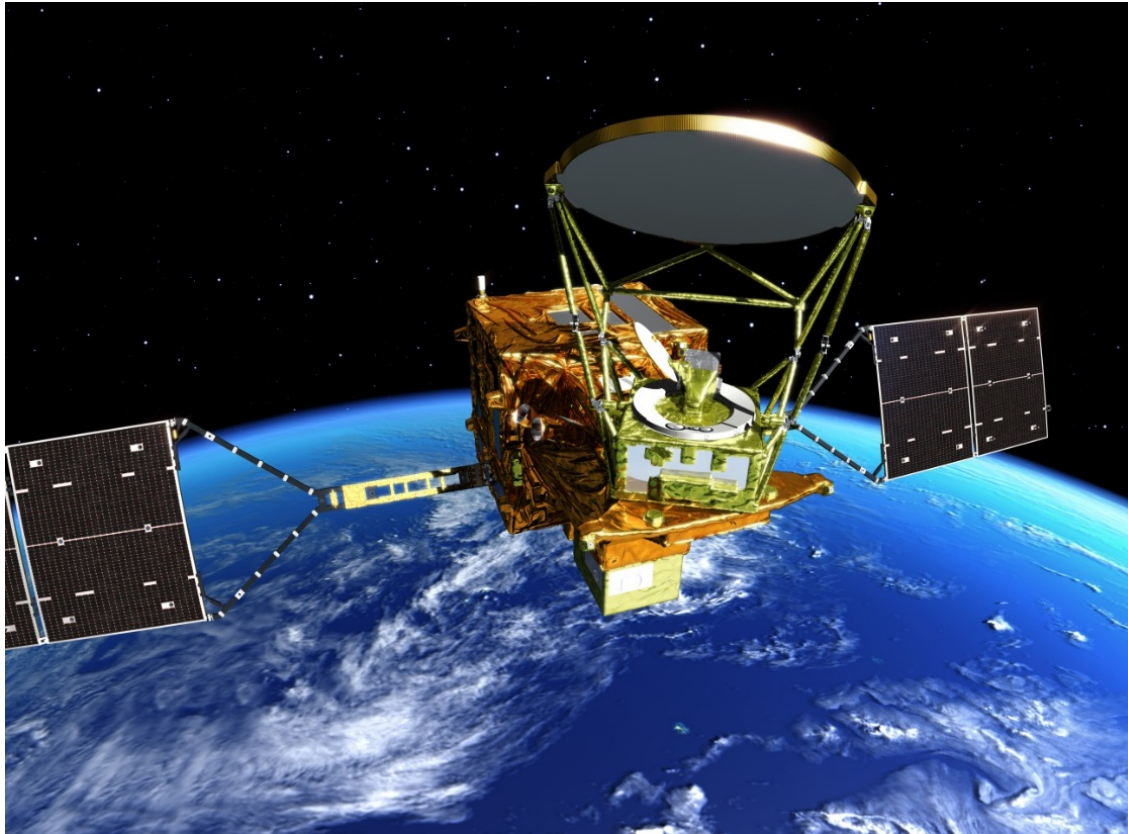# Evaluation of Marine Surface Wind observed by AMSR2 on GCOM-W

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Outline

1. Evaluation of Standard SSW product (v3, v4)

+ Comparison with buoy measurements

+ Comparisons with ERA-interim and RapidSCAT

2. Evaluation of ASW product

+ Comparison with airborne SFMR measurements

+ Comparison of 50-kt radius with JMA Best-track data

3. Assessment of long-term stability

+ Seasonal and interannual variations in the wind speed bias

Data

- JAXA V4, V3beta, V2.1 AMSR2 Level 2 Sea Surface Wind Speeds

    Aug. 2013 – Aug. 2015

- NDBC, TAO, PIRATA, RAMA, WHOI, KEO buoys

    Aug. 2013 – Aug. 2015

- ERA interim 10 m wind

    Jan. 2015 – Mar. 2015

- RapidSCAT 12.5 km vector wind product (JPL)
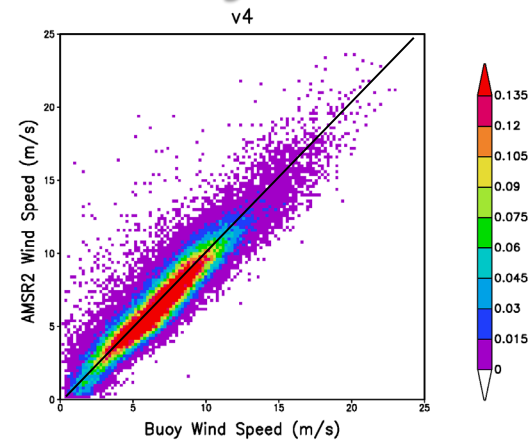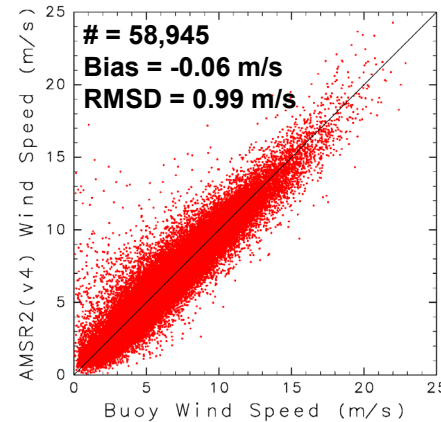
    Jan. 2015 – Mar. 2015
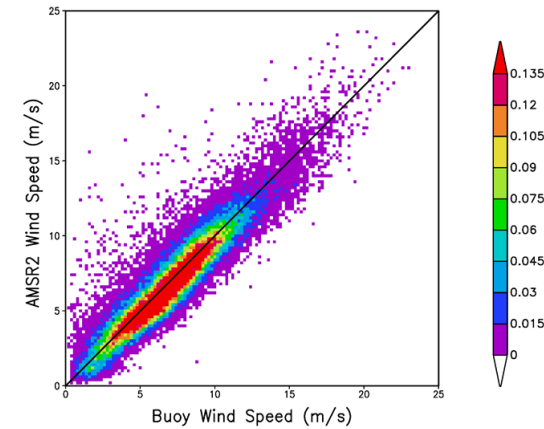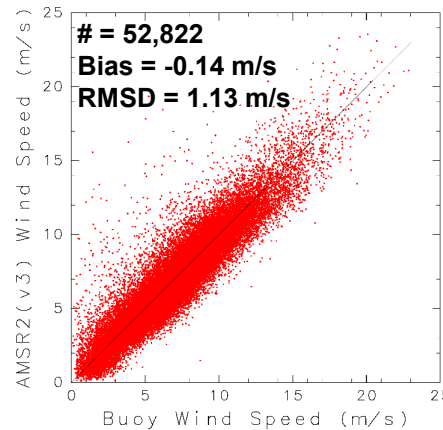
Comparison with Buoy Data
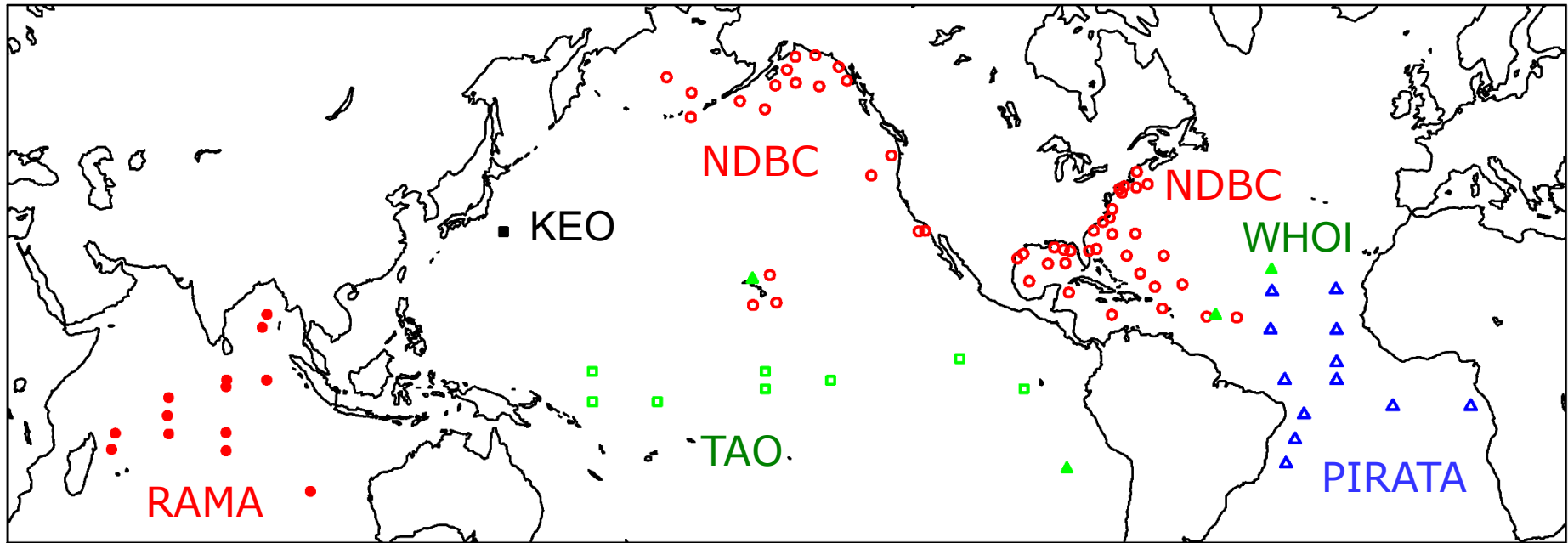
- Collocation
  - Δr < 12.5 km, Δt < 5 min.
- Height and Stability Collections
  - Liu and Tang (1996) Code
  - 10-m height Equivalent Neutral Wind Speed
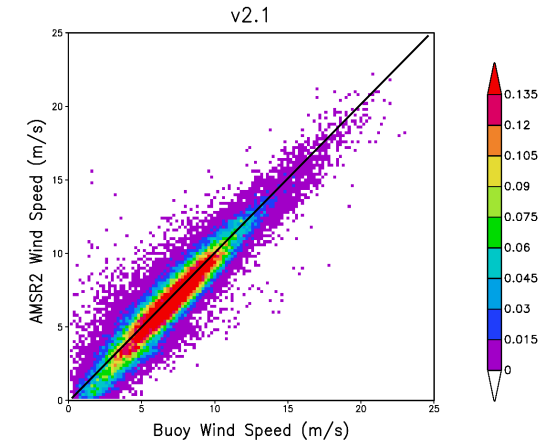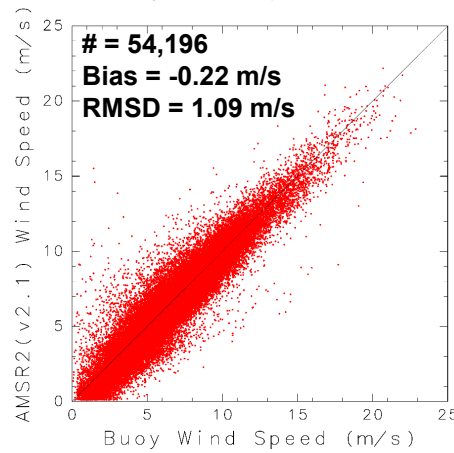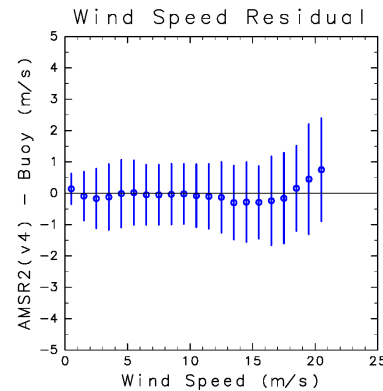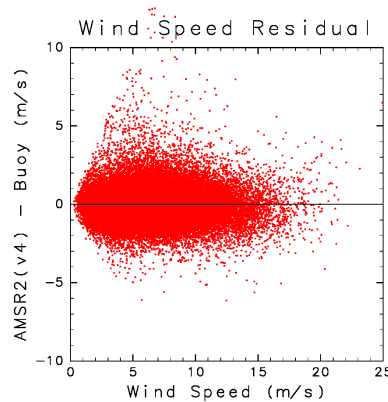
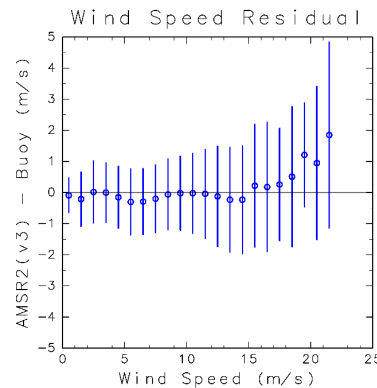# Comparisons with Buoy Data (1)

V4

V3 beta

V2.1

Wind Speed Residual - Buoy

V4

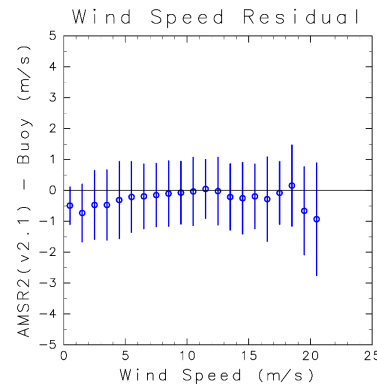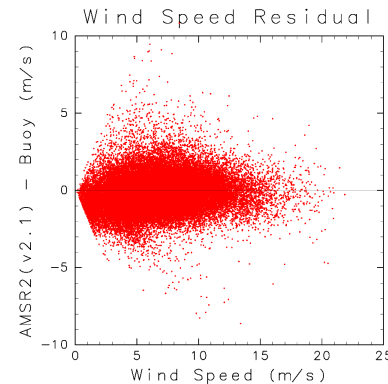**V3 beta**
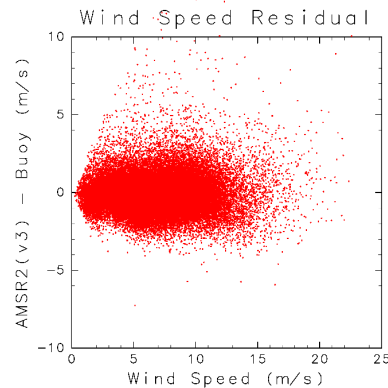
V2.1

Binning wind speed = (AMSR2 + Buoy) / 2

Global Comparison with ERA-interim Reanalysis Data

- AMSR2 Level 2 (swath) wind speed

- Jan-Mar 2013 (3 months)

- Global ocean, 60^oS – 60^oN

- Collocated with ERA-interim winds (Non-EN wind)

    0.75^o x 0.75^o, 6-hour interval

    Linear interpolation in time and space to AMSR2 obs.

- Total number of collocated data points ~ 300 million

Comparison with ERA interim
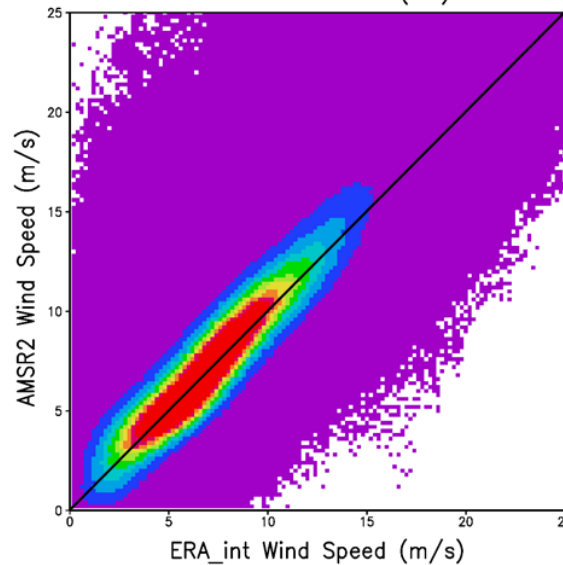
V4

Jan–Mar 2015 (v4)

V3 beta

Jan–Mar 2015 (v3)

V2.1

Jan–Mar 2015 (v2.1)
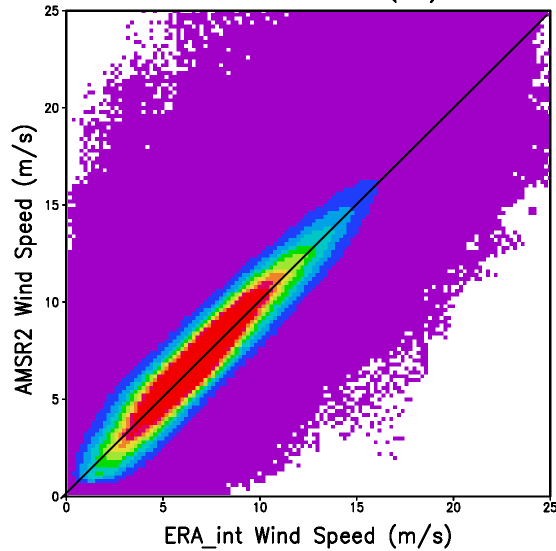
	V4	V3 beta	V2.1
Number of data points	311,976,062	305,814,484	302,216,252
Bias	0.23 (m/s)	0.35 (m/s)	-0.03 (m/s)
RMS Difference	1.28 (m/s)	1.48 (m/s)	1.48 (m/s)
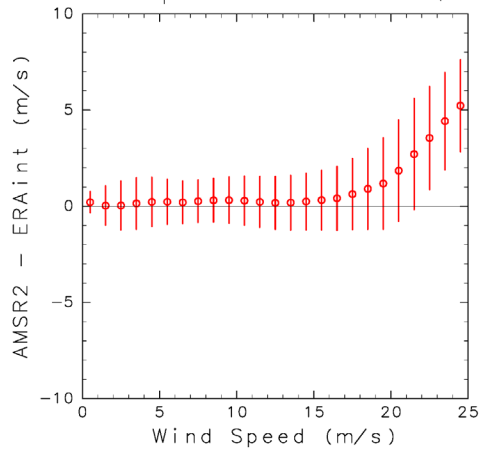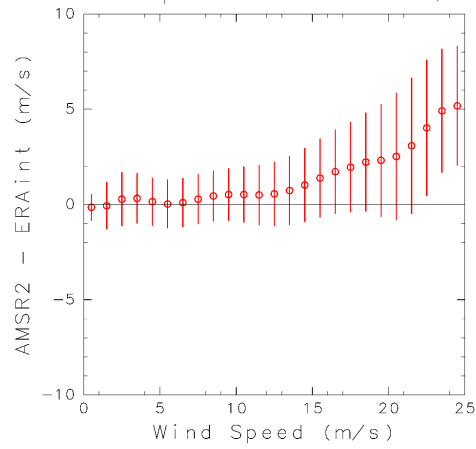
Global Wind Speed Histogram – ERA interim
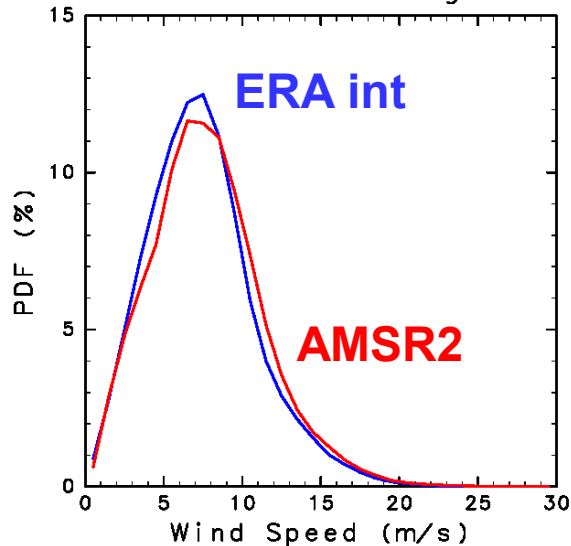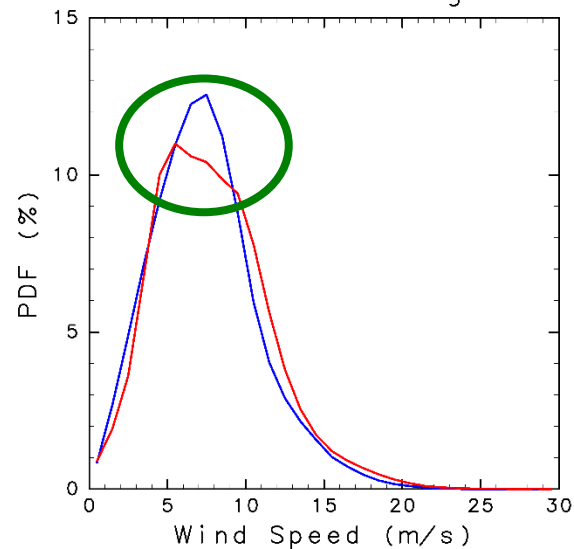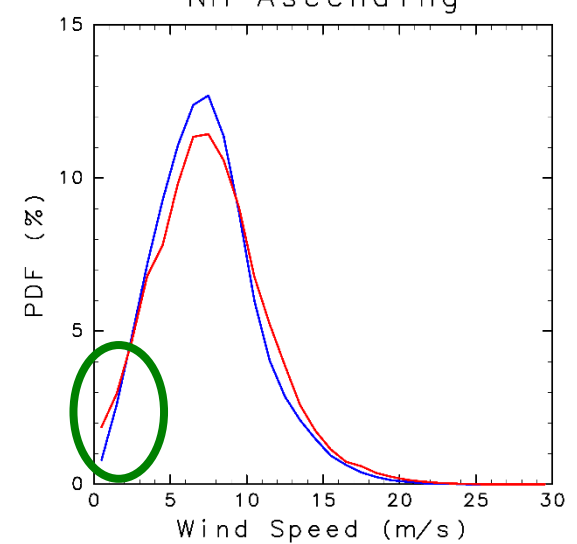
Comparison with RSCAT

V4

V3 beta

V2.1
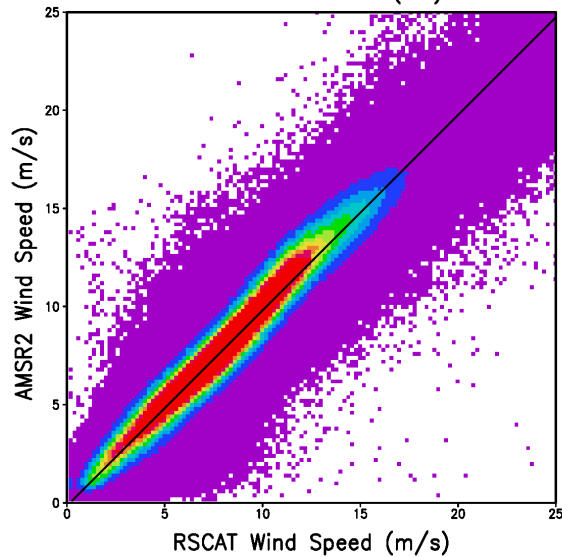
	V4	V3 beta	V2.1
Number of data points	4,253,769	4,202,260	3,850,522
Bias	-0.02 (m/s)	0.22 (m/s)	-0.34 (m/s)
RMS Difference	1.03 (m/s)	1.42 (m/s)	1.20 (m/s)
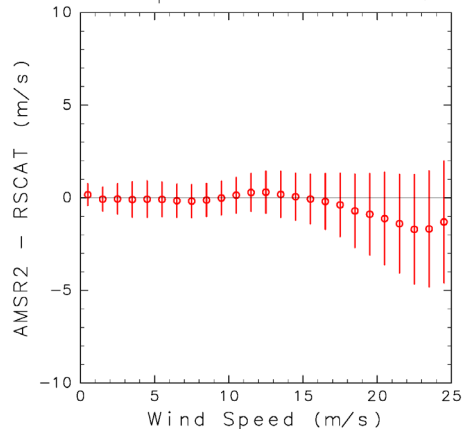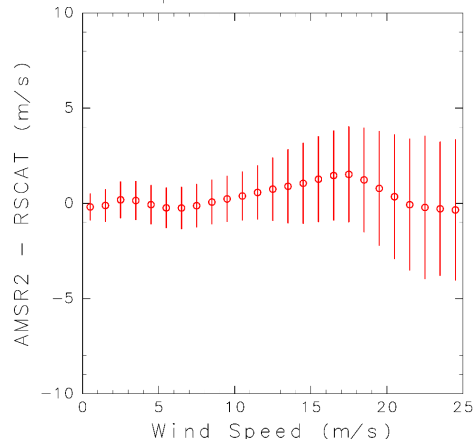
Triple Collocation (AMSR2/Buoy/ERA)

V4

Number of data points = 3,195

	Slope	Bias (m/s)	Error (m/s)
Buoy	1.000	0.000	0.869
ERA interim	1.000	-0.451	1.112
AMSR2	0.887	0.614	0.713

V3 beta

Number of data points = 3,035

	Slope	Bias (m/s)	Error (m/s)
Buoy	1.000	0.000	0.806
ERA interim	0.980	-0.262	1.081
AMSR2	0.897	0.625	1.016

V2.1

Number of data points = 1,761

	Slope	Bias (m/s)	Error (m/s)
Buoy	1.000	0.000	0.782
ERA interim	1.046	-0.698	1.100
AMSR2	0.898	0.596	0.931

Summary 1

- JAXA AMSR2 (v4) wind speed data were evaluated by comparisons with data from offshore buoys, ERA interim, and RSCAT.

- The AMSR v4 wind showed better agreements with those data compared to v3 (and previous versions). No systematic bias was discernible.

- The global wind histogram of v3 wind speed showed broader peak (or double peaks) compared to ERA interim wind. This trend is much reduced in v4.

- Results of the triple collocation analysis indicated that the random error in AMSR2 v4 wind speed is lower than that in buoy data???

Ignacio (Aug 31, 2015)
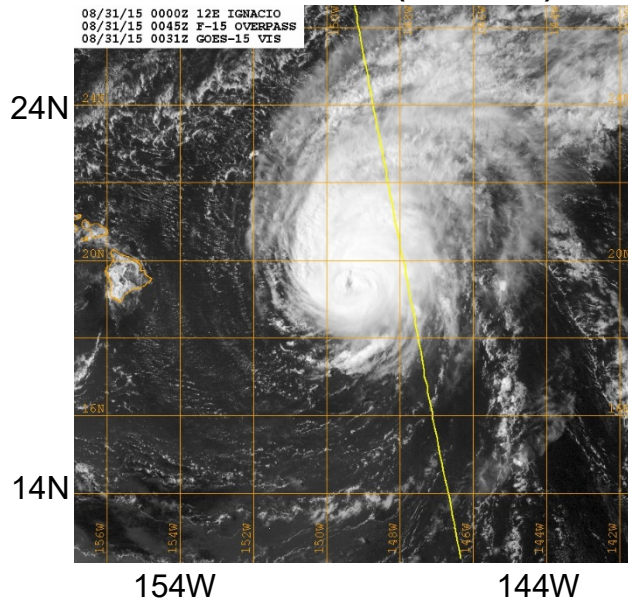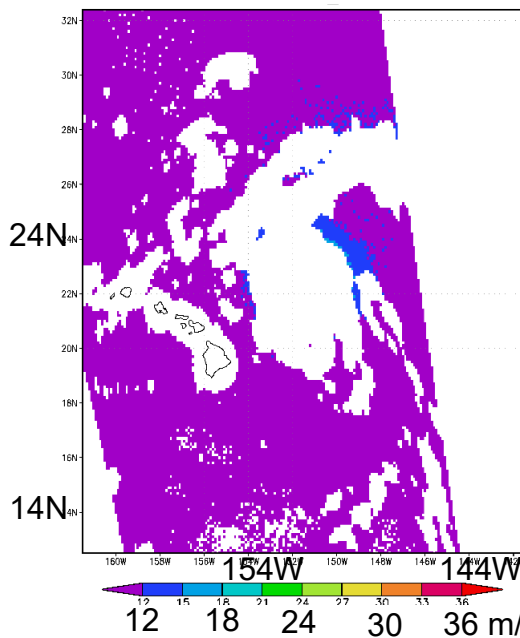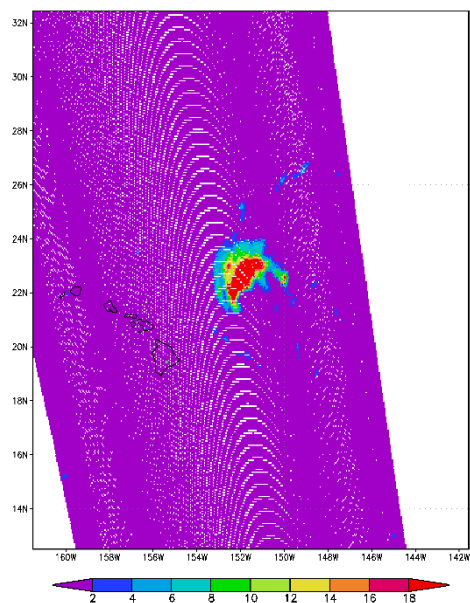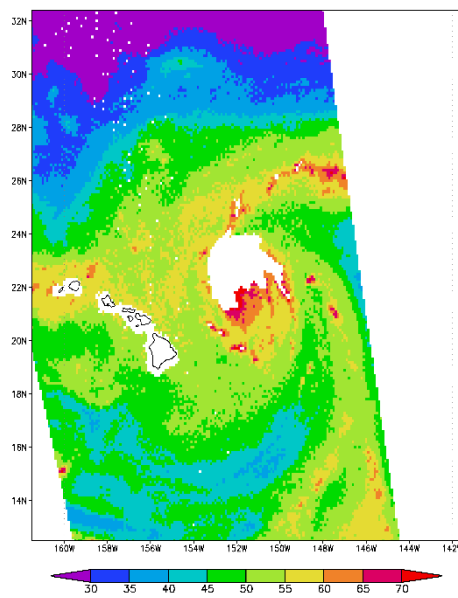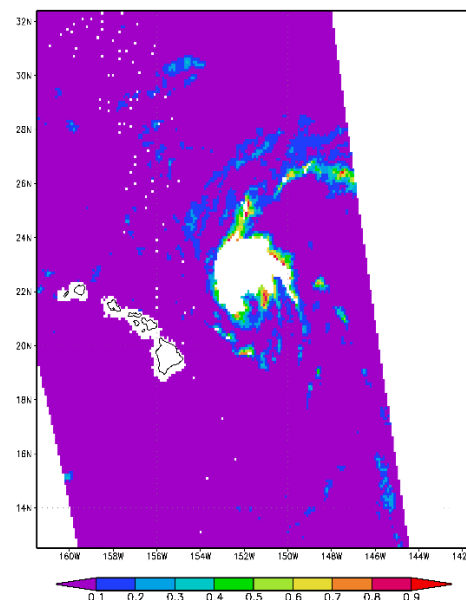
Comparison of AMSR2 AWS Wind Speed with SFMR
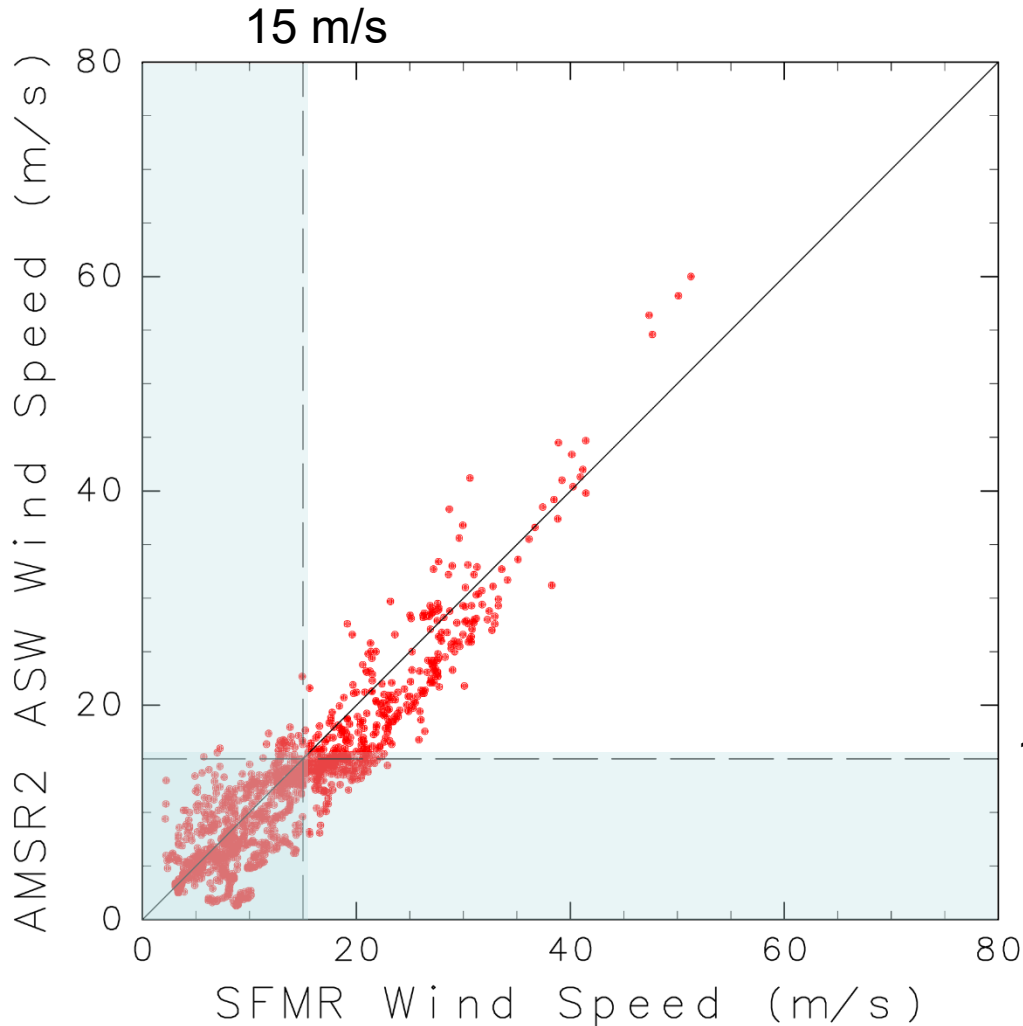
For data points of wind speed higher than 15 m/s.
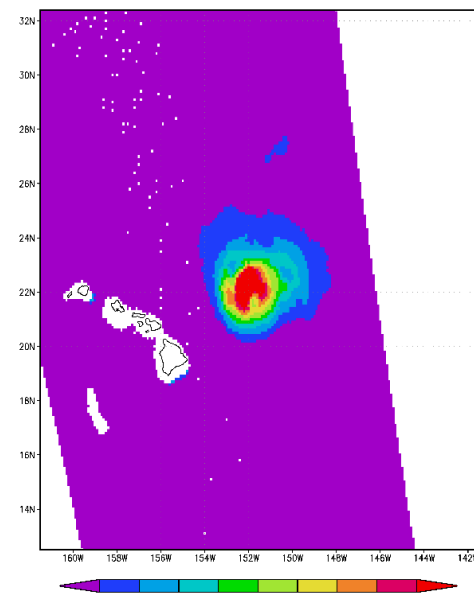
Number of data points	347
Bias	-1.94 m/s
RMS difference	3.26 m/s

Typhoon Nangka (T1511)

GMS Cloud Image
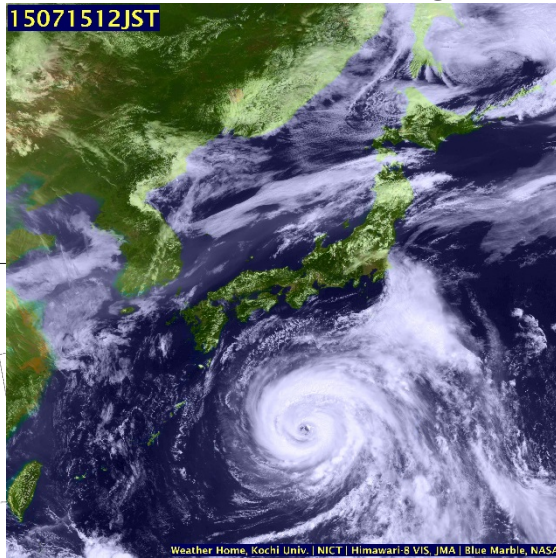
AMSR2 AWS Data
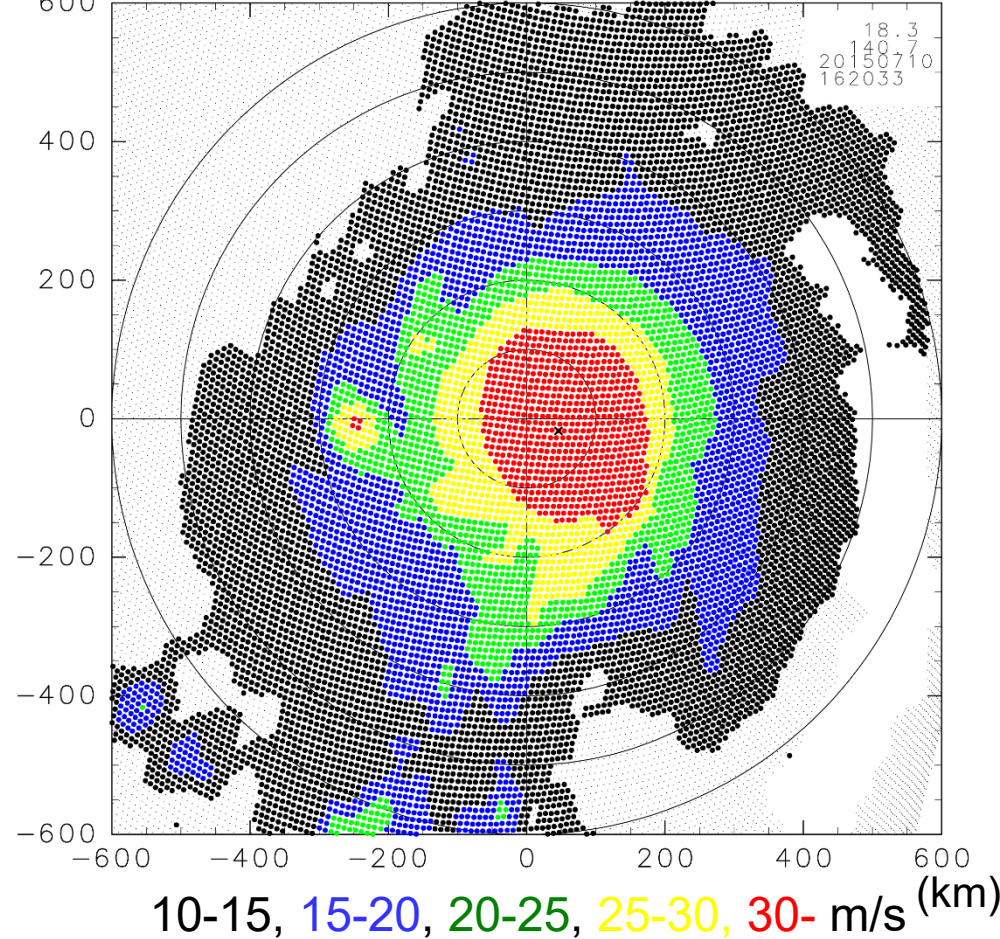
Trajectory from the JMA Best-track data

10-15, 15-20, 20-25, 25-30, 30- m/s
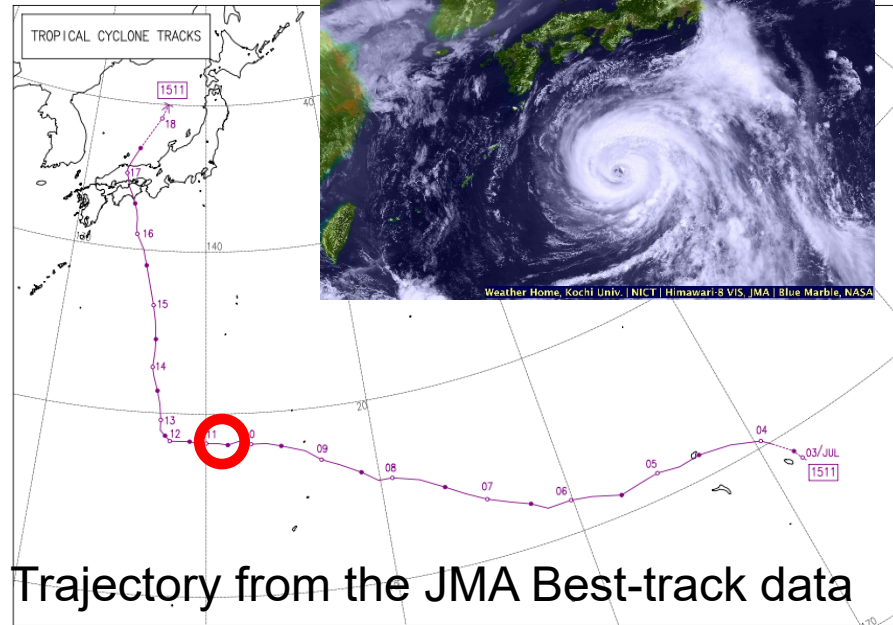
To evaluation spatial distribution of extreme wind area, the 50-kt radius was estimated from the AMSR2 AWS data and compared with the JMA Best-track data.

Time Series of 50-kt Radius and Max Wind Speed (T1511)
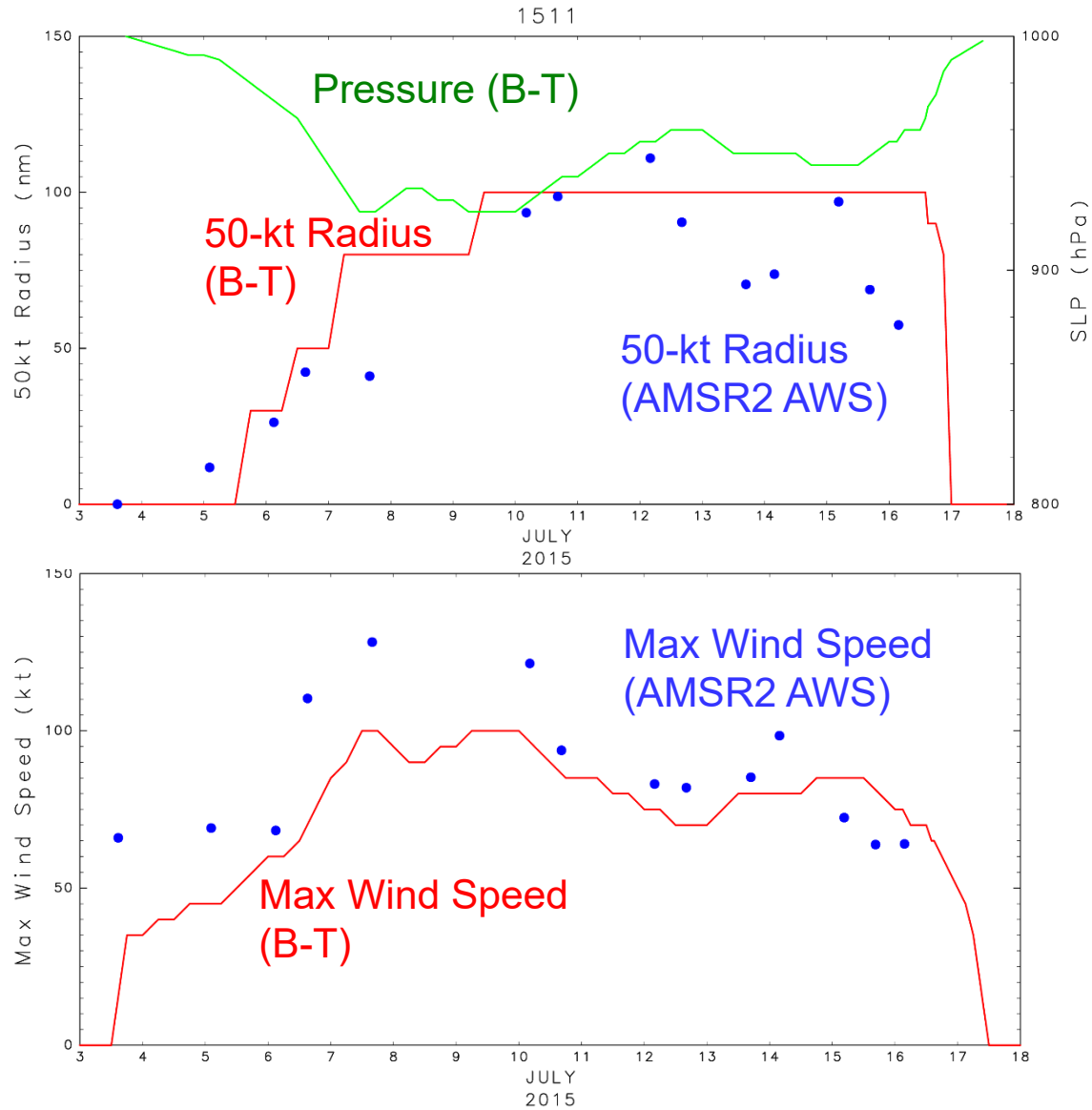
Comparison of 50-kt Radius
(28 Typhoons in 2012-2017)
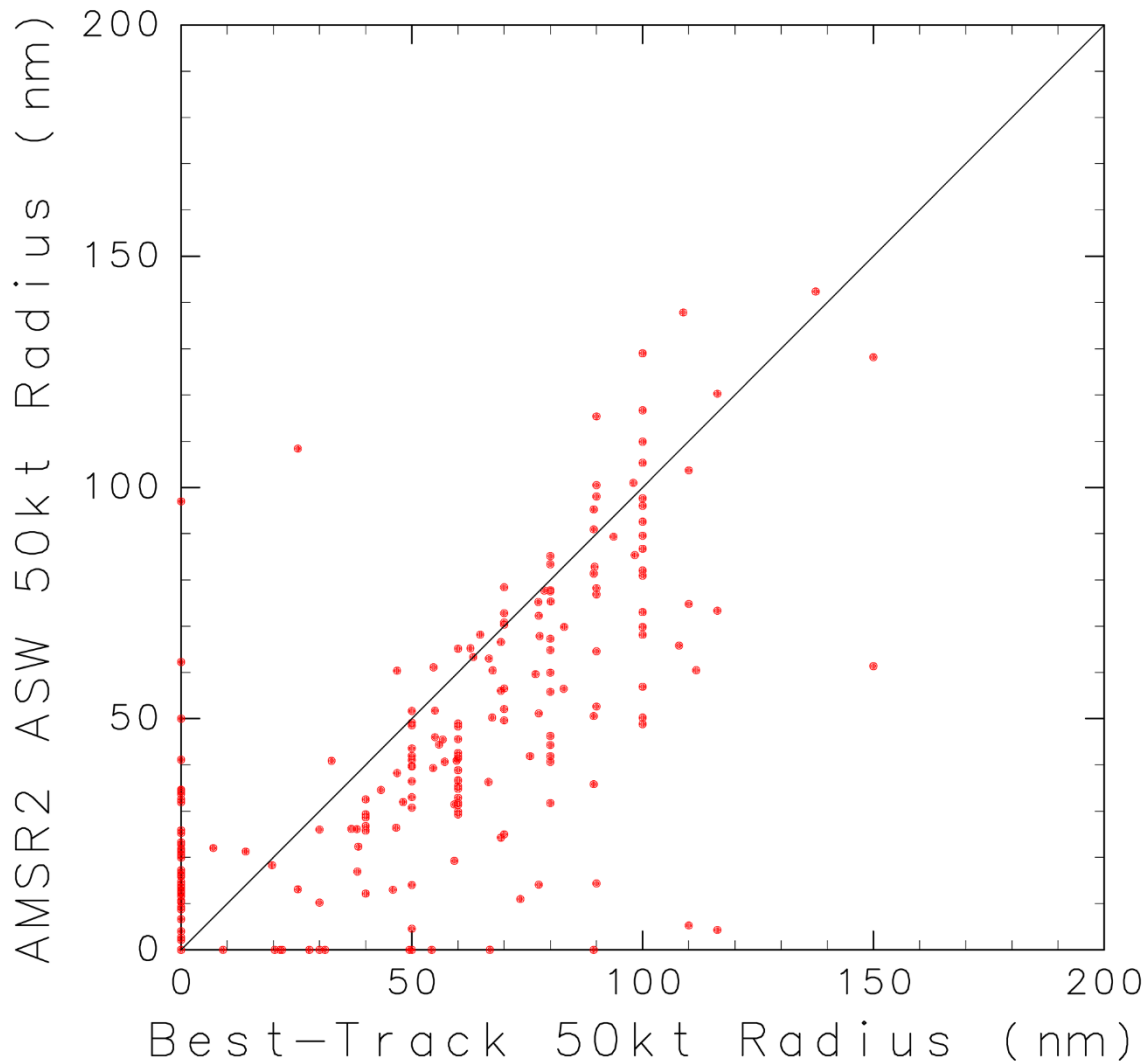
Number of
data points   154

Bias   -16.3 km

RMS difference 28.2 km

Correlation   0.650

Summary - 2

- JAXA developed the AMSR2 All-weather Sea Surface Wind Speed (AWS) Product for high-wind and heavy-rain conditions.

- To validate the AWS product, airborne SFMR data were calibrated with dropsonde observations and smoothed along flight tracks.

- The AWS wind speed agreed well with the SFMR data with RMS difference of 3.26 m/s in the wind speed range higher than 15 m/s.

- Spatial distribution of high-wind area of the AWS is evaluated by comparisons of the JMA Typhoon Best-track data.

- Comparison of 50-kt radius around 28 typhoons during a period from 2012 to 2017 showed reasonable correlation (correlation coefficient = 0.650) , although the AMSR2 AWS tends to underestimate the 50-kt radius compared to the best-track data.

- It is exhibited that AMSR2 AWS product is useful to monitor wind speed around tropical and extratropical cyclones under extreme wind and rain conditions.

Time Series of Bias from AMSR-E (v8) and AMSR2 (v4) (All the Buoys)
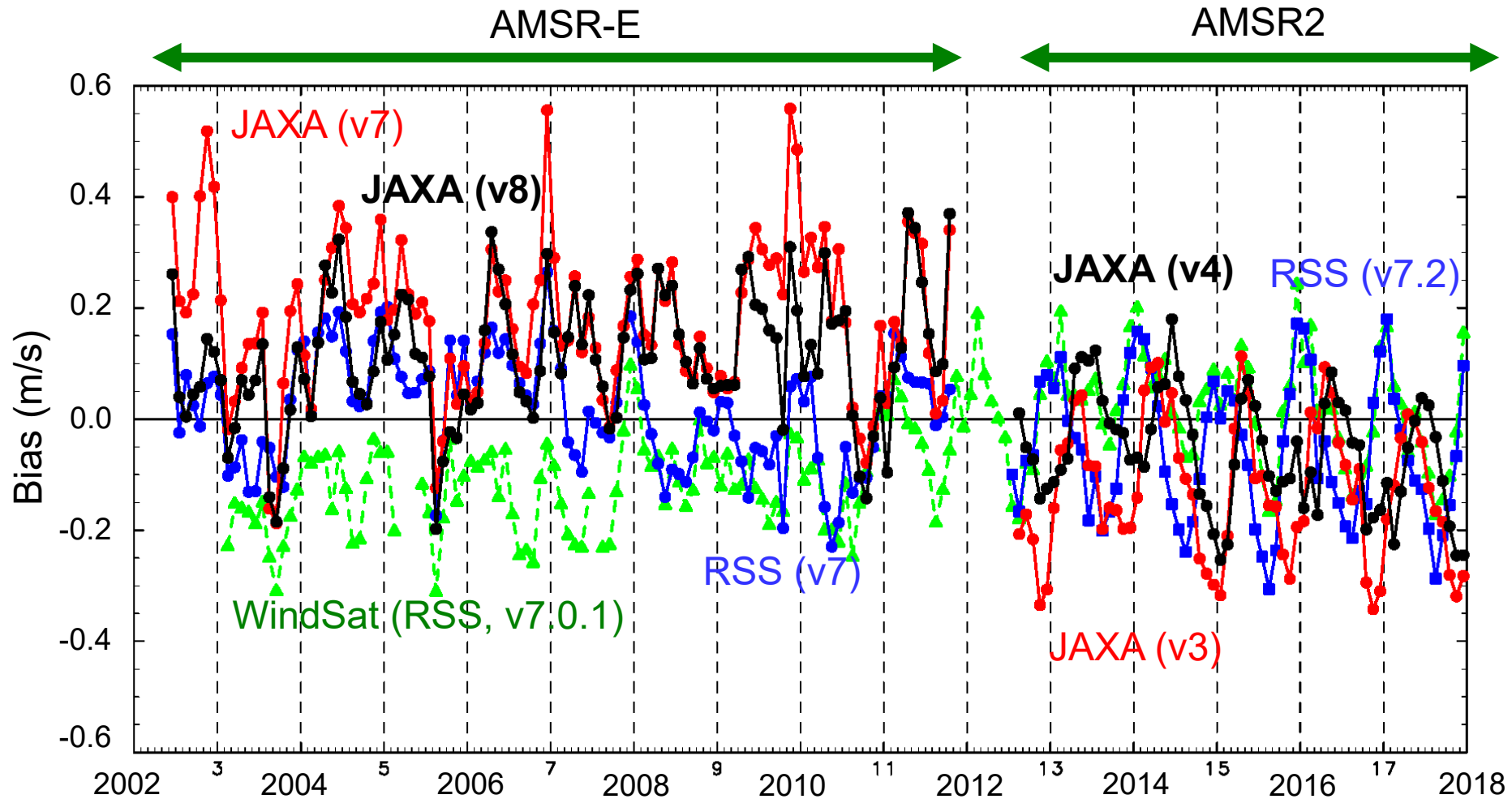
Seasonal Variations in Bias
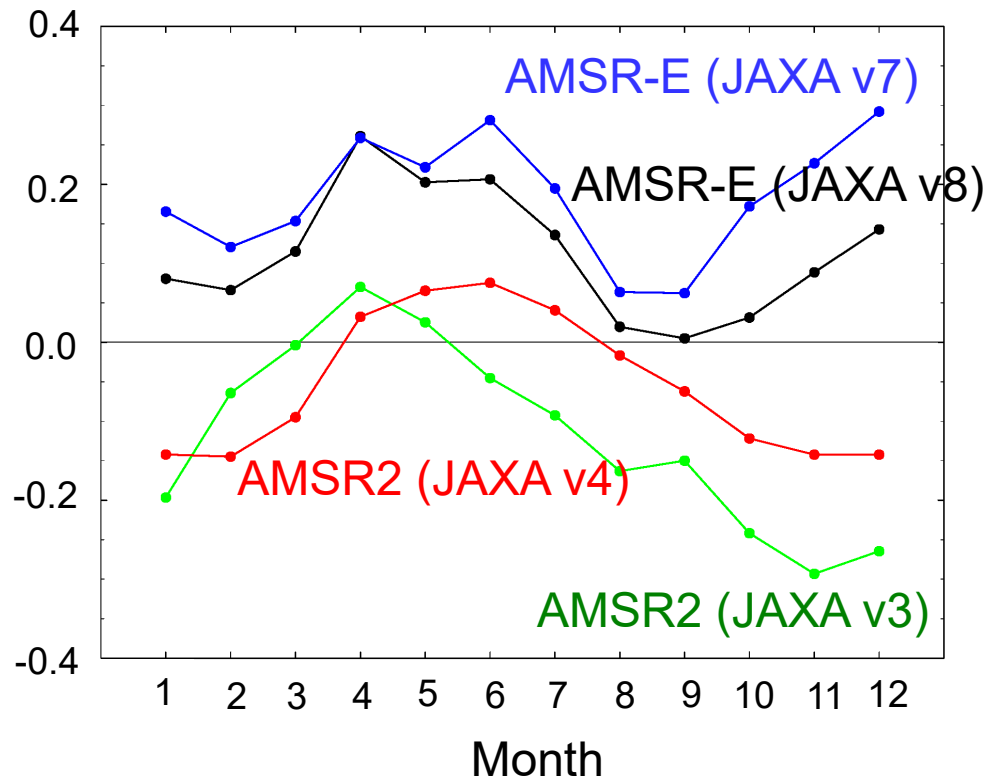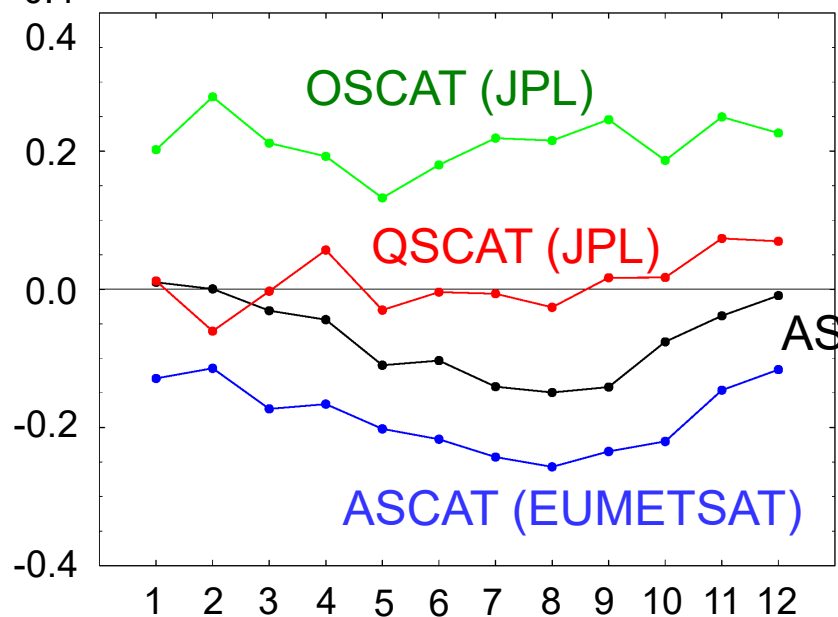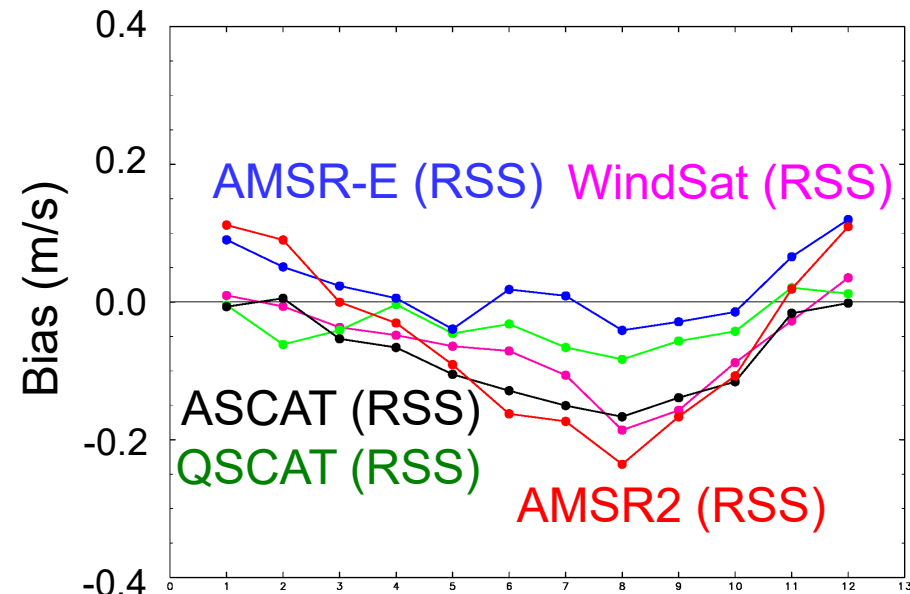
Summary - 3

- To assess long-term stability of marine surface wind speed observed by the AMSR series, the wind data from AMSR2 and AMSR-E were compared with buoy observations.

- The wind speed bias showed clear seasonal and interannual variations.

- In mid and high latitudes, the seasonal variation is significant, while the interannual trend exceeds in low latitudes.

- A large gap (0.4 m/s) exists between JAXA's AMSR2 (v3/v4) and AMSR-E (v7/v8). Improvement of the gap from AMSr-E v7 to v8 is not significant.

- In other wind products including the RSS's AMSR2 and AMSR-E wind data, the similar seasonal variations in the wind speed bias were discernible, although the phase shows a shift of 4-5 months.

- The seasonal variations were found in wind data from other passive and active wind sensors (WindSat, ASCAT, QSCAT, OSCAT…).

- To complete a consistent wind data set over 30 years by AMSR series (AMSR-E, AMSR2, AMSR3) for climate studies, further investigations and improvements are needed to reduce the seasonal and interannual variations in wind speed bias.