CGMS

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CURRENT STATUS ON MICROWAVE SENSOR APPLICATION AND GPM ACTIVITY IN KMA/NIMR

This paper reports the current status on GPM activity and their microwave sensor application efforts in KMA/NIMR during 2008 and 2009. CGMS members are invited to take note.

CURRENT STATUS ON MICROWAVE SENSOR APPLICATION AND GPM ACTIVITY IN KMA/NIMR

1 INTRODUCTION

This paper addresses current status of GPM activity and their microwave sensor application efforts at KMA/NIMR.

2 GPM ACTIVITY

2.1 Background

In 2002, NASA GPM team visited Korea and proposed to join GPM program. Starting with preliminary studying in 2003, "*Feasibility Study on Maximizing the Benefits from GPM Project*," KMA has participated in previous GPM Ground Validation (GV) workshops and GPM meetings. In 2008, KMA collaborates with GPM GV office for prototype ground validation with TRMM and ground-based radar in Korea. Six radar sites (including one WSR-88D) data will be used for the study. It started with direct reflectivity comparisons with TRMM PR data and Gosan (RGSN) radar site as beginning. This study was constructed with the previous comparisons with TRMM PR and 21 WSR-88D sites in the southeast of the US national network. KMA/NIMR submitted the NASA science proposal and currently under reviewing.

2.2 GV Prototype in Korea

RGSN S-band, 1-degree beamwidth radar site at Gosan, Jeju Is. has been selected to get started with. The viewing geometry appears to wide area of open sea water and RSSP (Sungsan) is located within about 100 km. Also both radars well overlap with RPSN (Gudeoksan) and RJNI (Jindo) within the TRMM PR swath. RGSN is located at 33.3N/126.2E and site runs since June 13, 2006. TRMM PR 2A25 and RGSN data has been resampled to 4 km horizontal grid on 3-dimensional uniform Cartesian grid for 300 x 300 km area centered on radar site and 1.5 km vertical grid from 1.5 to 19.5 km altitude. Collocated rain event cases selected on criteria of at least a 25 % overlap of the PR swath, and 25 % of the points in the overlap area indicating rain certain in the PR data. During August 2006 to May 2008, there are 60 events available to match-up these criteria. Both reflectivity data of 18 dBZ or greater were used.

TRMM product 2A-25 attenuation corrected PR radar reflectivity comparison statistics are generated for each match-up dataset. Left side of Fig. 1 shows the distribution of reflectivity values at the 6 km grid level for RGSN for an individual TRMM PR overpass during the period. The plot shows roughly 1.37 dBZ low bias over 163,586 points. Right side of Fig. 1 shows the layer-averaged reflectivity. More investigation is

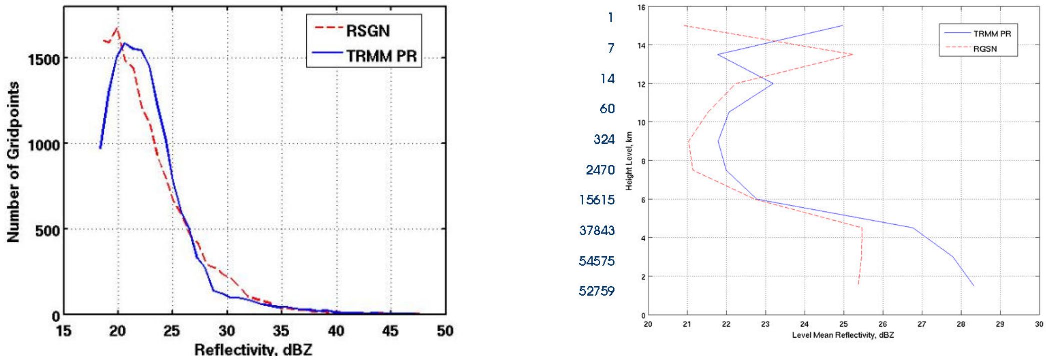

Fig. 1. Total distribution for the TRMM PR (blue solid) and RGSN (red dashed) for the TRMM overpass during the two-year period, (left) reflectivity values at 6 km height, (right) layer-averaged.

required to verify the trend and identify the vertical distribution reflectivity bias.

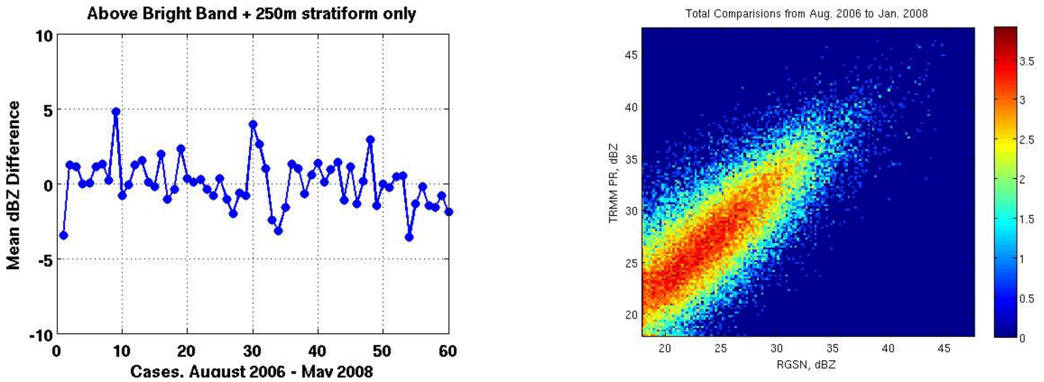

Fig. 2. Two-year rain events only those stratiform rain type and at least 250 m above the bright band. (left) mean reflectivity different between TRMM PR and RGSN, (right) total reflectivity comparisons at 1.5 km (colors are frequency in log scale).

Left side on Fig. 2 reveals the all 60 events mean reflectivity difference only points where the PR rain type is indicated as stratiform and the base of the 1.5-km-deep vertical layer represented by the grid point is at least 250 m above the bright band height, as indicated in the TRMM 2A25 PR product. It looks like there is no seasonal variation except normal systematic noise. Also on its right side, it is showing a good comparison between ground and satellite radar reflectivity at 1.5 km with around 3 dBZ low bias. Rain rate comparisons between GR and PR show PR over estimate the rain rate in these events.

These S-band ground-base results are similar with previous ground validation network prototype the U.S. national network of operational weather radars WSR-88D. One of the goals of the GPM VN prototype is to help improve the attenuation correction algorithm for the TRMM PR so that this knowledge can be applied to the future GPM Dual-Frequency Precipitation Radar (DPR). The results came out good quality and recently asked the TRMM Precipitation Processing System (PPS) to add the site to the daily TRMM site overpass coincidence table (CT) product.

3 MICROWAVE SENSOR APPLICATION

Information on the surfaces such as sea, land, desert, snow and sea ice are essential to the remote sensing. In general, the heterogeneity and variation of land surfaces lead to the difficulty in the satellite remote sensing. The main problem is related to the surface emissivity. The emissivity is affected by the roughness, view angle, refractive index, and polarizations.

A precise knowledge of the surface emissivity is essential for studying the radiative transfer of microwave radiation that is emitted by the surface, transmitted through the Earth's atmosphere and received by passive microwave sensors. For example, the ocean thermal emission strongly depends on the surface roughness. Wind speed is its main source to the increase of surface emissivity and the observed brightness temperature because the sea surface is roughened and the foam coverage increases as wind speed increases.

Accordingly, we are investigating various research topics such as roughness, wind speed, refractive index, soil moisture, and sea ice. The following paragraph summarizes related to soil moisture retrieval as an example of our current researches.

Surface soil moisture is a key variable in describing the water and energy exchanges at the land surface/atmosphere interface. In hydrology and meteorology, the water content of the surface soil layer, corresponding roughly to the 0–5 cm top soil layer is an important variable to estimate the ratio between evaporation and potential evaporation over bare soils, to estimate the distribution of precipitation between runoff and storage. We are developing a unique soil moisture algorithm. The following Fig. 3 shows an example of the estimated surface soil moisture by the NIMR methodology for a single day (Apr. 1, 2009) using the AMSR-E data, and the soil moistures provided by the current NASA algorithms at the same day.

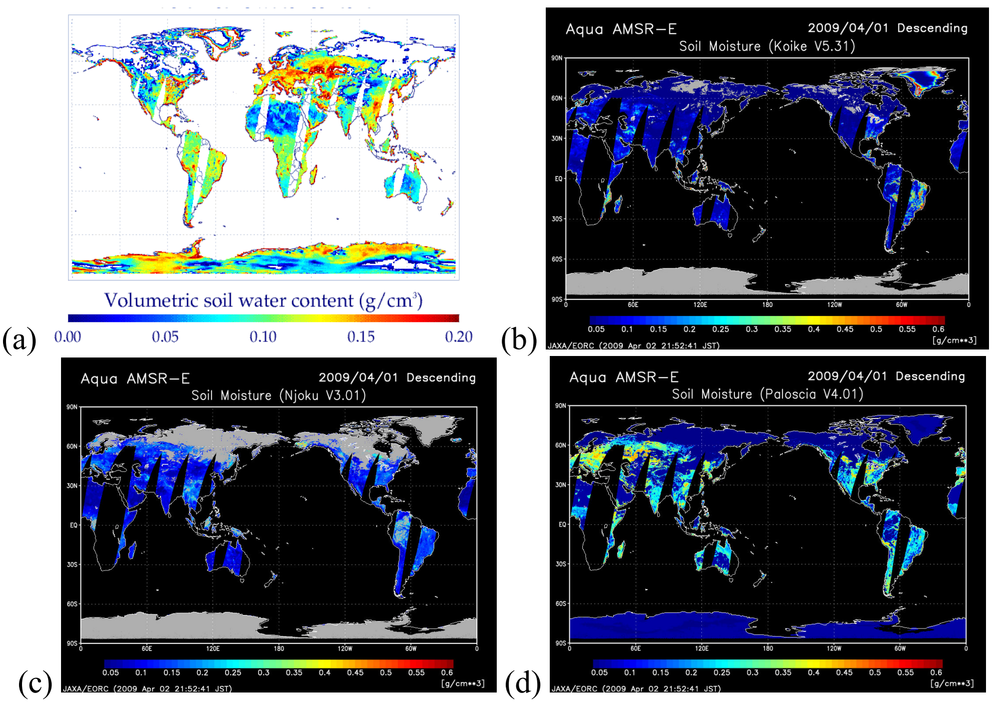

Fig. 3. Example of the estimated volumetric soil moisture using AMSR-E on 1 April 2009 (a) by the NIMR developed unique methodology, and by the current AMSR-E algorithms of (b) Koike, (c) Njoku, and (d) Paloscia

4 CONCLUSIONS

Korean GPM working group (KGPM WG) is getting formation as the research community including other research institutes and universities in Korea. KMA keep our efforts on participation of the international research collaboration and the field campaign like THORPEX-Pacific Asian Regional Campaign (T-PARC).