Overview of Global Satellite Mapping of Precipitation (GSMaP)

Misako KACHI
Earth Observation Research Center (EORC)
Japan Aerospace Exploration Agency (JAXA)

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Today’s Rainfall Distribution in the World

Rainfall and clouds in 00Z 16th March 2012 by GSMaP_NRT

I got this picture from our web site at 05Z of Today.
Precipitation Characteristics Observed by the Space Borne Instruments

(a) Precipitation radar:
- Back scattering from rain drops
- High accuracy
- Narrow swath width

(b) Infrared radiometer:
- Cloud top information
- Not related to surface rain rates

(c) Microwave imager (19V):
- Directly measures emission from rainfall & scattering from snow/ice over the ocean

(d) Microwave imager (85V):
- Directly measures scattering from snow/ice over the land

It is important to combine the data from different frequencies to retrieve precipitation.
Production of “GSMaP” from Multi-satellite Data

GSMaP: Global Satellite Mapping of Precipitation

Rainfall data retrieved from each microwave imager and/or sounder

Hourly merged microwave rainfall map

Calculate cloud moving vectors

GSMaP rainfall in 0.1-deg grid and hourly
Why We Need “Multi” Satellite Data?
GSMaP and JAXA “Global Rainfall Watch”

GSMaP

- MRI, Osaka Univ., Kyoto Univ., Univ. Tokyo

Near-real-time version of GSMaP (JAXA Global Rainfall Watch) is distributed via internet

- Binary and text data has been available since Oct. 2008 via password protected ftp site.
- Recently introduced
  - SSMIS (F16, F17) since Jun. 2010.
  - AMSU-A/B (N15, N16) and AMSU-A/MHS (N18) is in preparation

Reanalysis data from Mar. 2000 - Nov. 2010 has been available since March 2012.

3-hourly animation of three typhoons (No.17-19) in 2009 by GSMaP_NRT.
JAXA/EORC Global Rainfall Watch

1-8 August 2011 (6-hourly) - Typhoon No.9 in 2011 “MUIFA” can be seen near Okinawa, Japan.

0.1-deg and hourly global rainfall product available 4-hour after observation via internet.

http://sharaku.eorc.jaxa.jp/GSMaP/
GSMaP Accumulated Rainfall Amount over Thailand during Jun-Sep 2011

Accumulated rainfall amount by GSMaP_NRT was similar to those by rain gauges at Bangkok, Chiang Mai, and Vientian, provided by JMA.
Comparison to Rain Amount in 2010

Accumulated rainfall amount during Jun-Sep 2010

Ratio of $R_{2011}/R_{2010}$ during Jun.-Sep.
International Precipitation Working Group (IPWG) Validation Program

- Continental-scale validation (single number for entire domain) of satellite-based rainfall map
  - Some sites include NWP output rainfall as “data”
- Performed on daily totals
  - 12 – 12 UTC – N. America, S. America, Western Europe
  - 00 – 24 UTC – Australia, Japan
- Performed on 0.25-degree grid box
- Statistics and maps disseminated via web pages
- Rain gauge & radar (some) used as “truth”
- Currently 5 active validation “sites”
  - N. America, S. America, W. Europe, Australia, Japan

Example:
Heavy rain in 14 Jul 2010
Collaboration with Flood Forecast/Warning Communities

JAXA, ICHARM, and IFNet/IDI have studied possible application of satellite rainfall information to flood warning/forecast since 2003. GFAS operated by IFNet/IDI, and IFAS distributed by ICHARM use GSMaP and TRMM data as input rainfall data, and will contribute to flood forecast and early warning in poorly-gauged river basins.
GPM Asia Workshop

- Held every year in Japan since 2004, inviting 5-10 meteorological, hydrological or remote sensing agencies in Asian countries who are interesting in satellite precipitation.
- Promote satellite precipitation data utilization in Asia.
- Utilization of GSMaP and/or TRMM data and their comparison with ground-based data have started in Vietnam, Bangladesh, Philippines, Lao PDR, ICIMOD, Thailand, Indonesia, etc.
Following projects related to GSMaP are ongoing under JAXA and Asian countries. These projects focus on flood including river basin management and landslide (short-term events, debris flows, slope failures, etc).

- ADB Technical Assistance - ‘Applying Remote Sensing Technology in River Basin Management’
  - Bangladesh, Vietnam, Philippines
- THEOS Series and ALOS Series Cooperation
  - Thailand
- Sentinel Asia Success Story in the Philippines
Global Precipitation Measurement (GPM)

GPM Core Observatory and constellation of satellites will collaborate to realize
global precipitation frequent observation with high accuracy.

Dual-frequency Precipitation Radar (DPR) will calibrate GPM Microwave Imager
(GMI), and GMI will calibrate microwave imagers and/or sounders onboard
constellation satellites.

**Core Observatory**
- Understanding the horizontal and vertical structure of precipitation system
- Drop size distribution measurement
- Improvement of precipitation rate accuracy with constellation satellites
- DPR (JAXA, NICT) (13.6, 35.5GHz)
- GMI (NASA)
- Launch in JFY 2013 by H-IIA rocket
- Non-Sun-synchronous orbit, inclination: 65deg, altitude: 407km

**Constellation Satellites**
- Observation frequency
- Science, social applications
- Cooperation with constellation providers: JAXA (GCOM-W), NOAA (JPSS),
  CNES/ISRO (Megha-Tropiques) etc.
- 3 hourly observation of 80% of the globe.
- Launch around 2012-2015 by each organization
- Mainly sun-synchronous orbit with altitude 600~800km

Generation and dissemination of global map of precipitation rate with high frequency and accuracy
Summary

_production of GSMaP and GSMaP_NRT_

- JAXA and collaborative organizations has developed precipitation product, GSMaP, and distributed its near-real-time version 4-hrs after observation in hourly and 0.1-degree grid box. Reanalysis data of past period is also available.
- Rainfall retrievals from available MWRs are merged, and moving vector information from five GEO IR data with Kalman filtering techniques is combined to fill temporal gaps

*Validation of multi-satellite products*

- International Precipitation Working Group compares various multi-satellite products in a same manner at five active sites, including North America, South America, Eastern Europe, Australia and Japan.
- Japanese site operated by Kyoto Univ. in collaboration with JAXA to compare with JMA’s Radar-AMeDAS (gauge calibrated radar rainfall).

*Collaboration with flood community and Asian countries*

- JAXA collaborates with ICHARM and IFNet/IDI in utilization of satellite rainfall data in flood warning/prediction.
- JAXA also promotes GSMaP data utilization in Asia

- JAXA will continue and enhance production of GSMaP and collaborative activities toward GPM - Global Precipitation Measurement