

# Validation status of AMSR2 geophysical products



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AMSR-E Joint Science Team Meeting  
Oxnard, Sept. 4-5, 2013



# AMSR2 Standard Products

Products	Areas	Res.	Accuracy			PI	
			Release	Standard	Goal		
G E O	Integrated water vapor	Global, over ocean	15km	$\pm 3.5\text{kg/m}^2$	$\pm 3.5\text{kg/m}^2$	$\pm 2.0\text{ kg/m}^2$	Kazumori
	Integrated cloud liquid water	Global, over ocean	15km	$\pm 0.10\text{kg/m}^2$	$\pm 0.05\text{kg/m}^2$	$\pm 0.02\text{kg/m}^2$	Kazumori
	Precipitation	Global, except cold latitude	15km	Ocean $\pm 50\%$ Land $\pm 120\%$	Ocean $\pm 50\%$ Land $\pm 120\%$	Ocean $\pm 20\%$ Land $\pm 80\%$	Aonashi
	Sea surface temperature	Global, over ocean	50km	$\pm 0.8^\circ\text{C}$	$\pm 0.5^\circ\text{C}$	$\pm 0.2^\circ\text{C}$	Shibata
	Sea surface wind speed	Global, over ocean	15km	$\pm 1.5\text{m/s}$	$\pm 1.0\text{m/s}$	$\pm 1.0\text{m/s}$	Shibata
	Sea ice concentration	Polar region, over ocean	15km	$\pm 10\%$	$\pm 10\%$	$\pm 5\%$	Comiso and Cho
	Snow depth	Land	30km	$\pm 20\text{cm}$	$\pm 20\text{cm}$	$\pm 10\text{cm}$	Kelly
	Soil moisture	Land	50km	$\pm 10\%$	$\pm 10\%$	$\pm 5\%$	Koike

Research algorithms are not listed here.

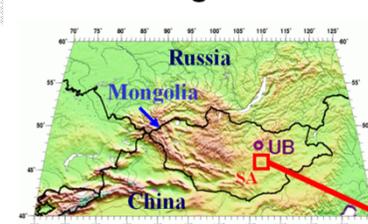
# AMSR2 Validation Activities

- Validation by utilizing the existing observation and/or networks:
  - Radiosondes and GPS networks, SST and sea surface wind speed from various buoy system, in-situ snow depth and other surface measurements by meteorological agencies, match-up with other satellite, etc.
- Specific field campaigns/monitoring
  - Soil moisture test sites such as Mongolia, Thailand, and CEOP sites including Australia Murray-Darling Basin.

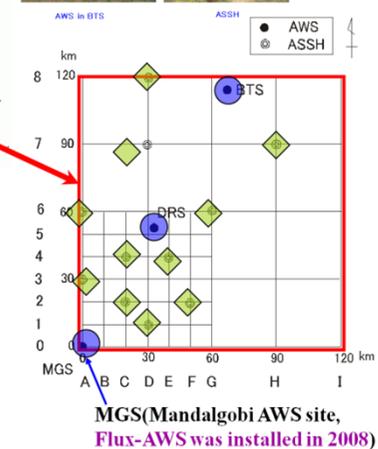
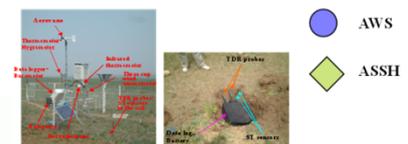


AMSR-E/AMSR2 Validation Sites

## Mongolia



Soil moisture stations (AWS and ASSH) in the MAVEX (Mongol AMSR/AMSR-E/ALOS Validation Experiment) study area as of April, 2008 (●: AWS (Automatic Weather Station), ◆: ASSH (Automatic Station for Soil Hydrology), SA: Study area of AMPEX/MAVEX, UB: Ulaanbaatar)

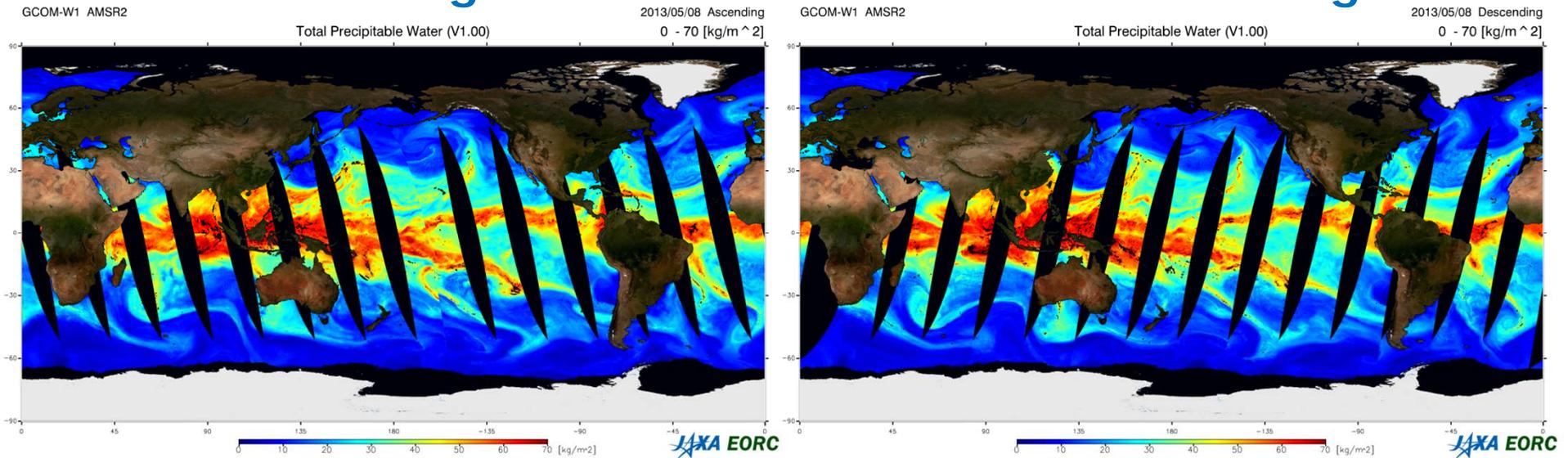


# Integrated Water Vapor

May 8, 2013

Ascending

Descending



- Validation period:

- Radiosonde (RAOB): from July 24, 2012 to March 31, 2013.
- GPS: from July 24, 2012 to March 30, 2013.

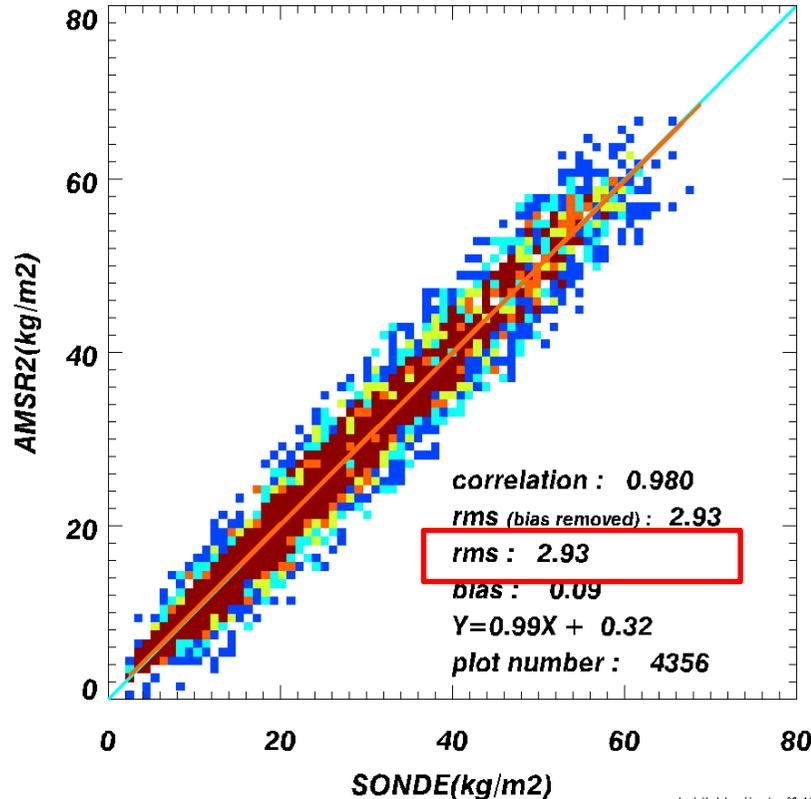
- Match-up condition:

- RAOB: Distance less than 30km, Time difference within 6-hr, nearest AMSR2 TPW observations to RAOB site
- GPS: Distance less than 30km, Time difference within 3 minutes, nearest AMSR2 TPW observations to GPS site

# Integrated Water Vapor

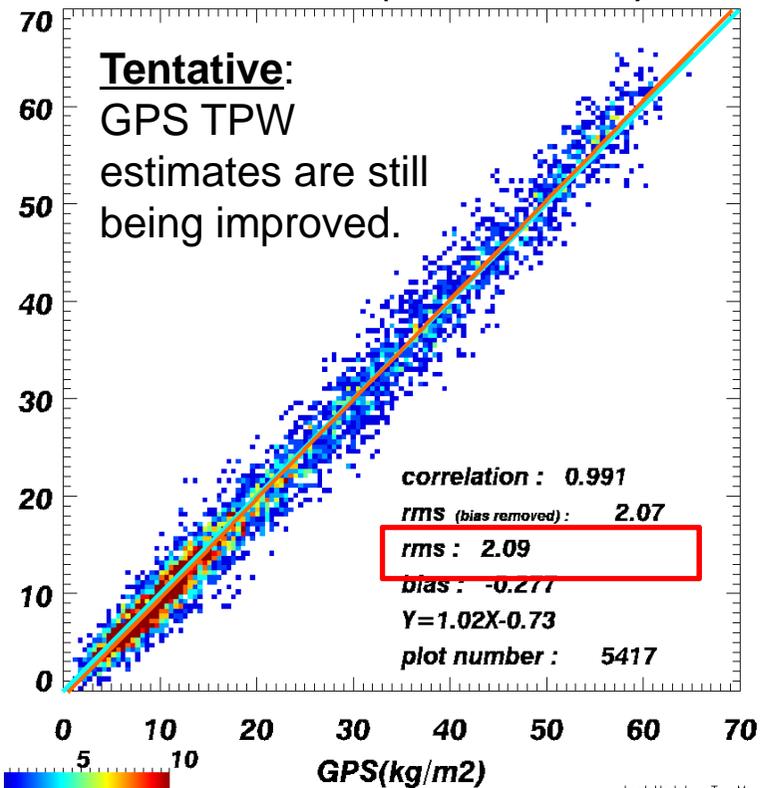
## with Radiosondes

AMSR2 - SONDE TPW ( 20120724 - 20130331 ) (Daily Mean)



## with GPS Estimates

GPS - AMSR2/TPW (20120724 - 20130330)



Validation	Required (Release)
2.9 kg/m <sup>2</sup>	3.5 kg/m <sup>2</sup>

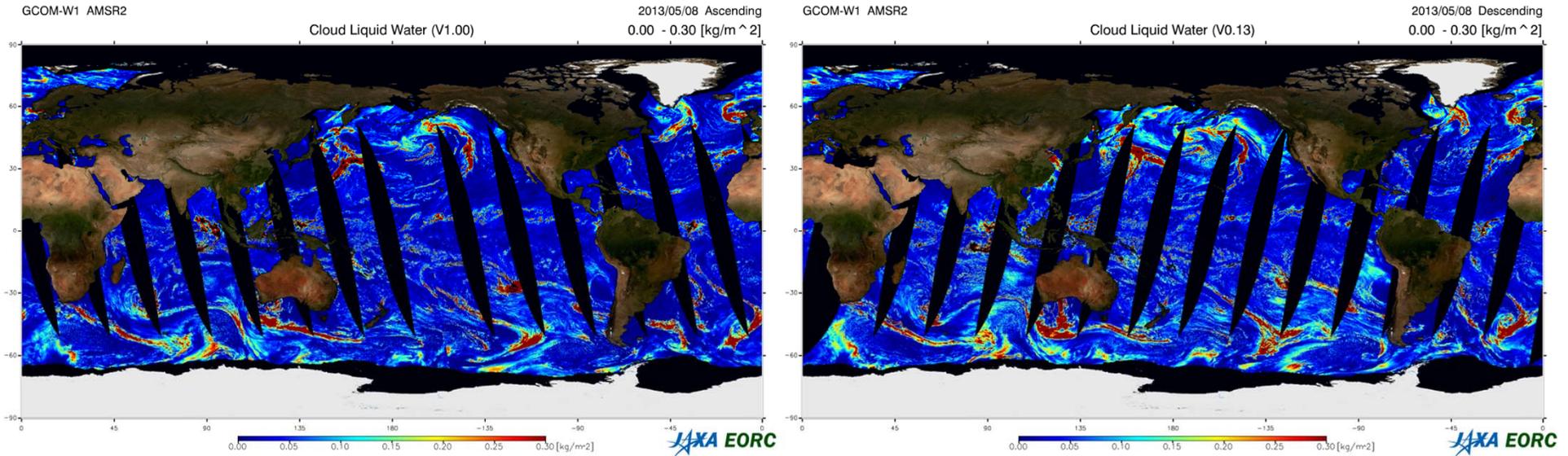
(RMSE)

# Integrated Cloud Liquid Water

May 8, 2013

Ascending

Descending



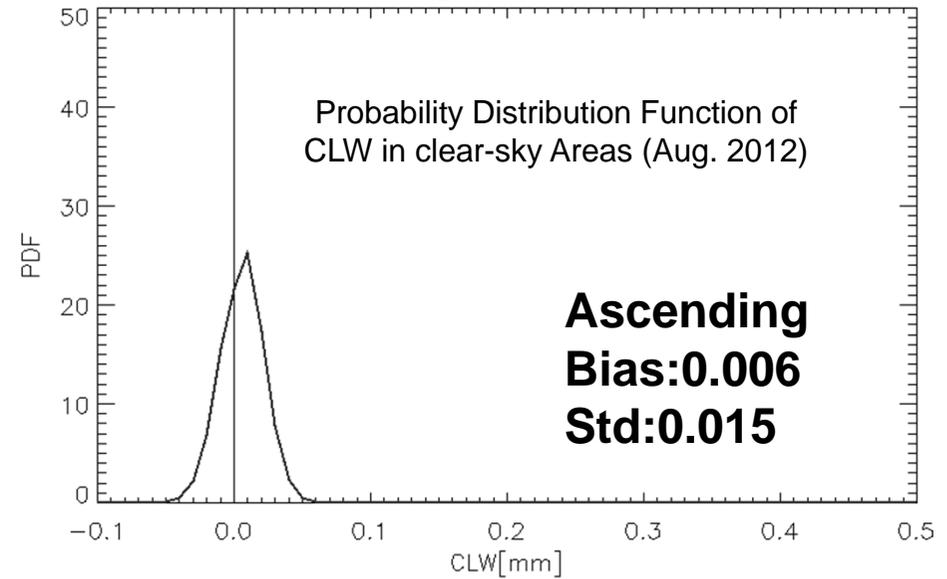
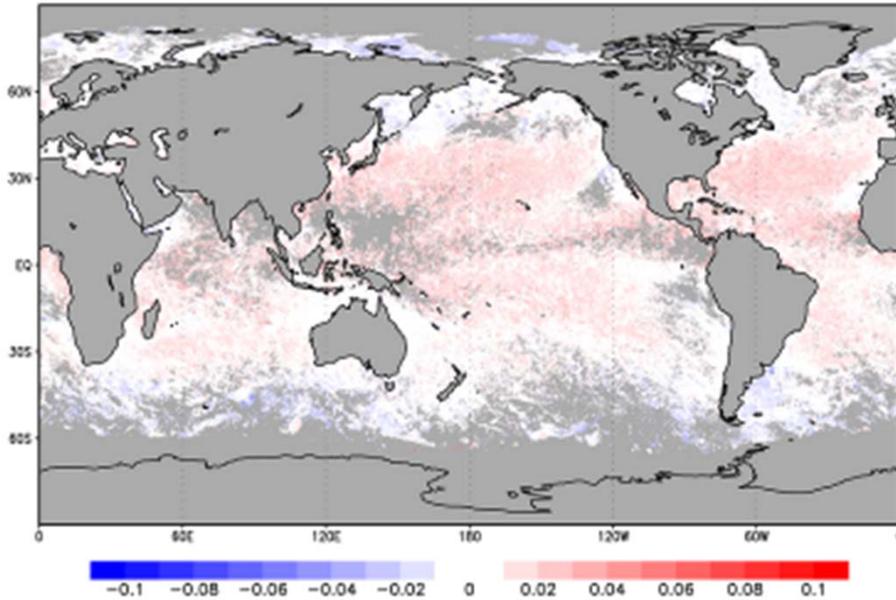
- Validation period: from August 2012 to March 2013.
- Select clear-sky areas detected by Aqua/MODIS cloud flags, and calculate Probability Distribution Function (PDF) of clear-sky regions of AMSR2 CLW in monthly basis.
  - We plan to use ground-based microwave radiometer observation located on islands when enough data period is available.



# Integrated Cloud Liquid Water

with Aqua/MODIS

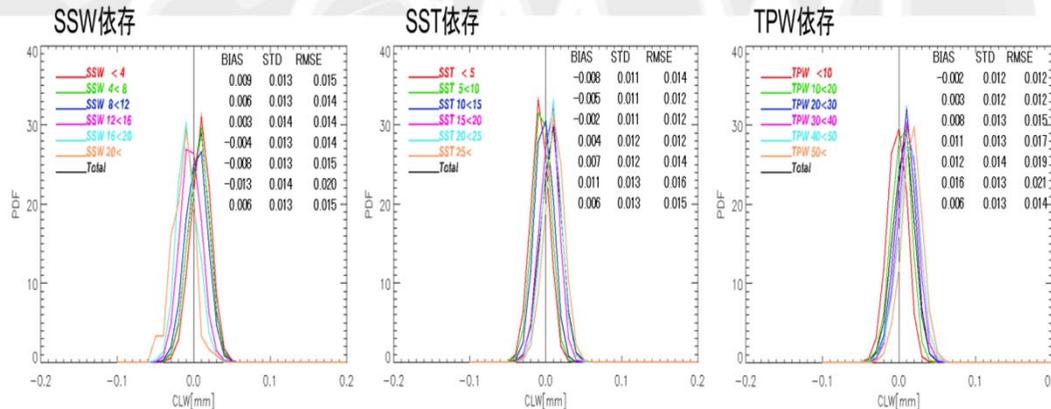
Kaz Clear-sky CLW[mm] 201208 ASC



CLW PDF for various environmental conditions (August 2012)

Cloud liquid water content by AMSR2 in clear-sky region by MODIS (August 2012)

Evaluated by the linear sum of the **worst bias (0.019)** and the **worst standard deviation (0.026)** for Aug. 2012 – March 2013

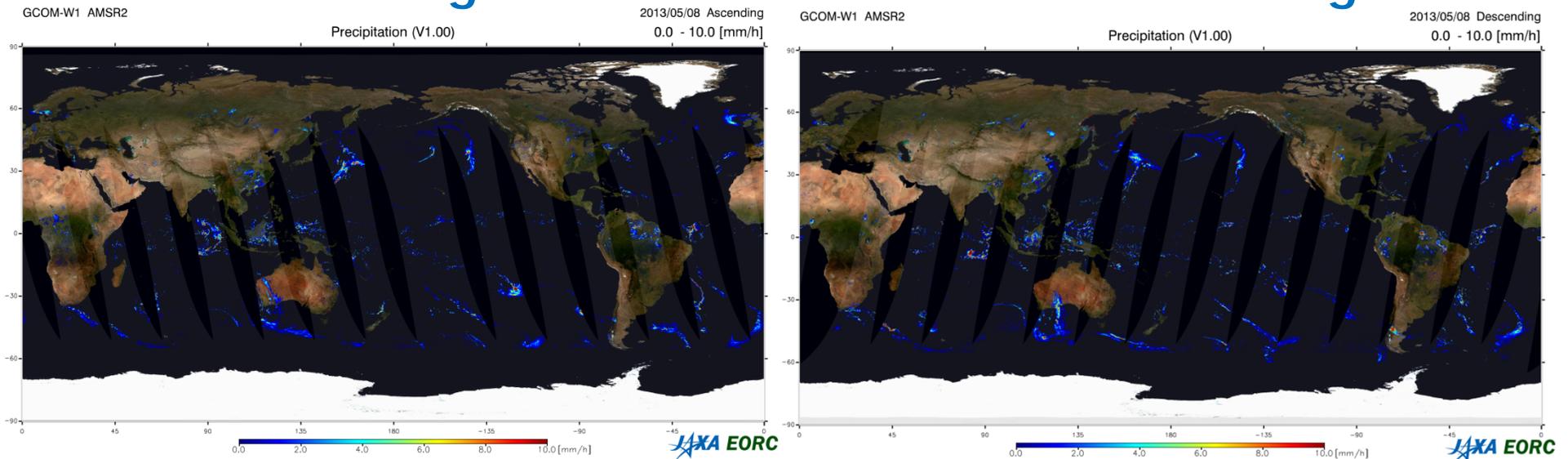


Validation	Required (Release)
<b>0.05 kg/m<sup>2</sup></b>	<b>0.1 kg/m<sup>2</sup></b>

May 8, 2013

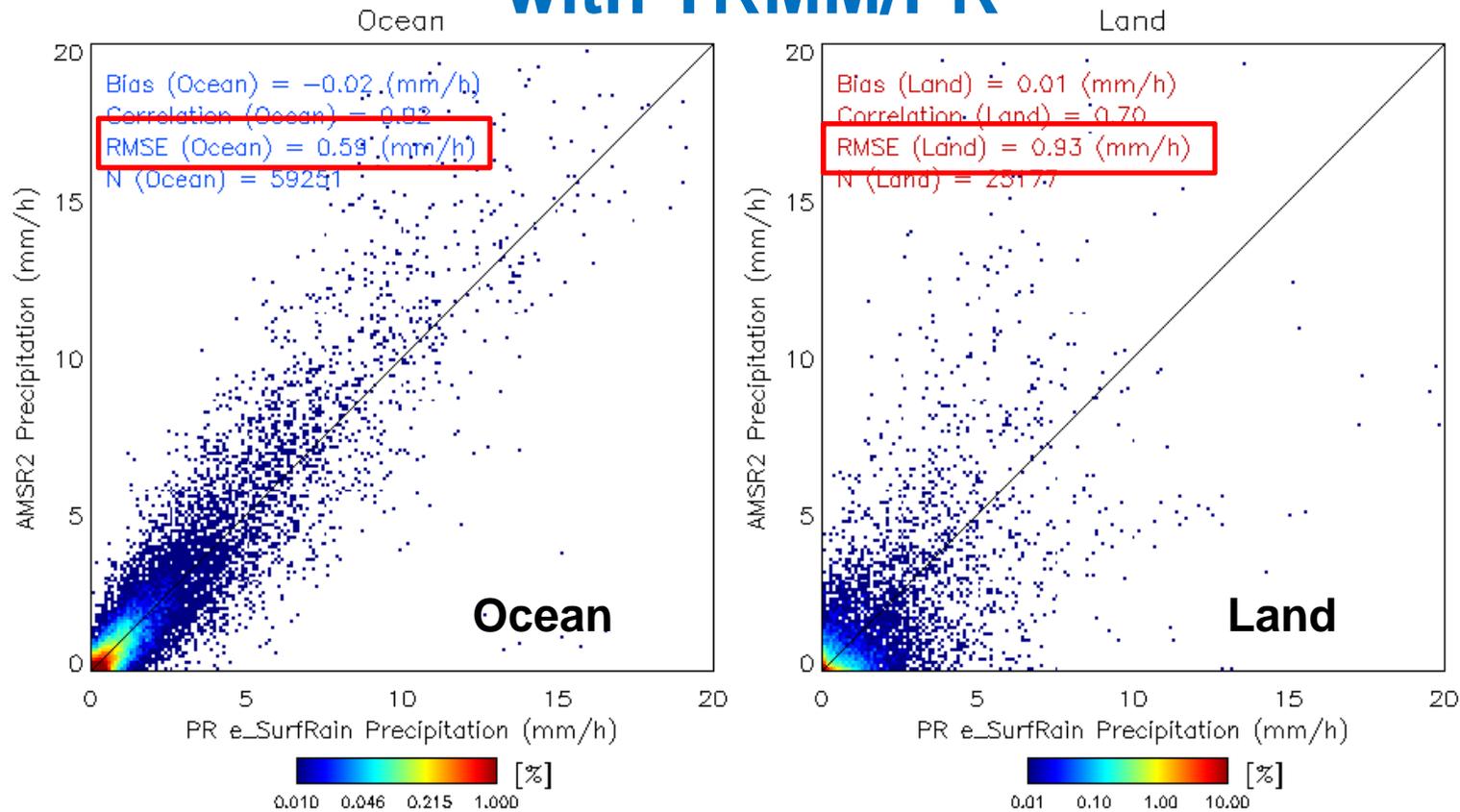
Ascending

Descending



- Validation period: from July 24, 2012 to March 31, 2013
- Compare with TRMM Precipitation Radar (PR) observation within 10 minutes, averaged to about 50km (same as FOV of TMI 10 GHz (63.2x36.8km))

## with TRMM/PR



	Validation	Required (Release)
Ocean	47 %	50 %
Land	91 %	120%

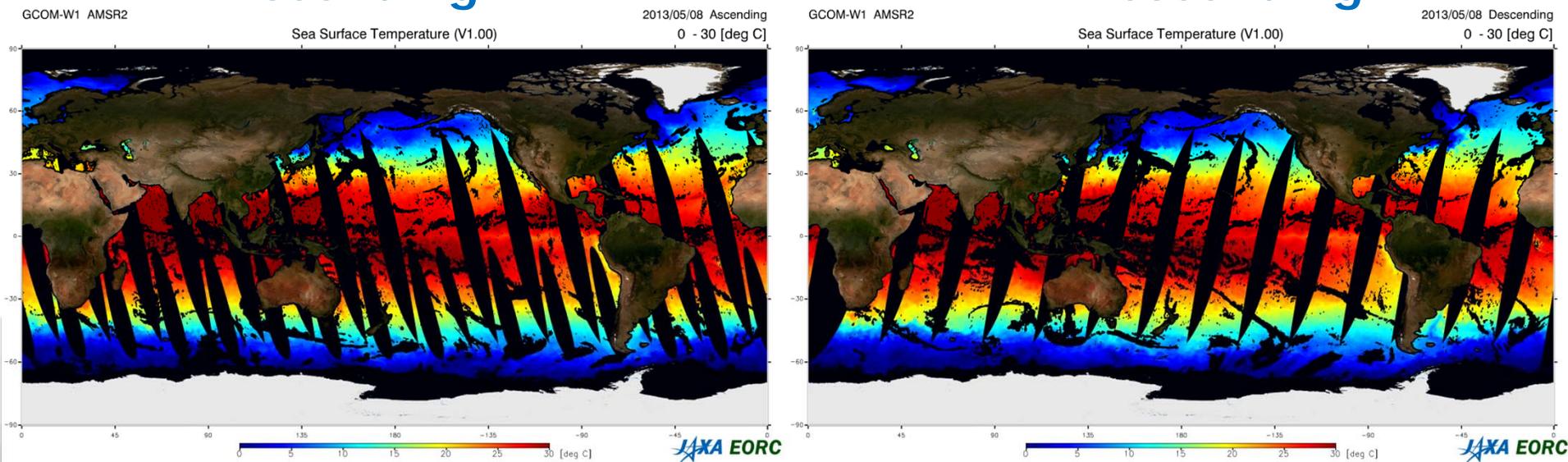
**Relative error  
 = RMSE/Mean (%)**

# Sea Surface Temperature

May 8, 2013

Ascending

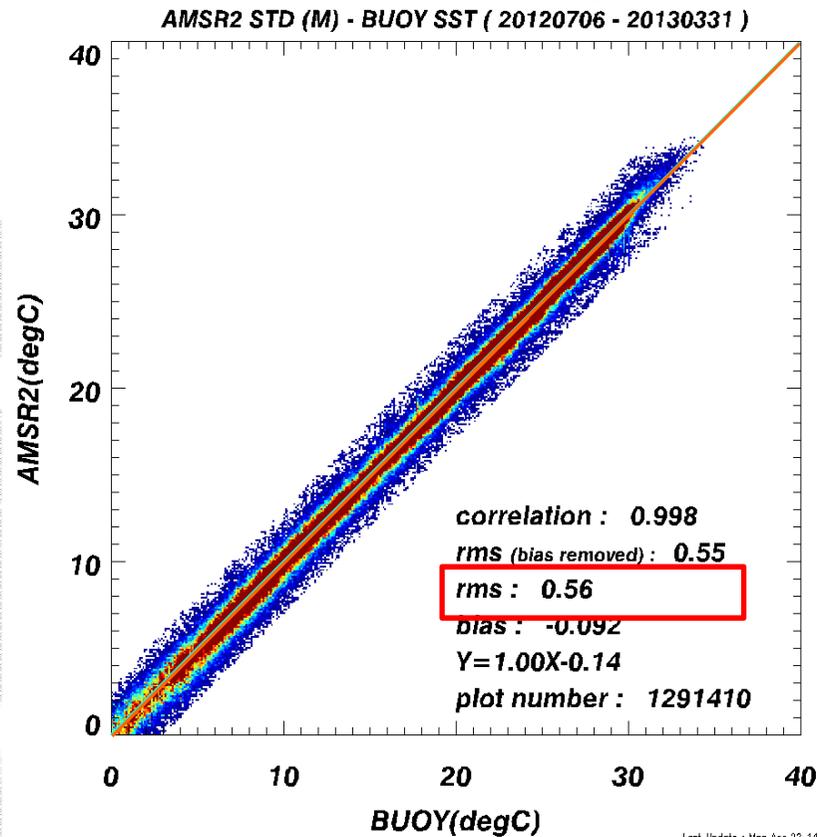
Descending



- Validation period: from July 6, 2012 to March 31, 2013.
- Compare with buoy SST derived from GTS within 2-hr in time and 30km in distance, 10-points average of AMSR2 SST (excluding those have differences larger than 3 degree C from corresponding buoy measurement based on AMSR-E experience).

# Sea Surface Temperature

with buoys



Ascending +  
Descending

Validation	Required (Release)
0.6 °C	0.8 °C

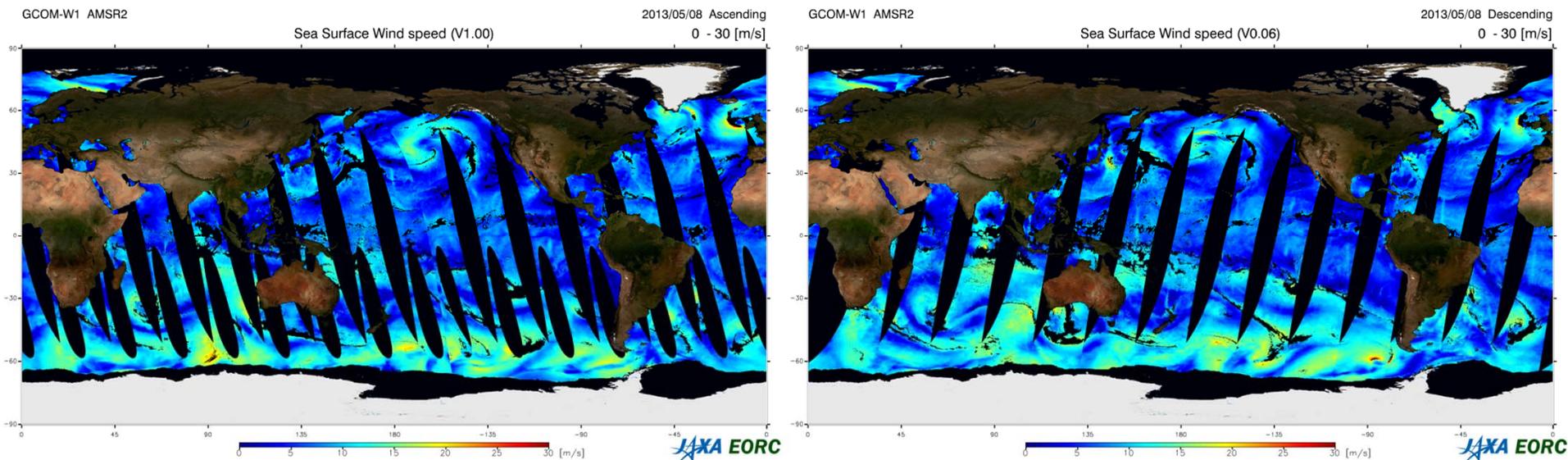
(RMSE)

# Sea Surface Wind Speed

May 8, 2013

Ascending

Descending

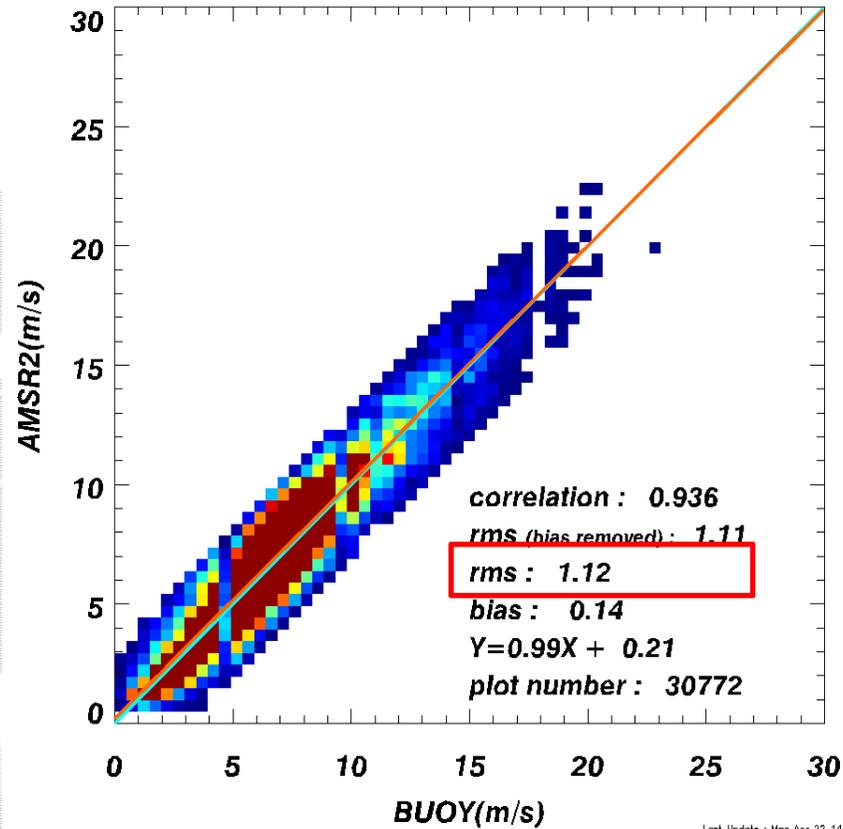


- Period of comparison: from July 6, 2012 to March 31, 2013.
- Compare with buoy SSW derived from GTS within 2-hr in time and 30km in distance, 10-points average of AMSR2 SSW (excluding those have differences larger than 3 m/s from corresponding buoy measurement).

# Sea Surface Wind Speed

with buoys

S0006000 AMSR2 - BUOY SSW ( 20120706 - 20130331 )(M)



Ascending +  
Descending

Validation	Required (Release)
1.1 m/s	1.5 m/s

(RMSE)

# Sea Ice Concentration

May 8, 2013

Ascending

Descending

COM-W1 AMSR2

2013/05/08 AsceI GCOM-W1 AMSR2

2013/05/08 Asce GCOM-W1 AMSR2

2013/05/08 Descen GCOM-W1 AMSR2

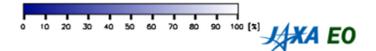
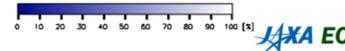
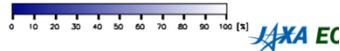
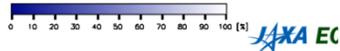
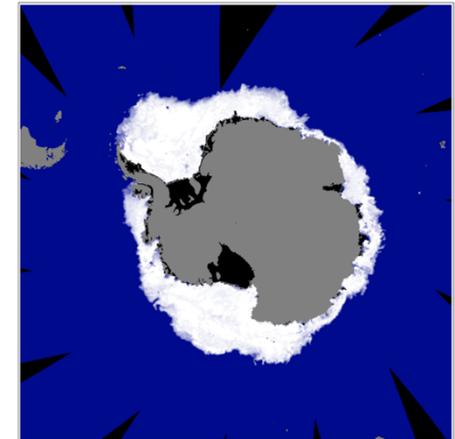
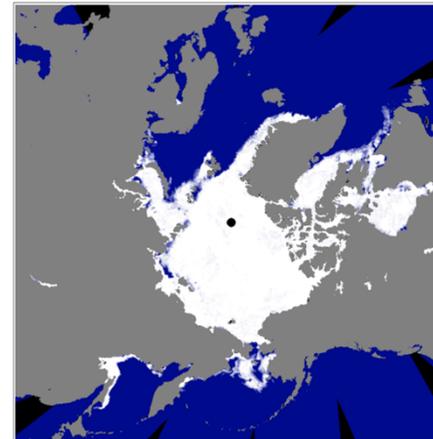
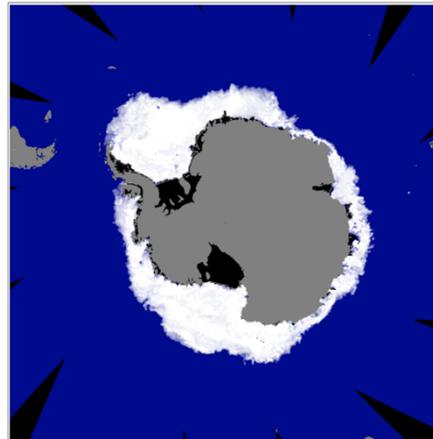
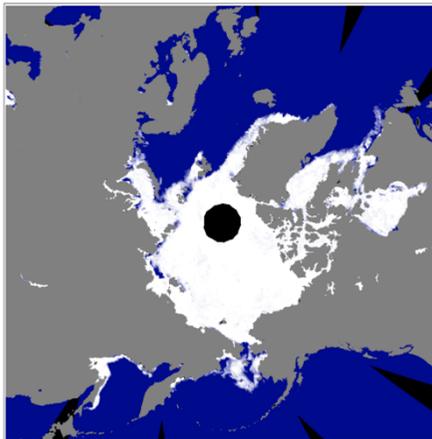
2013/05/08 Descen

Sea Ice Concentration (V1.00) 0 - 10

Sea Ice Concentration (V1.00) 0 - 10

Sea Ice Concentration (V1.00) 0 - 10

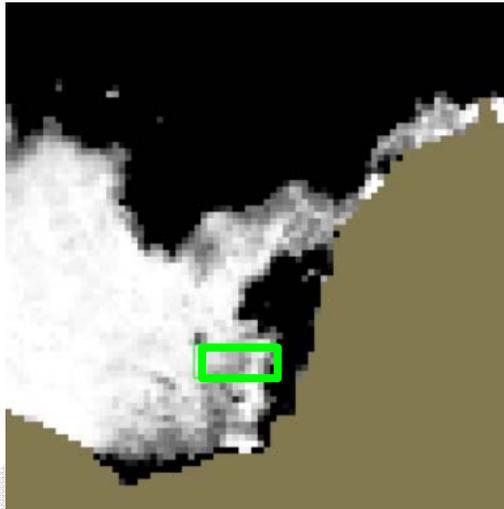
Sea Ice Concentration (V1.00) 0 - 100



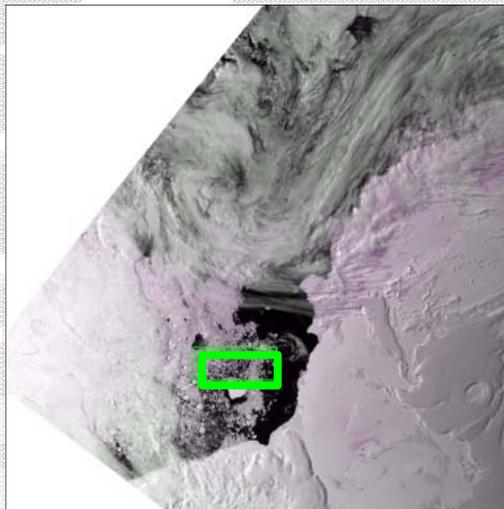
- Validation period:
  - October 31, 2012: Bellingshausen-Amundsen Sea
  - July 28, 2012: Arctic Sea – Greenland Sea
  - November 30, 2012: Bering Sea
  - March 5, 2013: Okhotsk Sea
- Compare with sea ice observation by Aqua/MODIS over clear-sky regions.

# JAXA Southern Hemisphere 2: Weddell Sea

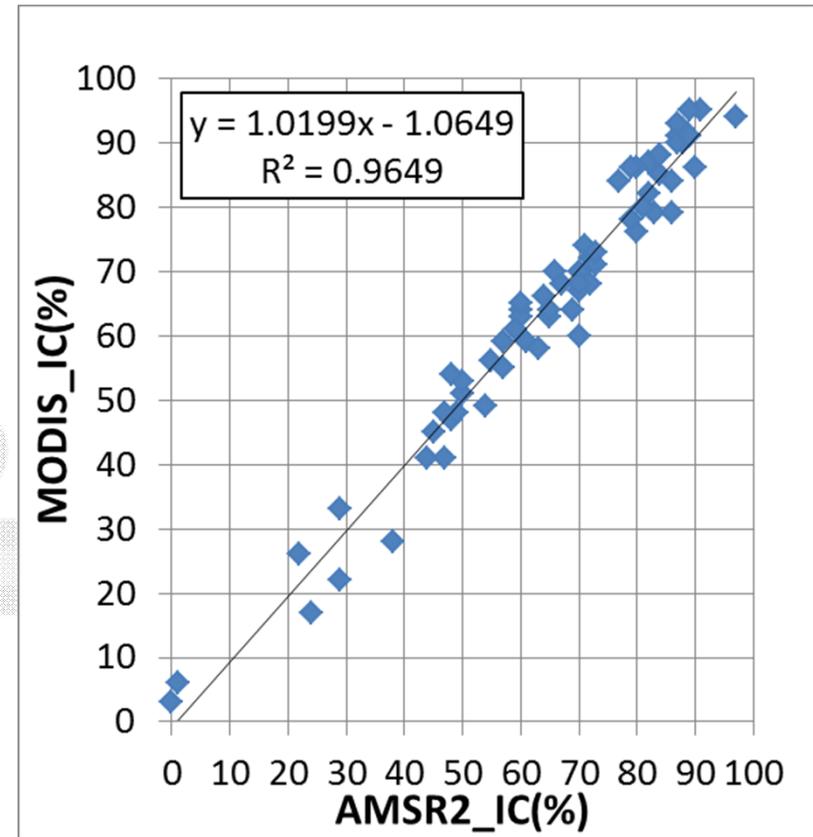
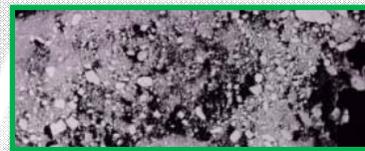
FEB 03 2013 -



AMSR2



MODIS

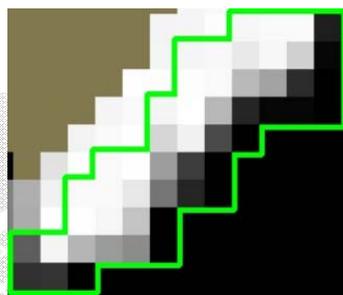


RMSE 4.13%

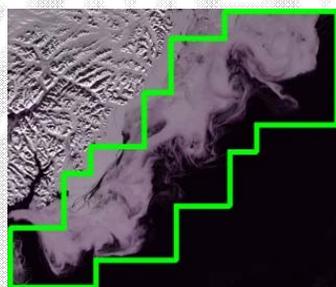
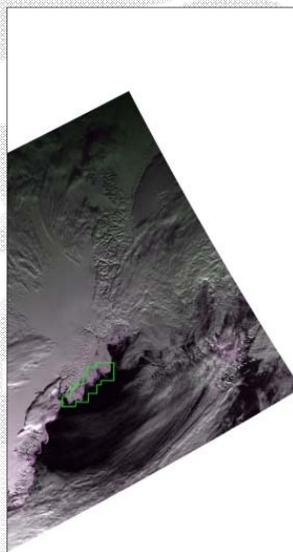


# Northern Hemisphere 2: Greenland Sea

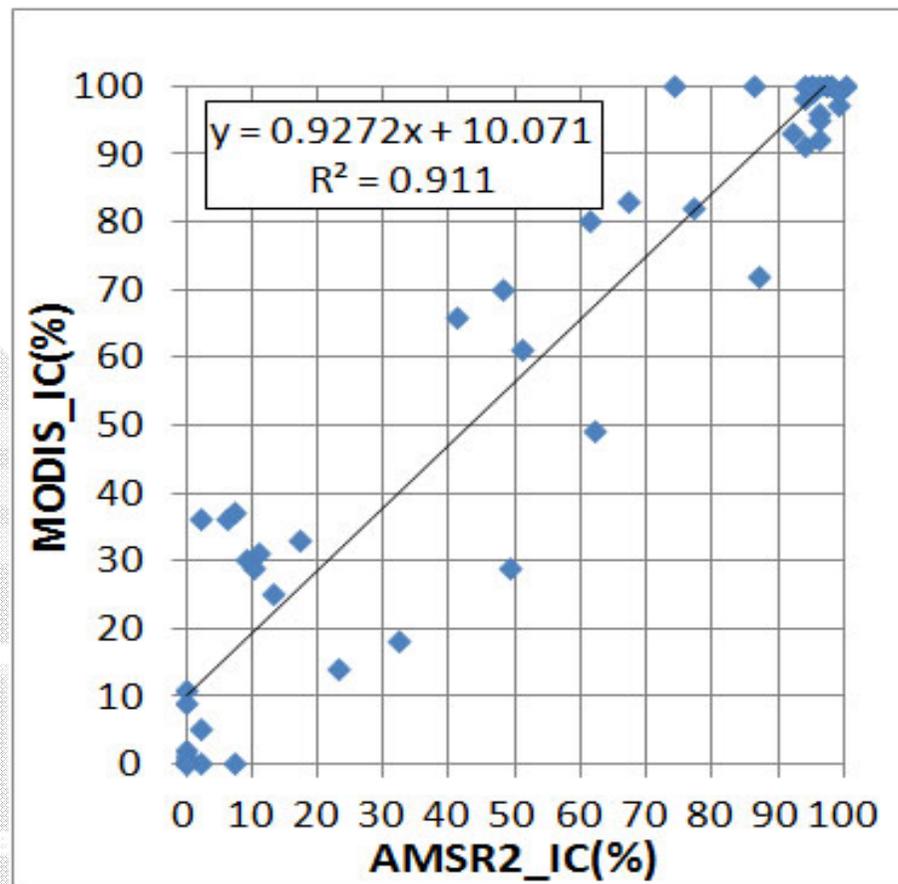
MAR 01 2013 -



AMSR2



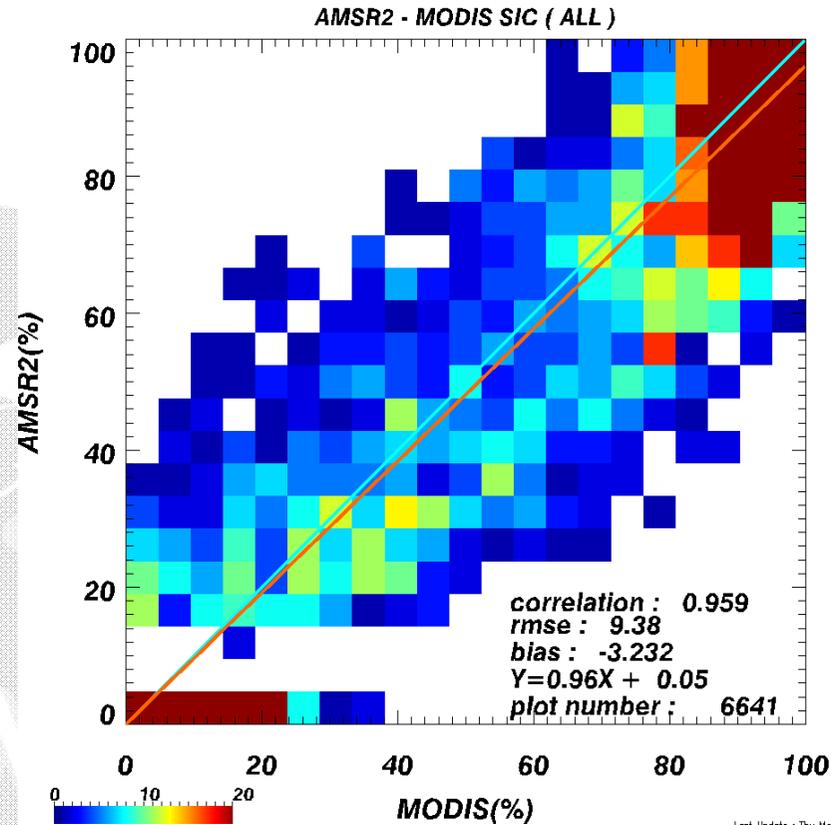
MODIS



RMSE 13.65%

# Sea Ice Concentration

## with Aqua/MODIS



correlation : 0.959  
 rmse : 9.38  
 bias : -3.232  
 $Y=0.96X + 0.05$   
 plot number : 6641

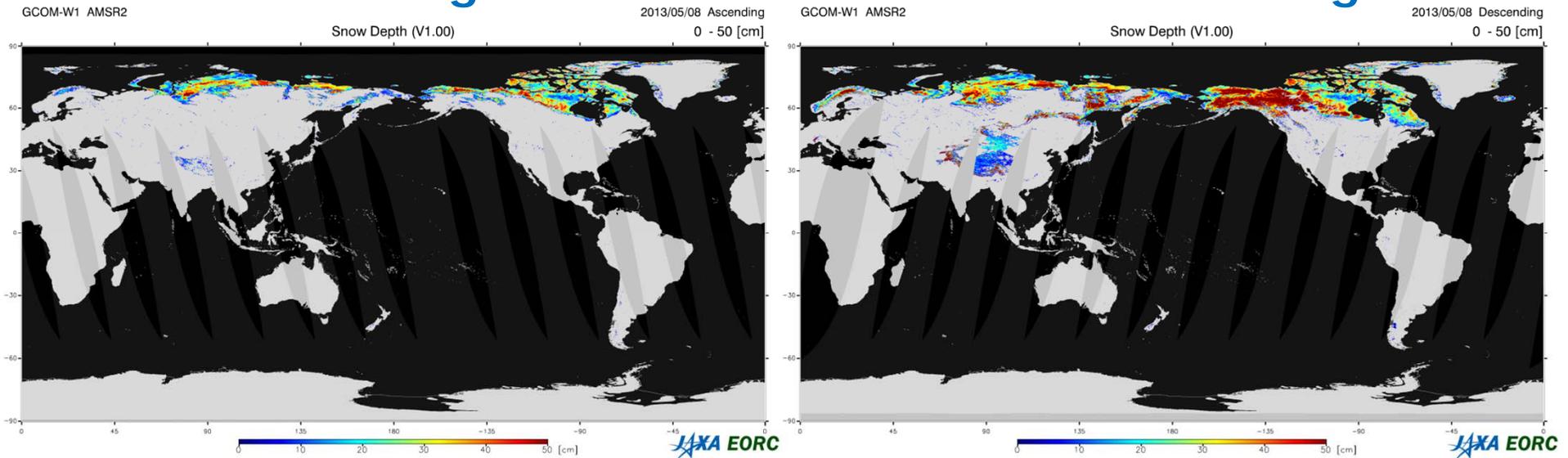
Validation	Required (Release)
9 %	10 %

(RMSE)

May 8, 2013

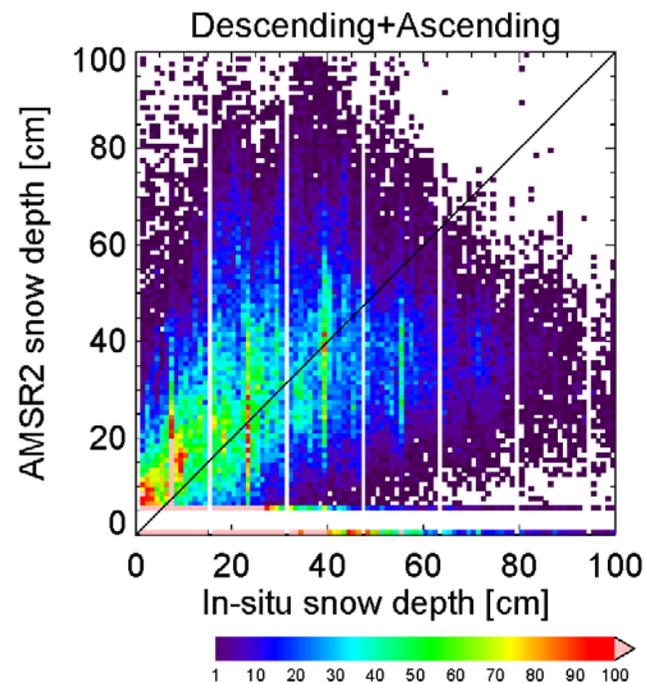
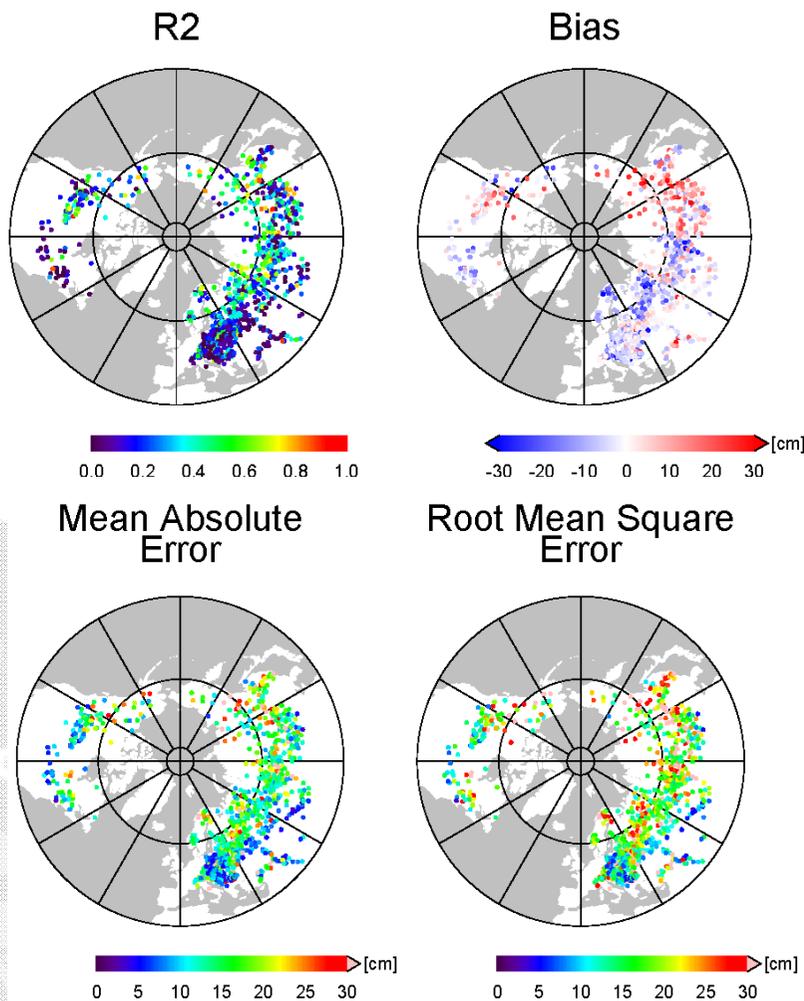
Ascending

Descending



- Validation period: from October 1, 2012 to March 31, 2013.
- Compare with 1,007 in-situ sites (less than 10% water area around 40km from the site), selected from Global Summary of the Day (GSOD) provided by NOAA, within 1-hr in time and 7km in distance.

## with Ground Observation (NOAA/GSOD)



Num. = 123883

R = 0.408

RMSE = 21.897

Bias = -1.080

**MAE = 16.106**

**(Mean  
Absolute  
Error)**

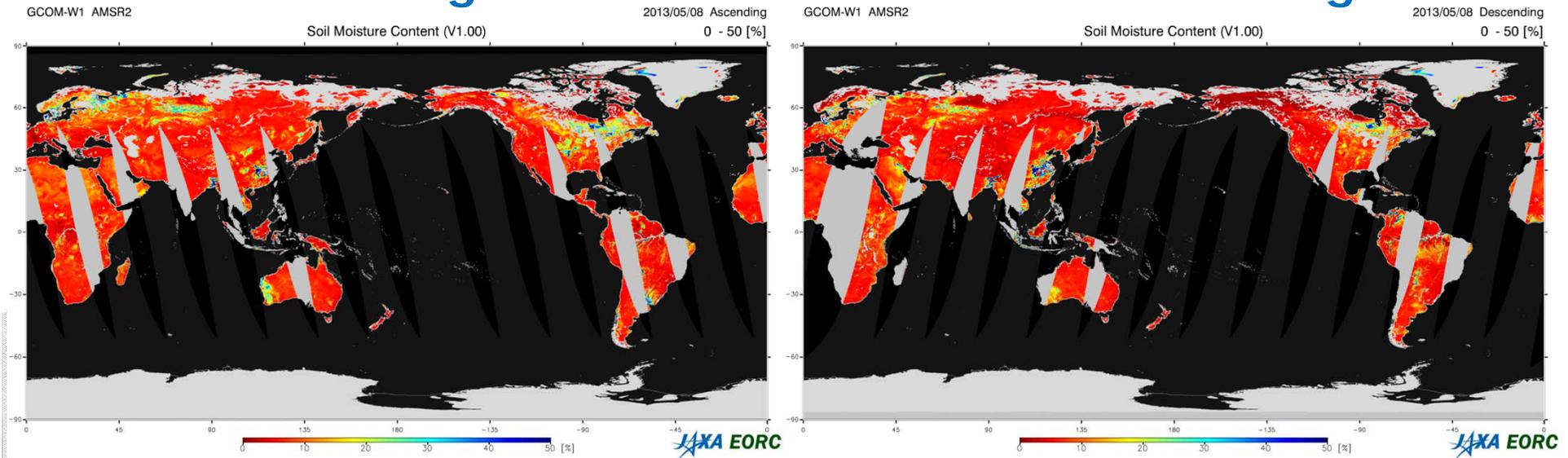
Validation	Required (Release)
<b>16 cm</b>	<b>20 cm</b>

# Soil Moisture Content

May 8, 2013

Ascending

Descending



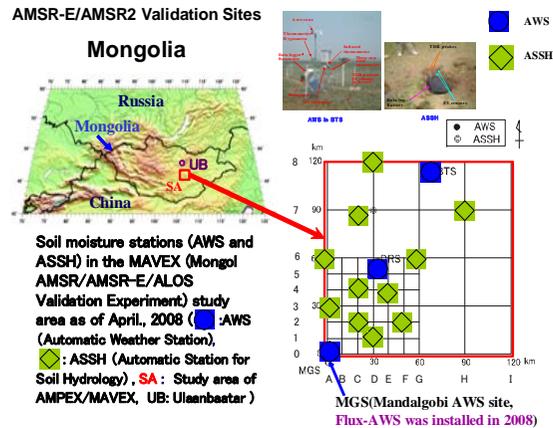
- Validation period:

- Mongolia and Thailand: from July to September 2012.
- Australia: from July 2012 to April 2013.
- Little River, US: from July 2012 to January 2013.

- Compare with in-situ sites in Mongolia, Australia, Thailand (50km area average) and Little River (point observation) within 1-hr (2-hr in Mongolia) in time and 7km in distance.

# SMC Validation Sites

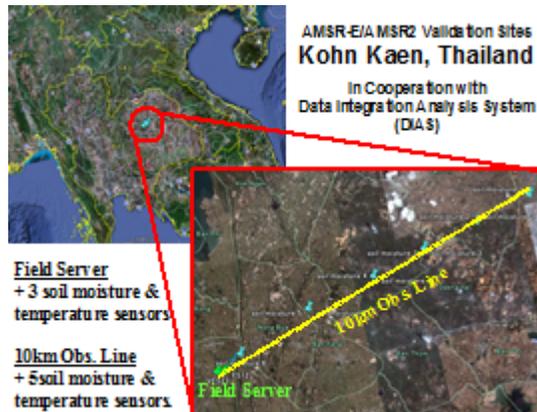
## Mongolian Plateau (Kaihotsu, 2000-)



- ✓ All sites were established and maintained by cooperation with domestic/international agencies and universities.
- ✓ Mongolian site has been used for AMSR/AMSR-E/ALOS validation for a long time. Sites in Thailand and Australia were established recently to increase conditions of SMC and surface/vegetation types.

USDA SCAN (Jackson et al.) including Little River

## Thailand (Kaihotsu and Mizoguchi, 2010-)



## Australia (Walker, 2012-)



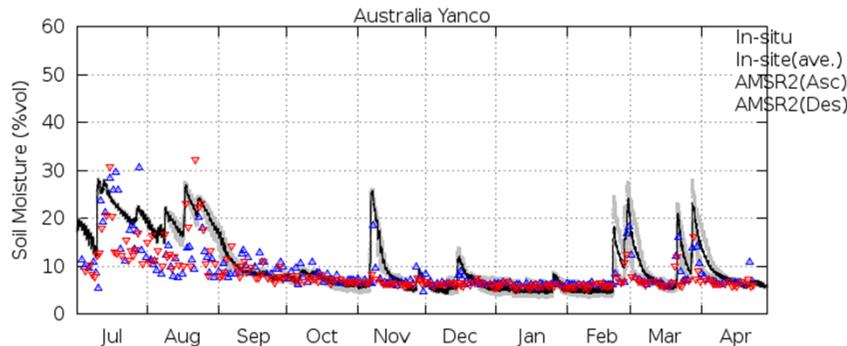
# Australia validation site



Murrumbidgee Catchment  
NSW, Australia

Photos provided by Mr. Darren J Hocking, Monash University

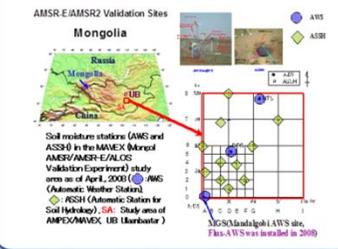
# Soil Moisture Content



Time Series at validation site in Australia

## Mongolia

モンゴル検証サイト (開発、2000~)

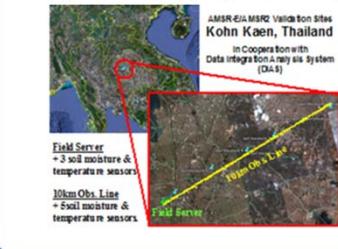


Validation data in four sites has been used for validation. Validation in longer period should be monitored.

米国 リトルリバー (USDA SCAN)

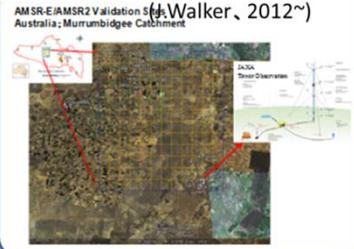
## Little River USA

タイ検証サイト (開発・溝口、2010~)



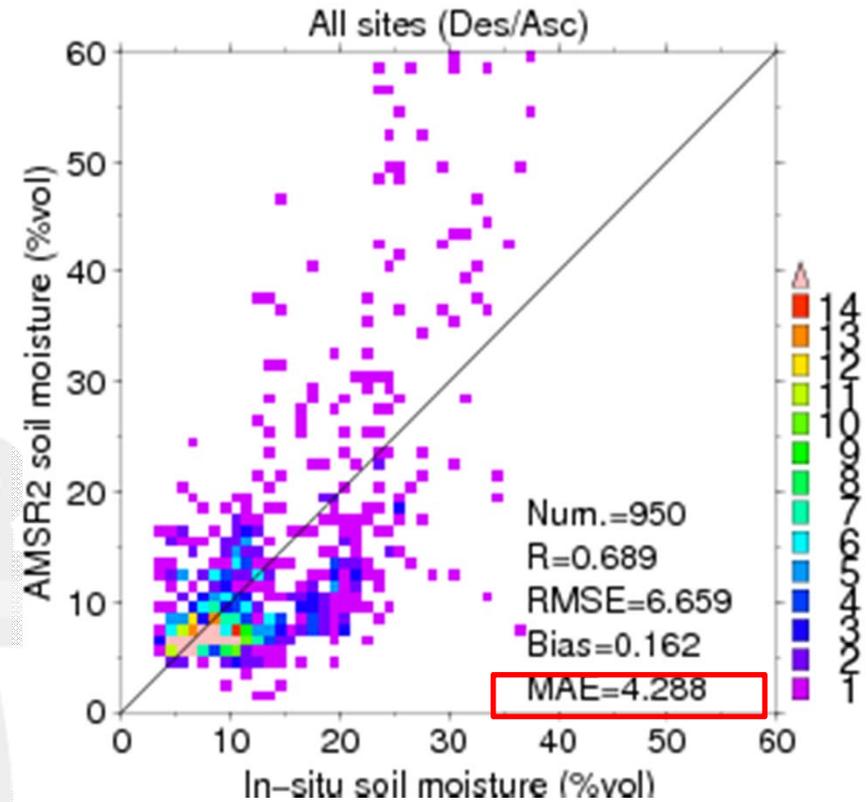
## Thailand

オーストラリア検証サイト (Walker、2012~)



## Australia

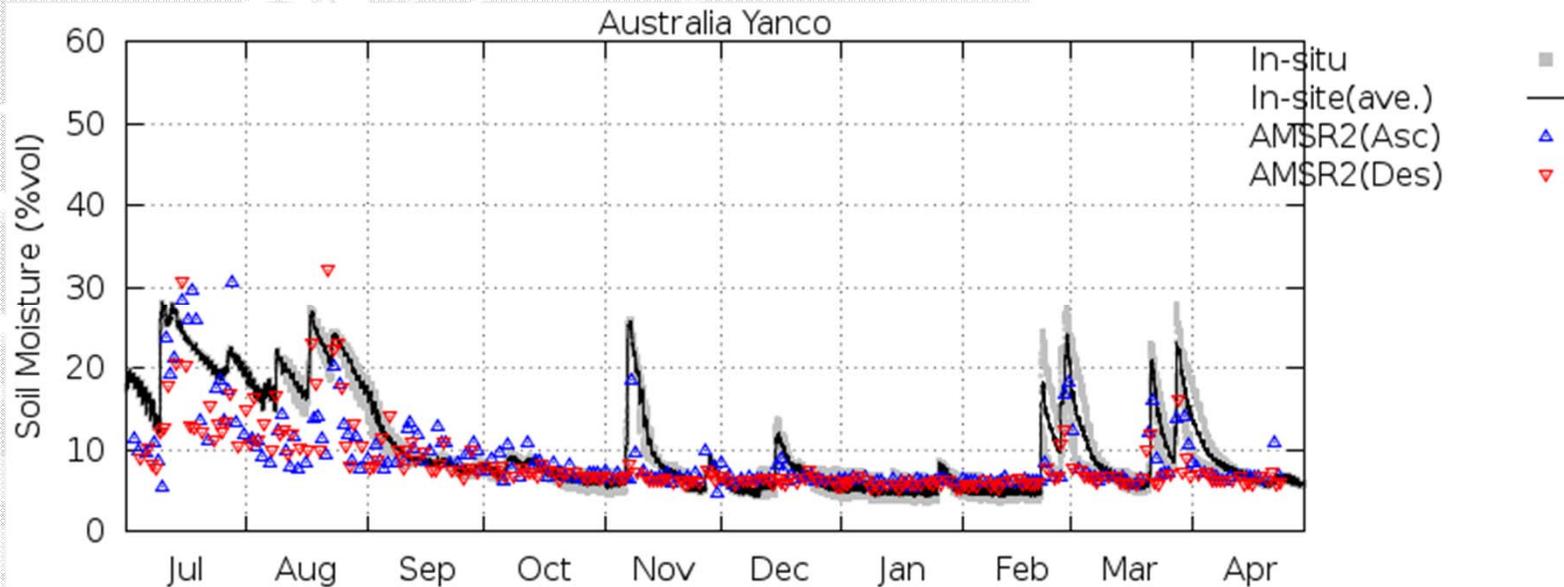
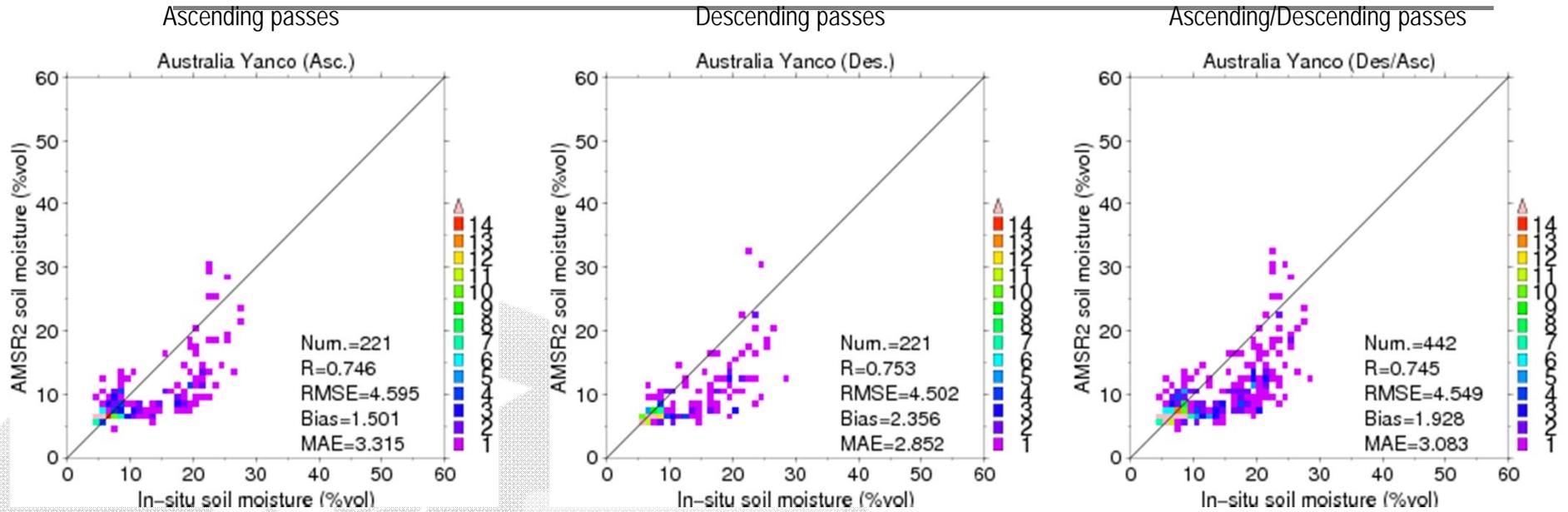
## with Ground Observation



Validation (MAE)	Required (Release)
4 %	10 %

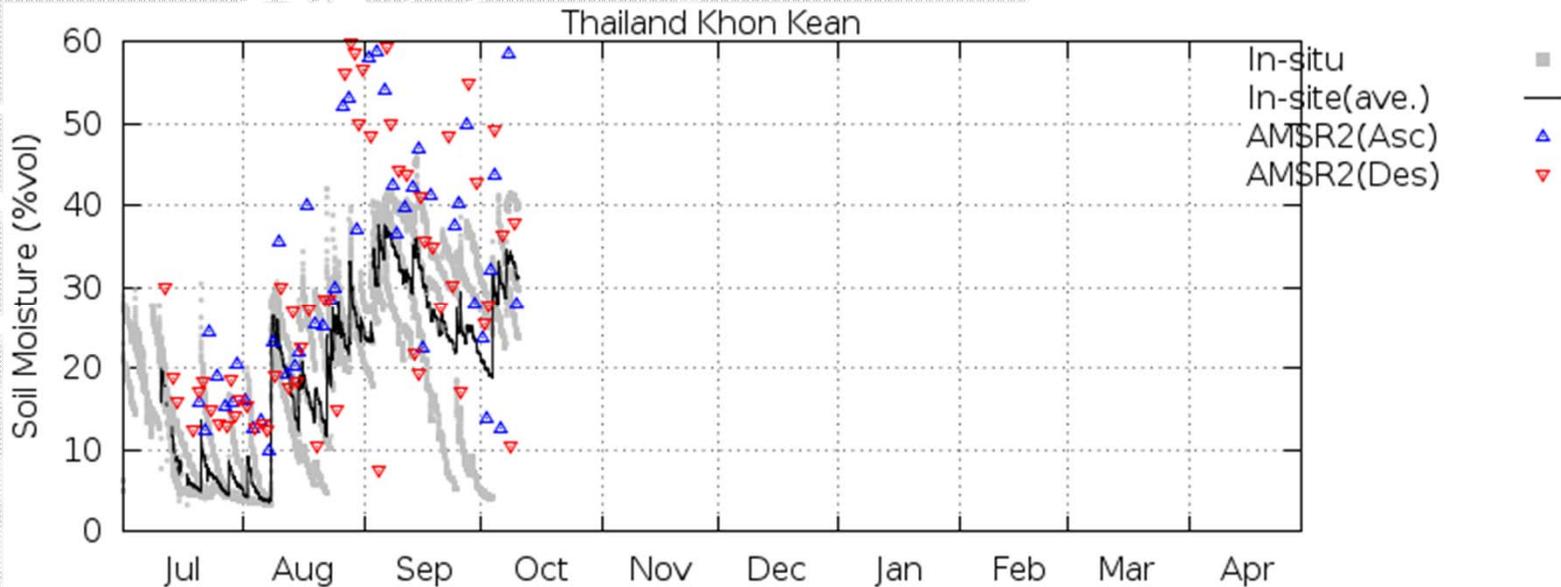
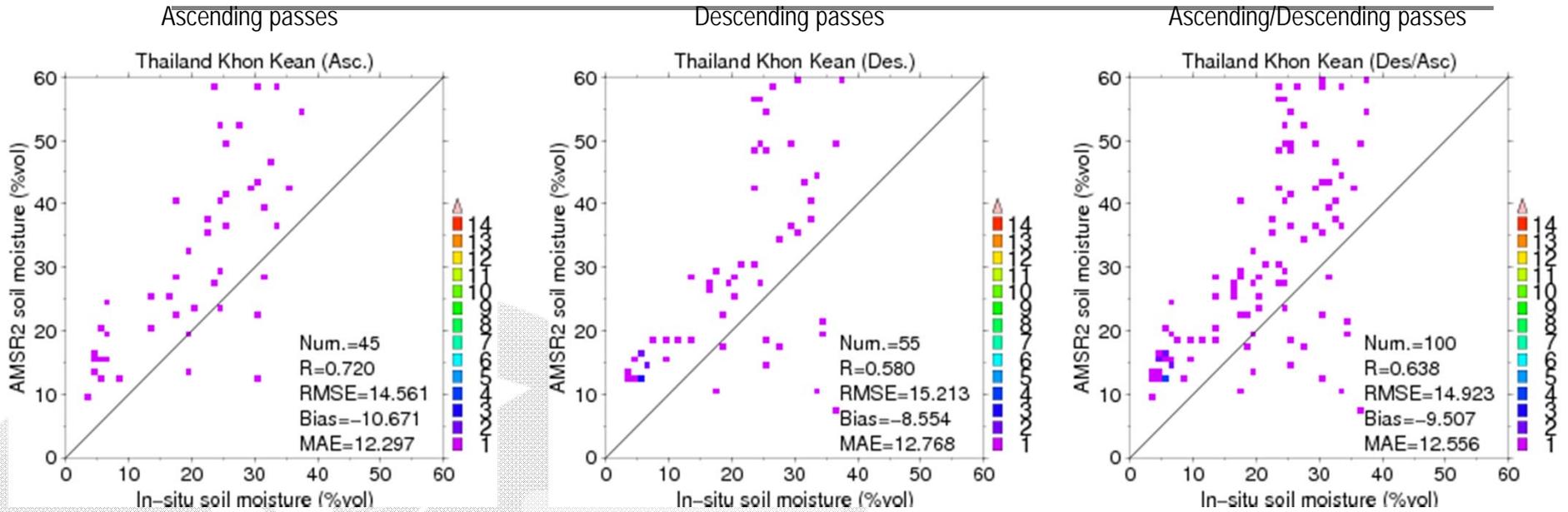


# Validation over Australia Yanco

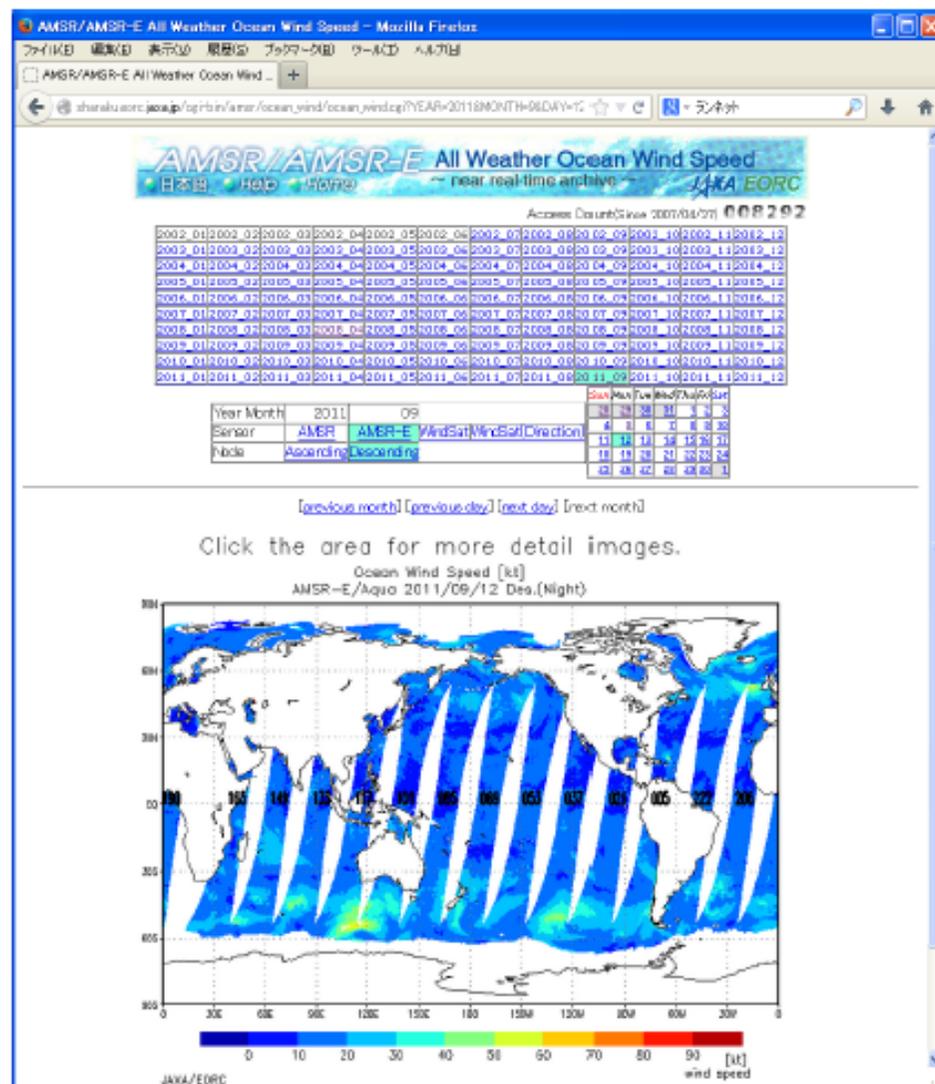




# Validation over Thailand

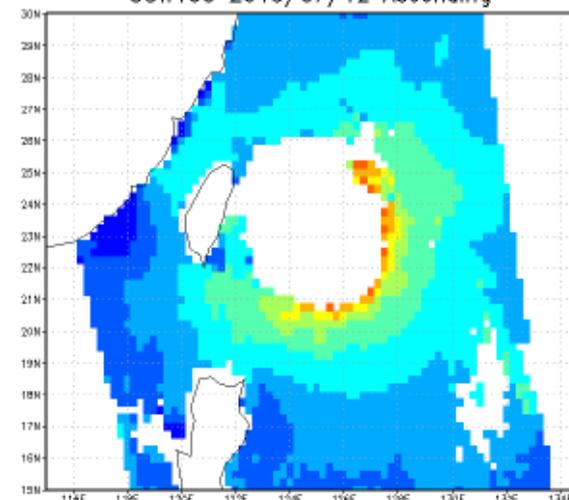


- All Level 2 geophysical parameter products satisfied release accuracy required, and have been released to public since May 17, 2013.
  - All standard products have been released to public from GCOM-W1 Data Providing Service System (<https://gcom-w1.jaxa.jp/>)
- Further calibration and validation activities are necessary and will be continued toward future algorithm improvements.
- Current plan of Research Products
  - all-weather sea surface wind speed
  - sea ice moving vector, thin sea ice detection
  - land hydrological assimilated products, etc.
- Long-term processing and dataset
  - AMSR-E and AMSR2
  - Long-term dataset, beginning with sea ice



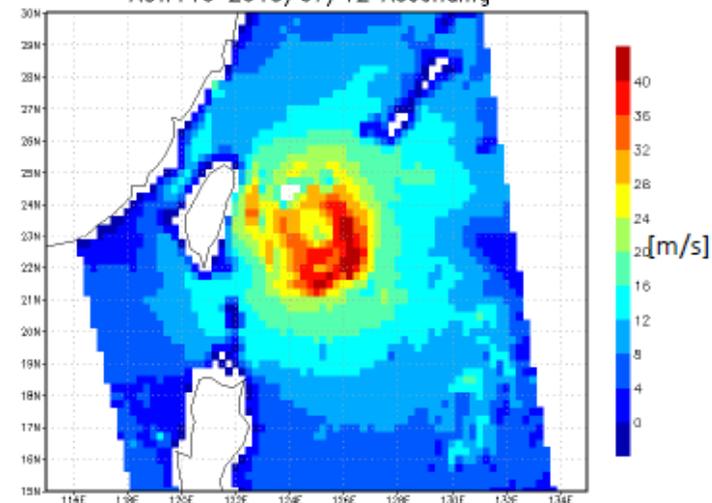
## Standard SSW

SSW100 2013/07/12 Ascending

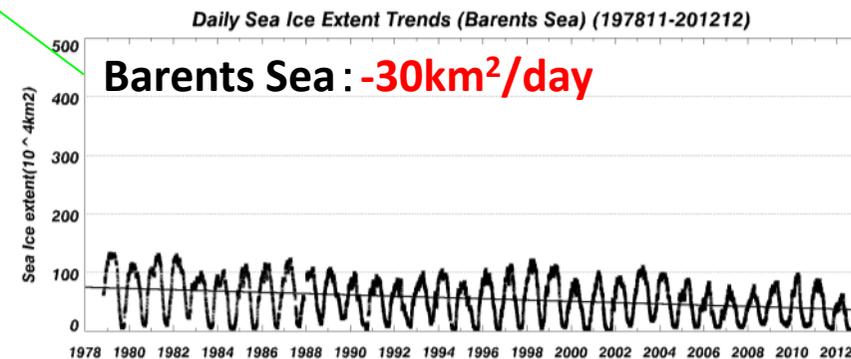
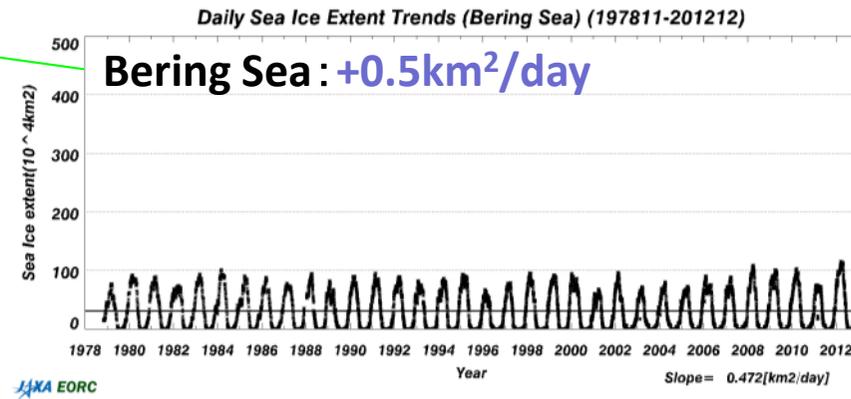
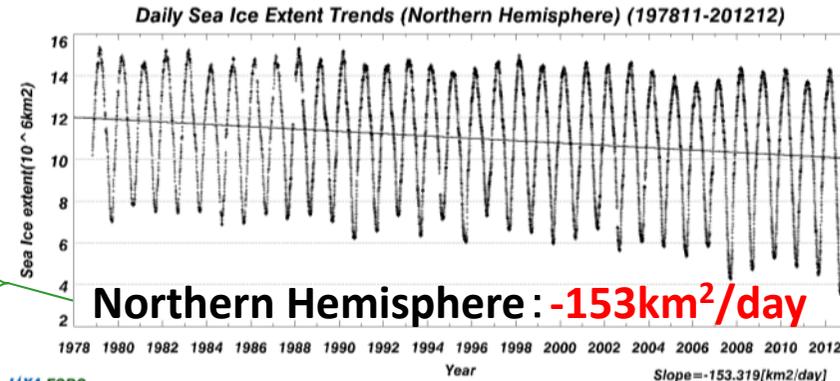
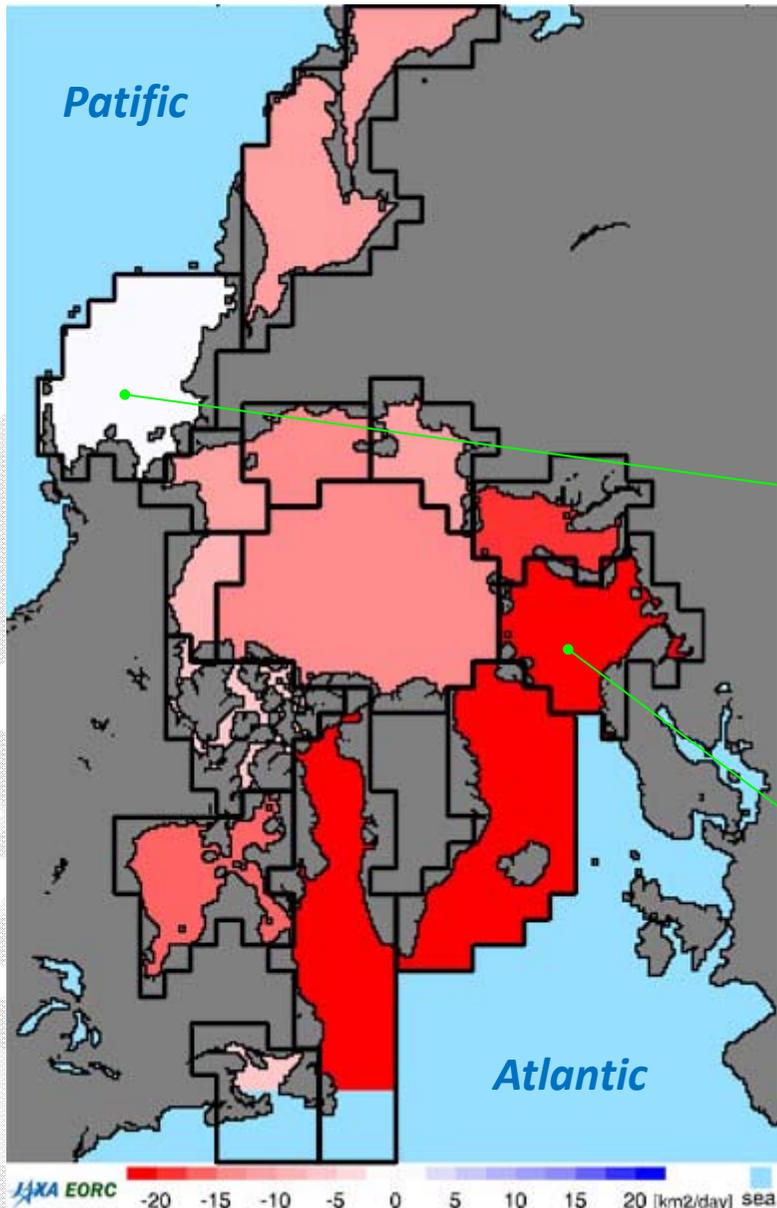


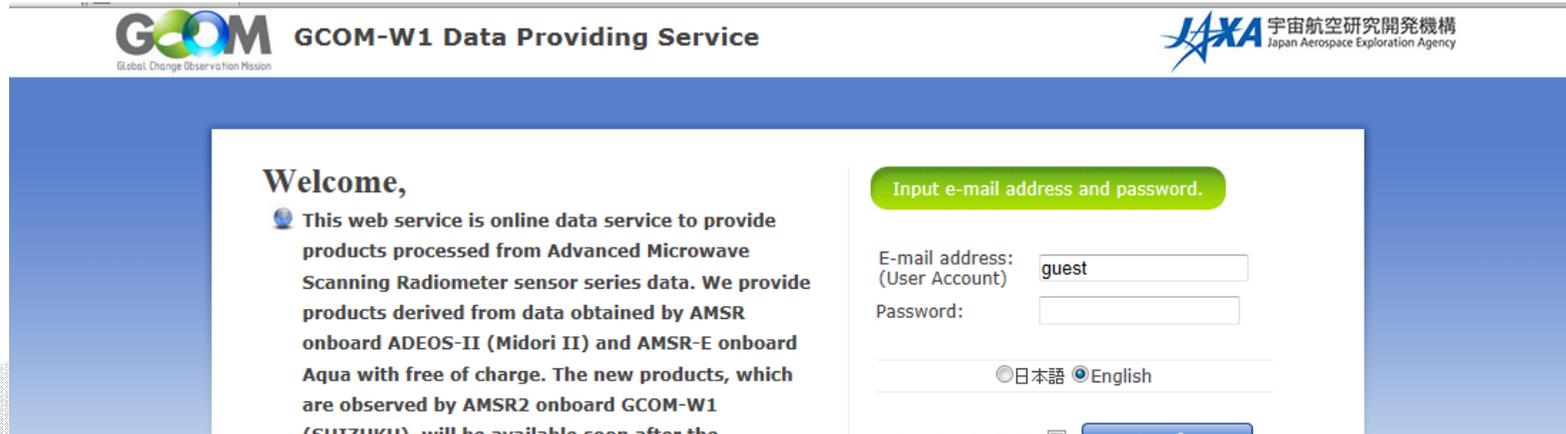
## All-weather SSW

ASW110 2013/07/12 Ascending



# Long-term Dataset





<https://gcom-w1.jaxa.jp/>



[http://suzaku.eorc.jaxa.jp/GCOM\\_W/JASMES\\_daily/](http://suzaku.eorc.jaxa.jp/GCOM_W/JASMES_daily/)