Application of AMSR-E all whether ocean wind speed algorithm to Windsat data.

Joint AMSR Science Teem meeting
15 July,2008

JAXA/EORC
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Outline

- Improvement of AMSR-E all whether wind speed algorithm.
- TB bias between AMSR-E and around tropical cyclone area.
- Application result of AMSR-E all whether ocean wind algorithm to WindSat data.

Improvement of AMSR-E all whether ocean wind algorithm.

- Wind speed bias reveled by verification against QuikSCAT/ Seawinds wind speed and its correction.
- Positive wind speed bias in slow speed area.
- Wind speed correction of relative wind direction dependency.
- Wind speed correction or exclusion in deep convection (heavy rain) area.

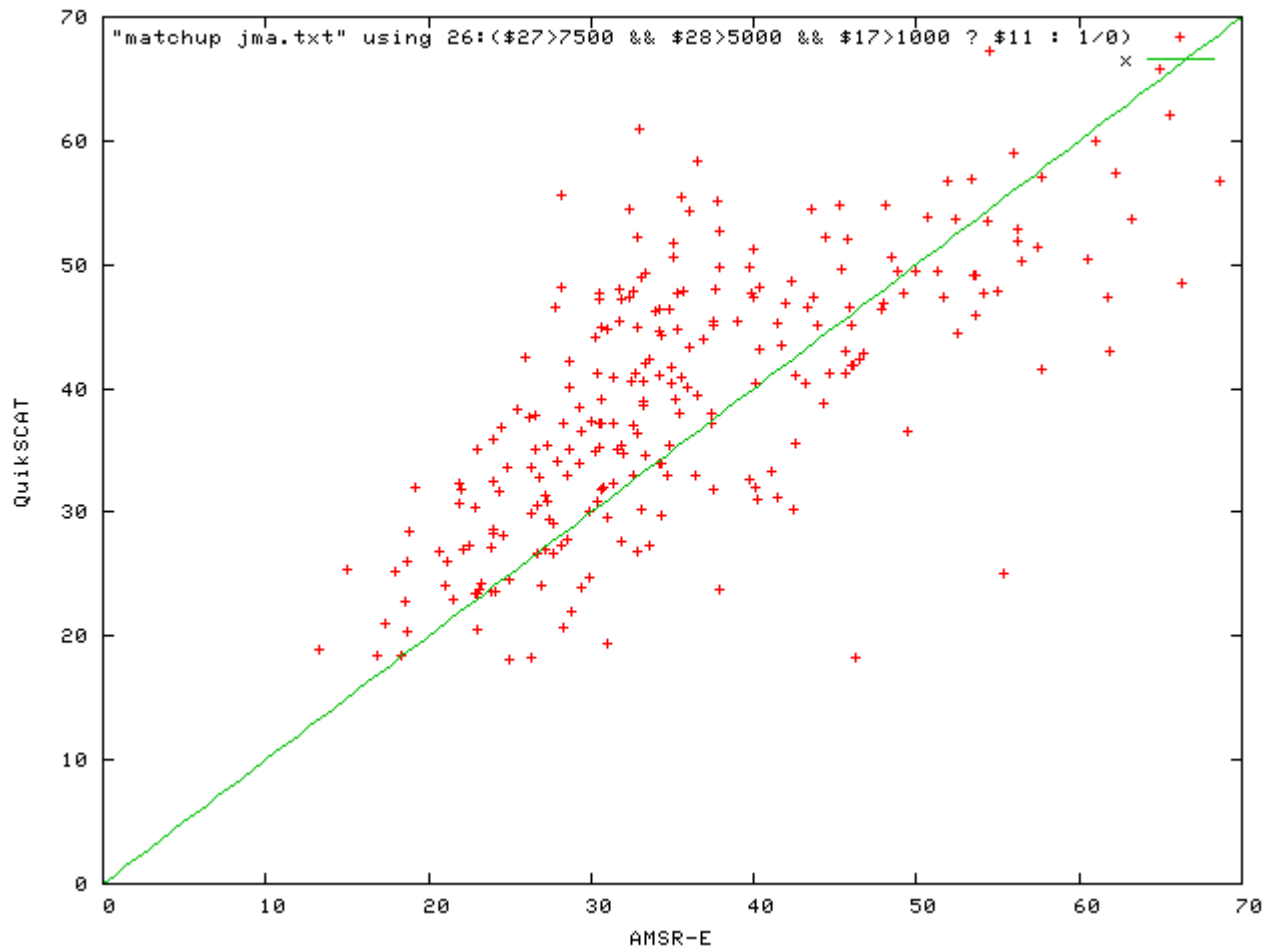# Verification result of AMSR-E all whether ocean wind speed.

Against National Hurricane Center best track data.
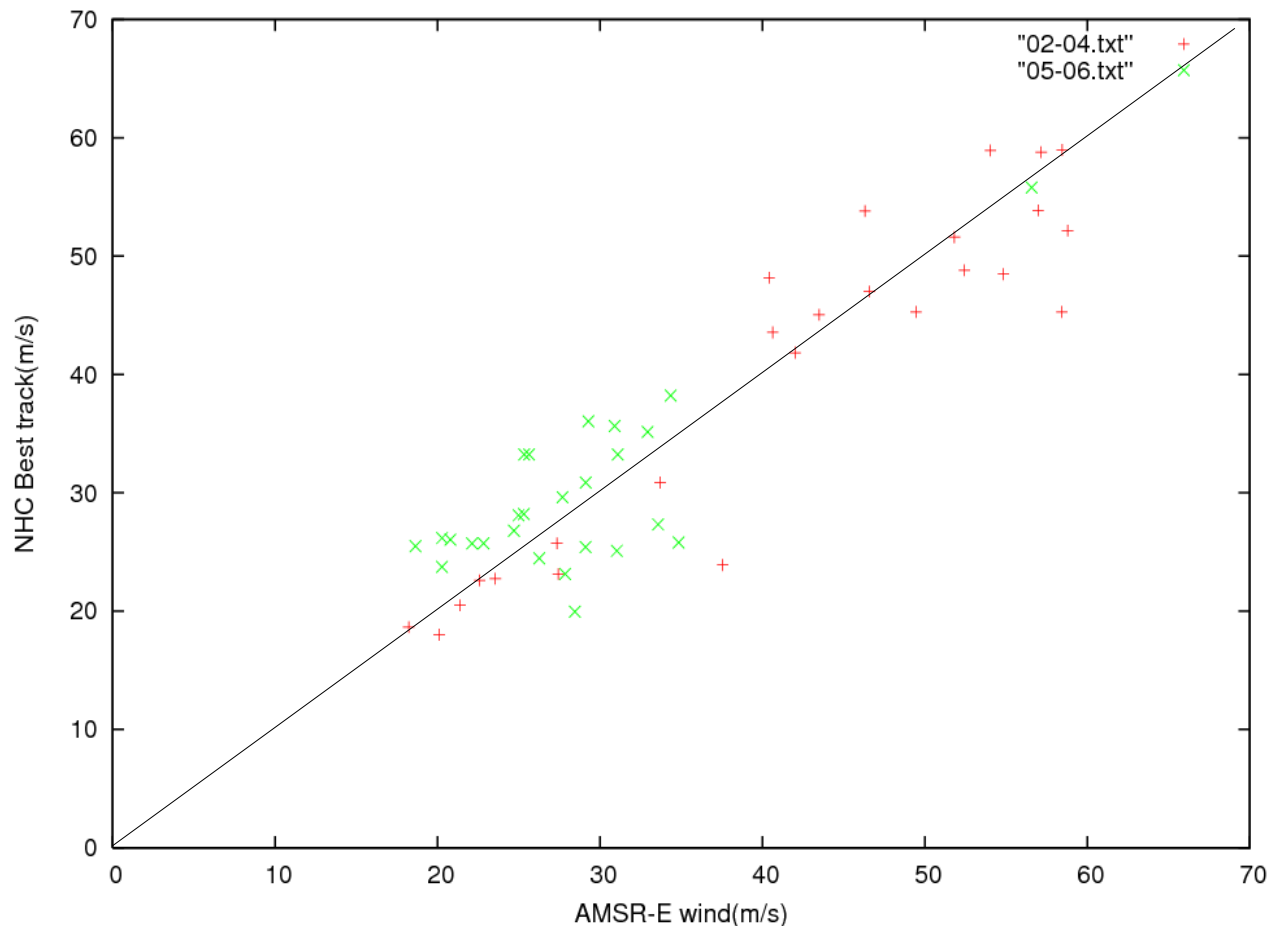
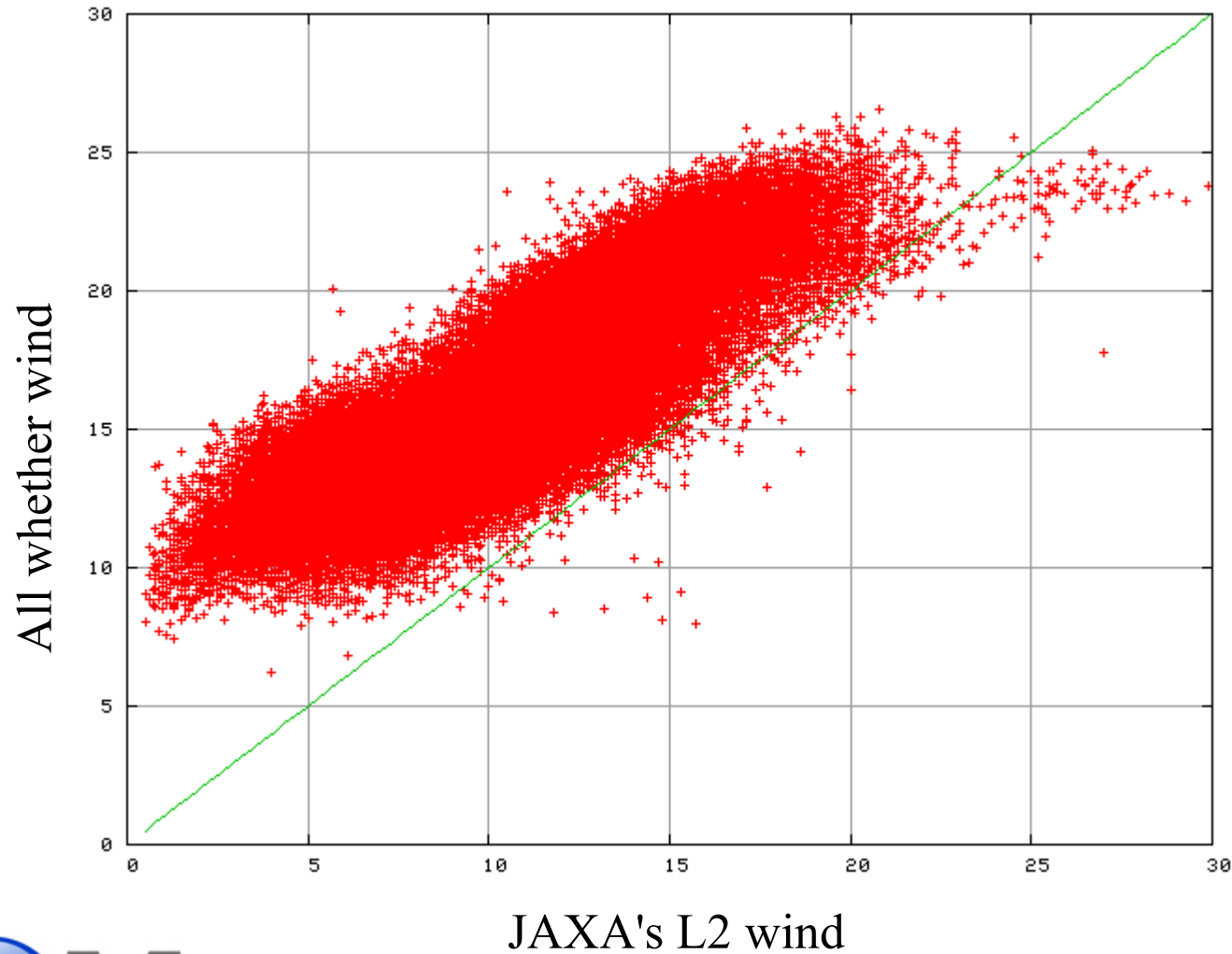AMSR-E all whether wind speed seems to have very high accuracy.

But it have some problems.

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Comparison of AMSR-E all whether wind speed and QuikSCAT/Seawinds.

AMSR-E all whether wind speed have slow bias against QuikSCAT/Seawinds wind speed around 35m/s region

QuikSCAT/Seawinds: Made by Remote Sencing Systems

Positive bias against JAXA's level2 wind speed

Scatter plot with x-axis labeled "JAXA's L2 wind" (range 0 to 30) and y-axis labeled "All whether wind" (range 0 to 30).
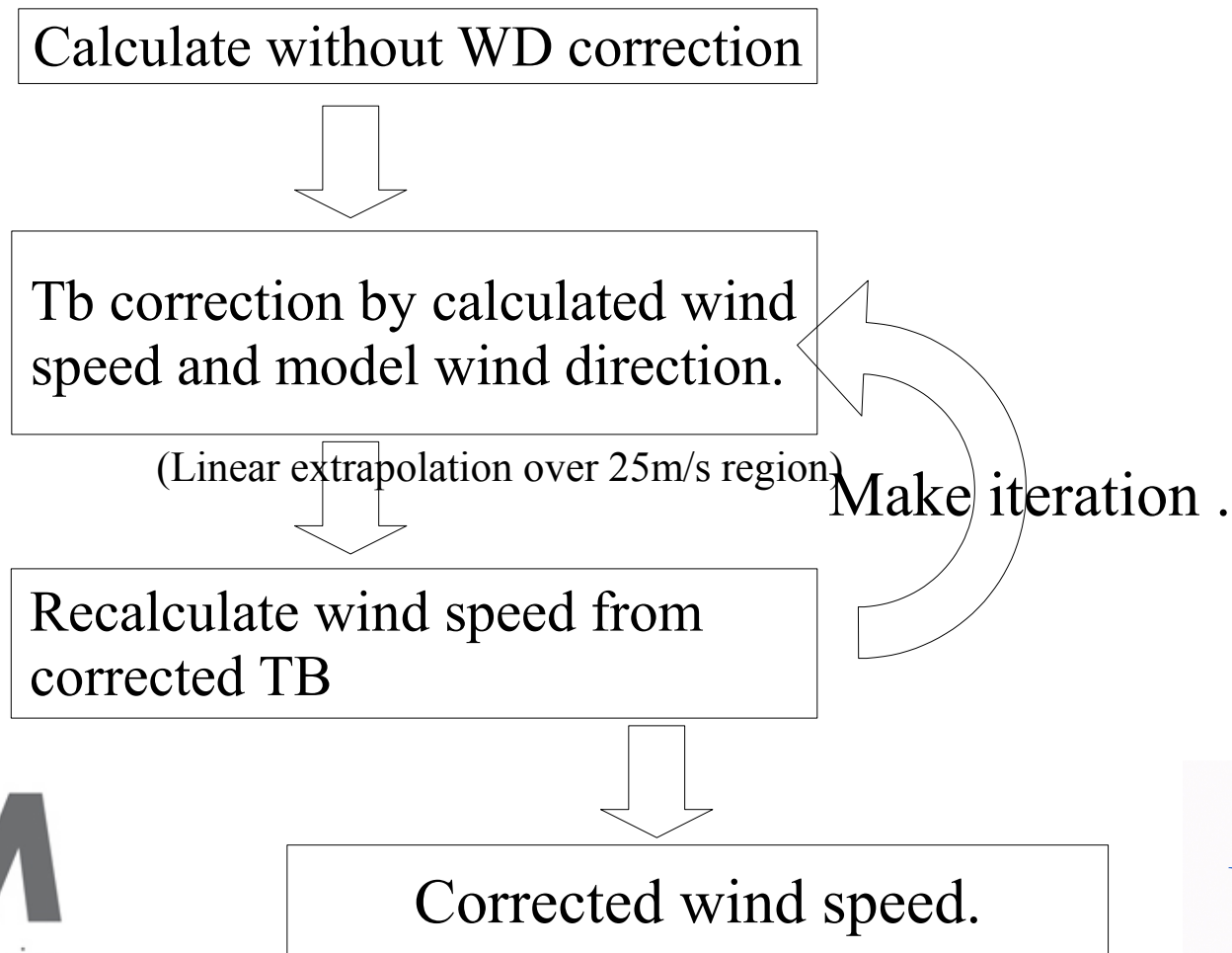
Wind speed correction of relative wind direction dependency.

By wind direction dependency, TB varies about 3K in 10 GHz and about 2K in 7 GHz channel under 20m/s wind speed.

Relative wind direction

Shibata(2006)
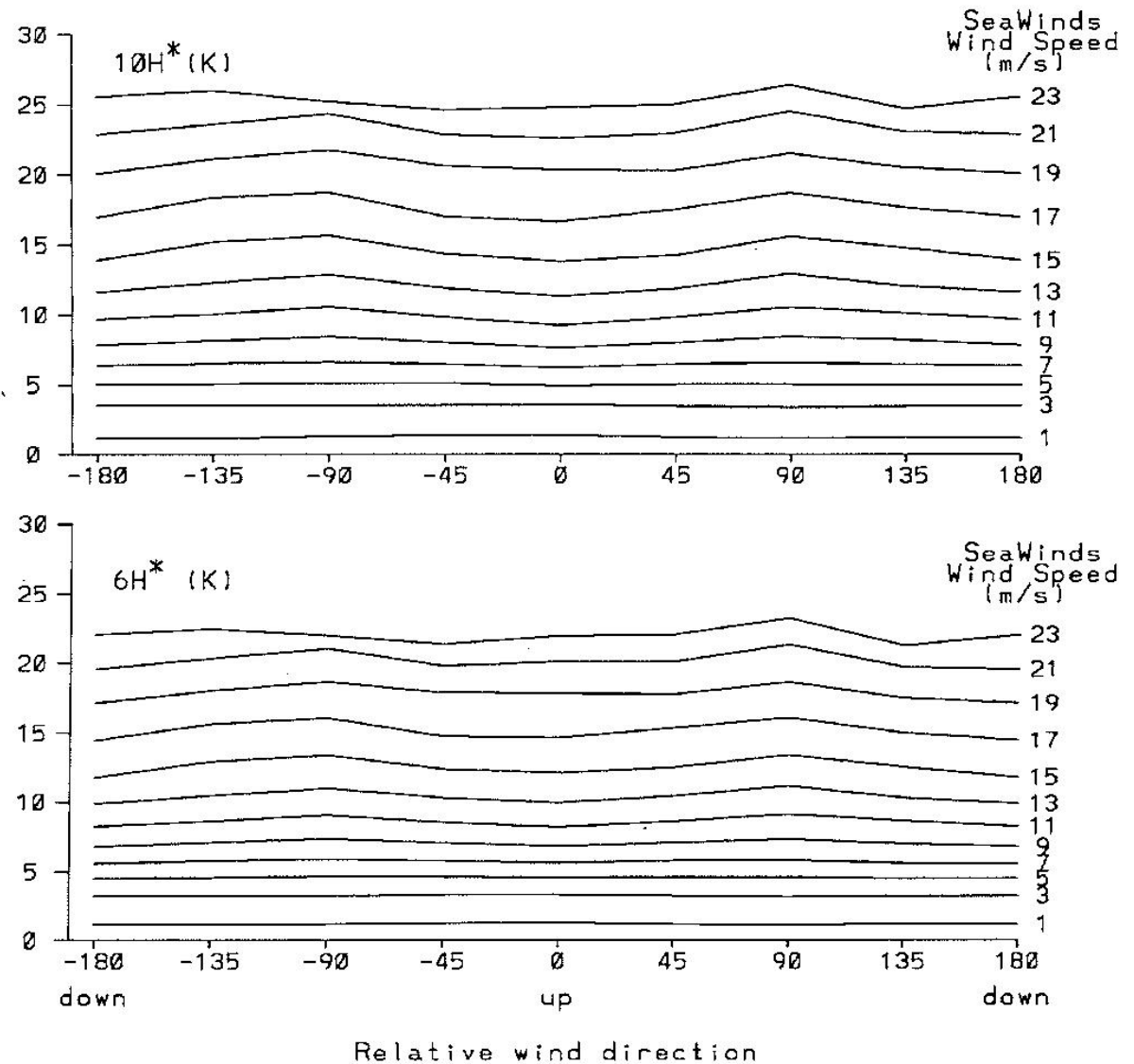
Outline for wind direction correction algorithm.
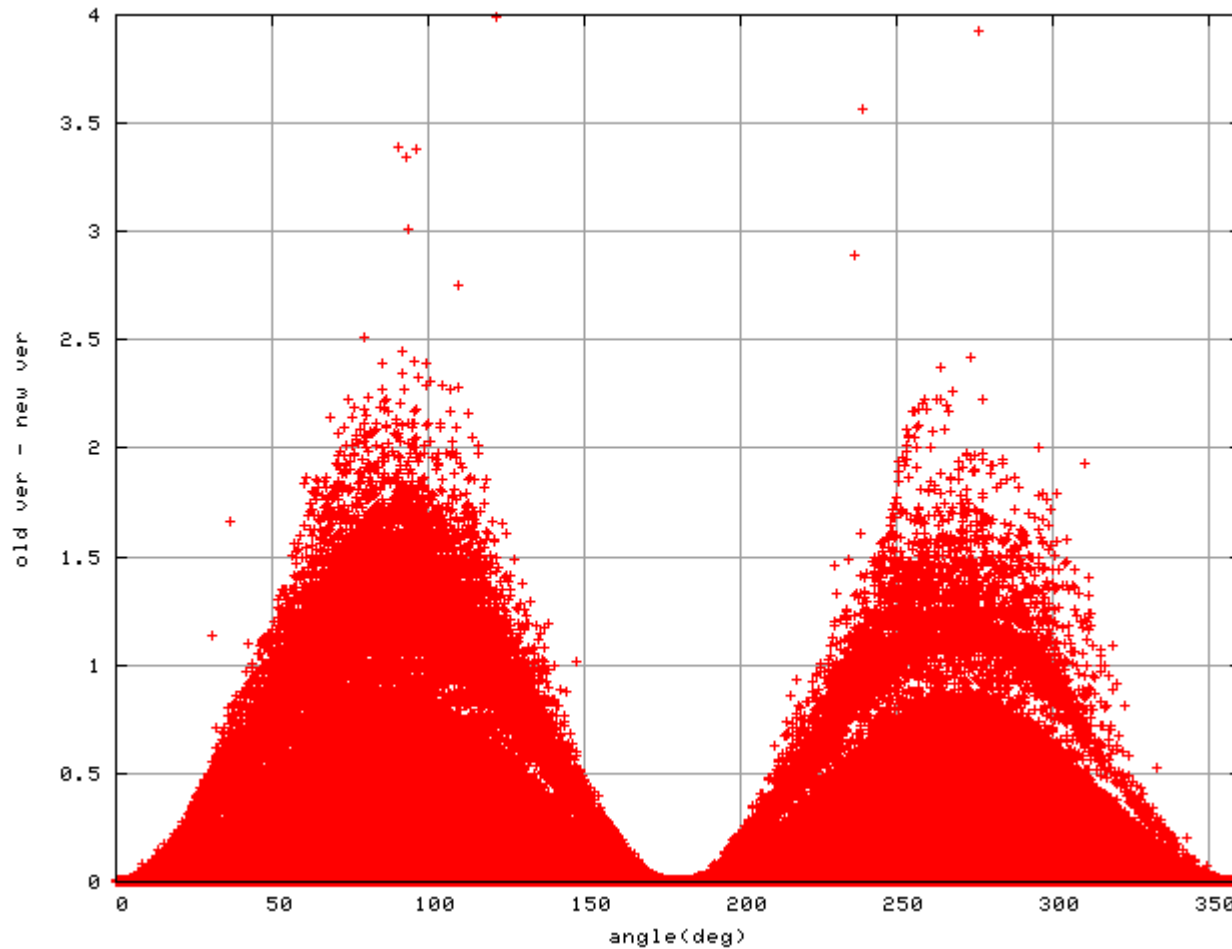
- Use wind direction as GANAL(JMA's global analysis) data not estimate from AMSR-E TB.

Flowchart image

Calculate without WD correction

Tb correction by calculated wind speed and model wind direction.

(Linear extrapolation over 25m/s region)

Make iteration .

Recalculate wind speed from corrected TB

Corrected wind speed.

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Result of relative wind direction correction.

Corrected value is less than 2m/s.

Effect of wind direction correction.

Compared with GANAL(JMA's whether analysis) data.

	WO correction	W correction
Average	8.345	8.136
Bias	1.221	1.012
Correlation coefficient	0.843	0.844
RMSE	2.832	2.661

N:1639404
GANAL average7.124

Although effect is small, wind direction correction works very well.

Wind speed correction or exclusion in heavy rain area.

In this algorithm, correction of brightness temperature under heavy rain cloud have already done. But in some cases, this correction is not sufficient.
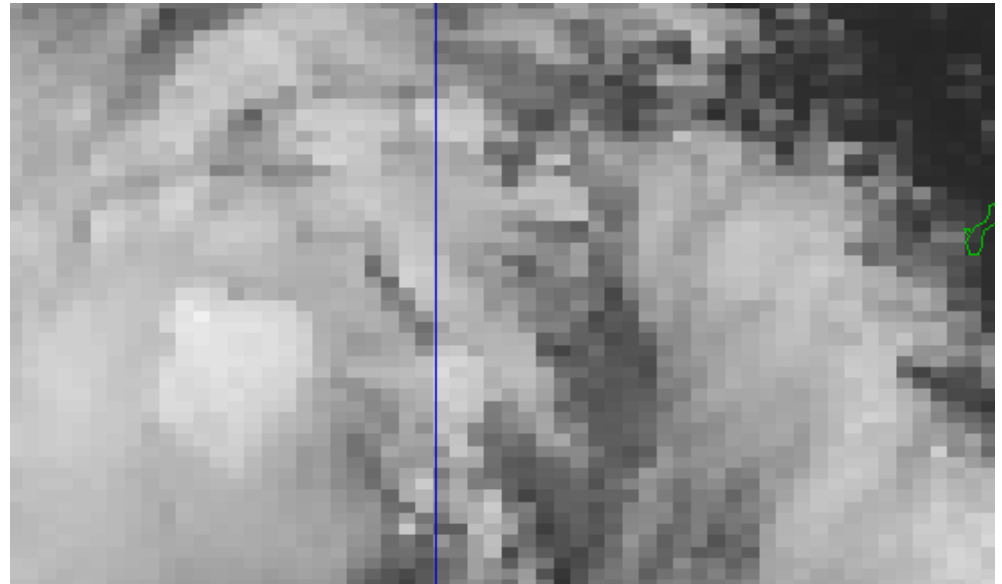
So, more effective correction scheme or exclusion algorithms of heavy rain area is needed.

Example of too strong estimation in heavy rain area.

On Nov 20, 2007 not tropical cyclone case.
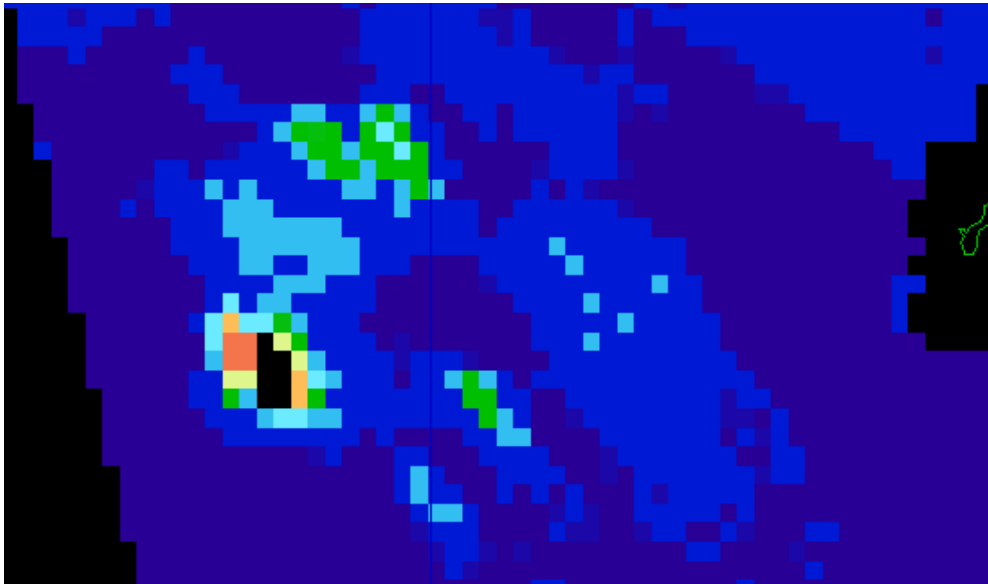

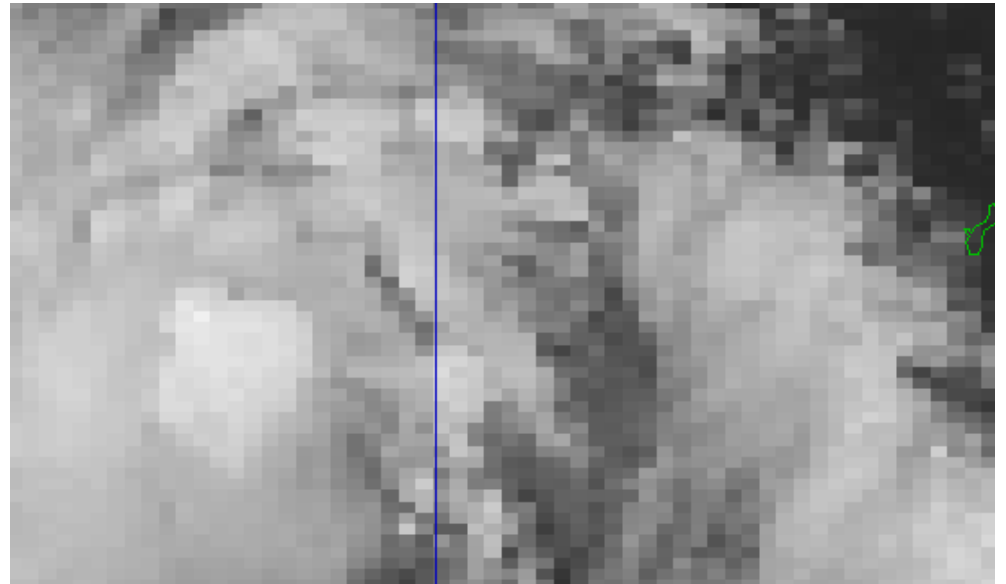All whether wind
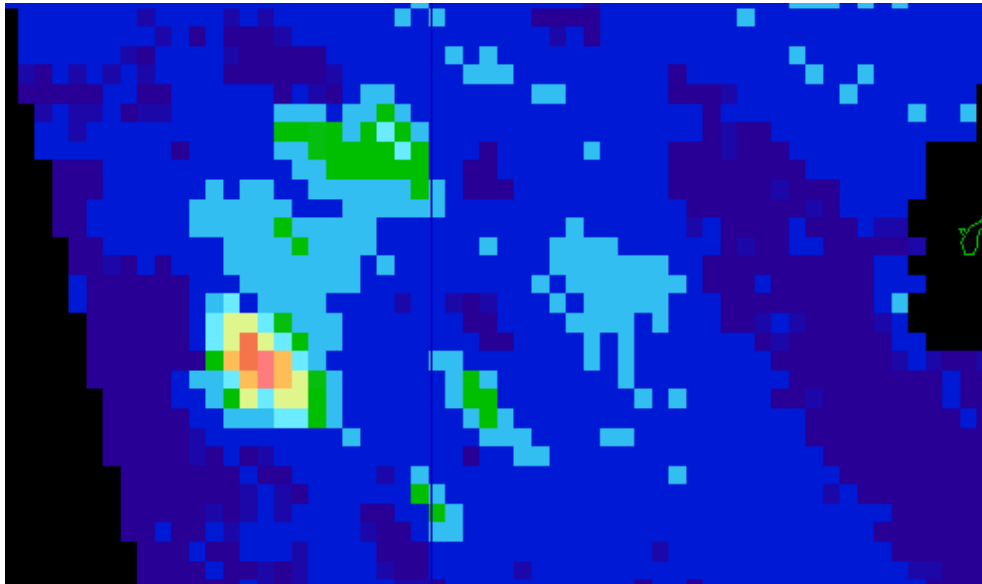
IR Imagery MTSAT-1R

Pinked dot indicates about 80kt(40m/s) wind speed. It corresponds to low Tb area in IR imagery.

Example of too strong estimation in heavy rain area.

On Nov 20, 2007 not tropical cyclone case.

All whether wind

IR Imagery MTSAT-1R

In heavy rain area, new version algorithm can exclude to retrieve wind speed. But in this case, it is not perfect.
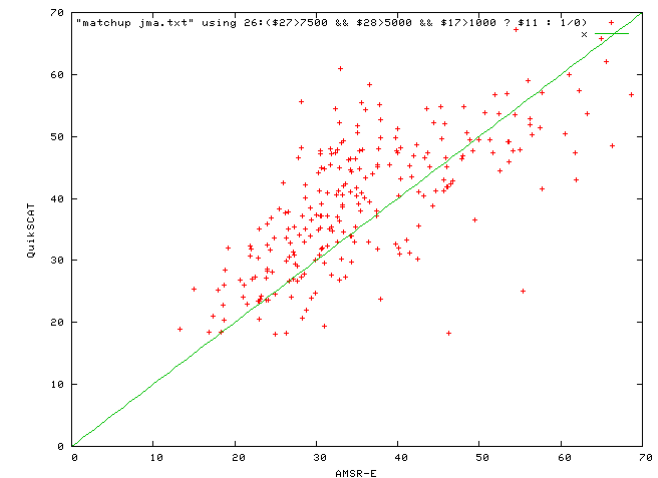
Improved algorithm of AMSR-E all whether ocean wind speed.

- Improve retrieval parameters especially in under 15m/s region, and in around 30m/s region
- Make correction of relative wind direction.
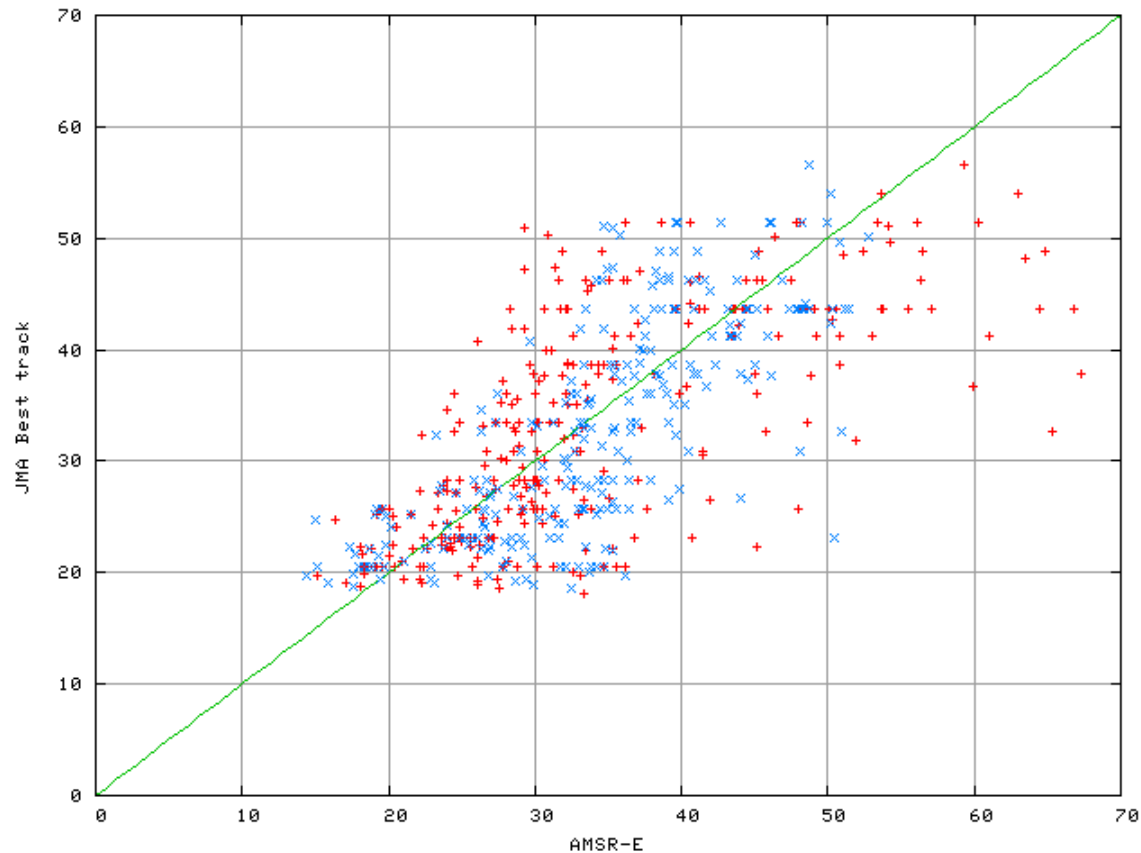- Eliminate heavy rain area.

Quality of improved all whether wind VS QuikSCAT/Seawinds.

Old version.

Underestimation around 30m/s and peaked at 50m/s are cleared.
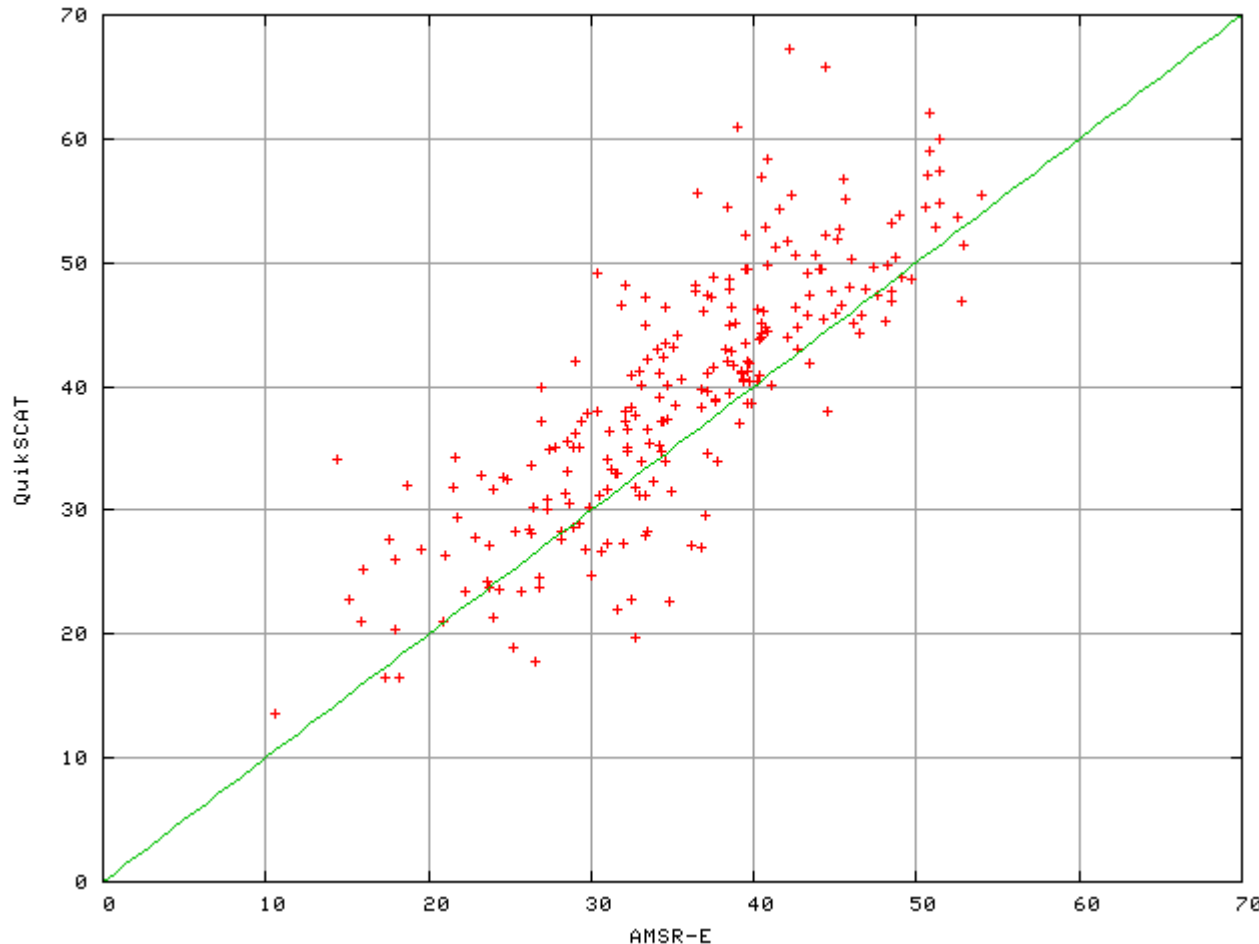
Scatter plot between AMSR-E wind and best track wind

Previous version(red dot)
N 211
AMSR-E average 34.252
best track average 33.502
Correlation 0.676
RMSE   8.639

New version(blue dot)
N 197
AMSR-E average 34.310
best track average 32.921
Correlation 0.744
RMSE   6.796

New version is better fit to northwestern pacific typhoons.

Comparison of brightness temperature between AMSR-E and Windsat in/around tropical cyclone area.

Within 500 km from center of typhoons or cyclones in northwestern pacific ocean or Atlantic ocean.
From Apr, 2003 to Oct 2003, 88 cases Windsat, 142 cases AMSR-E in nwp and 21 cases Windsat, 46 cases AMSR-E in Atlantic
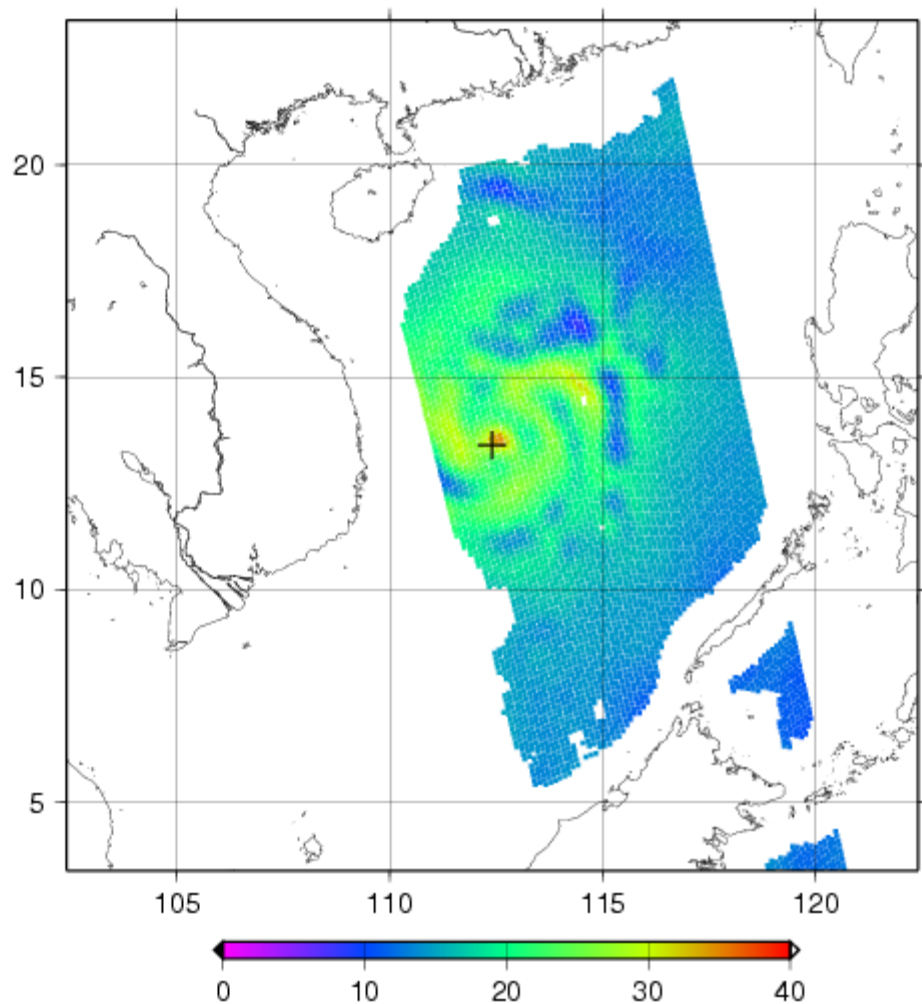
In tropical cyclones(=high TB area), AMSR-E TB seems to have positive bias. Especially in lower frequency channels. But this bias is calculated from all TB data in tropical cyclone area, I don't know its TB dependency.

Following discussion, I won't use this TB correction.

	AMSR-E	Windsat	Bias
7V	180.1	174.03	6.07
7H	98.89	97.19	1.7
10V	189.9	172.32	17.58
10H	115.89	110.73	5.16
19V	227.63	227.55	0.08
19H	181.03	179.19	1.84
23V	259.72	257.71	2.01
23H	239.37	236.31	3.06
37V	242.77	242.72	0.05
37H	208.2	207.56	0.64

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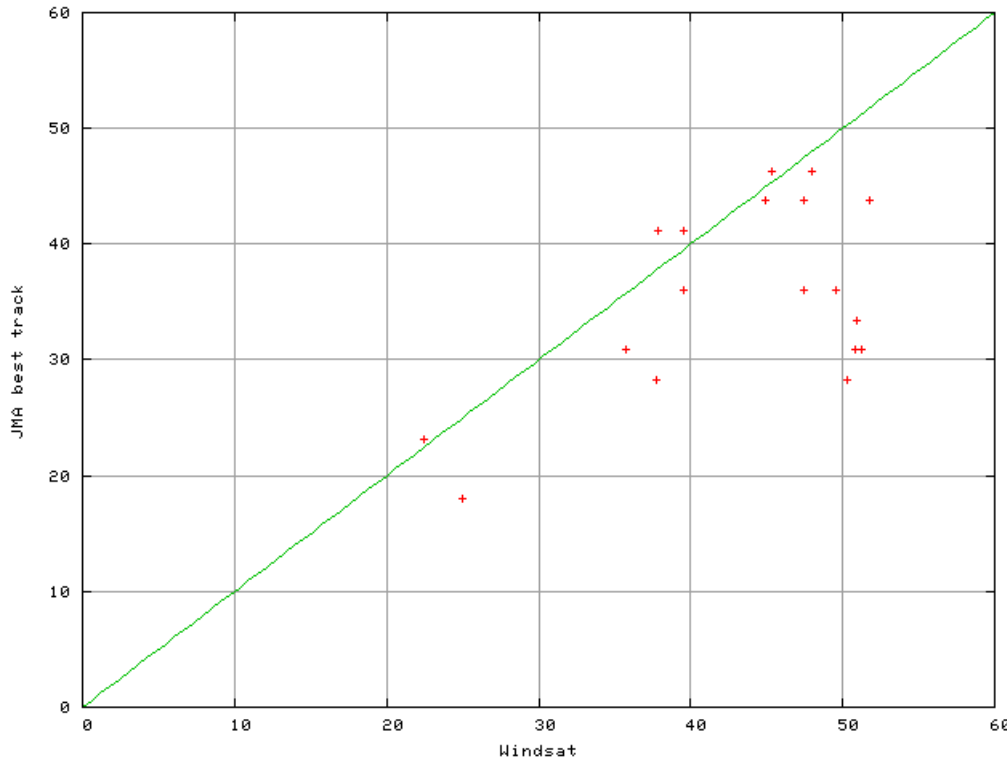Japan Aerospace Exploration Agency

An example of all whether wind speed applied to Windsat data.

On Apr 16, 2008 in southern China sea. Typhoon No. 1(NEOGURI)

All whether wind =36.53m/s
Best track(JMA) 55kt(=30m/s)

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Windsat all whether wind speed and Best track

From Apr 2003 to Oct 2003, 21 cases.
Retrieved from the same parameters as AMSR-E

Windsat vs JMA
N: 21
windsat average 43.813
best track average 35.890
correlation 0.538
RMSE   10.945

All whether wind retrieved from Windsat data have positive bias against best track. But making parameters for Windsat data, quality will be good.

Summary and conclusions.

AMSR-E All whether wind algorithm is improved. i.e. positive bias in low speed is corrected, wind direction correction is considered and high precipitation area data are removed.

These works seem to be well, but I've never made verification by pixel data especially in high wind speed region I think it is almost impossible.

Apply this algorithm to Windsat data, the result looks like well. By more research and making suitable parameters, "Windsat All Whether Wind Product" will be available.