Targeted Observations of Typhoons in DOTSTAR

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DOTSTAR (Dropwindsonde Observations for Typhoon Surveillance near the Taiwan Region) is a research program conducted by meteorologists in Taiwan partnered with some international scientists and operational centers. The DOTSTAR research team initiated the typhoon surveillance in 2003. During 2003 to 2006, 24 missions (20 typhoons and 386 dropwindsondes deployed) had been successfully conducted. Five models (4 operational and 1 research models) are used to evaluate the impact of the dropwindsonde on track forecasts of typhoons in 2004.

Multiple techniques have been used to help design the flight path for the targeted observations in DOTSTAR: (1) the area with the largest forecast deep-layer-mean wind bred vectors from the NCEP Global Ensemble Forecasting System at the observation time, (2) the Ensemble Transform Kalman Filter, which predicts the reduction in forecast error variance for all feasible deployments of targeted observations, and (3) the NOGAPS singular vectors that identify sensitive regions. Recently we have proposed a new theory to identify the sensitive area for the targeted observations of tropical cyclones based on the adjoint model. By appropriately defining the response functions to represent typhoon's steering flow at the verifying time, a unique new parameter, the Adjoint-Derived Sensitivity Steering Vector (ADSSV) has been designed to clearly demonstrate the sensitivity locations at the observing time. Special examples have been shown to illustarte the binary interaction and the typhoon-trouch interaction. The ADSSV are being implemented and examined in DOTSTAR, as well as the hurricane surveillance program of NOAA's Hurricane Research Division in the Atlantic in 2005. An inter-comparison study is being conducted to examine the common feature and difference among all the different targeting techniques. Overall, the DOTSTAR has made significant impact to the typhoon research and operation community in the

international arena, and will play some important role in the research area of targeted observations and typhoon predictability during the THORPEX-PARC in 2008.