17A.3 THE IMPACT OF SST COLD WAKE INDUCED BY TYPHOON RUSA (2002) ON THE INTENSITY EVOLUTION OF TYPHOON SINLAKU (2002)

Treng-Shi Huang[1], Chun-Chieh Wu[1] and I-I Lin[2]
[1]Dept. of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan
[2]National Center for Ocean Research, Taipei, Taiwan

1. INTRODUCTION

It is well known that the tropical cyclone (TC) would induce the SST cold wake preferably to the right of the TC track (Price 1981). Simulations from the atmosphere and ocean-coupled Geophysical Fluid Dynamics Laboratory (GFDL) hurricane model (Bender et al. 1993) showed that the hurricane-induced cold wake would in turn reduce the hurricane intensity. Schade and Emanuel (1999) showed that the intensity reduction by the SST-feedback would reach as much as 50 % in an idealized model simulation.

Bender and Ginis (2000) found that the use of the ocean-coupled hurricane model as compared to the hurricane model could improve the prediction of TC intensity by 26 % during the 1998 Atlantic hurricane season. They also showed that the cold wake left behind from Hurricane Edouard (1996) impeded the intensification of Hurricane Fran (1996).

Recent observational study based on the advanced multiple remote-sensors (Lin et al. 2003a, b) well identified and quantified some of the above typhoon-ocean interaction processes. By reconstructing the SST data obtained from the TRMM/TMI satellite, we notice that the passage of Typhoon Rusa (2002) induced a clear 3 °C SST cold wake, where Typhoon Sinlaku encountered a week later (Fig. 1). It is speculated that the Rusa-induced SST cold wake may have some negative impact on the intensity of Sinlaku. In this paper, preliminary results from the numerical experiments to address this issue are shown.

2. EXPERIMENT DESIGN

The model used in the study is the fifth-generation nonhydrostatic, three-dimensional PSU-NCAR Mesoscale model version 5 (MM5). The AVN analysis data are used as the initial and boundary conditions for our simulations. In order to investigate how the SST cold wake induced by Rusa affected the intensity of typhoon Sinlaku, two experiments are performed. The control experiment is based on the typical monthly mean SST from the AVN (hereafter, CTRL). The sensitivity experiment uses the newly-composited SST field containing the patch of cold wake obtained from the TRMM/TMI data (hereafter, TRMM).

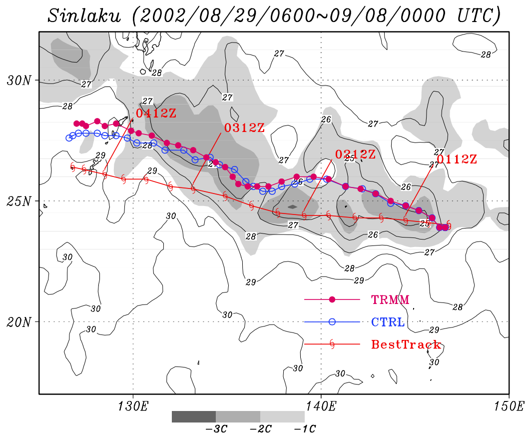

Fig. 1. The best tracks of JTWC and the modelling tracks of the two simulations with SST fields from the AVN (CTRL) or TRMM/TMI (TRMM).

3. RESULTS

The difference in the SST field between the CTRL and TRMM is shown in Fig. 1, along with the model tracks from the two experiments. Figure 1 shows an evident patch of 3 °C SST cold wake after the passage of Typhoon Rusa (2002), while the Sinlkau follows and passes through this cold-wake zone.

The storm intensity from the simulation (TRMM) with the cold wake is about 20 hPa weaker (figures not shown) than that (CTRL) not containing the cold wake. Strong contrasts in the latent and sensible heat fluxes are found in the two experiments, especially near the storm core area (Fig. 2). This difference in total heat flux increases in time as the difference in the intensity also increases.

* *Corresponding author address*: Chun-Chieh, Wu, Dept. of Atmospheric Sciences, National Taiwan University, No. 1, Sec. 4, Roosevelt Rd., Taipei, 106, Taiwan. e-mail: cwu@typhoon.as.ntu.edu.tw

The difference in their impact on the Maximum Potential Intensity (MPI) is also shown to evaluate the impact of cold wake on the theoretical upper bound of the storm intensity (figures not shown). Work is undergoing to run a simple mixed-layer model to investigate how Rusa induces such a cold wake. An air-sea coupled model will also be employed to study the whole typhoon-ocean interaction processes.

REFERENCE

Bender, M. A., I. Ginis, and Y. Kurihara, 1993: Numerical simulations of tropical cyclone-ocean interaction with a high-resolution coupled model. *J. Geophys. Res.,* **98,** 23 245-23 263.

Bender, M. A. and I. Ginis, 2000: Real-case simulation of hurricane-ocean interaction using a high-resolution coupled model: Effects on hurricane intensity. *Mon. Wea. Rev.,* **128,** 917-946.

Hong, X., S.-W. Chang, S. Raman, L. K. Shay, and R. Hodur, 2000: The interaction between hurricane Opal (1995) and a warm core ring in the Gulf of Mexico. *Mon. Wea. Rev.,* **128,** 1347-1365.

Lin, I.-I., W. T. Liu, C.-C. Wu, G. Wong, C. Hu, Z. Chen, W.-D. Liang, Y. Yang, and K.-K. Liu, 2003b: New evidence for enhanced ocean primary production triggered by tropical cyclone. *Geophys. Res. Lett.,* **30(13)**, 1718, doi:10.1029/2003GL017141.

Lin, I.-I., W. T. Liu, C.-C. Wu, J. C. H. Chiang, and C.-H. Sui, 2003a: Satellite observations of modulation of surface winds by typhoon-induced ocean cooling. *Geophys. Res. Lett.,* **30 (3)**, doi:10.1029/2002GL015674.

Price, J. F., 1981: Upper ocean response to a hurricane. *J. Phys. Oceanogr.,* **11,** 153-175.

Schade, L. R. and K. A. Emanuel, 1999: The ocean's effect on the intensity of tropical cyclones: Results form a simple coupled atmosphere-ocean model. *J. Atmos. Sci.,* **56,** 642-651.

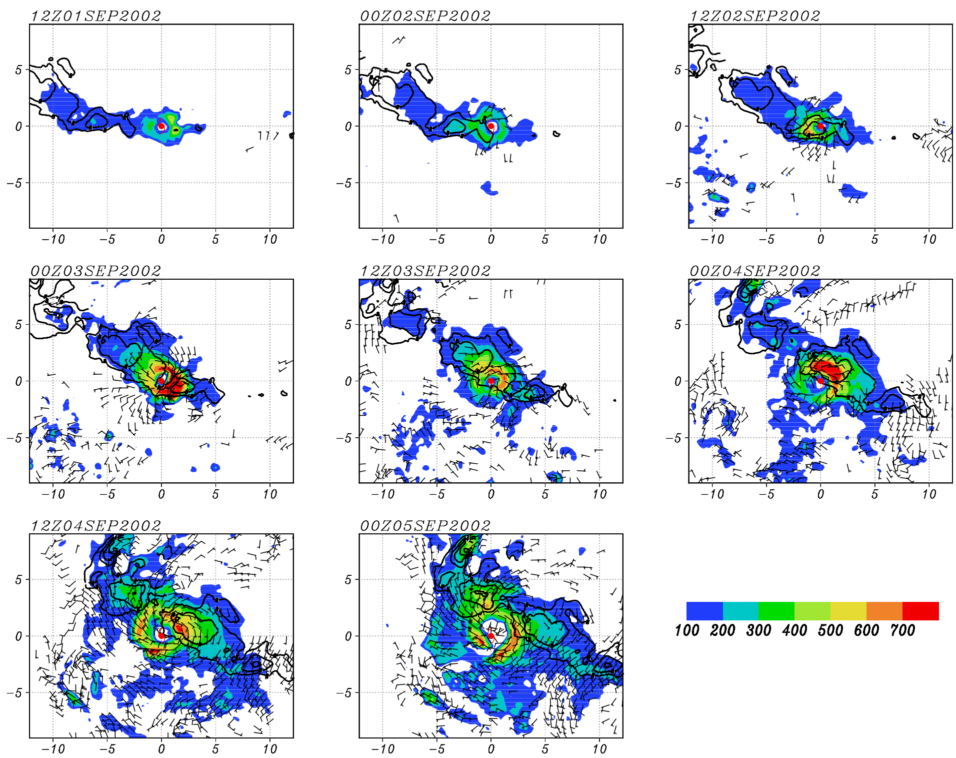

Fig. 2. Time series of the total heat flux difference and the surface wind difference (one full wind bar = 5 m s^{-1}, only those larger than 2 m/s are shown) between the CTRL and TRMM.