Future precipitation measuring mission from space

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Since freshwater resources (precipitation) are directly linked to our life and are becoming social issue. For example, 1) securing global water resources (drinking water, agriculture) is an urgent issue now, 2) climate change will cause the increasing of risk of disasters associated with typhoon/torrential rainfall, 3) climate change will increase in health risks such as infectious diseases, and then 4) accurate climate change forecast is necessary for appropriate global warm countermeasure.

Under this situation, what required for science community on the water issues are: 1) providing information that can be used for weather, disaster prevention, agriculture, public health and that cover the entire earth (e.g. precipitation map like GSMaP, and global soil moisture map), and 2) understanding the changes and impacts of precipitation by the climate change which needs long-term monitoring of precipitation and improvement of climate prediction by numerical climate model. Furthermore, the responses of the cloud-precipitation system to the climate change and the understanding of the cloud and rainfall system including the interactions among the hierarchical scales of meteorological phenomena are also important.

Both observations by ground based, airborne and spaceborne instruments, and model research are necessary in order to understand the overall structure of the Earths' atmospheric systems. Of course progress of the data assimilation technique is necessary for the improvement of weather forecast.

The histories of precipitation radar missions are briefly explained. The Tropical Rainfall Measuring Mission (TRMM 1997-2015) achieved better understanding of the tropical precipitation systems (accurate rainfall data, three-dimensional structure, diurnal cycle, etc.) and lead the improvement of global precipitation estimation such as GSMaP.

Global precipitation measurement (GPM 2014-) is planned to utilize many satellites as an international cooperation mission that means actual utilization of global precipitation map (GSMaP) and has achieved better understanding of precipitation system and also improved the estimation of rain and snowfall throughout the earth.

Considering that the scientific requirements and the achievements of TRMM and GPM, the directions of future precipitation observation mission are: 1) monitoring of global precipitation monitor with better accuracy and real-time delivery, 2) precipitation process studies, and 3) understanding of cloud-precipitation interactions. Mission requests to achieve above science purposes are: multi-frequency radar with high sensitivity in order to observe cloud and precipitation, observation of dynamics in the cloud with Doppler velocity observation, and expansion of observation area by wide swath observation and/or multiple satellites (e.g. small satellite and/or micro-sat).

Proposed mission is so called DPR-2 in which the main instrument is upgrade of GPM/DPR. The DPR-2 has twice wide swath width, 10-20 dB improvement of sensitivity, and high horizontal resolution (2-4

times finer) than DPR. According to the preliminary conceptual design study, these improvements can be achieved by current technology based on the heritages of TRMM/PR and GPM/DPR.

Considering that the DPR has also been nearly four years since the launch and the design life has already past, the development of DPR-2 must be started soon. On the development of the DPR-2, we must consider international cooperation like as the framework of TRMM and GPM. Recently, the US National Academy of Science/Engineering/Medicine reported the “decadal survey for earth science and applications from space.” In this report, “louds, convection & precipitation” observation is one of the top priorities and their concept will support the collaboration with the us.

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