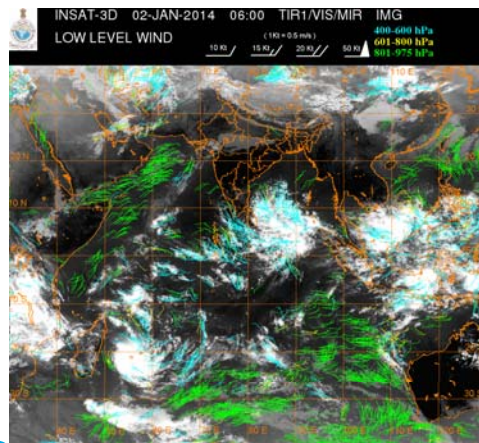
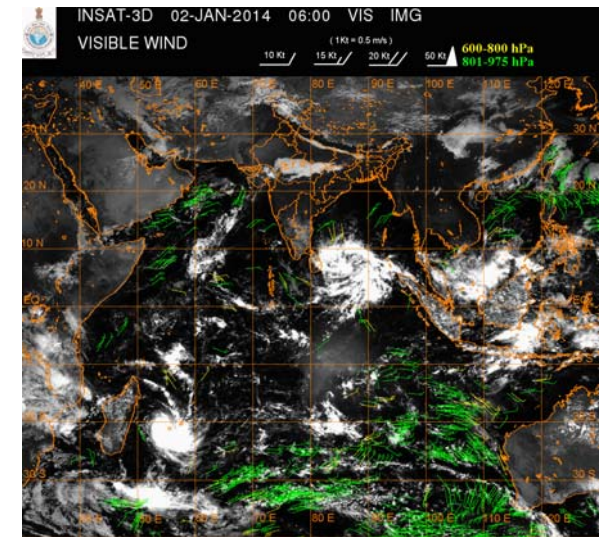
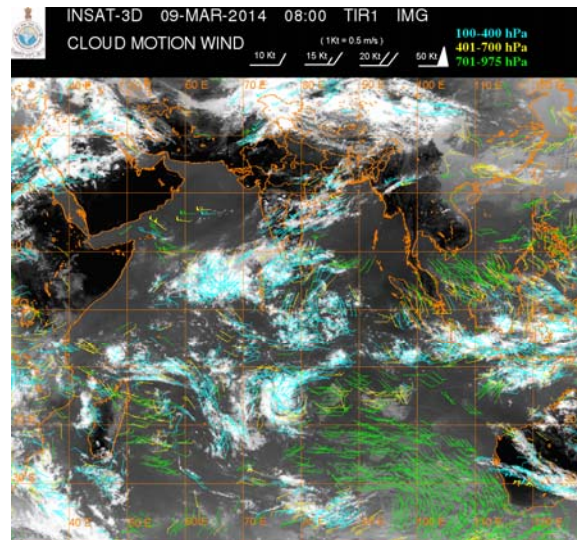
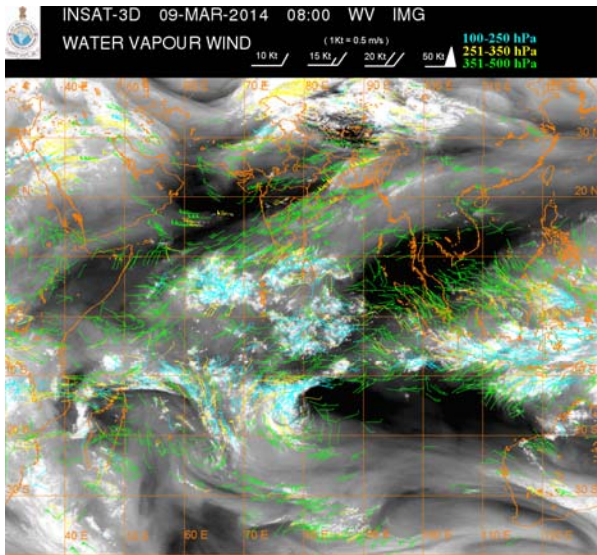
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INSAT-3D Wind Products: Visible/MIR,CMV,WVW,LLW & HLW)



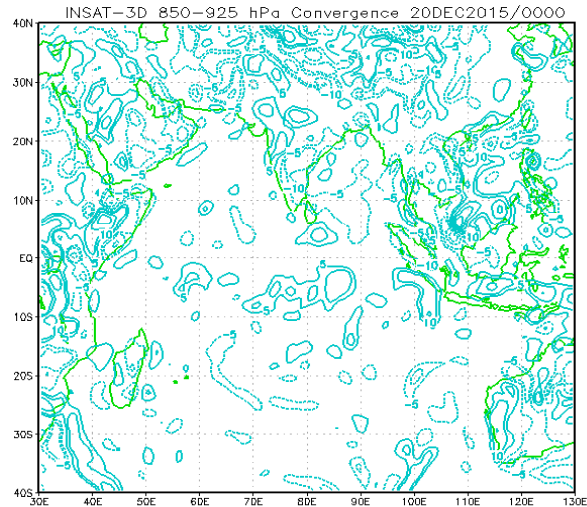
**Coordination Group for
Meteorological Satellites**

IMD



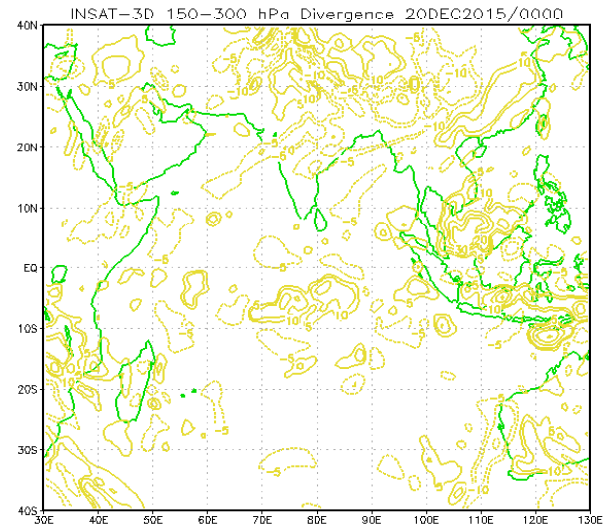
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Wind Products (convergence, Divergence & wind Shear)



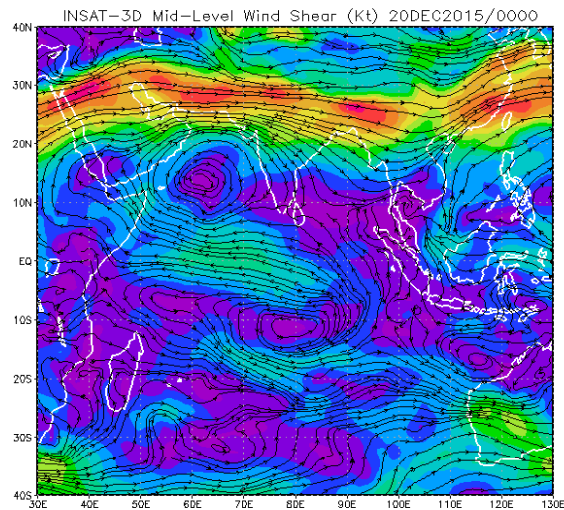
GRADS: COLA/IGES

2015-12-20-06:09



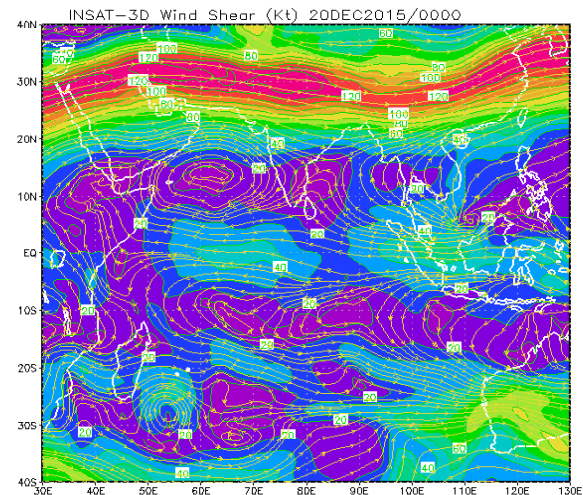
GRADS: COLA/IGES

2015-12-20-06:09



GRADS: COLA/IGES

2015-12-20-06:09

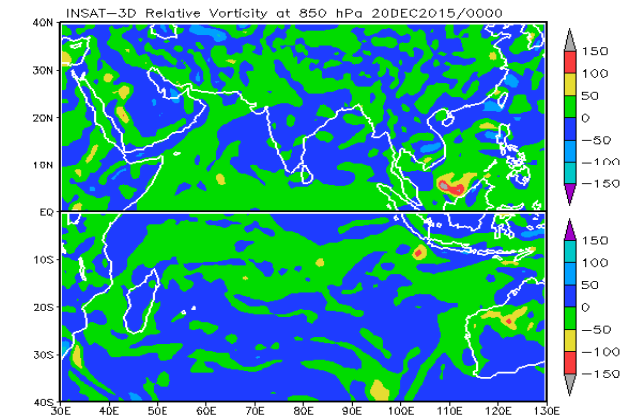
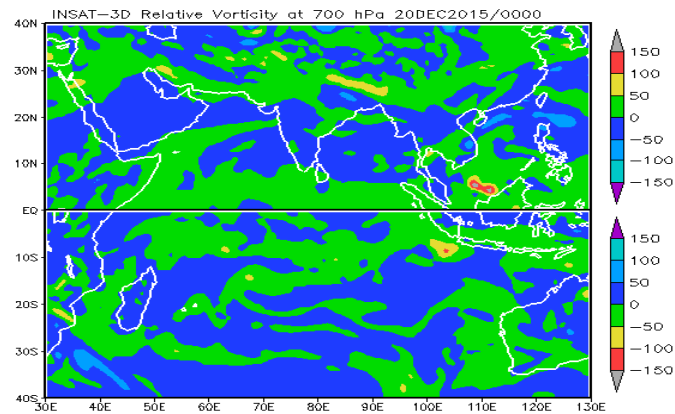
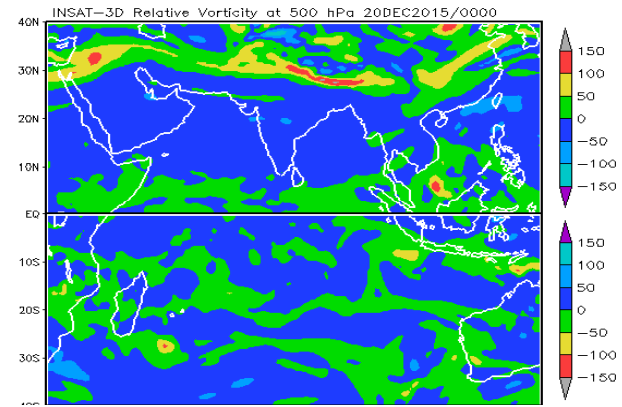
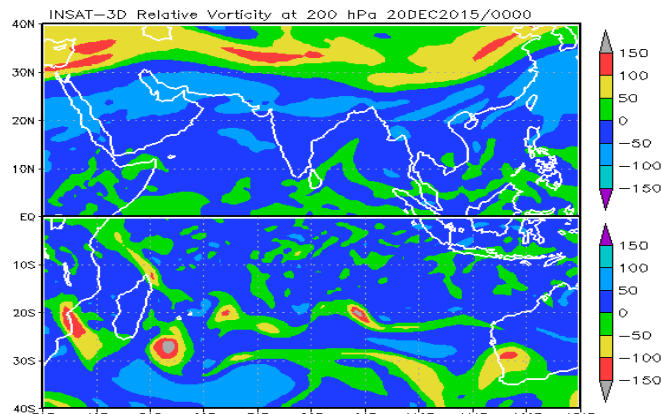


GRADS: COLA/IGES

2015-12-20-06:09

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Wind Products (Vorticity)



GRADS: COLA/IGES

2015-12-20-06:09 GRADS: COLA/IGES

2015-12-20-06:09

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IMD



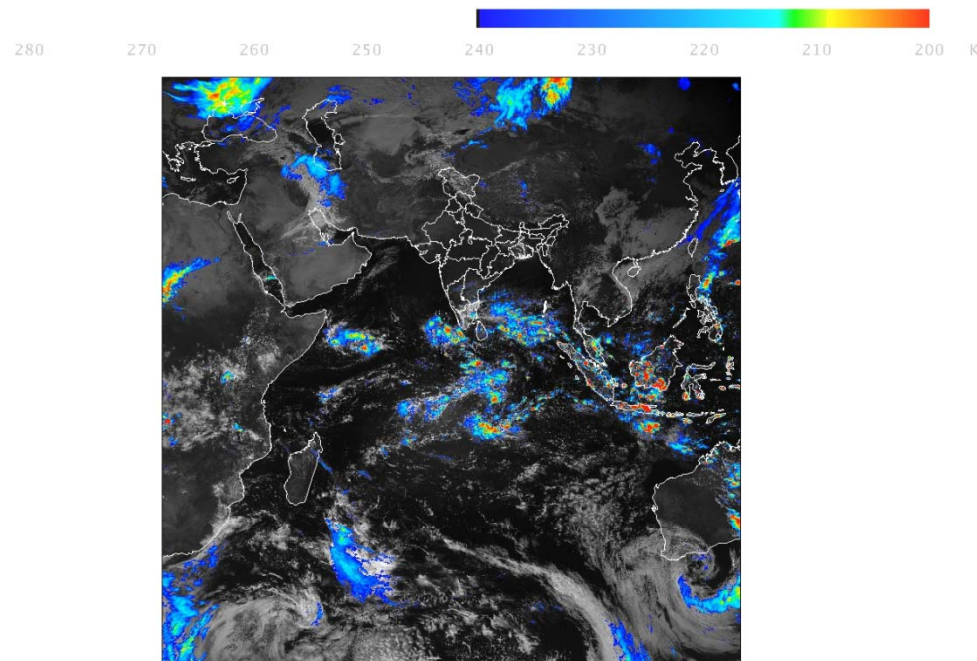
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Geophysical parameters from Sounder

S.No.	Parameter	Data Input
1.	Temperature, Humidity profile and Ozone	Brightness temperatures for 18 Sounder Channel and grey count for channel 19
2.	Geo-potential Height	Sounder retrieved temperature and humidity profiles at 40 pressure levels
3.	Layer Perceptible Water	Retrieved humidity at standard pressure levels
4.	Total Perceptible Water	Retrieved humidity at standard pressure levels
5.	Lifted Index	Sounder retrieved temperature and humidity profiles at standard pressure levels
6.	Dry Microburst Index	Sounder retrieved temperature and humidity profiles at standard pressure levels
7.	Maximum Vertical Theta-E Differential	Sounder retrieved temperature and humidity profiles at standard pressure levels
8.	Wind Index	Geo- potential Height and retrieved temperature and humidity profiles at standard pressure levels

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Generation of Sandwich Images with TIR1 BT and VIS Channels for thunderstorm activities is under development



IMG_TIR1_IEMP - Image Display 06-Dec-2015 07:30
IMG_VIS - Image Display 06-Dec-2015 07:30

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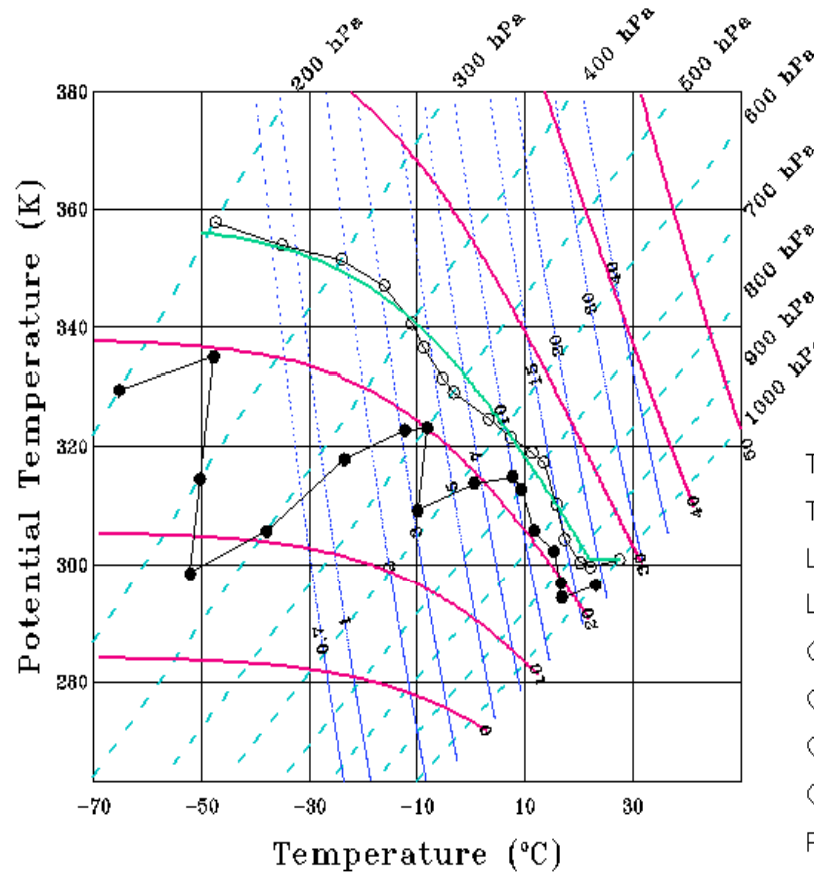
Generation of T-phi gram for 105 locations is under development

20AUG2015_0300_Ahmedabad

Nearest Sounding Location

Distance = 0.21 Deg.

LAT: 23.25, LON: 72.60



Tlcl: 22.0 °C

Td: 23.10 °C

LCL: 935.84 hpa

LFC: 935.84 hpa

CAPE: 160.15 J/kg

CIN: -430.08 J/kg

CCL: 953.1 hpa

Conv. Temp: 26.4 °C

Pafc: 998.10 hpa

Coordination Group for
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6/8/2016

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Details of
Volume of
data
generated in
IMDPS

Satellite	Data – Type	Data Size for 1 Day		Data Size Monthly	
K1VHR	RAWDATA	5.6 GB	11.4 GB	170 GB	342 GB
	HDF	4.8 GB		145 GB	
	Images & Products	1 GB		30 GB	
3AVHR	RAWDATA	4 GB	5.9 GB	120 G	177 GB
	HDF	1.8 GB		54 GB	
	Images & Products	66 MB		2 GB	
3ACCD	RAWDATA	2.1 GB	8.4 GB	65 GB	246 GB
	HDF	6 GB		180 GB	
	Images & Products	33 MB		1 GB	
3DIMG	RAWDATA	50 GB	114 GB	1.5 TB	3.4 TB
	HDF	50 GB		1.5 TB	
	Images & Products	14 GB		420 GB	
3DSND	RAWDATA	333 MB	3.1 GB	10 GB	95 GB
	HDF	833		25 GB	
	Images & Products	2 GB		60 GB	
TOTAL SIZE		142.8 GB		4.2 TB	

MODIFIED DATA – ARCHIVAL SCHEME

Satellite wise and type of data (Raw, HDF, JPG) data is being archived sequentially on Linear Tape Object (LTO) mounted on Tape Library in following three categories :

- RAWDATA
- HDF Files (Level-1, Level-2 & Level-3 Data)
- Channels & Products IMAGES(jpg & png)

**Coordination Group for
Meteorological Satellites**

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<http://satellite.imd.gov.in/insat.htm>

The screenshot displays the website satellite.imd.gov.in/insat.htm in a browser window. The page features a navigation menu at the top with links for **RAPID**, **Animation**, **CT BT**, **Archived Images**, **Product Information**, **INSAT 3D SRF**, **DRT Secretariat**, and **FAQ**. The main content area is divided into three columns:

- Left Column:** Contains a list of products under the heading **INSAT 3D**.
 - Atmospheric Motion Vector:** [WWW](#) | [CMV](#)
 - Visible Wind:** [MIR](#) | [Wind](#)
 - Vorticity:** [850mb](#) | [700mb](#) | [500mb](#) | [200mb](#)
 - Shear:** [Wind Shear](#) | [Mid Shear](#) | [Shear](#)
 - Tendency:** [Convergence](#) | [Low Level](#) | [Divergence](#) | [Upper Level](#)
 - Current Rainfall Product:** [HEM](#) | [IMR](#) | [QPE](#)
 - Daily Rainfall Product:** [HEM](#) | [IMR](#) | [QPE](#)
 - Other Products:** [OLR](#) | [UTH](#) | [SST](#) | [INS](#) | [LST](#) | [AOD](#) | [Fog](#) | [Snow](#)
 - Sounder Products:** [Vertical Profile](#) | [TPWV](#) | [Total Ozone](#)
 - [Satellite Bulletin](#)
- Center Column:** Displays a satellite image of India with a grid overlay. Metadata includes: **SAT: INSAT-3D IMG**, **IMG: IIRL 10.8 um**, **10-02-2016/14:30 GMT**, **10-02-2016/20:00 IST**, and **LIC: Mercator (LINEAR STRETCH: 1.0%)**.
- Right Column:** Lists various image products under the heading **INSAT 3D**.
 - Full Disk Images:** [Visible](#) | [SWIR](#) | [MIR](#) | [IR-1](#) | [IR-2](#) | [WV](#) | [IR_1 Brightness Temperature](#) | [Colour Composite](#)
 - Asia Sector Images:** [Visible](#) | [SWIR](#) | [MIR](#) | [IR-1](#) | [IR-2](#) | [WV](#) | [IR_1 Brightness Temperature](#) | [Colour Composite](#)
 - High Resolution North East Sector Images with District Boundaries:** [Visible](#) | [SWIR](#) | [MIR](#) | [IR-1](#) | [IR-2](#) | [WV](#)
 - High Resolution North West Sector Images with District Boundaries:** [Visible](#) | [SWIR](#) | [MIR](#) | [IR-1](#) | [IR-2](#) | [WV](#)
 - High Resolution South East Sector Images with District Boundaries:** [Visible](#) | [SWIR](#) | [MIR](#) | [IR-1](#) | [IR-2](#) | [WV](#)
 - High Resolution South West Sector Images with District Boundaries:** [Visible](#) | [SWIR](#) | [MIR](#) | [IR-1](#) | [IR-2](#) | [WV](#)
 - Cyclone Enhancement Images:** [SW Sector BD Curve](#) | [SW Sector IMD Curve](#) | [SE Sector BD Curve](#) | [SE Sector IMD Curve](#)
 - Special Sectors Images:**

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Online Archival of all channel images & products are available of <http://satellite.imd.gov.in/archive/>

Index of /archive

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 Parent Directory		-	
 CYCLONE-IMAGES/	30-Oct-2015 10:24	-	
 INSAT-3A-CCD/	14-Sep-2015 10:59	-	
 INSAT-3A-VHRR/	15-Jan-2015 04:05	-	
 INSAT-3D-IMAGER/	05-Sep-2015 09:43	-	
 INSAT-3D-SOUNDER/	14-Jan-2015 14:31	-	
 KALPANA-1/	15-Jan-2015 03:05	-	
 MODIS/	14-Jan-2015 14:56	-	
 REQUESTS/	17-Nov-2015 11:23	-	

Apache/2.2.15 (Red Hat) Server at satellite.imd.gov.in Port 80



Index of /archive/INSAT-3D-IMAGER

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 Parent Directory		-	
 3D-ASIA-SECTOR/	27-Nov-2015 11:59	-	
 3D-FULL-DISK/	03-Sep-2015 13:04	-	
 3D-PRODUCTS/	07-Sep-2015 11:31	-	
 DISTRICT_BOUNDARIES/	03-Sep-2015 12:34	-	
 HIGH-RESOLUTION/	05-Sep-2015 10:07	-	

Apache/2.2.15 (Red Hat) Server at satellite.imd.gov.in Port 80

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RAPID(Real time Analysis of Products & Information Dissemination) :- It is a web based quick visualization and analysis tool for satellite data on a real time basis.

<http://www.rapid.imd.gov.in>

- Connects atmospheric- and geosciences
- No specific OS/ software/ library / compiler required on the desktop. Access through web browser
- Provides features of interest to scientific community
- Open standards OGC
 - Web Mapping Service (WMS) – For visualization
 - Extensions written for scientific community
- Zero learning curve

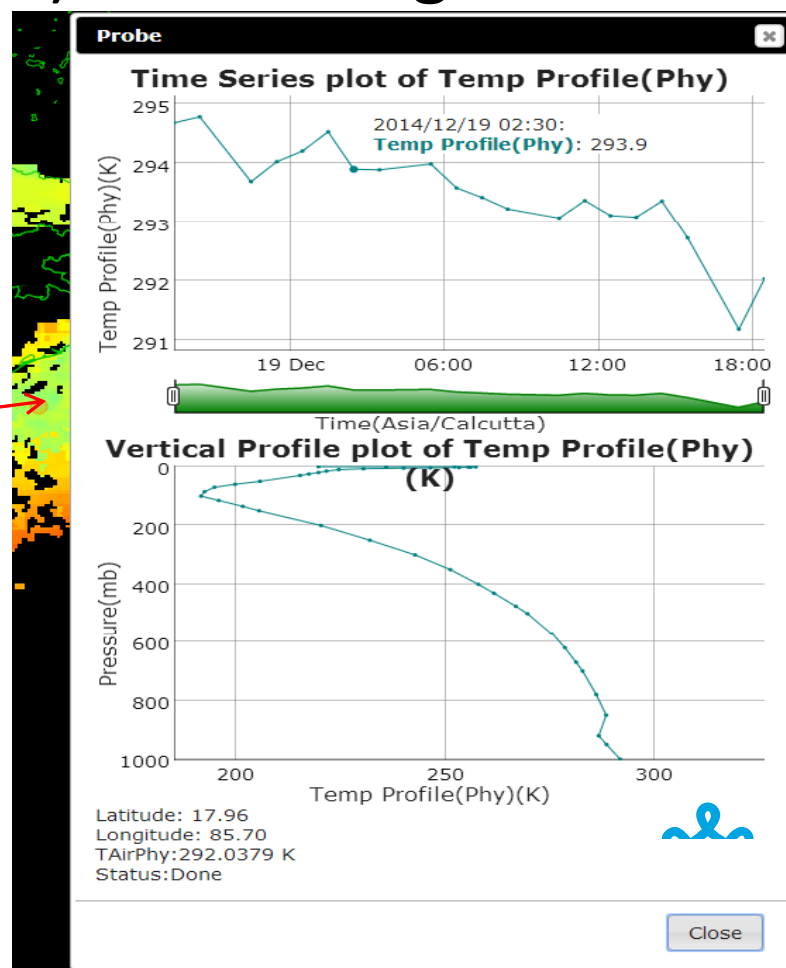
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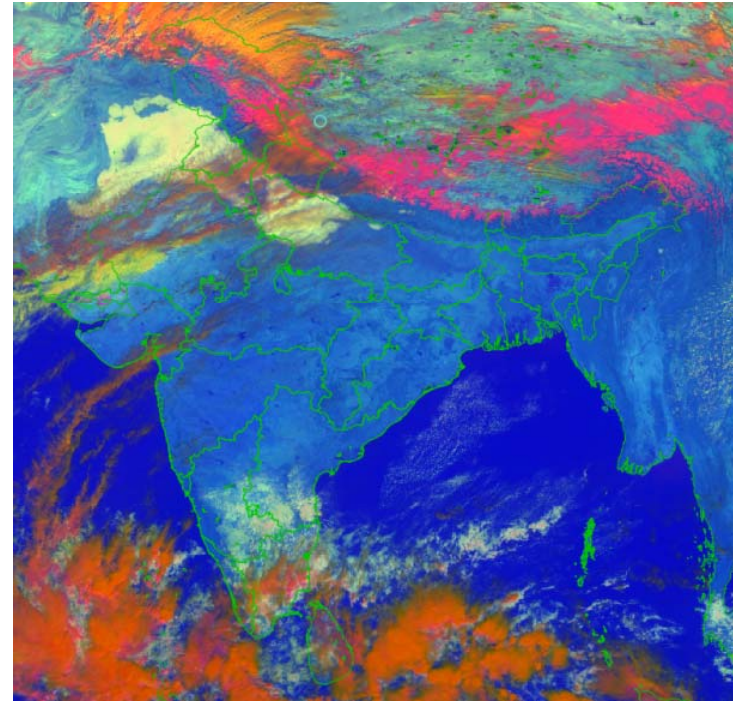
RAPID Features

- Overlay Map Boundaries (World Coastline, State, District Boundaries, Gridlines) with configurable:
 - Color
 - Opacity
 - Thickness
- Contrast Stretch
- Lookup Table Application
- Probe Data (on the fly)
 - Time Series
 - Vertical Profile
 - Transect



Features (Contd.)

- Animation
- RGB Composites
- Contouring
- Change Map background
- Base layers:
 - Open StreetMap
 - River Basins
 - Blue Marble
 - Bhuvan



RGB Composite: Day Microphysics

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National/ International Exchange of Data

Type of Data	Destination of Dissemination
Bufr Data Kalpana-1: IUCN40_DEMS IR IUCN41_DEMS WV IUCN42_DEMS VIS 3D-IMAGER: IUCN43_DEMS IRW IUCN44_DEMS VSW IUCN45_DEMS WVW IUCN46_DEMS MRW	GTS
Rawdata : 3AVHRR 3ACCD	SAC
HDF Data : 3DIMG_L1B_STD 3DSND_L1B_SA1.h5 3DSND_L2B_SA1.h5	NCMRWF (half hrly.)
HDF Data : 3DIMG_L1B_STD 3DSND_L1B_SA1.h5 3DSND_L2B_SA1.h5	NOAA (3hrly.)

AWS Data of ISRO/ IMD Network is also received/Archived at IMDPS New Delhi

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Future Plans

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INSAT - 3DR/ INSAT-3DS LAUNCH: 2016/2017



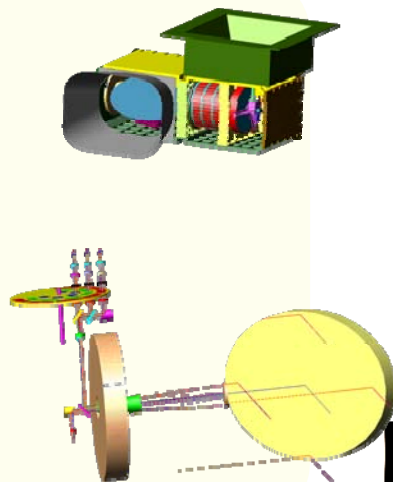


6 Channel IMAGER

- | | | |
|---------------------------|---------|--------|
| Spectral Bands | | |
| (μm) Visible | : 0.55 | - 0.75 |
| Short Wave Infra | : 1.55 | - 1.70 |
| Red Mid Wave | : 3.70 | - 3.95 |
| Infra Red Water | : 6.50 | - 7.10 |
| Vapour Thermal | : 10.30 | - 11.3 |
| Infra Red – 1 | : 11.30 | - 0 |
| Thermal Infra | | 12.5 |
- | | |
|------------|-----------------------|
| Resolution | : 1 km for Vis & SWIR |
| | 4 km for MIR & TIR |
| | 8 km for WV |

19 Channel SOUNDER

- | | | |
|----------------------------------|---------------|--|
| Spectral Bands (μm) | | |
| Short Wave Infra Red | : Six bands | |
| Mid Wave Infra Red | : Five Bands | |
| Long Wave Infra Red | : Seven Bands | |
| Visible | : One Band | |
- | | |
|-----------------|-------------------------|
| Resolution (km) | : 10 X 10 for all bands |
|-----------------|-------------------------|
- | | |
|--------------------|-----------------------|
| No of simultaneous | : 4 sounding per band |
|--------------------|-----------------------|

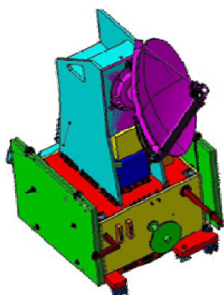


6/8/2016

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FUTURE LEO SATELLITES: (SCATSAT)

SCATSAT-1 is planned as an in-orbit replacement for the Scatterometer carried onboard Oceansat-2, which is non-functional after 4 ½ years of service.



Orbit : 720 km in sun-synchronous

LAUNCH: End 2016

- IMS-2 Bus
- Ku-Band (13.515 GHz) Pencil beam Scatterometer
- Ground resolution: 50 km x 50 km
- Swath: 1440 Km
- Polarization: HH and VV
- Wind Direction: 0 to 360 deg with accuracy of 20 deg
- Wind Speed: 4 to 24 m/s with accuracy of 10% or 2m/s

Objectives:

- To provide global wind vector data for national and international user Community.
- To provide continuity of weather forecasting services to the user communities.
- To generate wind vector products for weather forecasting, cyclone detection and tracking.

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FUTURE GEO Imaging SATELLITE: (GISAT)

Payloads:

1. High resolution multi-spectral VNIR (HRMX-VNIR):

Bands:	B1 (0.45 mm – 0.52 mm)	} 50m Res.
	B2 (0.52 mm – 0.59 mm)	
	B3 (0.62 mm – 0.68 mm)	
	B4 (0.71 mm – 0.74 mm)	
	B5 (0.77 mm – 0.86 mm)	
	B6 (0.845 mm – 0.875 mm)	

2. Hyper spectral VNIR:

No. of Bands : 60 bands in range 0.4 mm to 0.87 mm

Resolution : 320 m

3. Hyper spectral SWIR (HyS-SWIR):

No. of Bands : 150 bands in range 0.9 mm to 2.5 mm

Resolution : 192m

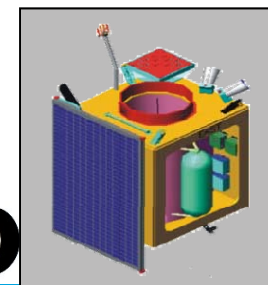
4. High resolution Multi-spectral (HRMX-TIR):

Bands:	TIR1 (7.1 mm – 7.6 mm)	} 1.5 km Res.
	TIR2 (8.3 mm – 8.7 mm)	
	TIR3 (9.4 mm – 9.8 mm)	
	TIR4 (10.3 mm – 11.3 mm)	
	TIR5 (11.5 mm – 12.5 mm)	
	TIR6 (13 mm – 13.5 mm)	

6/8/2016

•
*Multi-spectral
multi-resolution imager
Full of part of the earth
disk from
Geosynchronous orbit.*

**Frequent
Monitoring of
Coastal &
Ocean
Parameters**



CGMS

Immediate Plans

- Earth Station for future INSAT-3DR, INSAT-3DS and GISAT.
- Acquisition & Quick Look system for current and future satellites including AWS/ARG stations data.
- Processing and dissemination systems for current and future satellites including AWS/ ARG stations data with provision of 100% redundancy.
- Storage and data archival/ retrieval system of 01 Petabyte (PB) capacity with scalability up to 10 PB along with provision of on line visualization and analysis tools.

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- Integration of existing algorithms developed by SAC for Kalpana-1, INSAT-3A & INSAT-3D data processing and derivation of products and development of new algorithms as per IMD requirements.
- Development of new algorithms for data receiving, processing and products retrieval Algorithms for GISAT satellite as per IMD requirement.
- The detailed requirement of project will be worked out by joint committee of IMD and ISRO.

Satellite Applications

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The following are the main work performed by Satellite Application Unit :-

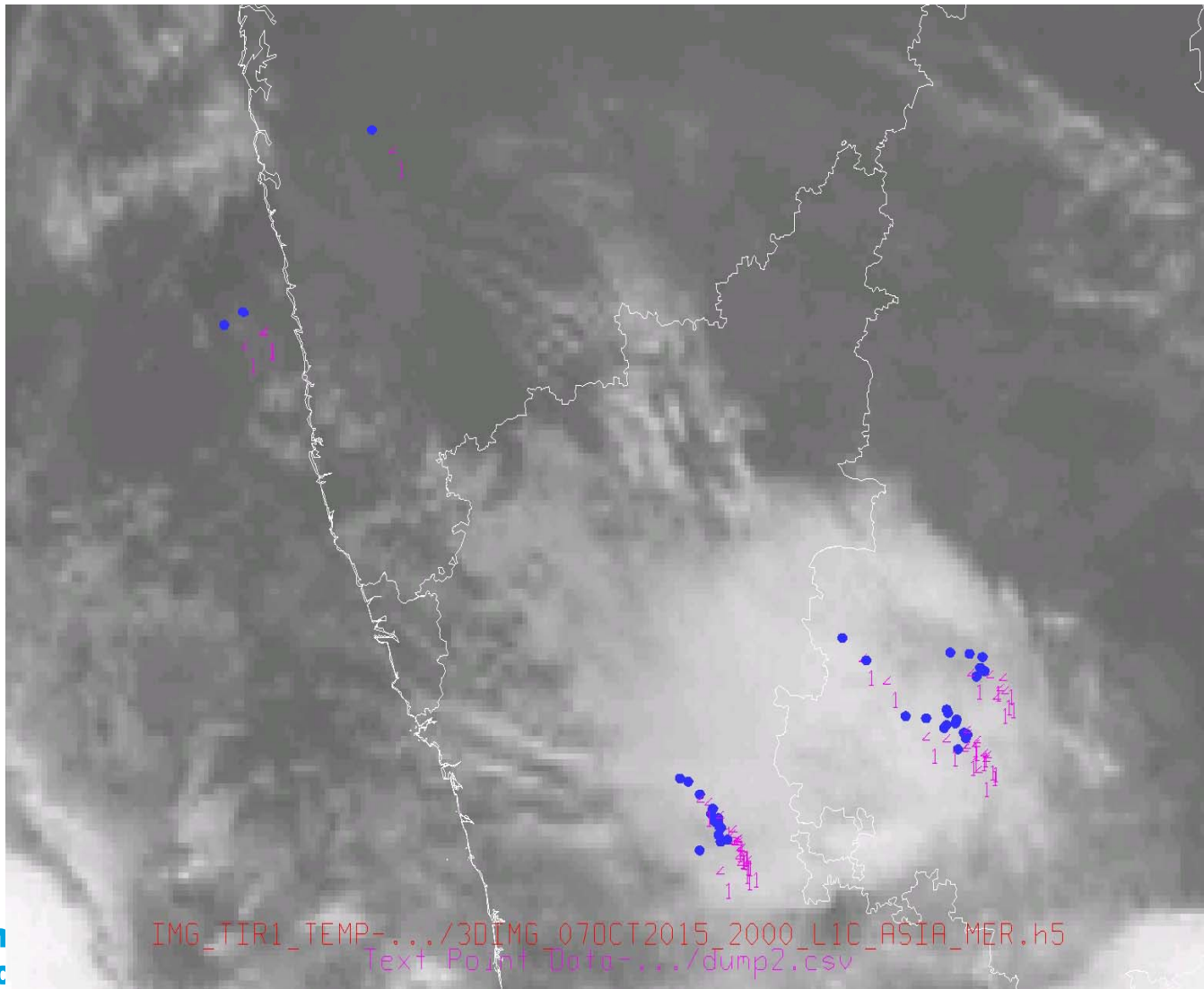
- Issuance of Satellite bulletins 3-hourly on the basis of all INSAT 3D derived products and transmitting the same to all users via GTS and email and put on website.
- Now casting of any severe weather phenomena's like thunderstorm and intimating the same to nearby stations via phone and email (special hourly bulletins) on priority basis.
- Issuance of special Hourly FOG bulletins with area estimation.
- Organizing and imparting training at national and international level.

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- At present Dvorak technique is used but manually applied for cyclone monitoring. Recently efforts have been made for automation of this technique. Automated Dvorak technique(ADT8.2.1) is running in experimental mode at Synoptic Application Unit, Satellite Meteorology Division.

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LIGHTENING DATA OVERLAID ON SATELLITE IMAGE



**Coordination
Meteorologic**



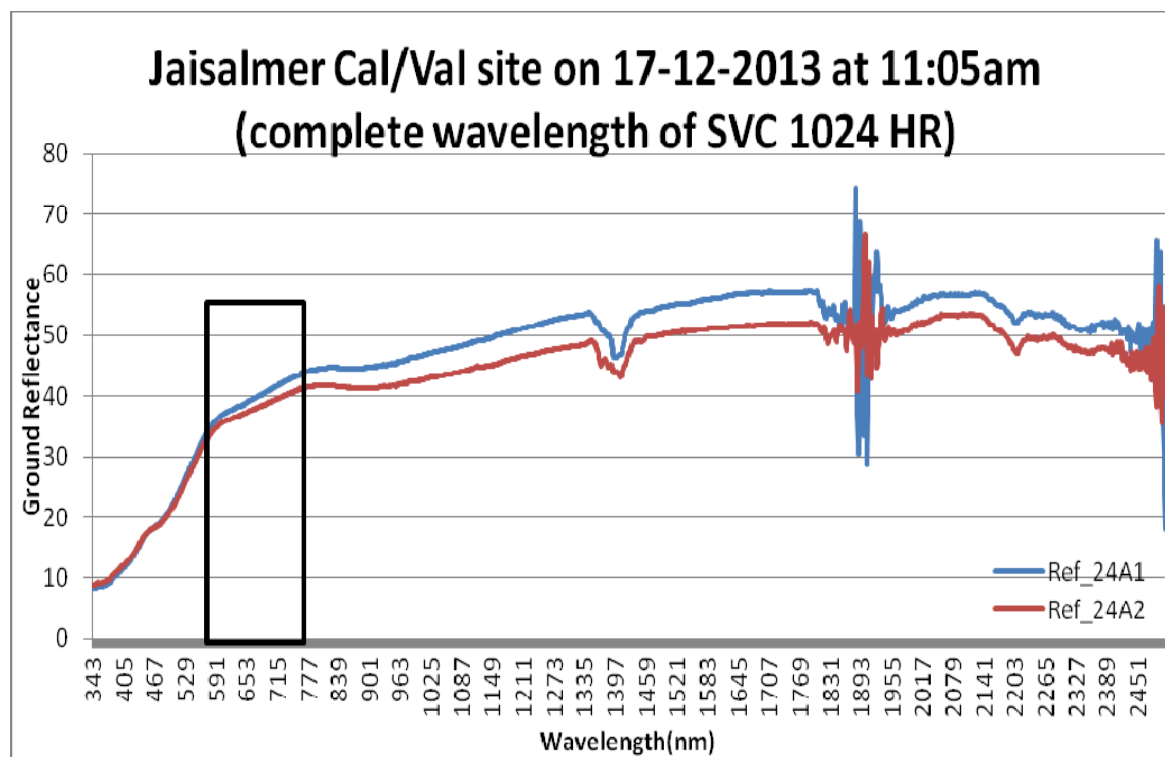
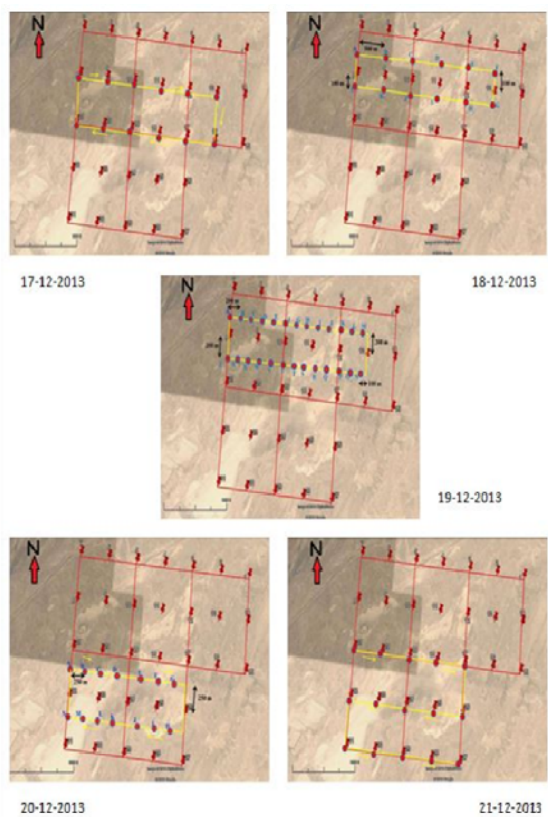
STATUS OF INSAT-3D RADIANCES AND WINDS

- INSAT-3D radiances (Imager/Sounder) are being assimilated in to the IMD NWP models. *INSAT/Kalpana-1 Satellite radiance assimilation is also done into the IMD Models.*
- INSAT-3D derived Winds (CMV/WVW) are being assimilated to NCMRWF models.
- INSAT-3D/Kalpana-1 derived Winds (IR/WV/Vis) as in BUFR format is also being provided to users.

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CAL/VAL WORK :

Two successful site campaigns done at Jaisalmer and Bhuj with NRSC RRSC, SAC,(ISRO), IITM and NPL scientists during December 2013 and May 2015 respectively.



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BHUJ

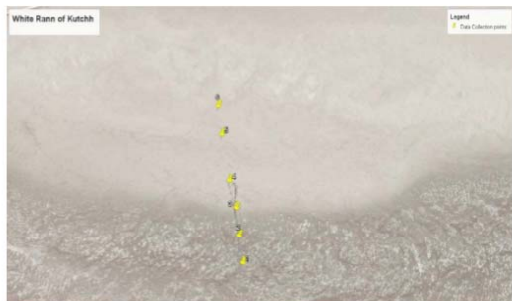


Figure 2: White Rann of Kutch along with data collection points for 01st May 2015.



Figure 1: Calibration Site at Great Rann of Kutch including the data collection points.

Work done for the Site suitability for vicarious calibration of imager and over Great Rann of Kutch for INSAT3D satellite. It was found that site spatial variability was a critical factor in site selection and sensor calibration. The comparison of TOA radiance computed for Visible & SWIR channels over Great Rann of Kutch and INSAT-3D satellite radiance matches as per expected.

Recently, for *Bhuj* site, a campaign has been done. Results show that this site may be selected for ideal Cal/Val site for INSAT-3D satellite.

FINDINGS:

The TOA radiance was simulated by 6S RT model using ground measurements. The conclusions based on this study are summarized below :

1. The present study concludes that GROK site is the preferred site for post launch calibration due to its accessibility, high degree of homogeneity, which helps to derive precise vicarious calibration coefficients.
2. The 6S simulated radiances are well comparable with the INSAT-3D imager measured radiance for all three dates over GROK and for WROK.
3. The estimated overall uncertainties in the calibration coefficients are found to be 3.63% in VIS and 4.11% in SWIR channels of INSAT-3D imager.

VALIDATION OF DATA PRODUCTS

The derived products are regularly validated with statistical methods and comparing with similar products of other satellites . If any major deviations are seen the algorithm improvement steps are taken along with ISRO.

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PROJECT : INTER-CALIBRATION OF IMAGER OBSERVATIONS FROM TIME-SERIES OF GEOSTATIONARY SATELLITES (IOGEO),SCOPE-CM.

The major objective of this SCOPE-CM (Sustained and Coordinated Processing of Environmental Satellite data for Climate Monitoring) project is the generation of a Fundamental Climate Data Record (FCDR) of calibrated and quality-controlled geostationary sensor data.

The FCDR will contain the visible, IR window and water vapour absorption channels of geostationary satellites. It is proposed to utilise the inter-satellite methodology developed by GSICS to tie existing time series of satellite data to the best reference available in space.

PROJECT PARTNERS

The India Meteorological Department (IMD) has become part of the SCM-06 IOGEO project team.

The IOGEO project team composition at the end 2014 is as follows:

1. EUMETSAT (Darmstadt, Germany) Rob Roebeling, Tim Hewison, Alessio Lattanzio, and Viju John
2. EUMETSAT CM SAF, DWD (Offenbach, Darmstadt) Marc Schröder
3. JMA (Tokyo, Japan) Masaya Takahashi
4. NOAA's NCDC (Asheville, NC, US) Kenneth Knapp, Anand Inamdar
5. CMA NSMC (Beijing, China) Peng Zhang, Xiuqing Hu
6. IMD (Delhi, India)* A.K Sharma, Ashim Mitra

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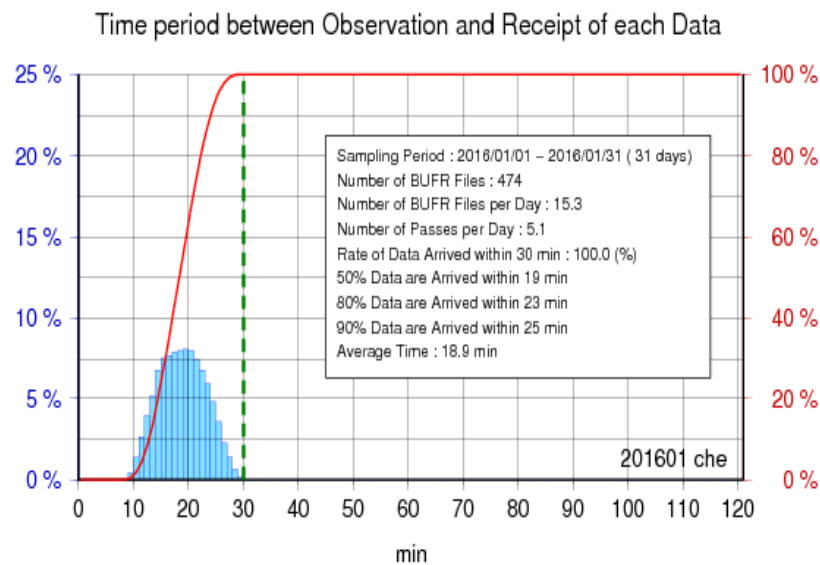
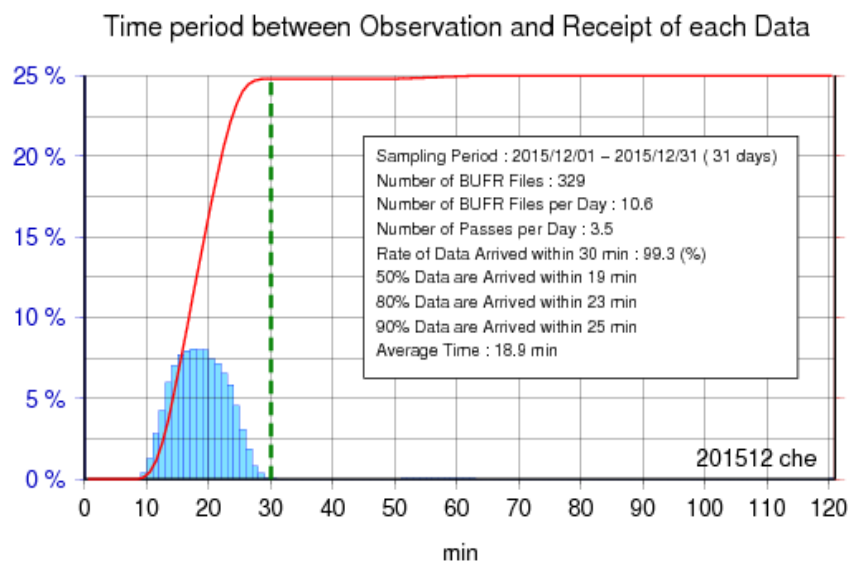
NOAA/METOP radiance BUFR data on RARS network

The NOAA/METOP data (AMSU/HIRS/MHS) data from New Delhi and Chennai are being provided to a Regional ATOVS Retransmission Services (RARS) which are operational arrangements for the real-time acquisition of polar-orbiting satellite data over a wide region containing a network of direct readout stations and their rapid delivery to the global user community through regional Processing Centers. The aim of this task is :

- To ensure that the data is used operationally (specially for NWP applications);
- To facilitate inter-regional data exchange and interoperability around the globe, with a particular focus on ensuring the global consistency of our own NOAA/METOP ground receiving system datasets.

DATA TRANSMISSION TO RARS NETWORK

Meenambakkam Chennai RARS data transmission to RTH/ JMA Tokyo reached 100% with in a stipulated time period for the month of December 2015& January 2016.



Present State of National Satellite Data Center (NSDC) and GNSS Data Processing Unit

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- The present NSDC was established in 2006 to archive INSAT data and products.
- New Data center is proposed . The salient features of the proposed Data Center are :
 - 1) Near Real-time Information sharing with experts, research institutes and others, Interactive, Easier, efficient way to Analyse, Visualize and Share the data.
 - 2) All time data availability (past and present).
 - 3) Portal to allow Search, Visualization, Analytics, Modeling, Download, Online Payment, if any.
 - 4) Collect and Manage Level 0, 1, 2 of INSAT Image and Sounder Data.
 - 5) Data validation or quality control at each phase.
 - 6) Store processed data, based on category, grouping, metadata tagging etc.
 - 7) Ability to convert the data output in different formats based on user requirement.
- **This project will be completed by 2017 and will have capability to archive data from future satellites launched in next 5 years.**

GNSS Data Processing Center

1. The IMD is in the process of installing 25 nos. network stations for estimating Integrated Precipitable water vapour (IPWV) using GNSS receivers . It is likely to be operational from July, 2016 onwards.
2. IMD is also in the process of exchanging GNSS data with MoES, INCOIS, NGRI and other research institutes of India.
3. Assimilation of GNSS IPWV data along with Met. data in NWP in next 6 months.
4. As proposed in the vision 2020, in the next five years, IMD may expand the GNSS network by addition of 100 more stations.

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GNSS Network



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Thank you