

# The French cooperation efforts in Asia Pacific region in the domain of Space

Within the ESCAP region, France has been active in cooperative efforts both on Regional and Bilateral terms.

## Regional cooperation

France has supported financially and technically this program through several, multi year regional initiatives.

## Bilateral cooperation

France has a long history of cooperation with the Regional space fairing nations, cooperation implemented under the framework of Intergovernmental/Interagency agreements signed with China, India and Japan. These agreements, based on equitable and reciprocal terms, lead to various on going cooperation projects which include, so far :

- Exchanges of TT&C services for satellite LEOP operations, making use of the TT&C stations belonging to each cooperating agency
- Joint development of dedicated Earth observation systems

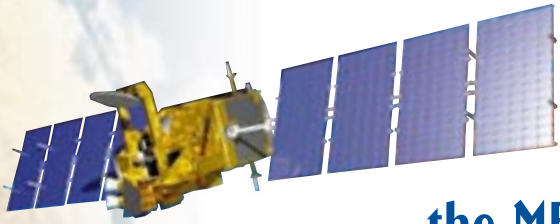
Among those projects, it is worth mentioning the current feasibility studies undertaken with India for the joint development of the MEGHA-TROPIQUES mission dedicated to the studies of tropical climate.

For the nations aspiring to develop some indigenous space technology capability, France has made a standing offer for cooperating in the joint development of specialized microsats, such as DEMETER going to explore the possibility of Earthquake prediction from Space.

Corresponding efforts are consistent with the joint proposal, made by ESA and CNES during the last UNISPACE conference, to set up a Charter of the satellite systems operators for contributing more efficiently to the management of natural or man made disasters. Set up of this Charter is particularly relevant to Asia-Pacific countries taking into account the number of disasters occurring each year in the region.

To facilitate the coordination of these various efforts, CNES will open soon a Regional Permanent Office in Tokyo, with anover all responsibility extended over the whole Asia-Pacific region.

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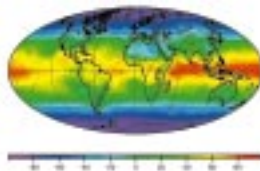


# Main objectives and principle of the MEGHA-TROPIQUES mission

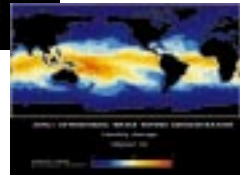
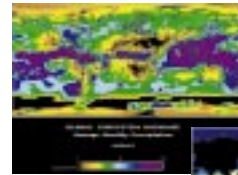
The main objective of the “MEGHA-TROPIQUES” mission is to study the convective systems that influence the tropical weather and climate. The tropical region is the domain of monsoons, squall lines and tropical cyclones.

## Ended:

- the water cycle is particularly intense in inter-tropical regions, which receive over 60% of global precipitation,
- solar heating of the Earth occurs mostly in the tropics, much of which is covered by ocean,



(SCARAB/Meteor: Net radiation flux, averaged over 11 months from March 1994 to February 1995 in Watt per m<sup>2</sup>)

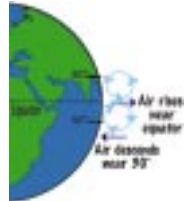
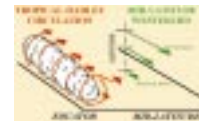


The vast quantity of water vapour evaporated over sub-tropical and tropical oceans is condensed by tropical convection systems, most of it falling back as precipitation. The horizontal and vertical distribution of clouds, water vapour and precipitation resulting from such processes determines energy exchanges by radiation and the latent heat release.

These exchanges influence atmospheric dynamics on a medium and large scale.

So, any change in the energy and water budget of the Land-Ocean-Atmosphere system in the tropics has an influence on global climate. This reveals the need to study tropical convective systems and associated precipitation, and their relationship with humidity and wind fields.

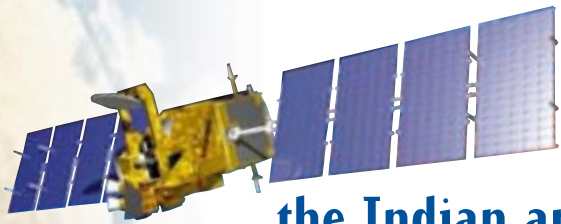
It is necessary to obtain frequent measurements in order to sample the life cycle of the convective systems and to obtain significant statistics over a sufficient time period.



## The basic principles of the MEGHA-TROPIQUES mission are therefore as follows:

- to provide simultaneous measurements of several elements of the atmospheric water cycle: water vapour, clouds, condensed water in clouds, precipitation and evaporation,
- to measure the corresponding radiative budget at the top of the atmosphere,
- to ensure high temporal sampling in order to characterise the life cycle of the convective systems and to obtain significant statistics.

The principle of MEGHA-TROPIQUES is to get a satisfactory sampling of the intertropical band, and specially the latitudes between 10° and 20°, with instruments relevant for water and energy budget of the tropical convective systems.



# MEGHA-TROPIQUES: a co-operative project between ISRO and CNES, the Indian and French Space Agencies

- Agreement signed between the Government of India and the Government of France on June 21, 1977, in which they affirmed their mutual desire for strengthening and increasing their existing co-operation in the field of exploration and utilisation of outer space for peaceful purposes,
- Agreement signed between ISRO and CNES in December 1993 and formally renewed in December 1998, in which ISRO and CNES agreed to study co-operative programmes in satellites intended for space Research and application of space technology,
- ISRO and CNES recognise the major role in the climate dynamics of the atmospheric energy exchanges and water cycle in the tropical belt,
- ISRO and CNES agreed in December 1997 to initiate a co-operative project relative to a joint Earth observation mission from space, and dedicated to tropical atmosphere: MEGHA-TROPIQUES. A Statement of Intent for phase A to be signed very soon by CNES and ISRO
- Preliminary schedule of the MEGHA-TROPIQUES Project:
  - Phase 0: December 1997 - June 1999,
  - Phase A: October 1999 - April 2000,
  - Phase B: May 2000 - February 2001,
  - Phase C/D: mars 2001 - April 2005,
  - Launch date: mid-2005
  - Phase E: mid-2005 - 2010.

#### ● Technical characteristics of the MEGHA-TROPIQUES Project:

- Payload:
  - MADRAS: a microwave imager aimed mainly at studying precipitation and cloud properties (10, 18, 23, 36, 89, 157 GHz).
  - SAPHIR : a 6 channels microwave instrument for the retrieval of water vapour vertical profiles (183 GHz),
  - SCARAB: A radiometer devoted to the measurement of outgoing radiative fluxes at the top of the atmosphere.
- Plate-form: PROTEUS BUS
- Launcher: PSLV (Polar Space Launch Vehicle)



#### ● Organisation of the MEGHA-TROPIQUES Project ;

- SAPHIR et SCARAB provided by CNES, and developed by French Laboratories (LMD and CETP),
- MADRAS jointly developed by CNES and ISRO, under ISRO responsibility: CNES will provide the mobile part of the MADRAS instrument (micro-wave reception) developed by Matra Marconi Space, and ISRO will develop the fixed part,
- ISRO will be responsible of the integration and test of the overall payload, with CNES assistance for the SAPHIR and SCARAB integration,
- BUS provided by CNES, and responsible of the satellite integration,
- Control and operation ground segment provided by CNES,
- Shared CNES/ISRO Processing and Archiving ground segment,
- PSLV provided by ISRO

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