

An accuracy of wind speed retrieval algorithm from AMSR-E 7 & 10 GHz data.

Joint AMSR Science Team Meeting
Aug 15,2007

Earth Observation Research Center(EORC)
Japan Aerospace Exploration Agency(JAXA)

Sadao Saitoh

Introduction

- About retrieval algorithm
- Resampling of brightness temperature
- Effect of TB resampling
- Apply to hurricanes in the Atlantic Ocean
- Apply to typhoons in northwestern Pacific Ocean
- Result and conclusions

About retrieval algorithm

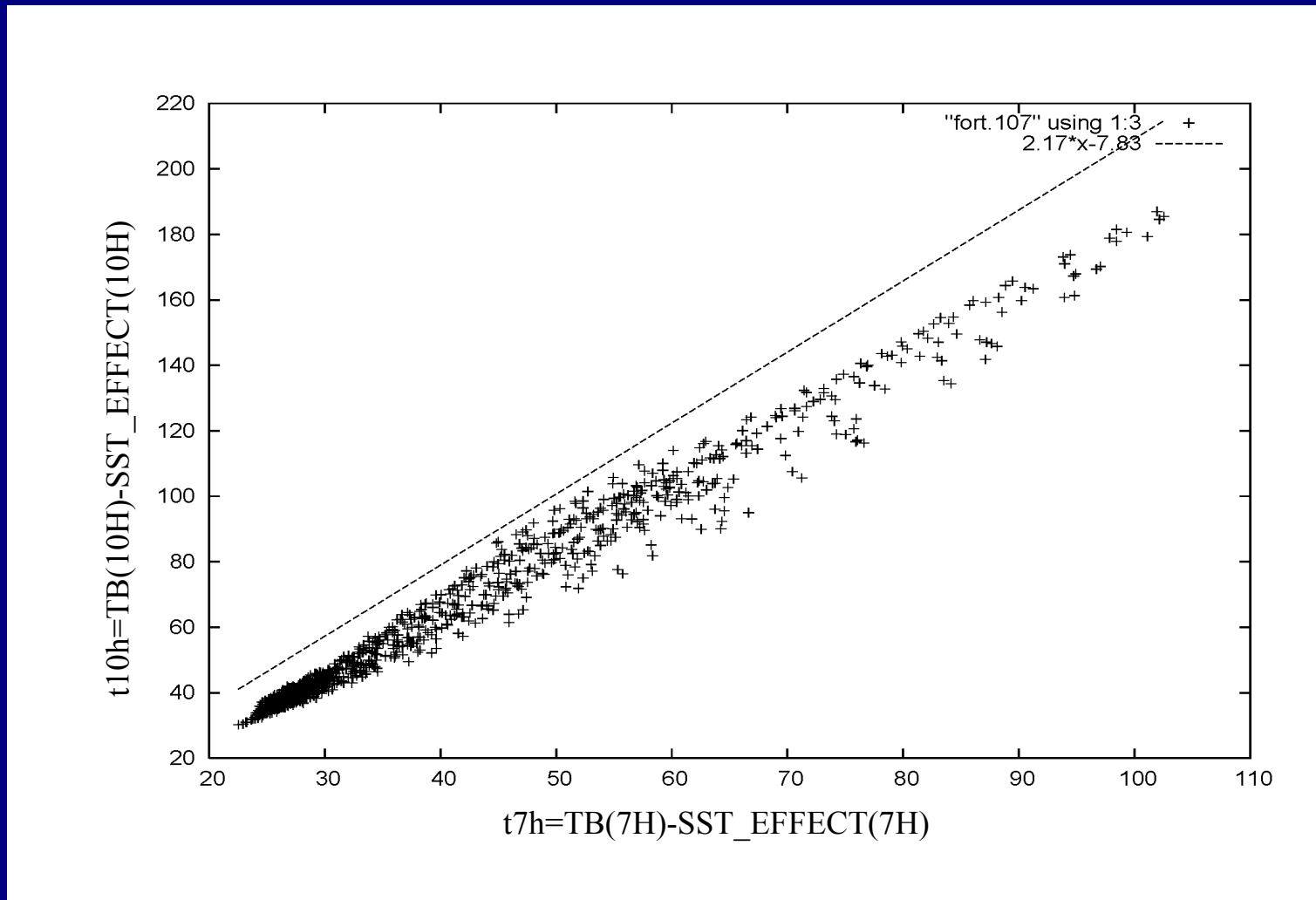
This algorithm named “All weather ocean wind speed” is made by Shibata-san(Shibata 2006) .

Wind speed is retrieved from AMSR-E 7 and 10 GHz horizontal polarization brightness temperature(TB).

Outline of algorithm(very very easily)

- 1.Exclude data including the land in those FOV.
- 2.Remove effect of SST from 7 and 10 H TB.
- 3.Calculate distance between calm state line(already calculated) .
- 4.Convert distance to wind speed.

Images of retrieval algorithm.



Dotted line indicates calm status. Distance between dots and dotted line converts to wind speed.

Resampling of brightness temperature

AMSR-E 7 and 10 GHz TB have different spacial resolution.

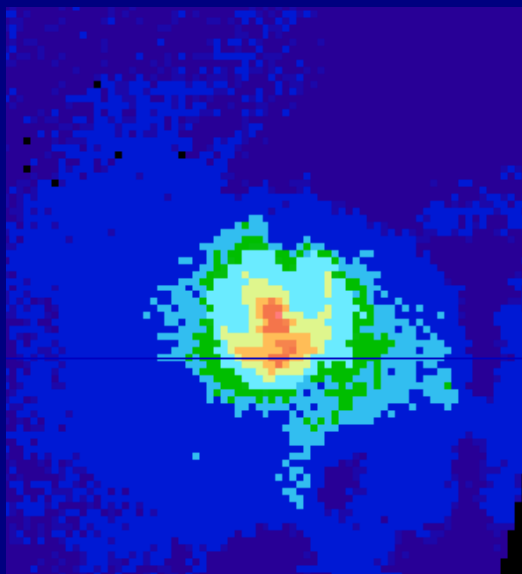
	7GHz	10GHz
FOV(km)	43.2×75.4	29.4×51.4
FOV area(km ²)	3257.3	1511.2

* FOV area is calculated as oval figure.

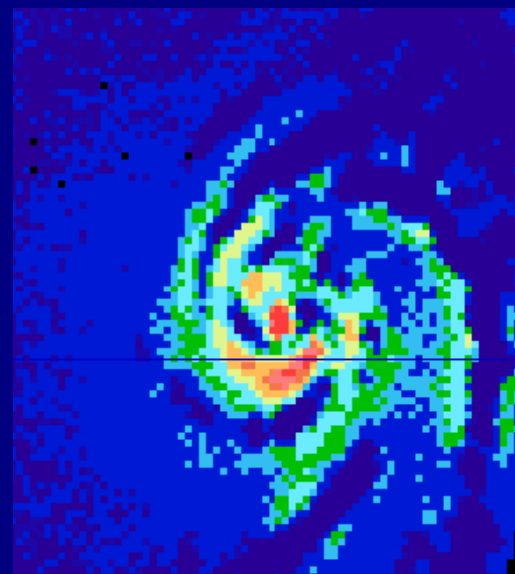
Effect of small scale phenomena such as precipitation may remain.

Taniguchi-san made TB resampling algorithm. This algorithm resamples 10 GHz TB to 7GHz spacial resolution with considering antenna pattern.

Effect of TB resampling



Retrieved from resampled TB



Retrieved from original TB



Typhoon No.2, 18UTC May 20, 2007(At East of Philippine)

In right image, cloud band pattern thought to be dependence on precipitation is very clear but in left image, that disappears.

Apply to hurricanes in the Atlantic Ocean

Use maximum wind speed of National Hurricane Center(NHC) best track as truth data, only when direct measurements of hurricane were done. Direct measurement means not remote sensing observation. Specifically, it means aircraft observation, dropped sonde, buoy and station.

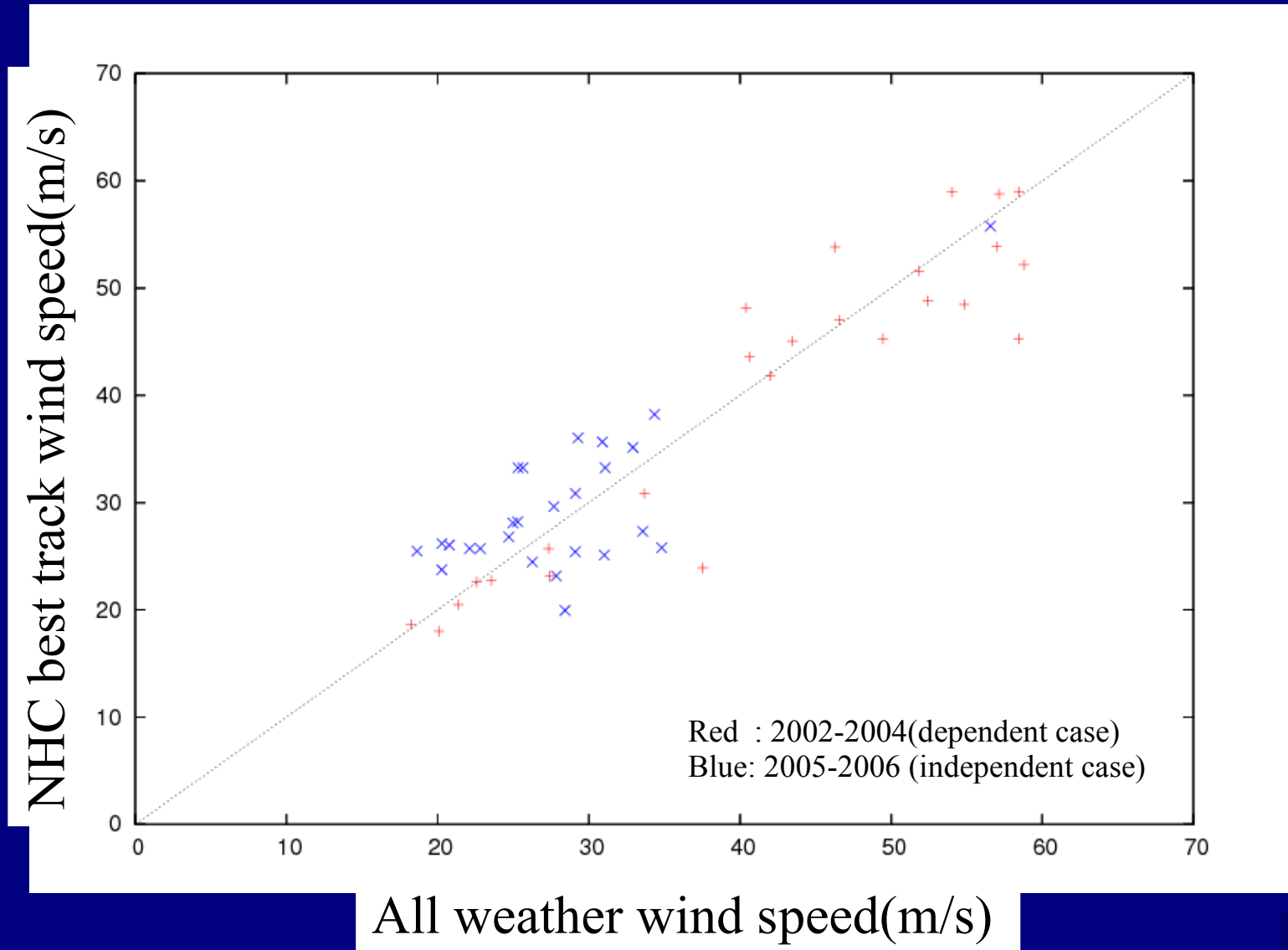
I had made retrieval parameters by 2002 to 2004 data, and verified accuracy of this algorithm by 2005 and 2006 data.

In my presentation, all wind speed is 10 minutes average vale. Wind speed conversion equation from 1 minute average to 10 minutes average is as follows(JMA's conversion equation).

$$W_{10}=W_1 \quad (W_1 < 33.44)$$

$$W_{10}=(W_1+16.26)/1.495 \quad (W_1 > 33.44)$$

Scatter plot of maximum wind speed of hurricanes in the Atlantic Ocean.



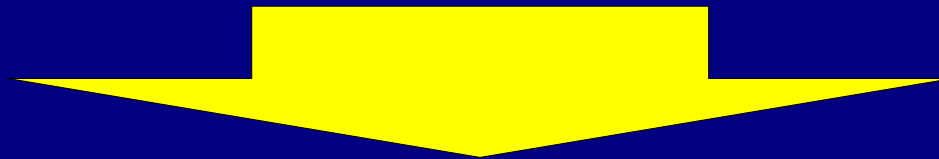
Statistics of maximum wind speed between AMSR-E all weather wind and NHC best track in the Atlantic Ocean.

	2002-2004	2005-2006
Number	25	26
Average(m/s)	40.31	29.55
Mean error(m/s)	1.44	-1.32
Correlation Coefficient	0.93	0.77
RMSE(m/s)	5.19	5.01

Considering the rank of maximum wind speed of best track is 5 knot($\sim 2.5\text{m/s}$), accuracy of this algorithm is very high.

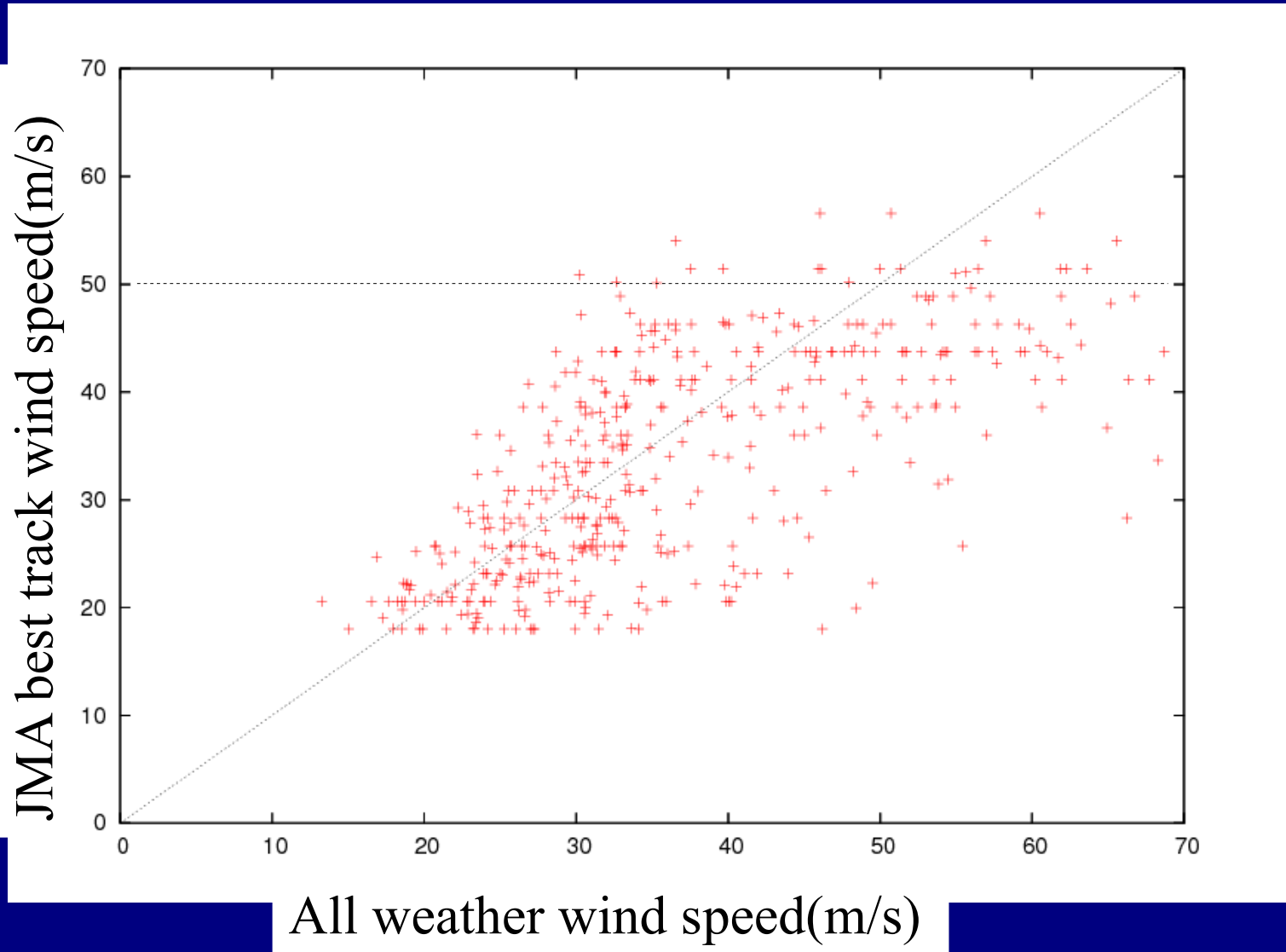
Apply to typhoons in the northwestern Pacific Ocean.

In the Japan Meteorological Agency(JMA), maximum wind speed of typhoon is estimated from Dvorák technique except island observation.



To compare maximum wind speed derived from this algorithm and that of the JMA best track, accuracy of the JMA best track data is first verified by almost direct observations.

Scatter plot of maximum wind speed of typhoons in northwestern pacific ocean(2002-2006).



JMA typhoon best track may have peaked at 50 m/s

Result and Conclusion

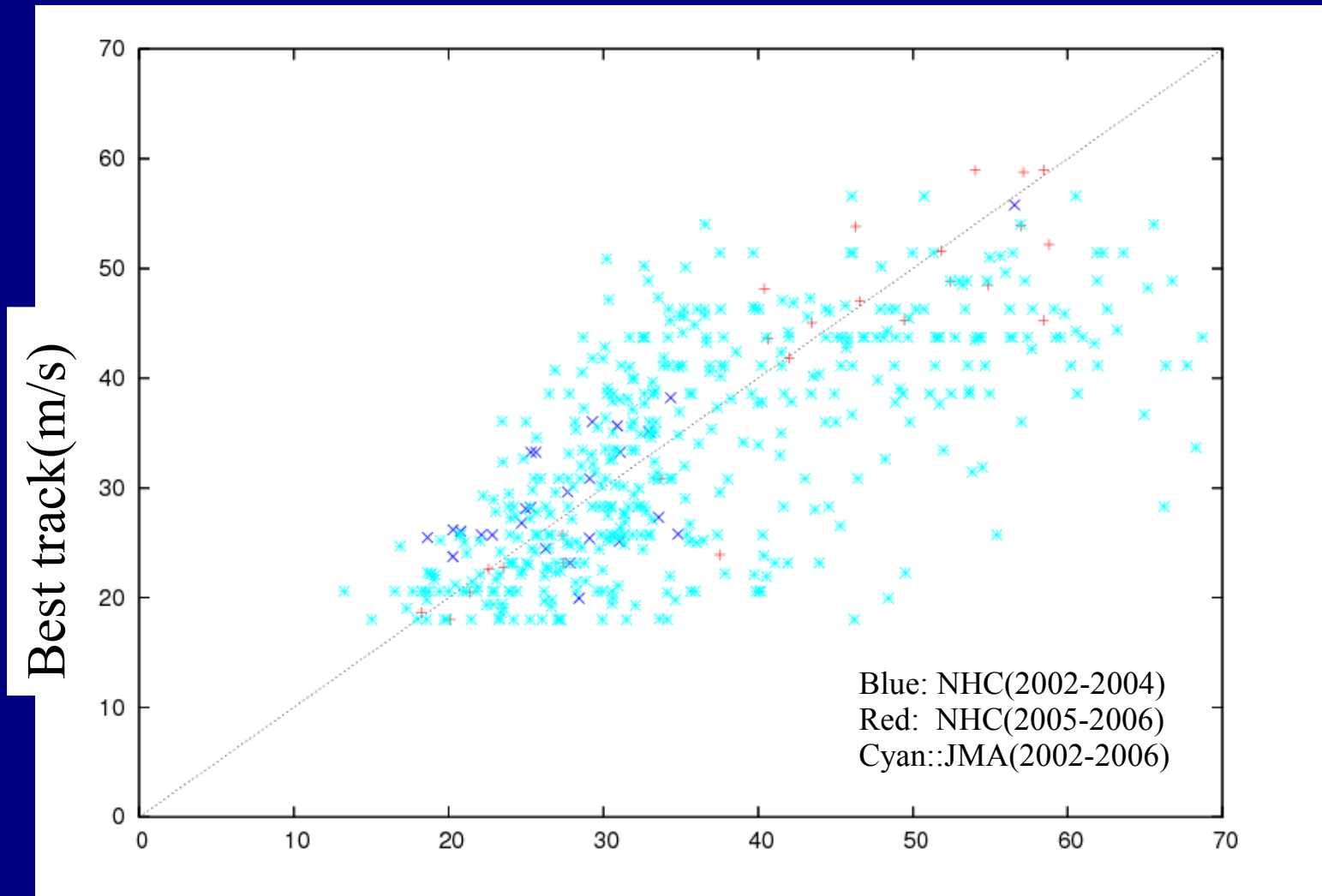
AMSR-E all weather wind speed retrieved from 7 and 10 GHz TB have very high accuracy.

By applying this algorithm to tropical storms of various regions, we can understand regional characteristics of tropical storms. i.e. Atlantic, Pacific and Indian ocean.

Reference

Shibata,A.(2006):A Wind Speed Retrieval Algorithm by Combining 6 and 10 GHz Data from Advanced Microwave Scanning Radiometer: Wind Speed inside Hurricanes, *J. Oceanogr.*, 62, 351-359.

Scatter plot of maximum wind speed of hurricanes or typhoons.



All weather wind speed(m/s)

Statistics of maximum wind speed of hurricanes or typhoons between AMSR-E all weather wind speed and NHC/JMA best track.

Analysis center	NHC(atlantic)		JMA(pacific)
	2002-2004	2005-2006	2002-2006
Year			
Data number	25	26	447
Average(m/s)	40.31	29.55	33.61
Mean error(m/s)	1.44	-1.32	2.86
Correlation Coefficient	0.93	0.77	0.66
RMSE(m/s)	5.19	5.01	9.7