Megha-Tropiques

- ## MEGHA

  ### IN SANSKRIT MEANS <u>CLOUDS</u>

- ## TROPIQUES

  ### IN FRENCH IS <u>TROPICS</u>

MEGHA - TROPIQUES MISSION

- **Indo - French collaboration   (ISRO - CNES)**
- **Climate / atmosphere research and applications satellite for studies over the tropics**
- **Inclined orbit of 20 degrees for high repetitivity**
- **IRS bus –1500 kg class (Megha-Tropiques: 1000 kg)**
- **Shared responsibility of payloads**
- **Launched by ISRO's PSLV–C18 on 12 October 2011**
- **Spacecraft control and data reception from ISTRAC, Bangalore**
- **Science data reception from ISTRAC, Bangalore and CNES GS at Kourou / HBK (Africa)**
- **Level-0 and Level-1 Data Products by ISRO**

MISSION OBJECTIVES

1. To collect a long-term set of measurements with a good sampling and coverage over Tropical latitudes to understand better the processes related to tropical convective systems and their life cycle.

2. To improve the determination of atmospheric energy and water budget in the tropical area at various time and space scales.

3. To study tropical climatic events and their predictability: droughts, monsoon variability, floods and tropical cyclones.

MEGHA - TROPIQUES MISSION

UNIQUENESS OF THE MISSION

- **INCLINATION**: Low orbital inclination **20°**
- **SWATH**: Large swath **1700 to 2200 km**
- **REPETITIVITY**: **6 times** a day over 10 – 20 deg latitude band, **4 times** at many other latitudes
- **PAYLOADS**: 4 payloads: A large number of climate/ atmospheric parameters from a common platform:

PAYLOADS

❑ **MADRAS:** *Microwave Analysis and Detection of Rain and Atmospheric Structures* **– ISRO and CNES**

   ❖ **5 – Frequency, 9-channel Microwave imager; <u>18, 23, 36, 89 and 157</u> GHz;**

   ❖ **All in V & H Polarisations except for 23 GHz – V only**

   Wind speed, total water vapour, cloud liquid water, rainfall, cloud ice

❑ **SAPHIR: Sounder for Atmospheric Profiling of Humidity in the Inter-tropical Regions - CNES**

   ❖ **Six-channels at <u>183 GHz</u> Water vapour Resonance frequency**

   Humidity Profiling at 6 altitudes

❑ **SCARAB: SCAnner for RAdiation Budget – 4 Channels - CNES**

   Long-wave radiation fluxes

❑ **ROSA: Radio Occultation Sounder for Atmosphere – Procured from Italy**

   ❖ **GPS receivers at L1 and L2 channels**

   Temperature and humidity profiles

PARAMETERS TO BE MEASURED

BY MEGHA - TROPIQUES

- Cloud condensed water content
- Cloud ice content
- Convective-stratiform cloud discrimination
- Rain rate
- Latent Heat release
- Integrated water vapour content
- Profile of water vapour content
- Radiative fluxes at the top of the atmosphere
- Sea surface wind

BY OTHER MISSIONS

- Cloud cover
- Cloud top height
- Cloud albedo
- Sea surface temperature
- Sea surface evaporation fluxes
- Temperature profile
- 3D wind field

MEGHA-TROPIQUES MISSION

Mainframe
Structure : I1.5K IRS bus with heritage
Mechanisms: Solar array deployment mechanism
Solar array drive assembly (SADA)
MADRAS Scan Mechanism (MSM)
Madras Hold-down & Release Mechanism (HDRM)
ROSA hold-down & release mechanism

Thermal : Passive system with heritage
Power : 1160 W generated (max @ EOL)
2 x 24 AH NiCd batteries
User specific DCDC Converters
Payload Power: 300W
Bus power: ~325 W
Data Rates: ~100 kbps
SSR : 16Gb
Tx rate : 5.2Mbps – S Band
TTC : 4Kbps , S-band
OBC : ASIC Based with heritage s/w
AOCS : 3-axis stabilised with 4RWs, 1 MCW Gyros & Star sensors, N2H4-based RCS
Pointing : 0.1 deg
Drift rates : 1×10^{-3} deg/sec

Mass : 997 kg
Launch : PSLV-C18, October 12 2011

MADRAS UNDER THERMO-VAC TESTS

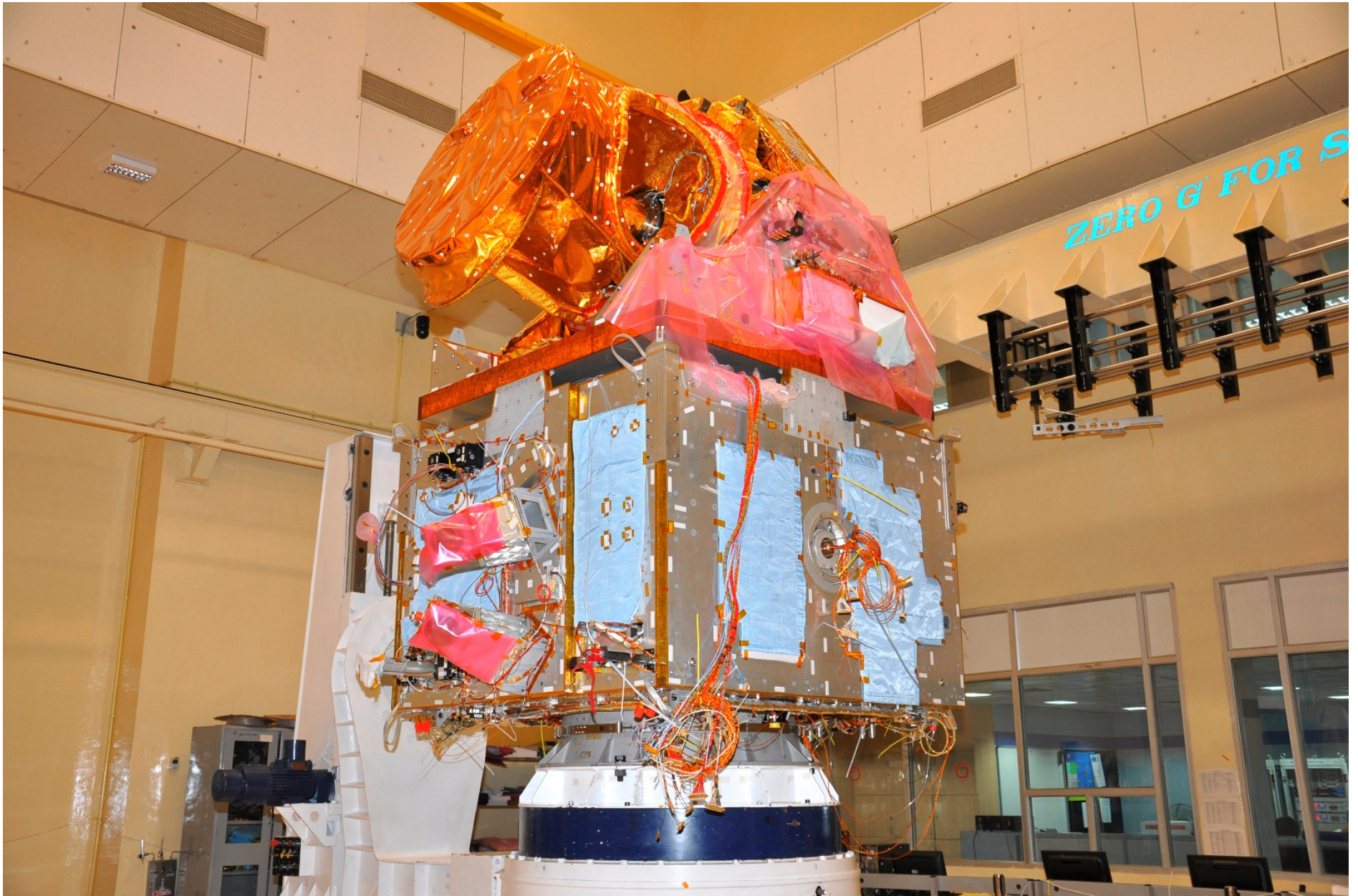
CRYO
TARGET
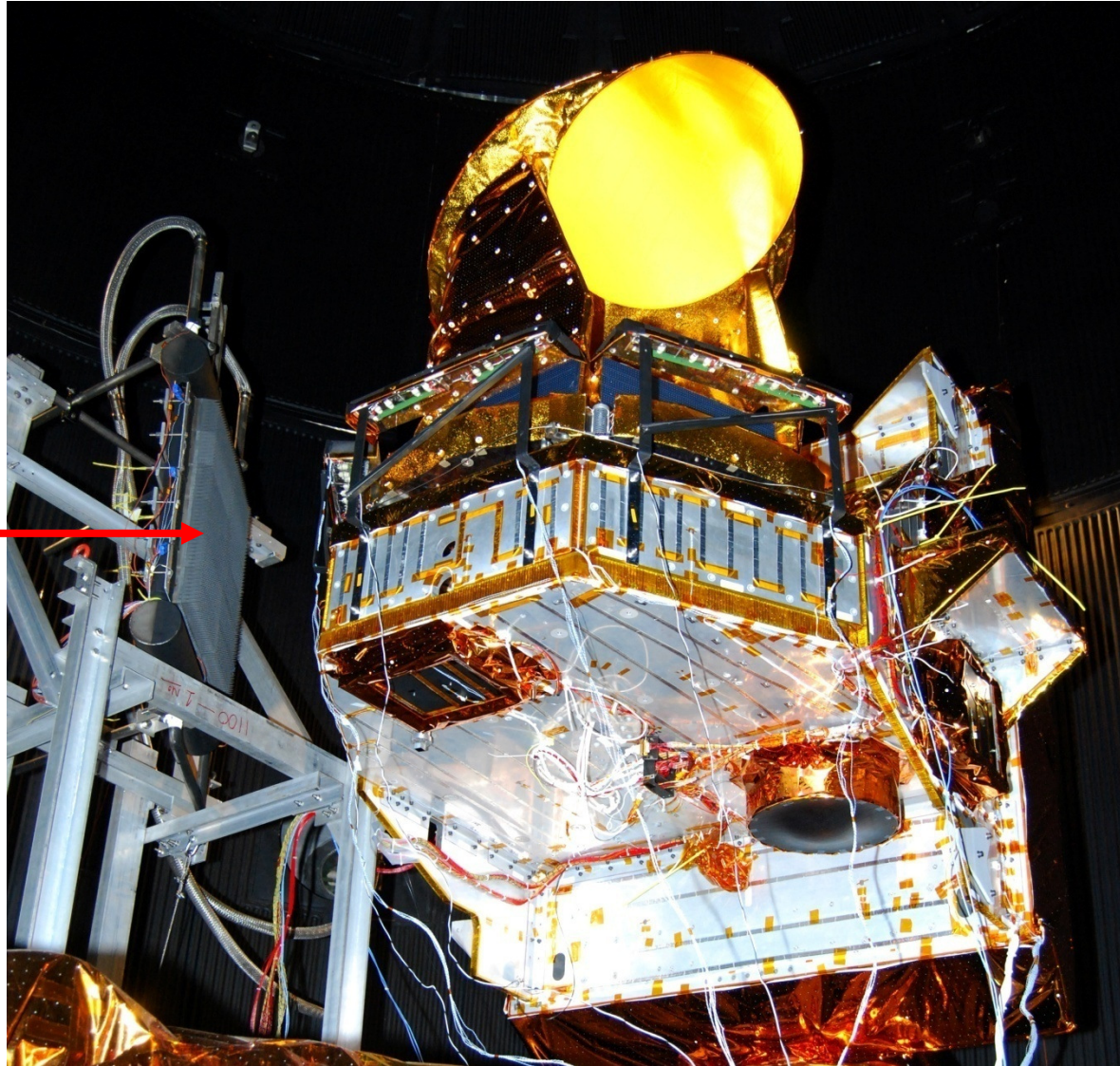
MADRAS, SAPHIR and SCARAB integrated on PIM

- MADRAS, SAPHIR and SCARAB mechanically integrated on Payload Instruments Module (PIM)

- Electrically interconnected with platform

- Telecommand and House-keeping Telemetry checks have been carried out in disassembled mode test

- Science Telemetry from all the three payloads acquired and checked for   CCSDS packet integrity
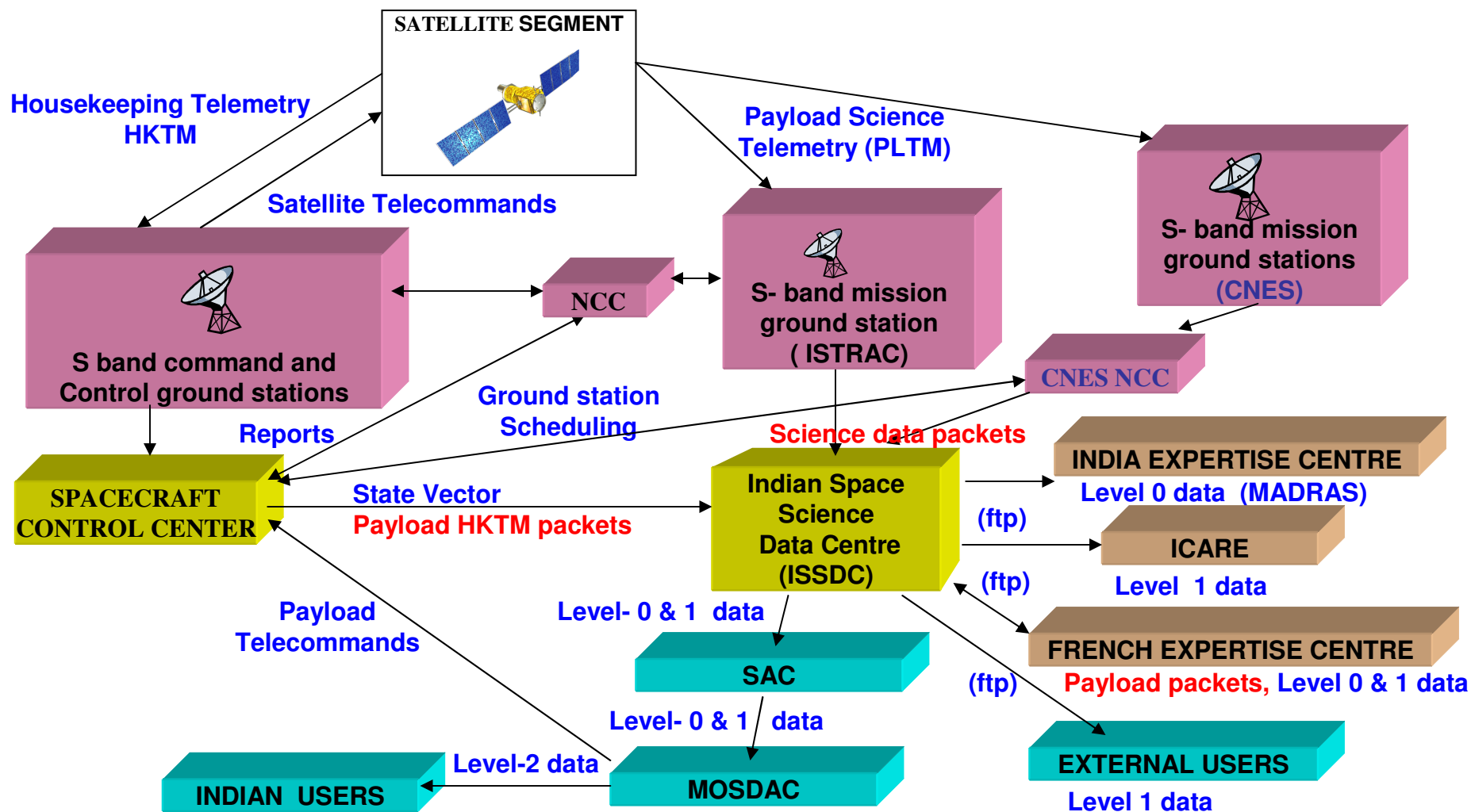
Spacecraft Disassembled Mode Test

MEGHA-TROPIQUES IN CLEAN ROOM

# MT Ground Segment Plan
Agreed by both ISRO & CNES Project teams

SATELLITE SEGMENT

Housekeeping Telemetry HKTM

Payload Science Telemetry (PLTM)

Satellite Telecommands

S- band mission ground stations (CNES)

NCC

S- band mission ground station (ISTRAC)

S band command and Control ground stations

CNES NCC

Ground station Scheduling

Reports

Science data packets

INDIA EXPERTISE CENTRE

SPACECRAFT CONTROL CENTER

State Vector
Payload HKTM packets

Indian Space Science Data Centre (ISSDC)

Level 0 data (MADRAS)

(ftp)

ICARE

Level 1 data

(ftp)

Payload Telecommands

Level- 0 & 1 data

FRENCH EXPERTISE CENTRE

SAC

Payload packets, Level 0 & 1 data

(ftp)

Level- 0 & 1 data

Level-2 data

EXTERNAL USERS

MOSDAC

INDIAN USERS

Level 1 data

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Levels of Data Products

Level-1A: **It is the brightness temperature (MADRAS & SAPHIR) & radiance (SCARAB) geo-tagged product for all channels in scan mode (acquired geometry). Parameters for each acquired sample is computed. Both segment-wise and orbit-wise product are generated. Orbit-wise products are archived.**
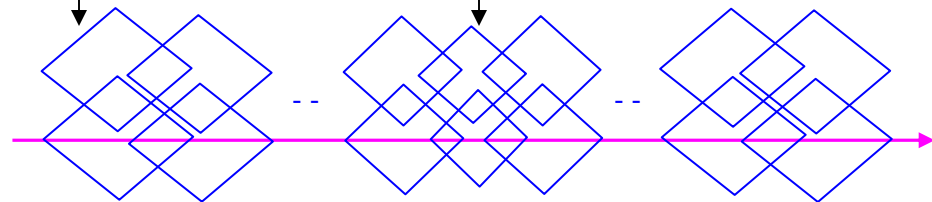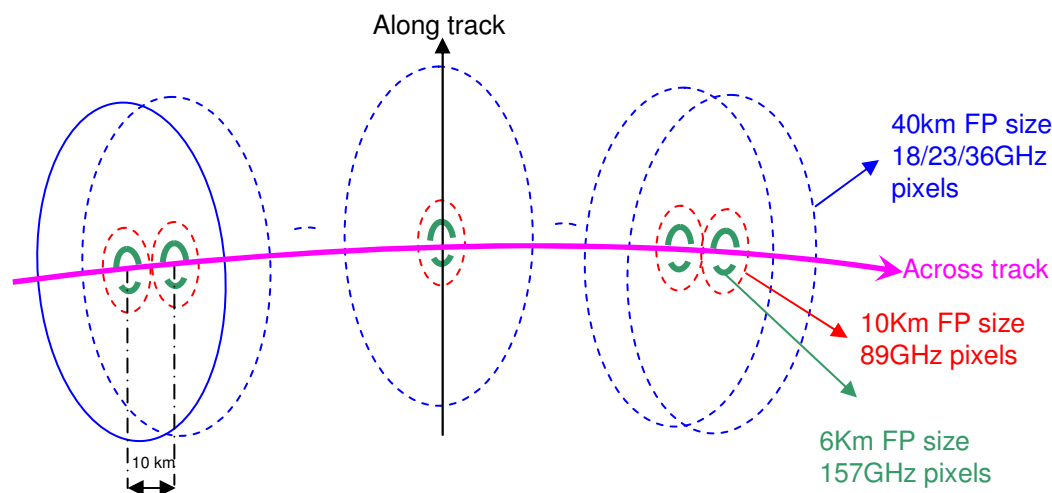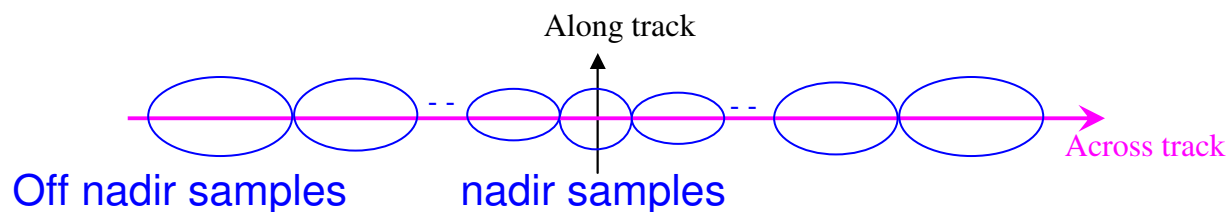
(a) MADRAS Footprints

(b) SAPHIR Footprints
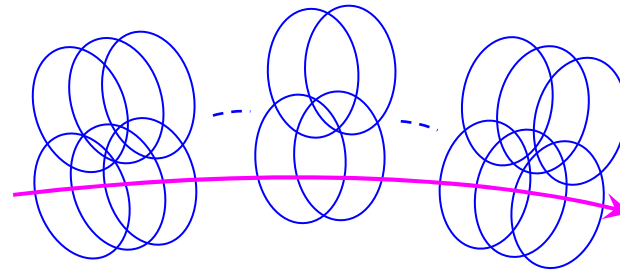
Off nadir samples   nadir samples
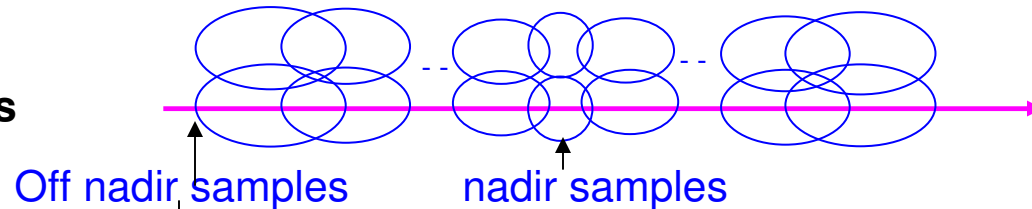
(c) SCARAB Footprints

Levels of Data Products

Level-1A2: **It is the brightness temperature (MADRAS & SAPHIR) product covering the scan swath with non overlapping MADRAS 89Ghz pixels for MADRAS and non overlapping SAPHIR pixels for SAPHIR sensor products respectively for all channels. Segment wise and orbit wise product are generated.**

(a) MADRAS non overlapping Pixels

(b) SAPHIR non overlapping Pixels

Along track

40km FP size
18/23/36GHz
pixels

Across track

10Km FP size
89GHz pixels

6Km FP size
157GHz pixels

10 km

Along track

Across track

Off nadir samples

nadir samples

MT Raw Data Simulation & Product Generation

TB-18.7V-Interpolated-CNRS

Simulated Orbit

Geometric Processing

Geo-locations for Scan geometry

Raw Data Generation Algorithm

gain & offset for each scan and PRT coefficients

DP SW Chain

Simulated Products

MADRAS-18.7V-Counts
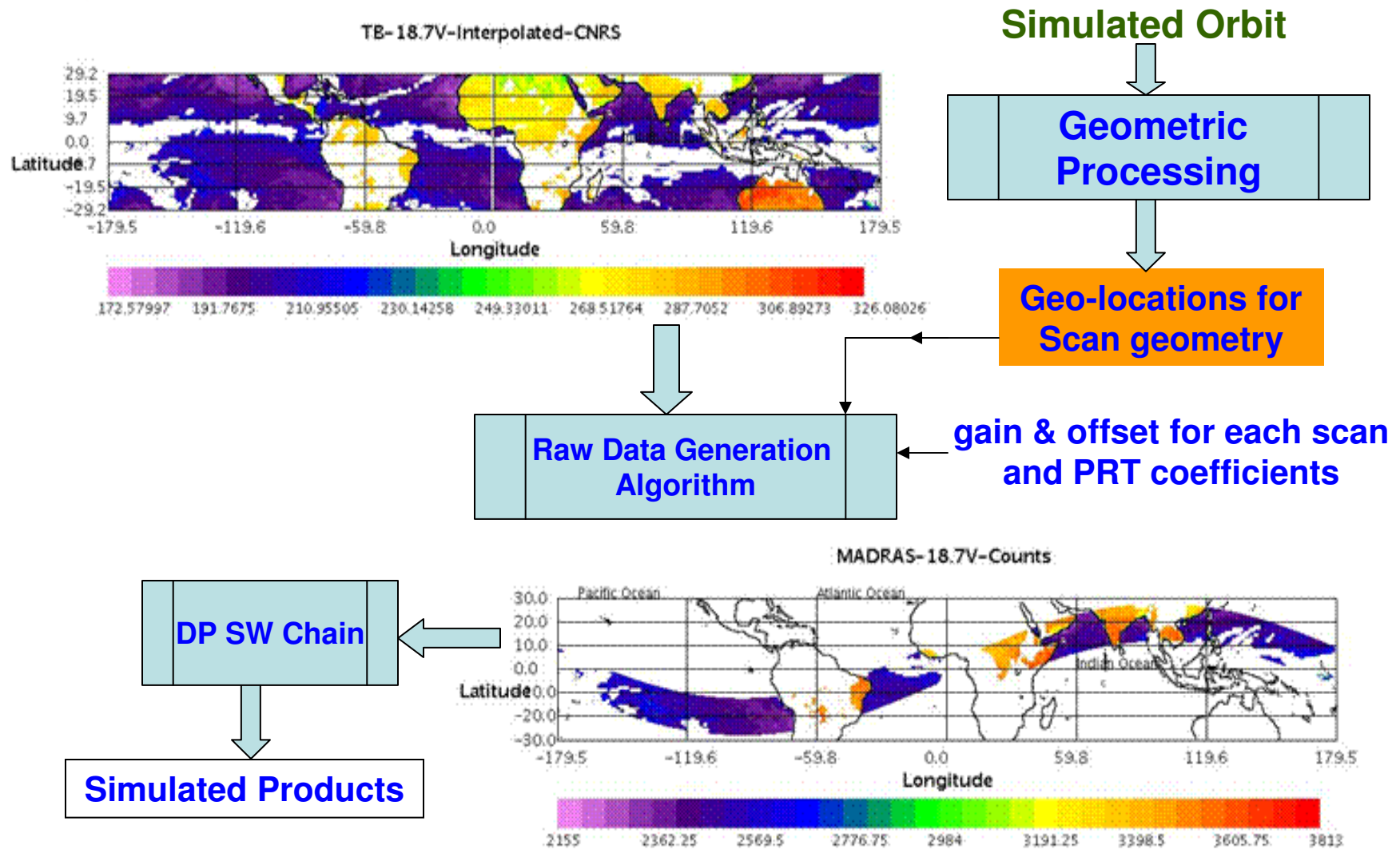
Oceanic Geophysical Parameters from MADRAS (Oct 18, 2011)

MT TPW — 18 Oct 2011   g/cm2
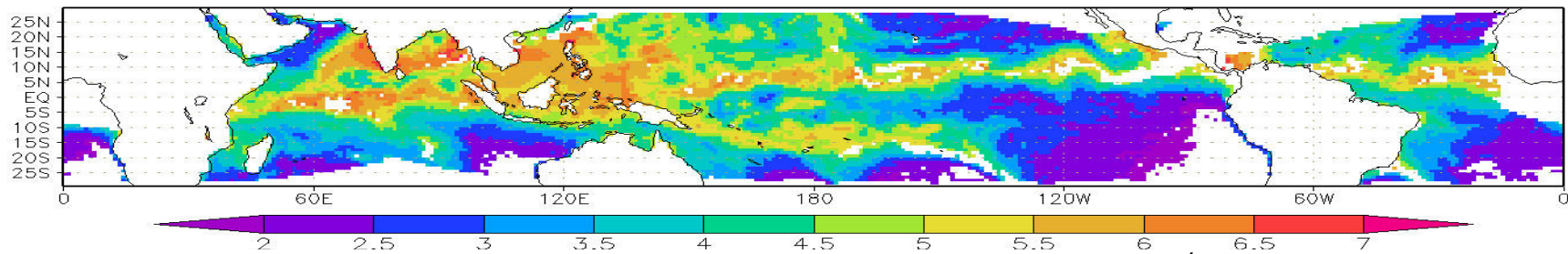
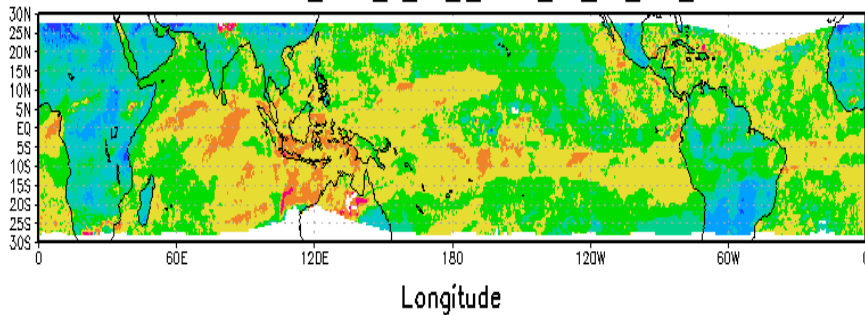MT WS — 18 Oct 2011   m/s
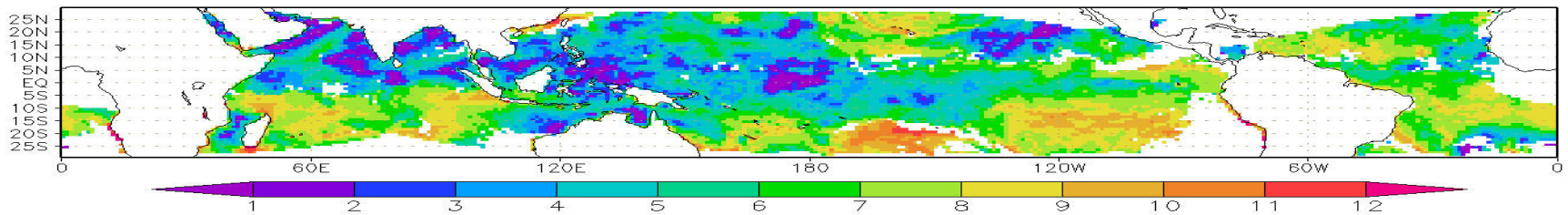
MT CLW — 18 Oct 2011   mg/cm2
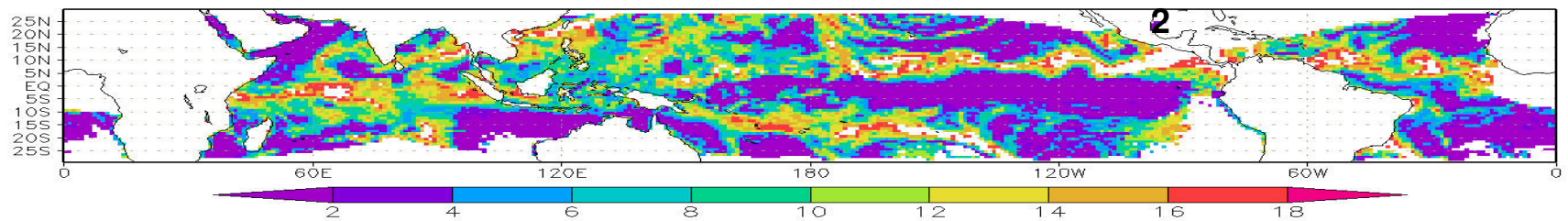
Oceanic Rain-rate from MADRAS (Oct 18, 2011)
(mm/hr)

17
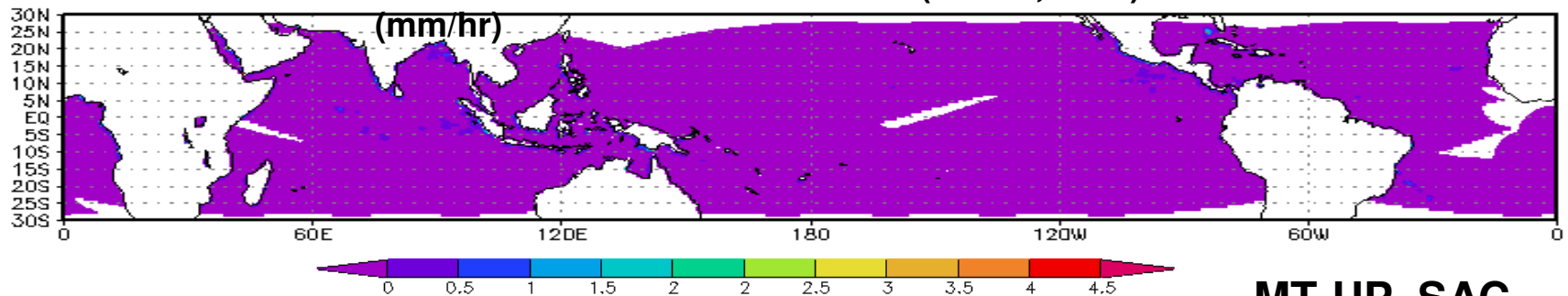
MT-UP, SAC

Day-1 Humidity Profile from SAPHIR (Oct 18, 2011)

LAYER AVERAGE RELATIVE HUMIDITY (1000-850)mb
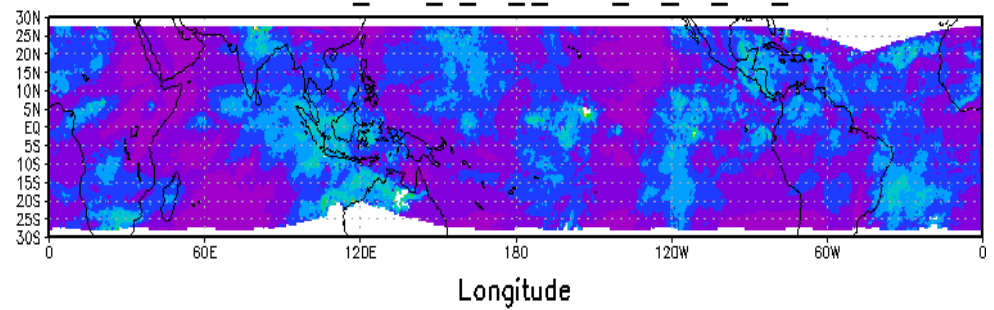MT1SAPSL1A_1.00_9_01_I_2011_10_18_asc_larh

LAYER AVERAGE RELATIVE HUMIDITY (550-400)mb
MT1SAPSL1A_1.00_9_01_I_2011_10_18_asc_larh
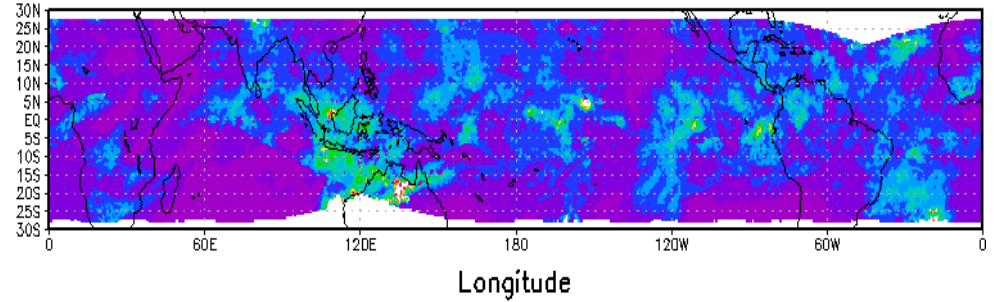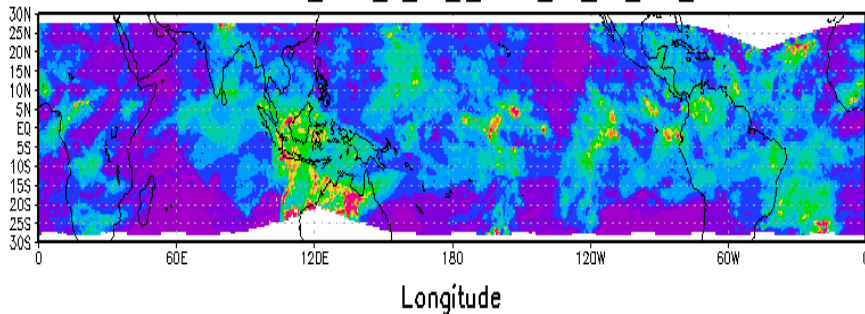
LAYER AVERAGE RELATIVE HUMIDITY (850-700)mb
MT1SAPSL1A_1.00_9_01_I_2011_10_18_asc_larh
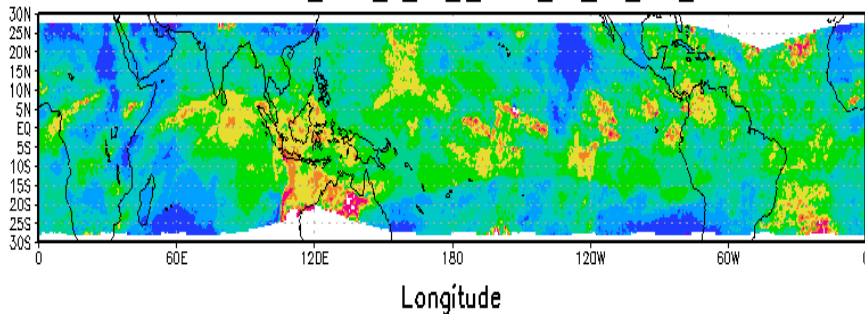
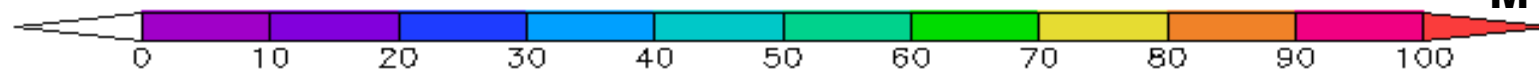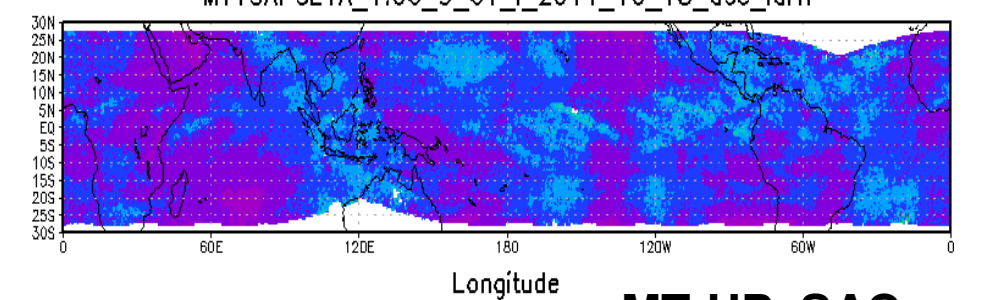LAYER AVERAGE RELATIVE HUMIDITY (400-250)mb
MT1SAPSL1A_1.00_9_01_I_2011_10_18_asc_larh

LAYER AVERAGE RELATIVE HUMIDITY (700-550)mb
MT1SAPSL1A_1.00_9_01_I_2011_10_18_asc_larh

LAYER AVERAGE RELATIVE HUMIDITY (250-100)mb
MT1SAPSL1A_1.00_9_01_I_2011_10_18_asc_larh

MT-UP SAC 18
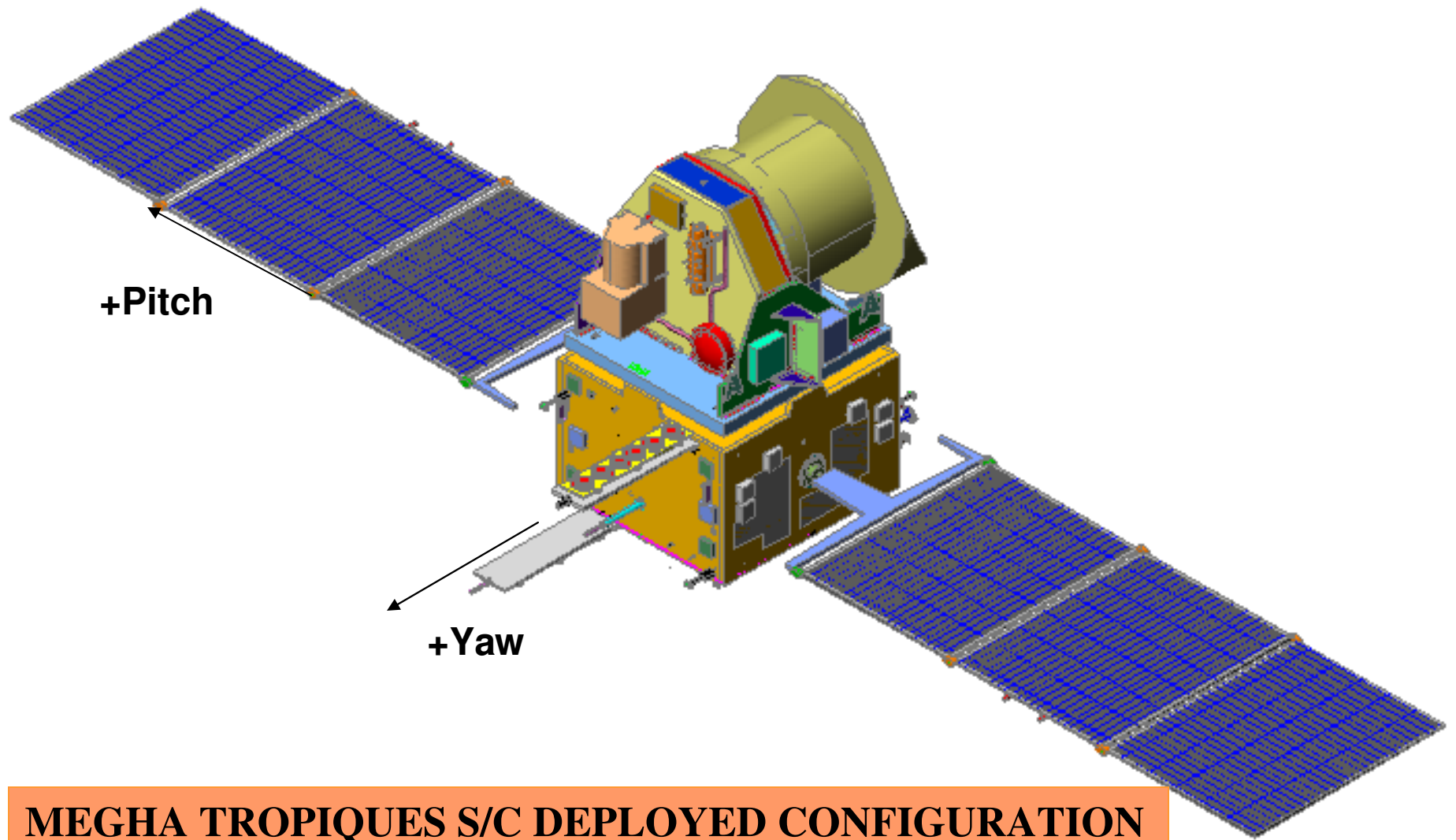LARH (%)

+ Roll

+Pitch

+Yaw

MEGHA TROPIQUES S/C DEPLOYED CONFIGURATION

THANK YOU