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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MEGHA – TROPIQUES

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.
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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)
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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)
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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
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Daily orbit coverage

Projection: Raised Asset IIco

C.C.: 0.0°, 75.0° E / 28.1° N, 75.0° E

Type: (divers)

Aspect: Direct

[±90.0° / -180.0°]

N. asc.: 0.00° [06:00 TSM]

Incl. app. = 21.52°
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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
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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
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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
COSPAR/IAF Symposium, Vienna, February 12, 2007
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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

![Diagram showing the orbit of satellites and the complementarity of the MEGHA-TROPIQUES mission to the GPM mission.](image)

MEGHA – TROPIQUES ORBIT WILL COMPLEMENT GPM