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STATUS AND OUTLOOK OF A QUANTITATIVE RAINFALL ESTIMATION TECHNIQUE IN CENTRAL WEATHER BUREAU, TAIWAN

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1. Introduction

Torrential rainfall (and the ensuing flash flood) is one of the major natural disasters in Taiwan. Not only human lives and personal property were severely demolished, but also the societal stability and sustainability were greatly threatened. For reducing the damage, The Very Short-Range Forecasting (VSRF) System under the Climate Variation, Severe Weather Monitoring, and Forecasting System Development Project in Central Weather Bureau (CWB) has being under progressive development in CWB since 2002. The first sub-system of VSRF is the Quantitative Precipitation Estimation-Segregation Using Multiple Sensors (QPESUMS) system. It's designed to be able to integrate the radar data to make real-time QPE with the island wide Doppler radar network (Fig 1) and ultimately make 0-2 hr quantitative precipitation forecast (QPF) on severe weather events. The second sub-system is the diabatically initialized LAPS (local analysis and prediction system) PSU/NCAR MM5 system, which is designed to be capable of mitigating the well-known spin-up problem of numerical model and of making the 2-12hr QPF on the severe weather systems. Reasonable QPE/QPF information will be directly beneficial to hazard mitigation, hydrological application and dam water management as well. Continuing efforts have been put to two major components of the VSRF system. Only the QPESUMS system is described in this article.

2. QPESUMS

The QPESUMS system is an integrated system incorporating data from multiple radars, numerical models, satellite, lightning and surface sensors. All data are mosaicked to a common grid coordinate with the goals of making reasonable QPE/QPF applicable to flash flood warning and water resources managements. The initial QPESUMS system in Taiwan was operational in late 2002 and has been under functional improvement. To enhance the usefulness of QPESUMS toward near real-time QPF and the monitoring of severe storm, several features were developed: (1) Radar echo statistics (Chang et al., 2003) for understanding the effective coverage of the radar echo data for each individual elevation angle; (2) Doppler velocity dealiasing algorithm development (Fig. 3); (3) Severe storm and Typhoon tracking (Fig. 4); (4) GIS/Surface observation overlay (Fig. 5); (5) QPE and basin QPE development (Fig. 6); (6) QPE for individual river basin (Fig. 7).

The Z-R relationship of is applied in the QPESUMS system for the routine operational QPE. It is noted that the QPEs made by the QPESUMS tend to deviate from the raingauge data, resulting from different types of precipitating systems (convective or stratiform, etc.). A general Z-R relation suitable for the QPE on entire Taiwan is seemly non-existent (Chiou et al., 2004). Yet, once the previous QPE is adjusted by the raingauge data, the upcoming QPE will be highly correlated with the corresponding rainfall observation (Fig. 8). Subsequently, time series of the adjusted QPE with respect to the rainfall observation of a certain raingauge station show a high consistency (Fig. 9).

3. Future work:

As stated above, the VSRF system is under intensive development in order to satisfy the increasing need for short-term severe weather forecasts. The QPESUMS system has been installed in seven government agencies in charge of hazard mitigation since 2003. The responses from the QPESUMS system users are the bases for future system enhancement. Future tasks for the QPESUMS system are: (1) the real-time operation of a statistical analysis to reveal the relationship between the radar estimated rainfall and rain gauge data (similar to Fig. 9), (2) an adjustment of satellite rainfall estimation based on radar data to estimate the precipitating systems, which are beyond the coverage of radar network, moving toward Taiwan, (3) the application of lightning data to demonstrate the lead or lag of lightning with respect to rainfall events. (4) 0-1hr QPF technique development (Fig. 10), (5) the inclusion of dual-polarization techniques for a more precise segregation of convective and stratiform precipitation and etc.

The long-term goal set for the QPESUMS system is to be able to make reasonable 0-2 hr QPF on the severe weather systems. All tasks in QPESUMS system, with multiple observing systems, are to promote the accuracy of QPF techniques applied in Taiwan and the adjacent oceanic area. An ensuing warning system for flash floods or debris flow (Fig. 11) will be jointly developed with other government agencies in the future.

REFERENCE

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