The GPM Mission, Cloud Resolving Models, and Microwave Precipitation Retrieval

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Abstract

The GPM mission is currently planned for start in the 2007-08 time frame. Its main scientific goal is to help answer pressing scientific problems arising within the context of global and regional water cycling. These problems cut across a hierarchy of scales and include climate-water cycle interactions, techniques for improving weather and climate predictions, and better methods for combining observed precipitation with hydrometeorological prediction models for applications to hazardous flood-producing storms, seasonal flood/draught conditions, and fresh water resource assessments. The GPM mission will expand the scope of precipitation measurement through the use of a constellation of some 9 satellites, one of which will be an advanced TRMM-like "core" satellite carrying a dual-frequency Ku-Ka band precipitation radar and an advanced, multifrequency passive microwave rain radiometer with vertical-horizontal polarization discrimination. The other constellation members will include new dedicated satellites and co-existing operational/research satellites carrying similar (but not identical) passive microwave radiometers. The goal of the constellation is to achieve 3-hour sampling at any spot on the globe -- continuously. The constellation's orbit architecture will consist of a mix of sun-synchronous and non-sun-synchronous satellites with the "core" satellite providing measurements of cloud-precipitation microphysical processes, plus calibration-quality rainrates to be used with the other retrieval information to ensure bias-free constellation coverage.

GPM is organized internationally, involving existing, pending, projected, and under-study partnerships which will link NASA and NOAA in the US, NASDA in Japan, ESA in Europe and additional space agency partners. Moreover, the program is actively pursuing agreements with other international collaborators and domestic sister institutions, as well as individual scientists from academia, government, and the private sector to fulfill mission goals and to pave the way for what ultimately is expected to become an internationally-organized operational global precipitation observing system. Notably, the broad societal applications of GPM are reflected in the United Nation's identification of this mission as a foremost contributor to peaceful uses of space.

An overview of the GPM mission design is given, followed by an explanation of its scientific agenda as an outgrowth of making improvements in rain retrieval accuracy, microphysics dexterity, sampling frequency, and global coverage. All of these improvements offer new means to observe variability in precipitation and water cycle fluxes, to improve water budget closure at regional and global scales, and to leverage these improvements in achieving improved predictability of weather, climate, and hydrometeorology. Specifically, the scientific agenda of the GPM mission is being designed to leverage the measurement improvements to improve prognostic model performance, particularly quantitative precipitation forecasting and its linked phenomena at short, intermediate, and extended time scales. In this context, the talk will focus on how GPM measurements will be used to improve the fidelity of mesoscale cloud resolving models (CRMs) and how in turn, CRMs will be used to improve the microwave algorithms designed to retrieve GPM satellite rainrates.