NASA Facts

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Tropical Rainfall Measuring Mission

An International Effort

Many of NASA's major space missions have been cooperative efforts between the United States and other nations. This sharing of effort recognizes that our global society benefits from the findings of such missions.

Programs such as the French/U.S. TOPEX/Poseidon mission, which measures the topography of the world's oceans, have been highly successful. Other successful examples include the key role Japan is playing as a major contributor to NASA's Mission to Planet Earth (MTPE), and in such programs as the joint Tropical Rainfall Measuring Mission (TRMM), scheduled for launch in November 1997. While the U.S. and Japan are providing the spaceborne elements of the mission, several other nations are involved in the ground-based elements, crucial to the success of TRMM objectives.

Japanese and U.S. scientists have seen the potential benefits of studying rainfall in the tropics and subtropics. More than two-thirds of all the rainfall that hits the surface of the Earth occurs in the tropics. The energy that is released due to this precipitation helps to drive global circulation. But rainfall measurements in the tropical regions are scarce because there are few weather observing stations in the area, and almost no observations are taken over the vast expanse of the ocean, with the exception of a few ships.

Of special interest to the Japanese is the weather phenomenon known to them as "Baiu." This disturbance, which appears in the vicinity of 30 degrees north latitude in the spring, can bring tremendous amounts of rain to certain parts of Japan while leaving other parts extremely dry. Forecasts of Baiu conditions are of great importance to the planting and harvesting of rice across the country, and it is hoped that observations from TRMM will assist in predicting this annual phenomenon.

The U.S. has many years of experience measuring rainfall using passive microwave sensors on spaceborne satellites such as NASA's Nimbus-5 and -6 space missions. The U.S. also has used cloud-top infrared emissions as an indirect means of estimating rainfall. The Japanese have developed a Precipitation Radar (PR) to measure the reflectivity of rain from space as a more direct way of determining rainfall rates. This radar will use a pulsed signal to determine how precipitation rates vary with altitude.

The two nations are combining their efforts on TRMM, with the U.S. supplying the passive microwave and infrared sensors as well as the

basic spacecraft, and Japan supplying the Precipitation Radar (PR) and performing the launch of the satellite. Data from the sensors will flow into analysis centers in both Japan and the U.S.

Many years of experience have taught scientists that remotely sensed measurements from space must be supplemented with measurements from ground-based observing stations, a process known as “ground truthing.” Rainfall characteristics vary widely between land and ocean, and are dependent on the type of climate regime. The signals that the precipitation radar receives over an island in the middle of the Pacific Ocean may mean something slightly different than the signals received over the Amazon jungle or on the northern coast of Australia. Recognizing this problem, TRMM has enlisted the help of several nations (Australia, Israel, the Republic of the Marshall Islands, Taiwan, Thailand and Brazil) to set up ground-based facilities for measuring rain and supplying the data to TRMM scientists to validate the spaceborne measurements. These data, as well as measurements made by Japan and the U.S. validation sites, will flow into a major data archive at NASA’s Goddard Space Flight Center in Greenbelt, MD. They will be useful both for validating TRMM measurements and as a new source of valuable climatological records for researchers who are interested in knowing more about the world’s climate regimes.

Visit the TRMM Homepage at
http://trmm.gsfc.nasa.gov