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RA II WIGOS Project Newsletter

DEVELOPING SUPPORT FOR NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES IN SATELLITE DATA, PRODUCTS AND TRAINING

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Launch of JMA's New International Service "HimawariRequest"

The Japan Meteorological Agency (JMA) launched a new international "HimawariRequest" service, in collaboration with the Australian Bureau of Meteorology. The service allows NMHS users in Himawari8/9 coverage area to request Target Area observation.

The Advanced Himawari Imager (AHI) on board Himawari-8/9 is capable of frequent and flexible observation, providing Full-Disk images of the earth every 10 minutes and regional images with shorter intervals. Full-Disk and other regional observations have spatial resolutions of 0.5 to 2 km and spectral coverage incorporating 16 bands.

Target Area observation covers a 1,000 km x 1,000 km area every 2.5 minutes with flexibility for location changes to support JMA's national and international services. The observation is normally focused on an area of active volcanoes in the domain of the Tokyo Volcanic Ash Advisory Center (VAAC), and is adapted to encompass typhoons within the responsibility area of the Regional Specialized Meteorological Center (RSMC) - Tokyo Typhoon Center.

In response to a recommendation made at the Joint RA II/RA V Workshop on WIGOS for Disaster Risk Reduction (2015), the Project work plans for the period from 2017 to 2020 incorporate activities "to develop a protocol for NMHSs of the countries in the Region to request event-driven rapid scan imagery". The HimawariRequest service is an outcome of related efforts.

The WMO Secretariat recently announced the launch of the service and forwarded JMA/DG's letter on the subject (link below) to RA II/RA V Members.

https://www.wmo.int/edistrib_exped/grp_Semicircular/_en/01564-2018-0BS-SAT-HimawariR

equest_en.pdf.
Details are provided in the HimawariRequest Service Description attached to the letter.

JMA expects the HimawariRequest service to support disaster risk reduction activities in the region based on the monitoring of extreme events such as tropical cyclones and volcanic eruptions.

(Ryo Yoshida, JMA)

Himawari-8 Maintenance

Maintenance of the Himawari-8 satellite took place over a two-day period from 02:20 UTC on 13 February to 07:20 UTC on 14 February 2018. All products during this time were created using data from the operational Himawari-9 satellite.

This maintenance was for the Advanced Himawari Imager (AHI) on Himawari-8, and encompassed the following:

1) Scanner calibration
2) Special observation with switching of AHI detectors
3) Update of best detector select (BDS) map

For information on Himawari-9 product performance see JMA (2017), which reports on validation results from a period of Himawari-9 in-orbit testing (IOT).

1) Scanner calibration

The Himawari-8/AHI (AHI-8) has two scan mirrors (Fig. 1). One rotates on the X axis and the other on the Z axis to scan the earth's surface. The mirrors are commanded using the angle of the X/Z axis to fix the line of sight. There are differences between the commanded and actual mirror angles, and these discrepancies gradually increase with operation. This could in turn cause image navigation and registration (INR) errors.

Annual scanner calibration is recommended to reduce these differences and maintain INR performance.

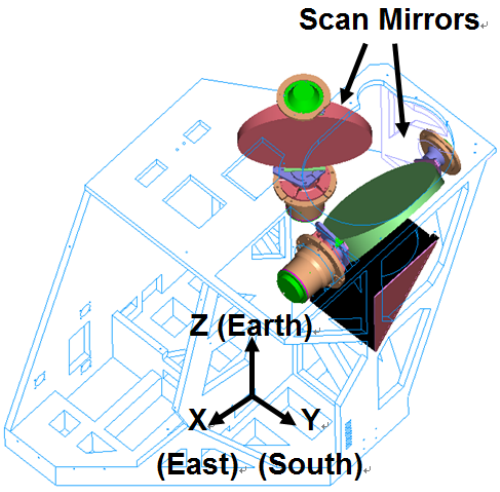


Fig. 1. NS and EW scan drive assemblies of the Advanced Himawari Imager (Griffith, 2015).

2) Special observation with switching of AHI detectors

AHI-8 has several redundant detector columns for each band (three for Bands 1 to 3 and six for the other bands), and the best detector in each row is selected. The layout of selected detectors (known as the best detector select (BDS) map) can be expressed as shown in Fig. 2 (right).

The performance of all detectors was evaluated during in-orbit testing (IOT) in December 2014 and the best detectors were chosen, but the performance of several detectors has changed over the past three years. To evaluate the latest characteristics (e.g., signal-to-noise ratios) of all detectors, special observation was performed with switching of redundant detector columns.

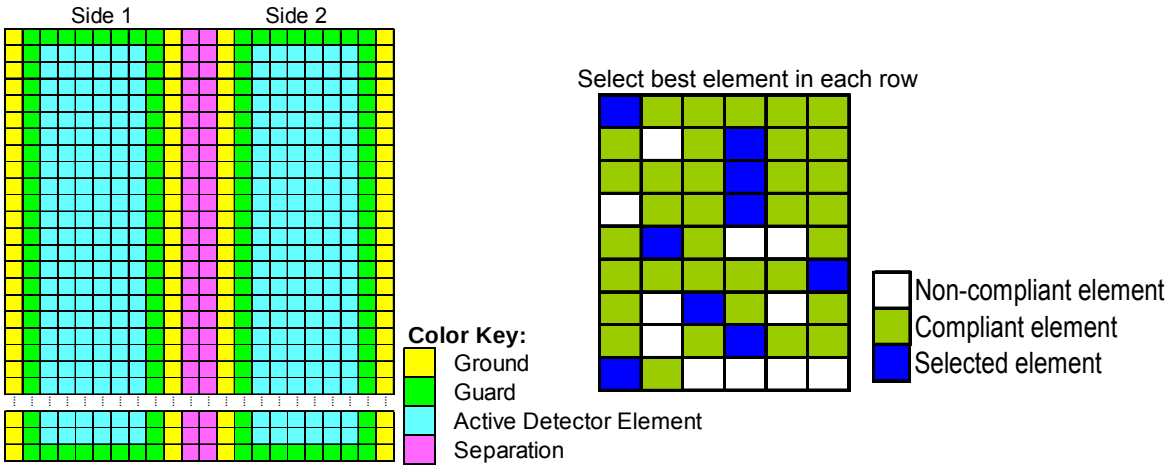


Fig. 2. Left: Layout of detectors for one of Bands 4 to 16. Right: A BDS map for one of Bands 4 to 16 (Griffith 2015).

3) BDS map update

As described in Section 2), the characteristics of several AHI-8 detectors had become unstable in orbit, resulting in stripe noise in the E-W direction on Himawari-8 imagery.

Figure 3 shows two examples of such noise. (a) and (b) show an infrared differential image and a Band 8 image, respectively, with very clear stripe noise in the E-W direction. This could degrade the quality of geophysical products (e.g., the number of valid grid-point data) and affect the qualitative use of satellite imagery (e.g., for volcanic ash monitoring).

To eliminate this noise, the use of around 10 unstable detectors in infrared bands was switched to redundant detectors. Table 1 shows the number of detectors changed for each band.

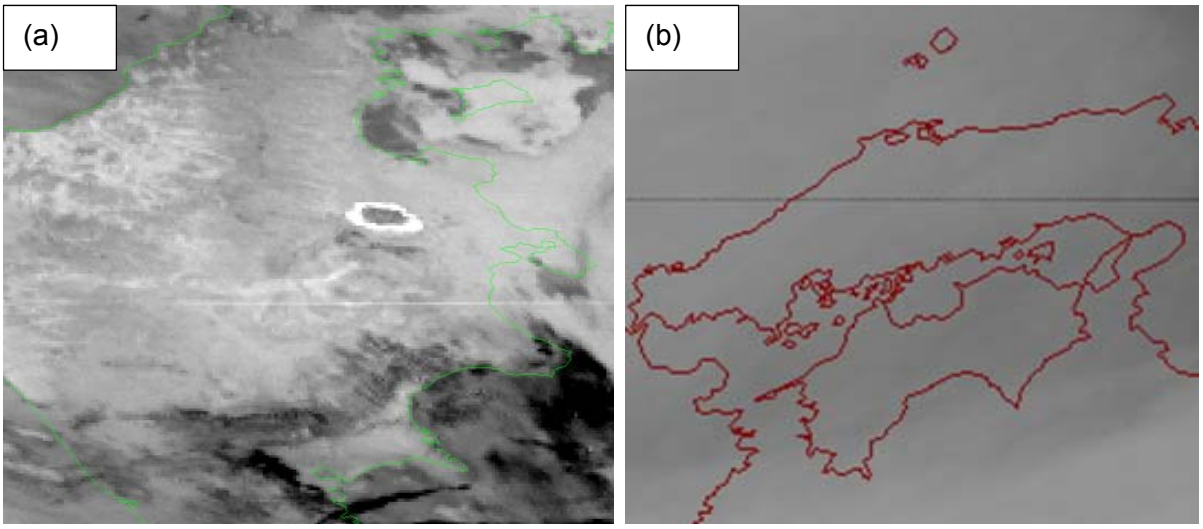


Fig. 3. Stripe noise in Himawari-8 imagery. (a) Infrared differential image (Bands 13 – 15), 17:10 UTC, 14 June 2017. (b) Band 8 image, 19:00 UTC, 6 January 2017.

Table 1. Number of changed detectors for each band

Band	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number	0	0	0	0	0	0	0	2	0	5	0	0	1	0	0	3

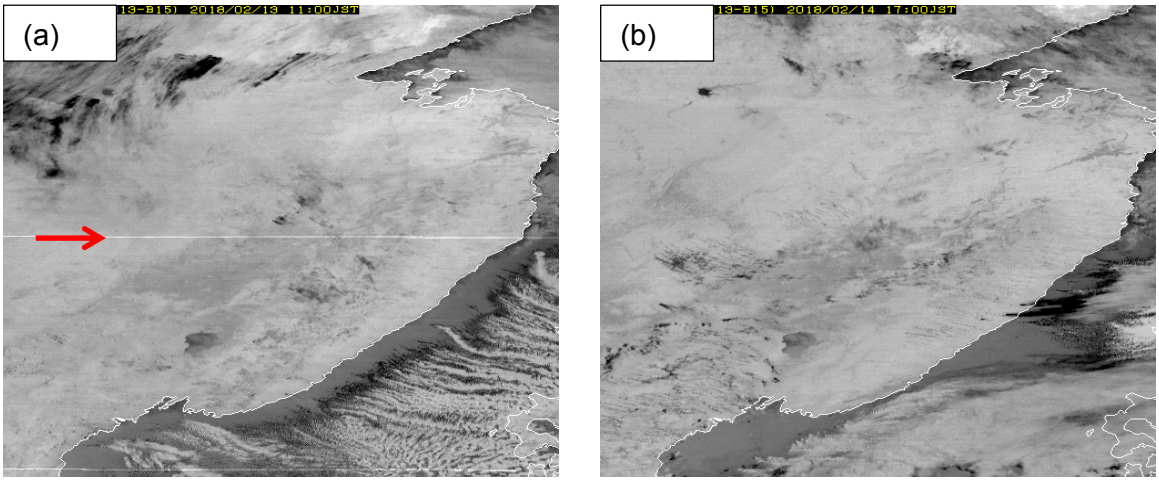


Fig. 4. Infrared differential imagery (Bands 13 - 15) from Himawari-8. (a) Before BDS map update, 02:00 UTC, 13 February 2018. (b) After BDS map update, 08:00 UTC, 14 February 2018.

Figure 4 shows the impacts of the BDS map update on Himawari-8 imagery. The clear white stripe noise in the E-W direction in (a) is effectively removed in (b).

References

JMA, 2017: Validation of Himawari-9/AHI Level-1 and -2 data during In-orbit Test. Working Paper of the 45th Meeting of the Coordination Group for Meteorological Satellites, Jeju, Republic of Korea, 11-16 June, 2017. https://www.cgms-info.org/Agendas/WP/CGMS-45-JMA-WP-04

Griffith, P. C., 2015: Advanced Himawari Imager (AHI) Design and Operational Flexibility. Sixth Asia/Oceania Meteorological Satellite User's Conference, Tokyo, Japan, November 9-13, 2015. http://www.data.jma.go.jp/mscweb/en/aomsuc6_data/oral/s02-01.pdf

(Akiyoshi Andou, JMA)

RAPID: Real Time Analysis of Products & Information Dissemination

With an increase in the number of Earth Observation satellites, large volume and types of data products available to users from meteorological satellites has created a requirement for a web enabled environment, which can provide quick visualisation and analysis capabilities to end users and in-particular to meteorologists and decision makers.

Real time Analysis of Products & Information Dissemination called ***RAPID*** is a web based quick visualization and analysis tool for satellite data and products. This introduces Next Generation Weather Data Access & Advanced Visualization Application that touches the life of common man in one or other way ranging from severe weather monitoring to various sectoral applications like agriculture, tourism, sports etc. For example, we can assess the fog over railway tracks and surface transportation highways, aviation, navigation & a pilot can monitor the location, intensity & movement of cumulonimbus clouds enroute.

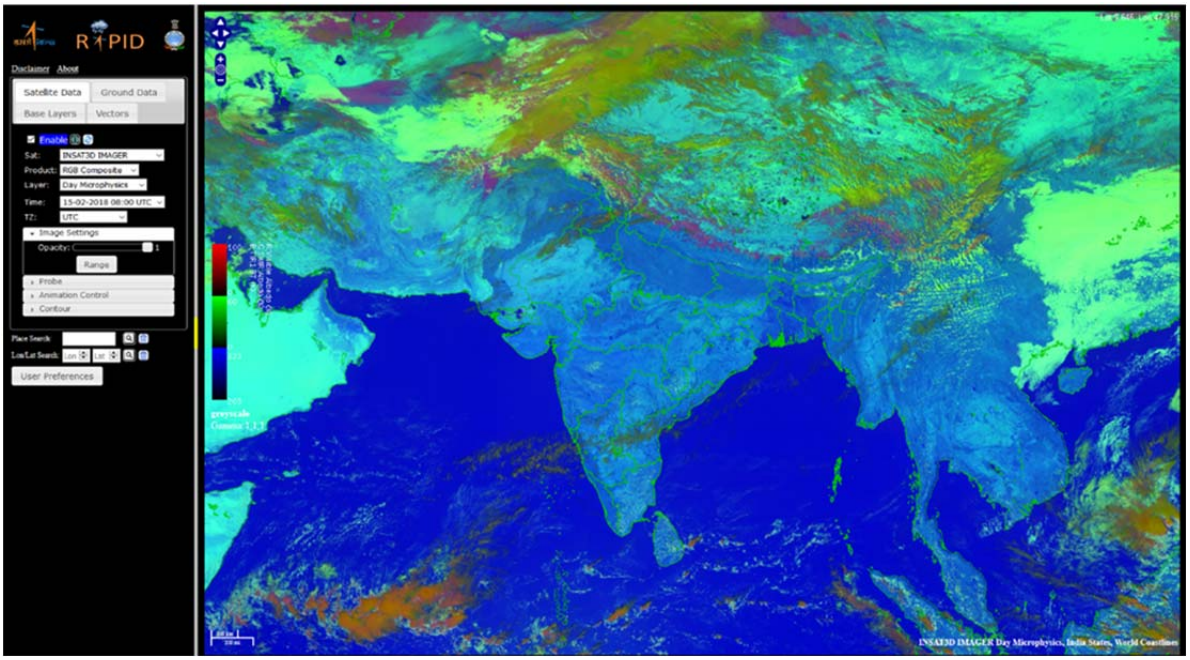
This tool was conceptualized and developed by Satellite Application Centre (SAC), ISRO in collaboration with India Meteorological Department (IMD), New Delhi to enhance

the visualization and analysis of INSAT Meteorological Satellite data on real time basis by the forecasting community. This system is operationally sustained by National Satellite Meteorological Centre (IMD), New Delhi. It has various functionality such as Contours, RGB Composites, time series profiles, transect plots, calculation of area and distance, Capability to control opacity, enhancements and apply different pseudo LUTS. Provides capability to animate different layers as a function of time. This tool is hosted at http://www.rapid.imd.gov.in/ and automatic updated of most recent data. User guide for operating this tool is available on http://satellite.imd.gov.in/desc/RAPID_User_Guide.pdf.

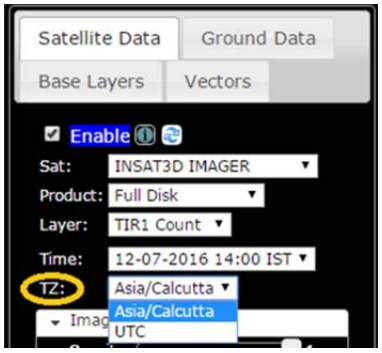
Salient features of RAPID

- It connects atmospheric science and geosciences.
- There is no specific Operating System/ software/ library / compiler required on the desktop to access RAPID. It is accessed through web browser.
- It provides features of interest to scientific community
- RAPID follows Open Geospatial Consortium's (OGC) open standards.
- Web Mapping Service (WMS) – For visualization of meteorological data (Satellite and ground observations).
- Extensions written for scientific community
- Zero learning curve
- It can overlay Map Boundaries (World Coastline, State, District Boundaries, Gridlines) with configurable:
  - Color
  - Opacity
  - Thickness
  - Contrast Stretch
  - Lookup Table Application
- It has Probe Data feature (on the fly) i.e. analysis of data
  - Point
  - Time Series
  - Vertical Profile
  - Transect
  - Area Measurement
  - Distance Measurement
- Animation can be generated of desired area of interest and no frame selection in respect of time.
- Visualization of Day and Night time microphysics RGB Composites imageries with provision of recipe modification for further refinement of RGB product.
- Contouring feature over meteorological data.
- Map background can be changed based on user preference.
- Base layers can be chosen from:
  - Open Street Map
  - Indian Sub Basins
  - FMO Basins
  - True Marble
  - Blue Marble
  - Bhuvan

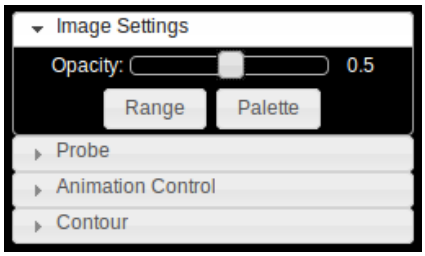
In next few paras, some of the settings and features of RAPID tool are discussed, for details the reader is suggested to go through RAPID user guide available on http://satellite.imd.gov.in/desc/RAPID_User_Guide.pdf.



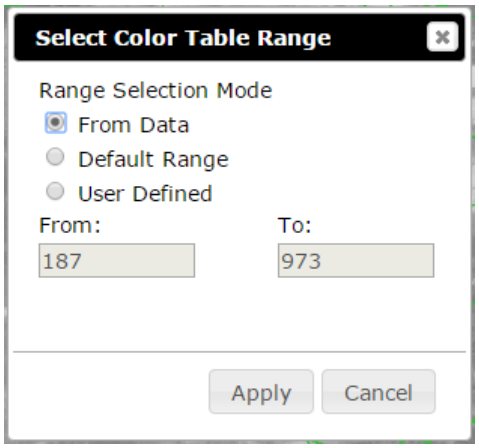
1. **TZ (Time Zone):** Here user can select the Time zone according to user need. Currently on Asia/Calcutta and UTC are available for selection.

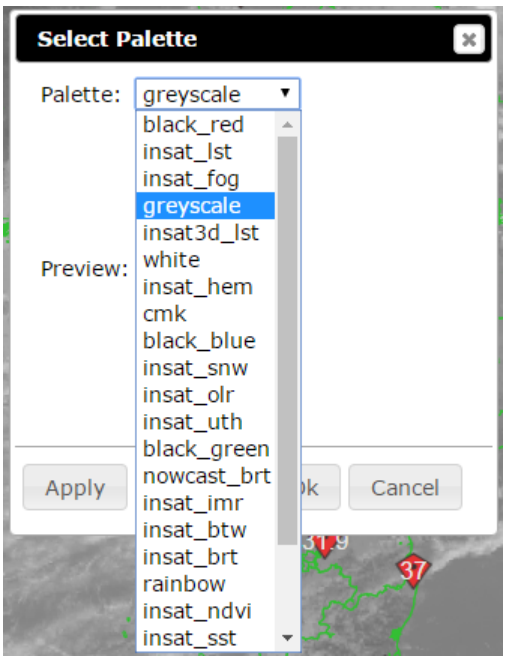


2. **Image Settings:** Here user can select the Opacity of the layer for better visualization of overlaid images. 0 corresponds to complete transparent and 1 to opaque.

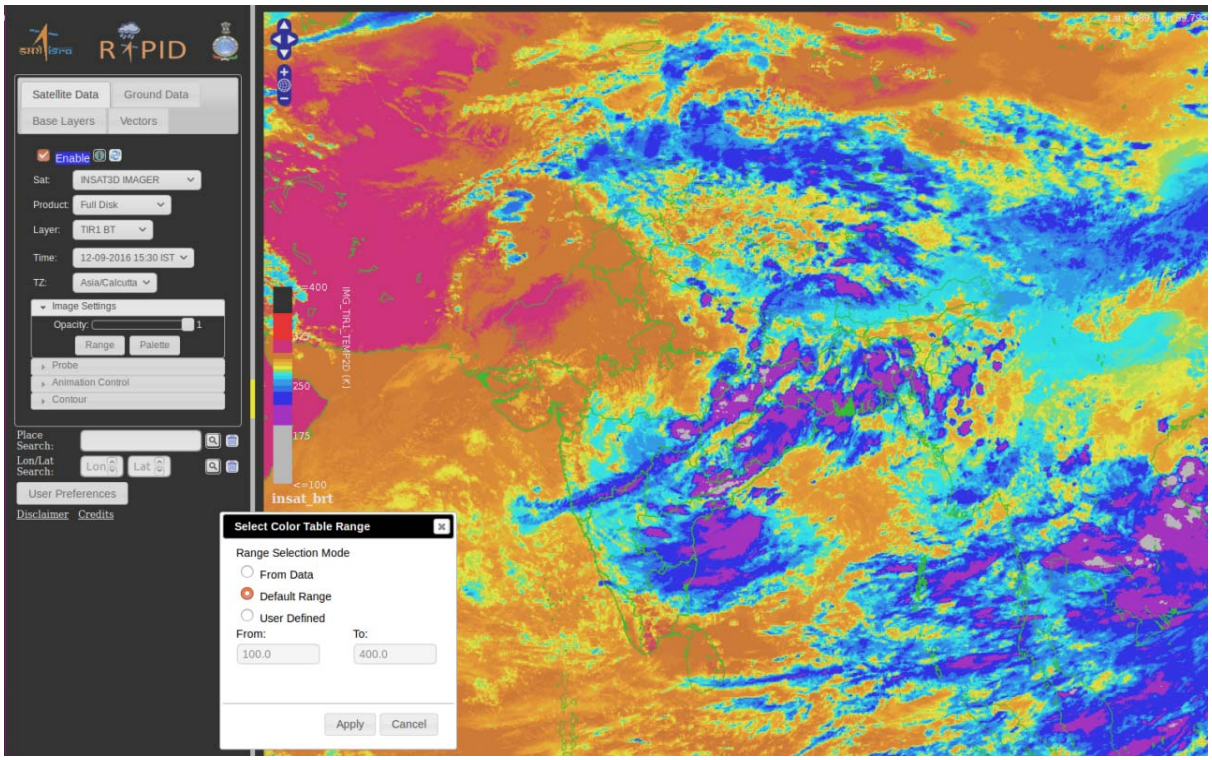


i) ***Range Selection:*** User can choose Range as well as Palette according to user need. These options help in bringing out the desired and targeted outputs.



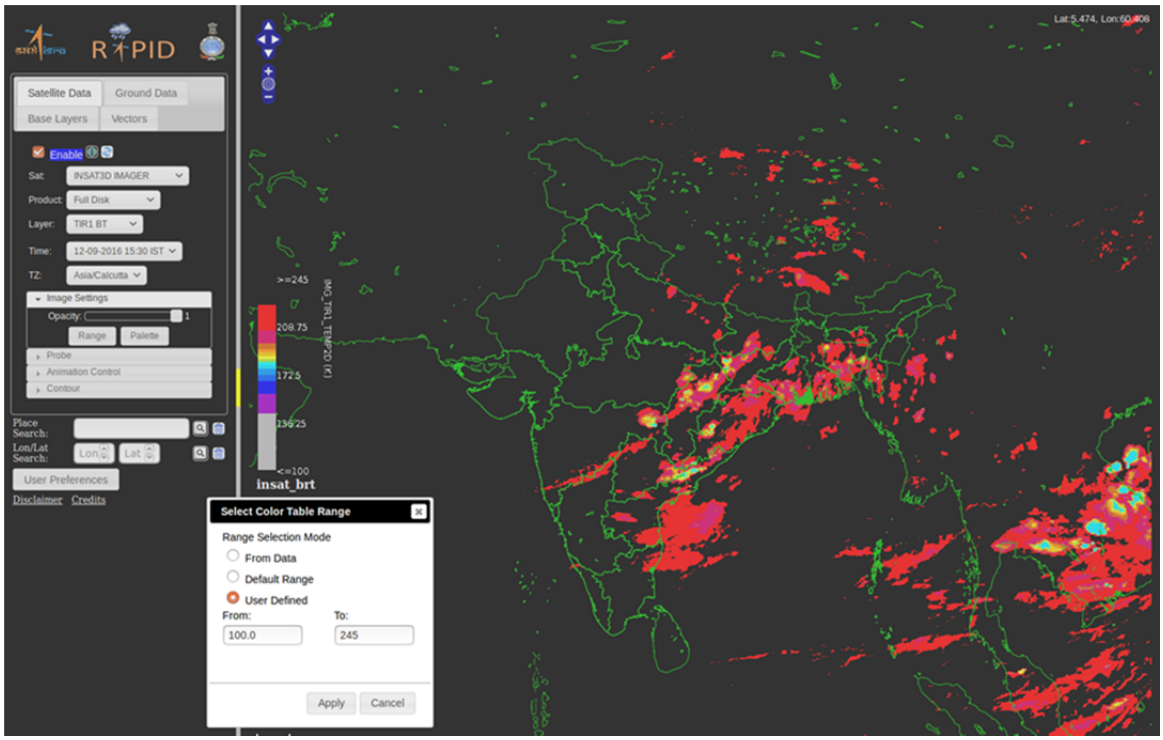


Default Range

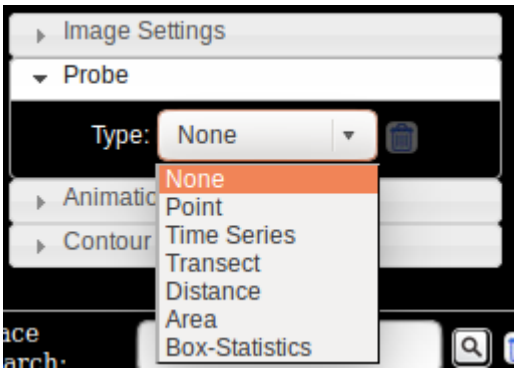


User Defined Range: This option can be useful for TIR1 BT, to identify thunderstorm cells. In this user-specific range can be entered for specific visualization.

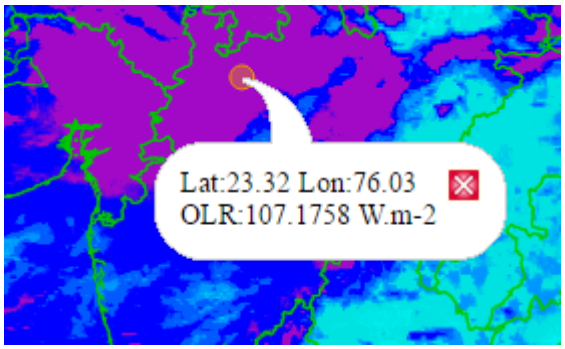
User Defined Range



3. **Probe:** This tool allows user to extract more information in the form of digital values out of an image/product dataset and is very helpful for the analysis of the image data from forecasting point of view. User can select among 6 different options to probe the image data as shown below:

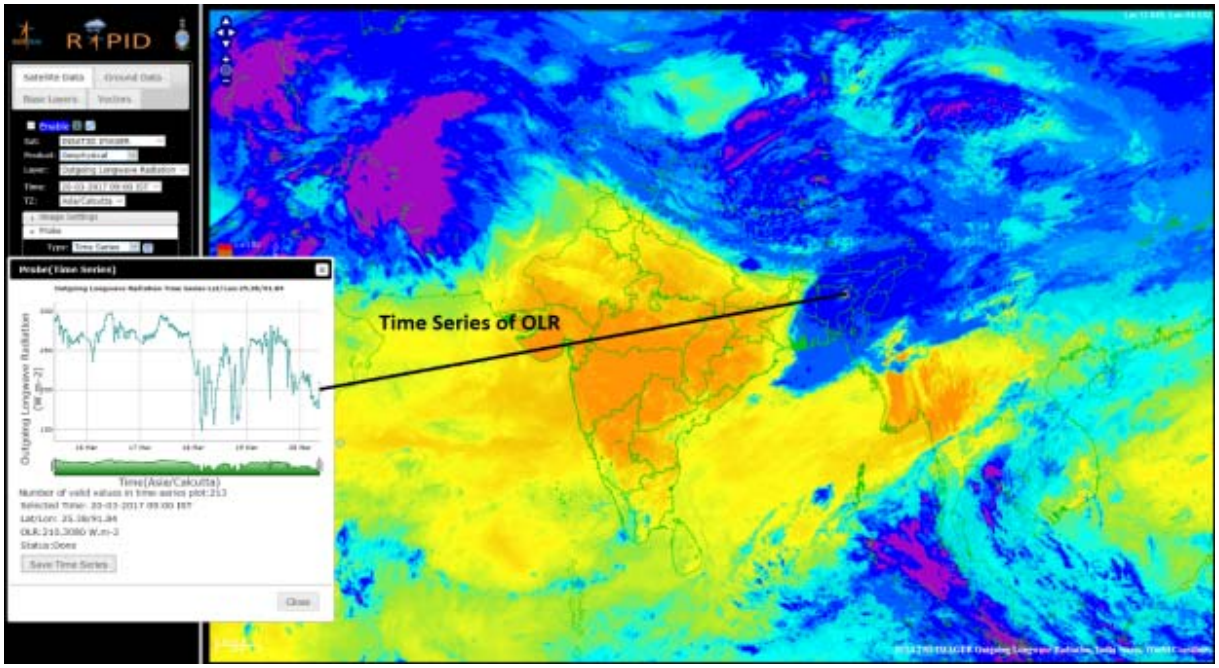


i) ***Point:*** User can use this option to get the information at a particular point. User need to select this option and click the point location on image to be probed. It shows the Latitude, Longitude and the digital value of data along with the unit of the parameter at that point as shown in the example of OLR parameter.

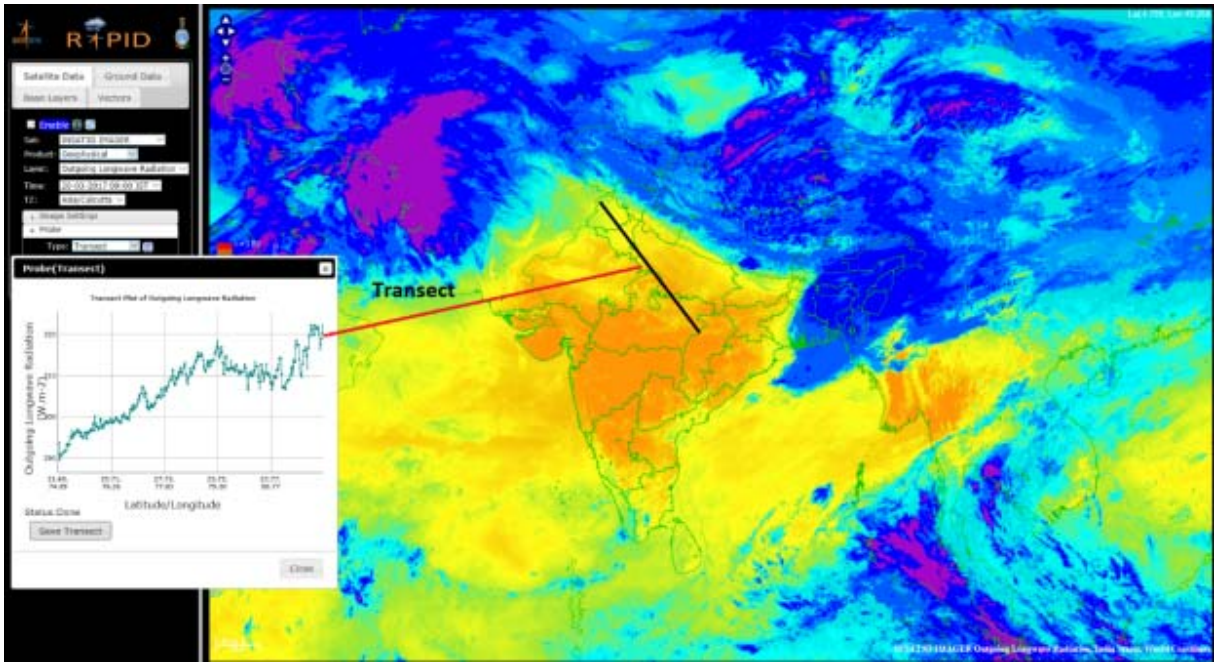


ii) ***Time Series:*** Under this option user can plots a time series graph of the parameter of his choice at a particular point. User need to select this option and click the point location on image to be probed. This allows user to know the variation of that particular parameter in time at that particular point. This can be helpful to study the temporal variation of parameter at

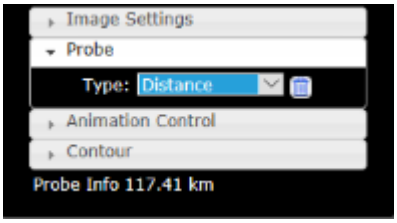
that point to probe the events that have occurred or to know the trend of variation helping forecaster to foresee the possible future development. A example here shows the time series plot of OLR at that particular point. On moving cursor over the time series graph digital value of parameter with date and time will be displayed.

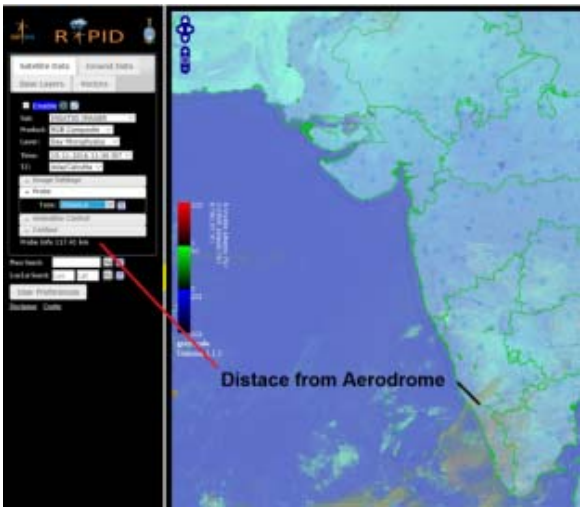


iii) ***Transect:*** Under this option user can visualize the variation of the parameter along a line in the form of plot. This option is very helpful for route forecast in aviation sector. To use this option user has to click at the starting point and then draw the line across which plot is required and at the end of this line, user has to double click in order to generate Transect plot. This will draw a line on image and the graph will be shown alongside as shown below. This is important tool particularly for the aviation forecasters' community which needs to know the variation of a parameter along the flight routes

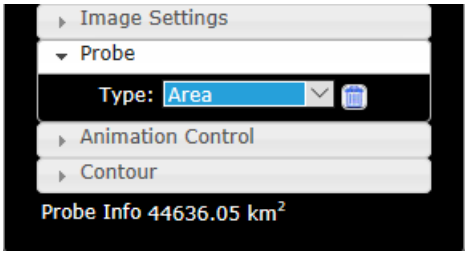


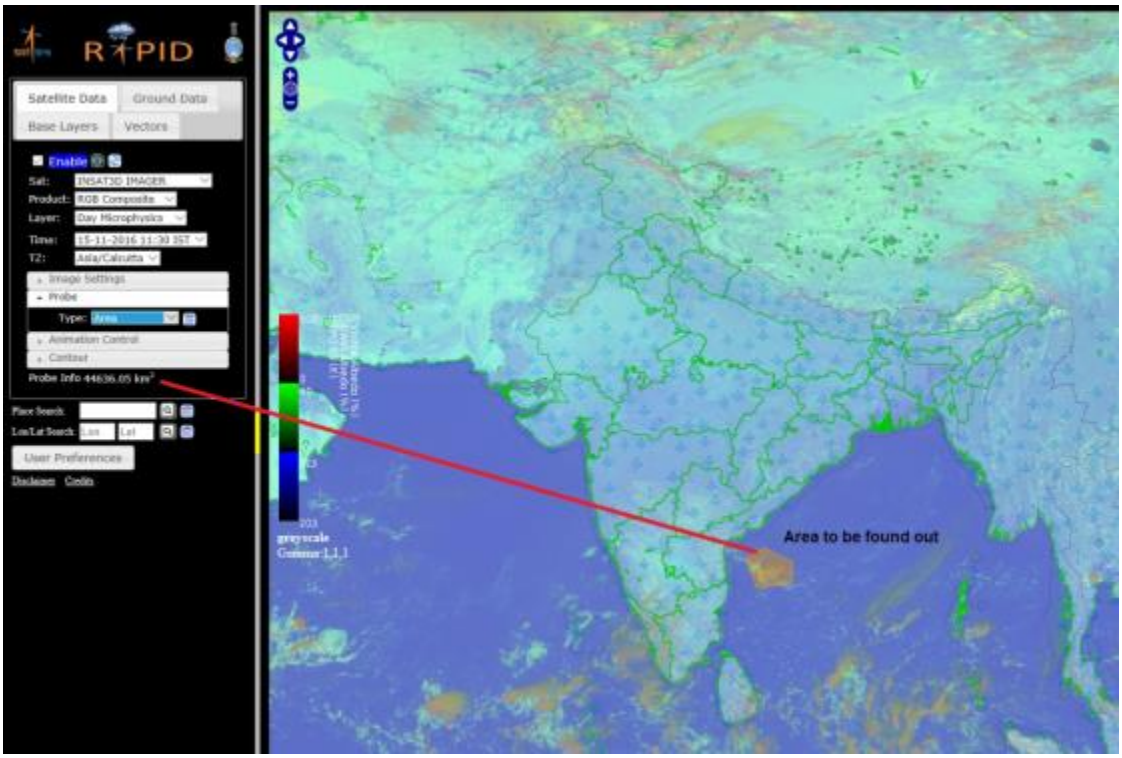
iv) ***Distance:*** Under this option user can measure the distance between two points on image or distance of cloud from particular station. User need to select this option and then click at two different points on the image to get the distance between them. This is useful for forecasters to check the future possible movement of system towards their station. This is very useful to predict the time at which a weather event will cross a particular location by calculating speed using distance observation at two different time. The distance is shown at the bottom as shown in the alongside figure.



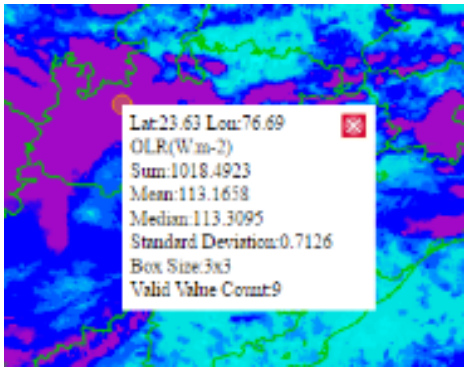


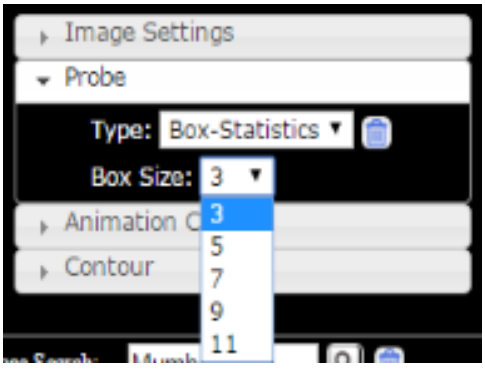
v) ***Area:*** Under this option user can measure the area of weather system/cloud/rainfall affected area on the image data. User need to select this option and then define a closed area on image with number of clicks ending in double click. This area can be of any shapes (regular/irregular).



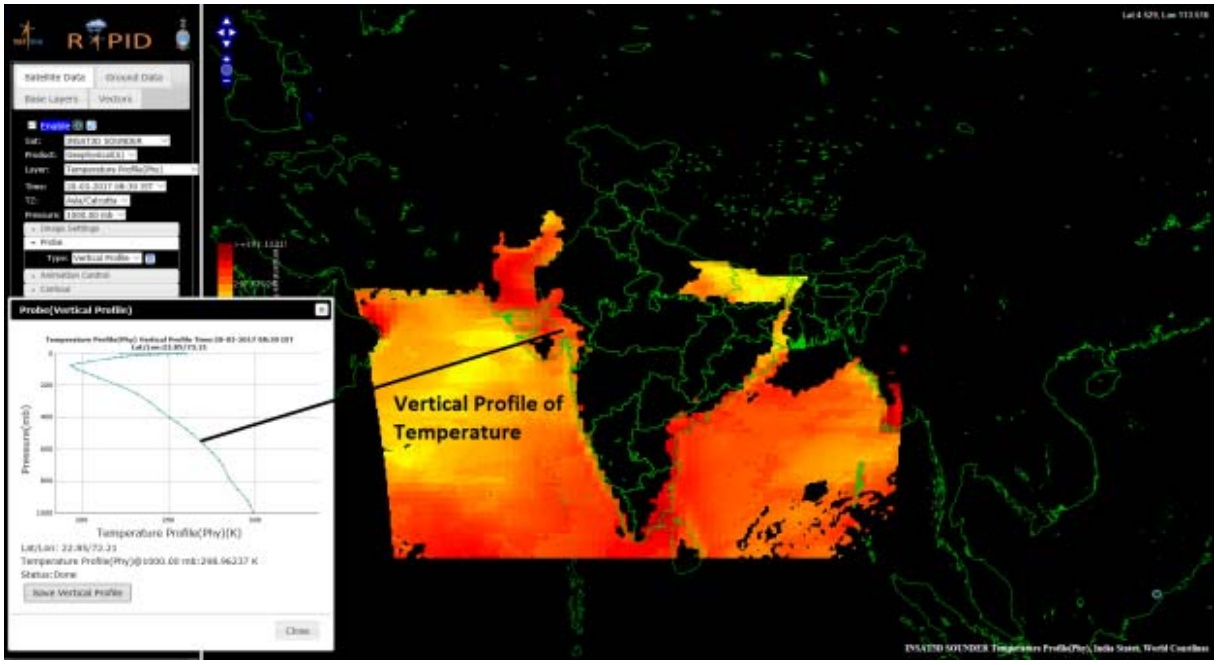


vi) ***Box Statistics:*** This tool allows user to get the statistics information of a box around a point. This box can be of 3x3, 5x5, 7x7, 9x9 & 11x11 pixel size. User has option to choose this from the drop-down menu of box size. Once user select these two options and click on the image user get the statistical information of that box as shown in the alongside figure.

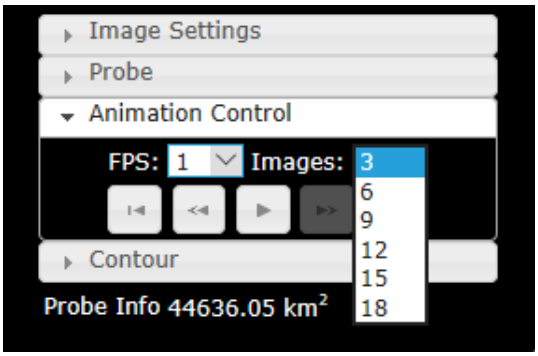


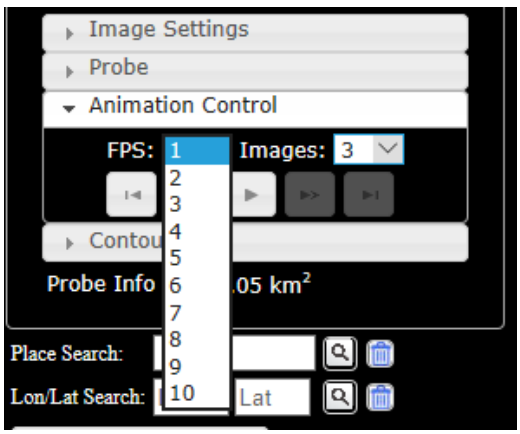


vii) ***Vertical Profile:*** This option is available to user when he/she selects Sounder under Satellite tab and Geophysical under Products tab and Temperature Profile or Humidity Profile under Layer tab. The vertical profile of temperature is available at 40 levels (1000hPa to 0.1hPa) and vertical profile of humidity is available at 21 levels.



4. **Animation Control:** This tool allows user to make an animation using available images. User has options to choose FPS (Frames per second) and the number of images to be used in animation. Once user select these options and click the play symbol the animated will be displayed in the data viewer pane. This is useful to see the movement of weather systems.





5. **Contour:** This tool allows user to draw the contour lines in the image. User need to check the enable and then select the color bar / palette to be used, minimum and maximum values and the interval. Once user select all this and press Interval the contour lines will be drawn on the image accordingly. This is useful to analyze the image while concentrating on specific area / gradient.

(Virendra Singh and Amit Kumar, IMD)

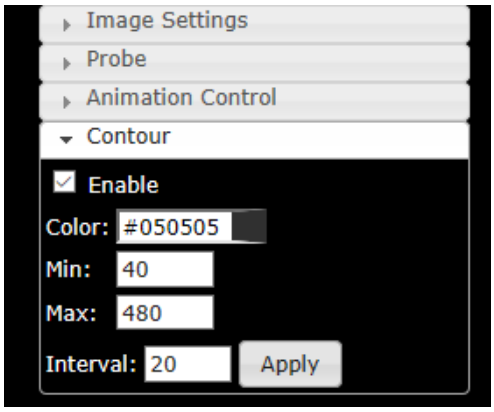


Image Settings
Probe
Animation Control
Contour
Enable
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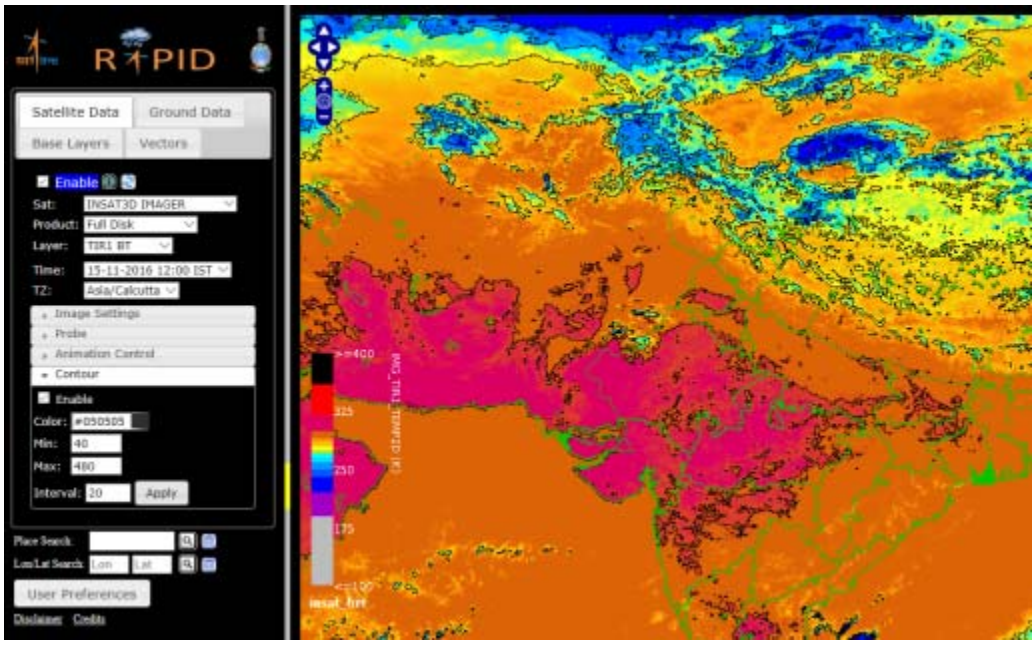
Max: 480
Interval: 20
Apply


RAPID
Satellite Data
Ground Data
Base Layers
Vectors
Enable
Sat: INSAT3D IMAGER
Product: Full Disk
Layer: TIR1 BT
Time: 15-11-2016 12:00 IST
TZ: Asia/Calcutta
Image Settings
Probe
Animation Control
Contour
Enable
Color: #050505
Min: 40
Max: 480
Interval: 20
Apply
Place Search
Lon/Lat Search
Lon
Lat
User Preferences
Disclaimer
Credits

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Chief Scientist
EUMETSAT

From the Co-editors

The co-editors invite contributions to the newsletter. Although it is assumed that the major contributors for the time being will be satellite operators, we also welcome articles (short contributions of less than a page are fine) from all RA II Members, regardless of whether they are registered with the WMO Secretariat as members of the WIGOS Project Coordinating Group. We look forward to receiving your contributions to the newsletter.
(Dohyeong KIM, KMA, and Hiroshi KUNIMATSU, JMA)

RA II WIGOS Project Home Page

http://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/ra2wigosproject-intro_en_jma.html

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