Paper:

To understand typhoons' behavior over Indochina

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To understand the behavior of typhoons after their landing on the Indochina, radars operated by national meteorological services of countries in Indochina and numerical model. Radar echo intensity data from many radars in Thai, Lao and Vietnam were composed covering almost whole Indochina. Regional numerical model simulation reproduced the typhoon center position very well, and, more over, caught the characteristics of internal structure of decaying typhoon in the Indochina as well as Doppler radar analysis of Lao radar data.

Keywords: Typhoon, Tropics, Indochina

1. Introduction

Tropical storms landed Indochina normally decrease their intensity exponentially owing to the loss of kinetic energy or vorticity by the viscosity on the rough land surface and the shortage of water vapor supply on the land (ex., Kaplan and DeMaria 2001; Roy Bhowmil et al. 2005). Some of them, however, weaken much slower than the normal storms after landing (Sugimoto and Satomura 2010), and produce heavy rainfall, flood and landslides in the inland regions of Indochina.

It is indispensable for understanding the mechanisms of heavy rainfall by the landed typhoons that the clarification of structures of and energy supply to the these tropical disturbances over the land. Observation network in Indochina is, however, not well prepared yet. Many radars are in operation in Indochina as shown in Fig. 1 but the radar data is not integrated across the country borders. Automatic rain gauge network and data collection system are recently installed in Thailand, but it does exist in other countries in Indochina.

The purposes of this study are

- Making a radar echo composite map over Indochina to understand structures of tropical disturbances as a whole,

- Revealing structures of tropical disturbances in Indochina by using radars and numerical model.

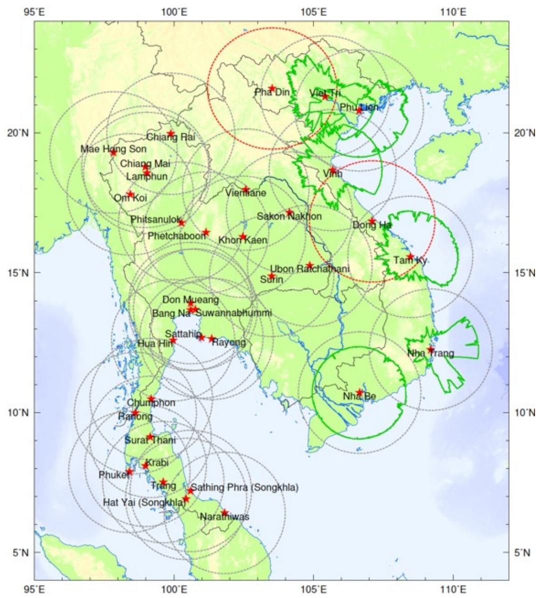

Fig. 1. Radar sites and their observation areas ($r < 250km$) in Indochina

2. Radar and Numerical Model

To show the feasibility of completing the radar echo composite map in the Indochina scale, the rainfall event by Typhoon Lekima in October 2007 is chosen.

The mesoscale numerical model WRF is used to simulate Typhoon Lekima. The horizontal grid interval is 6 km and cloud microphysics scheme (WSM 3-class simple ice scheme, Hong et al. 2004) and cumulus parameterization scheme (Kain 2004). The initial and boundary data are constructed from the 6-hourly NCEP FNL data set with 1° resolution.

3. Results

Though the radar manufacturers and radar data format, in addition to the observation setting and scheduling, are differnt among radars shown in Fig. 1, a series of radar echo composite map during the passage of Lekima is successfully produced as shown in Fig. 2 by using all radar data available. Because only the Indochina-scale radar echo composite map can capture overall structure of typhoon scale disturbances in Indochina, it is clear that

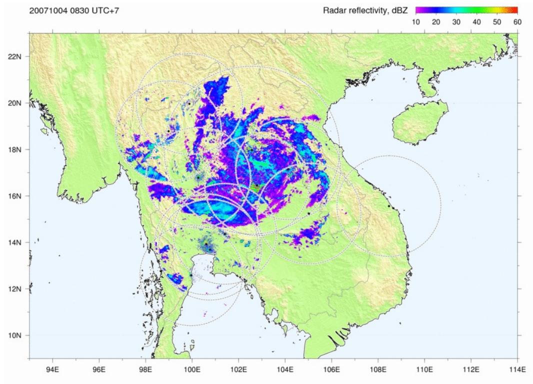

Fig. 2. Radar echo composite map at 0830UTC 4 Oct. 2007

making this type of composite map is important and useful for understanding the disturbances and preventing water disaster by these disturbances.

The mesoscale numerical model can simulate the center track of Lekima precisely as shown in Fig. 3. The total rainfall during the passage of Lekima is also reproduced by the model. Thus, it is considered that the model succeeded to simulate Lekima behavior in Indochina.

The model reproduces inner structure as well. Figure 4 shows radial wind component of Lekima is positive (outflow) almost all troposphere except in the boundary layer below 800 hPa height. This characteristics agrees with doppler velocity observation by Vientiane radar and indicates that Lekima is under decaying stage at this time.

Acknowledgements

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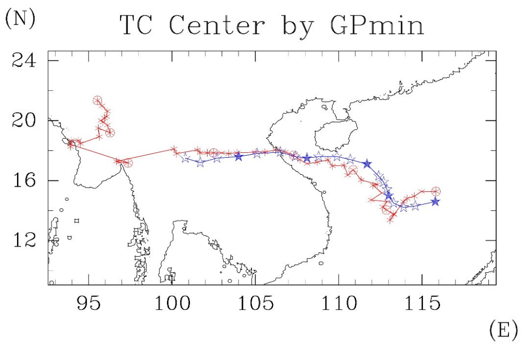

Fig. 3. Typhoon Lekima center position tracks. Blue line is the best track data by RSMC Tokyo, and red line is the minimum pressure center in the model.

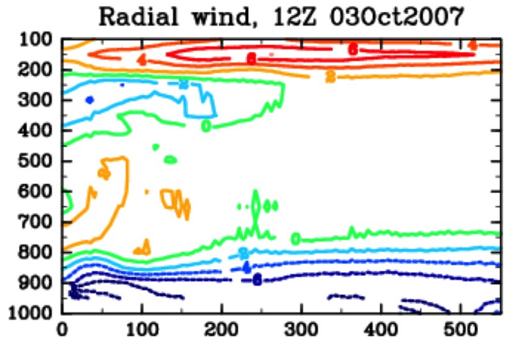

Fig. 4. Vertical cross section of radial wind for Typhoon Lekima at 1200UTC 3 Oct. 2007. The origin of horizontal axis is the typhoon center. Cool color lines are inflow (negative) and warm color lines are outflow (positive).