

WORLD METEOROLOGICAL ORGANIZATION

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COMMISSION FOR BASIC SYSTEMS  
OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS

EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS

ITEM: 7

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## **Use of visualization tools: Example case from RA II**

*(Submitted by Suman Goyal, IMD)*

### **Summary and Purpose of Document**

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India Meteorological Department (IMD) routinely provides the processed imagery and derived quantitative products from various INSAT satellites (INSAT-3D, KALPANA1, INSAT-3A) to the user community. INSAT-3D is an advance meteorological Satellite launched by Indian Space Research organization (ISRO) carrying advance weather monitoring payloads. It improves imaging system and atmospheric sounder. INSAT-3D monitor earth surface and carryout oceanic observation and also provide data dissemination capabilities. The visualization of satellite data is done by java based software MIAS (**M**eteorological **I**mage **A**nalysis **S**oftware).

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### **ACTION PROPOSED**

The eighth session is invited to review the document and consider input to its conclusions and recommendations as appropriate.

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## Discussion

### Introduction

KALPANA 1, INSAT-3A, INSAT-3D are the weather satellites of IMD where INSAT-3D is the latest and advance weather satellite launched by ISRO (Indian Space Research Organisation). INSAT-3D is a multipurpose geosynchronous spacecraft with main meteorological payloads (imager and sounder). The main objectives for this mission are to provide an operational, environmental and storm warning system to protect life and property. INSAT-3D will:-

1. Monitor earth's surface and carryout oceanic observations and also provide data dissemination capabilities.
2. Provide Broadcast Satellite Services (BSS) through two S-band transponders.

The data acquisition and processing system is established in the India Meteorological Department, Lodi Road, New Delhi, India. The processing of INSAT-3D data will take place broadly in four steps:-

1. Ground receiving system to receive data
2. Data Reception (DR) system to generate raw data (L0) files
3. Data Processing (DP) system to process L0 data and produce L1B data files (Calibrated and Geo located).
4. Product generation and Dissemination system

The INSAT-3D spacecraft incorporates advanced Imager and Sounder instruments. The INSAT-3D sounder has 18 infrared channels distributed over longwave and shortwave bands. A visible channel provides synoptic view of the clouds and the earth to aid in generating three dimensional map of temperature and moisture structure of the atmosphere

The data format obtained by weather satellites is in Hdf5 format and that can be visualized and analysed by MIAS (Meteorological image analysis software) developed by SAC (Space Application Centre) a branch of ISRO. The main goal is to provide new and innovative ways of displaying and analysing earth science data as well.

MIAS is very powerful software for display and analysis of satellite imagery. It is a Data Visualization and Analysis Tool for Climate and Weather datasets. It has many of the facilities for satellite, Radar, radiosonde and other application according to all meteorological prospects. It is a sophisticated software packages that perform a wide variety of functions with satellite imagery, observational reports, numerical forecasts, and other geophysical data. The brief introduction of MIAS is:

1. It is a collection of User Program and libraries for visualizing and analysing geophysical data (Environment Satellite like INSAT-3D, KALPANA 1, INSAT-3A etc.)
2. It is a JAVA based for LINUX platform software. A synergistic tool that integrates numerous data types into one system.
3. Access to extensive Geophysical data base.
4. It is based on SSEC (Space Science and Engineering Center), VisAD (Visualization for Algorithm Development), Unidata IDV (Integrated Data Viewer) and netcdf-java.

Libraries:-

VisAD <http://www.ssec.wisc.edu/~billh/visad.html>

IDV (Integrated Data Viewer) <http://www.unidata.ucar.edu/software/idv/>

netcdf-java <http://www.unidata.ucar.edu/software/thredds/current/netcdf-java>

### **Functionality:-**

The main attributes of MIAS are that it visualized the imagery for local as well as server data for both real time and archived data set and having extensive visualization capabilities. It has a lot of functionality for analysing the satellite data.

MIAS is very useful to scientists (to gain insight into weather and climate phenomena), modellers (developing diagnostic to explain weather and climate changes) and software developers (creating tools to visualize and manipulate data for use by researchers and operational meteorologists)

The main functionality of the MIAS is:

1. Image processing in digitalized format and having a lot of tools for DIP (Digital Image Processing) for easy analysis of data.
2. It is a GUI (Graphical User Interface) based software and having a lot of functionality for GIS (Graphical Information System) application with standard product and geophysical parameters.
3. MIAS is visualized the satellite data set in plan view, vertical cross section, vertical profile, iso-surface, volume rendering and the most important is combination of multiple data set. It has also capabilities in advance 4-D interactive visualization i.e. very useful for meteorologist to analyse the weather.
4. It also supports the ASCII format and having a feature to display satellite data in ASCII format i.e. very useful for validation process.
5. Analysis:
  - a. Stretching and LUT (Look Up Table) Application
  - b. Data Probe/ Time Series and Transects
  - c. Derived Quantities
  - d. Image Arithmetic

### **Data Format:**

MIAS accesses numerous data type of satellite, different observation and modal analysis. It supports scientific, societal and educational data formats. For scientific data formats it supports Geo-infrared netcdf data (local and remote), HDF-5, GRIB (GRIdded Binary or General Regularly-distributed Information in Binary form). For societal data format it supports Area, Shapefile and ASCII data format. The remote data are also accessed by MIAS like ADDE (Abstract Data Distribution Environment), open DAP, http, ftp and directly from URL's. For the image data set it supports RTIMAGES (Real Time Images), GINIEAST (GOES East Images), GINIWEST (GOES West Images), GINICOM, CIMSS (Cooperative Institute for Meteorological Satellite Studies), and NEXRCOMP (Composite of NEXRAD Imagery).