

CURRENT OPERATIONAL SATELLITES OF INDIA

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CGMS Members are invited to take note.

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INTRODUCTION

INSAT is an operational multipurpose satellite system catering to the needs of three different services, viz Television & Radio Broadcasting, Communications and Meteorology. The INSAT project is a joint venture of the Department of Telecommunications (DOT), the India Meteorological Department (IMD), Doordarshan and All India Radio (AIR). The responsibility for overall management and coordination of the INSAT system among the user agencies rests with the INSAT co-ordination committee (ICC).

All INSAT satellites are three-axis body stabilized spacecrafts. The last satellite of INSAT-2 series i.e., INSAT-2E was launched successfully on 3 April 1999. It is operational from May 1999 and acting as a backup satellite. It has a payload, called Charged Coupled Device (CCD) camera capable of taking 1 km resolution images in 3 bands. The meteorological imaging capability has also been upgraded on this satellite, as compared to its predecessors, by providing a water vapor channel with 8 km resolution in the VHRR, the imaging instrument of the satellite. A dedicated Meteorological Satellite Kalpana-1 has been launched by India in Sept, 2002 for earth imagery with three channel Very High Resolution Radiometer (VHRR) and Data Relay Transponder (DRT) for collection of meteorological and hydrological data from automatic weather stations. One more satellite INSAT 3A was launched by India in April 2003 with 3 channel VHRR cloud imagery (Visible, Infrared and Water Vapour), Charged Coupled Device (CCD) camera (Visible, Near IR and SWIR) and a DRT payload. Both these satellites are working satisfactorily and are operationally used for meteorological applications for day to day weather forecasting and derivation of satellite data products.

1.2 CURRENT OPERATIONAL STATUS

The imaging mission is working satisfactorily with Kalpana-1 and INSAT - 3A satellites are being used operationally. The activities like image processing, derivation of meteorological products, data archival and dissemination of products to field stations for operational use are being done on routine basis.

VHRR images are now a days normally received at hourly intervals. More frequent images are taken for monitoring the development of special weather phenomena as and when the situation demands. More frequent images are taken if situation demands. For the derivation of CMV's half hourly triplets at 0000 UTC and 0700 UTC from Kalpana-1 and 1200 UTC from INSAT-3A are received and processed. The INSAT-3A and Kalpana-1 derived CMV are transmitted on GTS.

1.2 Automatic Weather Stations (AWS)

AWS are installed all over the country to take meteorological observations every hour and transmit it to the satellite. The Data Relay Transponder on-board the satellite receives these data and retransmit it to Delhi Earth Station of IMD. Satellite Division receives these data and processes it to get meteorological data in the required format. Data from remote unmanned stations & ocean buoys is also received. At present there are about 180 AWS operating in the network using DRT.

1.3 Meteorological Data Dissemination (MDD)

IMDPS transmit processed imagery, meteorological and fax weather charts to field forecasting offices distributed over the country using the Meteorological data Dissemination (MDD) facility, through INSAT-3C in broadcast mode using C x S band transponder.

Synoptic bulletins providing descriptions of the cloud organisation and coverage are also sent as advisory to forecasting offices every synoptic hour. When cyclones are detected in satellite imagery, these bulletins are sent every hour. Such advisories are also transmitted to the neighboring countries.

Processed satellite imagery, analyzed weather charts and conventional synoptic data is unlinked to the satellite in C-band. Satellite broadcasts these data to MDD stations in S - band. MDD Stations analyse weather imagery and other data to generate required forecast. The processing system is also being used for generating analogue type of cloud imagery data which are transmitted through INSAT-3C to field station using S-band broadcast capability of the satellite along with other conventional meteorological data and FAX charts. This scheme is called Meteorological Data Dissemination (MDD). There are about 90 MDD receiving stations in the country being operated by different agencies. Two MDD receiving stations are also operating in neighboring countries at Sri Lanka and Male under bi-lateral agreement. In general, the processed images are sent to these stations every three hours, and every hour during cyclone periods. These stations

are receiving direct broadcast of cloud imager, weather facsimile charts and meteorological data on an operational basis. The frequency of transmission from ground to satellite (Uplink is 5899.225 MHz and downlink is at 2599.225 MHz).

It is proposed to switch over from analogue MDD to digital MDD in order to further improve the quality of operational data received at the out stations to shorter the time of transmission and to improve utilization of data by field stations.

1.4 Cyclone Warning Dissemination System (CWDS)

This is a direct broadcast service of cyclone warning in the regional languages likely to likely affected areas. There are 250 stations along the Indian coast that provide the useful service. The India Meteorological Department's Area Cyclone Warning Centers (ACWCs) at Chennai, Mumbai and Calcutta are responsible for originating and disseminating the cyclone warnings through INSAT in the broadcast mode to likely affected areas. This service is unique in the world and helps the public in general and the administration, in particular, during the cyclone season.

A cyclone warning is generated based on the observation from satellite imageries. The cyclone warning is uplinked to the INSAT Satellite in C-band. Satellite broadcasts this warning to the coastal stations in their regional languages. Warning is selective and will be received only by the affected stations. It is a very useful system and has saved lives & property from the fury of cyclones. For quick dissemination of warning against impending disaster from approaching cyclones, IMD has installed specially designed receivers within the vulnerable coastal areas for direct transmission of warnings to the officials and people in general using broadcast capability of INSAT satellite. IMD's Area Cyclone Warnings Centers (ACWC) generate these special warning bulletins and transmit them every hour in local languages to the affected areas. IMD in the field areas has installed 250 such receivers. CWDS has proved very effective system of warning people during the cyclone affecting the coastal areas. For this service the frequency of transmission from ground to satellite (uplink) is 5859.225 MHz and Downlink is at

2559.225 MHz. Recently, a digital CWDS scheme has been implemented in Andhra Pradesh. One hundred digital receive stations with an uplink station at IMD, Chennai have been installed. These have shown good results.

It is proposed to switch over from analogue CWDS to digital CWDS in order to further improve the quality of cyclone warning received at the coastal stations.

1.6 TRAINING AND REASEARCH ACTIVITIES

IMD is providing training in satellite meteorology to Indian and foreign students under SAARC and other related programmes on a regular basis. Expert scientists conduct the theory and practical classes. A new institute had been set up in 1998 at Ahmedabad (India) to teach Satellite Meteorology and other related subjects to national and foreign personnel. This institution is named as “ Center for Space Science and Technology Education for Asia and the Pacific (CSSTE-AP)” and is affiliated to the United Nations. IMD’s experts are delivering lectures on satellite Meteorology in the Post Graduate training courses conducted periodically by this Institute.

IMD and other institutions namely, Space Applications Center, Indian institute of Technology, National Center for Medium Range Weather Forecasting (NCMRWF), Indian Institute of Tropical Meteorology (IITM). Indian Institute of Science and a few national universities are utilizing INSAT data for research in meteorology and Atmospheric Science.

1.7 RECEPTION OF NOAA SATELLITE DATA

The data from NOAA series of polar orbiting satellites are received and processed by IMD at Delhi. Both AVHRR and ATOVS data are processed in real time till the antenna control unit developed fault in December 2004. The derived products are archived for distribution on demand basis to the scientists for use in research work. The vertical temperature and moisture profiles derived from the NOAA satellite have shown positive impact on forecasts generated with numerical models.

1.8 PDUS for METEOSAT-5 data reception :

A PDUS receiving station has been working at IMD, New Delhi for reception of imagery data from METEOSAT-5 SATELLITE LOCATED AT 63 deg E over the Indian Ocean. This system is operational since March, 2000.

1.9 INDO –US data Exchange Centre

Under the bilateral programme of co-operation with USA, an INDO-US data Exchange Centre has been established at IMD, New Delhi in Nov, 99 for exchange of satellite data with USA. Processed INSAT imagery data is being transmitted every three hours to the USA. GOES imagery data is also being received from USA.

Data exchange takes place through dedicated communication links.

Appendix-A

INSAT-2 : Geostationary Satellite Series

Satellite	Launch Date	Met. Payload with Wavelength Bands	Major Applications
INSAT-2E	April,1999	1. VHRR with 3 Channels 0.55 – 0.75 μm 10.5 – 12.5 μm 5.7 – 7.1 μm 2. CCD with 3 Channels 0.63 - 0.69 μm 0.77 - 0.86 μm 1.55 - 1.70 μm (VHRR onboard INSAT-2E is not operating due to technical snag)	<ul style="list-style-type: none"> • Monitoring cyclones & monsoon • Mesoscale features • Flood/intense precipitation advisory • Snow detection • Crop discrimination • Aerosols studies

Appendix-B**INDIAN NATIONAL SATELLITE INSAT-3A and Kalpana-1****INSAT-3: Geostationary Satellite Series – PRESENT**

Satellite	Launch Date	Met. Payload with Wavelength Bands	Major Applications
Kalpana-1	September, 2002	VHRR : Similar to INSAT-2E/3A	<ul style="list-style-type: none"> • Monitoring cyclones & monsoon • CMV Winds • OLR Rainfall Estimation
INSAT-3A	April, 2003	1. VHRR : (As above) 2. CCD Payload Bands : 0.63-0.69 μ m 0.77-0.86 μ m 1.55-1.70 μ m (VHRR onboard INSAT-3A is identical to VHRR onboard KALPANA-1 and 2E)	<ul style="list-style-type: none"> • Monitoring cyclones & monsoon • CMV Winds • OLR • Rainfall Estimation • Mesoscale features • Flood/intense precipitation advisory • Snow detection