

A Wind Speed Retrieval Algorithm by Combining 6 and 10GHz Data of AMSRs - Wind Speed Inside Storms -

Akira Shibata

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

email ashibata@eorc.jaxa.jp

Research Purpose

To obtain wind speed inside storms with heavy rain

frequencies	36 – 18 GHz	10 – 6 GHz
sensitivity to wind	large	small
effects by rain	serious	not serious

Method (1/2)

Firstly, we define a parameter, $6(10)H^*$, which is applicable in no-rainy areas.

$$6(10)H^* = \text{AMSR_}6(10)H - \text{atmos_effect_}6(10)H - \text{SST} \times (1-r)$$

$\text{atmos_effect_}6(10)H$; derived from 23V and 36V

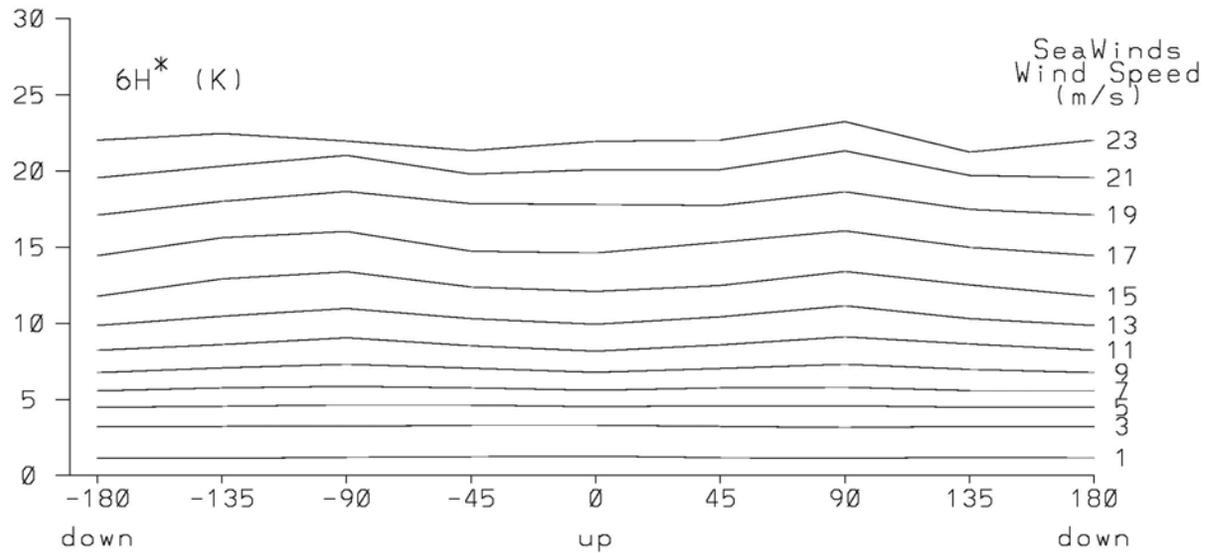
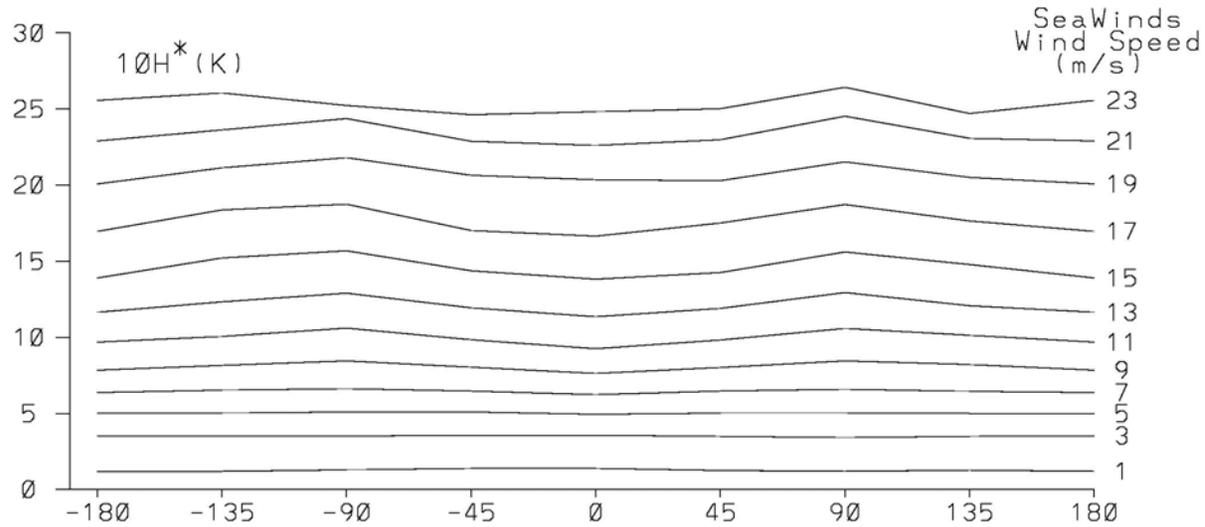
Then, we investigate characteristics of $6H(10)H^*$ due to ocean wind, by comparing them with SeaWinds.

Method (2/2)

Secondly, we simulate Tbs of 6 (10)H in rainy areas, and define a parameter W6.

Results (1/3)

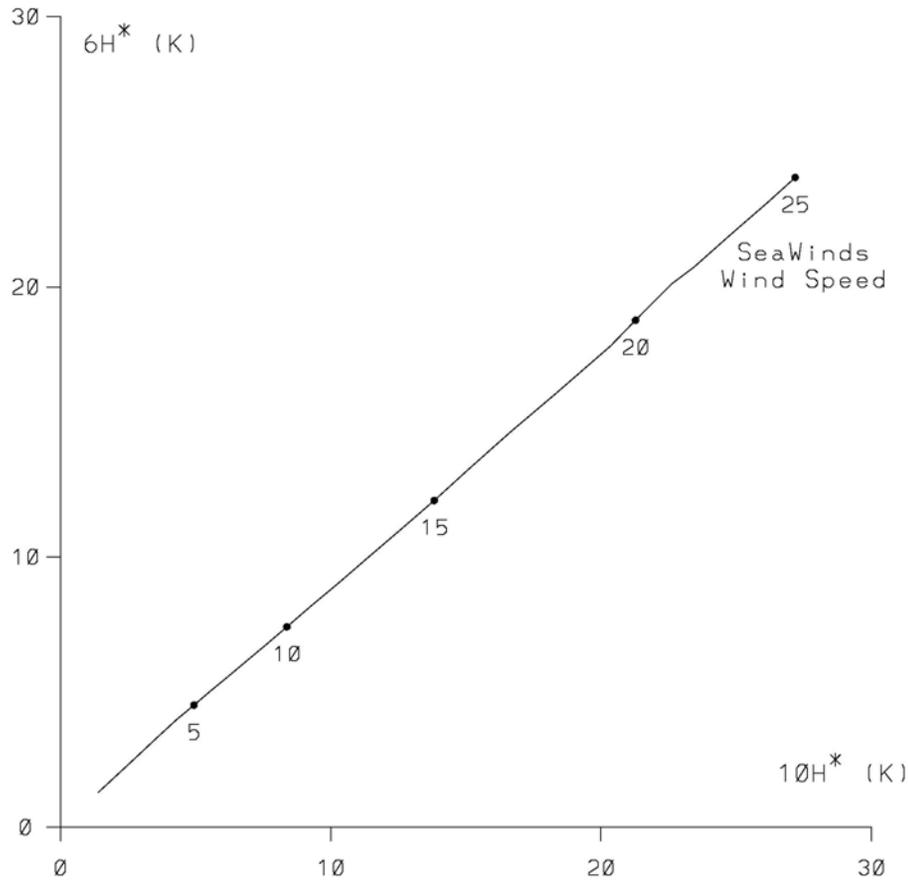
characteristics of 6H* and 10H* due to ocean wind



Relative wind direction

Results (2/3)

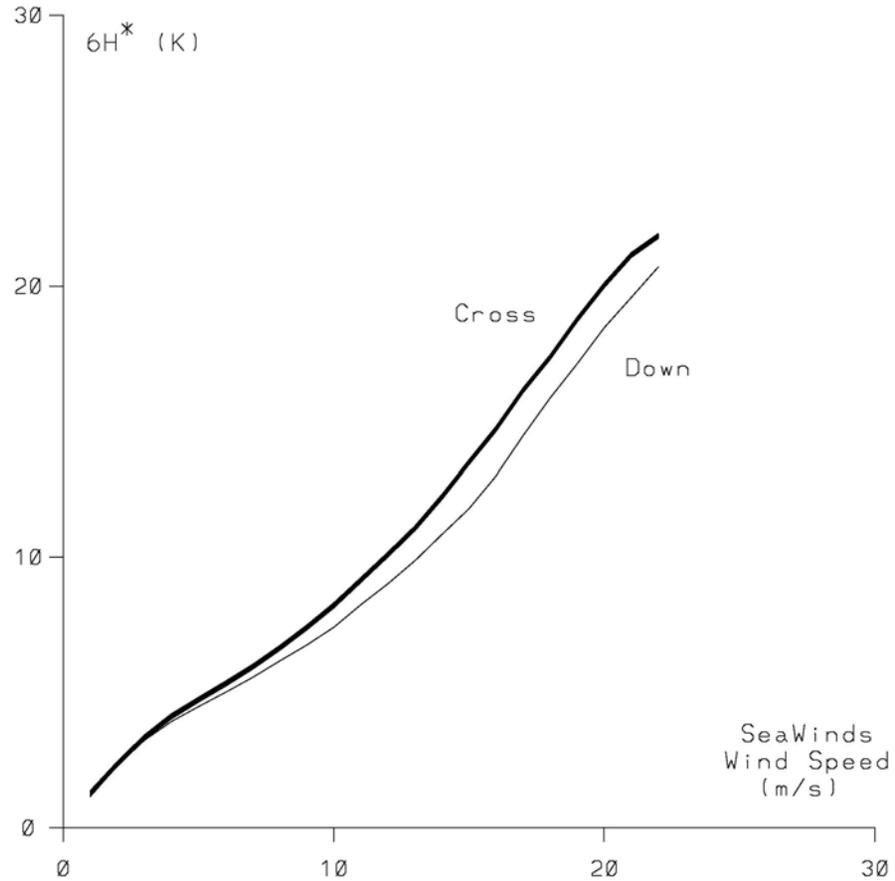
characteristics of $6H^*$ and $10H^*$ due to ocean wind



**Ratio of $6H^*$ to $10H^*$
= 0.9**

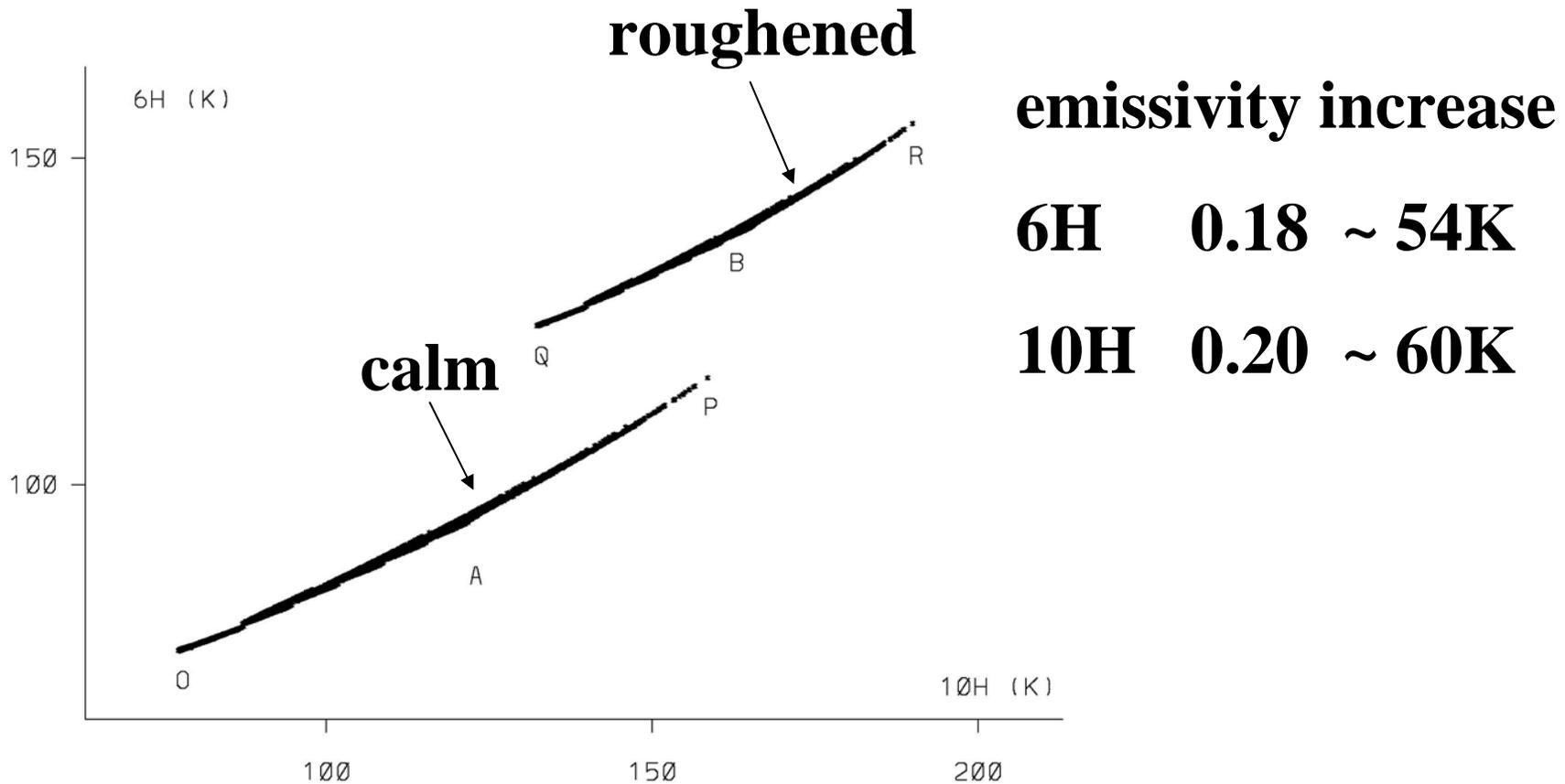
Results (3/3)

relation of $6H^*$ to SeaWinds wind speed



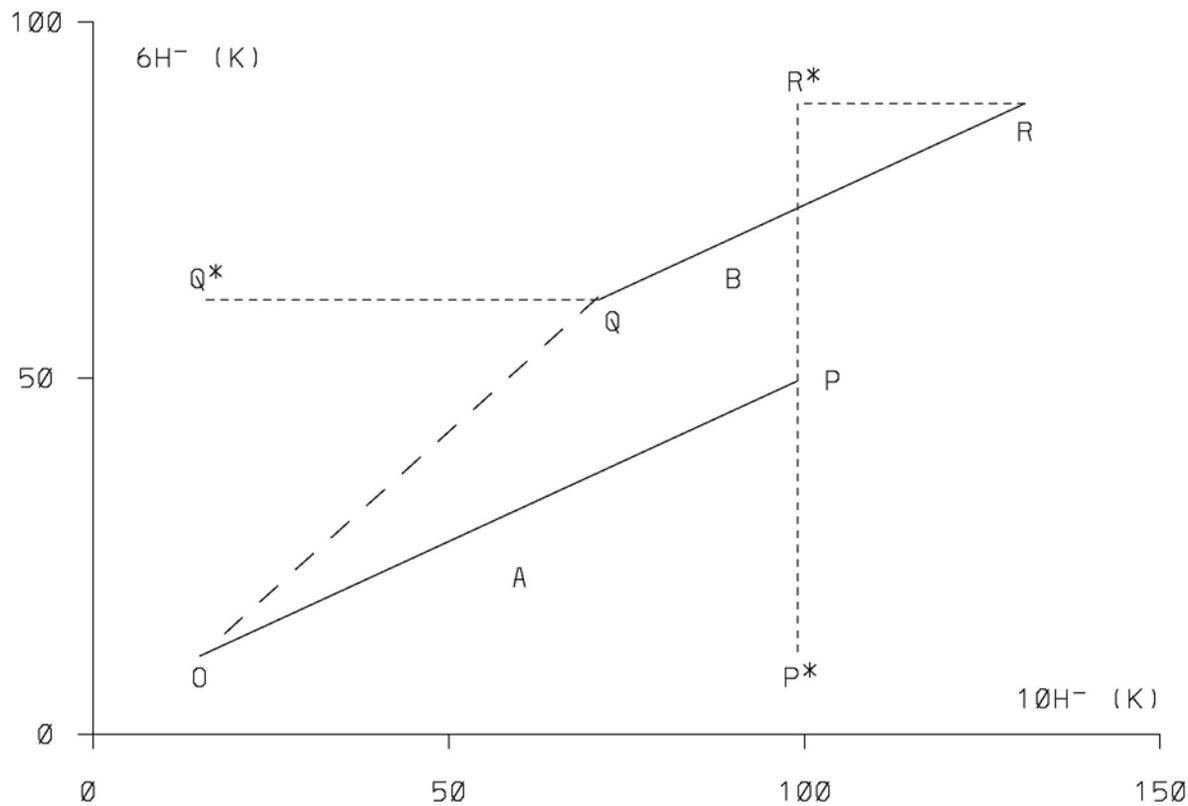
Parameter definition; W6 (1/2)

- Tb simulations in calm and roughened ocean -



Parameter definition; W6 (2/2)

- Linear approximation -



Equation

$$W6 = (-a \times c + b + sl \times 10H - 6H) / (sl - c) / fac$$

where $a=15$, $b=10.5$, $c=0.46$,

$$sl = 0.90 + 0.40 \times OP^*/80,$$

$$fac = 1 - 0.20 \times OP^*/80$$

$$6(10)H = AMSR_6(10)H - SST \times (1-r)$$

Comparison of W6 with wind speed analyzed by National Hurricanes Center (NHC)

Data sources of NHC

all kinds available data including drop-sonde

Hurricanes

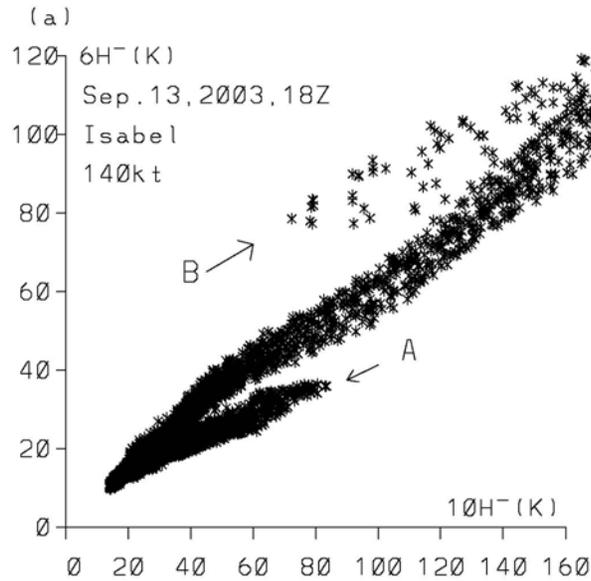
Gustav and Lili in 2002

Fabian; Isabel, and Juan in 2003

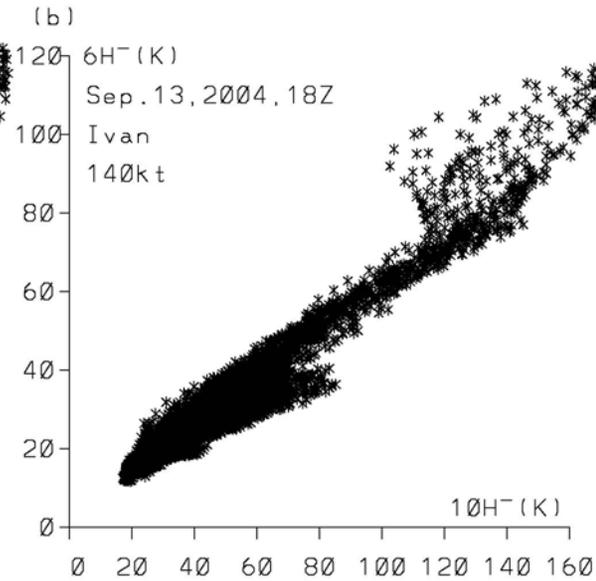
Alex, Frances, Ivan, and Jeanne in 2004

W6 for several cases

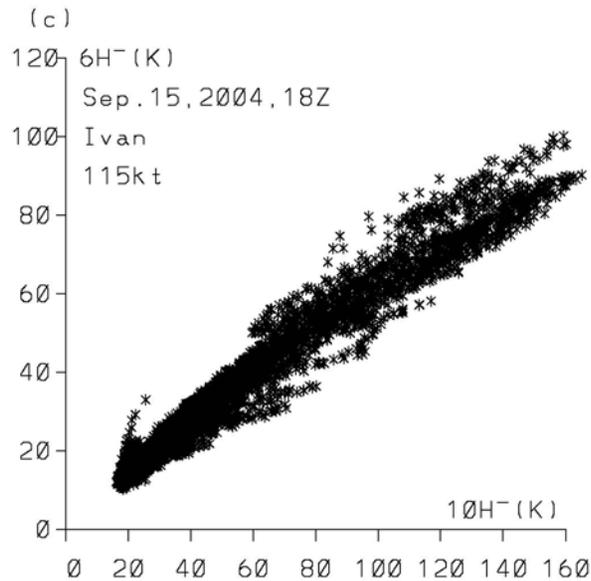
Isabel
140kt



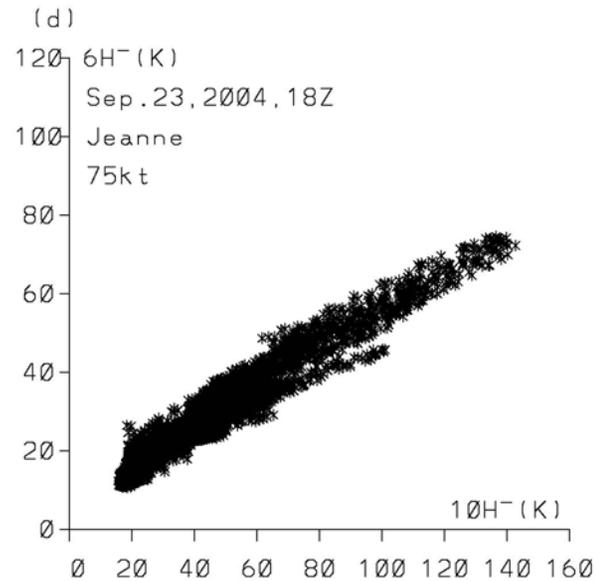
Ivan
140kt



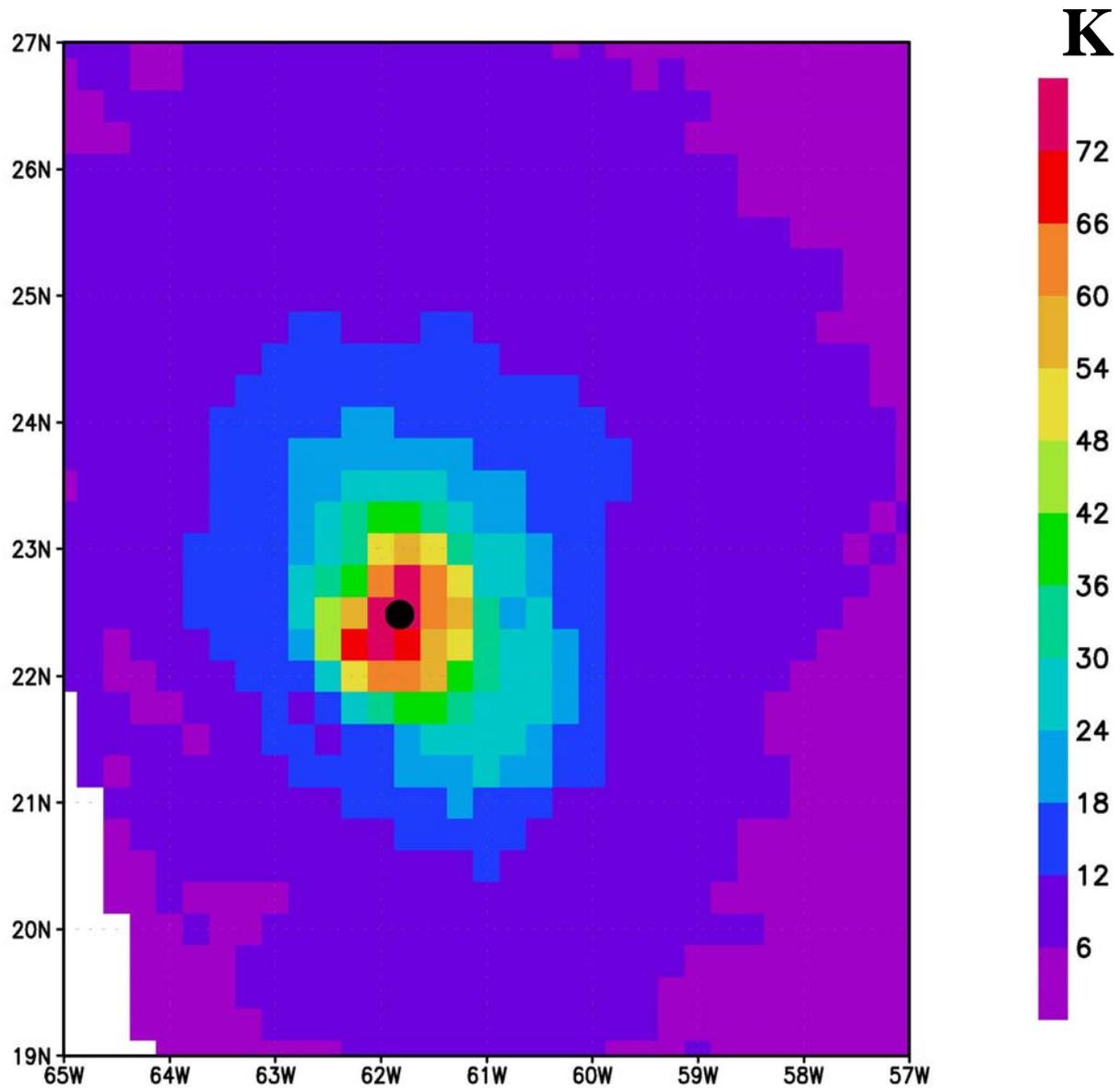
Ivan
115kt



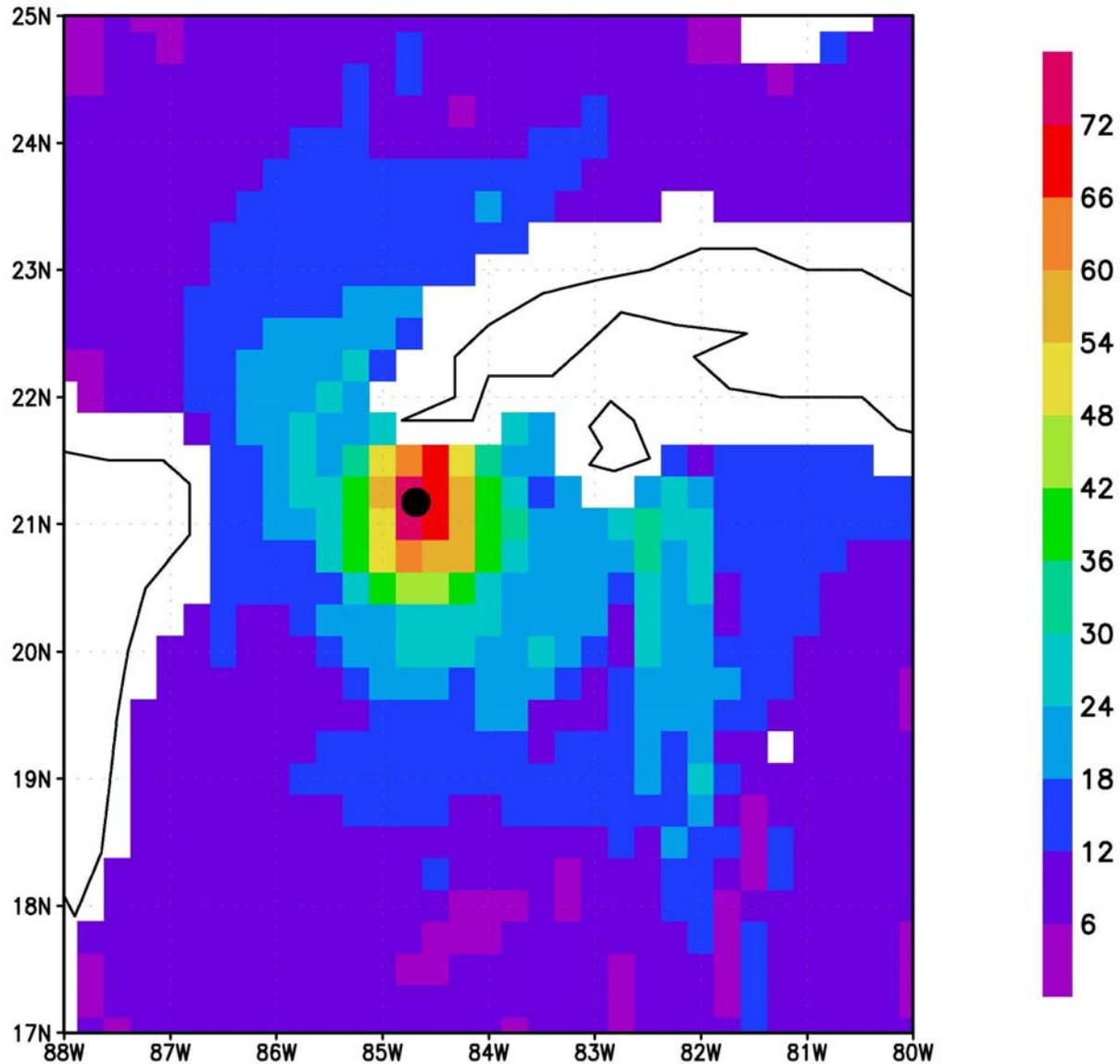
Jeanne
75kt



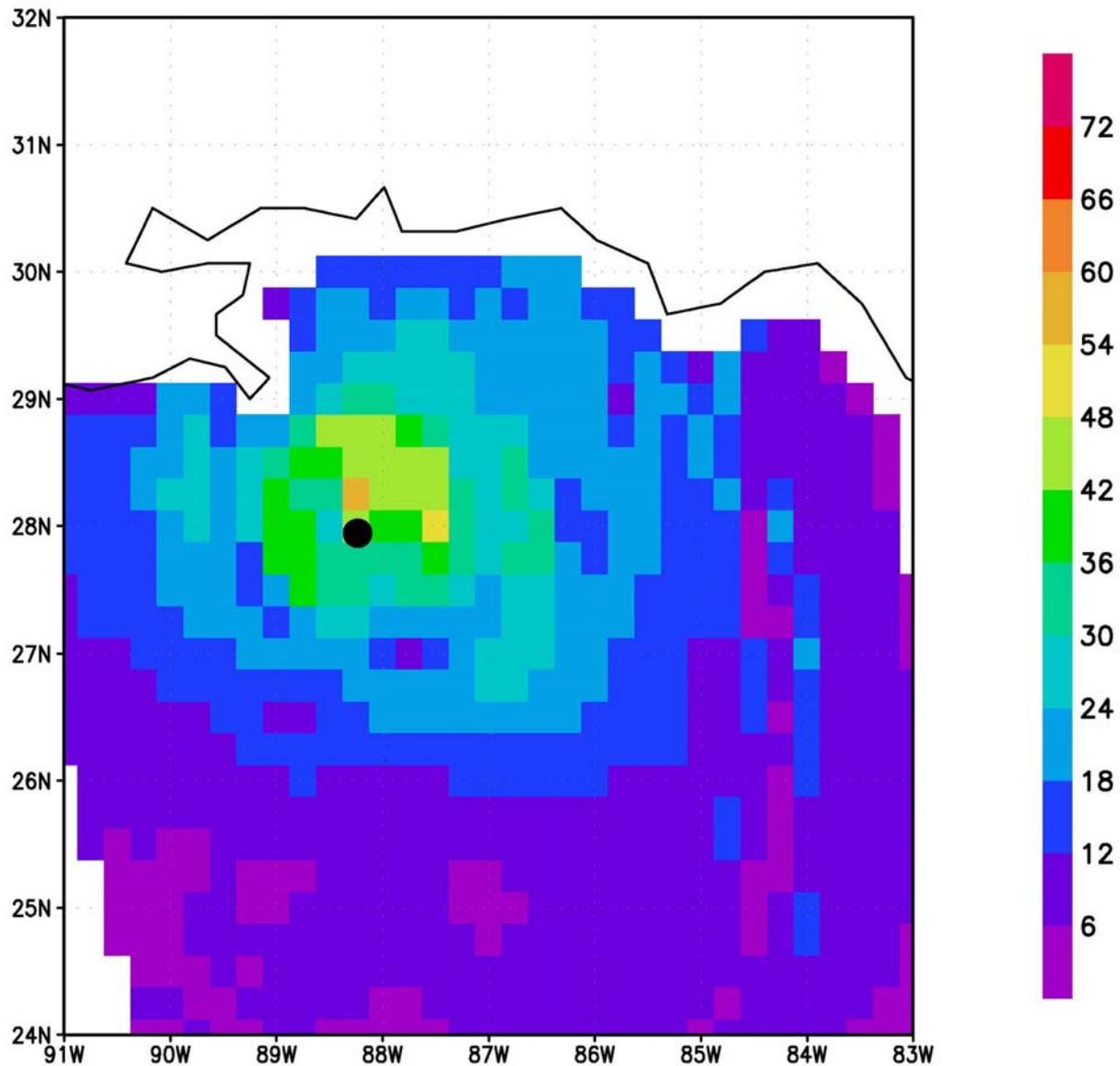
W6 inside Isabel with 140kt



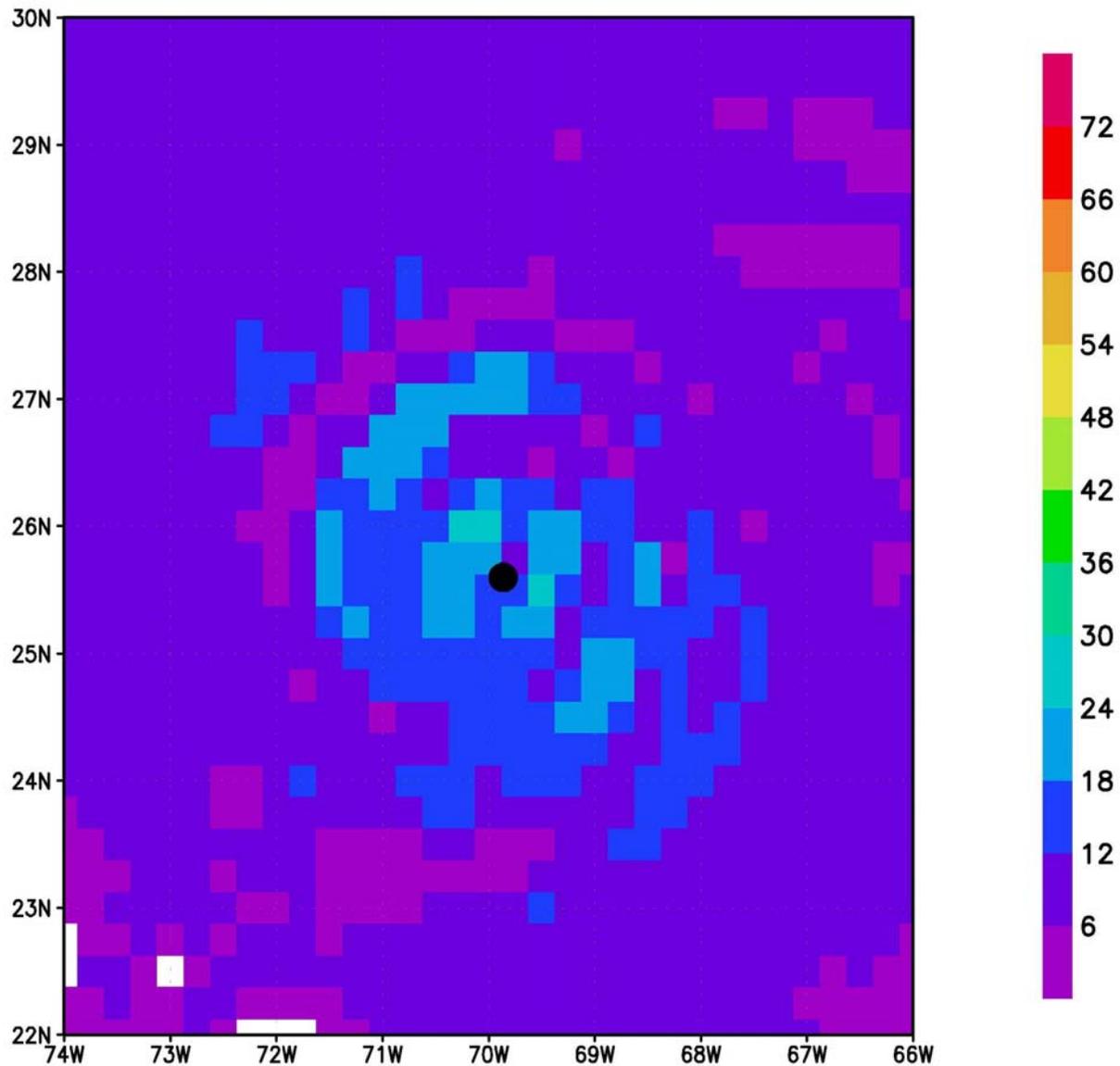
W6 inside Ivan with 140kt



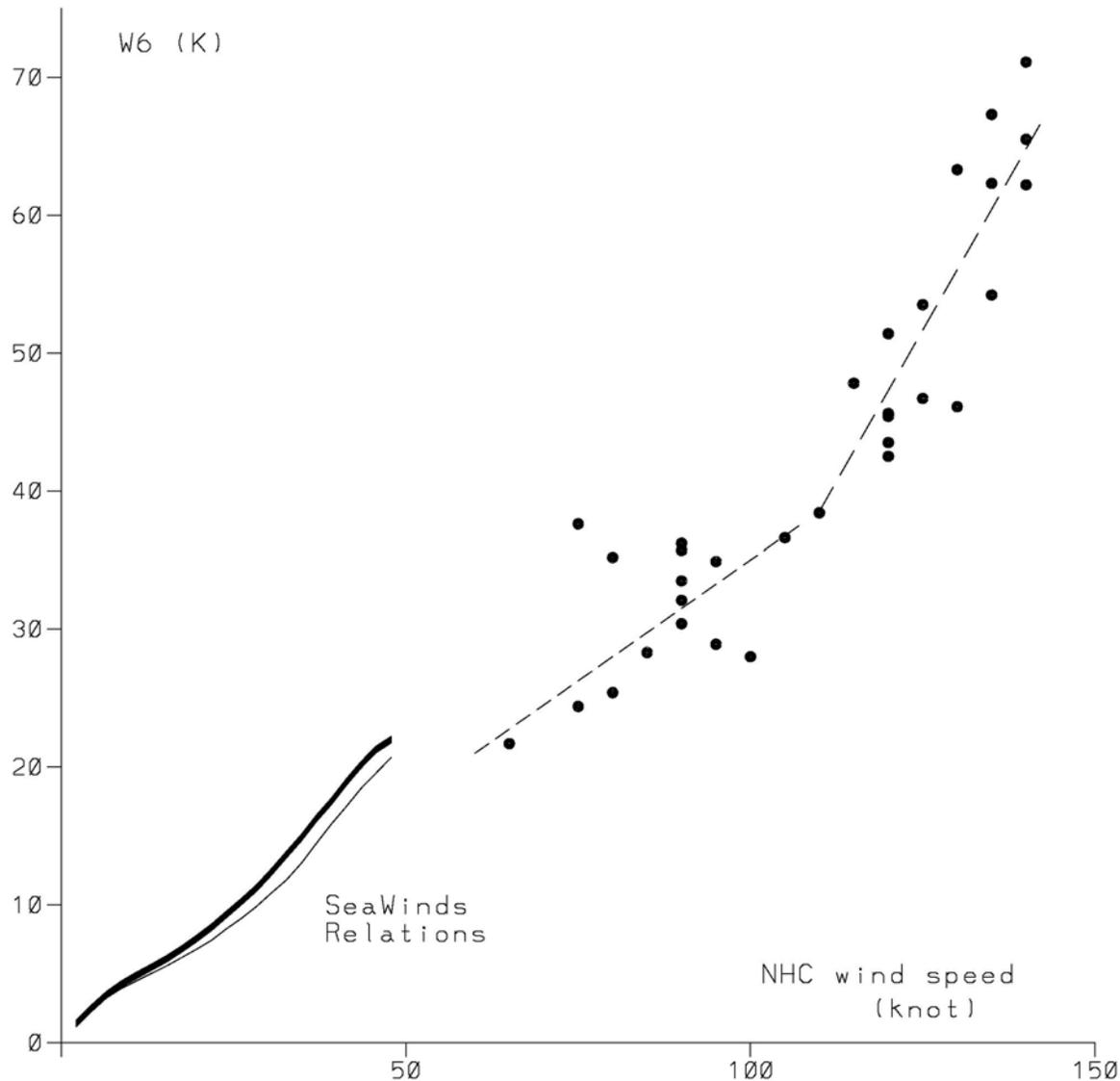
W6 inside Ivan with 110kt



W6 inside Jeanne with 75kt



Comparison of W6 with NHC wind speed - all cases -



**Calculation of W6;
to average 100 pixels
from the maximum
value to smaller**

Equation of relating W6 to wind speed

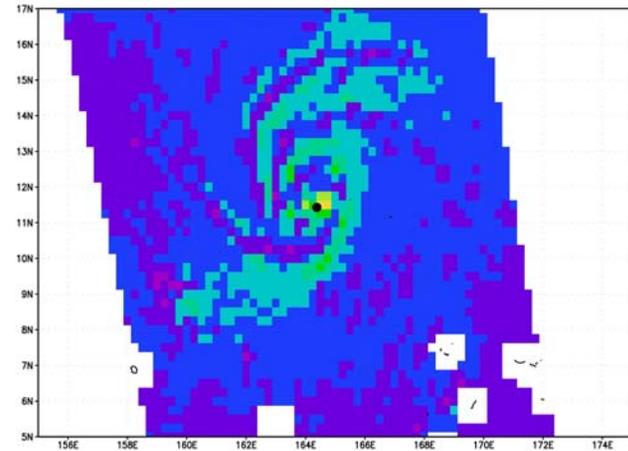
Wind_speed (knots)

$$= 2.86 \times W6 \quad \text{if } W6 < 38.5 \text{ K}$$

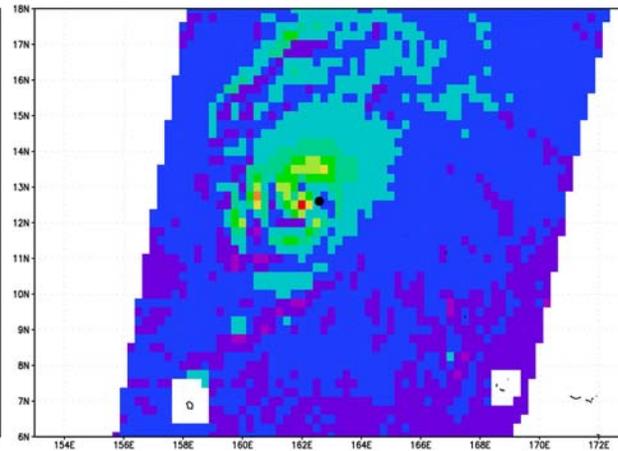
$$= 1.14 \times (W6 - 38.5) + 110.1 \quad \text{if } W6 > 38.5 \text{ K}$$

Development and decay of Typhoon 18 (2004) in the Pacific

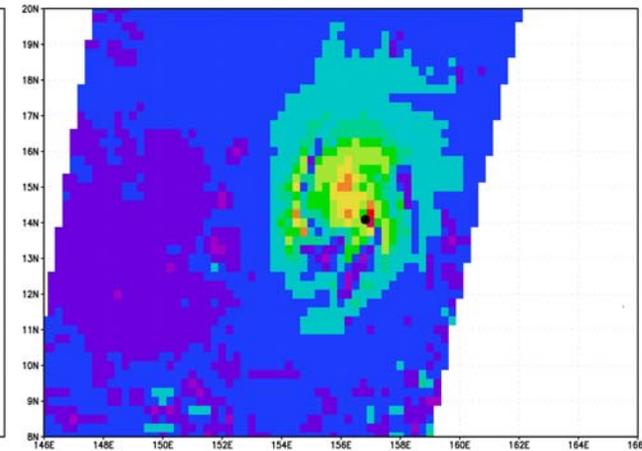
Aug. 28, 54kt



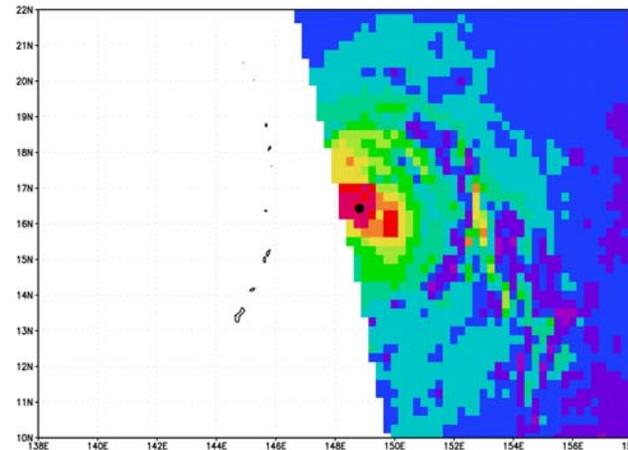
Aug. 28, 66kt



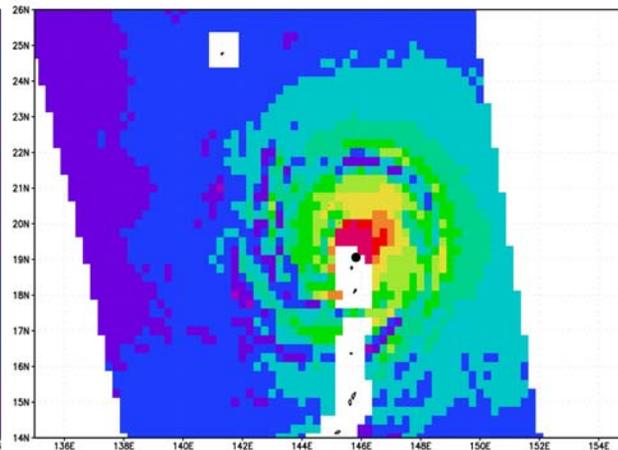
Aug. 29, 80kt



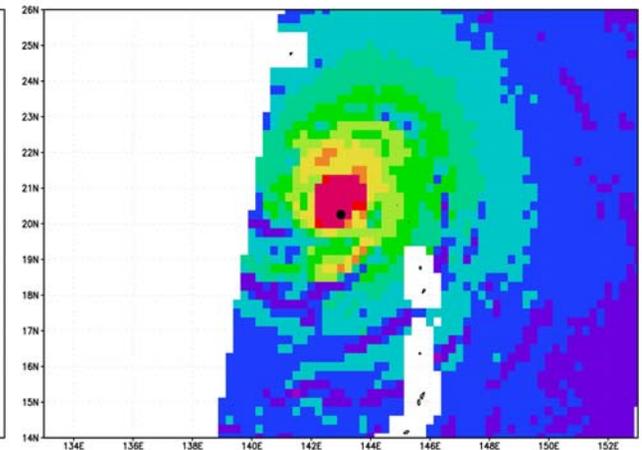
Aug. 31, 108kt



Sep. 1, 107kt

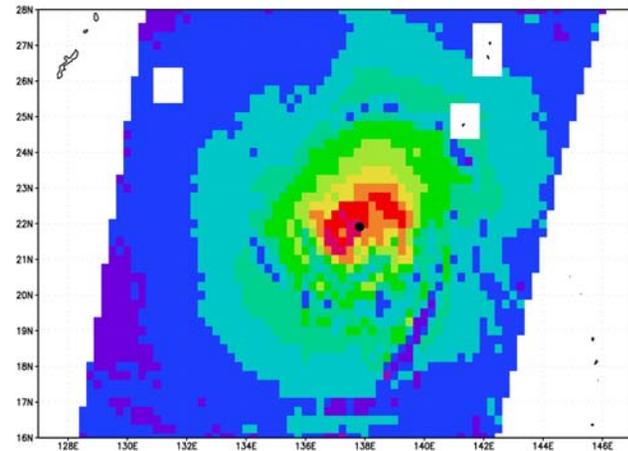


Sep. 1, 126kt

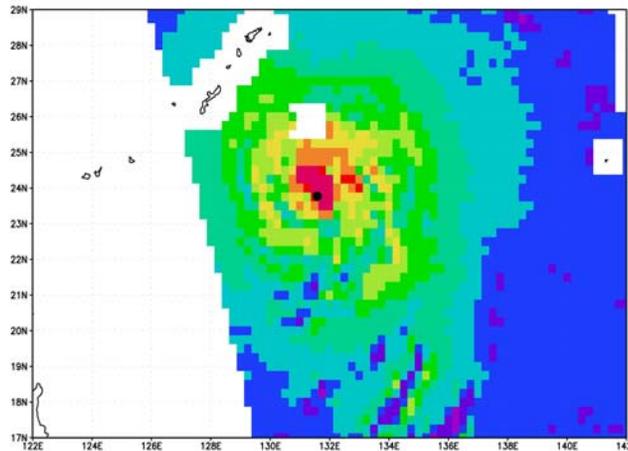


Development and decay of Typhoon 18 (2004) in the Pacific

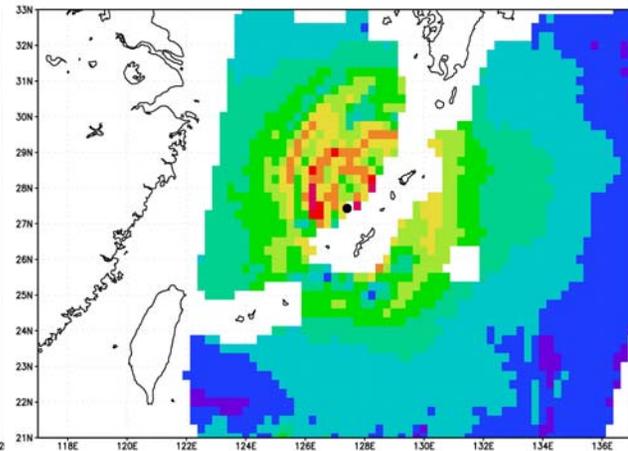
Sep. 2, 98kt



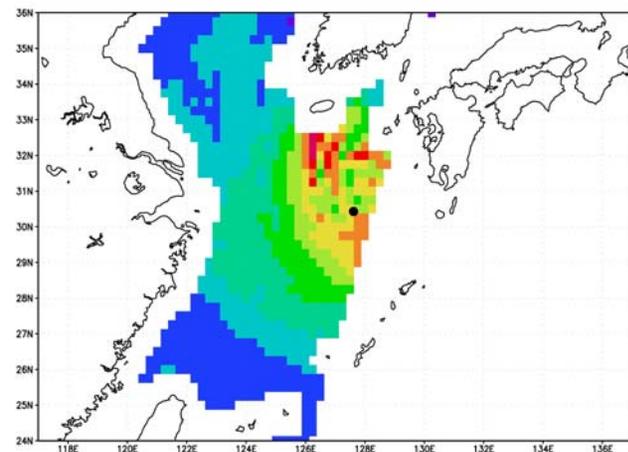
Sep. 4, 104kt



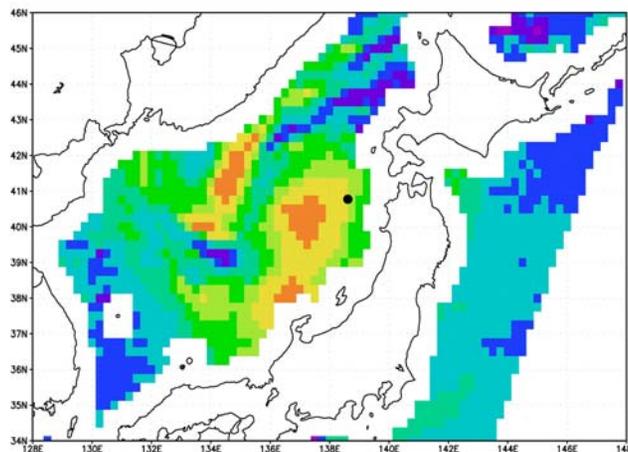
Sep. 5, 89kt



Sep. 6, 93kt

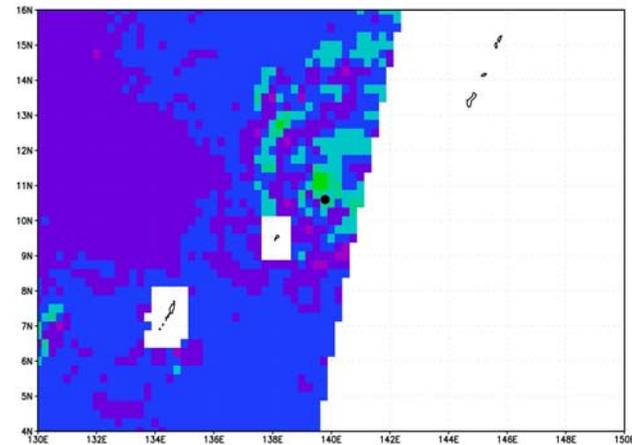


Sep. 7, 76kt

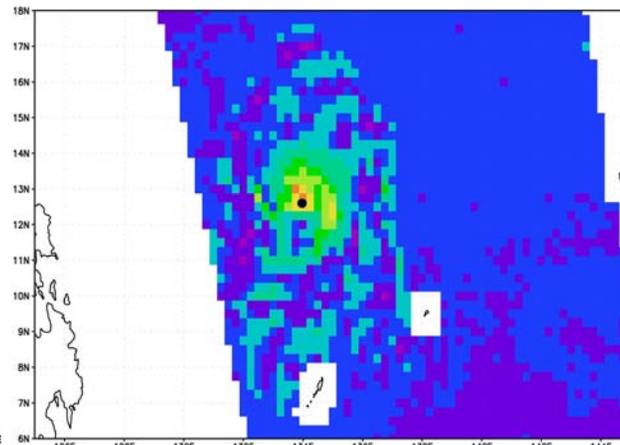


Development and decay of Typhoon 4 (2005) in the Pacific

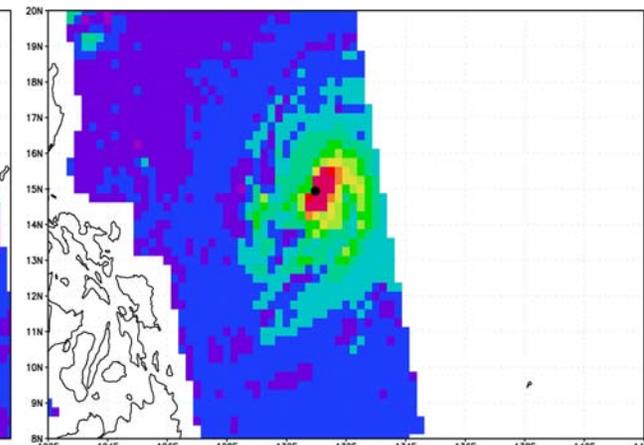
Jun. 1, 46kt



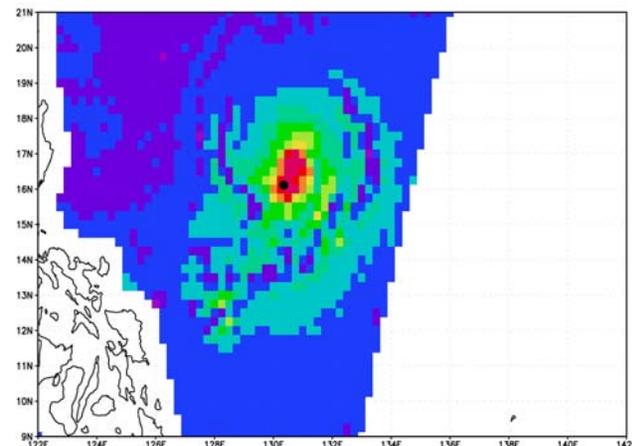
Jun. 3, 68kt



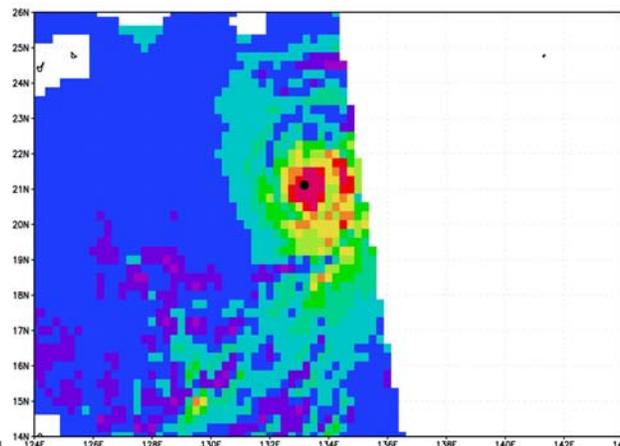
Jun. 4, 108kt



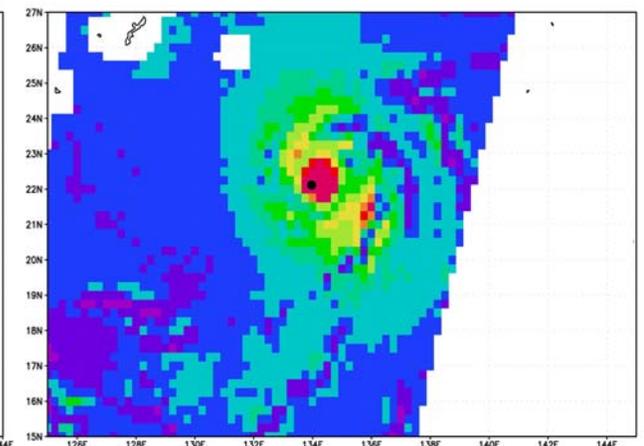
Jun. 4, 98kt



Jun. 6, 121kt



Jun. 6, 107kt

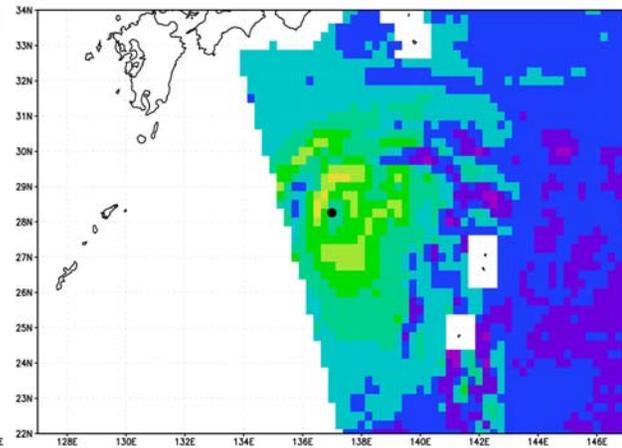
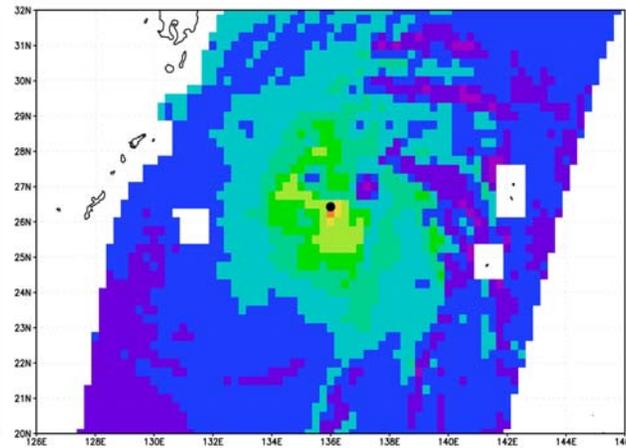
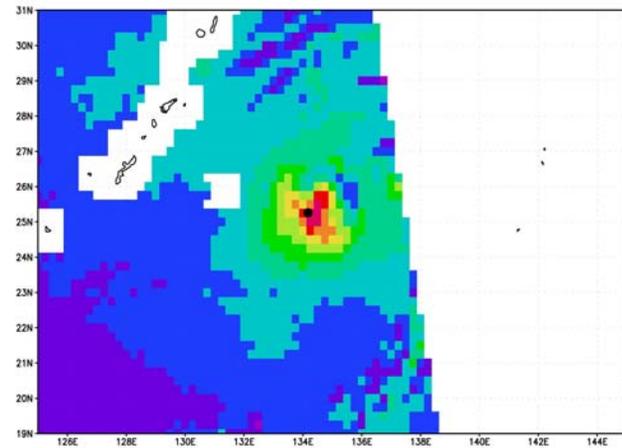


Development and decay of Typhoon 4 (2005) in the Pacific

Jun. 8, 92kt

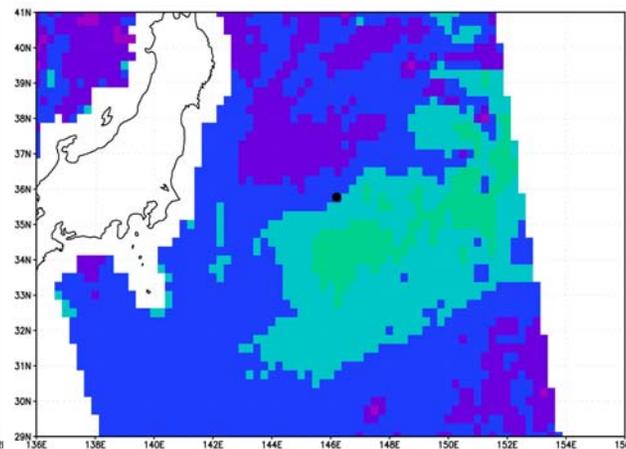
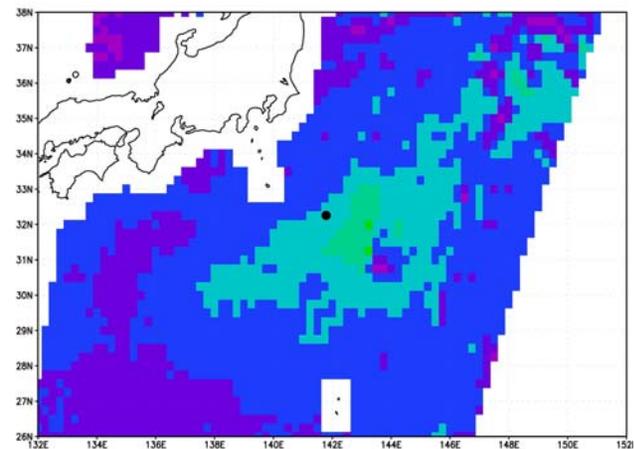
Jun. 8, 62kt

Jun. 9, 62kt



Jun. 10, 40kt

Jun. 11, 39kt



Conclusions

- **6(10)H characteristics**

6H Tb increase due to ocean wind was about 20K at wind speed 20m/s.

6H Tb difference between cross- and down-wind directions was about 1.5K at wind speed 20m/s.

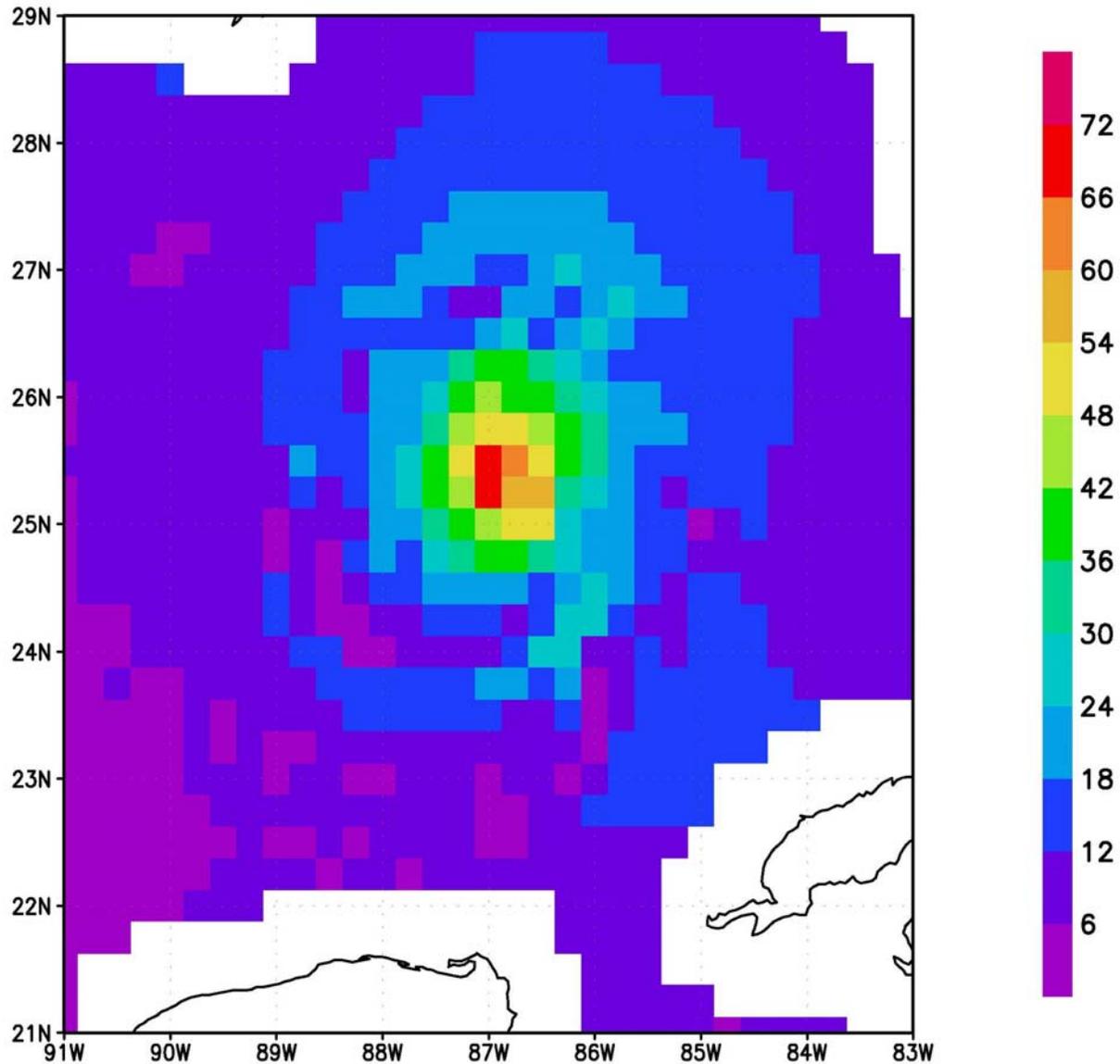
Increment ratio of 6H to 10H due to ocean wind was 0.9.

- **6 (10)H Tbs were simulated under calm and roughened conditions, and a parameter (W6) was defined.**

- **W6 increased from about 22K to 65K as the wind speed increased from 65 to 140kt in hurricanes.**

- **A practical technique for monitoring wind speed inside storms will be possible in near future.**

Katrina Aug. 28, 2005 AMSR-E 128kt



W6 inside Isabel with 140kt

