Development of synthetic GPM/DPR data from TRMM/PR observations and evaluation of GPM/DPR level-2 "at-launch" algorithms using them

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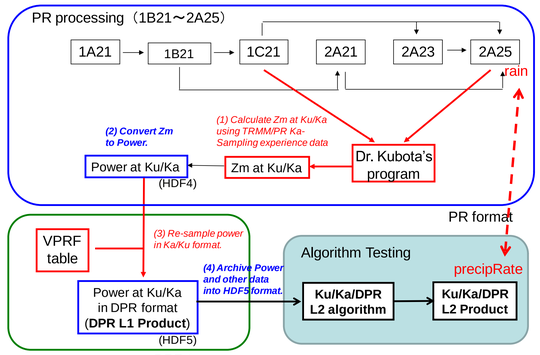
Introduction and Methodology

JAXA status for synthetic DPR Level 1 data

- Synthetic DPR Level 1 data with the DPR format is necessary for the higher level algorithm development.
  - We use the synthetic data as a test bed of DPR-L2 algorithm, and evaluate the estimation of the DPR algorithm using the synthetic data.
  - Our synthetic L1 data will be also used at GPM ground segment tests by NASA/PPS and JAXA/MOSS.
- This work presents current status of Japan's activity for GPM/DPR synthetic data development and evaluations of the "at-launch" codes of Ku/Ka/DPR-L2 algorithm (Version 4.20130306).

JAXA's DPR Synthetic data generation from TRMM/PR



Current list of the DPR Synthetic L1 data

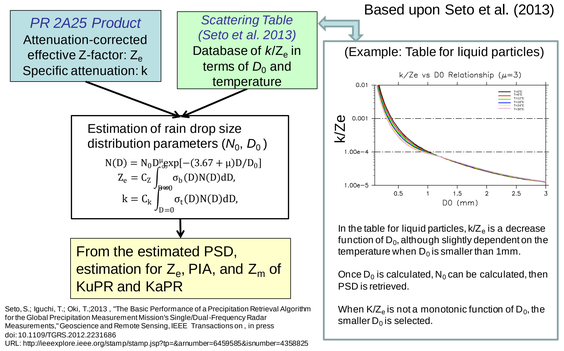
1. Synthetic L1 data from the TRMM PR data during KaPR Sampling Experiment
   - 7 orbits during 15th March 2007
     - JAXA operated the PR according to the scanning geometry of the KaPR during the experiment.
     - The scan angles and their sequence of the PR were changed by sending operational control commands from the ground system during the experiment
2. Synthetic L1 data from TRMM PR ordinary data
   - 32 orbits during 31st Mar. to 1st Apr. 2011
     - This date was determined according to the End-to-End (ETE) test of NASA/PPS and JAXA/MOSS.
     - This methodology can be applied to another orbit data of the TRMM PR.

Calculate Z_m at Ku/Ka using TRMM/PR observations

- Calculation process can be divided into 3 parts, as following.
  1. Estimation of precipitation particles
     - Based upon a method of Seto et al. (2013)
  2. Estimation of non-precipitation (WV, O2, CLW)
     - Based upon the ancillary data and the cloud liquid water database from the numerical model (NICAM) (Kubota et al. 2012)
  3. Estimation of surface scattering in the KaPR
     - Sigma-0 statistics from airborne measurements by Dr. Meneghini (Meneghini et al. 2012)
     - Consideration of PIA differences between Ku and Ka
     - Surface scattering in the KuPR is same as in the PR

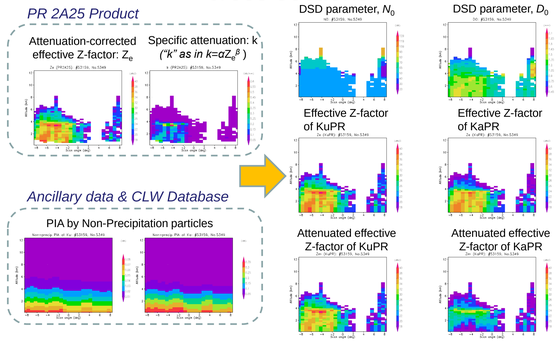
Estimation of precipitation particles using PR 2A25

Based upon Seto et al. (2013)



Seto,S.; Iguchi, T.; Oki, T.;2013 , "The Basic Performance of a Precipitation Retrieval Algorithm for the Global Precipitation Measurement Mission's Single/Dual-Frequency Radar Measurements," Geoscience and Remote Sensing, IEEE Transactions on , in press
doi: 10.1109/TGRS.2012.2231686
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6459585&isnumber=4358825

An example of the synthetic data at vertical cross sections



Summary

- The DPR L1 synthetic data from TRMM/PR data were produced with the DPR format in this work.
- The at-launch codes of L2 Ku, L2 Ka, L2 DPR algorithms (Version 4.20130306) were applied to the synthetic data, and estimations of the algorithms were evaluated with reference to the TRMM/PR standard products.
- Precipitation rates at 2km altitude estimated from the current Ku/Ka/DPR-L2 algorithms were well correlated with those from the PR 2A25, in particular, over the ocean.

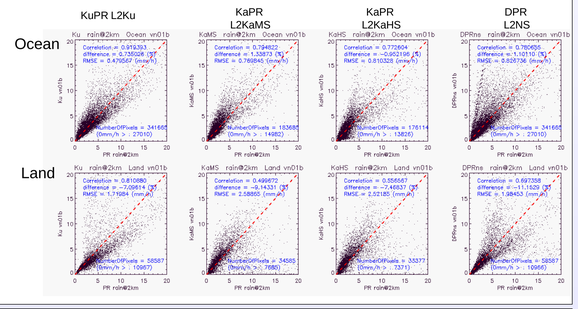
Scatter plot

TRMM Orbit Number 76162 on 31st Mar. 2011

Upper panels: Over-Ocean
Lower panels: Over-Land

Horizontal axis is a rain rate at 2km altitude of the PR 2A25 Version 7.

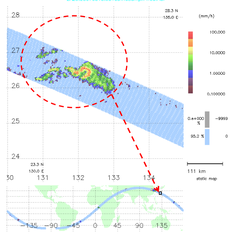
Vertical axis is an estimates from the Ku/Ka/DPR-L2 algorithms using the synthetic DPR L1 data.

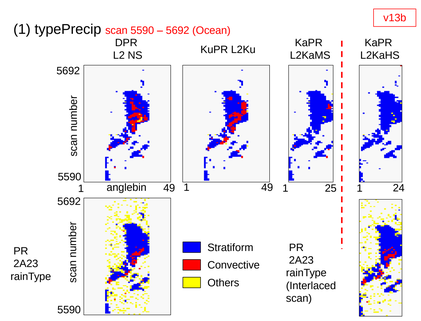


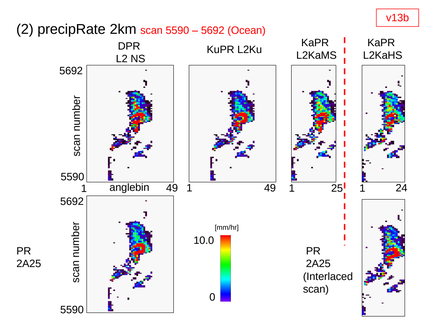
Case studies

Sub-tropical ocean case

(TRMM Orbit Number 53159 on 15th Mar. 2007, A orbit of KaSampling experiment)

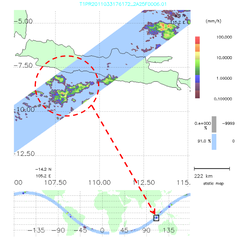


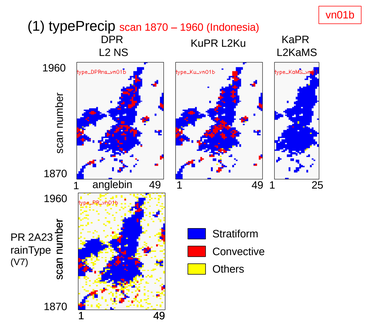


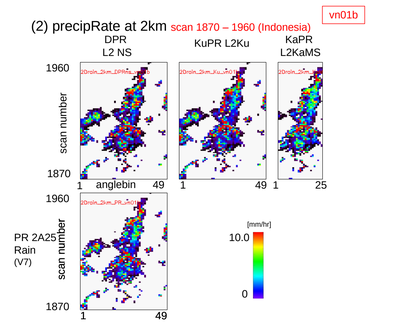


Tropical ocean case

(TRMM Orbit Number 76162 on 31st Mar. 2011)







Tropical land (Amazon) case

(TRMM Orbit Number 76162 on 31st Mar. 2011)