RAIN RATE ESTIMATION IN SUMMER OF TAIWAN

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Abstract

Mr. Zhao has derived an algorithm (Zhao, L. and Weng, F. ,2002) to estimate rain rate over both land and ocean. In this presentation we only discuss rain rate over land. We use AMSU-A ch1,ch2 and AMSU-B ch1,ch2,ch3 to estimate rain rate. The accuracy about diagnose no-rain area is 92%, accuracy about diagnose rain-area is 83%, its mean value is 87%, the rms error of rain rate is about 3.6 mm/hr.

Method and data

(Weng and Grody, 2000) derived a formula

$$T_B(Zt,\mu) = \frac{T_B(Z_b,\mu)}{1+\Omega(\mu)} \quad \text{.....(1)}$$

Where $T_B(Zt,\mu)$, the upwelling brightness

Temperature at the cloud top, is a direct measurement from satellites. $T_B(Zb,\mu)$, the upwelling brightness temperature at the cloud base is derived from an empirical formula. μ is cosine of zenith angle, Ω is scattering parameter, so then we can derive cloud ice water path

$$IWP = \mu De \rho i(\Omega / \Omega_N) \quad \text{.....(2)}$$

ρi is ice particle bulk volume density

Ω_N is normalized scattering parameter

De is particle effective diameter

rain rate rr can be derived as

$$rr = C_0 + C_1 IWP + C_2 IWP^2 \quad \text{.....(3)}$$

When rain rate data are retrieved, we use automatic rain gauge stations hourly data (less than 3 km far from observation point) to verify its accuracy, we also use radar echo map to compare its pattern. C_0, C_1, C_2 are coefficients got from website of NOAA .

Results

1. We collected 37 samples from July 2002 to Aug 2003 and compared its retrieved value with that of automatic rain gauge station, results are shown in table 1.

2. A typhoon called MINDULLE passed the Taiwan area from 28 June 2004 to 4 July 2004 and brought strong damage to Taiwan; its track is shown in Fig 1. We retrieved a NOAA pass at 18 UTC, 1 July; its rain rate map and radar echo map are shown in Fig 2 and Fig 4. The rain rate map for automatic rain gauge station is shown in Fig 3. We find the pattern is similar, but the retrieved value is lower than that of automatic rain gauge station.

Conclusion and future work

1. This algorithm is sensitive to scattering index or ice cloud, so that the retrieved number is small for a pass.

2. The retrieved rain rate values are lower than that of automatic rain gauge station, maybe we should adjust some coefficients to get better retrieved value.

References

Weng, F. and N. C. Grody, 2000□Retrieval of ice cloud parameters using a microwave imaging radiometer. J. Atmos. Sci. , 57, 1069-1081.

Zhao, L. and Weng, F. , 2002□Retrieval of ice cloud parameters using the advanced

microwave sounding unit. J. Apple. Meteor., 41, 384-395.

Table 1 retrieval samples statistics from July 2002 to Aug 2003

	Accuracy of diagnose	Rms of rain rate	Sample size
Rain	83%	3.6mm/nr	12
No-rain	92%		25
Total or mean	87%		37

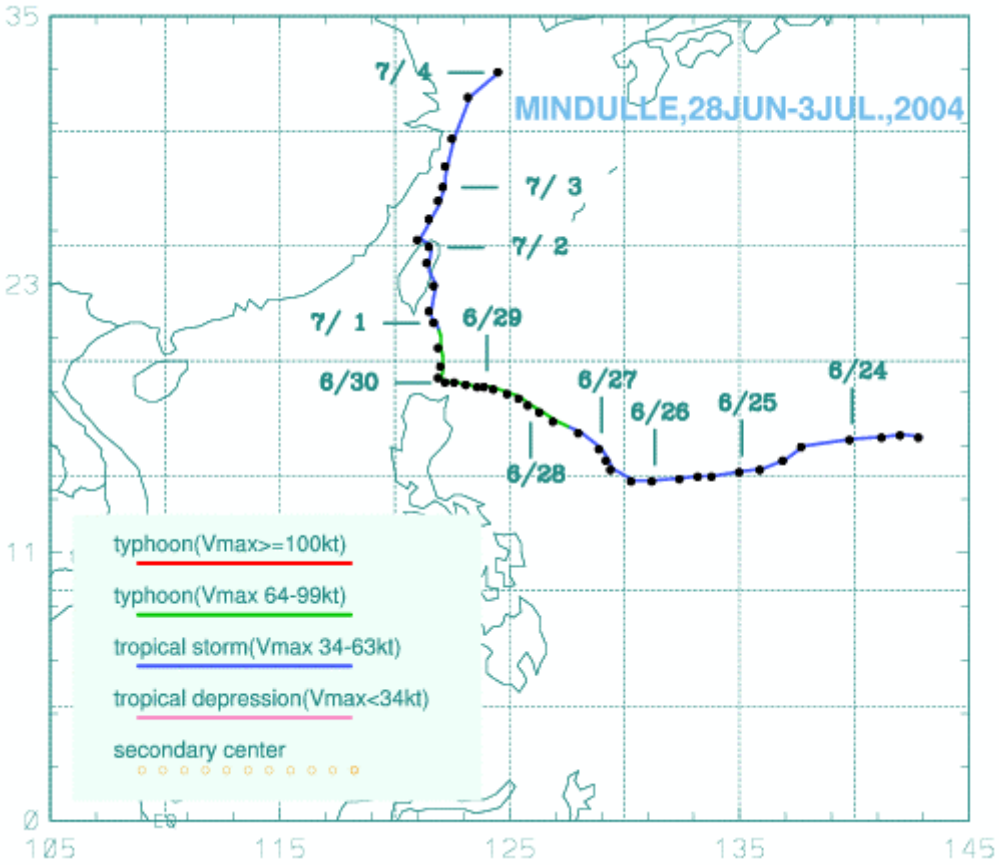

Fig 1.typhoon MINDULLE'S track

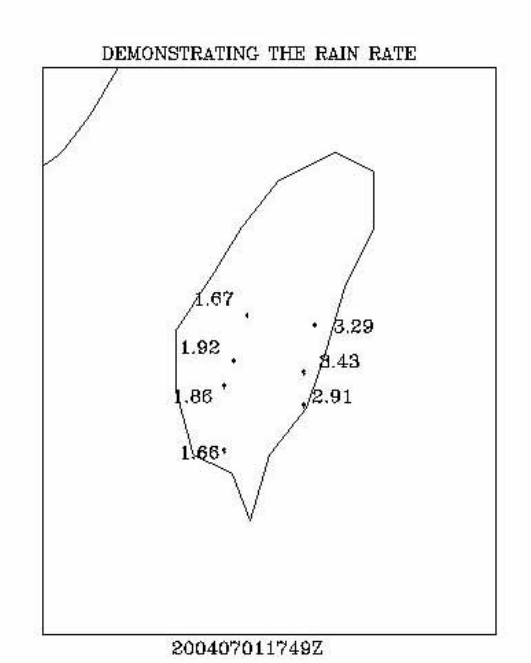

Fig 2 retrieved rain rate map at 18 UTC 1 July

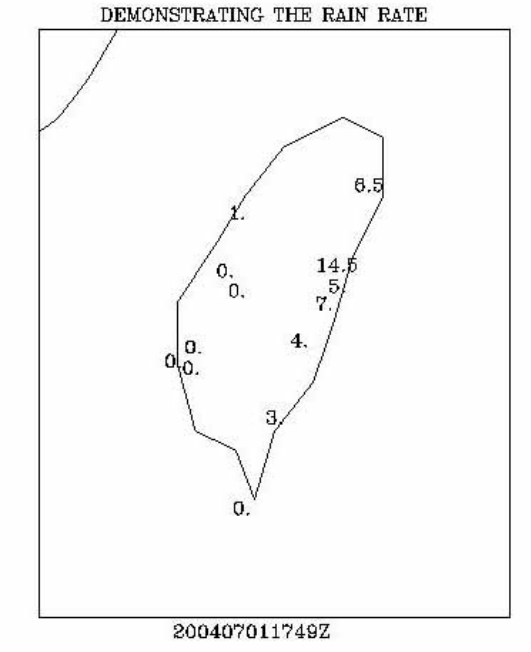

Fig 3 rain rate map of automatic rain gauge station at 18 UTC 1 July

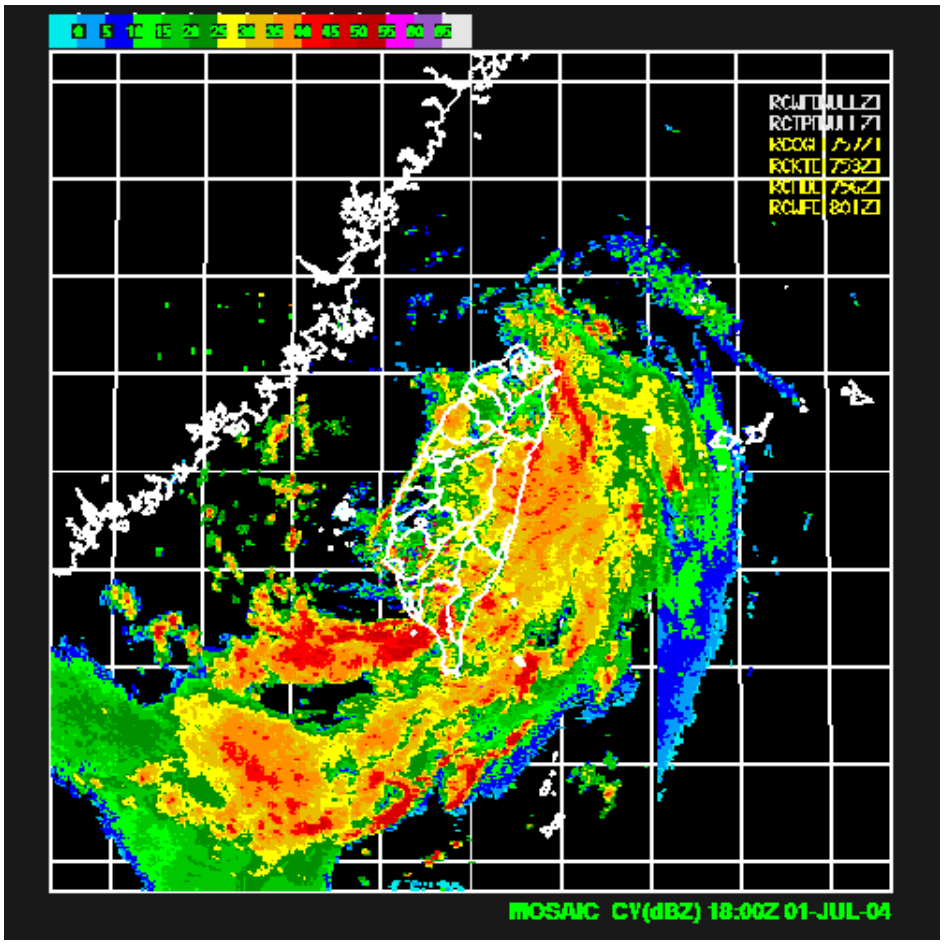

Fig 4 radar echo map at 18 UTC 1 July

INTERNATIONAL ATOVS WORKING GROUP

Proceedings of the Fourteenth International TOVS Study Conference

Beijing, China
25-31 May 2005