Utilization of multi-satellite data for construction of high-temporal resolution data and high-accuracy daily-mean data

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Topics

- Evaluation of JAXA/AMSR2 and RSS/AMSR2 by Triton buoy data
- Construction of high-temporal resolution wind speed using multi-satellite data
- Investigation of accuracy of daily-mean data derived from of high-temporal resolution wind speed data
- Impact of high-temporal resolution wind speed on accuracy of latent heat flux

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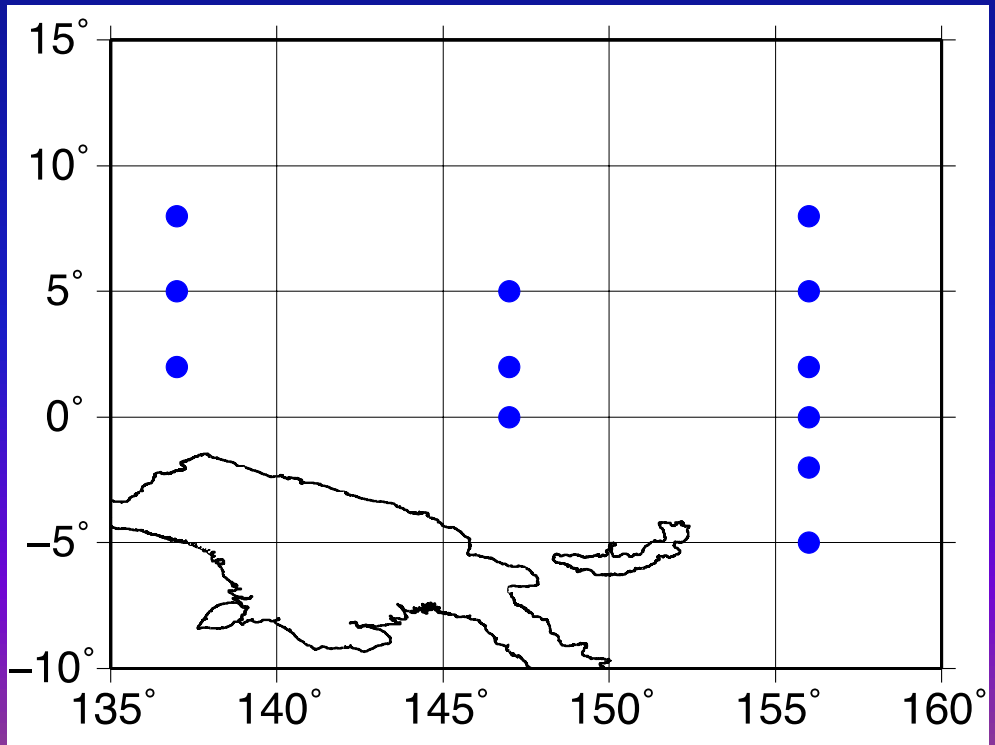
TRITON buoy data

	Temporal resolution	Height (depth)	Accuracy	Period
SSW	Hourly average	3.5 m	0.3 m/s	Jul. 2012– June. 2013
SST		-1.5 m	0.002℃	

Location of TRITON buoy



Height correction by COARE 3.0 from 3.5 to 10.0 m

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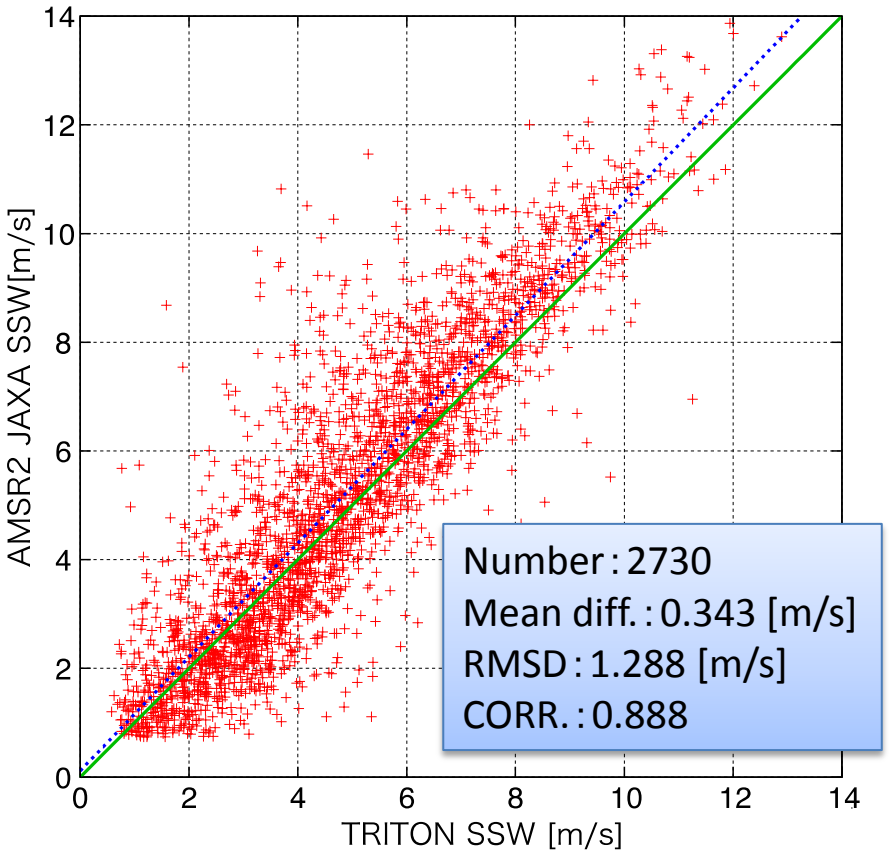
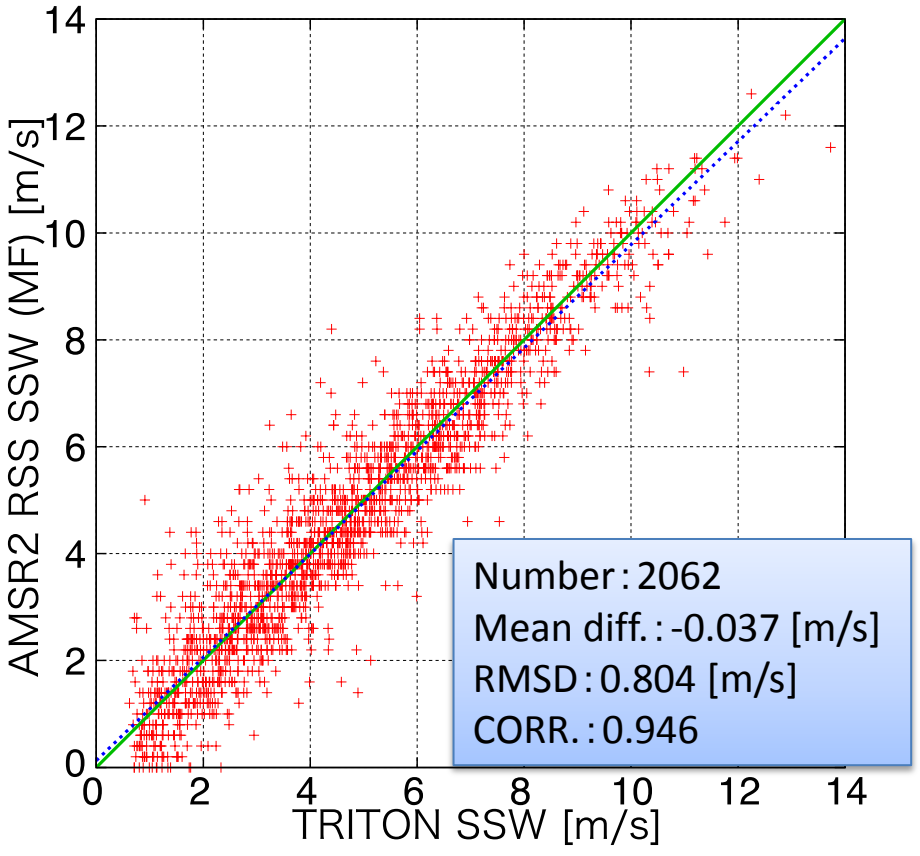
Evaluation of AMSR2 wind speed data by TRITON buoy data





We can find large mean difference for JAXA/AMSR2 data. Also the RMS difference is considerably large compared with RSS/AMSR2. Since the data number of JAXA/AMSR2 is extremely larger than RSS/AMSR2, we expect the reason of this difference of statistics between them is caused by quality control by JAXA.

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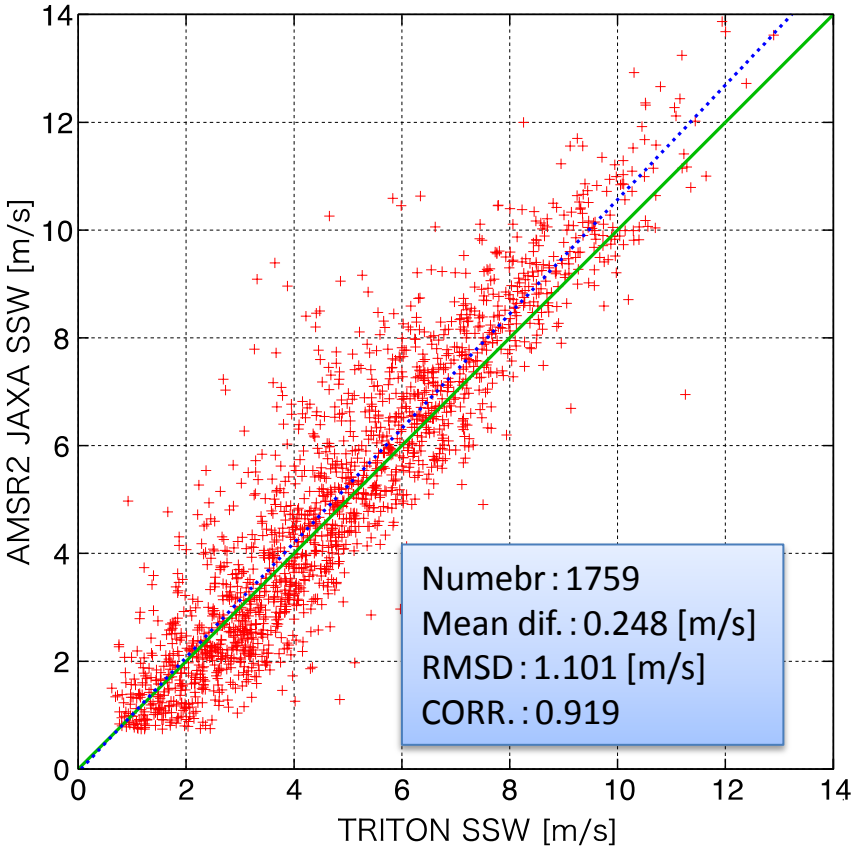
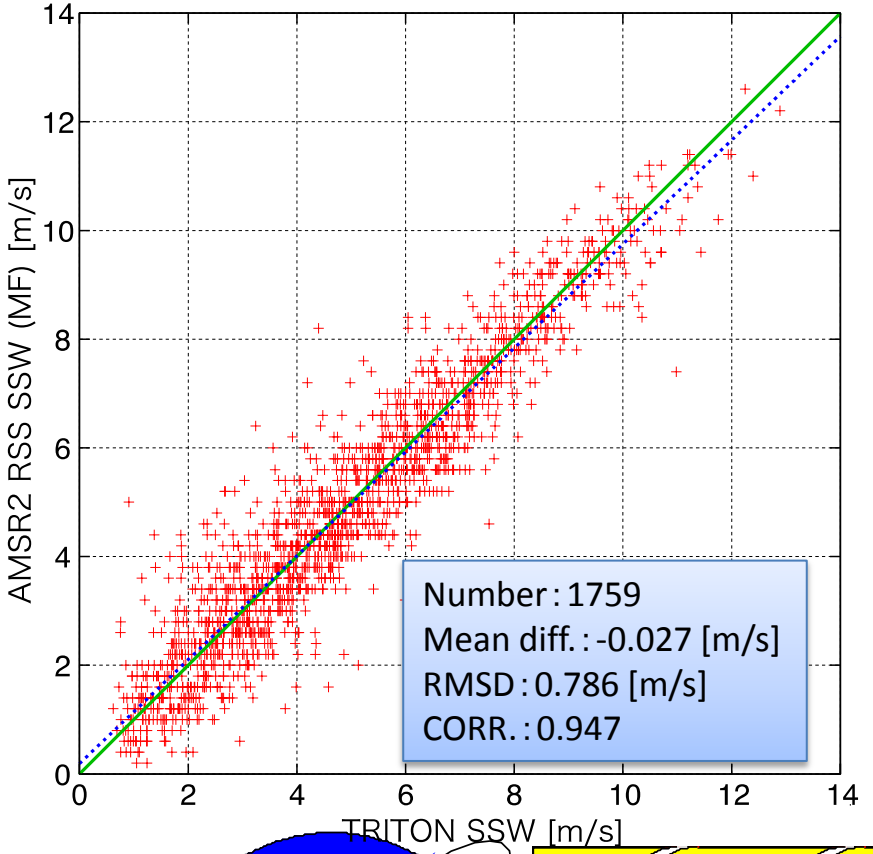
Collocated data, JAXA/AMSR2 and RSS/AMSR2





For JAXA/AMSR2 data, the data number decreases 1000 (2730->1759)for JAXA/AMSR2 and the statistics are improved. Therefore, it is concluded JAXA QC should be improved. However, the accuracy of JAXA/AMSR2 is still low compared with RSS/AMSR2.

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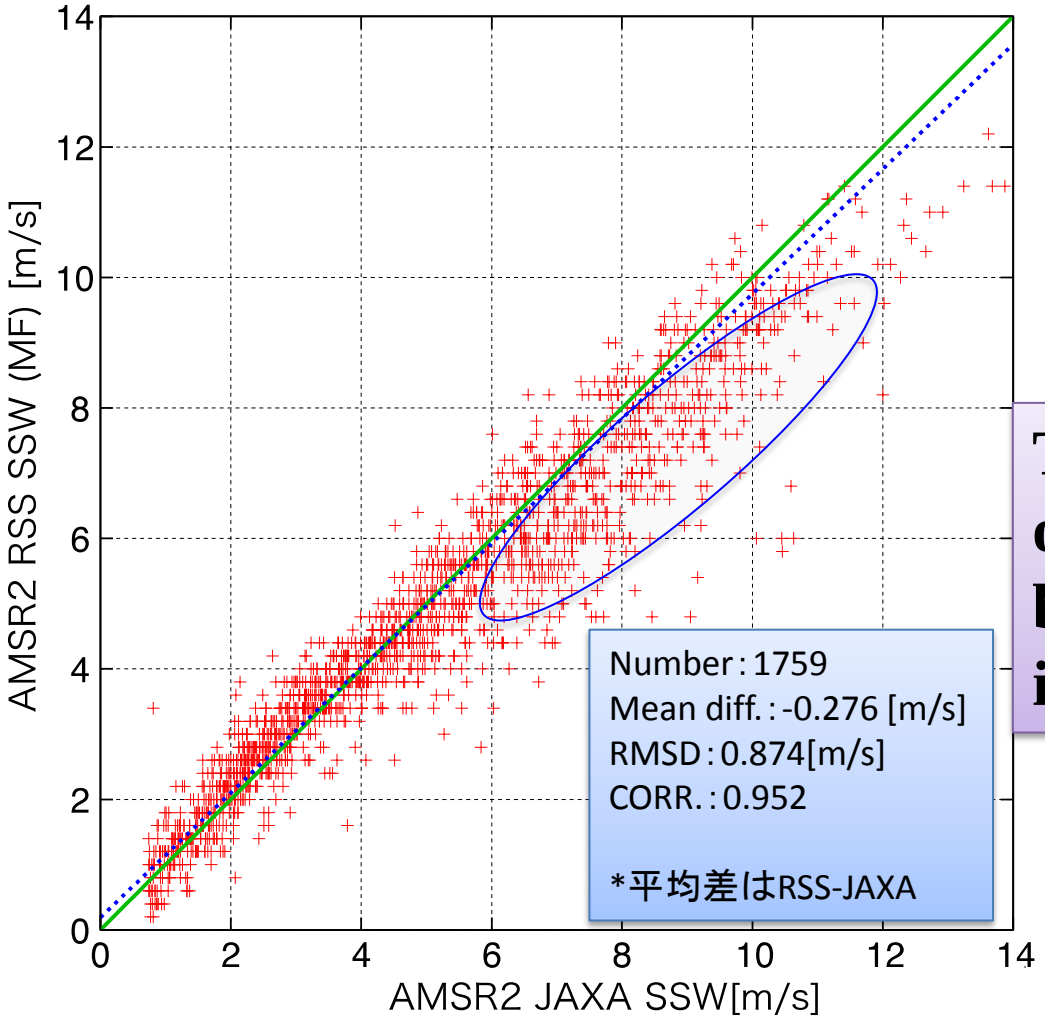
JAXA SSW vs RSS SSW



JAXA AMSR2 wind speeds are larger than RSS AMSR2 wind speeds in the high wind region.

These results suggest that not only quality control process but also algorithm should be improved for JAXA data.

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Topics

- Construction of high-temporal resolution wind speed using multi-satellite data

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Data

Sensors	Products	periods	Instruments	LECT	
				Asc.	Des.
AMSR2 v1	JAXA RSS	2012.7.3-	Radiometer	13:30	1:30
WindSat	RSS	2003.2.5-	Radiometer	18:00	6:00
Ascat-A	KNMI	2012.3.12-	Scatterometer	21:30	9:30
OSCAT	KNMI	2013.3.18-	Scatterometer	24:00	12:00

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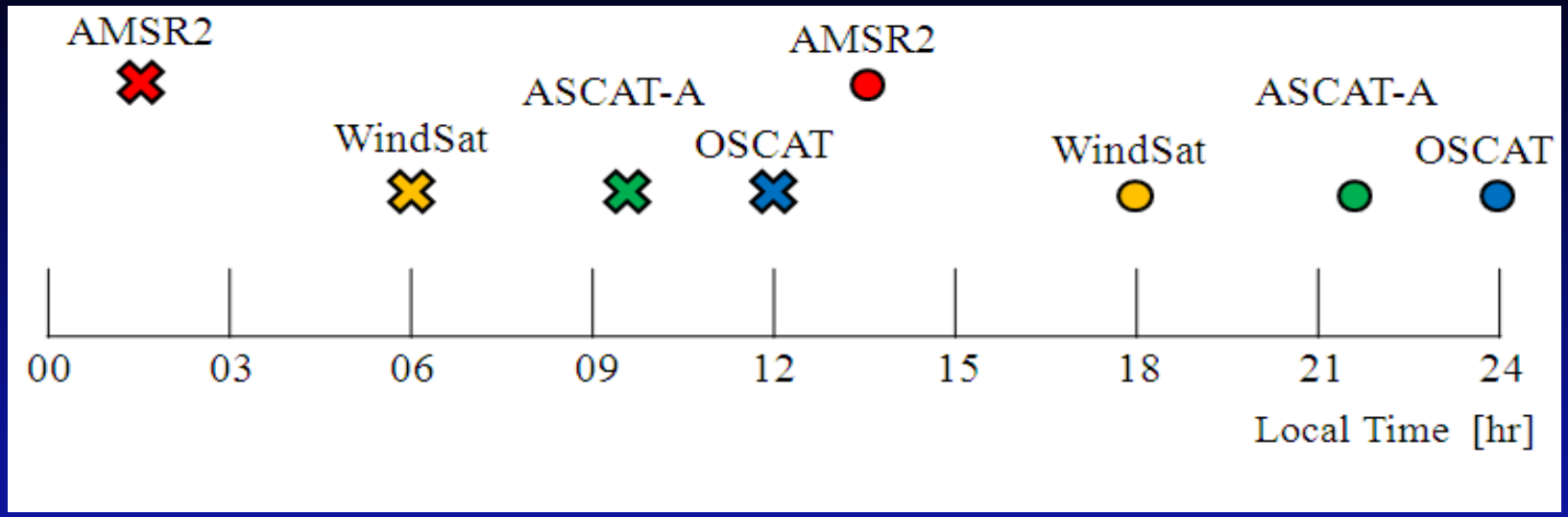
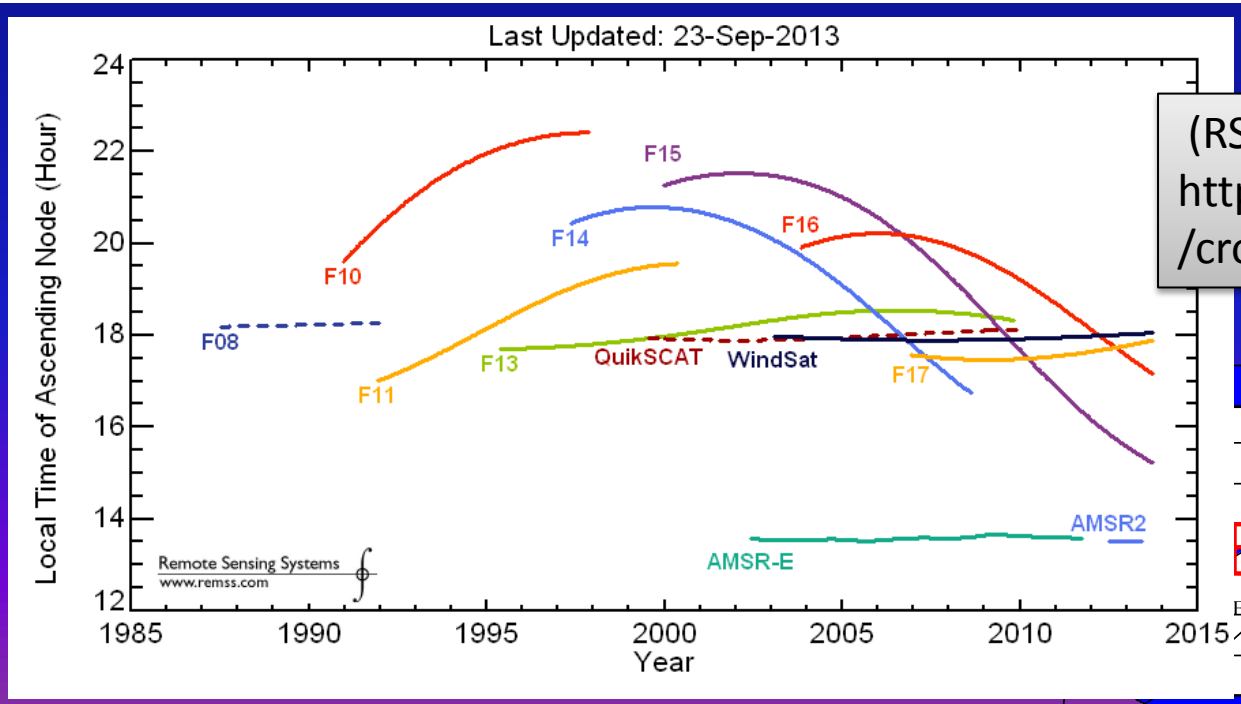
Equatorial Crossing Time

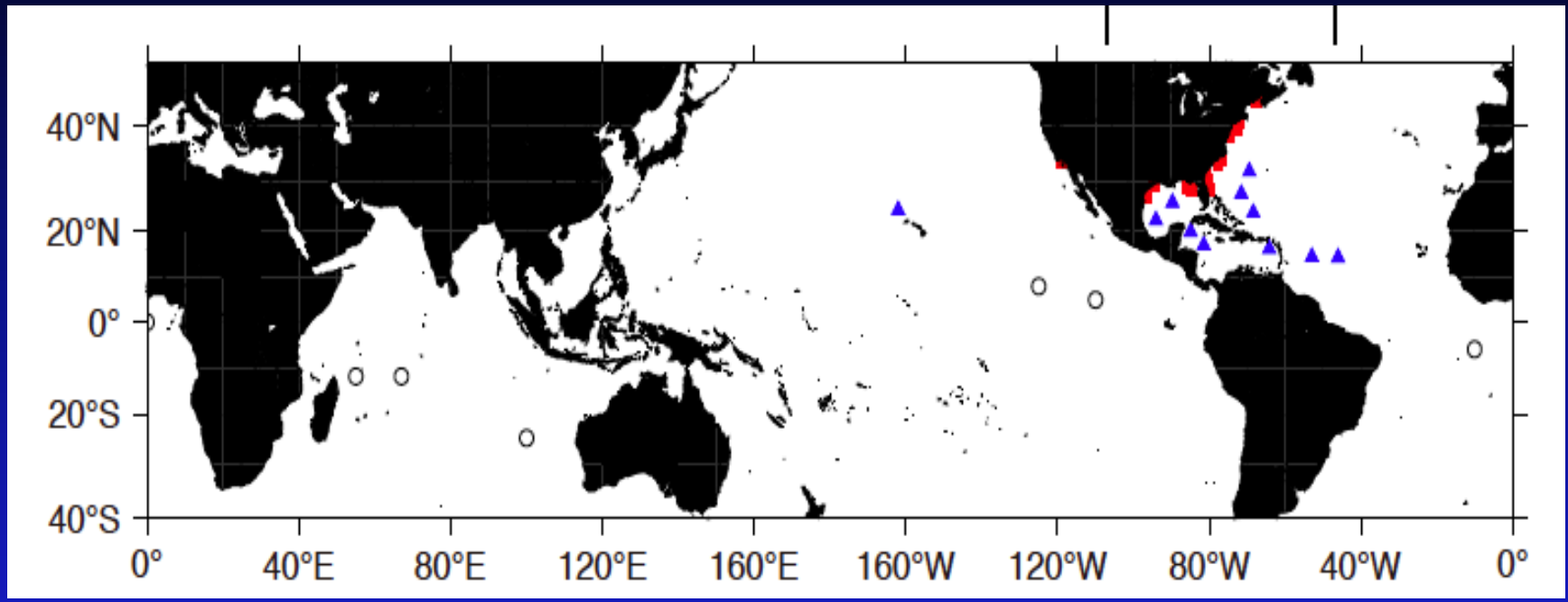


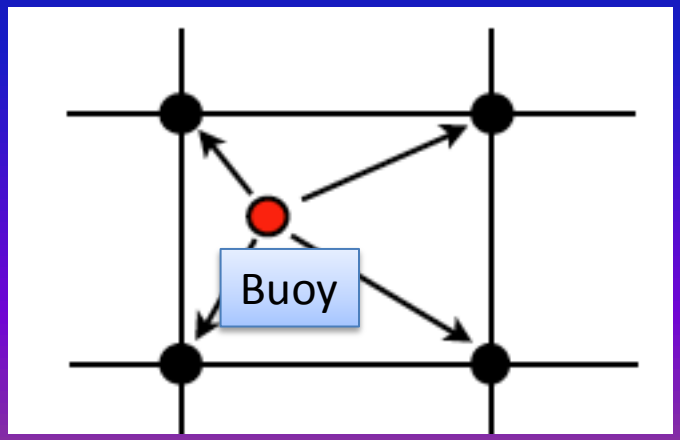


(RSS HP: http://www.remss.com/support/crossing-times

Data

NDBC, TAO, RAMA, PIRATA buoys





Δt＜30 min

Ånalysis period: 2013/3/18—2013/5/31

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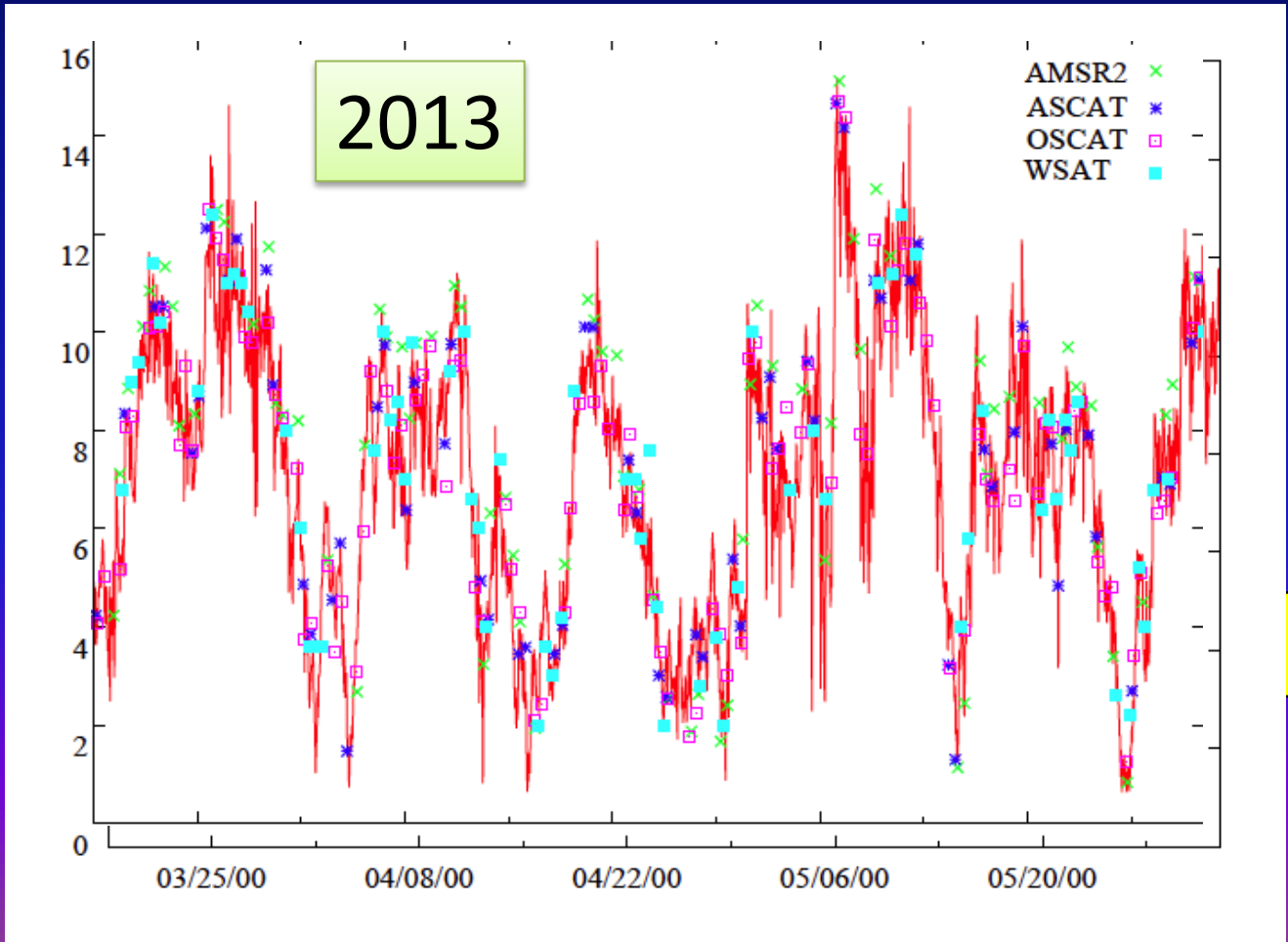
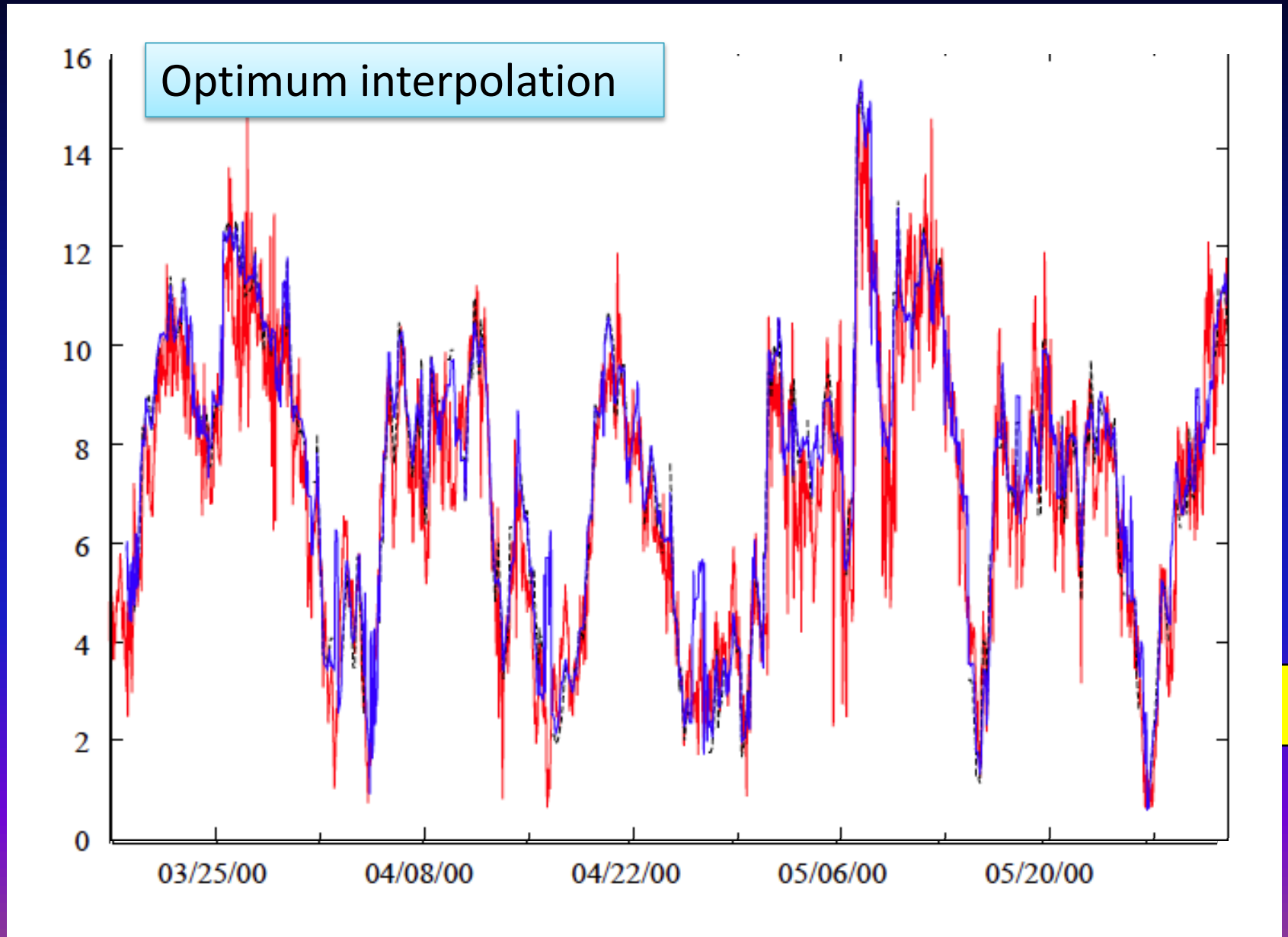
Processing

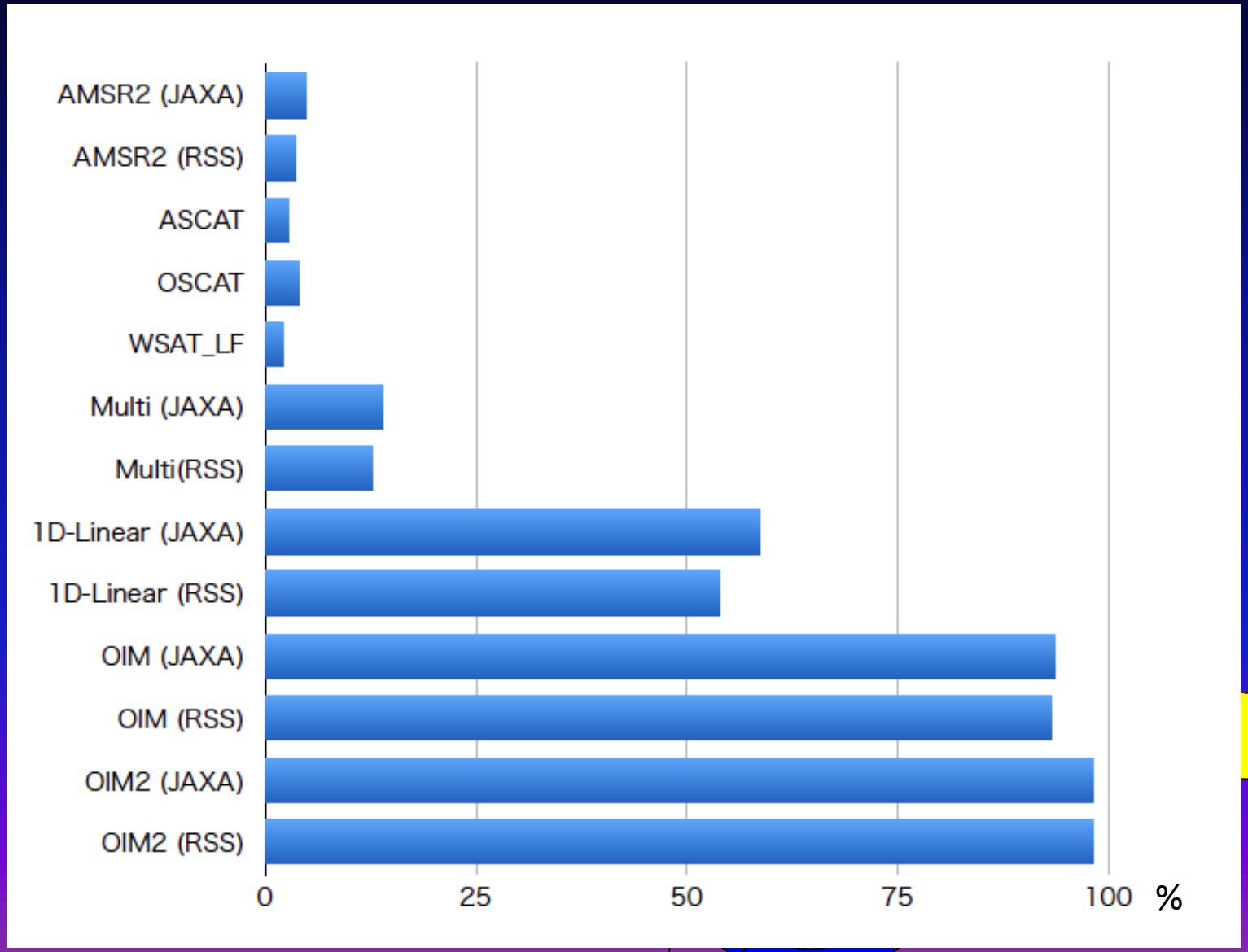
1. Satellite observation data
2. Linear interpolation
3. Optimum Interpolation



Time variation JAXA/AMSR2, Buoy :100°E, 25°S



Data Coverage



Statistics for hourly wind speeds

Products		Bias	RMS	Corr	Num.
AMSR2	JAXA	0.76	1.97	0.78	2362
	RSS	0.11	1.13	0.90	1761
ASCAT		-0.10	1.09	0.92	1311
OSCAT		0.02	1.18	0.90	1953
WSAT_LF		0.08	0.95	0.93	1081
Multi	JAXA	0.25	1.48	0.85	6720
	RSS	0.02	1.11	0.91	6137
1D-Linear	JAXA	0.19	1.48	0.84	28655
	RSS	0.00	1.23	0.88	26276
OIM	JAXA	0.37	1.70	0.80	45667
	RSS	0.21	1.63	0.82	45497
OIM (2)	JAXA	0.38	1.73	0.79	47842
	RSS	0.22	1.67	0.80	47866

NDBC/Open ocean buoys

NDBC (open ocean)

Products		Bias	RMS	Corr	Num.
AMSR2	JAXA	0.30	1.22	0.86	770
	RSS	0.13	0.93	0.90	744
ASCAT		-0.19	0.84	0.93	544
OSCAT		-0.06	0.92	0.91	939
WSAT_LF		0.10	0.86	0.92	505
Multi	JAXA	0.04	1.02	0.89	2765
	RSS	0.00	0.91	0.91	2749
1D-Linear	JAXA	0.03	1.13	0.87	12358
	RSS	-0.01	1.05	0.89	12260
OIM	JAXA	0.06	1.16	0.86	15318
	RSS	0.02	1.12	0.87	15318
OIM (2)	JAXA	0.07	1.20	0.87	16003
	RSS	0.03	1.17	0.86	16003

Topics

- Investigation of accuracy of daily-mean data derived from of high-temporal resolution wind speed data

If we use data observed by one satellite, we have two observations within one day and we have a large sampling error. Therefore, we can expect to reduce the sampling error, if we use the hourly data we constructed.

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Statistics for daily-mean wind speeds

We can extremely reduce the RMS difference if we use our hourly data.

Products		Bias	RMS	Corr	Num.
AMSR2	JAXA	0.65	1.77	0.80	1648
	RSS	-0.05	1.17	0.88	1339
ASCAT		-0.06	1.43	0.84	1048
OSCAT		0.05	1.38	0.84	1410
WSAT_LF		0.08	1.08	0.89	848
Multi	JAXA	0.34	1.36	0.86	1945
	RSS	0.01	1.16	0.89	1768
1D-Linear	JAXA	0.33	1.32	0.86	1953
	RSS	0.00	1.12	0.89	1812
OIM	JAXA	0.37	0.99	0.90	2028
	RSS	0.21	0.95	0.91	2028
OIM (2)	JAXA	0.37	0.99	0.90	2028
	RSS	0.22	0.95	0.91	2028

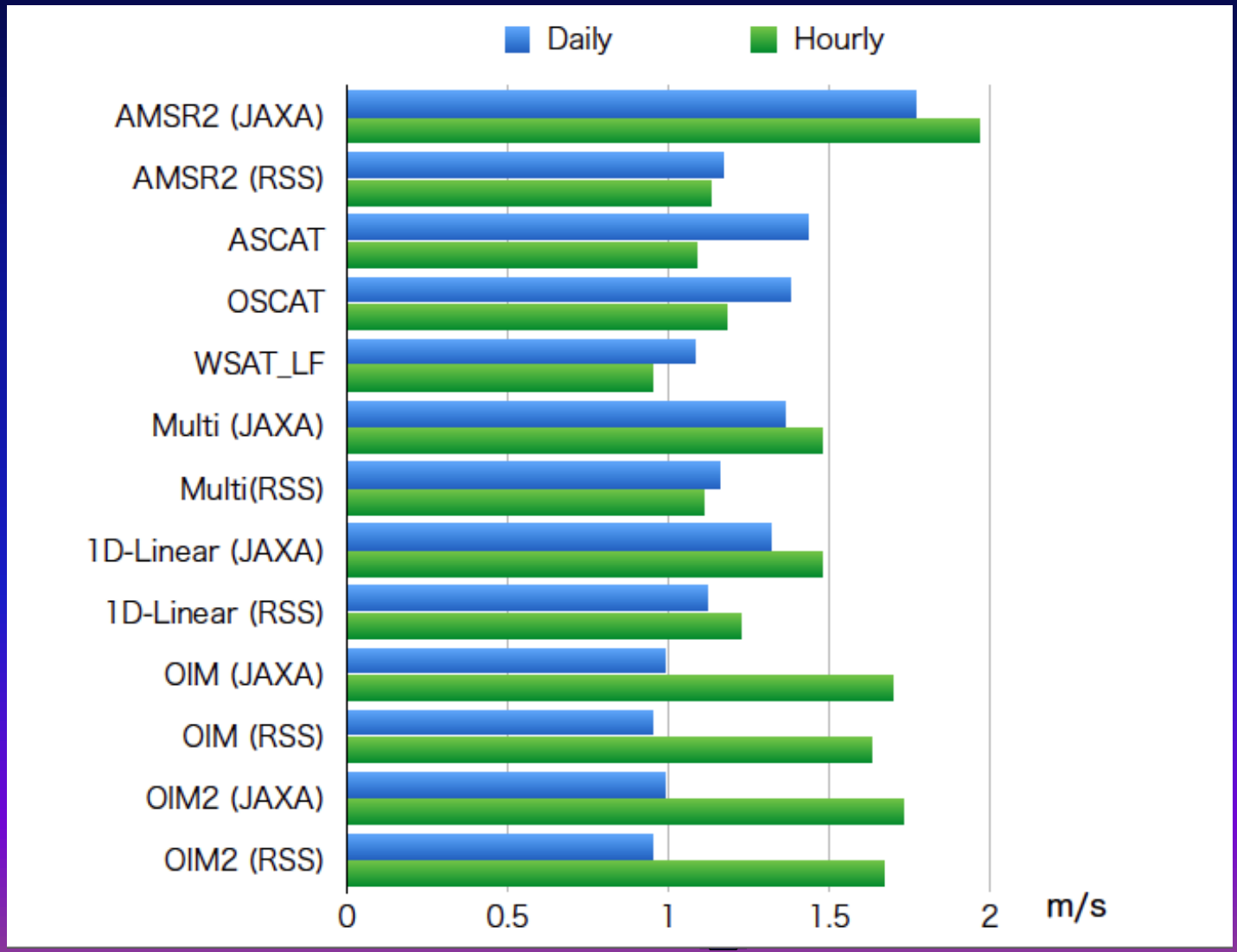
Statistics for daily-mean wind speeds

NDBC　open ocean buoy

Products		Bias	RMS	Corr	Num.
AMSR2	JAXA	0.19	1.26	0.83	595
	RSS	-0.15	0.95	0.87	568
ASCAT		-0.07	1.05	0.86	391
OSCAT		0.04	0.90	0.90	595
WSAT_LF		0.10	0.96	0.87	374
Multi	JAXA	0.05	0.75	0.92	675
	RSS	-0.03	0.75	0.92	669
1D-Linear	JAXA	0.04	0.76	0.92	678
	RSS	-0.02	0.70	0.93	678
OIM	JAXA	0.05	0.61	0.95	679
	RSS	0.00	0.59	0.95	679
OIM (2)	JAXA	0.06	0.62	0.94	679
	RSS	0.02	0.61	0.95	679

daily wind data vs. hourly wind data

RMS values for wind speed data



Topics

- Impact of high-temporal resolution wind speed on accuracy of latent heat flux

We investigate impact of high-temporal resolution wind speed on accuracy of latent heat flux by estimation of latent heat flux using satellite wind speed data instead of buoy wind speed data. We expect the impact is higher than the case of wind speed data because of the nonlinearity of latent heta flux estimation.

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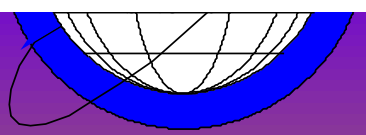
Statistics for hourly latent heat flux

Products		Bias	RMS	Corr	Num.
AMSR2	JAXA	11.94	27.37	0.96	2362
	RSS	6.68	18.36	0.98	1764
ASCAT		2.77	17.86	0.98	1311
OSCAT		4.66	17.50	0.98	1953
WSAT_LF		5.18	15.85	0.98	1081
Multi	JAXA	6.65	21.04	0.97	6720
	RSS	4.85	17.55	0.98	6140
1D-Linear	JAXA	6.65	21.04	0.97	28652
	RSS	4.29	20.33	0.97	26280
OIM	JAXA	6.52	24.15	0.96	45661
	RSS	5.07	23.25	0.96	45497
OIM (2)	JAXA	6.54	24.75	0.96	47836
	RSS	5.05	23.95	0.96	47866

Statistics for daily-mean latent heat flux

Products		Bias	RMS	Corr	Num.
AMSR2	JAXA	11.94	33.62	0.94	1648
	RSS	5.83	27.19	0.95	1339
ASCAT		0.88	33.91	0.91	1048
OSCAT		5.30	28.23	0.94	1410
WSAT_LF		6.58	27.00	0.95	848
Multi	JAXA	7.73	24.65	0.96	1945
	RSS	4.83	21.20	0.97	1768
1D-Linear	JAXA	7.37	23.85	0.96	1953
	RSS	4.48	22.05	0.97	1812
OIM	JAXA	6.50	13.80	0.99	2028
	RSS	5.11	13.23	0.99	2028
OIM (2)	JAXA	6.58	13.58	0.99	2028
	RSS	5.07	13.18	0.99	2028



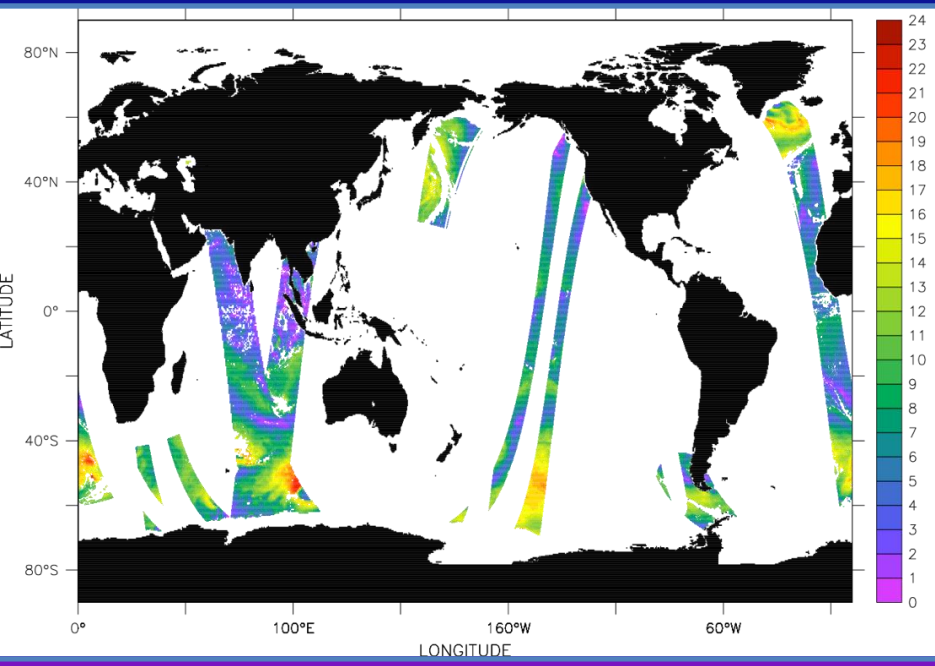
Summary

- **We compared JAXA/AMSR2 with RSS/AMSR2 wind speed data. The results suggest that not only quality control process but also algorithm should be improved for JAXA data.**
- **We constructed a hourly wind speed product by using multi-satellite data and evaluated the product.**
- **We evaluated impact of high temporal wind speed data on latent heat flux. The RMS difference of daily mean latent heat flux is 13 W/m^2.**
- **We demonstrated the effectiveness of high temporal resolution data to obtain highly accurate daily mean wind speed and latent heat flux data**

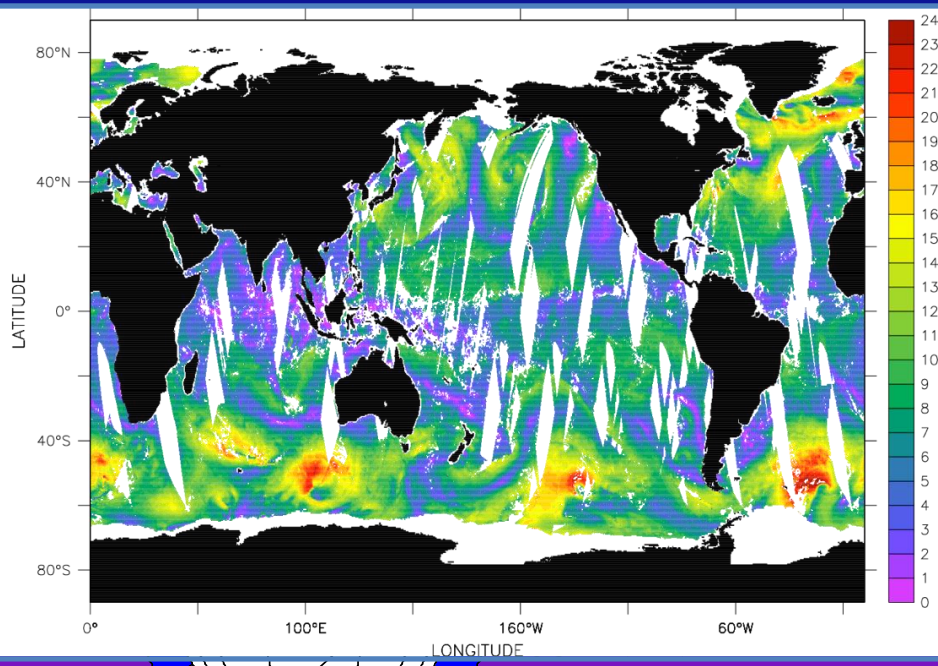
Spatial distribution

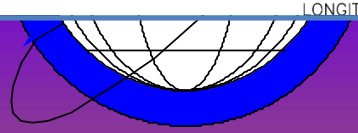
We linearly interporate satellite data into hourly data. But, linear interpolation is not carried out if the nearest data does not exist within 6 hours. Therefore, there are fairly missing data in this step.

Apri 23, 2013 20:00（UTC)



After linear interpolation





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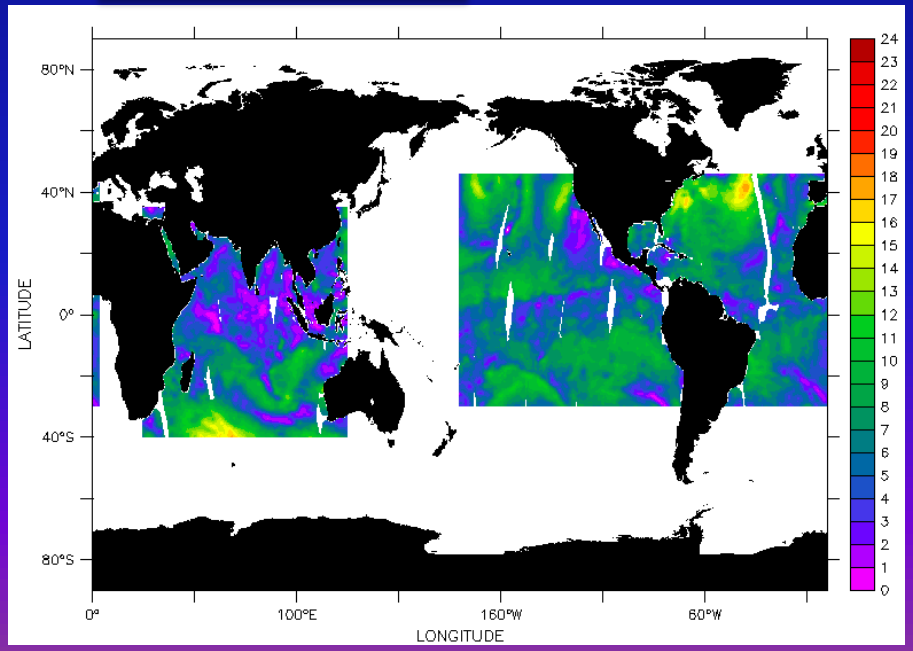
Moreover, we interpolate the linearly-interporated data by optimum interpolation method two times. Then, we can construct hourly data with no missing data.

After first OIM



After second OIM