# International Clouds Working Group (CWG)

**Activities in IMD (with reference to the progress in CGMS-ICWG activities):**

## 1. CTT/CTP and Effective cloud amounts, Cloud Optical Thickness from INSAT-3D /INSAT-3DR IMAGER:

India Meteorological Department (IMD) is the nodal agency to issue the national weather forecast and disseminated the related information to the neighbouring region countries as per the agreement and commitments. The algorithms of satellite derived products of INSAT-3D /3DR are indigenously developed by the Indian Space Agency, known as Indian Space Research Organisation (ISRO). IMD is using these satellite images and derived products for weather forecasting applications national as well as internationally. The cloud parameters (imageries as well as derived products) are very important for nowcasting, short, medium range forecasting (regional monitoring) and climate monitoring applications. This will also provide an important input to the various climate and weather models regarding the convection and cloud parameterization in these models. Currently, Clear Sky Radiances /Brightness Temperatures (BTs) from INSAT-3D/3DR Imager (9X9-TIR pixels) and Sounders (3X3 pixels) are being generated operationally and utilized for assimilation in weather prediction models. The Channels specification of payloads on INSAT-3D and INSAT-3DR satellites is given below:

**IMGAER SPECIFICATIONS**

| Spectral bands | Wave length (μm) | Ground Resolution (Km) | Quantization (bits) | IGFOV (μrad) |
|---|---|---|---|---|
| VISIBLE | 0.55 – 0.75 | 1 | 10 | 28 |
| SWIR | 1.55-1.70 | 1 | 10 | 28 |
| MIR | 3.80-4.00 | 4 | 10 | 112 |
| WV | 6.50-7.10 | 8 | 10 | 224 |
| TIR 1 | 10.3-11.3 | 4 | 10 | 112 |
| TIR 2 | 11.5 – 12.5 | 4 | 10 | 112 |

**SOUNDER SPECIFICATIONS**

| Spectral bands | Spectral Range ((μm)) | Resolution (Km) |
|---|---|---|
| VISIBLE | 0.67– 0.72 | 10X 10 |
| SWIR | 3.67– 4.59 | 10X 10 |
| MIR | 6.38– 11.33 | 10X 10 |
| LWIR | 11.66 – 14.85 | 10X 10 |

**MODE OF OPERATION OF INSAT-3D IMAGER**

| Mode of Operation | Time of coverage (minutes) | Coverage Area (degrees, NS & EW) |
|---|---|---|
| Full frame mode | 26 | 18X18 |
| Programmed /Normal scan mode | 23 | 14X18 |
| Rapid scan during extreme weather events from INSAT-3DR | 4.5 | 4 x18 |

2. **Cloud Microphysics products (day as well as night) as RGB composite from INSAT-3D /INSAT-3DR IMAGER:** In house developed the Day microphysics RGB scheme and Night microphysics RGB scheme using recipe on the line of International agencies given below:

**DAY TIME MICROPHYSICS**

| **Beam** | **Channel** (μm) | **Range** | **Gamma** |
|---|---|---|---|
| **Red** | VIS(0.55-0.75) | 0 …+100 % | **1** |
| **Green** | SWIR(1.67) | 0 … +60 % | **1** |
| **Blue** | IR(10.8 μm) | 203 … +323 ºK | **1** |

[This product is used during the daytime because a solar reflectance component is adopted. Colors and their interpretation are based on I. M. Lensky and D. Rosenfeld:Clouds-Aerosols Precipitation Satellite Analysis Tool (CAPSAT), Atmos. Chem. Phys.,8, 6739-6753, 2008]

**NIGHT TIME MICROPHYSICS (NTM)**

| **Beam** | **Channel** (μm) | **Range** | **Gamma** |
|---|---|---|---|
| **Red** | IR12.0 - IR10.8 (TIR2-TIR1) | -4 … +2 K | **1** |
| **Green** | R10.8 - IR3.9 (TIR1-MIR) | -4 … +6 K | **1** |
| **Blue** | IR10.8 μm (TIR1) | +243 … +293 K | **1** |

IMD had also developed on line visualisation tools, RAPID (http://www.rapid.imd.gov.in/) and work out the threshold values for detections of fog pixels in day Time Micro-Physics and night time micro-Physics are given below:
Fog pixels in DTM have VIS Albedo (25 to 50 %) SWIR Albedo (35 to 60 %) TIR1 (270ºK to 290ºK) and Fog pixels in NTM have TIR2BT – TIR1BT (Negative value) TIR1BT - MIRBT (>2.5ºK) TIR1BT (270ºK to 290ºK)

3. **Cloud derived products are operationally available severe weather applications (TCs, squall and thunder etc).**
4. **Cloud mask (operationally generated)**

5. **In future, Cloud retrieval over snow and ice are work is in progress to remove the cloud contamination in the derived products.**
6. **Work is in progress on L2 level data for cloud assessments for near-real-time applications and L3 level data as cloud assessments for regional and climate applications.**

**Work that need cooperation and coordination:**

1. Use of combined sensors approach for cloud retrievals;
2. Assessment of retrieval uncertainties for cloud products of INSAT-3D /3DR.
3. Climate application studies;

4. Development of cloud parameter data records assessments or Cloud Climate Data Records (CDRs) procedures;
5. Inter-comparison of cloud observations of similar type of payloads of other countries satellites;
6. The use of Polar as well as CLIPSO data for inter comparison of cloud products;
7. Standardize requirements and terminology for cloud products;
8. To enhance support and stimulate training of the operational and scientific community;
9. To enhance the communication in this field and develop international partnerships;
10. To perform regular cloud parameter retrieval assessments;
11. To Characterize the level-2/level-3 cloud parameter retrieval uncertainties at different space/time scales;
12. Work is in progress to develop the severe weather products which can be linked globally.