



मेघा - TROPIQUES

MEGHA – TROPIQUES

A joint French-Indian satellite mission for the exploration of the tropical water cycle and energy exchanges in the context of climate change

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A cooperation between French and Indian space agencies

- ◆ **ISRO (Indian Space Research Organization) and CNES (Centre National d'Etudes Spatiales, the French Space Agency) have signed a Memorandum of Understanding in November 2004 to jointly develop a satellite mission, named MEGHA-TROPIQUES, dedicated to the study of atmospheric water cycles and energy exchanges in the tropical belt**
- ◆ **The Megha – Tropiques mission is based on the development of one experimental satellite scheduled for launch between end 2008 and end 2009, with a nominal duration of 3 years**

Scientific objectives

- ◆ **Atmospheric energy budget in the intertropical zone and at system scale (radiation, latent heat...)**
- ◆ **Water budget of the systems (including precipitation and water vapor transport)**
- ◆ **Conditions of appearance and development of these systems (Surface temperature, water vapor, winds...)**
- ◆ **Life cycle of mesoscale convective complexes in the Tropics (over oceans and continents)**

Additional objectives

- ◆ **Pre-operational aspects**
 - **Data assimilation for cyclones, monsoons, and mesoscale convective systems forecasting (water vapor and precipitation)**
- ◆ **Contribution to climate monitoring**
 - **Radiative budget (complementary to the US CERES instrument)**
 - **Precipitation (enhanced sampling in the tropics)**
 - **Water vapor (tropical sampling)**

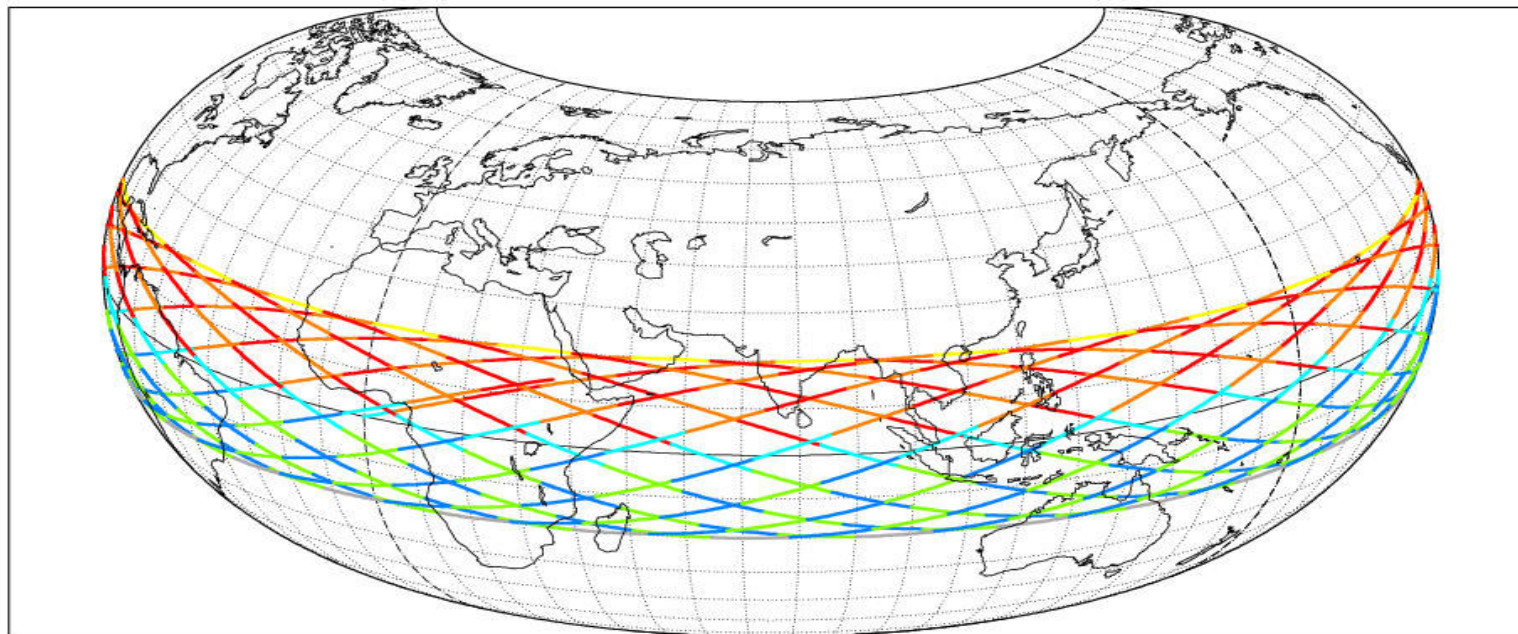
Principles of the mission

- ◆ **Frequent sampling of the intertropical zone to measure radiances related to**
 - **Cloud properties and precipitation**
 - **Water vapor horizontal and vertical distribution**
 - **Outgoing radiative fluxes**
- ◆ **Association with operational meteorological satellites (GEO and LEO)**

Main mission features

- ◆ Geographical coverage 23°N to 23°S, with a repeat time of 3 to 6 times per day
- ◆ Tropical orbit (20° inclination)
- ◆ Altitude 866 km
- ◆ Wide Swath: 1,700Km for microwave sensors and 2,200km for ScaRaB
- ◆ Study of mesoscale convective systems > 100 km
- ◆ Surface resolution from 10 to 40 km, depending on the observed parameters

Daily orbit coverage



Projection : Raisz Armadillo
 Propriété : (sans)
 Type : (divers)

C.C.: 0.0 ° ; 75.0 °E / 28.1 °N; 75.0 °E
 Aspect : Direct
 [+90.0 / +0.0 / -165.0]

N. asc. : 0.00 ° [06:00 TSM]
 Incl. app. = 21.52 °

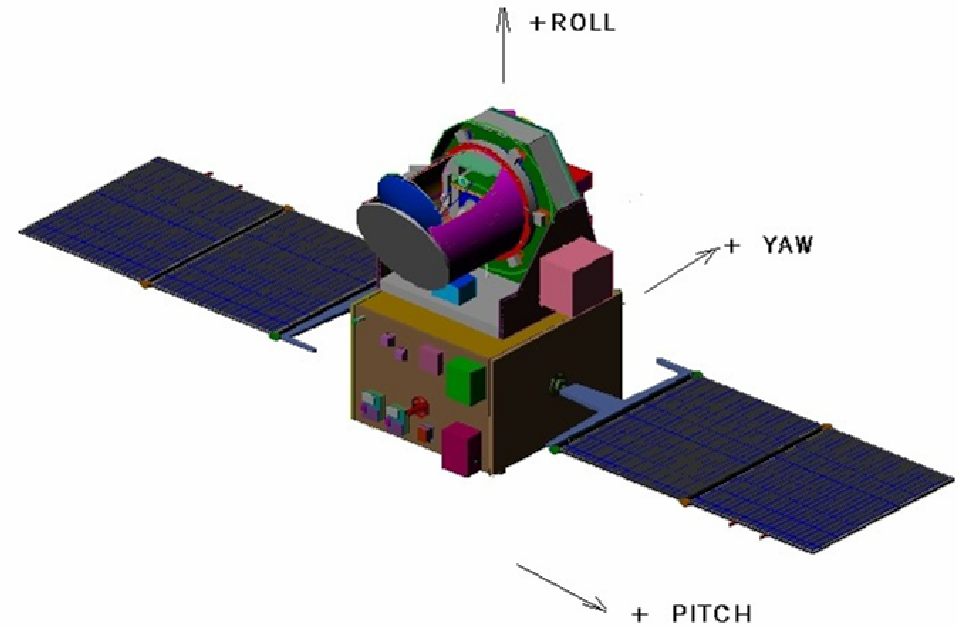
Ιξίων
MC ★ LMD
Ατλας

Organization

- ◆ **Indian and French science group**
- ◆ **Satellite: ISRO IRS bus**
- ◆ **Sensors**
 - **MADRAS microwave radiometer jointly developed by CNES and ISRO**
 - **SAPHIR and ScaRaB instruments provided by CNES**
- ◆ **Ground segment**
 - **Science data will be received at ISRO Bangalore station. ISRO and CNES joint data products will be processed and disseminated by ISRO Bangalore mission centre**
 - **Launcher: Indian PSLV rocket**

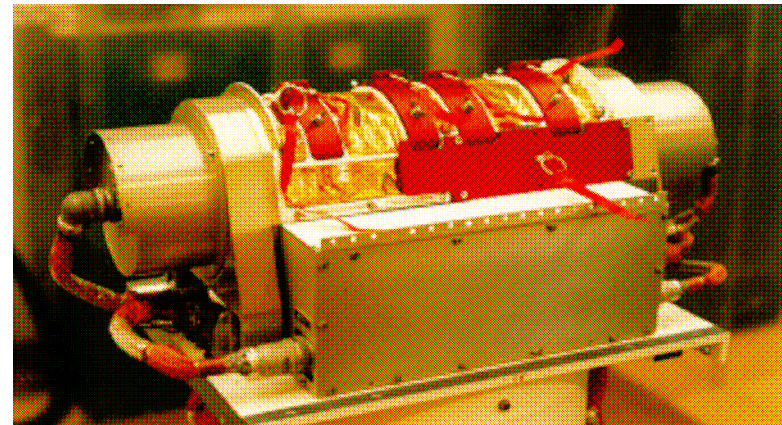
SATELLITE CONFIGURATION

- ◆ Mass ~ 900 kg
- ◆ Power ~ 1,100 watts
- ◆ Three instruments connected to the IRS bus
 - MADRAS
 - SAPHIR
 - SCARAB



ScaRaB

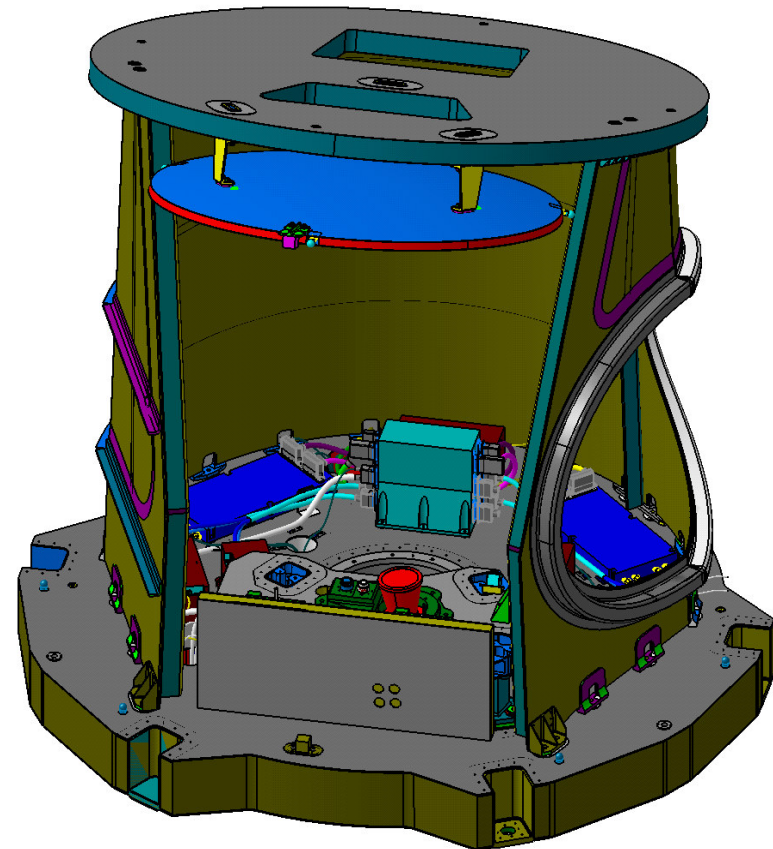
- ◆ **Broadband instrument used to derive longwave and shortwave outgoing fluxes at the top of the atmosphere**
- ◆ **Cross-track scanning with 40 km resolution at nadir**
- ◆ **Strong heritage from sensors formerly embarked on Russian METEOR RESURS satellites**



ScaRaB optical head

MADRAS

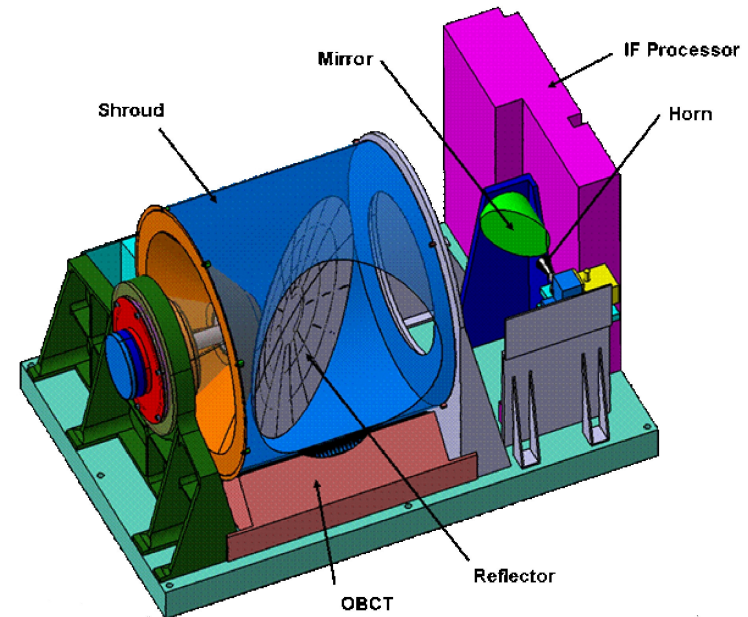
- ◆ Microwave imager for precipitation: channels at 18, 23, 37, 89 and 157 GHz, H and V polarizations
- ◆ Conical swath: 1,700 km
- ◆ Resolution: 6 km – 40 km
- ◆ Microwave subsystem (MARFEQ) developed by EADS-ASTRIUM under CNES contract
- ◆ ISRO provides mechanisms and some electronics

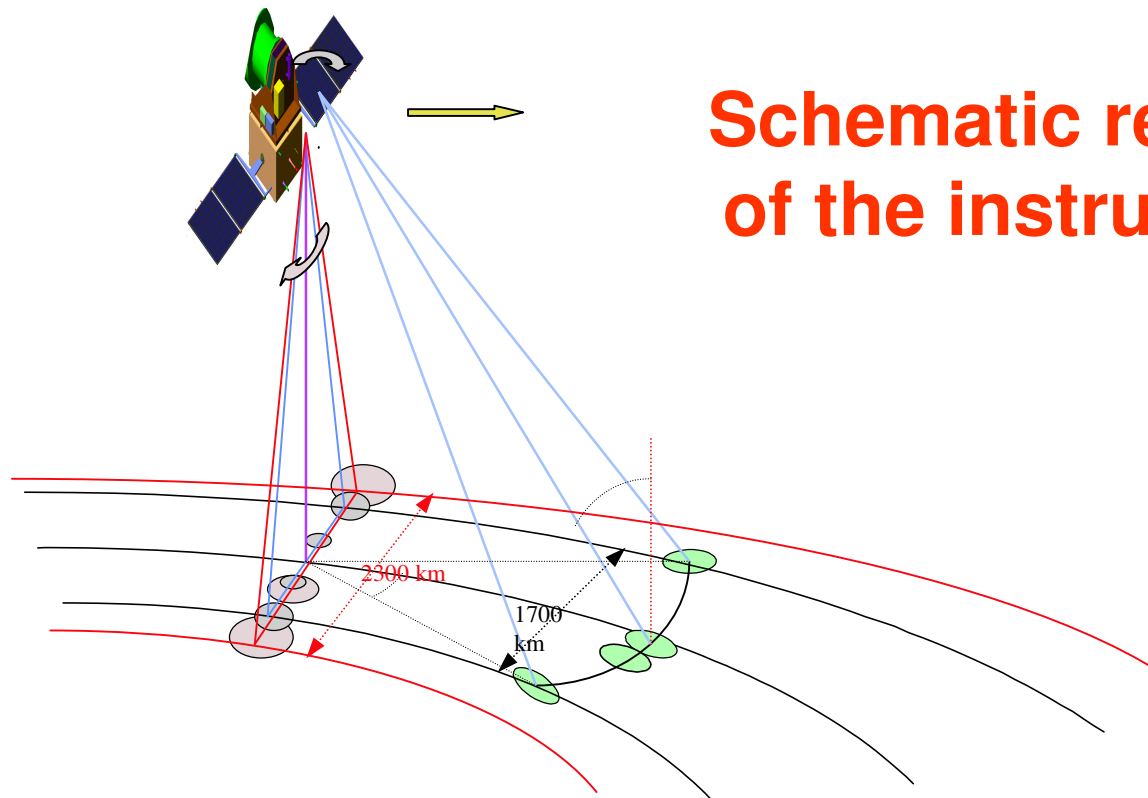


MARFEQ general view




SAPHIR

- ◆ **Microwave sounder to study vertical distribution of water vapor in the tropical troposphere using 6 channels in the WV absorption band at 183.31 GHz**
- ◆ **Cross track scanning radiometer, 1,700 km swath**
- ◆ **Pixel resolution at nadir : 10 km**

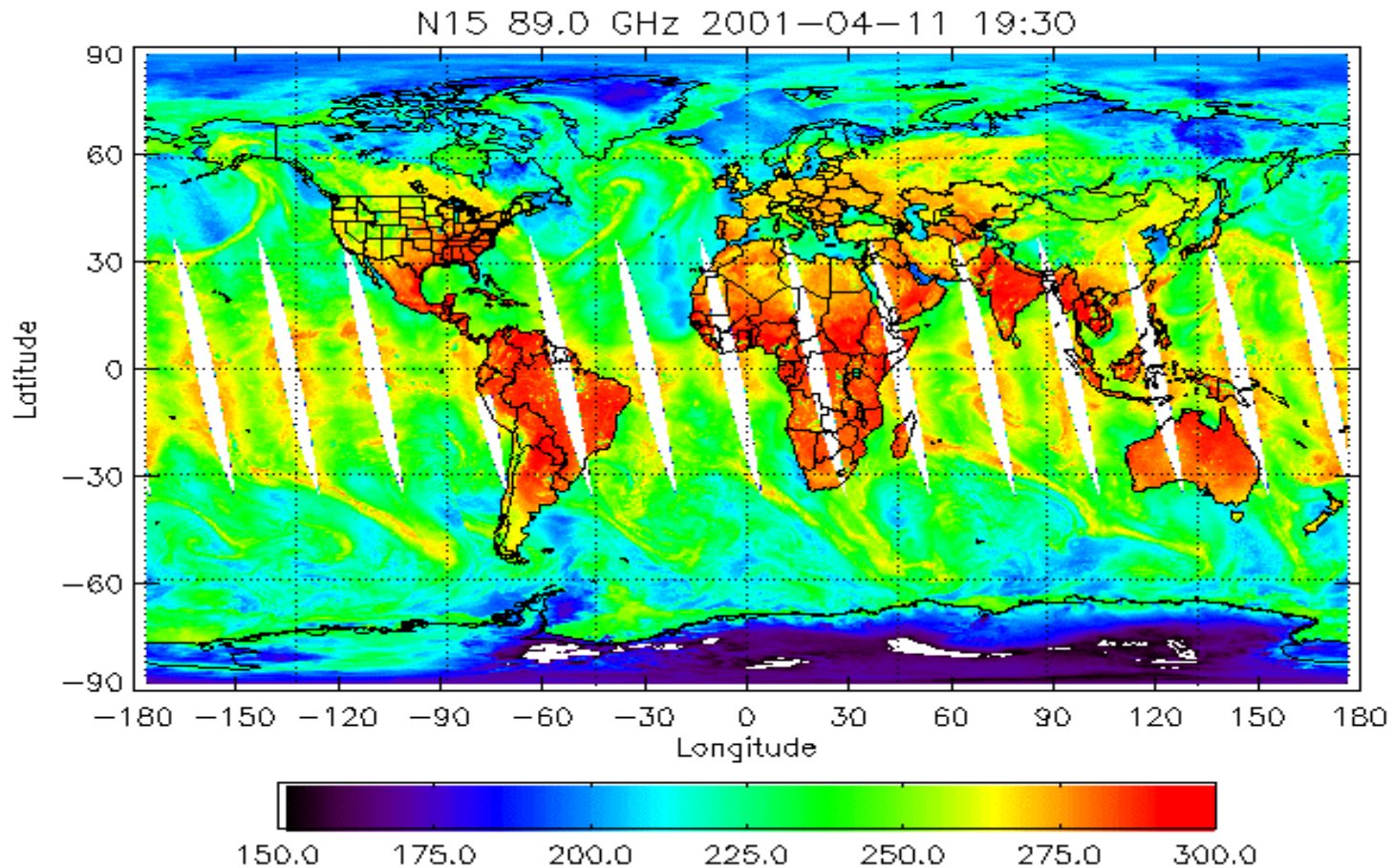




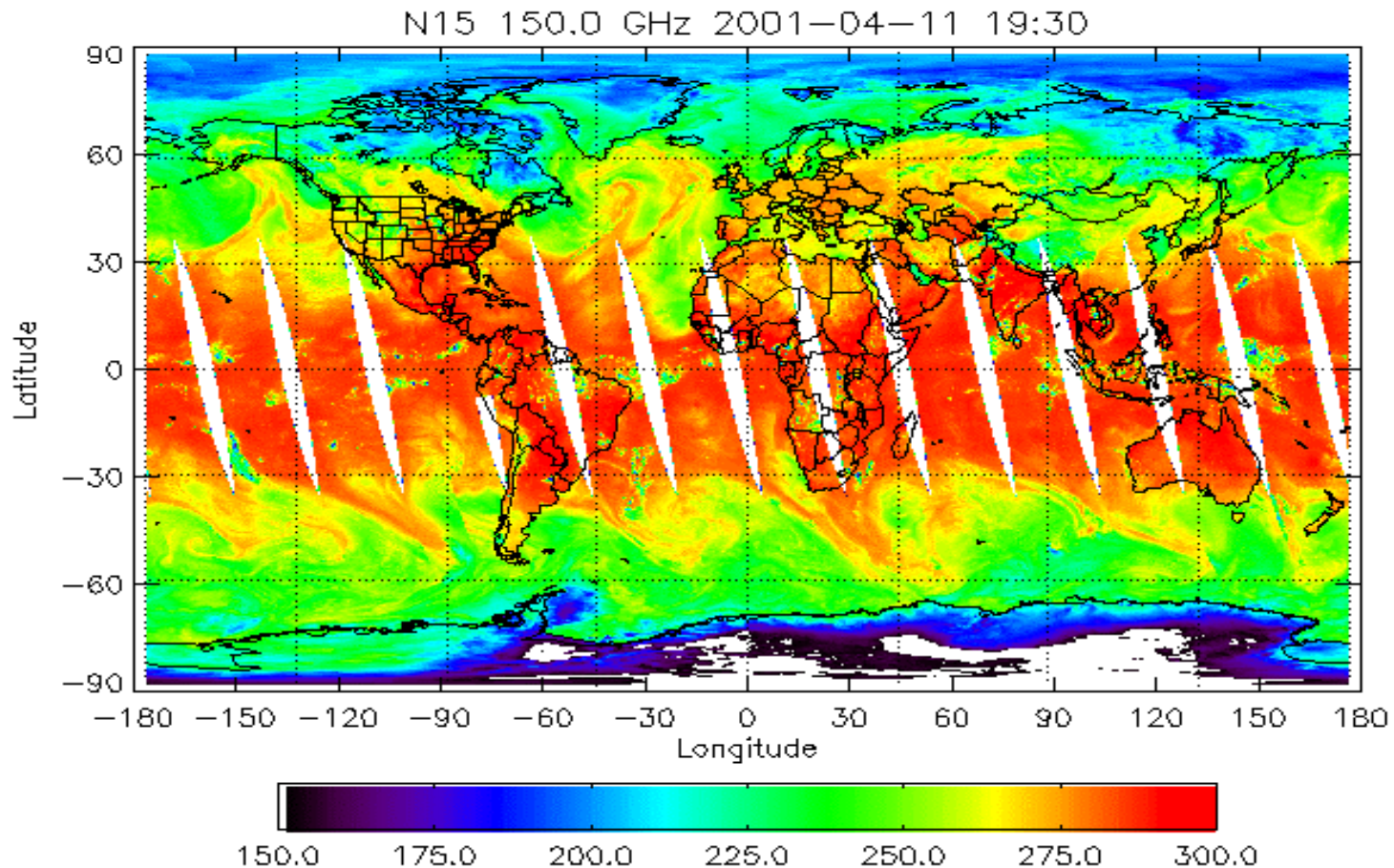
Schematic representation of the instruments swath

-  SAPHIR
-  ScaRaB
-  MADRAS

AMSU-B 89 GHz channel



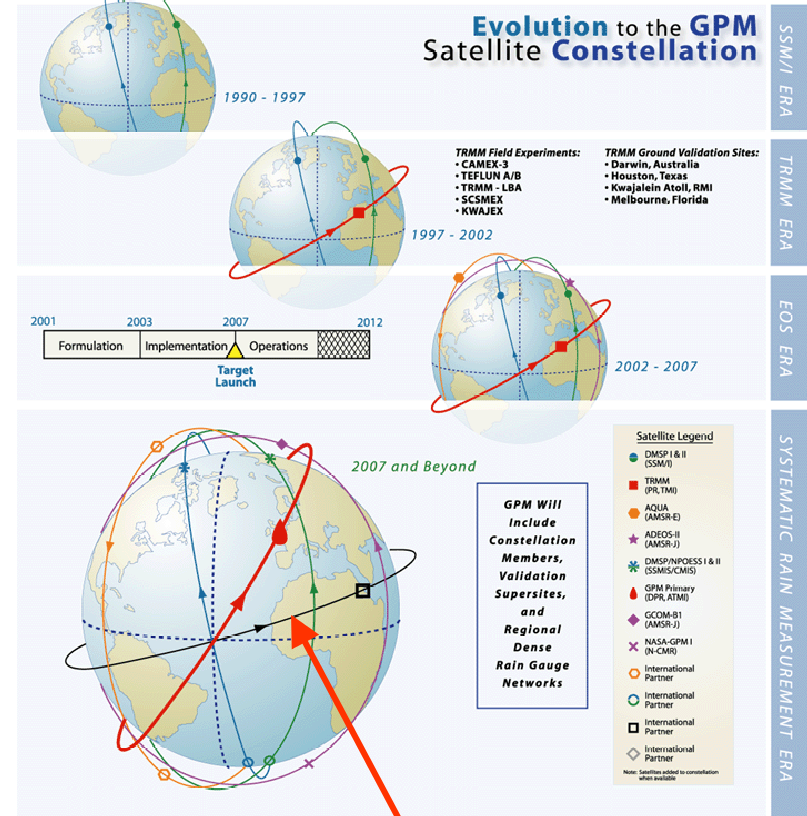
AMSU-B 150 GHz channel



MEGHA – TROPIQUES

Complementarity to other missions

- ◆ **Monitoring of the Earth Radiation Budget**
 - *ScaraB on Megha – Tropiques could partially fill in a gap in radiation budget measurements from CERES*
- ◆ **Global Precipitation Mission**
 - *Madras/Megha-Tropiques is proposed to be associated to this multi-satellite cooperative mission in order to increase its tropical sampling*



MEGHA – TROPIQUES ORBIT WILL COMPLEMENT GPM