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Retrievals of Falling Snow from Satellite-borne Active and Passive Sensors

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Precipitation, including rain and snow, is a critical part of the Earth's energy and hydrology cycles. Precipitation impacts latent heating profiles locally while global circulation patterns distribute precipitation and energy from the equator to the poles. For the hydrological cycle, falling snow is a primary contributor in northern latitudes during the winter seasons. Falling snow is the source of snow pack accumulations that provide fresh water resources for many communities in the world. Furthermore, falling snow impacts society by causing transportation disruptions during severe snow events. In order to collect information on the complete global precipitation cycle, both liquid and frozen precipitation must be collected.

The Global Precipitation Measurement (GPM) mission's Core satellite, scheduled for launch in February 2014, is well designed to detect and estimate falling snow. The GPM core carries a passive radiometer with frequencies (10-183 GHz) and an active radar with Ku- and Ka-band frequencies. Combined with the 65o inclination of the GPM Core satellite, these instruments allow for the GPM Core to sense and retrieve information about falling snow and light rain in regions of the earth where snow is common. The GPM Core's comprehensive active and passive channel set will also allow it to serve as a unifying reference for GPM constellation radiometer satellites.

Since falling snow from space is the next precipitation measurement challenge from space, information is needed to guide retrieval algorithm development for these current and future missions. This information includes thresholds of detection for various sensor channel configurations, sensitivity to macroscale snow event system characteristics, and sensitivity to microscale snowflake particle characteristics. While the work in this area will continue for many years to come, our group has made substantial progress in this area by identifying minimum detectable melted rates of $\sim$0.5 mm hr-1. Results will be presented for active radar at Ku, Ka, and W-band and for passive radiometer channels from 10 to 183 GHz.

We also helped to develop the GPM mission's at-launch retrieval algorithm code for falling snow. We will report on our tests to evaluate performance in terms of Bayesian database representativeness and database profile selection methodologies for the various surfaces, precipitation types, and real-time ancillary data. We will also describe implementation of specific algorithm enhancements such as database updates, code processing of profile selection methodologies and/or adjusting Bayesian channel weights for the falling snow retrievals.

Early imagery of GPM's retrievals of falling snow will be presented if available at the end of April 2014 (2 months after launch).