JAXA GCOM-W Status

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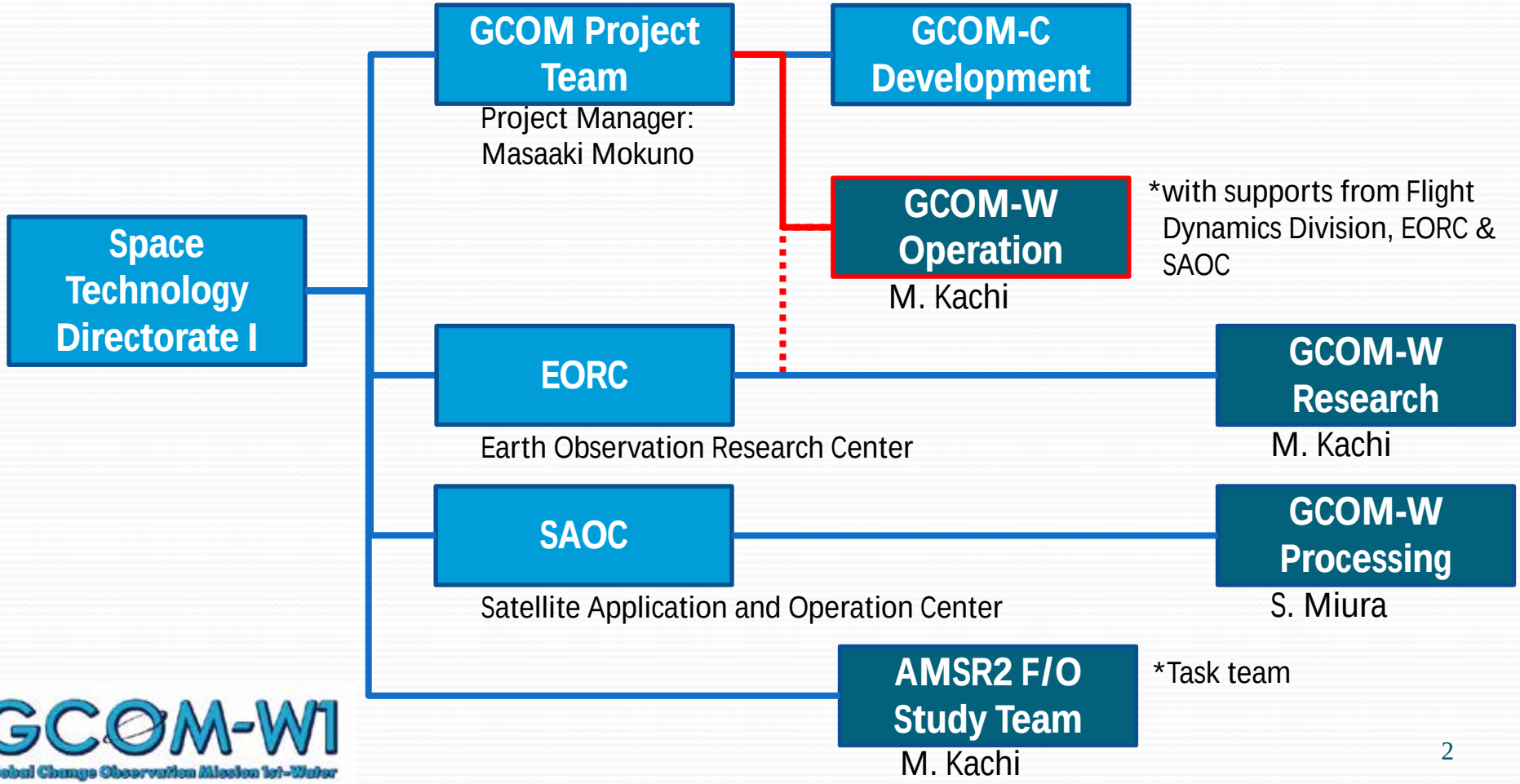
GCOM Project Team / Earth Observation Research Center

Space Technology Directorate I, JAXA

Sep. 22, 2016 @ US AMSR Science Team meeting

JAXA GCOM-W Organization

- GCOM-W operation has been placed under the control of the GCOM Project Team since June 1, 2016. (Previously under EORC)



GCOM-W Mission Summary

- May 17, 2012 : Launch
- June 28, 2012 : Injection into A-Train
- August 10, 2012 : Completion of initial checkout
- January 25, 2013 : AMSR2 Level 1 (Brightness temperature) products release to the public
- May 10 - 14, 2013 : AMSR2 Observation halt (SPC A to B)
- May 17, 2013 : AMSR2 Level 2 (Geophysical) products release to the public (Successful completion of Initial Cal/Val)
- March 26, 2015 : AMSR2 Level 1-3 Version 2 release
- October 6, 2015 : All-weather sea surface wind speed research product release to public
- August 23, 2016 : AMSR2 Level 1 minor version update

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GCOM-W Satellite System Updates

– The GCOM-W1 satellite system is working well.

Sub-system	Status	Notes
System	Normal	Maintaining the A-train orbit.
TT&C Subsystem	Normal	Data recorder temporarily stopped for 20 hours on Dec. 4, 2015 due to Single Event Upset.
Solar Array Paddle & Electric Power Subsystems	Normal	Solar array paddles generates 4000W. 400W lost on Nov. 15, 2015 probably due to debris. NO IMPACT on operation.
Attitude and Obit Control Subsystem	Normal	
Reaction Control Subsystem	Normal	
Thermal Control Subsystem	Normal	
Mission Data Handling Subsystem	Normal	
AMSR2	Normal	SPC B had been in operation since May 10, 2013 (instead of SPC A), and has switched to SPC A again on April 15, 2016. Data loss during 20 hours.

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GCOM-W Ground System Updates

- Operation
  - Mission data: 99.55% acquired from Jul. 3, 2012 to Aug. 31, 2016.
  - Started direct broadcasting to NOAA's Hawaii station at Jun. 25, 2016.
- System
  - L1 Minor version update (bug fix in RFI flag and no impact on TB) on August 23, 2016.
  - Currently preparing L2 & 3 version updates (except TPW & CLW) to Ver.3 scheduled in Jan. 2017.
  - Reprocessing of L2 new version will use the JAXA Super Computer system.

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GCOM-W Research Updates

- Algorithm & Validation
  - Research products has been released in Oct. 2015 for all-weather sea surface wind speed, and April 2015 for high-resolution SST.
  - Development and validation of L2 Ver.3 is underway to achieve standard accuracy.
- Review
  - Planning to held the 3rd Cal/Val Review to check achievement of standard accuracy and data release in Jan. 2017.
- Others
  - The 1st Research Announcement for Earth Observations including GCOM-W1 has been issued on Sep. 7, 2016 (deadline: Nov. 15, 2016).

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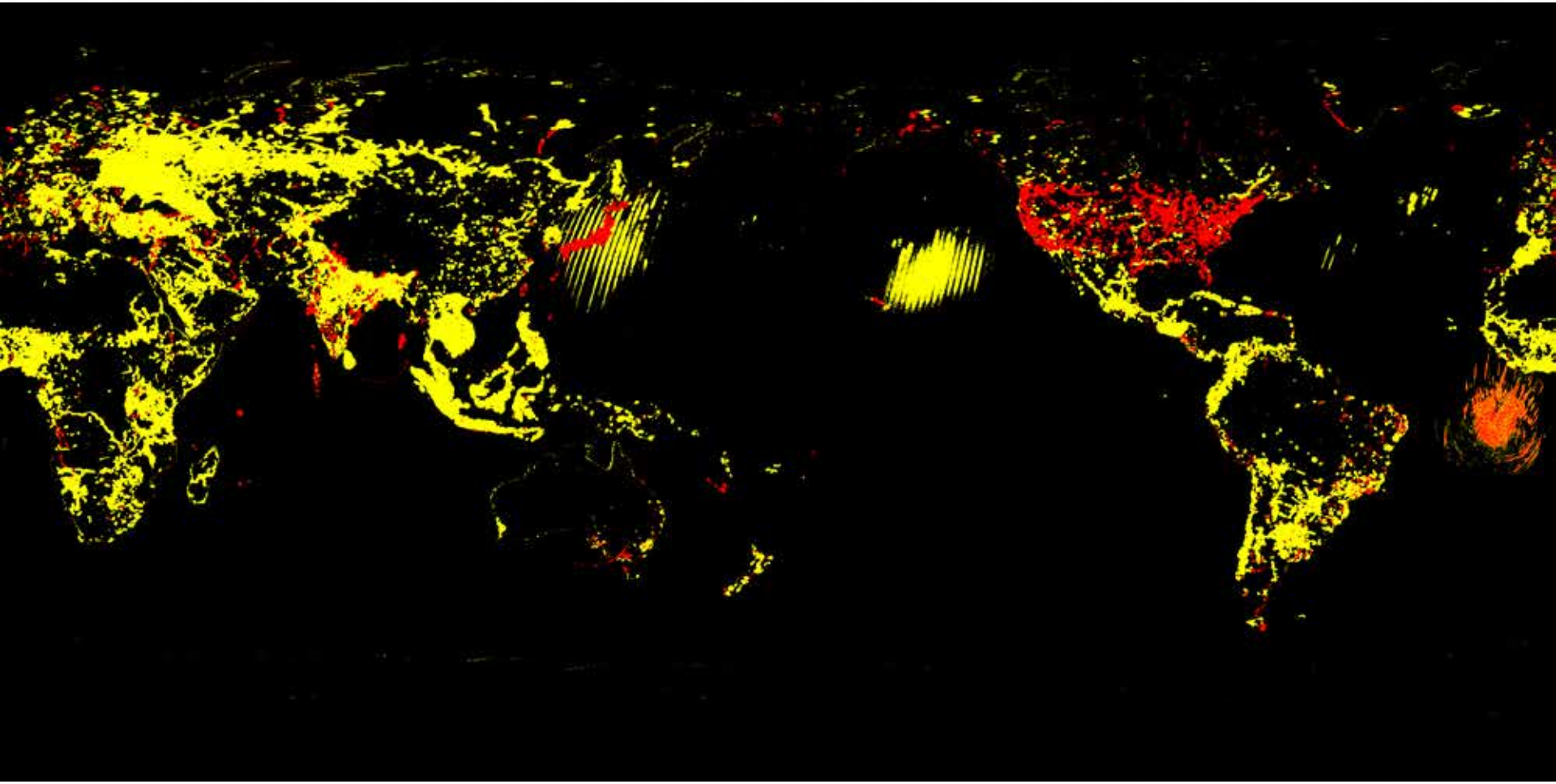
Level 1 Minor Version Update

- AMSR2 L1 products are updated from Ver.2.1 to 2.2 on August 23, 2016. Reprocessing of L1 is underway and will be completed by March 2017.
- RFI detection flag that is not stored in Ver. 2.1 is correctly stored in Ver.2.2.
- There is NO CHANGE in L1 algorithm itself, so there is no change in brightness temperature values. No reprocessing of L2 products is planned.

RFI detection @6.9V in July 2012 (AMSR2)



Red: RFI
Yellow: Possible RFI

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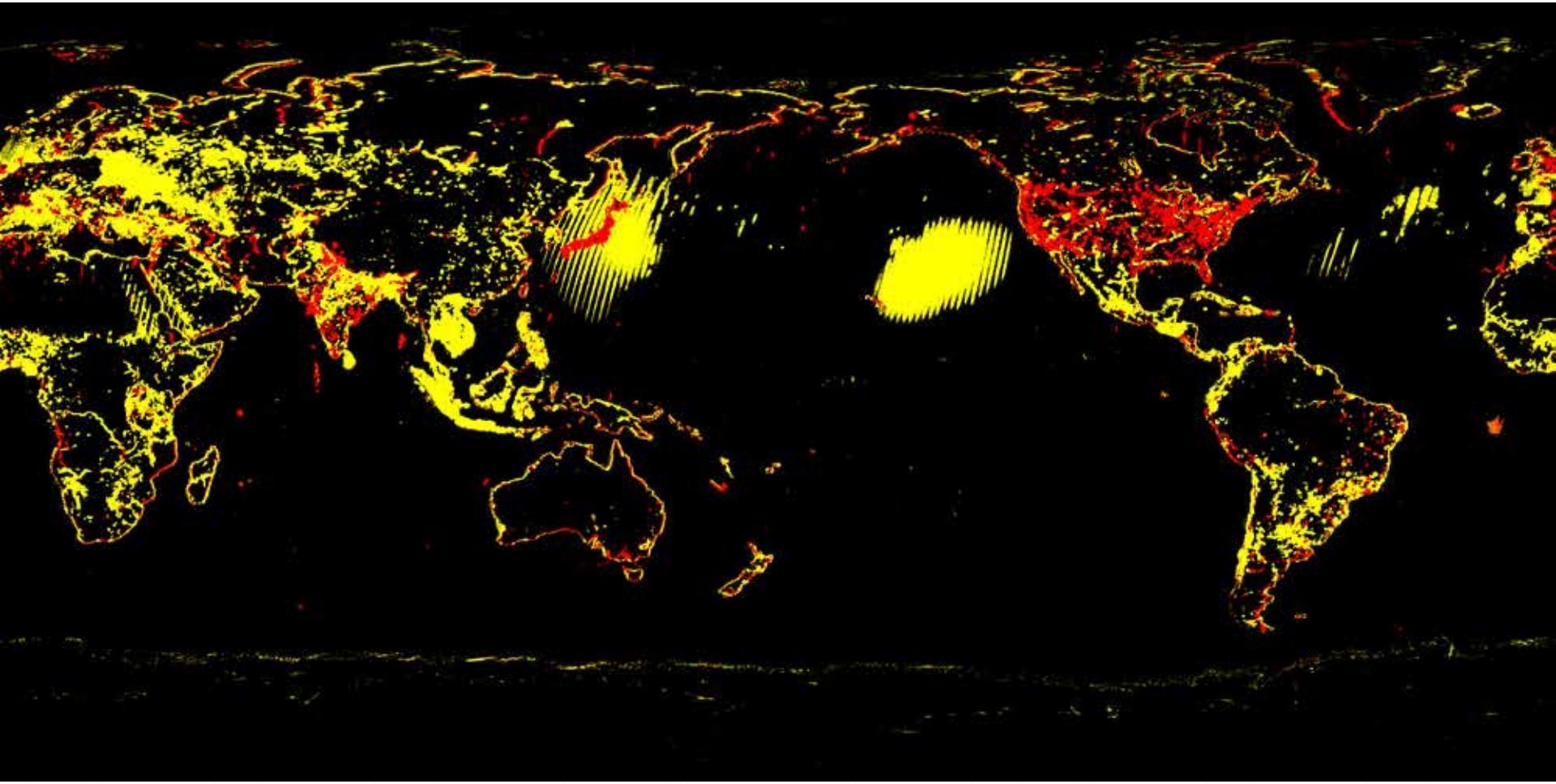
RFI detection @6.9H in July 2012 (AMSR2)



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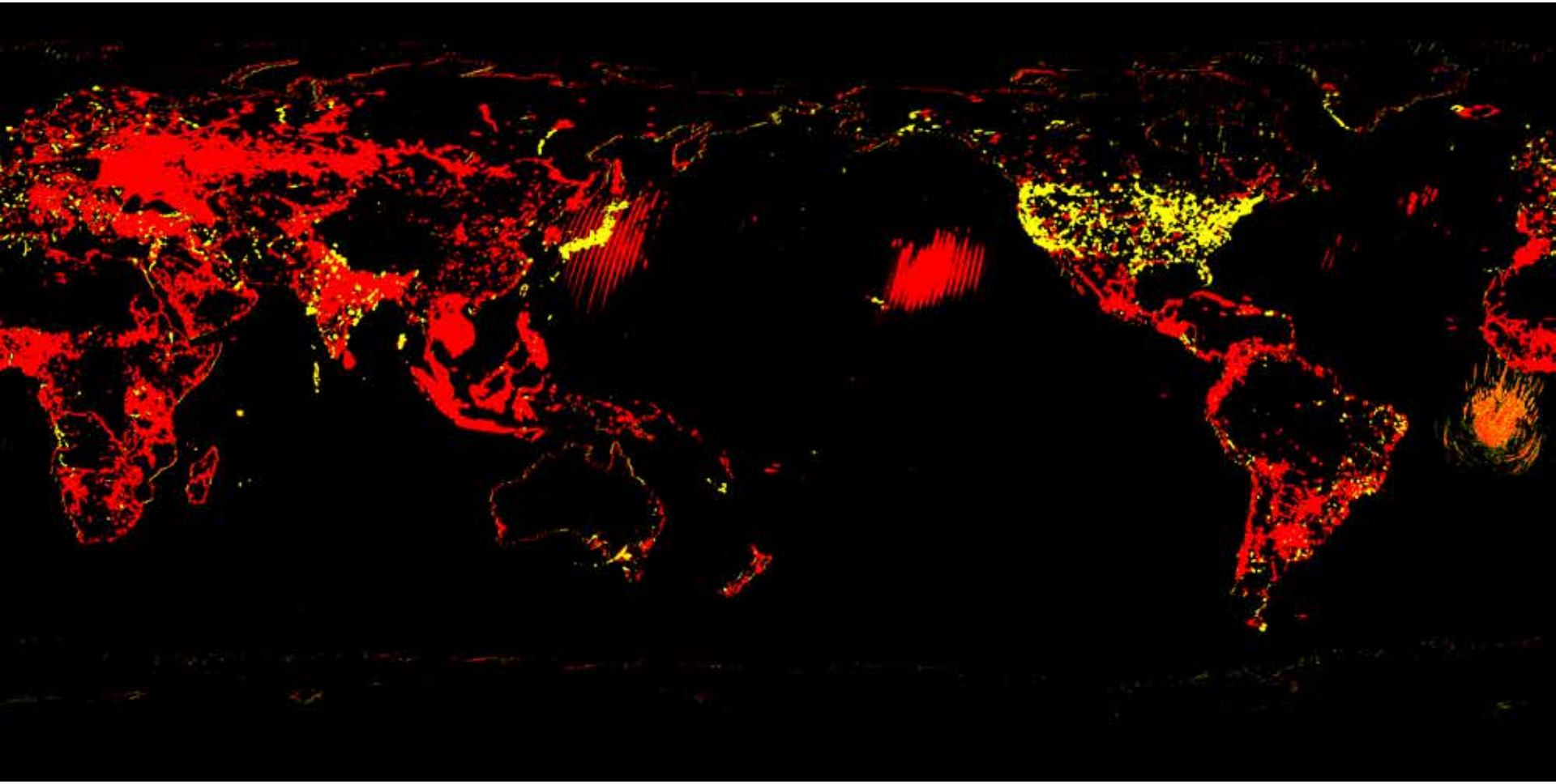
RFI detection @7.3V in July 2012 (AMSR2)



Red: RFI
Yellow: Possible RFI

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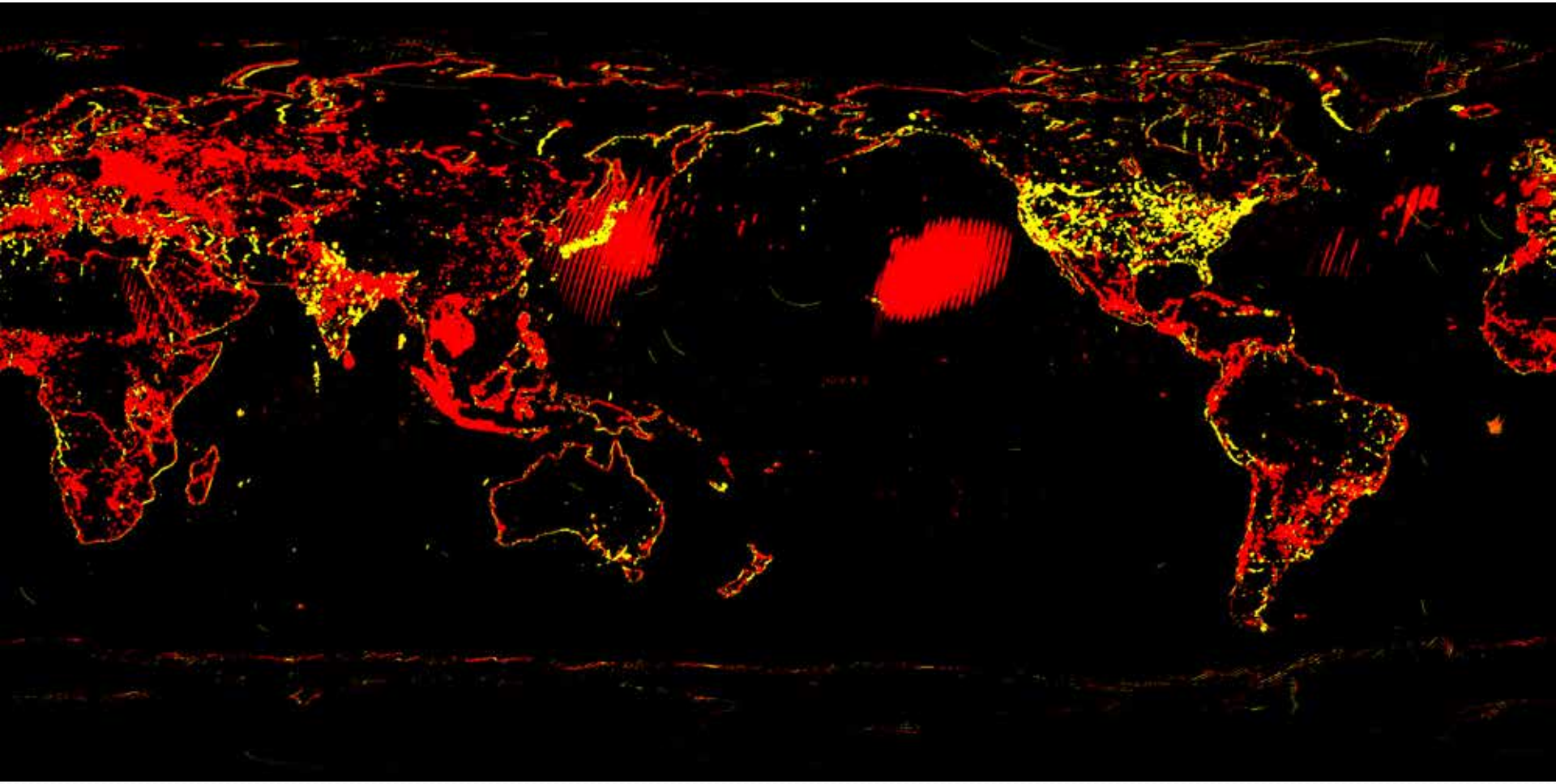
RFI detection @7.3H in July 2012 (AMSR2)



Red: RFI
Yellow: Possible RFI

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About L2 Version Update Plan

- Status of product accuracy
  - Six of eight standard products already achieved standard accuracy.
  - SST and sea surface wind speed should achieve standard accuracy in Ver.3.
- TPW and CLW will not be updated to Ver.3. Others are under preparation.

Product		Release Accuracy	Standard Accuracy	Target Accuracy	Ver.2 accuracy
GEO	Total Precipitable Water	±3.5 kg/m^2	±3.5 kg/m^2	±2.0 kg/m^2	ROB:2.6 kg/m^2 GPS:1.5 kg/m^2
	Cloud Liquid Water	±0.10 kg/m^2	±0.05 kg/m^2	±0.02 kg/m^2	0.04 kg/m^2
	Precipitation	Ocean ±50 % Land ±120 %	Ocean ±50 % Land ±120 %	Ocean ±20 % Land ±80 %	Ocean 48% Land 84%
	Sea Surface Temperature	±0.8 ºC	±0.5 ºC	±0.2 ºC	0.6 ºC
	Sea Surface Wind Speed	±1.5 m/s	±1.0 m/s	±1.0 m/s	1.1 m/s
	Sea Ice Concentration	±10 %	±10 %	±5%	8 %
	Snow Depth	±20 cm	±20 cm	±10 cm	16 cm
	Soil Moisture	±10 %	±10 %	±5 %	4 %

Achieve Release Accuracy | Achieve Standard Accuracy | Achieve Target Accuracy

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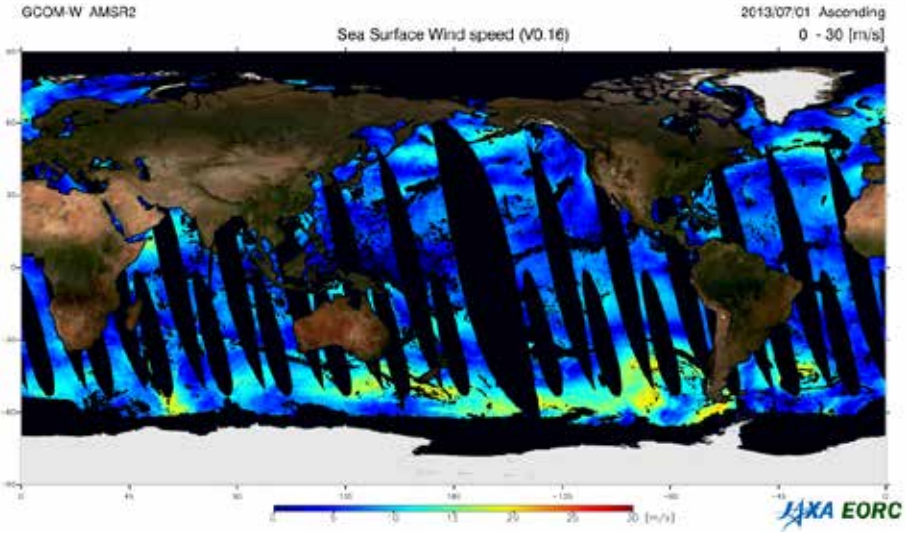
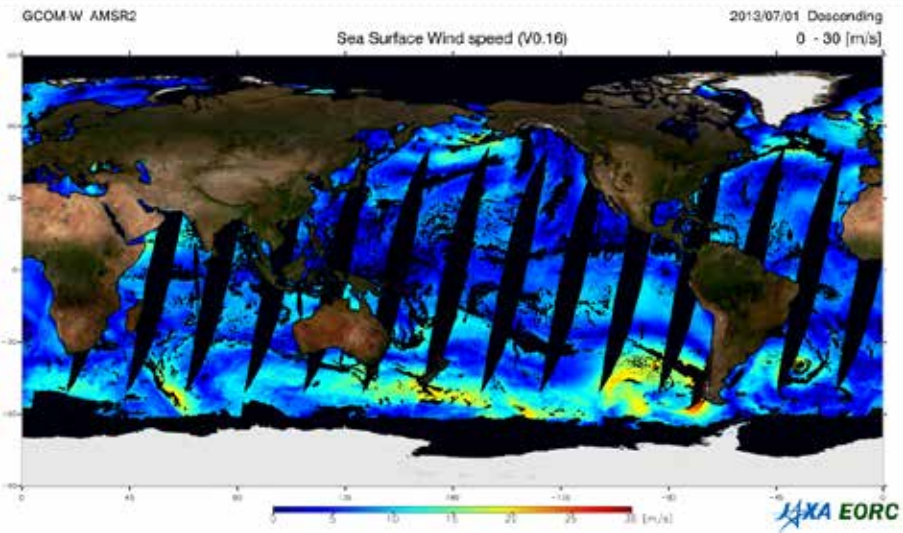
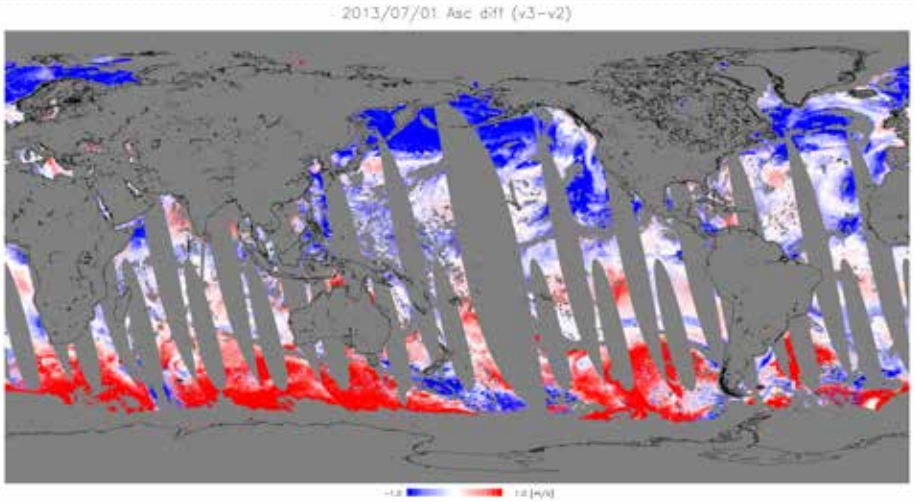
Sea Surface Wind Speed Ver.3 vs Ver.2

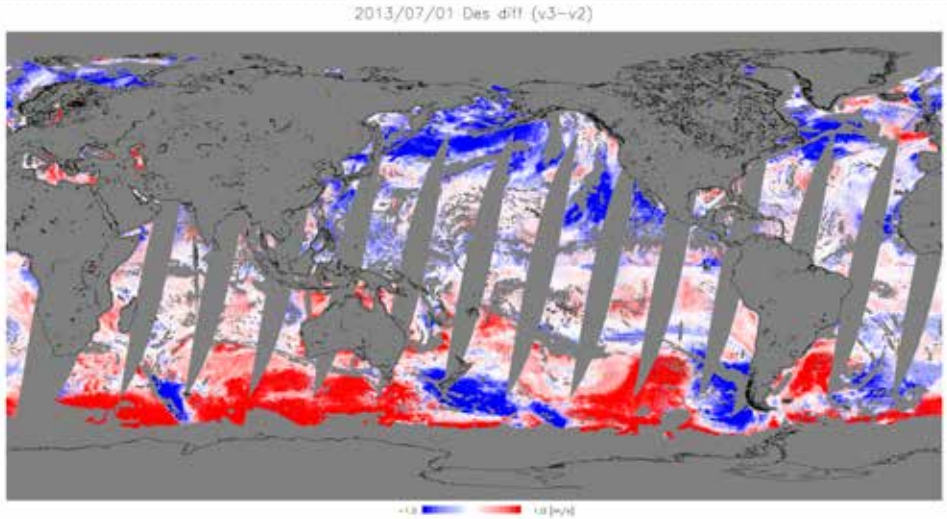
Upper；Ver.3 SSW, Lower：Ver.3-Ver.2 Diff (Left:Asc., Right: Dsc.)

July 1, 2013









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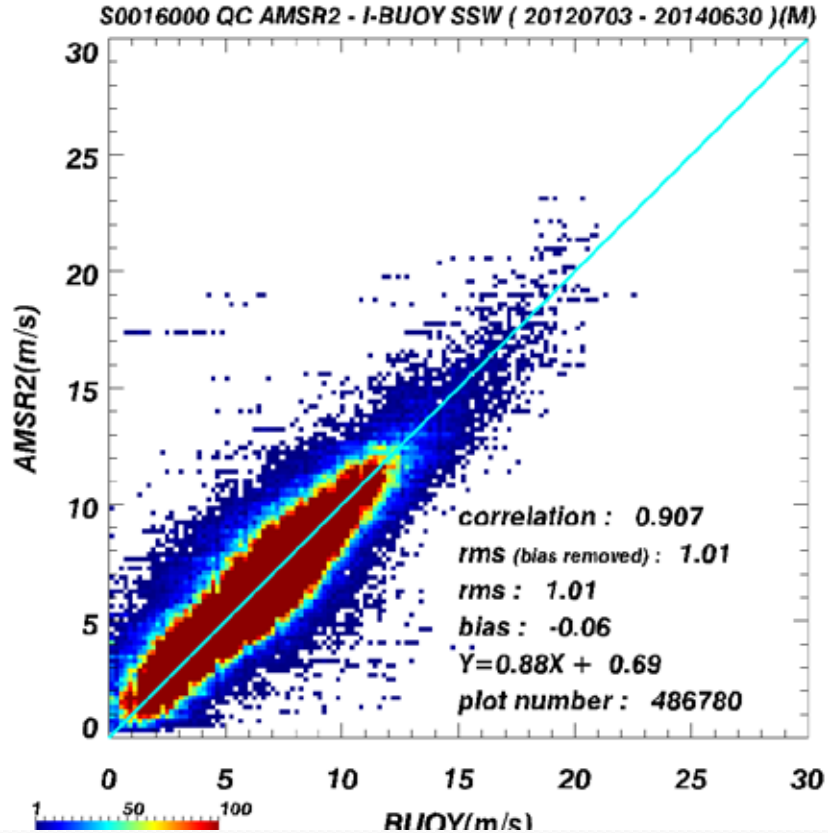
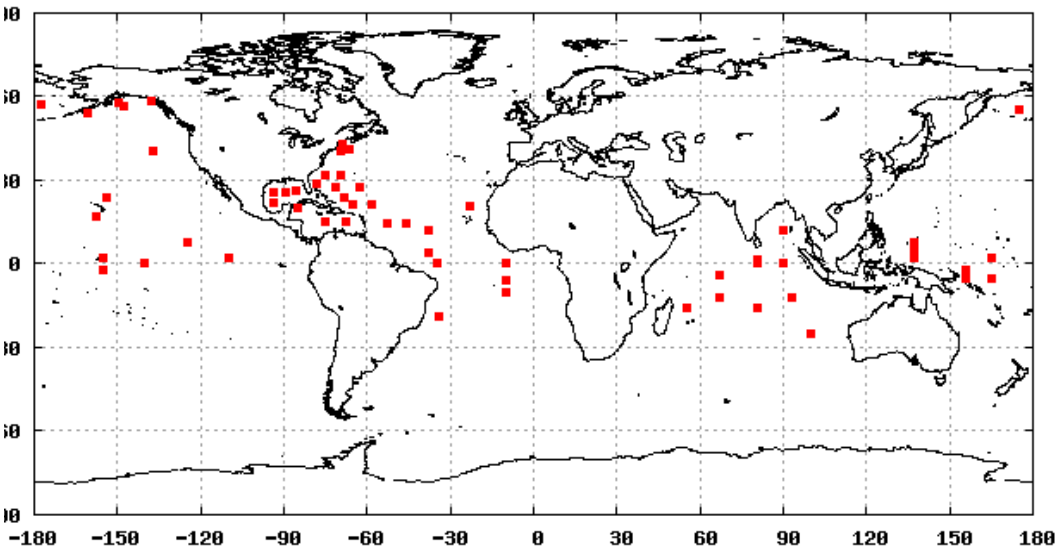
SSW vs Buoys: ASC+DSC

Ver.3(2012.7.3-2014.6.30) (Asc.+Dsc.)



2012.10.1 Buoy match-up points



Asc.+Dsc. Results (RMSE)	Standard/Target Accuracy
1.0 m/s	1.0m/s

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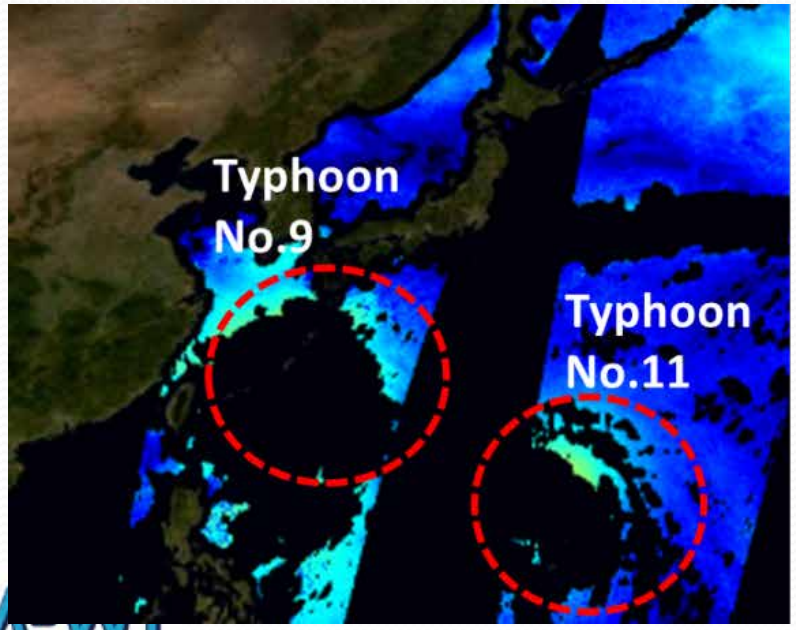
Research Product Integration Status

Product	Target Accuracy	Install at EORC	Early Validation	Current Accuracy
All-weather Sea Surface Wind Speed (ASW)	7 m/s (RMSE) (17-40 m/s area)	Completed	Completed	4.14 m/s Released on Oct. 2015
10GHz SST	0.8 degC (RMSE)	Completed	Completed	0.61 degC Included in SST standard Ver.2
Land Surface Temperature (LST)	Forest area: 3K (RMSE) Coarse vegetation area: 4K (RMSE)	Completed	Completed	3.93~5.00 K
Vegetation Water Content (VWC)	1 kg/m^2 (MAE)	Completed	Completed	1.29 kg/m^2
High-Resolution Sea Ice Concentration (AST)	15% (RMSE)	Completed	Completed	16~22 %
Thin Ice Detection (TSI)	80% (Percentage of right detection)	Completed	Underway	-
Sea Ice Moving Vector (SMV)	±3cm/s (Lat/Lon direction)	Completed	Underway	-

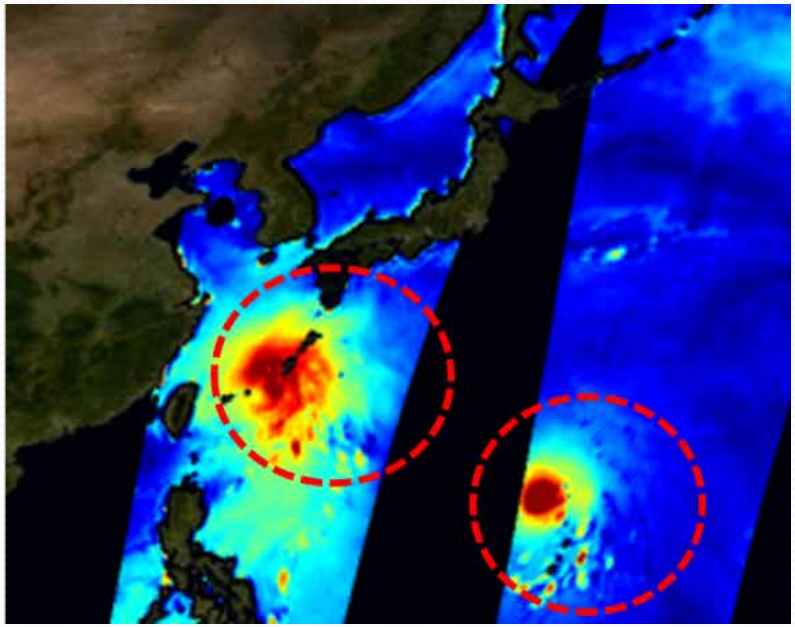
All-weather Sea Surface Wind Speed

- Use 6-GHz/10-GHz channels to avoid influence of rainfall (Shibata, 2006), corresponding to wind speed at best track released by JMA and NHC.
- AMSR2 all-weather SSW Released to public in October 2015 at **http://suzaku.eorc.jaxa.jp/GCOM_W/research/resdist.html**
- Used in JMA's operational typhoon analysis.

AMSR2 Standard SSW



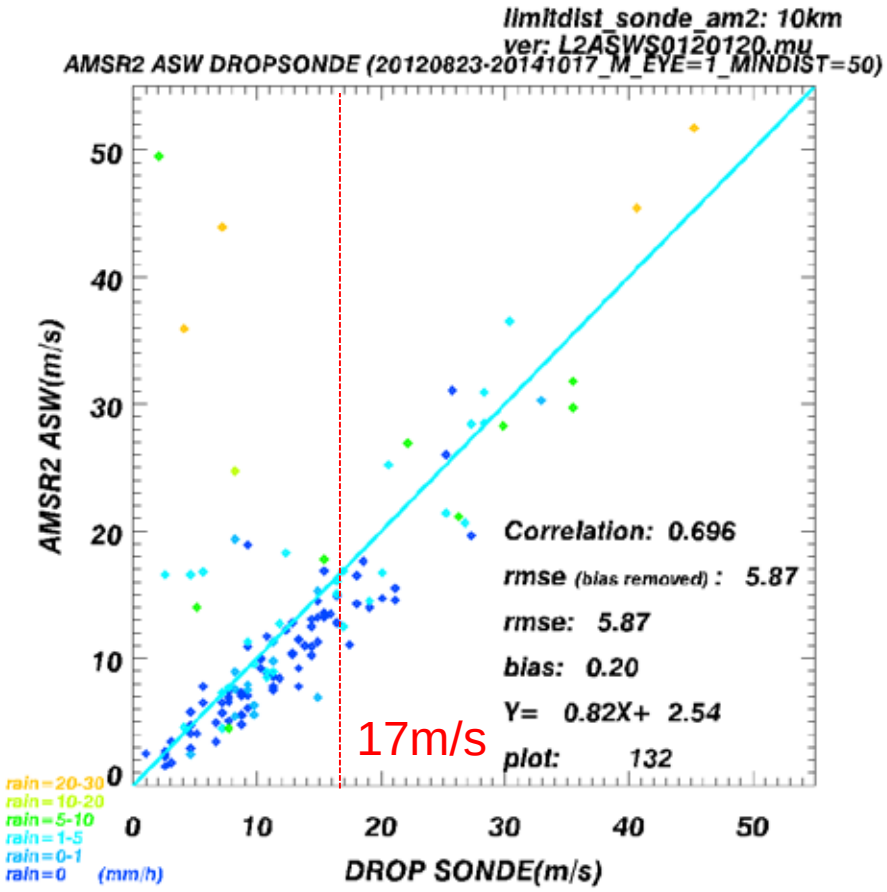
AMSR2 All-weather SSW



ASW Validation by Dropsodne

- Compared with NOAA GPS dropsonde wind speed with distance within 10km and time difference within 90 minute
  - Removed data at EYE_EYEWALL, less than 50km from best track
- Validation result for all-wind range
  - Bias 0.20 m/s
  - RMSE 5.87 m/s
- Validation result of strong wind range (more than 17m/s
  - Bias -1.51 m/s
  - RMSE 4.18 m/s
- Negative bias will be improved in future version

Period：Jul. 2012 – Oct. 2014



GPS-dropsonde data are provided courtesy of the NOAA/AOML/Hurricane Research Division in Miami, FL (USA).

Status of AMSR2 follow-on

- The implementation of a GCOM-W follow-up mission is conditioned on further progress, such as hosted payload arrangements.
- The Roadmap for the Basic Plan on Space Policy, revised in December 2015, stipulates that the government should begin to deliberate the future of the GCOM-W satellite, including the follow-up mission, in FY2016.
  - In June 2016, the Committee on National Space Policy released an interim report that will be reflected in the next revision of the Roadmap for the Basic Plan on Space Policy.
  - The report states that research for AMSR2's successor sensor through hosted payload arrangements with satellites other than the GOCM-W should be initiated in FY2017, taking into account the fact that the AMSR2 has significantly contributed to environmental observation and its data will continue to be sought.
- MEXT included the cost of JAXA's research associated with AMSR2's successor sensor in its budget for next fiscal year.
  - JAXA will conduct the research on the hosted payload capability of AMSR2's successor sensor in the next fiscal year.

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Small but important progress!

About the Next RA

- On Sep. 7, 2016, JAXA issued the "1st Research Announcement (RA) on the Earth Observations."
  - JFY 2017-2018 (two years)
  - Submission deadline: Nov. 15, 2016
- In the 1st RA, JAXA solicits following researches.
  - Product development researches
    - GCOM-W Algorithm Development
    - GCOM-W Calibration & Validation
  - Application researches
    - Each satellite projects (GCOM-W, GCOM-C, TRMM/GPM, ALOS-2)
    - Earth Observation Priority Researches (Ocean Environmental Monitoring, Water Cycle/Water Resource Management, Atmospheric Environmental Monitoring, Infrastructure Displacement, Climate System/Radiation Process, Ecosystems, Agriculture, Public Health)

Summary

- GCOM-W operation is now under the GCOM Project Team led by GCOM Project Manager, Mr. Masaaki Mokuno.
- Satellite, instrument and ground system is all working well.
  - SEU-induced AMSR2 observation halt for 20 hours in Apr. 2016.
  - GCOM-W1 will achieve 5-year designed mission life in May 2017, and expected to continue its operation further.
- L1 minor version (Ver.2.2) update on Aug. 2016
- L2 updates in preparation, Ver.3 scheduled in Jan. 2017.
- Research products integration underway.
  - new candidate, total precipitable water over land
- 1st Research Announcement on Earth Observations. Due date is Nov. 15, 2016.

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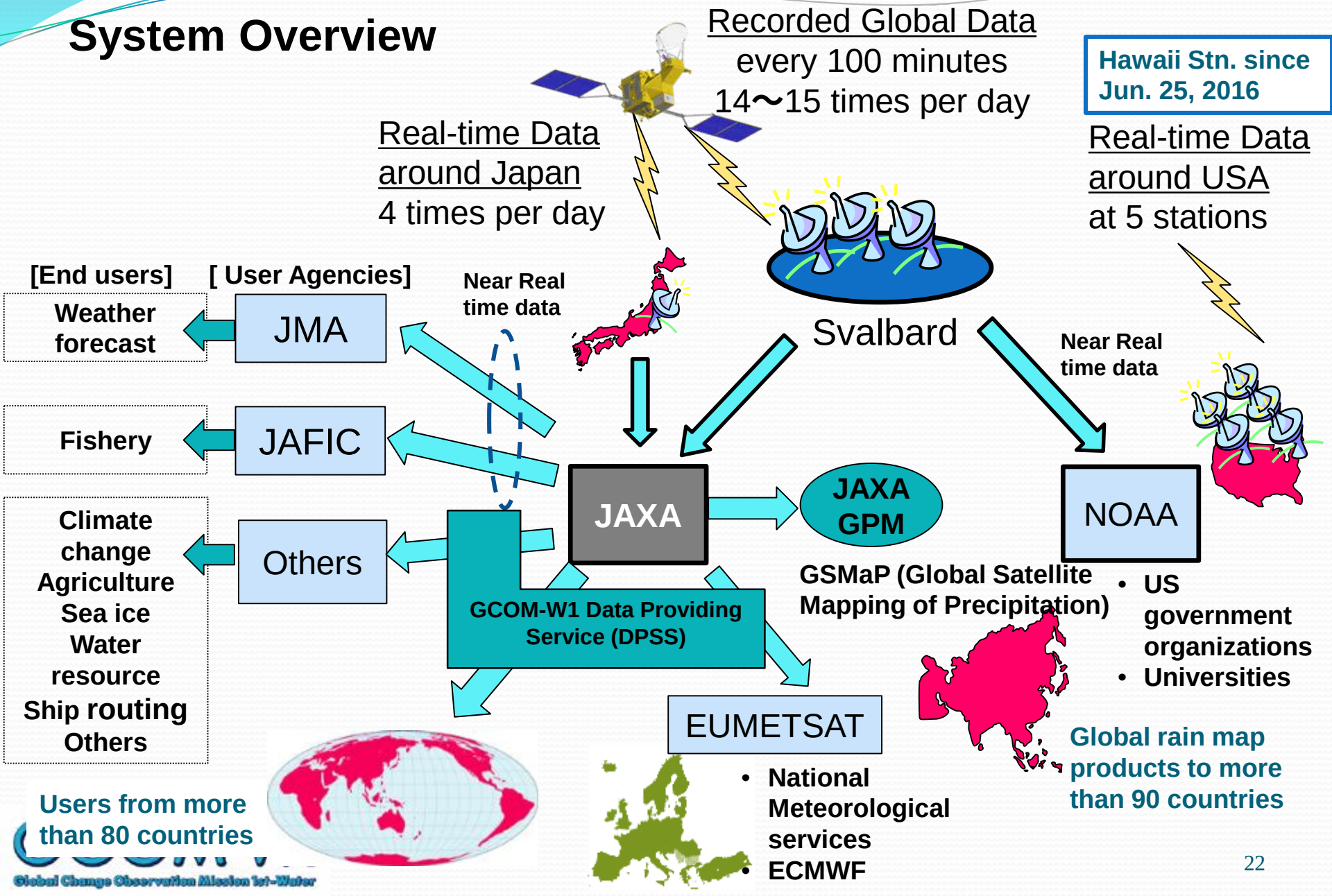
backup

GCOM-W Ground System Overview



Major Data Loss Events

Date	Event	Data loss
Jul. 17, 18, 23, 2012	AMSR2 onboard parameter change	Half orbit each day
May 10-14, 2012	SEU-induced AMSR2 observation halt	About 4-day
Mar. 27, May 27, 2013	Inclination Adjust Maneuver	Half orbit each IAM
Mar. 4, Apr. 16, 2014	Inclination Adjust Maneuver	Half orbit each IAM
Mar. 11, May 13, 2015	Inclination Adjust Maneuver	Half orbit each IAM
Dec. 4, 2015	SEU-induced data recorder halt	About 20 hours
Mar. 2, Jun. 15, 2016	Inclination Adjust Maneuver	Half orbit each IAM
Apr. 15-16, 2016	SEU-induced AMSR2 observation halt	About 20 hours
Aug. 3, 2016	Retrograde Maneuver	Half orbit

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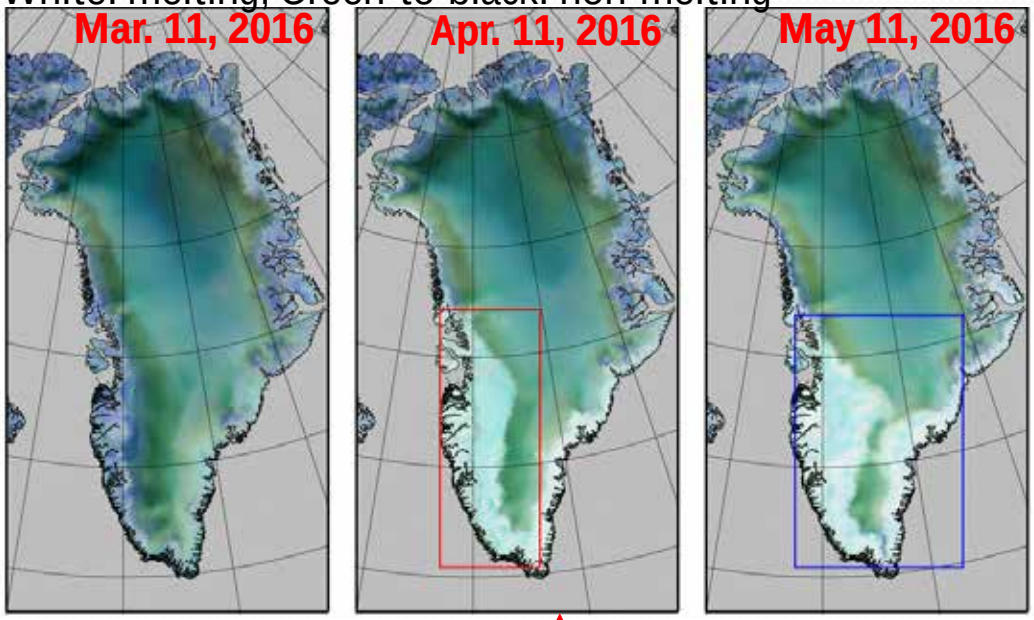
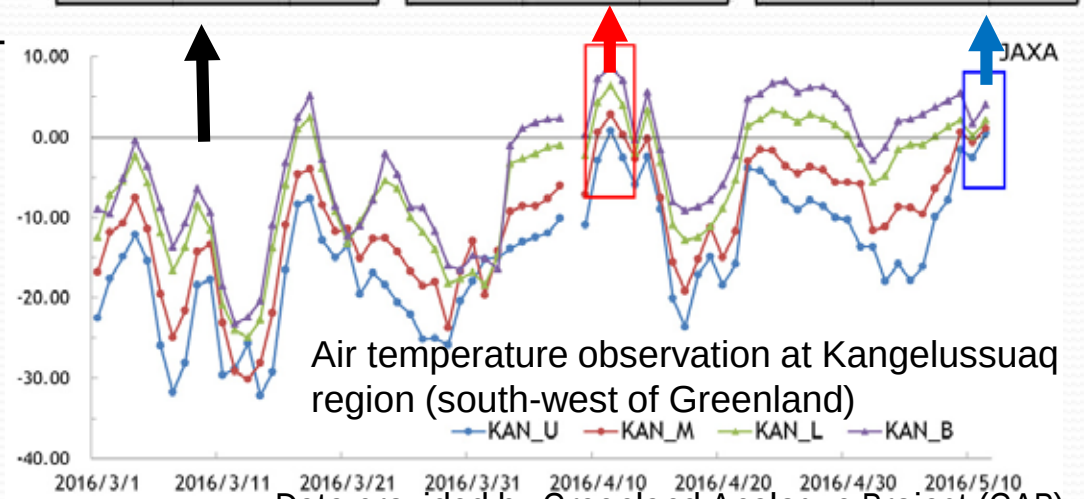
AMSR2 Captures large-scale Melting of Ice Sheet over the Greenland

- AMSR2 captures surface melting of ice sheet over the Greenland in large-scale. Usually, that melting starts during the end of May to early June, but this year, the melting seems to start anomalously earlier.
- This rapid melting may be caused by rapid increase of temperature starting from early April.
- Ground observation records 11.4 degC at lower altitude area (KAN_B, 350m, purple-line), and even at high-altitude region (KAN_U, 1840m, blue-line), observation records higher than 0degC on April 11.

Color composite of AMSR2 TB (18V/36V/36H).
White: melting, Green-to-black: non-melting





Air temperature observation at Kangelussuaq region (south-west of Greenland)

Data provided by Greenland Analogue Project (GAP)

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