



RECENT CAL/VAL UPDATES OF THE GCOM-W/AMSR2

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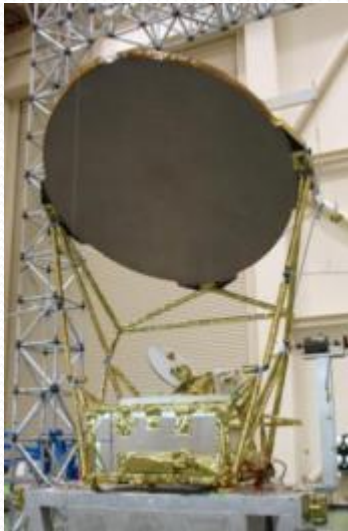
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July 21, 2015 @ GHRSSST-XVI, Noordwijk, Netherland

AMSR2 on GCOM-W



- ✓ Successor of AMSR-E on Aqua and AMSR on ADEOS-II.
- ✓ Deployable main reflector system with 2.0m diameter (1.6m for AMSR-E).
- ✓ Frequency channel set is identical to that of AMSR-E except 7.3GHz channel for RFI mitigation.
- ✓ Two-point external calibration with improved HTS (hot-load).
- ✓ Add a redundant momentum wheel to increase reliability.

GCOM-W1/AMSR2 characteristics	
Scan and rate	Conical scan at 40 rpm
Antenna	Offset parabola with 2.0m dia.
Swath width	1450km (effective > 1600km)
Incidence angle	Nominal 55 degrees
Digitization	12bits
Dynamic range	2.7-340K
Polarization	Vertical and horizontal

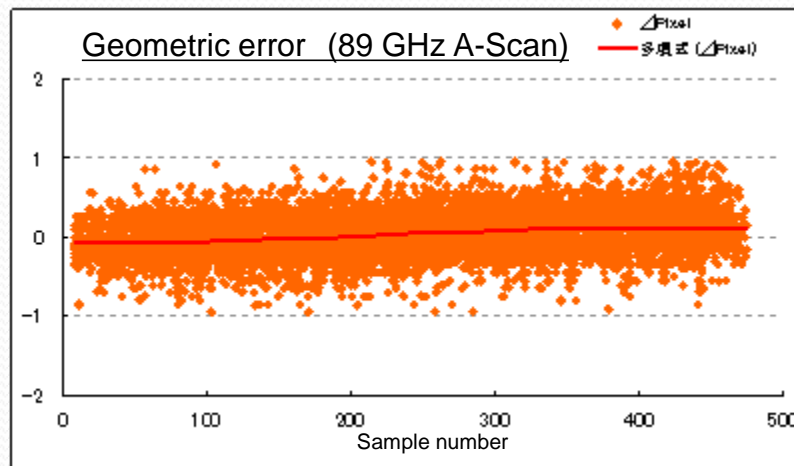
AMSR2 Channel Set				
Center Freq. [GHz]	Band width [MHz]	Pol.	Beam width [deg] (Ground res. [km])	Sampling interval [km]
6.925/ 7.3	350	V and H	1.8 (35 x 62)	10
10.65	100		1.2 (24 x 42)	
18.7	200		0.65 (14 x 22)	
23.8	400		0.75 (15 x 26)	
36.5	1000		0.35 (7 x 12)	
89.0	3000		0.15 (3 x 5)	5

AMSR2 L1 Update Overview

- AMSR2 level-1 algorithms and parameters were updated based on the validation results since the public release of Ver. 1.1 product on March 1, 2013.
- Update highlights:
 - Correction of the antenna temperature of the cold calibration target (CSM)
(max 0.2K for 6.9 V/H, 7.3 V/H)
 - Removal of radio frequency interference (RFI) included in the CSM
(max 3K for 10.65 V and max 0.1K for 18.7 V)
 - Removal of RFI included the hot calibration target (HTS)
 - Optimization of scan-bias correction
(max 2.5K for 6.9 V/H, 7.3 V/H and 10.65 V/H only at the scan-edge)
 - Optimization of geometric calibration (see the next page)
 - Weighting coefficients to calculate brightness temperatures in L1R products from those in L1B products
(max 2K for all channels)

There is almost no variation in brightness temperatures between Ver. 2 and Ver. 1.1 under normal situation.

Geometric Calibration



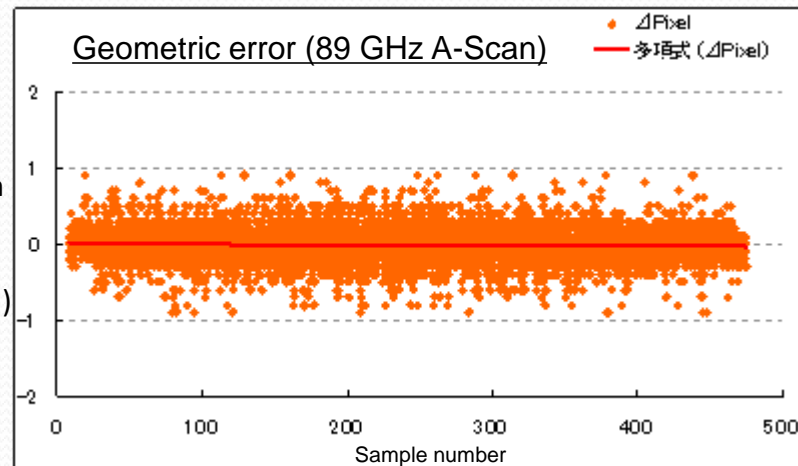
➡

Azimuth direction

RMSE

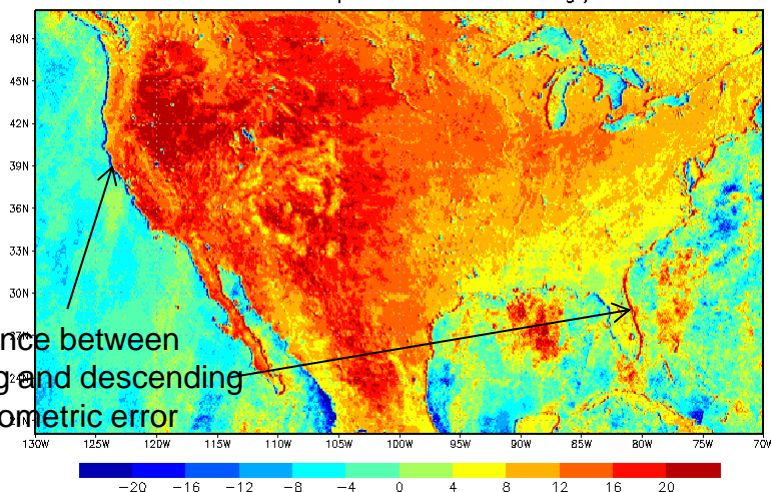
(1[pixel] = 4.5[km])

0.331 \Rightarrow 0.259



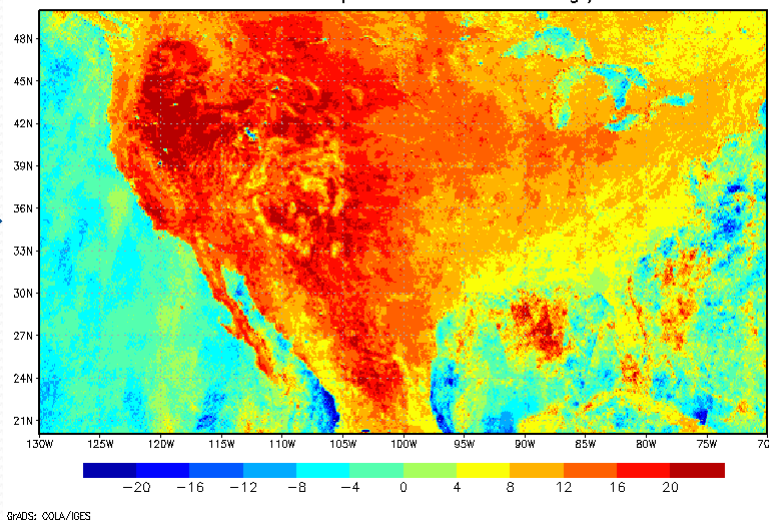
Current version (Version1.1)

Ver1.1 36.5GHz Hpol Asc. - Des. Aug./2012



New version (Version2.0)

Ver2.0 36.5GHz Hpol Asc. - Des. Aug./2012



Tb difference between ascending and descending (36GHz H-pol.)

AMSR2 Standard Products

Products		Areas	Res.	Accuracy			Range
				Release	Standard	Goal	
Brightness Temperature		Global	5-50km	±1.5K	±1.5K	±1.0K (systematic) ±0.3K (random)	2.7-340K
G E O	Integrated water vapor	Global, over ocean	15km	±3.5kg/m²	±3.5kg/m²	±2.0 kg/m²	0-70kg/m²
	Integrated cloud liquid water	Global, over ocean	15km	±0.10kg/m²	±0.05kg/m²	±0.02kg/m²	0-1.0kg/m²
	Precipitation	Global, except cold latitude	15km	Ocean ±50% Land ±120%	Ocean ±50% Land ±120%	Ocean ±20% Land ±80%	0-20mm/h
	Sea surface temperature	Global, over ocean	50km	±0.8°C	±0.5°C	±0.2°C	-2-35°C
	Sea surface wind speed	Global, over ocean	15km	±1.5m/s	±1.0m/s	±1.0m/s	0-30m/s
	Updated to version 2 in Mar. 2015.						
Soil moisture		Land	50km	±10%	±10%	±5%	0-40%

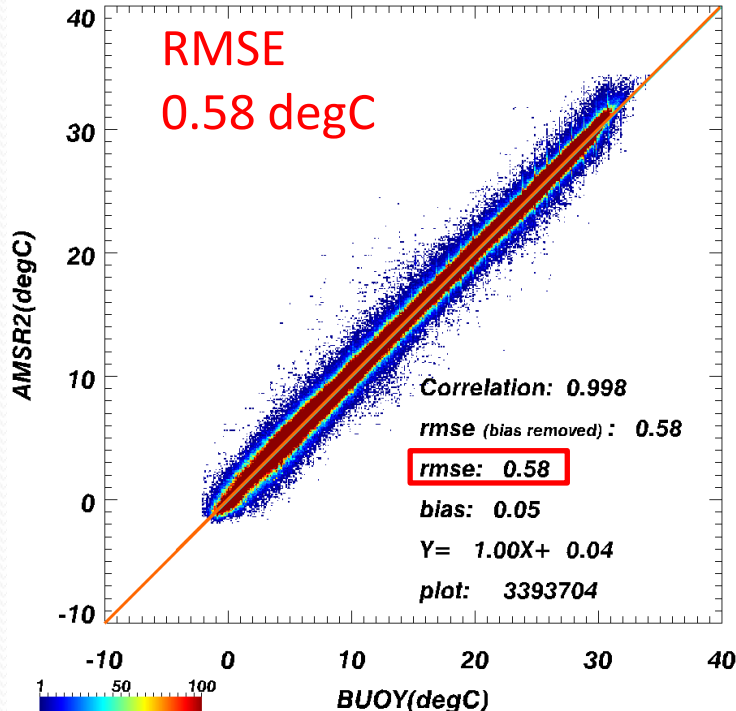
Sea Surface Temperature Ver. 2

- Update Highlights
 - Addition of RFI removal method.
 - Refined 6GHz Vertical polarization brightness temperature correction table.
 - Refined sea surface wind speed correction method.
 - Addition of 10GHz observed SST (research product, missing values stores SST less than 9 degC) to the second layer in the SST product.
- Improvement Highlights
 - Improvements in RFI error removal, brightness temperature error correction, and sea surface wind speed error removal.
- Validation
 - Matchup AMSR2 and buoy data included in NOAA's iQuam dataset with time difference within 2 hour and distance less than 30 km from August 1, 2012 to July 31, 2014.

Validation of Sea Surface Temperature

Ver. 2

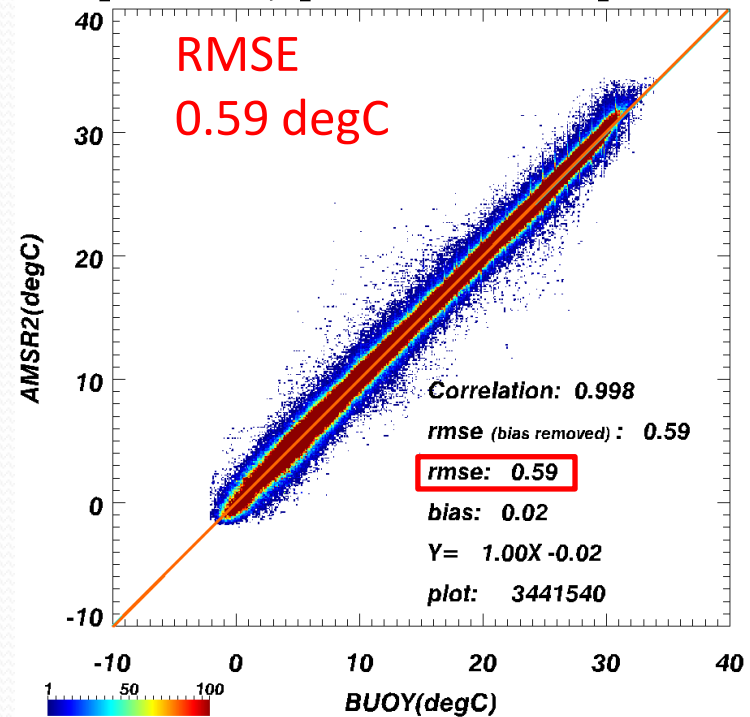
AMSR2_6G-IQUAM SST (All_term 20120801-20140731 M0_L2SSTS0013000.mu)



vs
iQuam
Buoy

Ver. 1

AMSR2_6G-IQUAM SST (All_term 20120801-20140731 M0_L2SSTB1100100.mu)



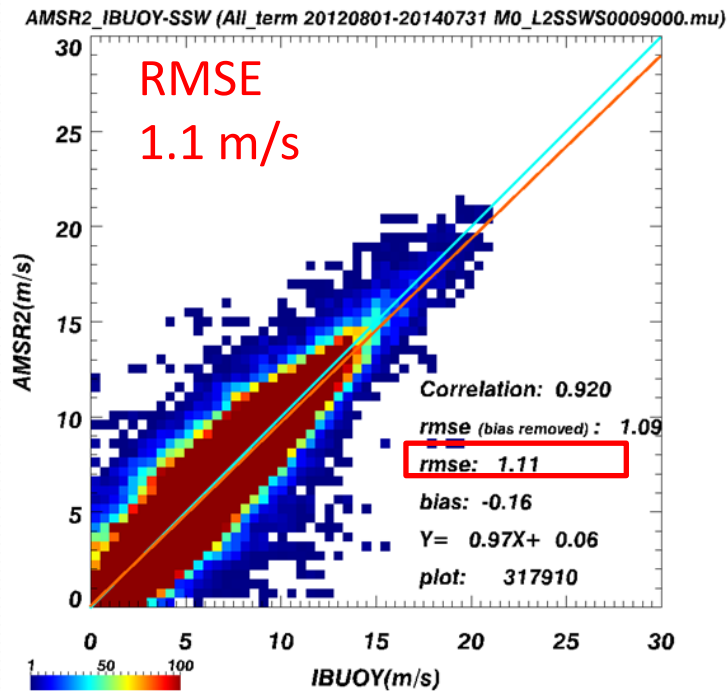
- New version shows smaller error compared to current version.
- This value also satisfied release accuracy of 0.8 degC.

Sea Surface Wind Speed Ver.2

- Update Highlights
 - Refined wind direction correction.
 - Updated wind speed conversion table.
- Improvement Highlights
 - Improvements in positive biases of AMSR2 in weak and strong wind speed ranges.
- Validation Method
 - Matchup AMSR2 and quality controlled buoy data with time difference within 2 hour and distance less than 30 km from July 23, 2012 to July 31, 2014.

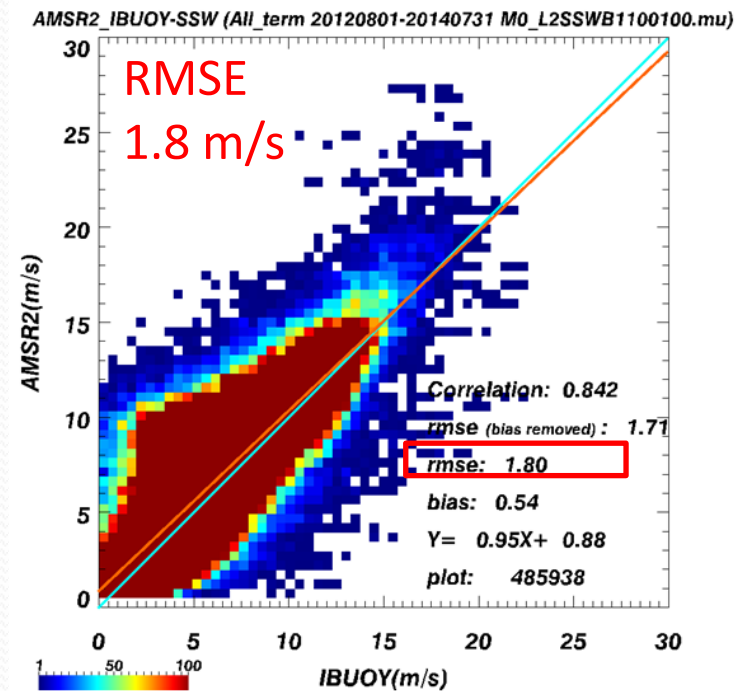
Validation of Sea Surface Wind Speed

Ver. 2



vs Buoy

Ver. 1



- New version shows smaller error compared to current version.

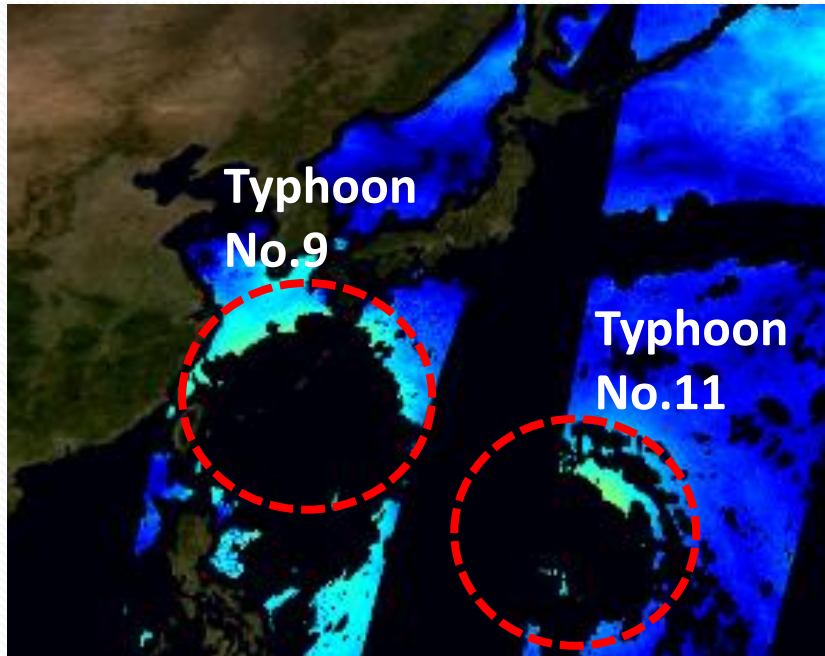
AMSR2 Research Products

Products	Area	Resolution	Target accuracy	Range
All-weather sea surface wind speed	Ocean	60 km	± 7 m/s (at 15-40 m/s range)	0 - 70 m/s
10-GHz sea surface temperature	Ocean	30 km	± 0.8 °C	9 – 35 °C
Soil moisture and vegetation water content based on the land data assimilation	Africa, Australia	25 km	soil moisture: $\pm 8\%$ vegetation water: ± 1 kg/m ²	0 – 100 % 0 - 2 kg/m ²
Land surface temperature	Land	15 km	forest area: ± 3 °C nondense vegetation: ± 4 °C	0-50 °C
Vegetation water content	Land	10 km	± 1 kg/m ²	0 – 4 kg/m ²
High resolution sea ice concentration	Ocean in high latitude	5 km	± 1 %	0 – 100 %
Thin ice detection	Okhotsk sea	15 km	± 80 %	N/A
Sea ice moving vector	Ocean in high latitude	50 km	2 components: 2 cm/s	0 - 40 cm/s

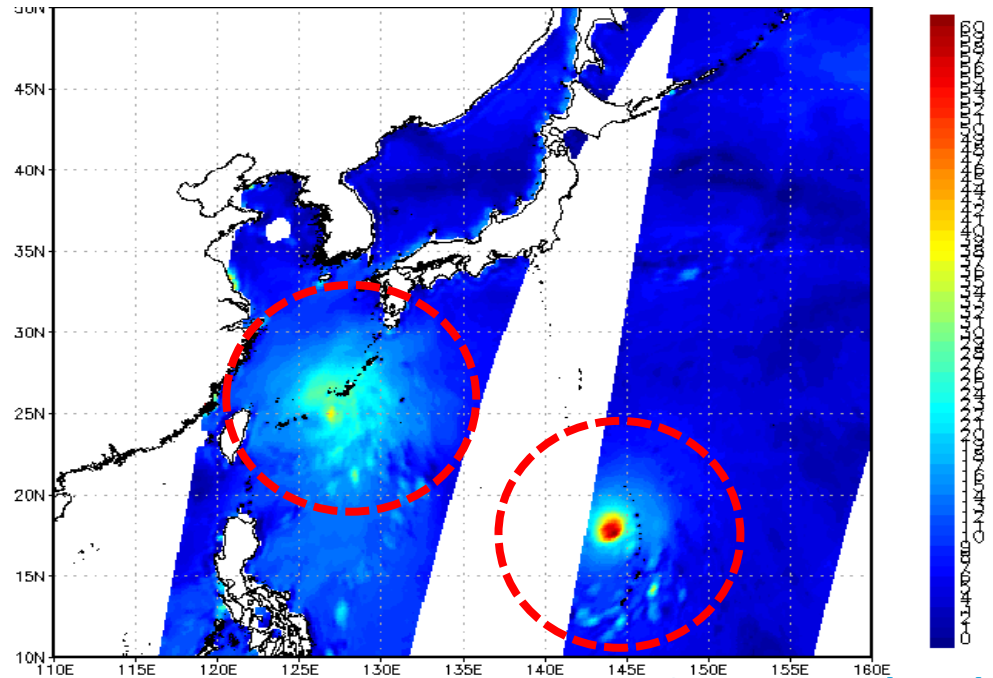
Defined in March 2015.

All-Weather Sea Surface Wind Speed

Standard Sea Surface Wind Speed



All-Weather Sea Surface Wind Speed

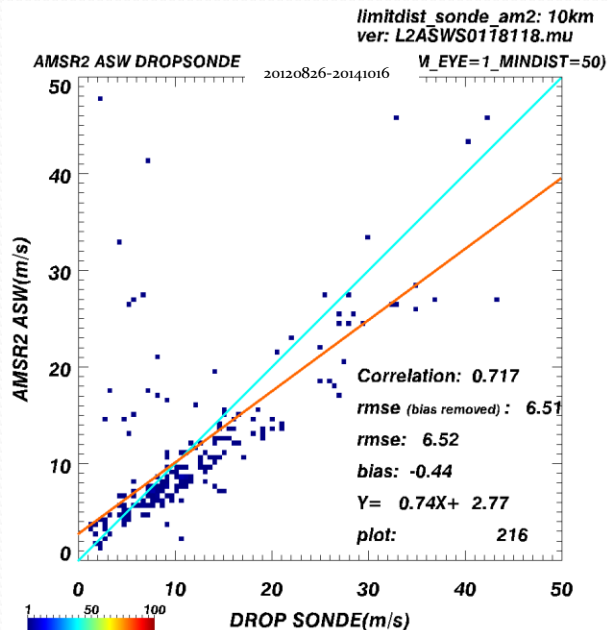


Jul. 9, 2015 (Dsc)

- 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.
- Enable to estimate wind speed under tropical cyclones (typhoons, hurricanes, cyclones) when standard one is missing.

Early Validation Results of ASW

Period: Aug. 2012 - Oct. 2014



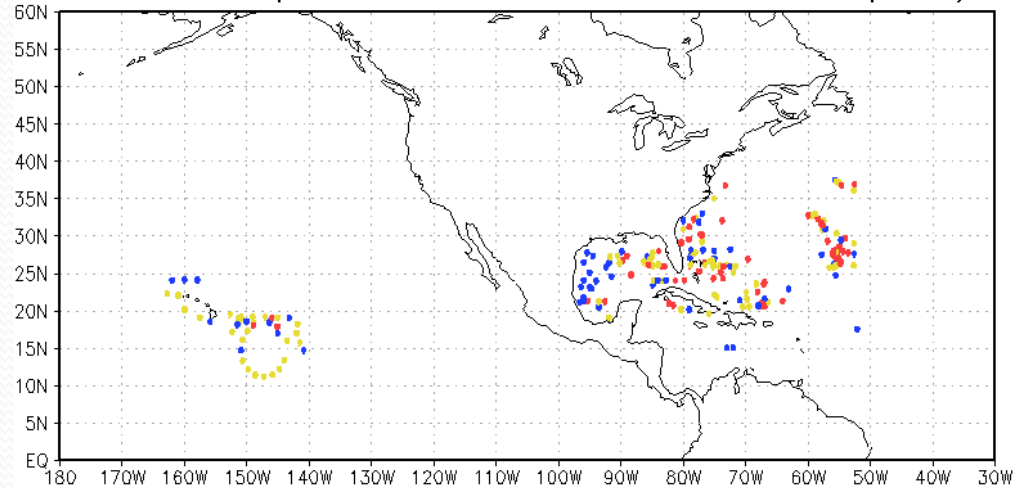
Number of obs.	216
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Bias	-0.44
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RMSE	6.52
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RMSE(bias removed)	6.51
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<AMSR2 ASW dropsonde start:20120723 end:20141016 plot A/D >



Currently we are working on evaluation of ASW accuracy for future data release in Autumn 2015. AMSR2 ASW was match-up with GPS-dropsonde data.

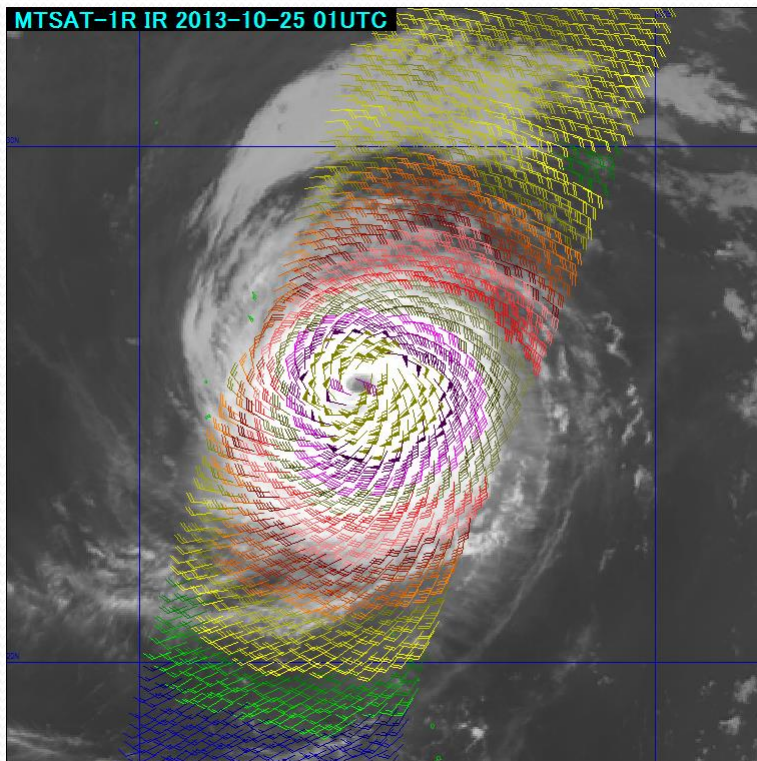
RMSE is 6.52 m/s at whole wind speed ranges. Although it satisfied target accuracy (7m/s@15~40m/s), we plan to refine the algorithm further before the release.

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

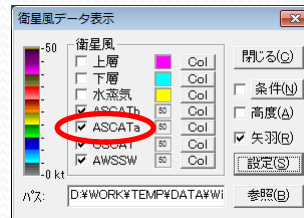
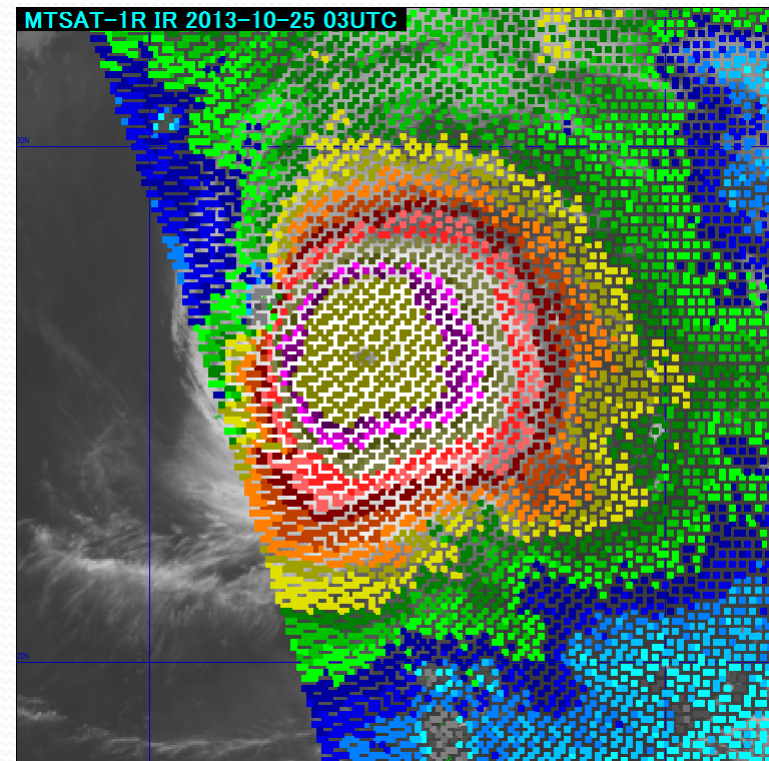
Use of ASW at JMA

- JMA uses AMSR2 All-weather sea surface wind speed (ASW) in their operational Typhoon analysis along with other satellites.

MetOp-A/ASCAT



AMSR2 ASW

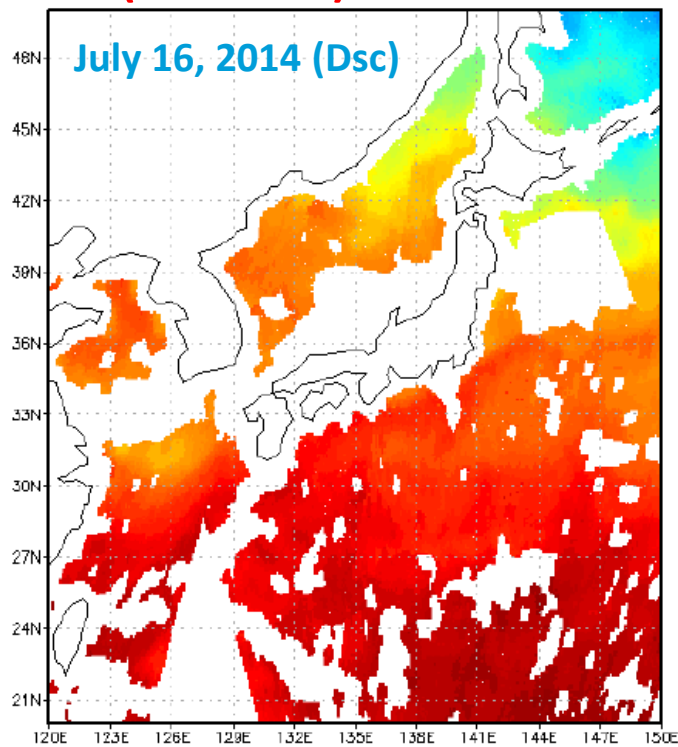


Typhoon No.28 in 2013

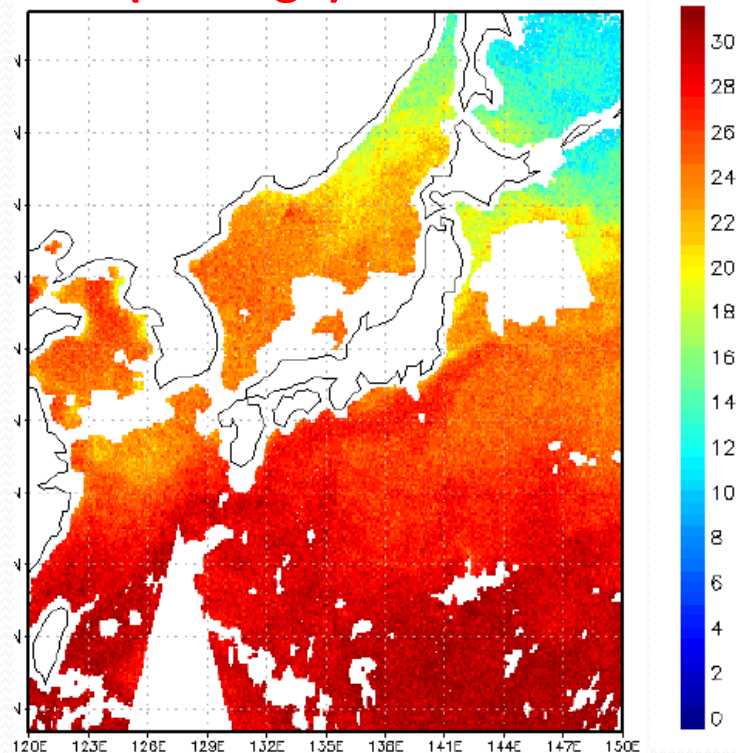
(Images provided by JMA)

10-GHz SST

**AMSR2 6-GHz SST
(standard) 35x62 km**



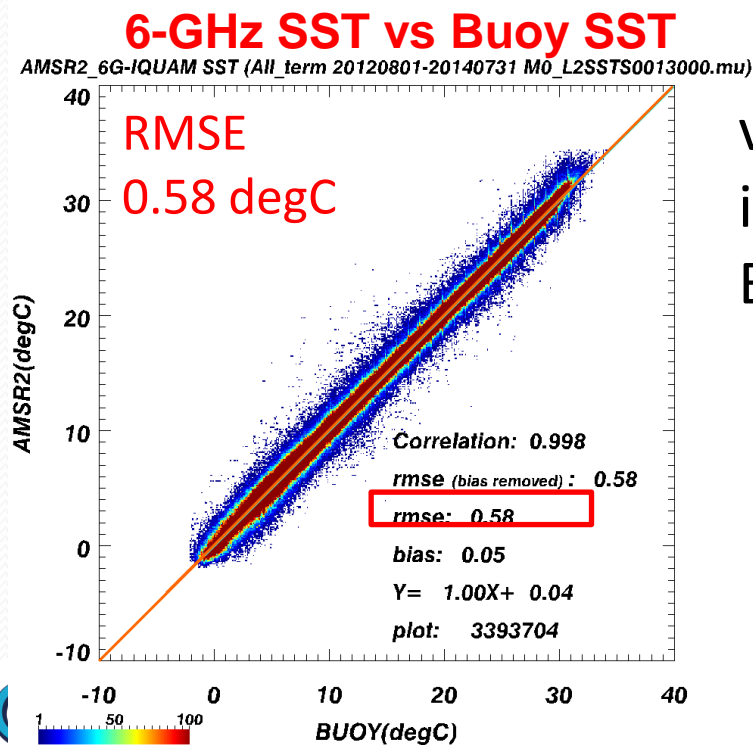
**AMSR2 10-GHz SST
(> 9 degC) 23x42 km**



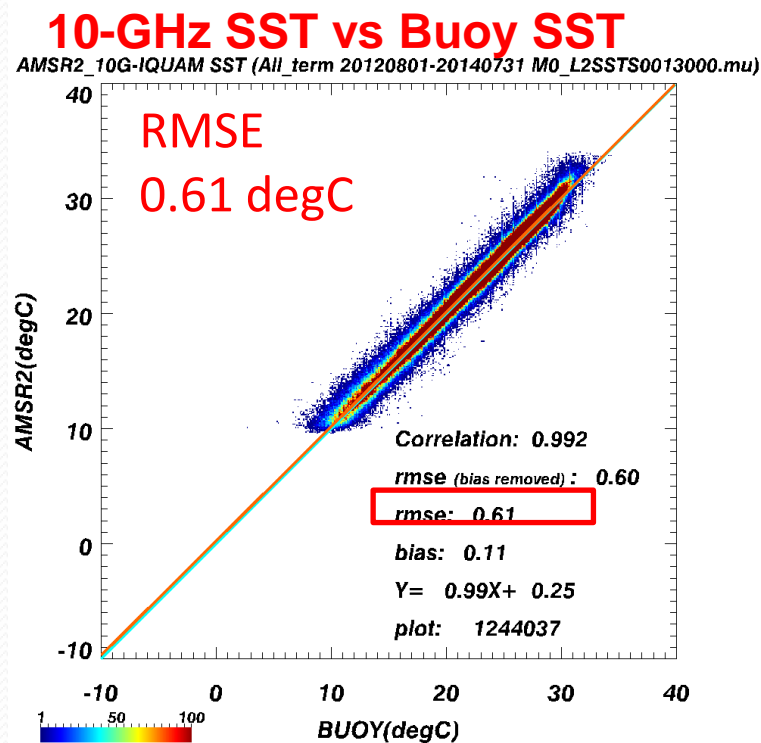
- 10GHz observed SST is included in the AMSR2 SST product in addition to standard SST, in order to provide complementary information to users.
- 10GHz SST that is less than 9 degC is set to missing value since it has poor sensitivity to low temperature range

Validation of 10-GHz SST

- Validation of 10GHz SST uses same method and data to those of 6GHz SST.
- RMSE of 10GHz SST to iQuam buoy SST is 0.61 degC, and 10GHz SST more than 9 degC shows almost equal performance to that of 6GHz SST (0.58 degC).



vs
iQuam
Buoy

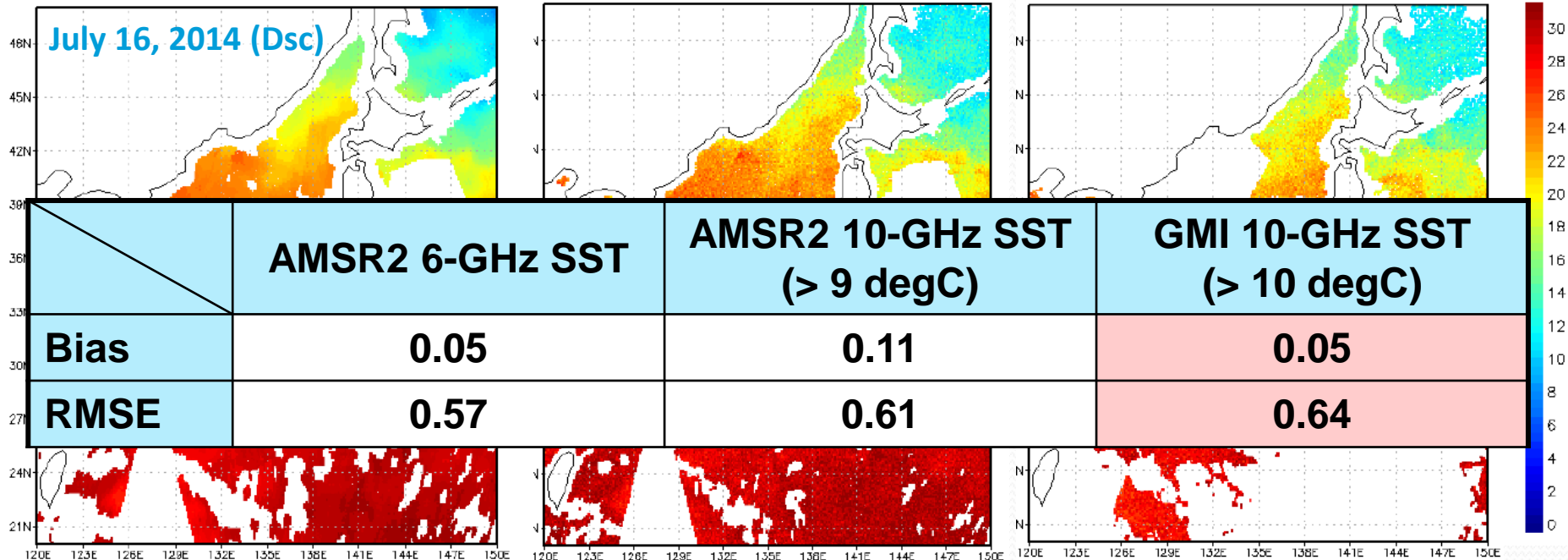


GPM-Core/GMI SST

AMSR2 6-GHz SST
(standard) 35x62 km

AMSR2 10-GHz SST
(> 9 degC) 23x42 km

GMI 10-GHz SST
(> 10 degC) 19x32 km

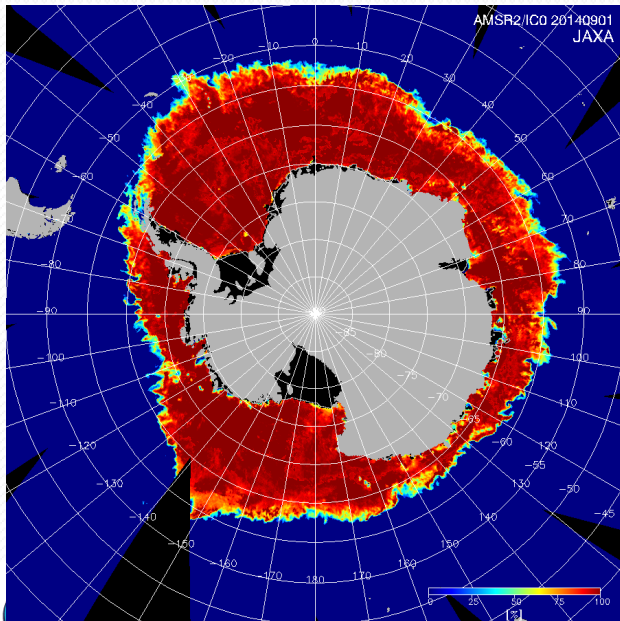


- GMI SST algorithm was developed based on AMSR2 10-GHz SST algorithm.
- GMI SST is already available from JAXA GHRSSST server (<http://suzaku.eorc.jaxa.jp/GHRSSST/>)

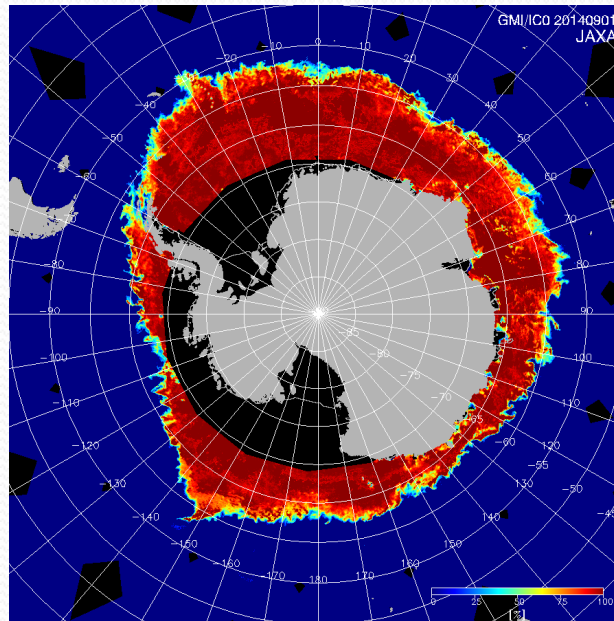
GPM Sea Ice Concentration

- GMI Sea ice concentration algorithm was developed based on that for AMSR2 except weather filter using 36-GHz V channel instead of 6-GHz V channel.
- DPR Sea ice concentration was produced by comparing noise power of DPR Ku-band (13.6-GHz) and AMSR2 SIC. Finer resolution SIC maps (5 km) can be obtained although the coverage is smaller.

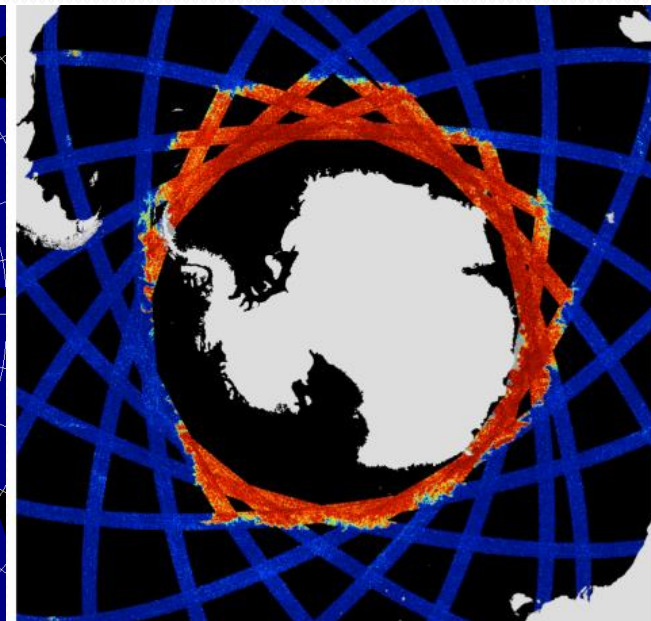
AMSR2 (1 Sep. 2014)



GMI (1 Sep. 2014)



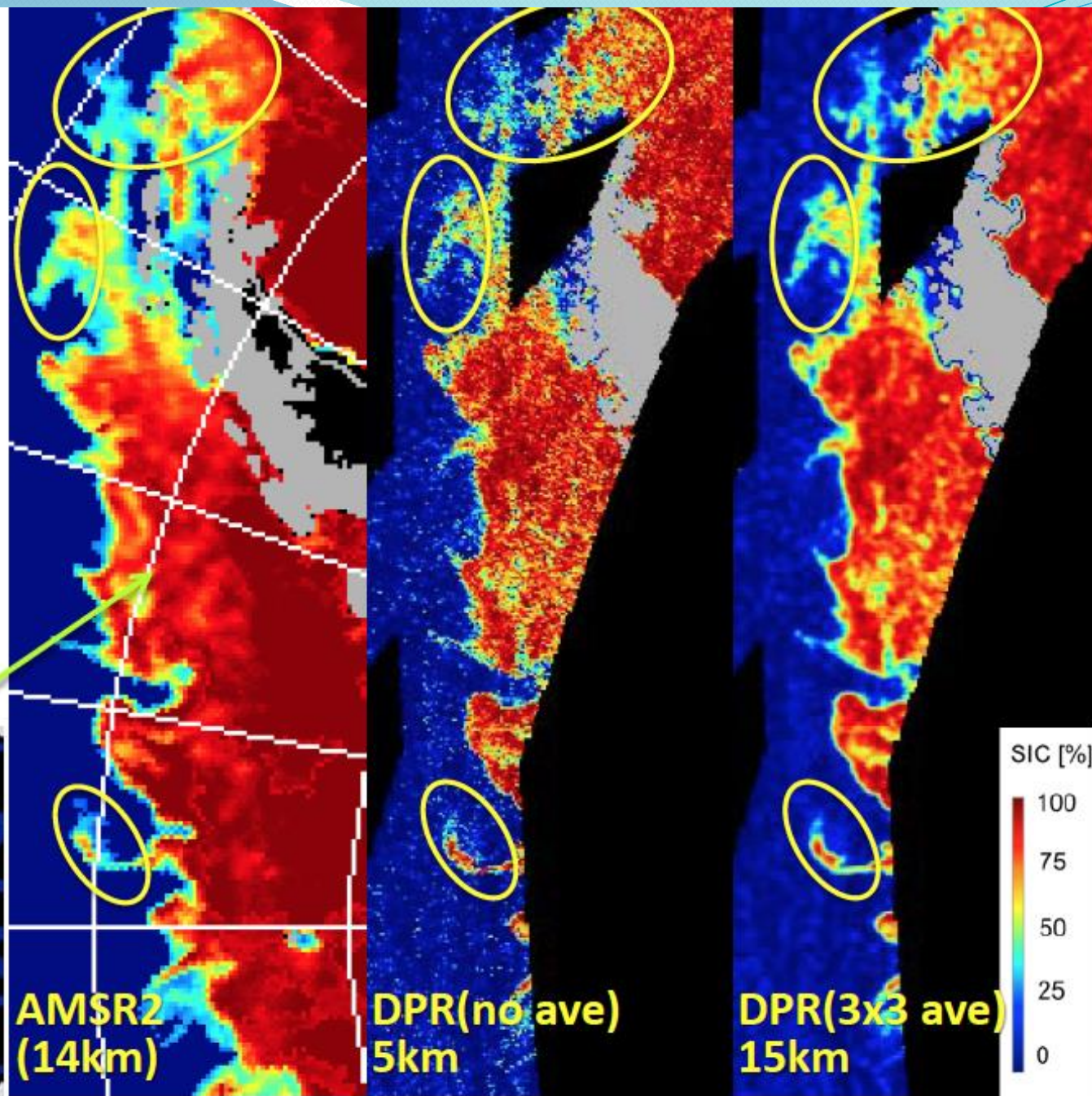
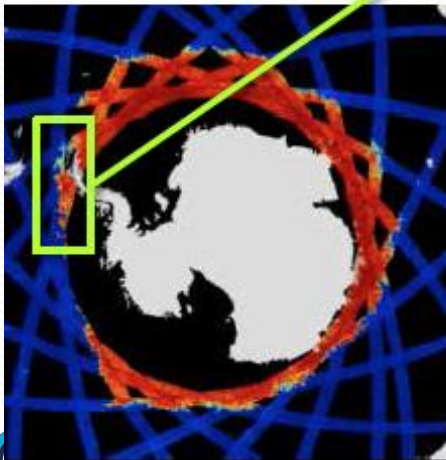
KuPR (1 Sep. 2014)



(DPR sea ice concentration: Motooka et al.,¹⁷ in preparation)

SIC images
from AMSR2
BT & GPM
DPR (noise
power) data
(preliminary)

KuPR (2014.9.1)



(Motooka et al.,¹⁸ in preparation)

Summary

- Standard Products
 - All standard products were updated to Ver.2 in March-to-April 2015. L2 reprocessing of past period is on-going.
 - Non-linear bias in L1 TB found during cross-calibration is not corrected, because we do not know the reason causes this. We're continuing cross-calibration among AMSR2, GMI and AMSR-E.
- Research Products
 - All-weather sea surface wind speed (ASW) is currently being validated by using GPS-dropsonde observations near hurricanes toward public release. JMA uses ASW since 2013. Planning to release ASW in 2015.
 - 10-GHz SST is already included in AMSR2 SST products in addition to standard SST. Japan Coast Guard uses 10-GHz SST since 2013.
 - We set missing value to SST less than 9degC of 10-GHz SST in standard product - Does GHRSSST request 10-GHz SST without missing value in low temperature but with flagging in l2p_flag?
- Collaboration with the GPM to produce GPM ocean products.