TRMM

Tropical Rainfall Measuring Mission

Mission Objective

The Tropical Rainfall Measuring Mission (TRMM) science objectives are to: 1) Advance scientific understanding of Earth's global energy and water cycles by determining how tropical rainfall influences global circulation; 2) Improve ability to obtain, determine, and model tropical rainfall rates, distribution, and quantities of precipitation; 3) Promote understanding of physical climate system, particularly distribution of precipitation and inferred latent heat release; 4) Improve ability to predict global circulation and rainfall variability trends; 5) Validate existing and future models of convection-driven precipitating cloud systems and their interactions with oceans and ambient atmosphere; and 6) Test, evaluate, and improve satellite rainfall estimation measurements and techniques.

TYPE OF MISSION	PROGRAM OFFICE	PROJECT LEAD CENTER	MANAGEMENT APPROACH	S/C CONTRACTOR	I&T CONTRACTOR
EARTH SCIENCES & APPLICATIONS	MISSION TO PLANET EARTH	GSFC/JAPAN	AUGMENTED HYBRID	GSFC	GSFC

Payload Description

The Tropical Rainfall Measuring Mission (TRMM) payload carries five instruments: (1) a single frequency (13.8 GHz) Precipitation Radar (PR) provided by Japan; (2) a visible-infrared scanning radiometer (VIRS) similar to AVHRR; (3) a passive microwave radiometer called the TRMM Microwave imager (TMI), similar to the SSM/I microwave radiometer on the DMSP-series; (4) a Lightning Imaging Sensor (US) for the detection and distribution of global lightning; and (5) the Clouds and Earth's Radiant Energy System (CERES) instrument for the measurement of the Earth's radiation budget. The TRMM spacecraft is a free-flyer with a low-altitude, non-sun-synchronous orbit. The primary C&DH link for the TRMM payload is the S-band Single Access (SSA) channel through the Tracking and Data Relay Satellite System (TDRSS). Spacecraft housekeeping command and telemetry and back-up for the science data are via the TDRSS S-band Multiple Access (SMA) channel. The orbital position of the spacecraft is determined by the TDRSS ranging system.

INSTRUMENT NAME	ACRONYM	PI AFFILIATION	PRINCIPAL INVESTIGATOR	I&T CONTRACTOR
CLOUDS & EARTH'S RADIANT ENERGY SYSTEM	CERES	LARC	8. R. BARKSTROM	TRW
LIGHTNING IMAGING SENSOR	LIS	MSFC	H. J. CHRISTIAN. JR.	MSFC
PRECIPITATION RADAR TRMM MICROWAVE IMAGER	PR TMI	CRL JAPAN GSFC	K. OKAMATO T. T. WILHEIT JR.	NASDA/TOSHIBA HUGHES SCG
VISUAL INFRARED SCANNER	VIRS	GSFC	W. L. BARNES	HUGHES SBRC

Instrument Descriptions
The TRMM Clouds and Earth's Radiant Energy System (CERES) instrument consists of three channels that provide a resolution of 10 km at nadir to measure radiant fluxes. The total channel covers the spectral region from 0.3 to 50 microns with a radiometric accuracy of 0.5%. The shortwave channel covers the region from 0.3 to 5 microns with an accuracy of 1. 0%. The longwave channel covers the region from 8 to 12 microns with an accuracy of 0.3%. The CERES is an improved and modified version of the ERBE instrument flown on the ERBS and NOAA polar orbiting satellites.
The TRMM Lightning Imaging Sensor (US) includes an expanded optics wide-FOV lens, combined with a narrow-band interference filter which focuses the image on a small, high-speed, CCD focal plane. The signal is read from the focal plane into a real-time processor for event detection and data compression. Four methods are used for measuring lightning: 1) spatial filtering; 2) spectral filtering; 3) temporal filtering to reduce the signal-to-noise ratio between the lightning event and the background; and 4) modified frame-to-frame background subtraction to remove the background.
The TRMM Precipitation Radar (PR) instrument objectives are to provide height profiles of precipitation content, from which a profile of latent heat release can be obtained. The PR is a single-frequency radar at 14 GHz. The radar has an IFOV of 5 km at nadir, with a minimum vertical resolution of 250 m. The PR will be able to detect rain rates of 0.5 mm per hour.
The TRMM Microwave Imager (TMI) is a 9-channel passive microwave radiometer. The TMl channels include: I) two 10.65 GHz channels for measurement of very heavy rainfall over oceans; 2) two 19.35 GHz channels for measurement of heavy rain over the oceans; 3) a single 21.30 GHz channel for measurement of total atmospheric water vapor over land and ocean; 4) two 37.0 GHz channels for measurement of light rain over land and ocean; and 5) two 85.5 GHz channels for measurement of very light rain over land and ocean.
The TRMM Visible Infrared Scanner (VIRS) consists of 5 channels: 1) Visible (0.63 microns) for daytime cloud mapping to determine areas of potential precipitation; 2) Near-1R (1.61 microns) for daytime water/ice discrimination; 3) mid-IR (3.75 microns) for day/night determination of water vapor; 4) Thermal-IR (10.80 microns) for day/night determination of cloud top temperatures; and 5) Thermal-IR (12.0 microns) for day/night determination of water vapor. The thermal-IR channels can also be used for calculating surface temperature.

Launch
8/16/97