JAXA’s GPM Mission Program

GPM Ground Validation Workshop
Abingdon, 4–7 November 2003

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JAXA
National Space Budget in FY2003

FY03 Budget Total 284.5 billion Yen

Ministry of Education, Culture, Sports, Science and Technology (MEXT) 186,112M
Ministry of Agriculture, Forestry and Fisheries 238M
Ministry of Economy, Trade and Industry 11,544M
Ministry of Land, Infrastructure and Transportation 18,359M
Ministry of Environment 321M
Ministry of Public Management, Home Affairs, Posts and Telecommunication 3,467M
The Cabinet 64,440M
Launch Schedule

JFY 2003
- HAYABUSAI (MUSES-C)
  Successful Launch on May 9
- Information Gathering Satellite (IGS)
- Multifunctional Transport 1 Replacement (MTSAT-1R)

JFY 2004
- Advanced Land Observing Satellite (ALOS)
- 17th Science Sat. (LUNAR-A)
- Engineering Test Sat-VIII (Communication Technology)
- Multifunctional Transport Sat (MTSAT-2)
- 23rd Science Sat. (ASTRO-EII)

JFY 2005
- Lunar Orbiting Sat. (SELENE)
- 21st Science Sat. (ASTRO-F)
- High-Speed Internet Sat. (WINDS)
- Life Science Globe Box
- JEM (KIBOU) Logistic Module

JFY 2006
- 22nd Science Sat. (SOLAR-B)
- JEM (KIBOU) Experimental Module

JFY 2007
- Green House Effect Gas Observation Sat. (GOSAT)
- HTV Technology Demonstration
- Centrifuge
- JEM (KIBOU) Exposure Facility /Pallet
NASDA provides satellites data for water cycle research

**CEOP** *(Coordinated Enhanced Observing Period)*
For global water cycle research from 2001 to 2005
GPM Reference Concept

Core Satellite
• Dual Frequency Radar
• Multi-frequency Radiometer
• H2-A Launch
• TRMM-like Spacecraft
• Non-Sun Synchronous Orbit
• ~70° Inclination
• ~400 - 500 km Altitude
• ~4 km Horizontal Resolution
• 250 m Vertical Resolution

Precipitation Validation Sites
• Global Ground Based Rain Measurement

Constellation Satellites
• Small Satellites with Microwave Radiometers
• Aggregate Revisit Time, 3 Hour goal
• Sun-Synchronous Polar Orbits
• ~600 km Altitude

Global Precipitation Processing Center
• Capable of Producing Global Precip Data Products as Defined by GPM Partners
Design of the GPM Core Satellite and the DPR

Basic design of KuPR and KaPR is the almost same as TRMM PR.

(Spacecraft design by NASA/GSFC)
GPM status in Japan

- GPM is ranked among future missions in the Roadmap of EO scenario for the new space agency.
- Phase B study from JFY 03 was approved by SAC (MEXT) on Nov. 27. Though Ministry of Finance did not approve GPM study as phase B officially, budget and personnel requests were accepted as requested by MEXT. Not an established project, but “quasi-project” in EORC/JAXA.
- GPM science team was established in August 2003.
- Preliminary evaluation has successfully passed in NASDA (JAXA) in the last August. Next one will be in February/March 2004.
- GCOM-B1: need feasibility study for less constellation satellite case.
- Building up International framework is a matter of great urgency for us to request next phase-up and budget by May/June time frame.
  - The 3rd GPM workshop was at ESTEC in June 2003.
  - GPM GV workshop is now in UK in November 2003.
  - Asia GPM workshop will be in February in 2004.
Water Cycle activities in Japan

Background

- Water Cycle Initiative has started from JFY 15(April,2003) under the CSTP (Council for Science and Technology Policy, Cabinet Office, Government of Japan)
- IGOS inter-ministry meeting was established

JAXA’s activity

- Roadmap of satellite Earth Observation program for the new space agency (SAC, MEXT)
  - Satellite Programs
- WSSD and its follow-up activities (MEXT, NASDA)
  - TRMM, AMSR-E, ADEOS-II and CEOP
  - CEOS WSSD Follow-up Program Module, Module2-Water Res. Management.
    JAXA would like to take a role in the IGOS-P water theme implementation.
Japan’s GV strategy
Japan’s contribution to GPM is via DPR
The core satellite is the core of GPM.
   TRMM: PR and TMI comparison improved the accuracy.
   WCRP Satellite WG emphasizes cross-calibration, overlapping.
Japan will have a responsibility for full utilization of DPR.
Japan’s GV will be focused on the DPR validation
Full utilization of TRMM GV experiences
   GV was not so effective. -> “Physical validation” is required.
Space oriented verification
   Radiometrically consistent way
      Assumed precipitation system model appropriateness
         DPR, GMI (+AMSU type sounder)
      Full utilization of quasi-simultaneous observation
      ➔ physical validation
      Direct-mirror echo, SRT (Ku, Ka, delta), …
TRMM Rain Total

Graph showing TRMM rain total over time with different lines representing rain on land, rain on sea, and both combined.
降水強度

conv rate (land)
conv rate (sea)
strat rate (land)
strat rate (sea)
What GV should do depends on the algorithms.
Calibration
Default type validation
Instantaneous validation
TMI-DPR combined data validation
Climatological validation
Default type validation
Algorithm development

TRMM PR algorithm development: Japan, US, France

Though a single-wavelength radar, a new paradigm emerged to improve accuracy of measurement: pattern, qualitatively \(\rightarrow\) quantitatively

Accurate measurement may be more required from sciences than from applications.

Z-R method with SRT: N+1 data

Originally, attenuating radiowave frequency is a compromise, but it enabled SRT technique applicable

Data: 2N Zm's at 2N range bins + two Zs's

Products: 2N x No and Do

How to use other two data --> determining two parameters along each ray

Calibration correction

Water vapor, cloud attenuation correction

Beam filling correction

Others
Z-R Relationship

# of data used: 2287

dBR average: 3.09

dBZ average: 27.94

y = 1.440 x + 23.485

cor: 0.94

図 2.3 PR に合うように 10 分積算のカウントを使用した場合の Z-R 関係
a and b in $Z = aR^b$

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