



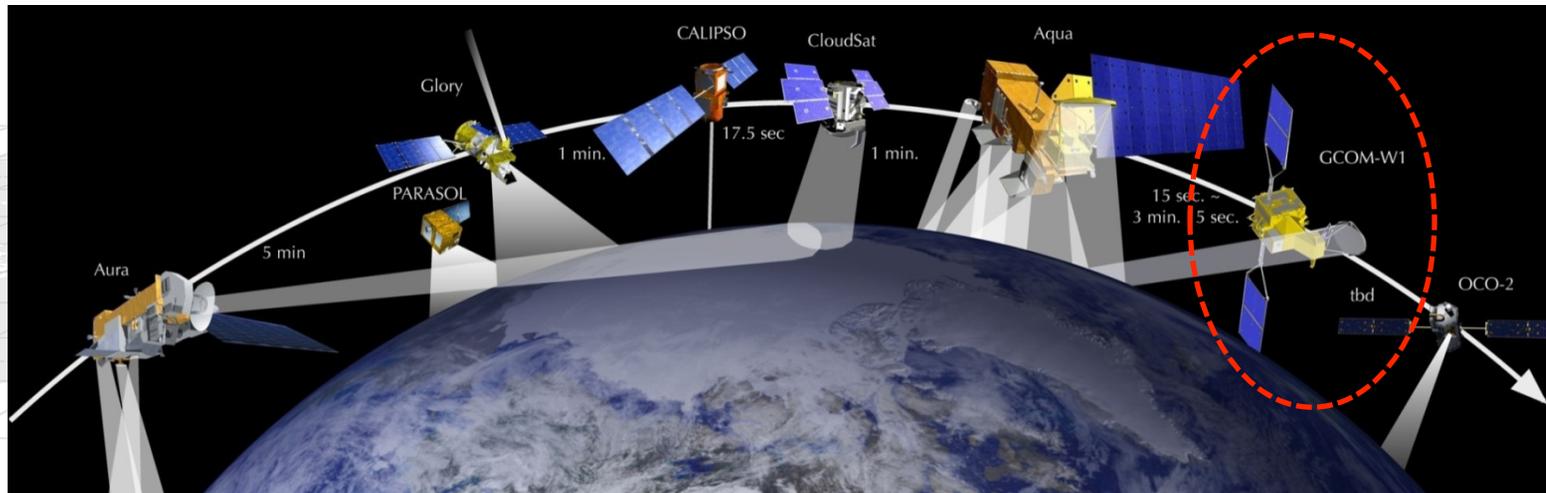
JAXA TRMM/GPM Program Status

Riko OKI (JAXA/EORC)



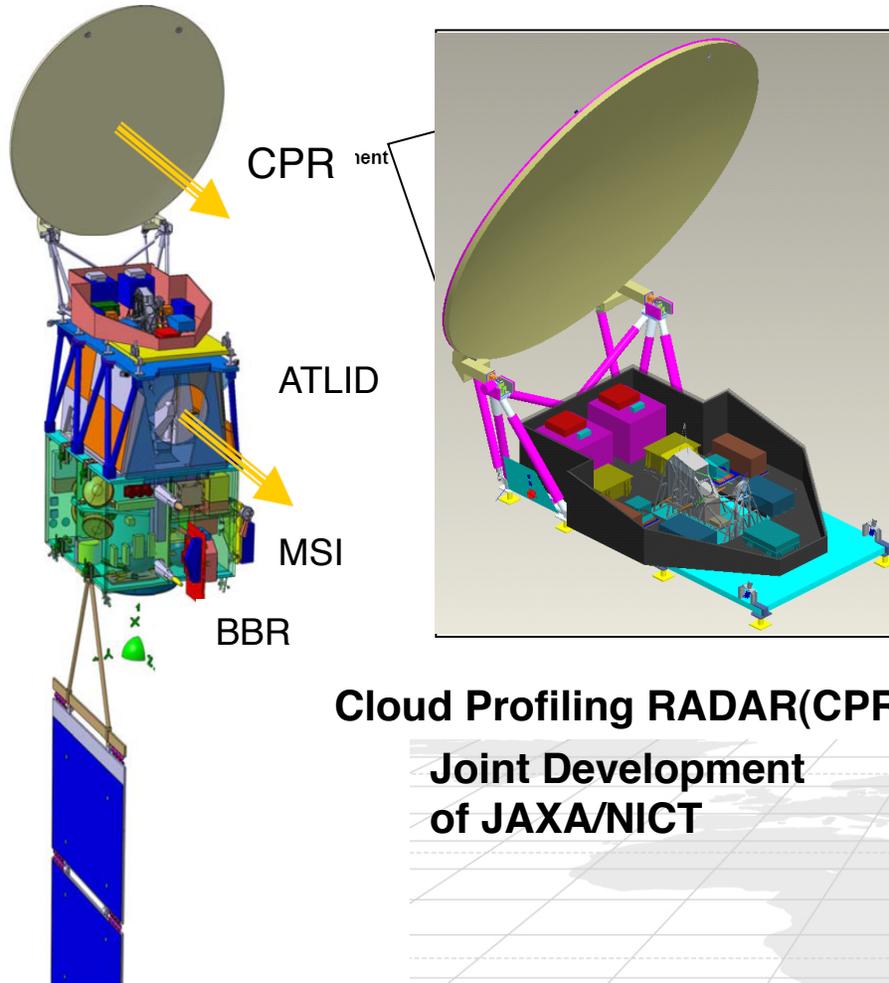
GCOM-W1/AMSR2: a successor of AMSR-E

- * GCOM-W1 (JFY 2011~) will carry microwave imager: AMSR2
 - * Deployable main reflector system with 2.0m diameter
 - * Achieve 20% finer resolution than AMSR-E with 1.6m reflector
 - * Frequency channel set is identical to that of AMSR-E except 7.3GHz channel for Radio Frequency Interference mitigation
 - * Two-point external calibration with the improved HTS (hot-load)
 - * Add a redundant momentum wheel to increase reliability
- * GCOM-W1 in the A-Train
 - * GCOM-W1 will join the A-Train constellation
 - * Participating in the A-Train will benefit
 - * Precise inter-calibration between AMSR-E and AMSR2
 - * Synergy with the other A-Train instruments for new Earth science research



EarthCARE / Cloud Profiling Radar

ESA Earth Explorer Core Mission



Cloud Profiling RADAR(CPR)

Joint Development
of JAXA/NICT

Radar type	94 GHz Doppler Radar
Center frequency	94.05 GHz
Pulse width	3.3 micro second (equivalent to 500m vertical resolution)
Beam width	0.095 deg
Polarization	Circular
Transmit power	> 1.5 kW (Klystron spec.)
Height range	-0.5 ~ 20 km
Resolution	500 m (100 m sample); Vertical, 500m integration; Horizontal
Sensitivity*	-35 ~ +21 dBZ
Radiometric accuracy*	< 2.7 dB
Doppler measurement	Pulse Pair Method
Doppler range*	-10 ~ +10 m/s
Doppler accuracy*	< 1 m/s
Pulse repetition frequency	Variable; 6100~7500 Hz
Pointing accuracy	< 0.015 degree

*; at 10 km integration and 387 km orbit height

CPR Development

CPR-Engineering Model with component Structure Model went through Thermal Vacuum / Balance Test and first antenna pattern measurement with Large Near Field Measurement system (NFM), and is going to mechanical test series at Tsukuba Space Center (TKSC), JAXA. Quasi Optical Feeder (QOF) and Transmitter Receiver Subsystem (TRS) are about to ship and will be integrated at NEC Toshiba Space (NTS) by next spring.



EM Thermal Vacuum / Balance Test @
TKSC 8m space chamber
With ESA EarthCARE team



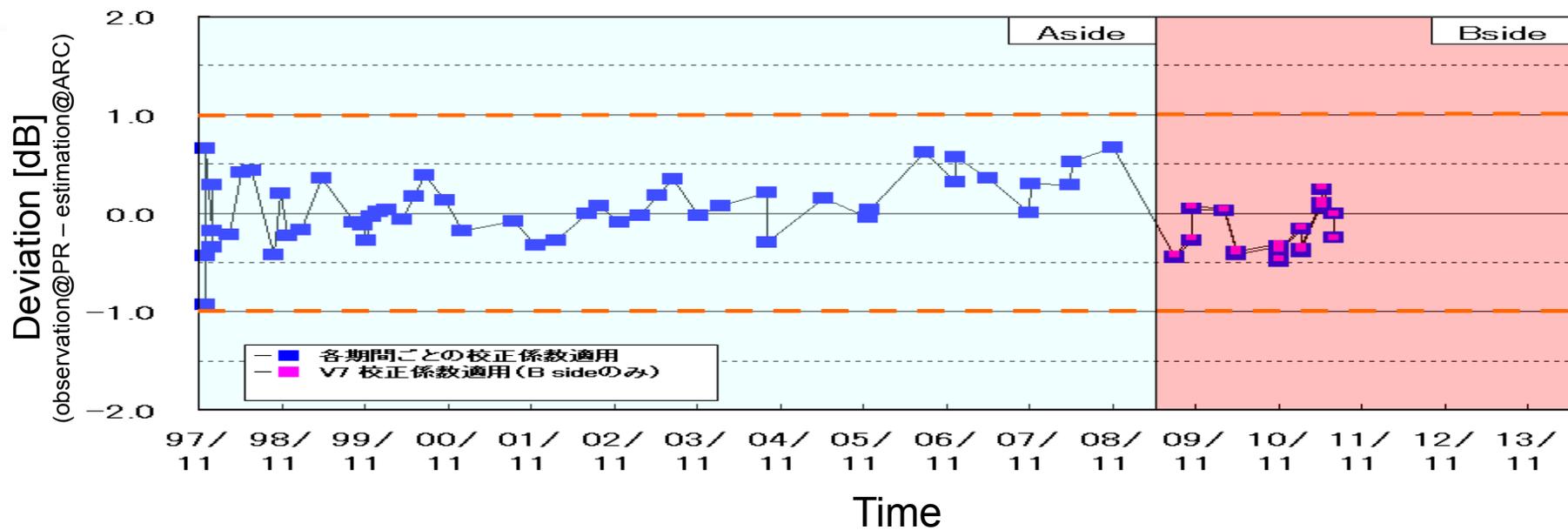
EM Antenna pattern measurement
with Large NFM @ Keihin, NTS

TRMM

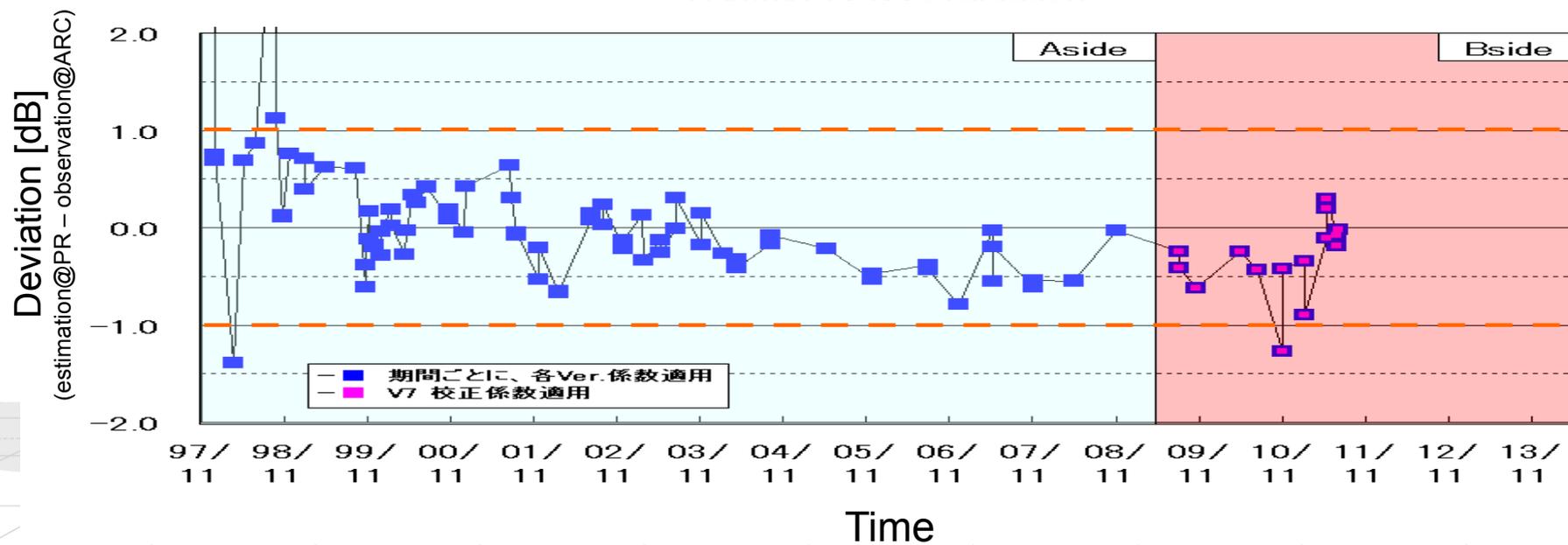
PR V7 product released

- * In June the U.S. and Japan both TRMM project scientists agreed that the new version of TRMM products would be released in July via validation activities.
- * In JAXA, the product release confirmation meeting was held and JAXA started to process and release PR V7 products in July. It was also confirmed that the latent heating product (SLH) would be newly released in Autumn as the standard products.
 - * Currently algorithm developers are their algorithm based on the V7 PR products.
- * Details will be reported by Prof. Takayabu

TRMM/PR RX evaluation



TRMM/PR TX evaluation



GPM

Concept of GPM



GPM = follow-on mission of the TRMM (Tropical Rainfall Measuring Mission)

Core Observatory

- Dual-frequency Precipitation Radar (DPR)
- Microwave Imager (GMI)
- ✧ Highly sensitive precipitation measurement
- ✧ Calibration for constellation radiometers

JAXA and NICT: DPR
 NASA : Spacecraft bus and GMI
 JAXA: H2A Launcher

Constellation Satellites

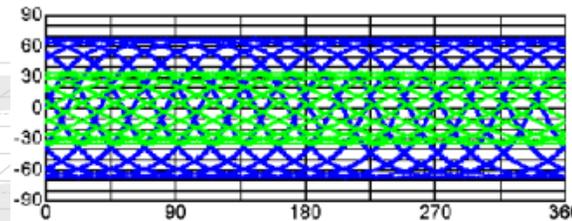
- Microwave Radio-meters installed on each satellite
- ✧ Frequent precipitation measurement

Expected Partners:
 NASA, NOAA, CNES-ISRO,
 China, others

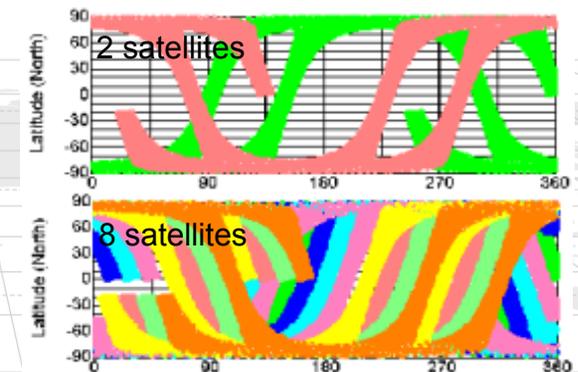


NASA

3-hourly global rainfall map

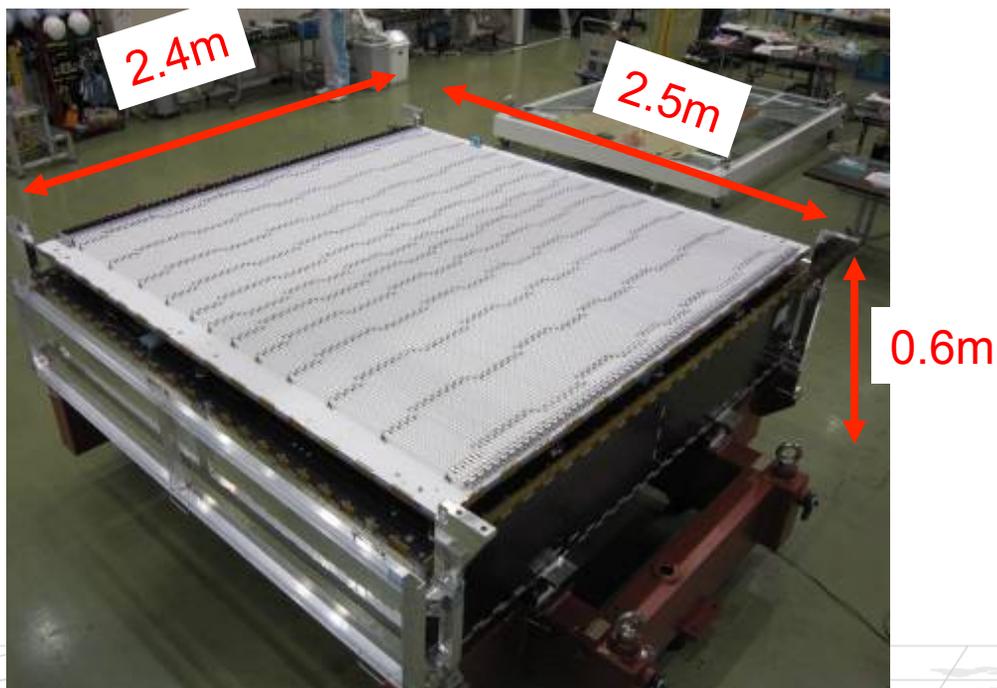


Blue: Inclination $\sim 65^\circ$ (GPM core)
 Green: Inclination $\sim 35^\circ$ (TRMM)



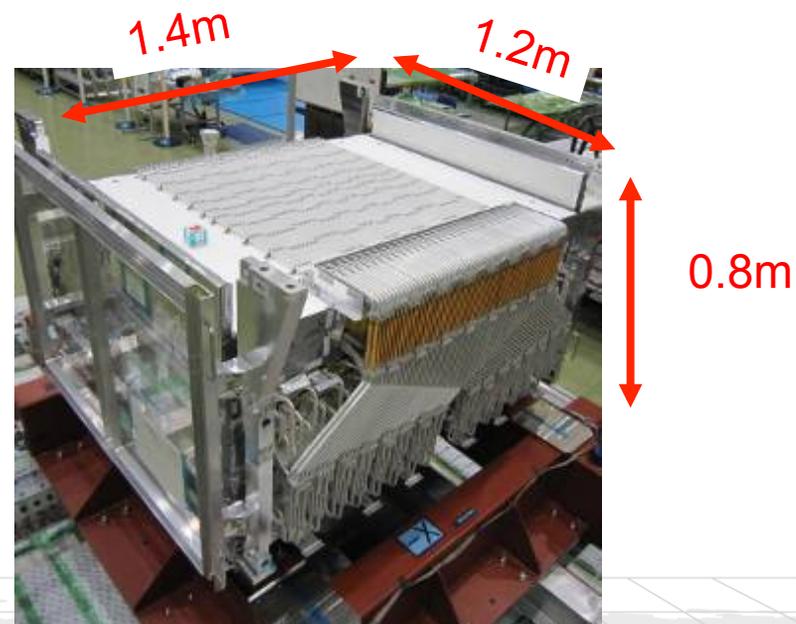
Outlook of KuPR and KaPR

KuPR



About 400kg

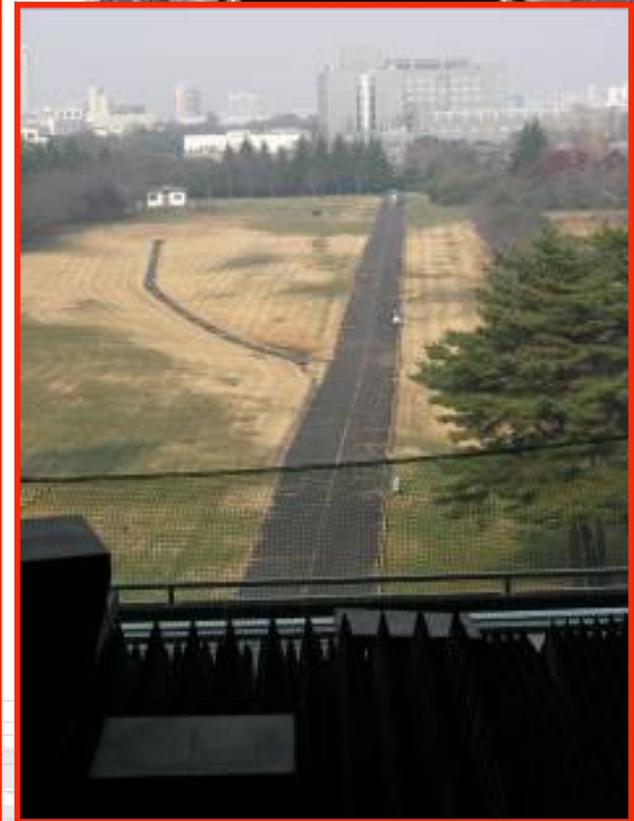
KaPR



About 300 kg

Test Configurations

KuPR



Electrical Performance Test



Acoustic Test
(Covers are attached in this picture.
They are removed during test)



Vibration test

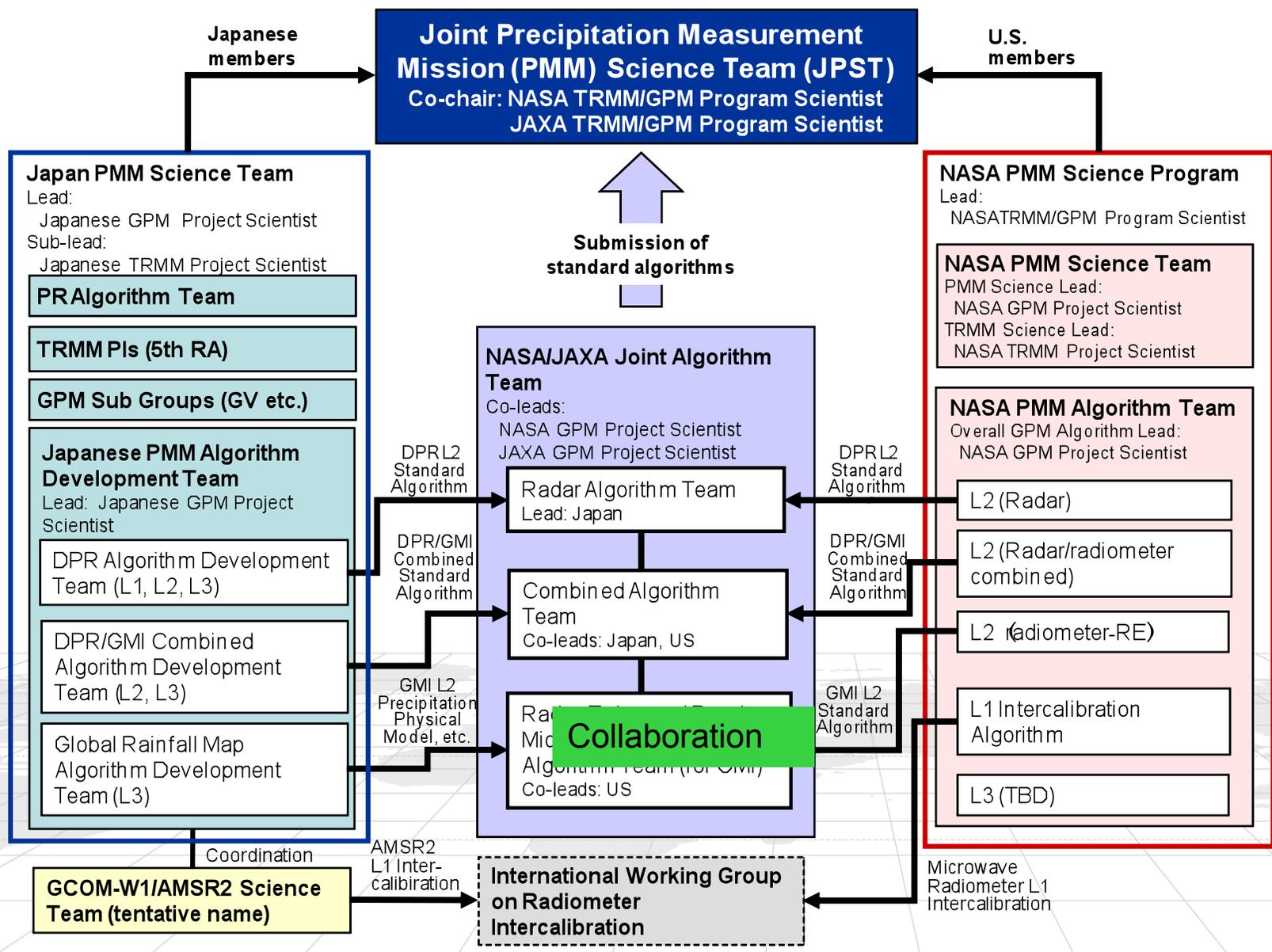
Japanese PMM Science Status

- * The current PMM Science Team has been organized in Apr. 2010 for three-year period (JFY2010-2012).
 - * It is the 6th RA since the first TRMM RA, but the 2nd as PMM
- * The science team includes both TRMM and GPM activities.
 - * Focusing on GPM algorithm development and related GV activities.
- * Categories by research theme
 - * TRMM/PR Algorithm Development – 2
 - * GPM Algorithm Development (DPR, Combined, Map) – 7
 - * GPM Ground Validation – 4
 - * Application – 7 (Asia collaboration, and operational application) → 6 → 7
 - * JAXA and NICT's TRMM/GPM researchers also included in PMM Science Team

Algorithm Development by PMM Science Team

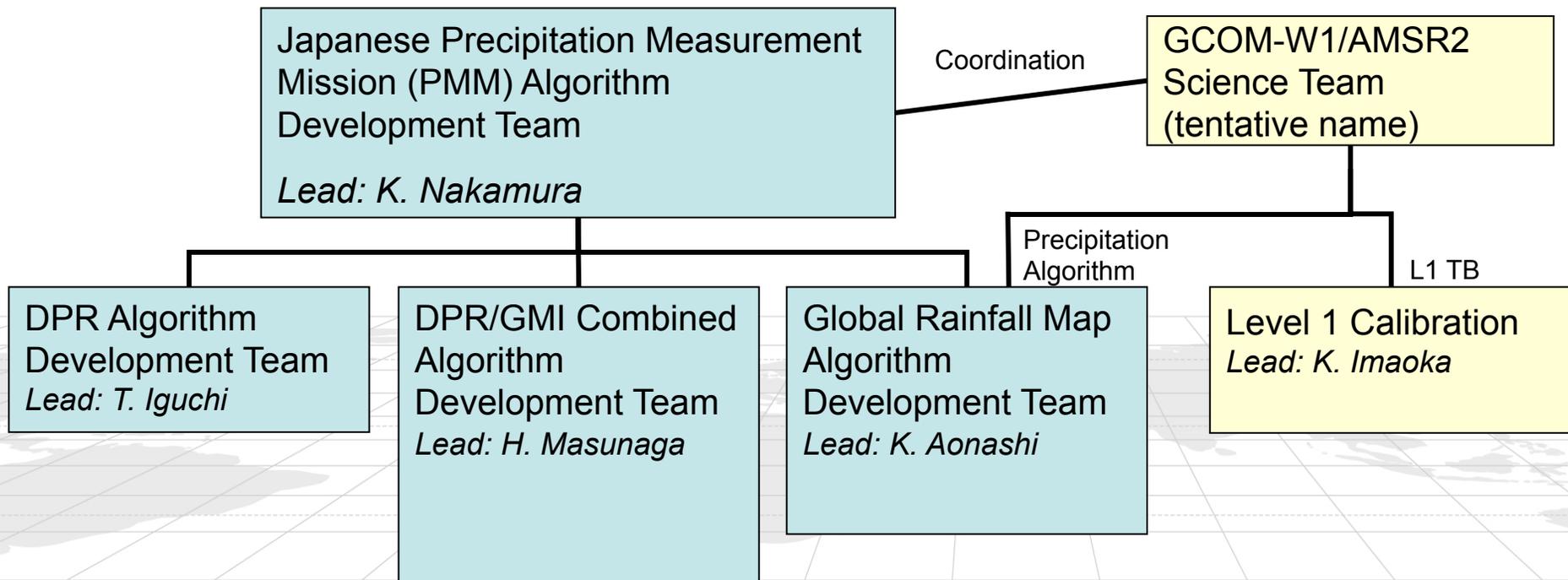
- * DPR algorithm
 - * JAXA is developing Level 1 algorithm of DPR.
 - * Higher level DPR algorithms are being developed by U.S.-Japan joint DPR team, led by Dr. Iguchi.
- * DPR/GMI combined algorithm (U.S.-Japan joint).
 - * Combined algorithm is being developed by U.S.-Japan joint Combined team, led by Drs. Masunaga and Olson.
- * Precipitation map algorithm including microwave radiometer algorithm (Japan)
 - * Global Satellite Mapping of Precipitation (GSMaP) under Core Research for Evolutional Science and Technology (CREST) framework finished in the of JFY19.
 - * JAXA succeeded this activity through the PMM science team activities. Map subgroup is led by Dr. Aonashi.
 - * MWR algorithm will be developed jointly with GCOM-W1 project.
 - * Team members are participating to the U.S. Radar-Enhanced Passive Microwave Radiometer team.

Japan and U.S. PMM Science Framework



GPM Algorithm Development

- * JAXA selected PIs to cover JFY2010-2012 TRMM/GPM science activities through the 6th RA and organized the Japanese PMM science team
- * GPM algorithm team under this science team
 - * DPR, DPR/GMI combined, Precipitation Map including MWR algorithm



DPR L1B Algorithm Development Status

Version 1 *until the end of October 2010*



- Basic flow frame.
- Partial basic functions.
- Generate HDF4 products controlled by PPS I/O TK.



Version 2 *until the end of November 2011 (draft)*
until the end of March 2012 (bug fixed)



- All basic functions.
- Preliminary database (related with H/W, DEM, calibration coefficients)
- Preliminary PPS TKs (I/O, Geo, Time)
- Generate HDF5 products controlled by PPS I/O TK.
- Minimum error handling are included.



Pre-launch *until the end of October 2012*



- Bias correction of received echo power
- Finalize database
- Error handling & robustness
- Speed up, if necessary



DPR L2 Development activities

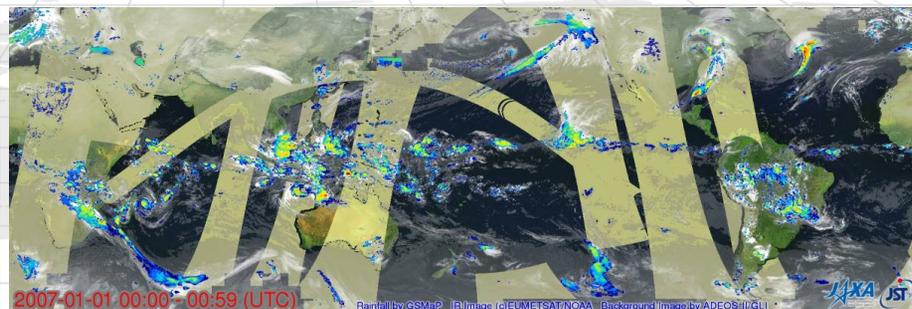
- * Domestic DPR L2 meetings were held 10 times since the last PMM meeting.
 - * Dec. 9, 2010 (PI workshop), Jan. 14, March 2, April 14 (with GV team), May 17, June 13, July 15 (Telecon with US team), Aug. 22, Sept. 15, Nov. 1, 2011.
- * Interface variables defined.
- * Skeleton code submitted in April.
- * “Baseline code” developed (ready to submit).
 - * 6 basic sub-modules were developed and submitted
 - * EORC/RESTEC compiled all (but SRT) modules successfully.
 - * SRT module was combined to the other modules last week in the US.
 - * Scattering tables created by Liao will be combined in the DSD module.
 - * Simulation data (ver. 1) with HDF/DPRL1B format was created.
 - * Overall flow of data were tested with the simulation data.
- * “Baseline code” will be submitted by the end of November 2011.
- * DPR algorithm development nearly in accordance with the original schedule.
- * “At-launch code” will be developed by next autumn.

Updates of the GSMaP system

- * Improvements in sampling of observation for rainfall
 - * DMSP SSMIS data have been merged into the system since Jun. 2010
 - * Kubota et al. (2011) for the current GSMaP_SSMIS algorithm
 - * Passive microwave sounder data from NOAA-19 and MetOp-A have been merged since Aug. 2011
 - * Shige et al. (2009) for the over-ocean GSMaP_MWS algorithm
 - * Now, the GSMaP_NRT system is operated with 7 PMW data and GEO IR data
 - * 7 PMW data : TMI, AMSR-E, SSM/I, DMSP F16&F17 SSMIS, and N19 & MetOp-A AMSU-AMHS
- * Re-processing (re-collection and more elaborated algorithms) is going on.
 - * We completed the re-processing with the period during 2007-2008 .
 - * The re-processing during 2000-2010 will be completed by Mar. 2012.
 - * The period in old version was 2003-2006.

TMI, AMSR-E, SSM/I

TMI, AMSR-E, SSM/I + SSMIS, AMSU/MHS

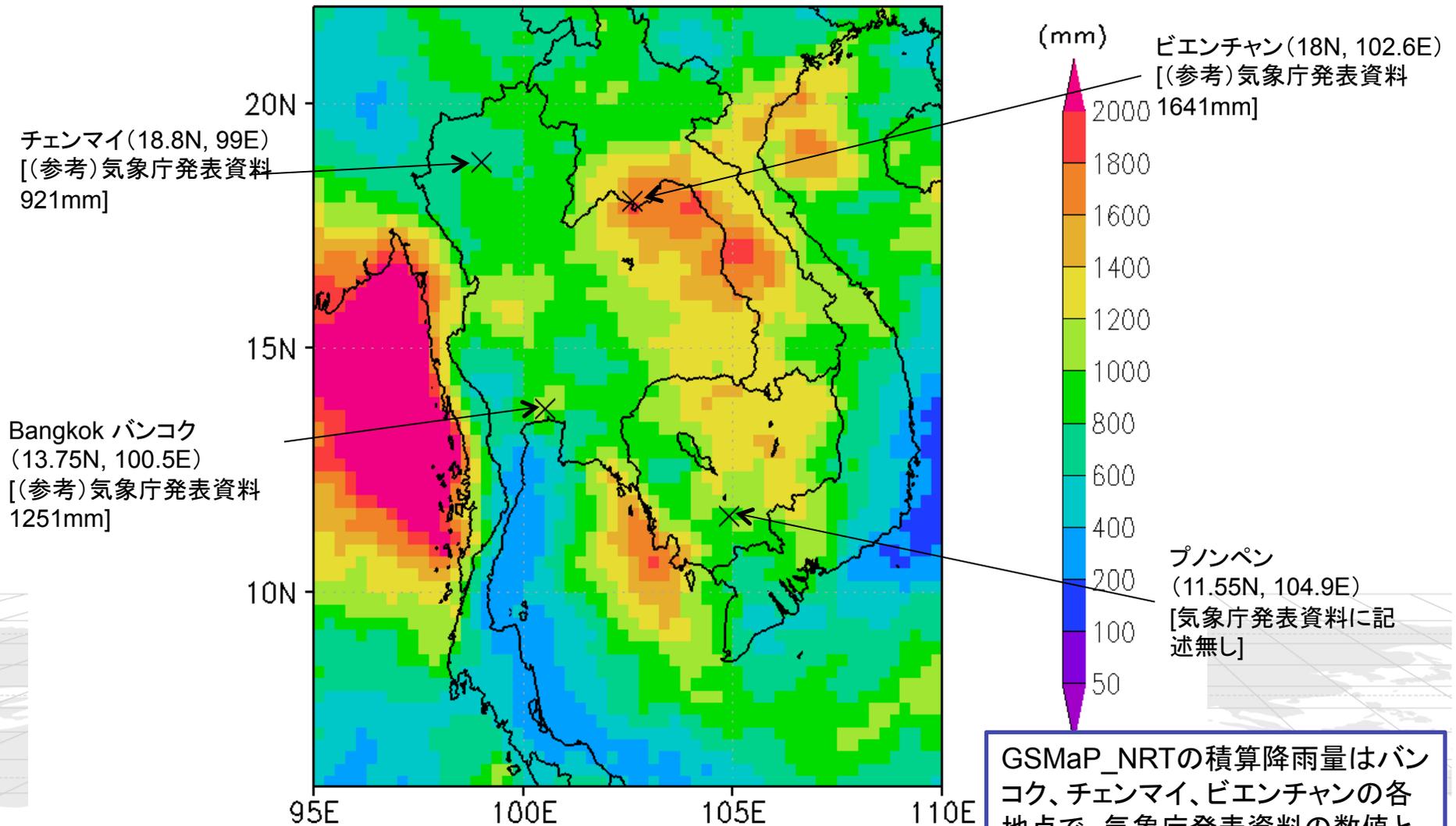


a

GSMaP accumulated rain amount in Thailand (from June to September, 2011)



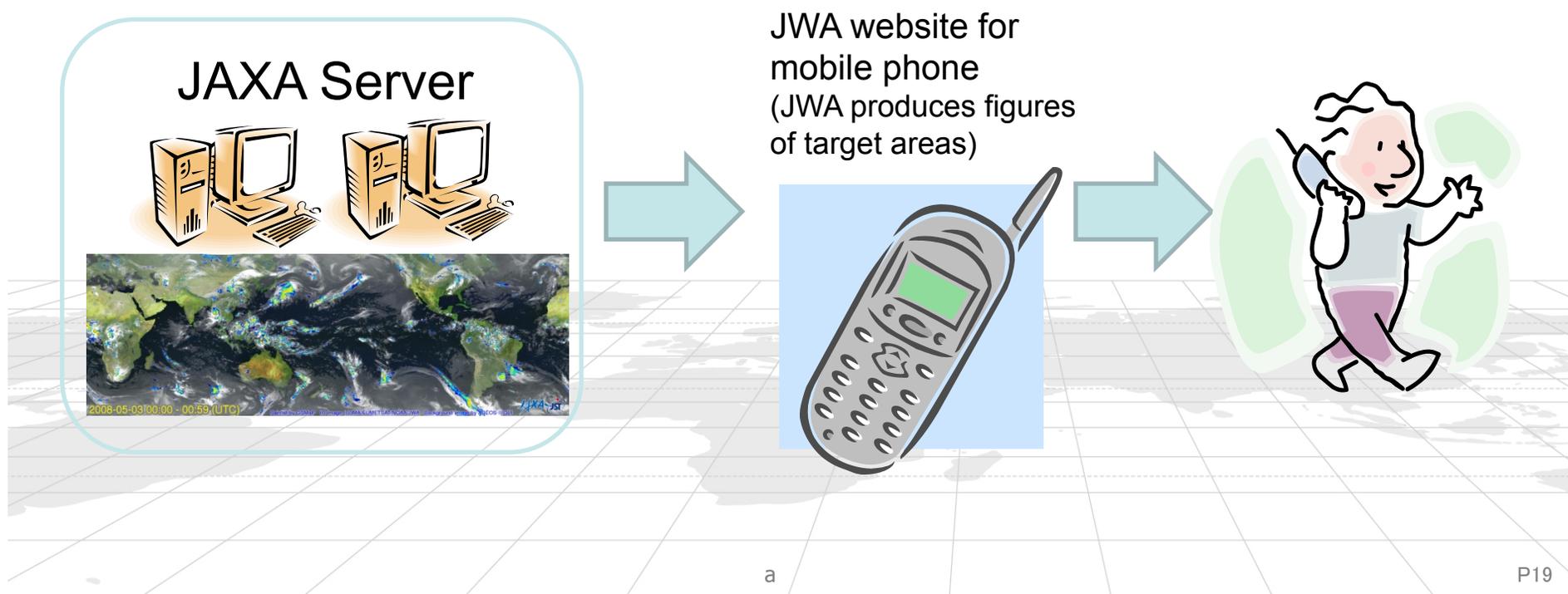
GSMaP_NRT Rainfall Amount (JUN-SEP 2011)



GSMaP_NRTの積算降雨量はバンコク、チェンマイ、ビエンチャンの各地点で、気象庁発表資料の数値と似た値を示す。

Available also by Mobile phone!

- * Under a joint study between JAXA and Japan Weather Association (JWA), JWA has provided near-real-time rainfall information as one of 'world weather' information in their website for **mobile phone**, since this mid-September.
 - * (The site is written by Japanese.)



Ground Validation

Two-way observation of Ka-band radars



For validation of DPR algorithm, it is important to validate **the specific attenuation (k)** and **the equivalent radar reflectivity factor (Ze)** independently.

Two-way measurement
using same Ka-band radars



k and Ze can be directly estimated using the same total attenuation amount regardless of the precipitation phase.

$$Z_A(r) = Z_e(r) - \int_A^r k(s) ds$$

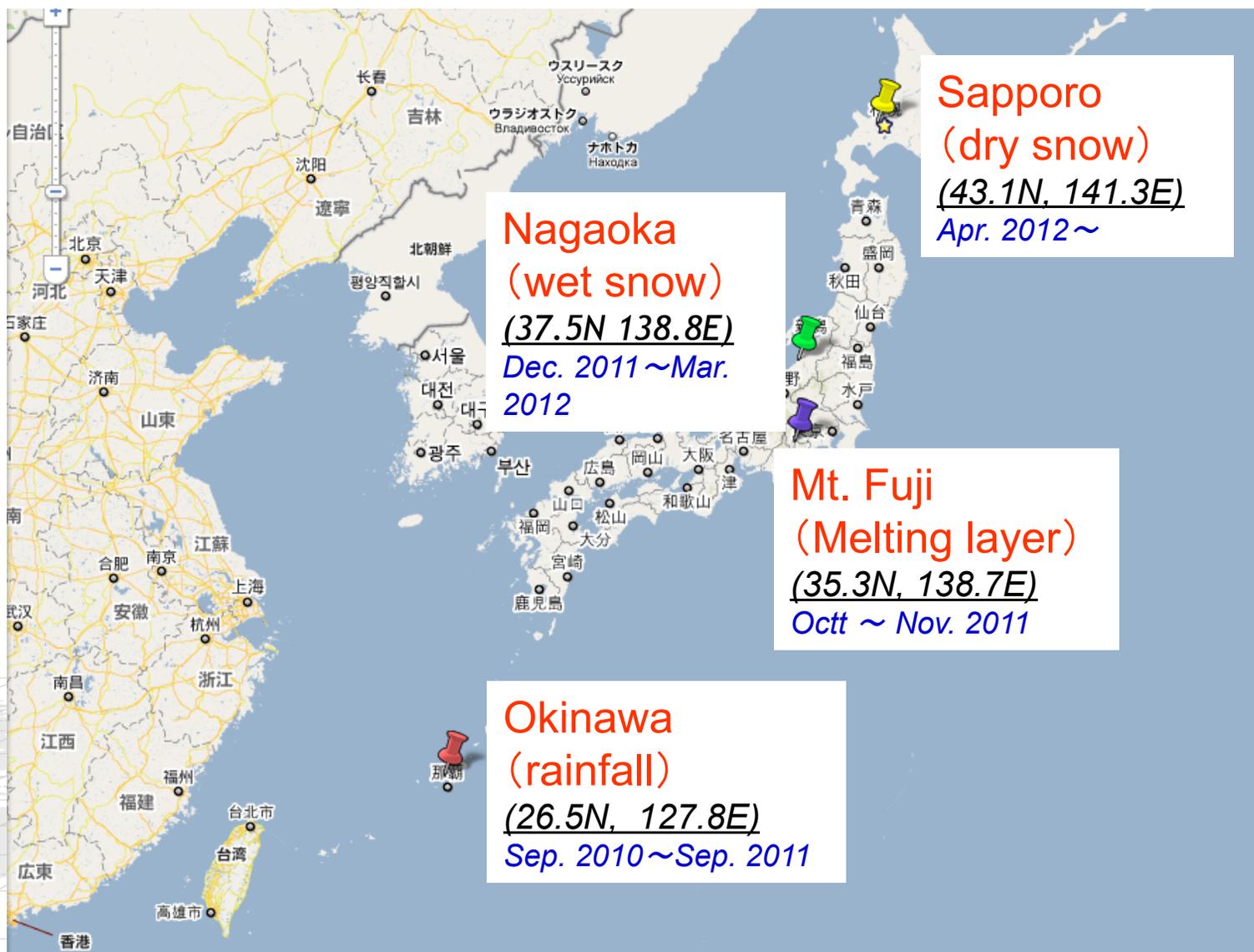
$$Z_B(r) = Z_e(r) - \int_r^B k(s) ds$$

$$Z_e(r) = \left[Z_A(r) + Z_B(r) + \int_A^B k(s) ds \right] / 2$$

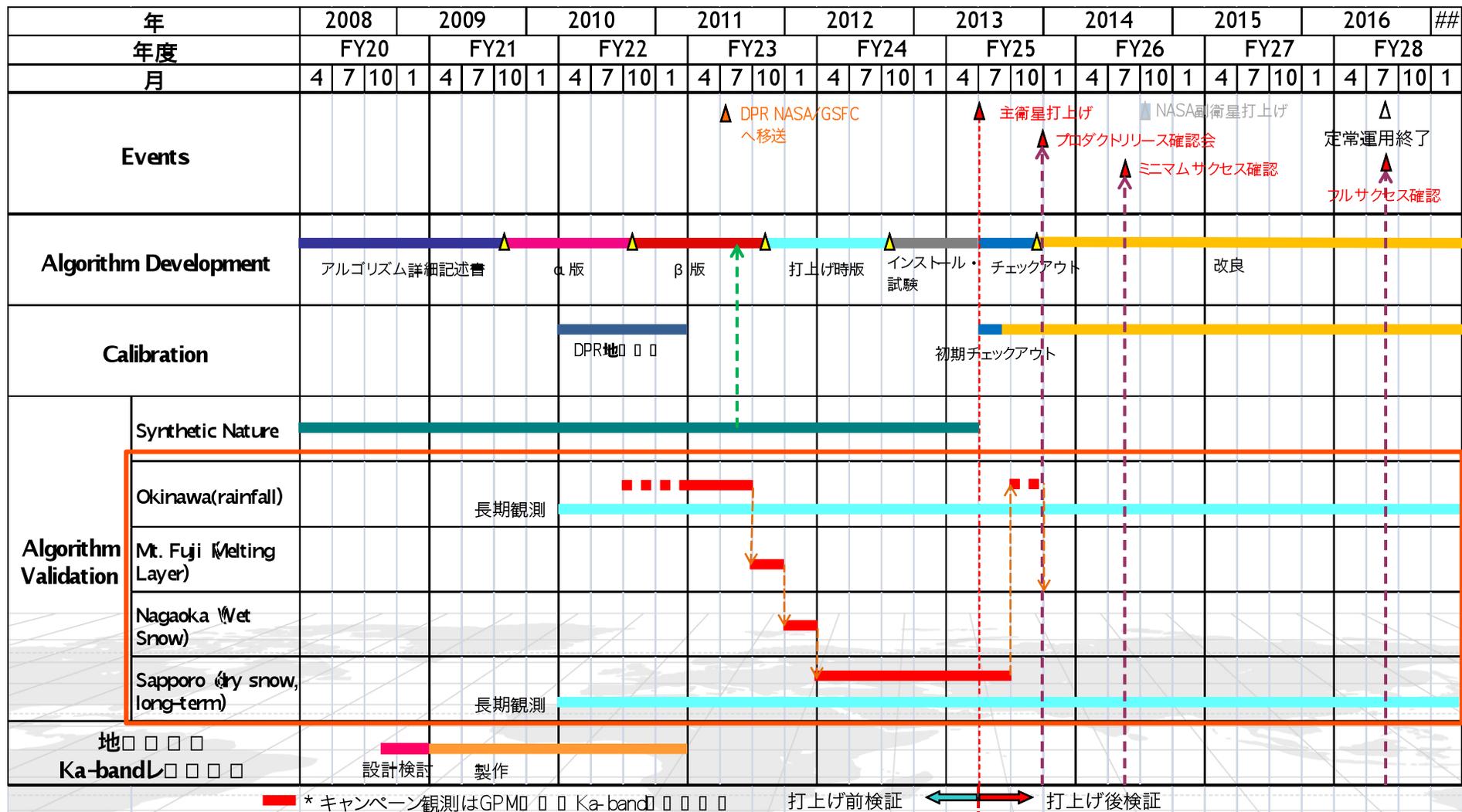
$$k(r) = \left[Z_A(r + \Delta r) - Z_A(r) - Z_B(r + \Delta r) + Z_B(r) \right] / 4\Delta r$$

JAXA developed two Ka-band radars for GPM/DPR ground validation.

GPM GV Observation Sites



Algorithm development and GV schedule in Japan



Mozilla Firefox
 ファイル(F) 編集(E) 表示(V) 履歴(S) ブックマーク(B) ツール(T) ヘルプ(H)
 http://sharaku.eorc.jaxa.jp/Ka-radar/

2011年 10月 22日 04時 30分 48秒 検索

- 01 min + GSMaP KMZ レーダー位置情報

レーダ1 (SNOO1)

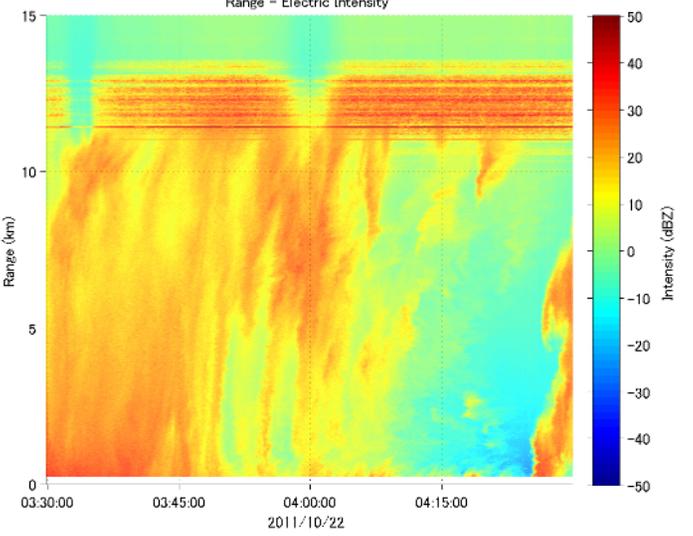
ヘッダ情報 空の様子
 RAWデータ取得 DRAWデータ取得 EFTデータ取得

SN001 : 20111022-042950.png
 SN002 : 20111022-043202.png

Data span : 20110208 - 20111025



Range - Electric Intensity



レーダ2 (SNOO2)

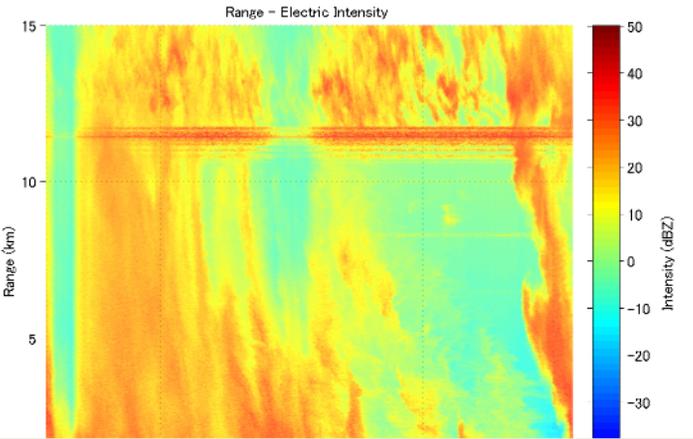
ヘッダ情報 空の様子
 RAWデータ取得 DRAWデータ取得 EFTデータ取得

SN001 : 20111022-042950.png
 SN002 : 20111022-043202.png

Data span : 20110208 - 20111027



Range - Electric Intensity



Ka-radar Photo Image - Mozilla Firefox

スライドショー

スライド間隔(速さ): High [スタート] [ストップ]

スライド番号: 1/94 [Go]

[back] [先頭に戻る] [next]



[Ka_image_SN1_20111025122006618.jpg]
 データ日時 : 2011/10/25 12:20:06.618

※Mouseスクロールでも画像切り替えができます。

Ka-radar Photo Image - Mozilla Firefox

スライドショー

スライド間隔(速さ): High [スタート] [ストップ]

スライド番号: 745/1459 [Go]

[back] [先頭に戻る] [next]



[Ka_image_SN2_20111025113100014.jpg]
 データ日時 : 2011/10/25 11:31:00.014

※Mouseスクロールでも画像切り替えができます。

Kaレーダのクイックルック画像と、同期した「空の様子」の動画を、準リアルタイムで見ることが出来ます。

Collaboration with Asian Countries

- * Objectives
 - * Promotion of GPM data use and seeking GV collaboration in Asia
- * The 2nd GPM Asia Workshop on Precipitation Data Application Technique, from 27th to 29th September 2010, Tokyo, Japan.
 - * Follow-up meeting of the first GPM Asia Workshop on Precipitation Data Application Technique in last year
 - * 50 participants = 33 Japanese + 1 U.S. +17 from Asia [Korea (KMA), Bangladesh (BMD, IWM), Indonesia (BPPT), Philippines (PAGASA), Thailand (TMD), Vietnam (NHMS), Laos (DMH), International (ICIMOD)]
 - * Asian countries are strongly interested in the high resolution rain map products for their weather prediction models, flood monitoring, etc. Also they have already use their own dense raingauge and radar network.
 - * Science interactions and discussions of methodology as well as data exchange are important for GV activities.
- * Special sessions at AOGS in August. 2009 (Singapore), July 2010 (Hyderabad) and August 2011(Taipei).

Meetings etc.,

- * 2011.11.10: CEOS PC workshop, Denver CO
- * 2011.12.6-9: GPM Asia Workshop in Tokyo
- * 2012.1.17-1.20: Japanese PMM annual meeting and the Joint JAXA PI workshop TRMM/GPM, GCOM-W, C and EarthCARE in Tokyo
- * (2012 April-May time frame:
 - * GPM joint algorithm team meeting in Japan??)
- * Summer: a GPM session in the AOGS-WPGM in Singapore, 2012
- * (late 2012 – early 2013 (JFY2012): GPM International Planning Workshop??)

Summary



- * Recent status of JAXA's precipitation observation related missions/sensors, PR, AMSR-E, GPM and GCOM-W, are updated.
- * JAXA has organized the PMM science team mainly focusing on GPM algorithm development and GV contributing to it.
 - * Algorithm developments for DPR and DPR/GMI combined L2 products are on going under U.S.-Japan joint team.
 - * Global Rainfall Map algorithm is being developed as an algorithm for Japanese GPM product.
- * Pre-launch ground based observation by the newly developed Ka-band radars has been conducted in Okinawa and Tsukuba. Now Mt. Fuji experiment is going on. After that, we will move them in Nagaoka to observe snow and Sapporo.

