LEVEL 1 ALGORITHM DEVELOPMENT OF SPACEBORNE DUAL-FREQUENCY PRECIPITATION RADAR (DPR) FOR GPM

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Global Precipitation Measurement (GPM) started as an international mission and follow-on mission of the TRMM project to obtain more accurate and frequent observations of precipitation. The accurate measurement of precipitation will be achieved by the Dual-frequency Precipitation Radar (DPR) installed on the GPM core satellite. DPR on the GPM core satellite is being developed by Japan Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT). DPR consists of two radars, which are Ku-band (13.6GHz) precipitation radar (KuPR) and Ka-band (35.5GHz) radar (KaPR). KaPR will detect snow and light rain, and the KuPR will detect heavy rain. In an effective dynamic range in both KaPR and KuPR, drop size distribution (DSD) information and more accurate rainfall estimates will be provided by a dual-frequency algorithm. The algorithm must use the difference in rain attenuation from the matched beam data observed by KaPR and KuPR.

Both KuPR and KaPR have almost the same designs as the TRMM PR. Level 1 algorithms for processing the products of each KuPR and KaPR will be developed based on the PR level 1 algorithm. JAXA is examining the specification of telemetry data and standard products, and is developing level 1 algorithm. House keeping (HK) and science telemetry data of the DPR is basically similar to that of PR except for pulse repetition frequency (PRF) and noise sampling. While PR has a fixed PRF that needs a wide enough sampling window that covers the large variation of the surface range from the satellite, DPR will use variable PRF (VPRF) technique to obtain higher sensitivity under the limited resources on the spacecraft. The PRFs of both KuPR and KaPR will vary according to the satellite altitude variation and to the antenna scan angles. The proper PRF is changed by the distance from satellite to the earth surface. Since the satellite altitude information is obtained by the GPS receiver onboard, the optimized PRF and sampling range can be selected in the VPRF table onboard. Sampling methods of noise for each angle are different between PR and DPR. Four range bins before (after) the nominal echo sampling window are used for noise sampling of PR. DPR adopts VPRF and does not have enough noise sample area similar to PR. Instead, noise signals will be sampled using last four hits without transmission pulses in a scan angle stopped and will be averaged for retrieving received powers. The information of VPRF table and noise sampling will be added to level 1 products of KuPR and KaPR. Simulation data of HK and science telemetries of KuPR and KaPR are constructed. In order to construct synthetic data for DPR level 1 and level 2 algorithm developments, we conducted the experiment to obtain KaPR geometric data for real precipitation data in March 2007. We constructed synthetic science telemetry data and level 1 data of DPR to the specification of VPRF table and data format with actual spaceborne radar data. The synthetic data will be used to develop the level 2 algorithms of GPM/DPR.

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