AMSR2 Research Products

All-weather Sea surface Wind speed (ASW)

and 10-GHz (high-resolution) Sea Surface Temperature (SST)

Validation Results

JAXA/EORC, RESTEC

October 8th, 2015

AMSR2 research products

Product	Areas	Grid (km)	Goal Accuracy	Range	
All-weather sea surface wind speed	Ocean	60	±7m/s	0 - 70m/s	Except sea ice areas.
10-GHz (high-resolution) SST	Ocean	30	±0.8℃	9 - 35℃	Except sea ice and precipitating areas.
Soil moisture (SMC) and vegetation water content (VWC) based on the data assimilation methodology	land over the continents of Africa and Australia	25	SMC: ±8% VWC: ±1kg/m²	SMC: 0 - 100% VWC: 0 - 2kg/m²	Profiles are retrieved for SMC.
Land surface temperature	Land	15	Forest: ±3K Low vegetation: ±4K	273.15 - 323.15K	Temperature at a canopy top is defined as land surface temperature.
Vegetation water content	Land	10	±1kg/m²	0 - 4kg/m²	-
High-resolution sea ice concentration	Ocean at high latitudes	5	±15%	0 - 100%	Accuracy is expressed in absolute value of sea ice concentration (%).
Detection of thin ice	Okhotsk Sea	15	80%	N/A	Sea ice area (≦ 30 cm) is defined as thin ice area. A flag representing whether thin ice area is dominant in a pixel is stored in a product. Accuracy is expressed in right answer rate (%).
Sea ice moving vector	Ocean at high latitudes	50	±3cm/s in latitude and longitude	0 - 40cm/s	-

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AMSR2 research products

- The AMSR2 research products were defined in the GCOM Advisory Committee held in March 2015.
- It was confirmed that the 10-GHz (high-resolution) Sea Surface Temperature (SST) (version 2.1) met the goal accuracy in this GCOM Advisory Committee to be released to the public as the part of the standard SST product.
- Additionally, it was confirmed that the AMSR2 All-weather Sea surface Wind speed (ASW) (version 1.2) met the goal accuracy in the AMSR2 Science Team Meeting held in September 2015 to be released to the public.
- This paper presents the validation results of 10-GHz SST and ASW.

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10-GHz sea surface temperature (SST)

- Principle Investigator
  - Akira Shibata（Remote sensing technology center)
- Product and algorithm's summary
  - The product contains the temperature within a few mm from the sea surface (sea surface temperature; SST) except for sea ice areas and strong precipitation areas. This algorithm retrieves SST values using brightness temperatures of 10.7-GHz channel. While this algorithm realizes to retrieve SST values in finer spatial resolution than the standard SST algorithm which retrieves them by brightness temperatures of 6.9-GHz channel, its retrieval accuracy deteriorates for low SST values. Therefore, the lower limit of retrieval is set to 9℃.
- Specifications
  - Spatial resolution：30 km
  - Goal accuracy：±0.8 ℃
  - Range：9 - 35 ℃
- Validation method
  - Similarly as the standard SST products, the SST values retrieved by this algorithm were compared with those observed by buoys of "In situ SST Quality Monitor (*iQuam*)".
  - The iQuam buoy data was provided by NOAA.
  - Validation period: August 2012 - July 2014

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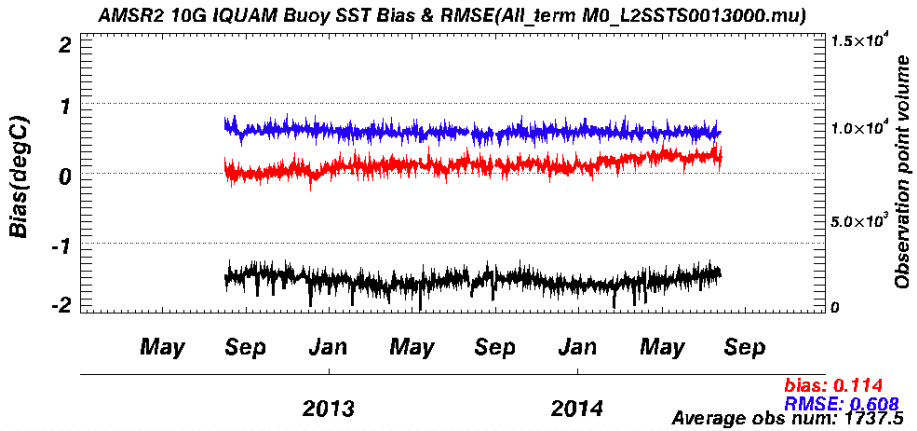
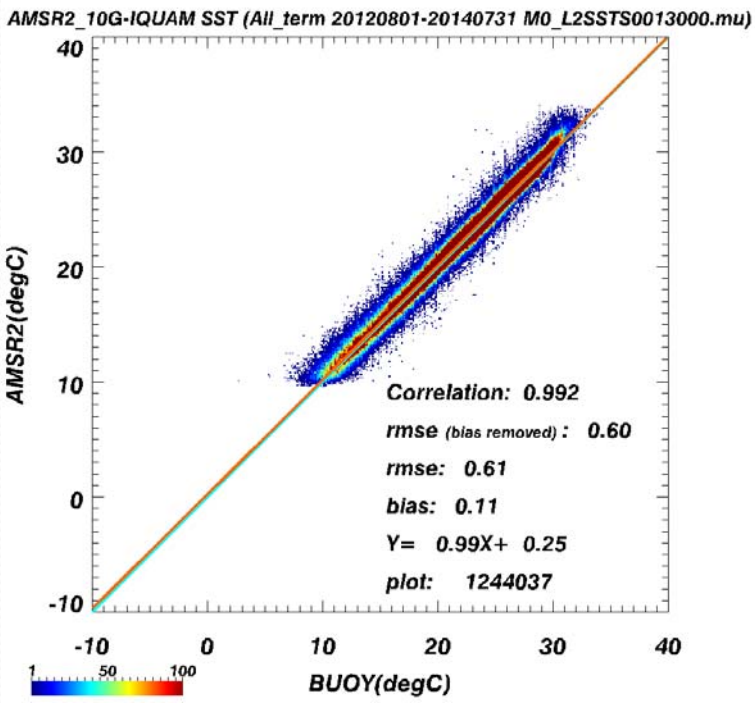
10-GHz SST Validation results

- Validation results for SST values more than 9 ℃
  - Bias 0.11 ℃
  - **RMSE 0.61 ℃**

(, which met the goal accuracy 0.8℃.)



Time series



Scatter plot

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All-weather sea surface wind speed (ASW)

- Principle Investigator
  - Akira Shibata（Remote sensing technology center)
- Product and algorithm's summary
  - The product contains wind speeds in the best track of typhoons announced by Japan Meteorological Agency and NOAA National Hurricane Center. This algorithm detects ocean waves corresponding to sea surface wind speeds caused by typhoons using brightness temperatures of 6.9- and 10.7- GHz H channels. This algorithm realizes to retrieve the sea surface wind speed more than 70 m/s. The wind speed retrieved by this algorithm is a little different from that retrieved by the standard sea surface wind speed outside the typhoons right now.
- Specifications
  - Spatial resolution：60 km
  - Goal accuracy：±7 m/s（for sea surface wind speed more than 17 m/s）
  - Range：0 - 70 m/s
- Validation method
  - The wind speeds more than 17 m/s retrieved by this algorithm were compared with the maximum wind speeds within 200 km from the center position of the best track or the wind speeds observed by dropsondes.
  - Validation period: August 2012 - October 2014

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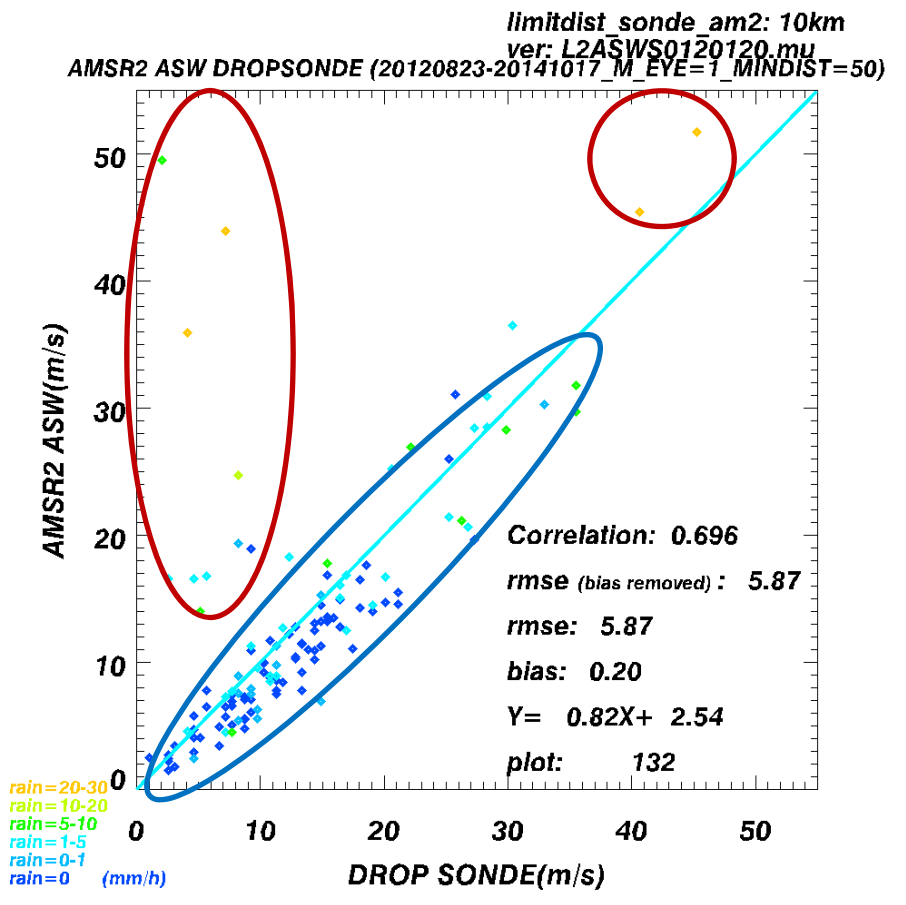
ASW validation results by dropsondes (1/2)

- discrepancy in distance < 10 km
- discrepancy in time < 90 min
- comparison with the wind speeds observed by dropsondes at the lowest layer (Saito and Shibata, 2010)
- elimination from comparison:
  - EYE_EYEWALL
  - Wind speeds within 50 km from the center position of the best track
- Validation results for the total range:
  - Bias 0.20 m/s
  - **RMSE 5.87 m/s**



Scatter plot

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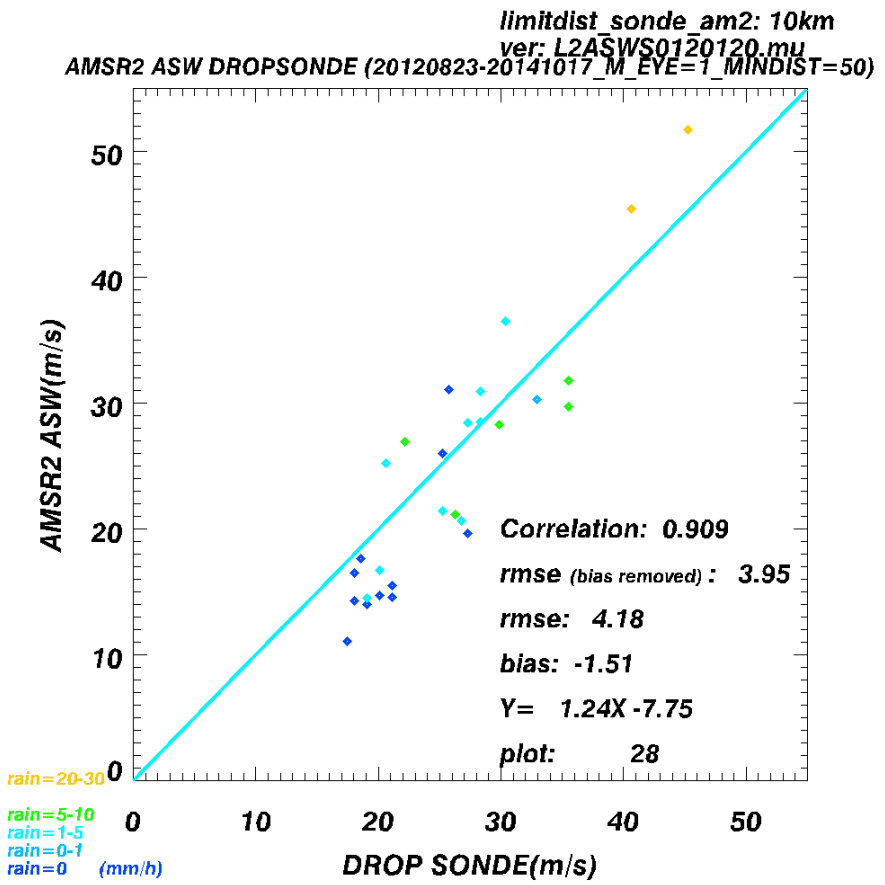
GPS-dropsonde data are provided courtesy of the NOAA/AOML/Hurricane Research Division in Miami, FL (USA).

ASW validation results by dropsondes (2/2)

- Validation results for wind speeds more than 17 m/s
  - Bias -1.51 m/s
  - **<u>RMSE 3.95 m/s</u>**

  (, which met the goal accuracy 7 m/s.)



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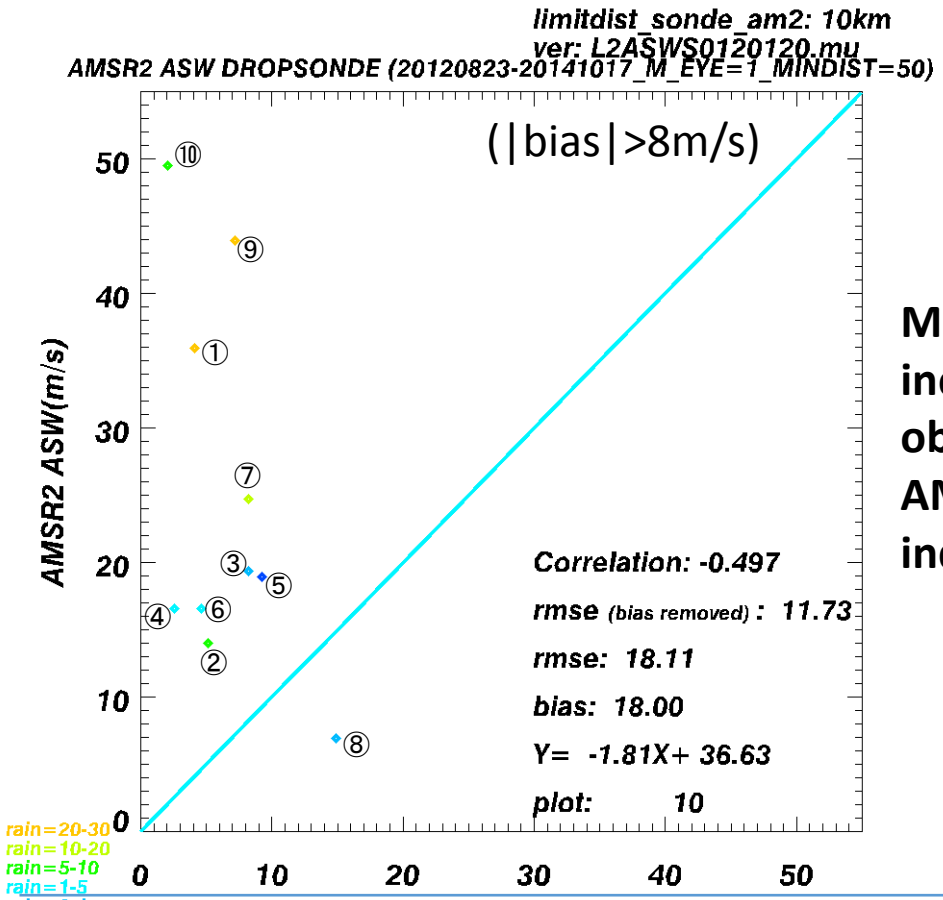
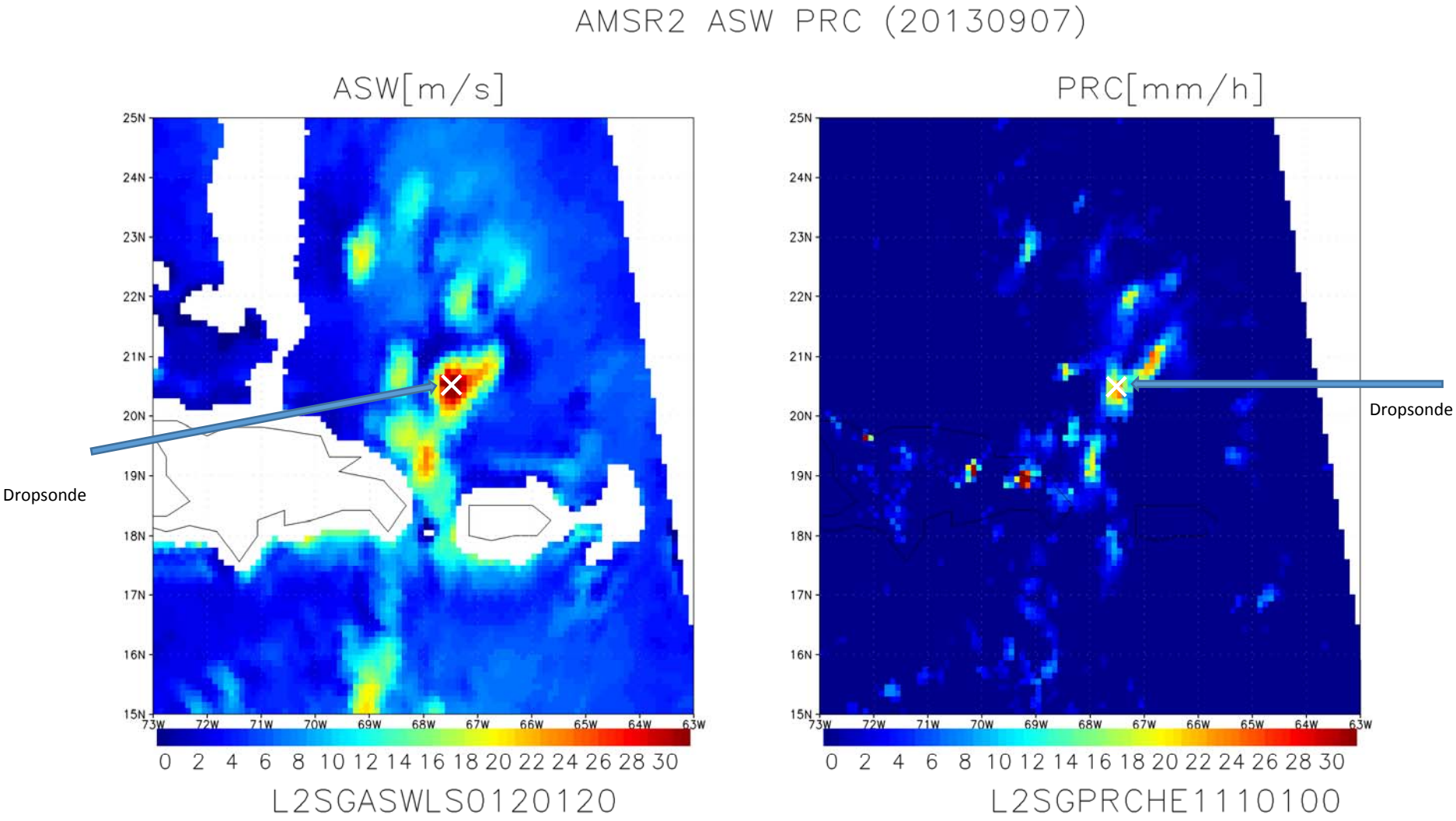
Investigation of incidents causing the large ASW biases



Most of the large biases were caused in the incidents whose time difference between the observation by the dropsonde and that by the AMSR2 was more than about 60 minutes indicated by red letters.

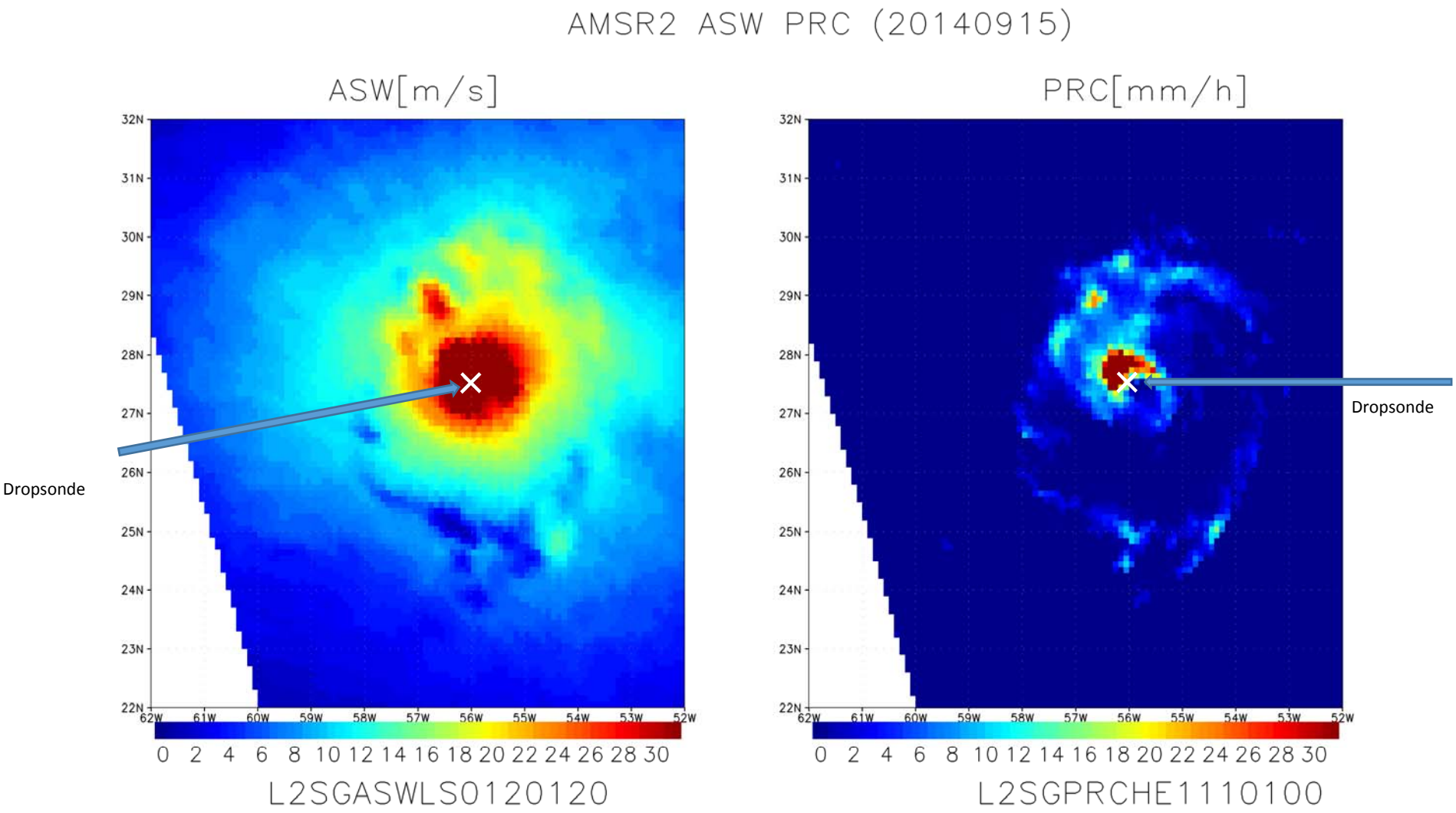
No	Year	Month	Day	Hour	Minute	Latitude	Longitude	Wind speed by the sonde	Sonde name	Dist. (Sonde - Best track) [km]	Wind speed of the best track	Path	ASW	Precip. [mm]	Dist. (Sonde – AMSR2) [km]	Time (Sonde – AMSR2) [min]
①	2013	9	7	18	58	20.52	-67.49	4.1152	GABRIELL	384	12.86	111A	35.9	23.695	5	54
②	2013	9	7	16	41	20.99	-67.48	5.144	GABRIELL	339	12.86	111A	14	5.715	4	83
③	2013	9	7	16	53	20.58	-66.92	8.2304	GABRIELL	409	12.86	111A	19.35	0.755	2	71
④	2013	9	7	17	26	20.96	-67.48	2.572	GABRIELL	342	12.86	111A	16.58	2.9	4	38
⑤	2013	9	7	17	46	20.54	-67	9.2592	GABRIELL	408	12.86	111A	18.95	0	3	18
⑥	2013	9	7	18	24	20.96	-67.46	4.6296	GABRIELL	343	12.86	111A	16.58	2.9	2	20
⑦	2013	9	7	18	38	20.65	-67.09	8.2304	GABRIELL	392	12.86	111A	24.7	17.23	2	34
⑧	2013	9	7	19	4	22.48	-68.11	14.9176	GABRIELL	167	12.86	111A	6.9	0.775	3	60
⑨	2014	8	25	19	24	26.86	-69.66	7.2016	CRISTBAL	333	25.72	111A	43.9	27.83	3	78
⑩	2014	9	15	18	11	27.51	-56.02	2.0576	EDOUARD	72	48.86	8098A	49.5	7.815	4	83

Incident ① (|Bias|>8m/s)



No	Year	Month	Day	Hour	Minute	Latitude	Longitude	Wind speed by the sonde	Sonde name	Dist. (Sonde - Best track) [km]	Wind speed of the best track	Path	ASW	Precip. [mm]	**Dist. (Sonde – AMSR2) [km]**	**Time (Sonde – AMSR2) [min]**
①	2013	9	7	18	58	20.52	-67.49	4.1152	GABRIELL	384	12.86	111A	35.9	23.695	**5**	**54**

Incident ⑩ (|Bias|>8m/s)



No	Year	Month	Day	Hour	Minute	Latitude	Longitude	Wind speed by the sonde	Sonde name	Dist. (the sonde - the best track) [km]	Wind speed of the best track	Path	ASW	Precip. [mm]	**Dist. (the sonde – AMSR2) [km]**	**Time (the sonde – AMSR2) [min]**
⑩	2014	9	15	18	11	27.51	-56.02	2.0576	EDOUARD	72	48.868	098A	49.5	7.815	**4**	**83**

Summary

- The 10-GHz SST (version 2.1) met the goal accuracy to be released to the public as the part of the standard SST product (version 2.1) in March 2015.

- Additionally, the AMSR2 ASW (version 1.2) also met the goal accuracy not only in the strong wind speed range (> 17 m/s) but in the total wind speed range. It was released to the public in October 2015.
  - There were negative biases（-1～-2 m/s）in the strong wind speed range. This is the current problem to be improved in the future.

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