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A Review on “Dropsonde Observation for Typhoon Surveillance near the TAIWAN Region (DOTSTAR)” and “Typhoon-Ocean-Bio-Geochemistry Interaction” Research Projects

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ABSTRACT

A review is presented on highlights of the two research projects under the “National Priority Research Project”, funded by the National Science Council (NSC) of Taiwan.

In light of the heavy damage done by typhoons to Taiwan year by year, the NSC of Taiwan places a great premium on typhoon research, and therefore provides ample research grant for the “National Priority Typhoon Research” project for the recent three years (from August 1, 2002 to July 31, 2005), especially including the field experiment, “Dropsonde Observations for Typhoon Surveillance near the Taiwan Region (DOTSTAR)”. The DOTSTAR is an international research program conducted by meteorologists in

Taiwan, partnered with scientists at the Hurricane Research Division (HRD) and the National Centers for Environmental Prediction (NCEP) of the National Oceanic and Atmospheric Administration (NOAA). This project marks the beginning of a new era for the aircraft surveillance of typhoons in the western North Pacific.

Built upon work pioneered at NOAA's Hurricane Research Division (HRD), the key to the project is the use of airborne sensors -- GPS dropwindsondes, which are released from jet aircraft flying above 13km in the environment of a tropical cyclone. These sensors gather temperature, humidity, pressure, and wind velocity information as they fall to the surface. Information from the surveillance flights is transmitted in near real-time to the CWB of Taiwan, as well as to the NCEP, FNMOC, and JMA. The data are immediately assimilated into the numerical models of CWB, NCEP (AVN / GFDL), FNMOC (NOGAPS / COAMPS / GFDN), UKMET, and JMA. The DOTSTAR are expected to provide valuable data which can help increase the accuracy of TC analysis and track forecasts, to assess the impact of the data on numerical models, to evaluate the strategies for adaptive/targeted observations, to validate/calibrate the remote-sensing data, and to improve our understanding on the TC dynamics, especially over the TC's boundary layer.

On September 1, 2003, the first DOTSTAR mission was successfully completed around Typhoon Dujuan. On November 2, the second mission was launched while the aircraft flew over the center of Typhoon Melor. Nine more flights have been conducted for Typhoons Nida, Conson, Mindulle, Magi, Aere, Meari, and Nock-Ten in 2004. As the DOTSTAR research team continues to harvest important data and gain valuable experience, we believe that future typhoon observations will reach full maturity, enabling significant progress in both academic research and typhoon forecasting. It is hoped that DOTSTAR will shed light on typhoon dynamics, enhance typhoon track forecasting accuracy, place Taiwan at the forefront of international typhoon research, and make a significant contribution to the study of typhoons in the Northwestern Pacific and East Asia region.

Regarding the work on the typhoon-ocean-bio-geochemistry interaction, the cooling of the ocean due to the passage of typhoons has been documented from satellite-retrieved SST data. The response to the wind change has also been demonstrated. Meanwhile, a striking interdisciplinary issue on the dramatic bio-response and ocean primary production due to typhoons has also been raised. Inspired by our recent observations, we are developing and using typhoon-ocean coupled models to understand the role of the ocean mixed-layer structure (including typhoon-induced SST cold wake, warm ocean eddies, and ocean currents) on the typhoon-ocean interaction problems and their feedback to the climate and biogeochemistry.

Key words : Typhoon, DOTSTAR, Primary production.