

Relationship Between GPM Mission and NASA's Global Water Cycle Research Program

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Second International Symposium on Earth Observation from Space
[November 14; Osaka, Japan]

Abstract

During the coming decade, the internationally organized Global Precipitation Measurement (GPM) Mission will take an important step in creating a global precipitation observing system from space based on an international fleet of satellites operated as a constellation of opportunity. One perspective for understanding the nature of GPM is that it will be a hierarchical system of datastreams beginning with very high caliber combined dual frequency radar/passive microwave (PMW) rain-radiometer retrievals, to high caliber PMW rain-radiometer only retrievals, and then on to blends of the former datastreams with additional lower-caliber PMW-based and IR-based rain retrievals.

Within the context of the now emerging global water & energy cycle (GWEC) programs of a number of research agencies throughout the world, GPM serves as a centerpiece space mission for improving our understanding of the Earth's water cycle from a global measurement perspective and on down to regional scales and below. One of the salient problems within our current understanding of the global water and energy cycle is determining whether a change in the rate of the water cycle is accompanying changes in climate, e.g., climate warming. As there are a number of ways in which to define a rate-change of the global water cycle, it is not entirely clear as to what constitutes such a determination.

This paper first presents an overview of the GPM Mission and how its overriding scientific objectives for climate, weather, and hydrology flow from the anticipated improvements that are being planned for the constellation-based measuring system. Next, the paper shows how the GPM observations can be used within the framework of the oceanic and continental water budget equations to determine whether a given perturbation in precipitation is indicative of an actual rate change in the water cycle, consistent with required responses in water storage and/or water flux transport processes, or whether it is simply part of the natural variability of a fixed rate cycle.