JAXA Processing Status

JAXA/EORC
GCOM Research Group
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23rd, September,2014

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GCOM-W Satellite Status

GCOM-W Status

- *All satellite sub systems work nominally, and be stable and healthy*

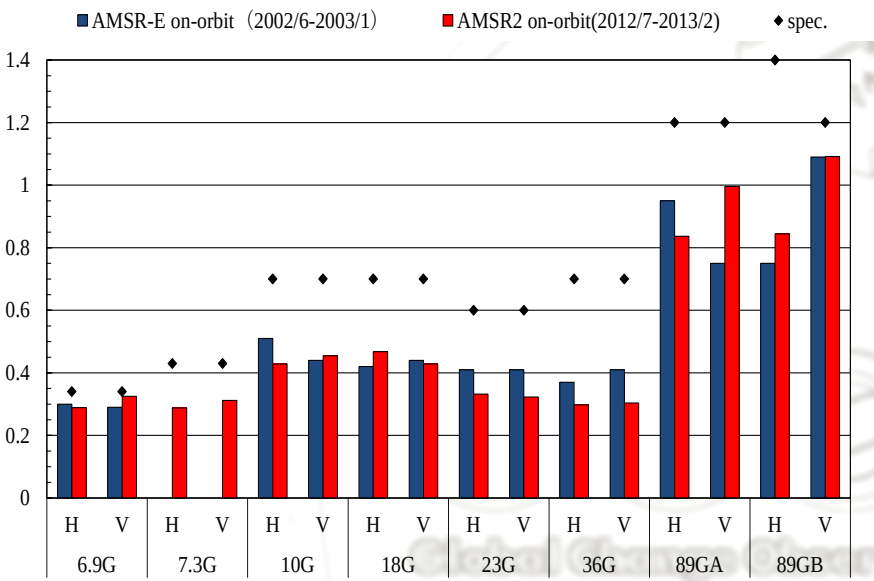
Sub-systems	Status
Solar panel and electric power sub-system	More than 4500w electric power is generated. (Satisfies the specification.) Auto-tracking the sun, and Battery DOD (Depth of Discharge) is below 9%.
Attitude and orbital control sub-system	Using Gyro and star sensor, fine attitude determination works well, and controlled nominally by reaction wheel works well.
Telemetry, tracking and command sub-system	Telemetry and commanding with S band and record telemetry data in invisible area. Communication with satellite works well.
Propulsion sub-system	Performing orbit control maneuver to keep A-Train orbit. Fuel has enough margin.
Thermal control sub-system	Temperature of all systems are in proper temperature. No temperature limits has been reported.
Mission data processor	Record observation data and transmit them with X-band (Foreign station is Svalbard, domestics are Katsuura, and Tsukuba.)
Sensor, AMSR2	Keep the observation mode with 40rpm. And its torque is stable.

AMSR-2 sensor status

AMSR2 Operation history so far

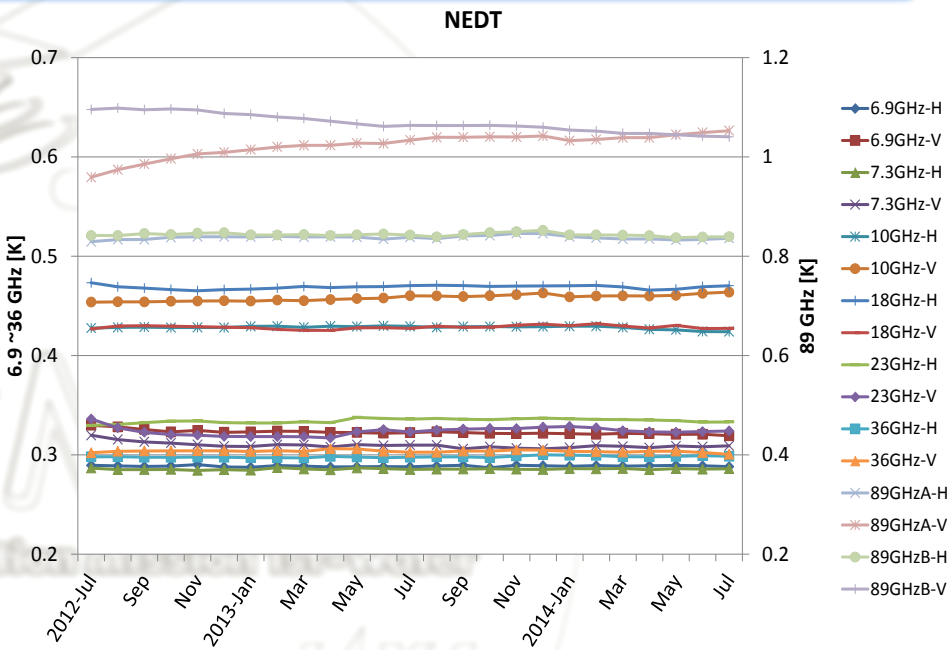
- *On 10th,May 2013, signal processor had changed from main to redundant system, and stopped the observation for 4 days. This could be triggered by the single event by radiation. We see no sings of failure and have no problem in the observation now.*
- *In some channels, annual changes have been seen in receiver characteristics, but not affect AMSR2's observation. Receivers of AMSR2 are almost healthy.*
- *Compared to torque of AMSR-E 2 years after the launch, AMSR2 is a little higher than AMSR-E. But there are much enough torque margin.*
- *And the other components are all stable and healthy.*

NEDT (Temperature resolution)



NEDT at the initial check out

(8 months average just after the launch)

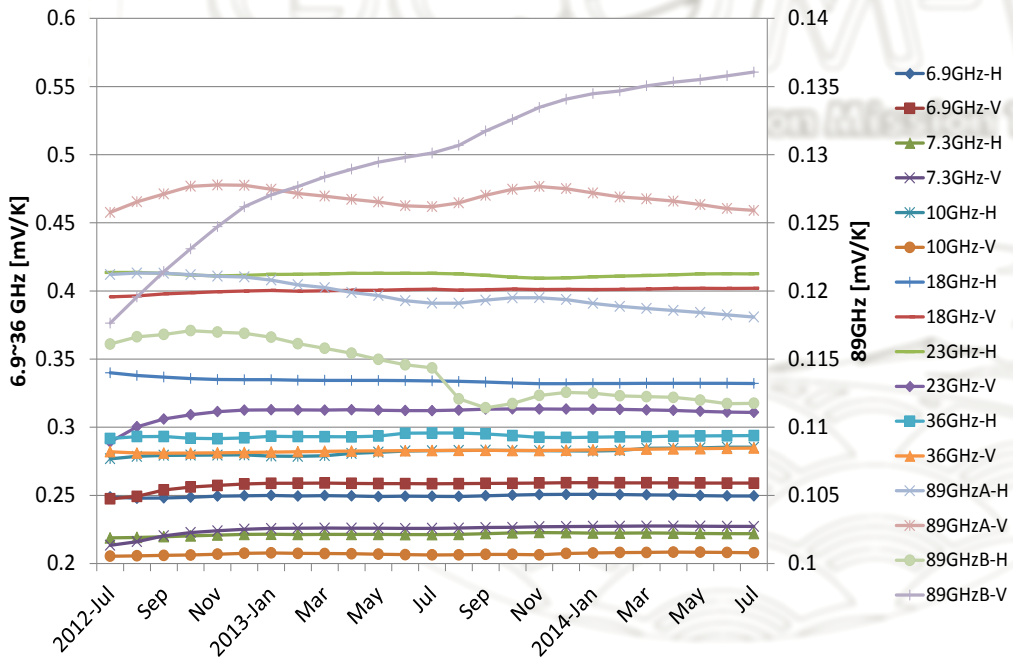


NEDT long term trend

- At the initial checkout
  - Satisfy their specifications
  - Almost equivalent performance to AMSR-E
- Long term trends
  - Lower channels have been stable
  - In 89GHz channels, especially A and B-vertical, slightly monotonous increase/decrease can be seen just after the launch, but seem to keep constant recently.

RF Receiver output

- *Long term trend*
  - *Lower frequencies channels output are stable.*
  - *In 89GHz channel, seasonal and annual changes can be seen.*
  - *89GHzB Vertical is raising monotonously, the gain, offset margin controlled by AGC function at DC is enough now, and therefore this doesn't affect observation.*



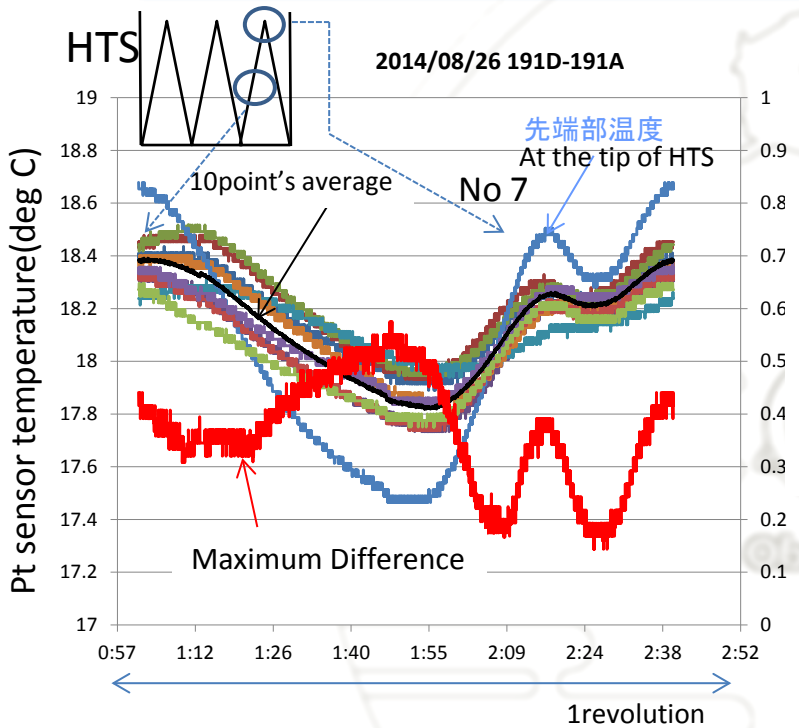
RF Receiver output

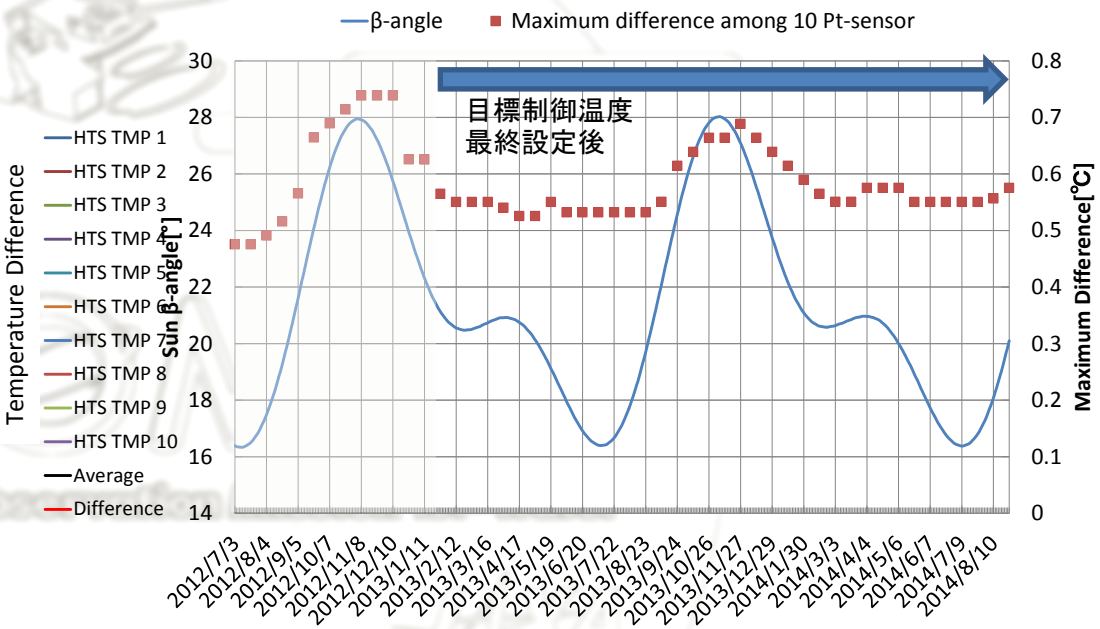
Torque at Rotation Actuator

➢ Trend

- *Torque was small and stable during one month after launch, then the level of torque jumped twice suddenly and has been keeping this level.*
- *We don't figure out the reason well, estimated reasons are the degradation of bearing or lubricant.*
- *AMSR2's level of torque is higher than that of AMSR-E in the same period and almost equal to that of AMSR-E 5 years after the launch.*
- *Although we need to monitor it carefully, there are enough margin to the maximum torque.*

Hot Load





Annual maximum temperature difference against Sun β angle

- *The temperature difference of 10 monitor points are maximum 1.2 degree C in a revolution.*
- *The maximum temperature difference is below 0.7 degree. Maximum is at the largest β angle, may suggest the influence of sun.*
- *For Level 1 processing, the averaged temperature of 10 points are used.*
- *Thermal characteristic is stable in long term, remarkable change has not be seen.*

Product update

Level 1 update Status

- *After we opened L1 product (Ver1.1) to public on March 2013, we have been checking calibration and observation data since then. Now we tune algorithms and processing parameters.*
- *By the end of this month, September, we complete to check new version of L1 products. Then we will provide them to our PI to tune new L2 algorithms since October.*
- *We plan to open new Level 1 and 2 product to public next March.*

Best case scenario, formally will be announced later

Outlines of update

- Description of update of CSM Calibration count data

No.	Items	Description	Remarks
1	Detect, eliminate and interpolation of RFI	Tune the algorithm for better detection.	Around the area where RFI occurs
2	Measure on mis detection of RFI （For 10GHz only）	Sometimes, data changes rapidly in connection with the change of thermal environment around receivers, like from “night” to “day”, software mis-detect this change as RFI. Software revised not to mis-detect.	Mainly ocean area in 10GHz-V. This phenomena was observed from August, 2013 to July , 2014, but now it is not observed.
3	Update the number of scanning for averaging （For 10GHz-V only）	We observe a temporal peak in 10G-V count values,the averaging on the data leads error averaging also in CSM. As wider averaging leads more error, we revised to reduce the number of averaging.	-

- Description of update of HTS Calibration count data

No.	Items	Description	Remarks
1	Detect, eliminate and interpolation of RFI	Tune the algorithm.	Around the area where RFI occurs

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Japan Aerospace Exploration Agency

Outlines of update

- *Description of update of Observation count data*

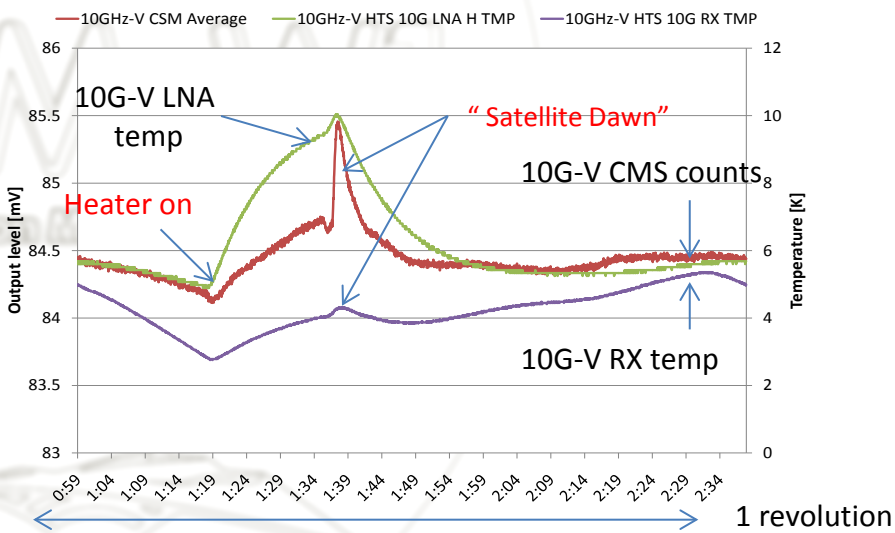
No.	Items	Description	Remarks
1	*Scanning bias （For lower frequencies 6.9GHz,7.3GHz, 10GHz）*	*Structure of AMSR2 and others interfere the view of horn, cause the error measurements. The previous version is not enough to eliminate the interference, especially in higher Tb region. We revised the parameters to fit both low (sea) and high Tb (land).*	-
2	Geolocation	Data has been collected for more than 1 years, use collected data, we revised geolocation.	—

- *Description of update of other data*

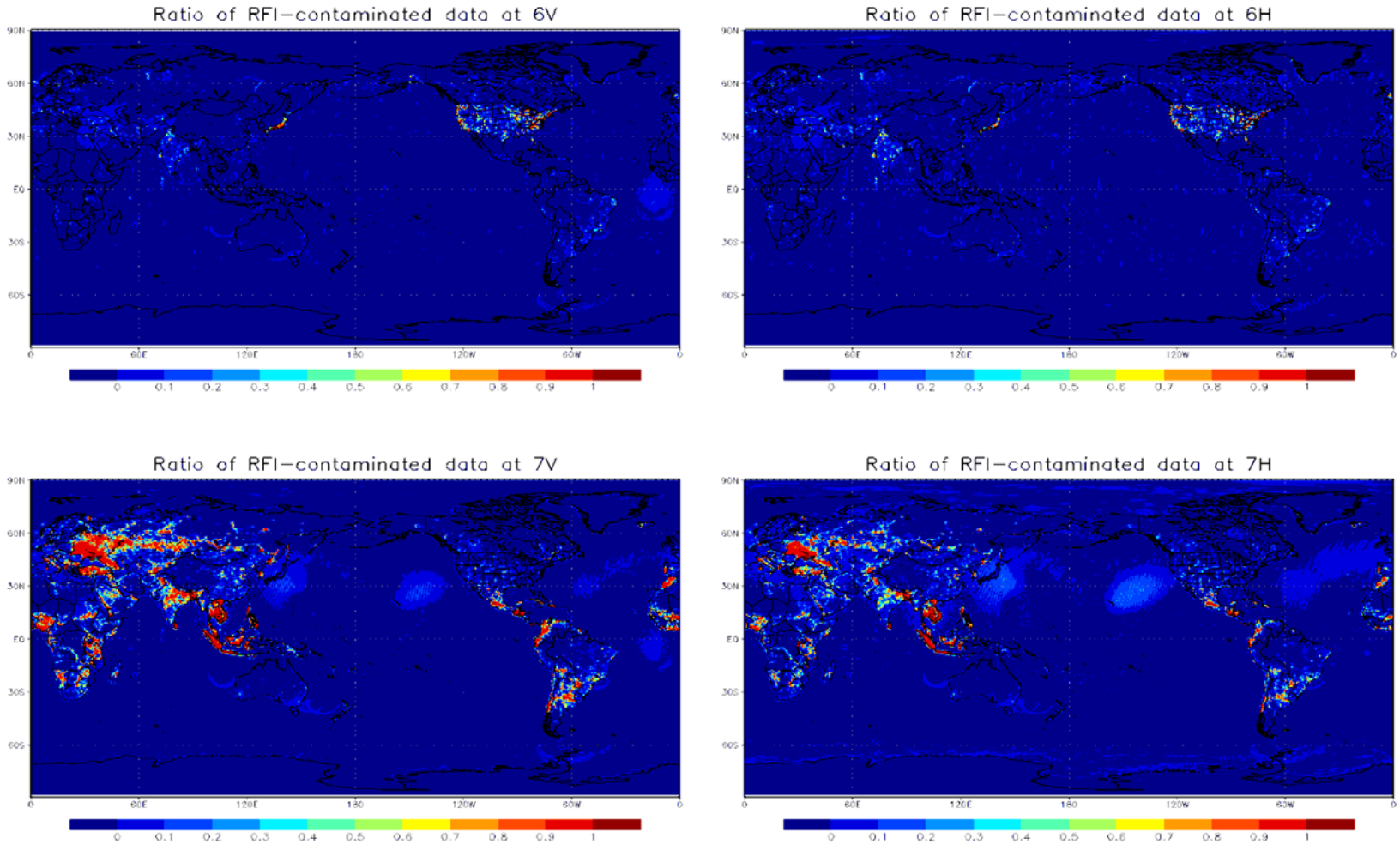
No.	Items	Description	Remarks
1	Interpolation flag (revise CSM, add HTS)	Format description documents didn't describe this flag correctly. Therefore the description was changed correctly.	Interpolation flag shows performing or not performing the interpolation on RFI data.
2	Quality information	Add the quality flag which shows RFI in C-band channel.(7GHz）	—
3	Metadata	Argument of perigee was blank, we fill 90 degree (mean).	—

Detail of mis-detection

- *In 10GHz, CSM count changes as thermal condition around receivers change. We want not detect this change as RFI.*
- *But software cannot distinguish if the change is by thermal condition or by RFI. If detected as "RFI", software processed to delete and interpolate.*
- *Because changes of CSM count was only used, we use both CSM count and thermal data to improve the detection.*



C-band RFI



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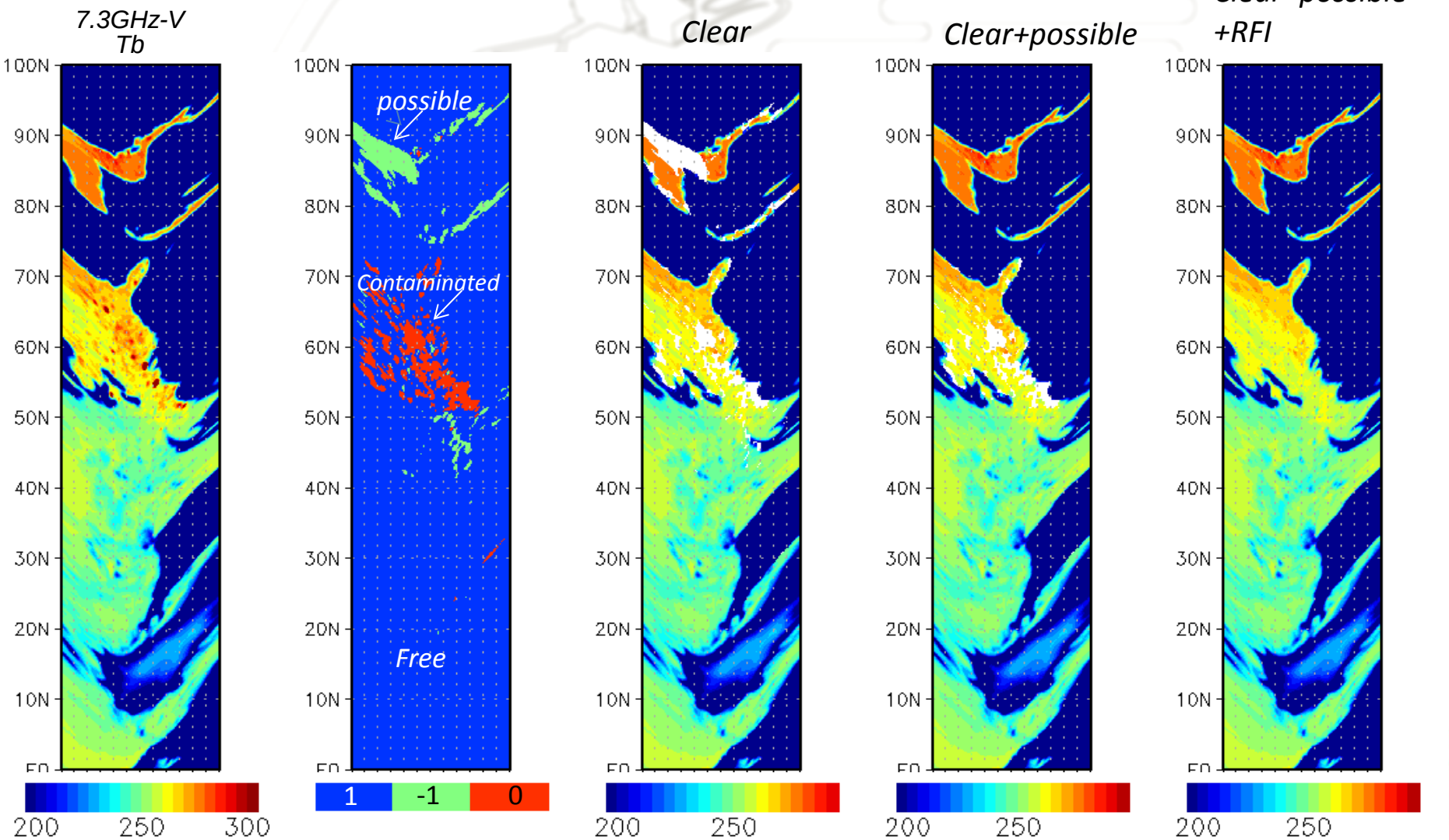
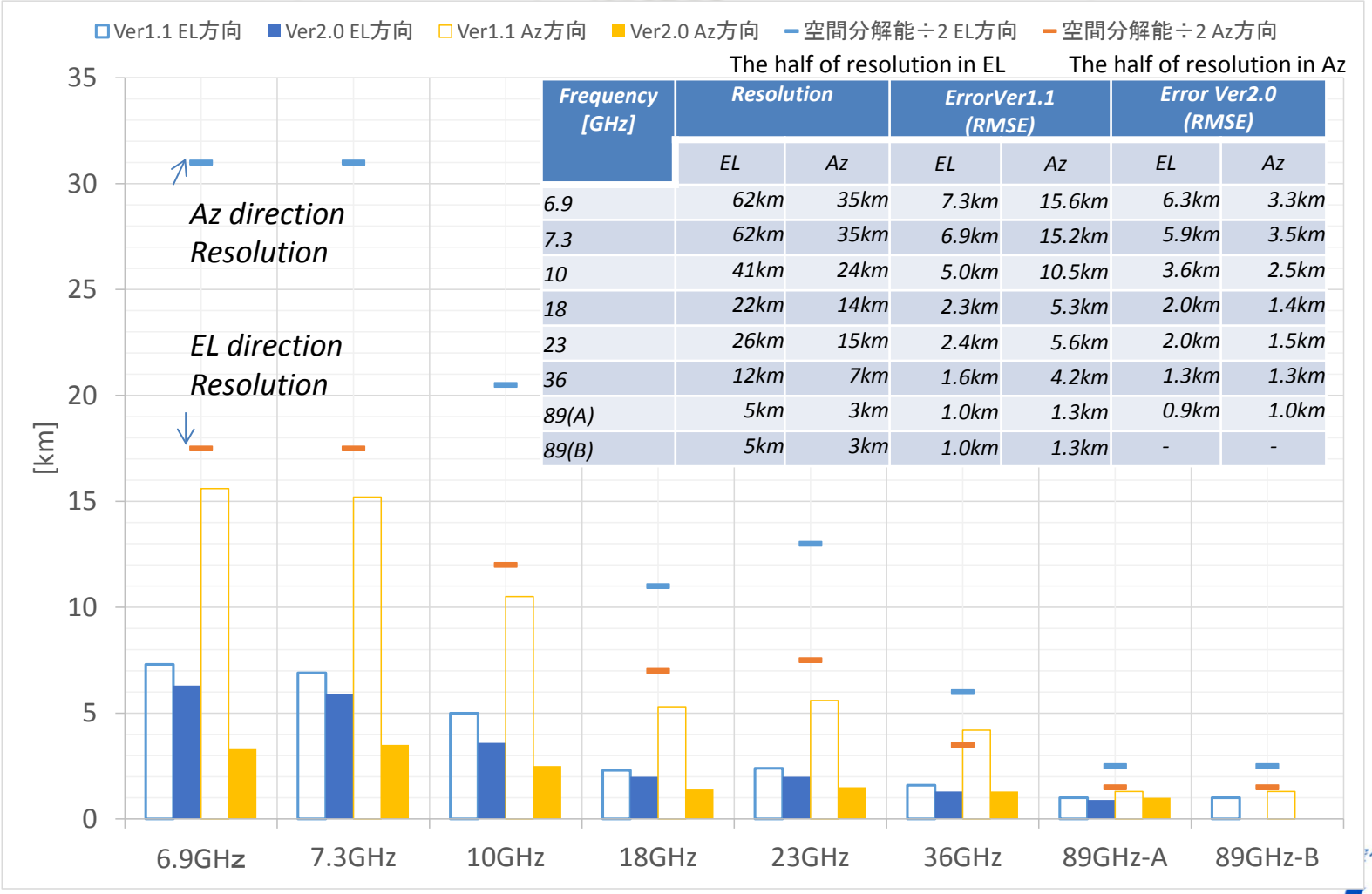
C-band RFI Flag

RFI Flag 1: RFI-free, -1: RFI-possible, 0: RFI-Contaminated



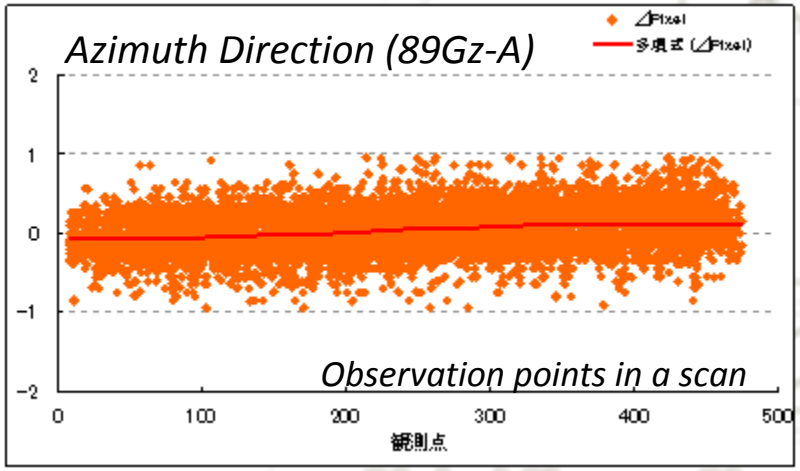
Geolocation Improvement

El: Viewing direction, Az: Scan direction

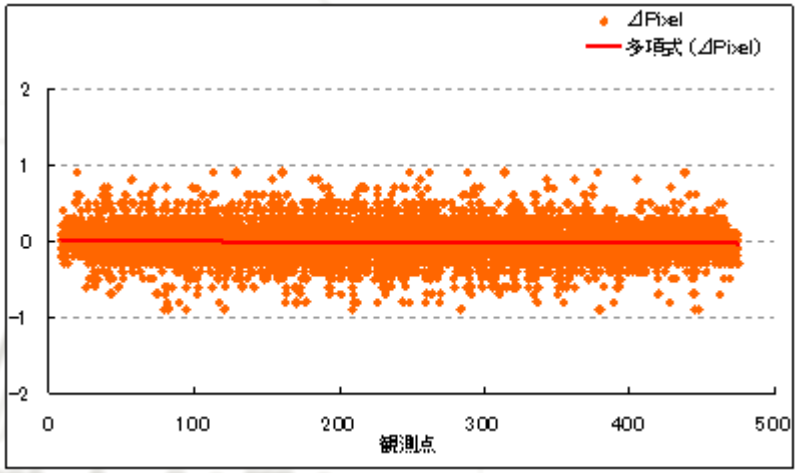


Frequency [GHz]	Resolution		ErrorVer1.1 (RMSE)		Error Ver2.0 (RMSE)	
	EL	Az	EL	Az	EL	Az
6.9	62km	35km	7.3km	15.6km	6.3km	3.3km
7.3	62km	35km	6.9km	15.2km	5.9km	3.5km
10	41km	24km	5.0km	10.5km	3.6km	2.5km
18	22km	14km	2.3km	5.3km	2.0km	1.4km
23	26km	15km	2.4km	5.6km	2.0km	1.5km
36	12km	7km	1.6km	4.2km	1.3km	1.3km
89(A)	5km	3km	1.0km	1.3km	0.9km	1.0km
89(B)	5km	3km	1.0km	1.3km	-	-

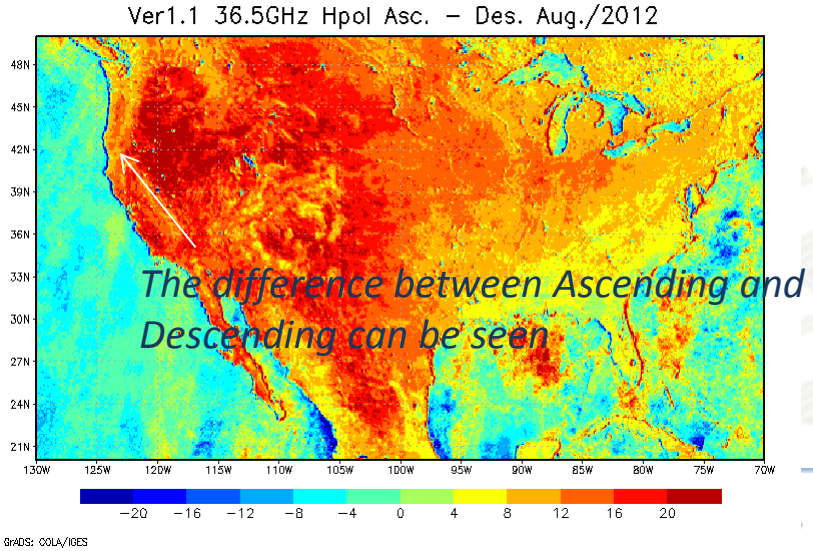
Geolocation Improvement

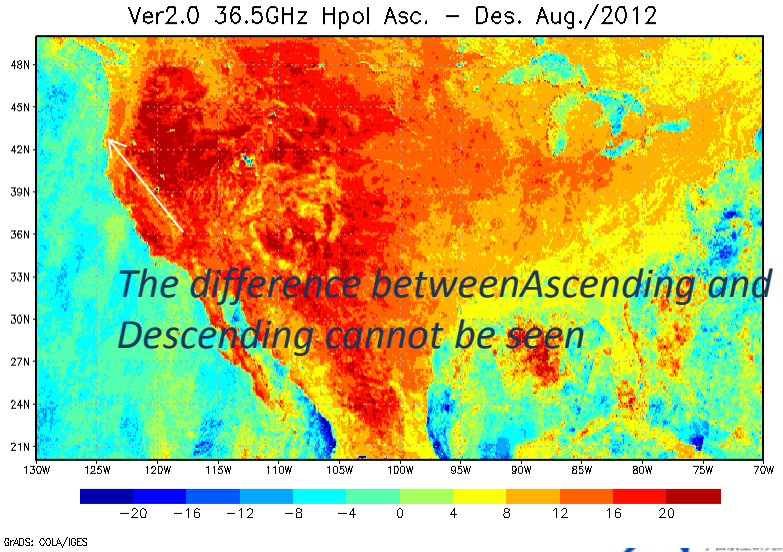


(Previous)

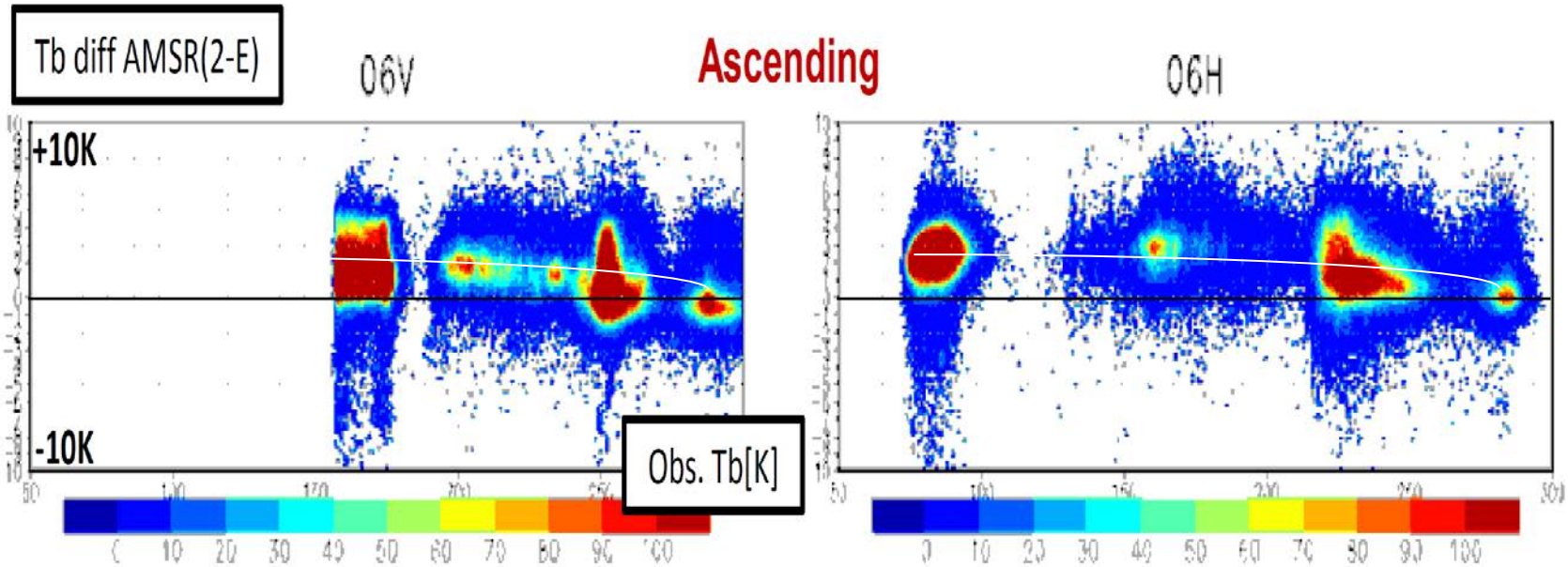


(Update)





Cross calibration with AMSR-E



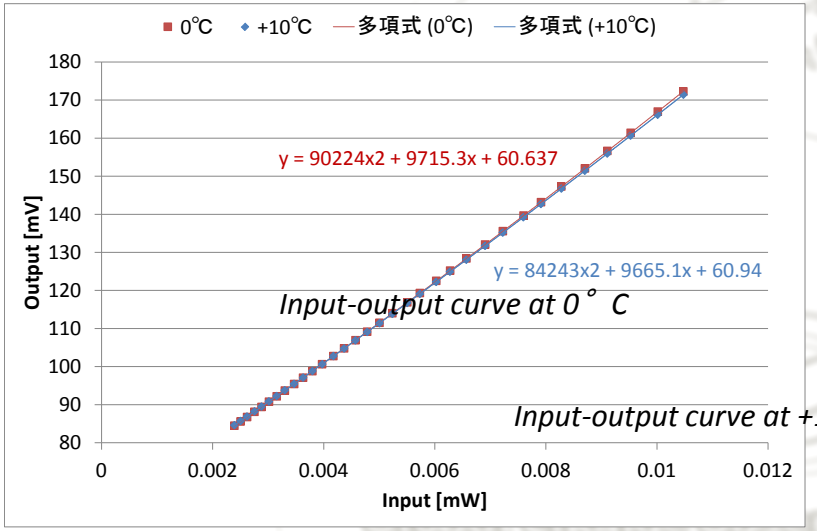
Cross Calibration between AMSR2 , AMSR-E

(Color : occurrence)

- *The correction amount is better for high temperate, not suite for lower temperature.*

=>We think this could be "over-correction", so we examine this again.

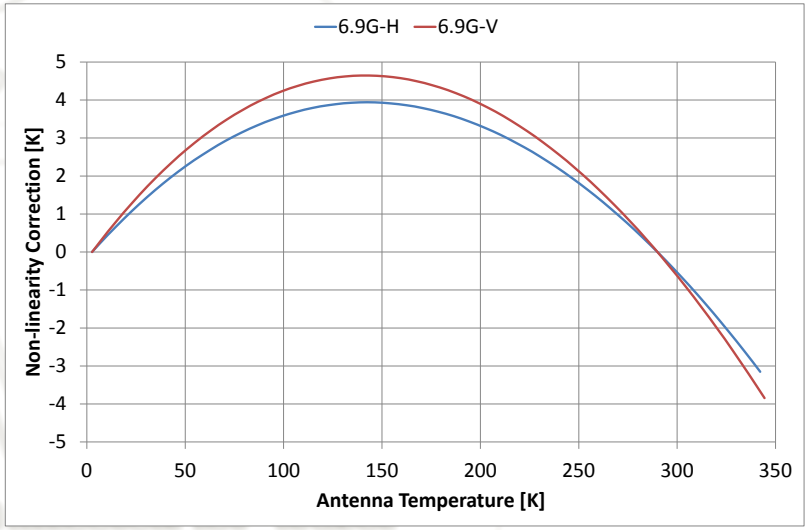
Explain of the examination



The receiver input output test

- *AMSR2's L1 bias correction is based on the data, which curve was gotten at the input-output test of receiver on the ground.*

Amount of correction at 6.9V,H



Calculated Antenna Temperature

- *Non linearity is larger at lower frequencies, We performed the test using EM(Engineering model, and other materials)again to confirm.*

Examination of Bias in Tb

- *And we have checked materials of EM (Engineering Model and others) and performed analysis again*
- *Test founds:*

- Re-test data shows almost the same characteristics as that of before.

- The characteristics input-output curves are different from that of "mono-tone"(single frequency) and multi-frequencies. AMSR2 observes with "multi-frequencies (Centered frequency + band width)

=> We haven't found out clear factors for bias,still looking for them.

Outline of L1R update

Concept: Calculate "larger antenna pattern by compounding small(high frequencies) antenna patterns

$$\boldsymbol{a} = \boldsymbol{V}^{-1}\left[v + \left(\frac{1 - u^T\boldsymbol{V}^{-1}v}{u^T\boldsymbol{V}^{-1}u}\right)u\right]$$

$\boldsymbol{a}$: *calculated antenna pattern filter*

$\boldsymbol{V} = \boldsymbol{G} + \kappa\boldsymbol{I}$ κ : *smoothing factor*

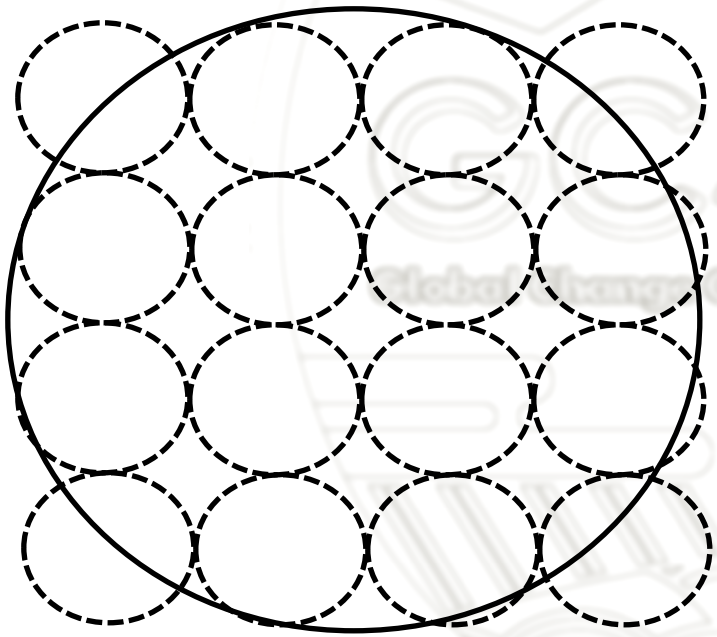
Tuned new version

$$u_i = \iint_A G_i(\rho)dA$$

$$v_i = \iint_A G_i(\rho)F(\rho)dA$$

$$G_{ij} = \iint_A G_i(\rho)F_j(\rho)dA$$

Citation: Stogryn, A., Estimates of brightness temperatures from scanning radiometer data,IEEE Trans. on Antennas Propagation, AP-26, pp. 720-726, 1978.

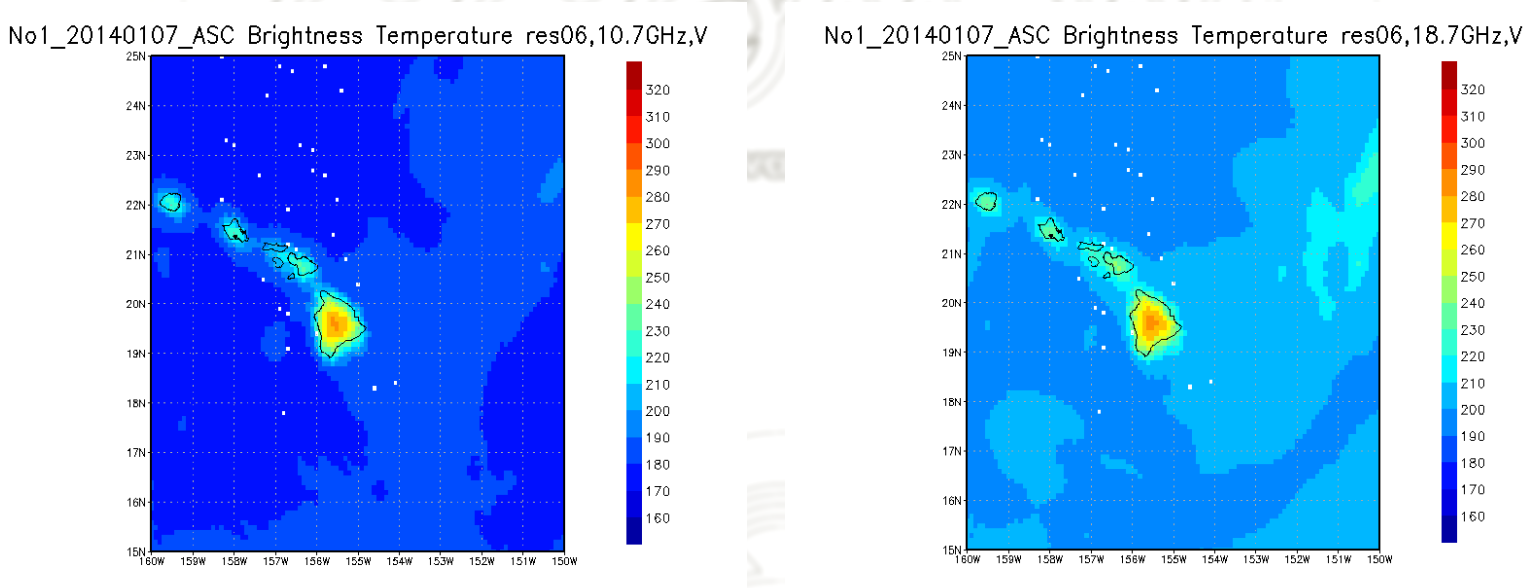


: *Antenna pattern of higher frequencies*

: *Calculated Antenna pattern filter corresponding to a lower frequency*

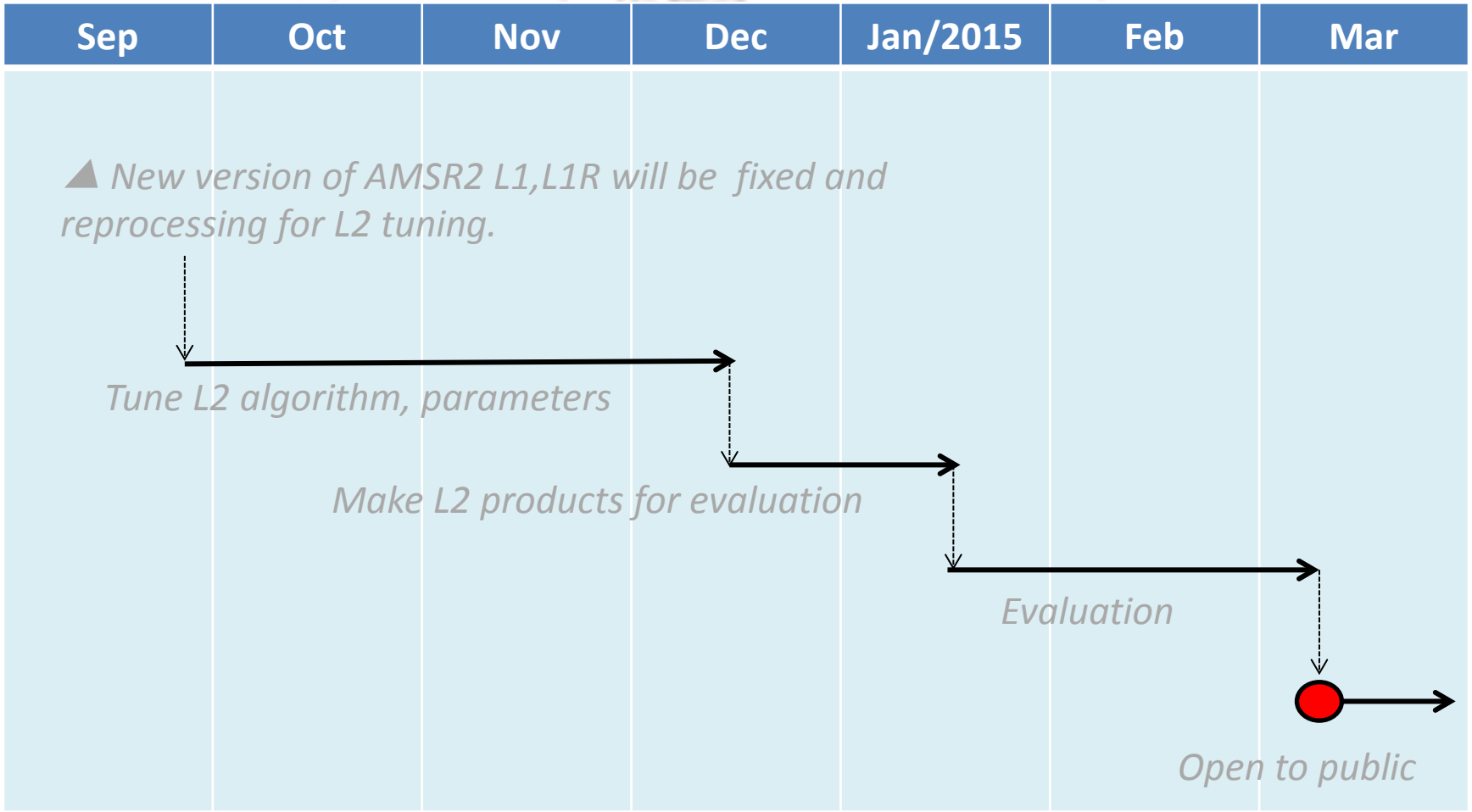
Status of L1R update

- *Tuned smoothing factor.*
- *As geolocation in L1 was updated, L1R filters are calculated again.*
- *Making sample products for evaluation will be completed by the end of September. (Tentative)*



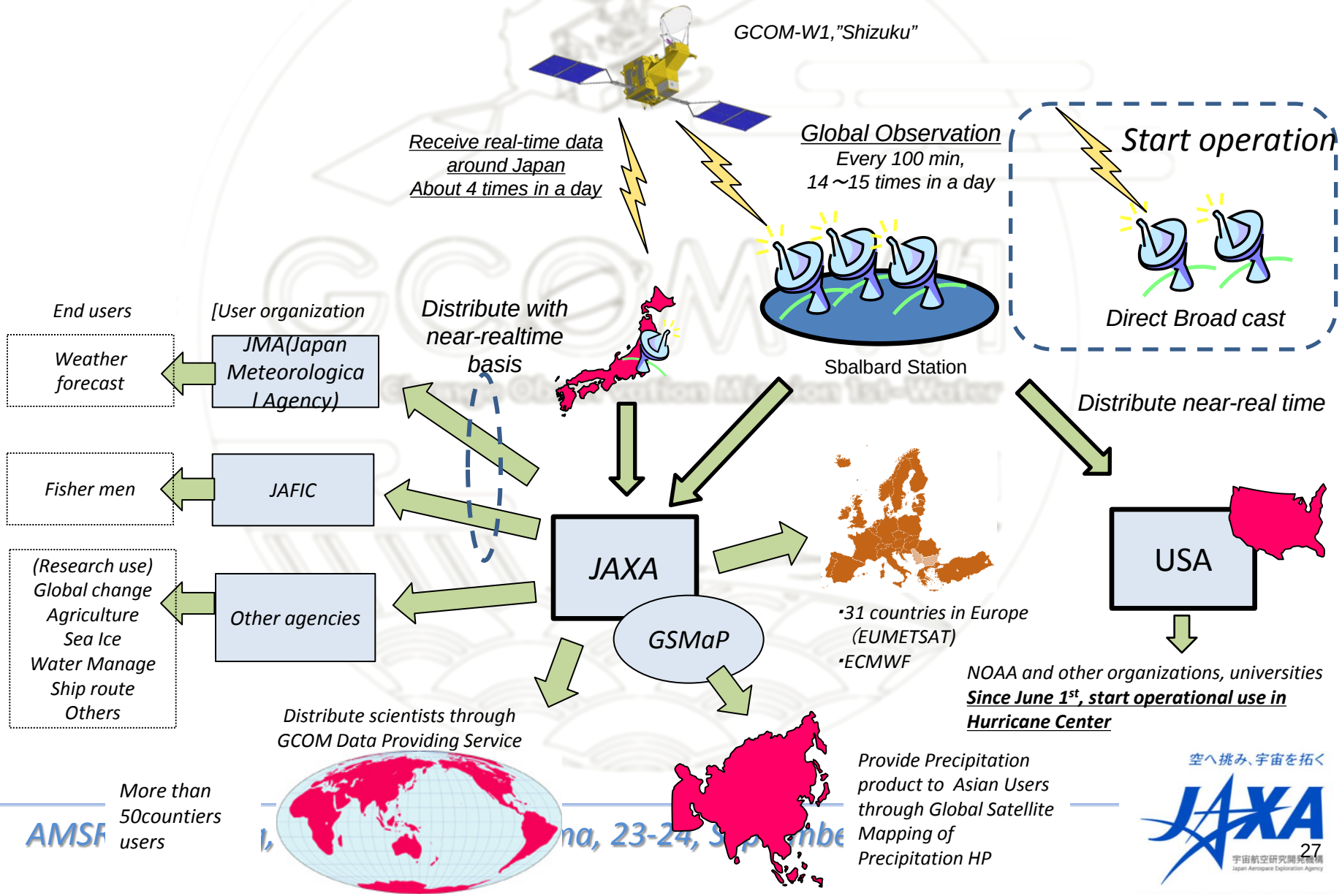
Sample products, 10.7GHz and 18.7 GHz with 6.9 GHz resolution

L2 update schedule(tentative)

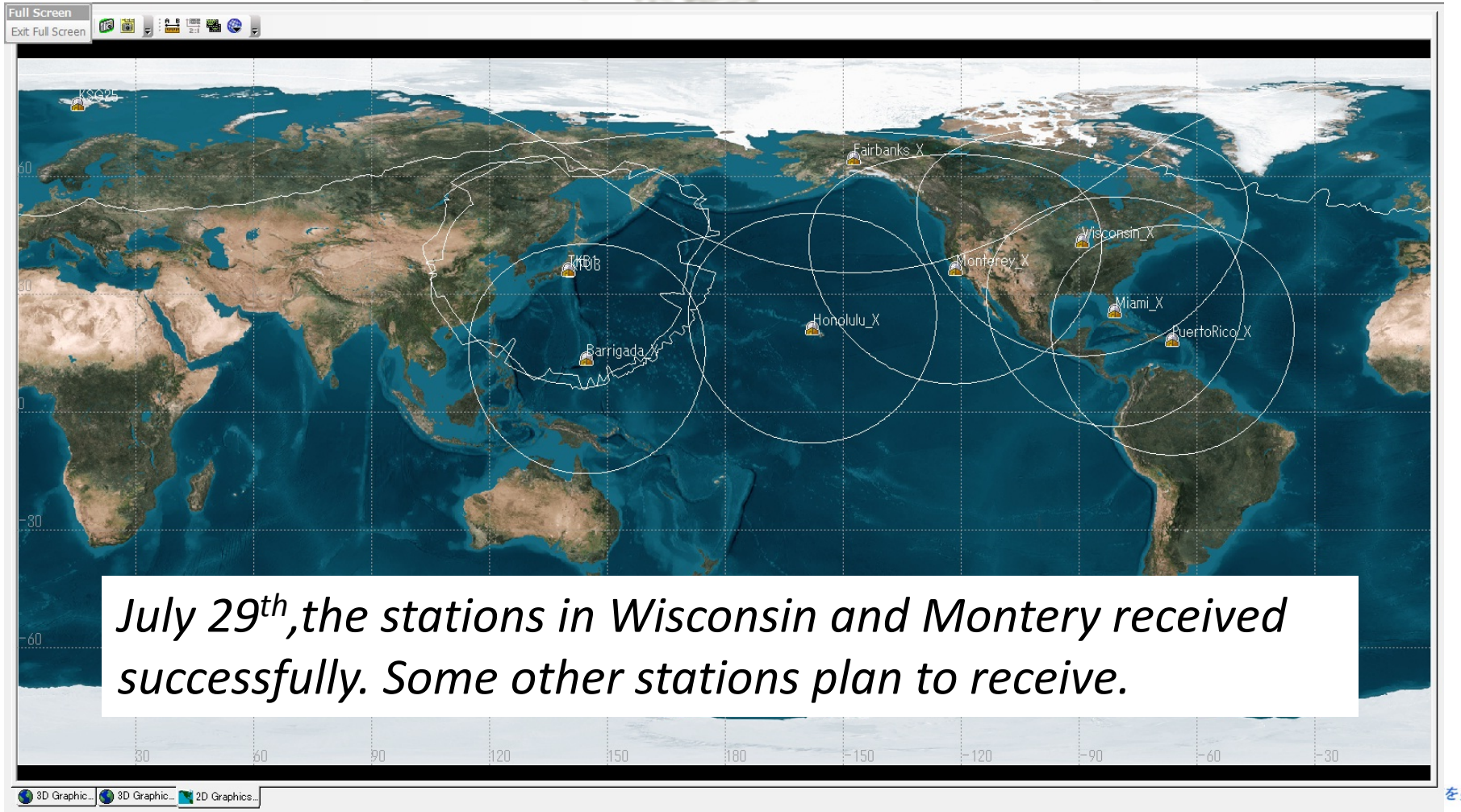


GCOM-W Users

GCOM-W Users


GCOM-W1,"Shizuku"
Receive real-time data around Japan
About 4 times in a day
Global Observation
Every 100 min,
14～15 times in a day
Start operation
Direct Broad cast
Sbalbard Station
Distribute with near-realtime basis
Distribute near-real time
End users
[User organization
Weather forecast
JMA(Japan Meteorological Agency)
Fisher men
JAFIC
(Research use)
Global change
Agriculture
Sea Ice
Water Manage
Ship route
Others
Other agencies
JAXA
GSMaP
・31 countries in Europe (EUMETSAT)
・ECMWF
USA
NOAA and other organizations, universities
Since June 1st, start operational use in Hurricane Center
Distribute scientists through GCOM Data Providing Service
More than 50countiers users
Provide Precipitation product to Asian Users through Global Satellite Mapping of Precipitation HP

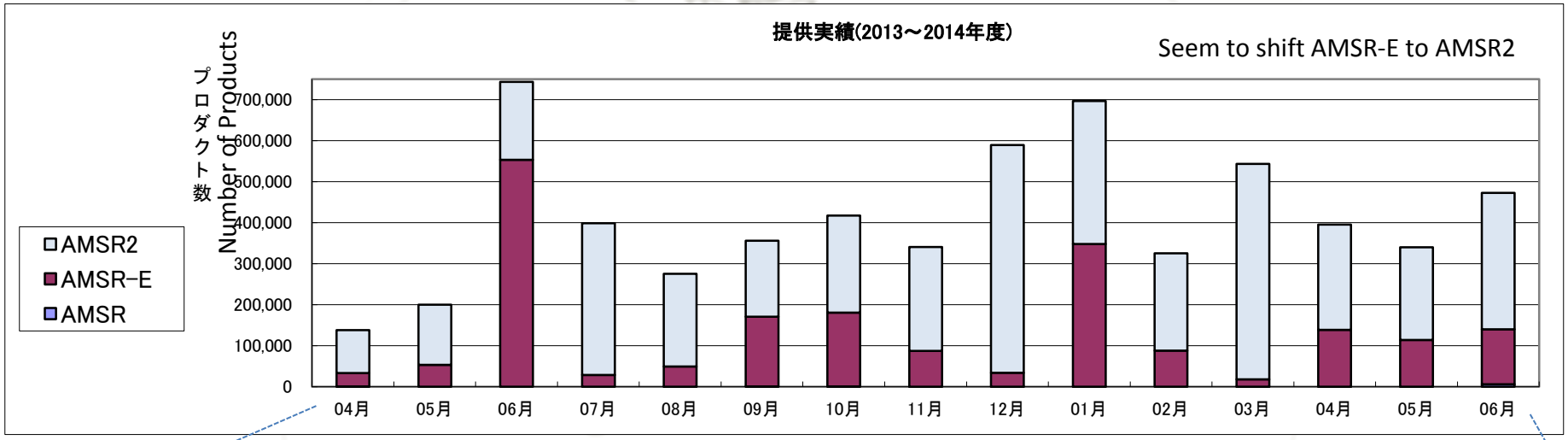
Direct Broad Cast receiving Station



July 29th,the stations in Wisconsin and Montery received successfully. Some other stations plan to receive.

Number of providing products

History of track records during JFY 2013-2014



	2013 JFY												2014 JFY		
	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
AMSR	632	0	0	0	9	456	798	269	118	3	0	24	19	152	5,795
AMSR-E	32,733	53,440	553,443	28,802	49,344	170,053	179,577	86,773	34,135	347,816	88,102	17,818	138,476	113,983	134,369
AMSR2	104,774	146,717	189,579	369,944	226,103	185,747	236,863	253,652	555,115	348,698	237,287	525,407	256,880	225,647	332,331
合計	138,139	200,157	743,022	398,746	275,456	356,256	417,238	340,694	589,368	696,517	325,389	543,249	395,375	339,782	472,495

Top 10 users

No	Users	No	Users
1	Space Reserch Organization(US)	6	Remote Sensing Organization(RUS)
2	Space Reserch Organization(CHN)	7	National University(CHN)
3	Domestic University	8	Domestic Technical College
4	Meteorogical Organization (US)	9	Meteorogical Organization (TWN)
5	National University(RUS)	10	National University(CHN)

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Future mission

Status of future mission

- *Discussions in the domestic science group*

✓ *Arrange requirements on the succeeding Satellite.*

✓ *Discuss the addition of higher frequency channels to observe solid precipitation, and simultaneous observation by the microwave radiometer and scatterometer.*

- *Discussions with international partners*

✓ *Currently discussing with JPL and the Indian Space Research Organization (ISRO) for potential cooperation on microwave radiometer and scatterometer mission.*

✓ *The first release of the science requirements document was defined by the research and operational users working group, which consists of users and scientists from India, US, and Japan.*

Next Meeting

Next meeting in Tokyo, this JFY

- **Schedules**
  - *Date : 14th to 16th , next January (Fixed)*
  - *14th AM : Plenary*
  - *14th PM to 16th : AMSR2 Splinter meeting The other projects , GCOM-C,GPM and EarthCARE missions, have meetings at the same venue. (as usual)*

- ***Venue*** *: TKP Gardencity Nagatacho,Tokyo (Tentative)*