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The Global Satellite Mapping of Precipitation (GSMaP) Project

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We have started to release hourly global rainfall data (0.1x0.1deg. lat/lon) in near real time (about four hours after observations) and visualize the latest data quickly.

Global Rainfall Map in Near Real Time by JAXA/EORC
http://sharaku.eorc.jaxa.jp/GSMaP/
Examples of the global rainfall maps

Global rainfall maps (overlapped with IR images) in the Near-Realtime system

Animation from 10th to 16th November 2007

A cyclon “SIDR” hit the coast of Bangladesh from the Bay of Bengal.

A movie made using figures in http://sharaku.eorc.jaxa.jp/GSMaP/
The system was constructed using algorithms of the Global Satellite Mapping of Precipitation (GSMaP) project.

Outline of the GSMaP project
- A project sponsored by Japan Science and Technology Agency (JST)
- P. I. : Prof. K. Okamoto (Osaka Pref. Univ., Japan)
- Research activities from Nov. 2002 to Oct. 2007

The algorithms are mainly composed of
- Microwave radiometer (MWR) algorithm
- Blended MWR-IR algorithms
Data collection in first three hours, and calculation within an hour

Production of Global Rainfall Map (hourly)

Look-up Tables for MWR retrievals (once a day)

Look-up Tables for daily 5.0 deg. resolution

Atmospheric variables
- JMA Global analysis (GANAL)
- JMA MGDSST

Objective analysis SST

RTM Calculation

LUT for MWR

MWR IR

Rainfall retrieval from each MWR sensor

Blended MWR-IR algorithm

Global rainfall maps

Public Server

Microwave Radiometer data
- TMI, AMSR-E, SSM/I(F13,14,15)
- GEO IR data
  Merged data by JWA from MTSAT, METEOSAT, GOES

Microwave radiometer algorithm
(GSMaP_MWR algorithm)

GEO IR data

GSMaP_MVR algorithm

GEO IR data

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Microwave radiometer algorithm
(GSMaP_MWR algorithm)

GEO IR data

GSMaP_MVR algorithm

GEO IR data
Observed TBs

Rainfall rate

Precipitation structures (Precipitation Profile, Melting layer, DSD)

Atmospheric variables (temperatures, ...)

Look-up Table

Retrieval Algorithm

RTM calculation

Precipitation physical model

• Precipitation structures
  (Precipitation Profile, Melting layer, DSD)
• Atmospheric variables
  (temperatures, ...)

• Physical algorithm based on the Radiative Transfer Model (RTM)
• Necessary for assuming precipitation physical model for RTM calculations and developing methods such as Rain/No-rain classification

(Aonashi and Liu 2000, Kubota et al. 2007)
Developments of GSMaP_MWR algorithm

**Atmospheric information:**

- Objective analysis (JMA GANAL)
- Rain/No-rain Classification (RNC) Method
- Tb Database method by Dr. Seto

**Improvement of scattering algorithm**

Utilization of PCTs at 85GHz and 37GHz (by Dr. Aonashi)

**Melting layer model**

Common model of PR2A25 algorithm (Nishitsuji model) by Prof. Awaka and Dr. Takahashi

**Rain drop size distribution (DSD) model**

Gamma DSD model estimated from epsilon values of TRMM PR (by Prof. Kozu)

**Rain/No-rain Classification (RNC) Method**

Tb Database method by Dr. Seto

**Precipitation profile model**

Statistical Profiles derived from TRMM PR (by Prof. Takayabu, with Dr. Hirose)

**Atmospheric information:**

Objective analysis (JMA GANAL)
Flowchart of Blended MWR-IR algorithm (GSMaP_MVK algorithm)

GEO IR data
- Present IR
  - 1-hour-before IR
  - Present IR
  - Cloud motion vectors
  - Zonal
  - Meridional

Past GSMaP data
- 1-hour-before GSMaP
  - GSMaP interpolated by the motion vectors
  - Kalman filter

Present MWR data
- MWR data observed during present 1 hour
  - (MWR overpasses)
  - (Outsides MWR overpasses)
  - Present GSMaP
Blue violet areas show MWR overpasses.

GSMaP_MVK Rainfall Rate: 00Z25JUL2005
Comparison of TMI retrievals (GSMaP_TMI) with COBRA data for four selected overpasses during June 2004 (0.25 x 0.25 deg.)

Rain rate (0.25x0.25 deg.) : GSMaP

Correlation : 0.82
RMSE(mm/hr) : 1.37

NICT Okinawa Bistatic Polarimetric Radar (COBRA)
C-band(5340 MHz)
10 minute cycle

A field campaign of observing precipitation in Okinawa, Japan during rainy season of 2004 (okn-baiu04)
The GSMaP joins the IPWG/PEHRPP activities and validates various satellite estimates around Japan using JMA Radar-AMeDAS analysis. Comparisons in daily averaged rainfall estimates with 0.25 x 0.25 deg. resolution are shown in [http://www.radar.aero.osakafu-u.ac.jp/~gsmap/IPWG/dailyval.html](http://www.radar.aero.osakafu-u.ac.jp/~gsmap/IPWG/dailyval.html).
Comparison between products of GSMaP and others

Daily series of correlation coefficients between the satellite estimates and the RA. The data are daily averaged with 0.25 deg. lat/lon.
Summary

- Web site in near-real time using GSMaP algorithms

- Microwave radiometer algorithm (GSMaP_MWR algorithm)
  - Algorithm developments using various attributes of TRMM PR observations
    - ex. Precipitation profile, DSD model, Scattering algorithm, Rain/no-rain Classification method
  - Developments based on the common physical model between MWR and PR algorithms
    - Melting layer model

- Blended MWR-IR algorithm (GSMaP_MVK algorithm)
  - Cloud motion vector and kalman filter

- Validation