Applications of NWP and Radar-based QPF Techniques for Flash Flood and Landslip Warnings in Hong Kong

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Abstract

In support of severe weather warning operation, the Hong Kong Observatory has developed an automated nowcasting system called Short-range Warning of Intense Rainstorms in Localized Systems (SWIRLS), designed to provide real-time radar-based quantitative precipitation forecasts (QPF) for the following three hours, updated frequently every six minutes, through the extrapolation of echo movement vectors derived from the Tracking Radar Echoes by Correlation (TREC) algorithm. This paper summarizes the features of SWIRLS and how relevant QPF information is extracted from the system in support of the operation of Rainstorm Warnings and Landslip Warning in the form of a combined warning panel. The design of the next-generation QPF forecasting suite, the Rainstorm Analysis and Prediction Integrated Data-processing System (RAPIDS), for forecasting precipitation in the next 6 hours through blending SWIRLS output with Non-hydrostatic Model (NHM) QPF will also be introduced. Armed with the above systems, QPF trends in the next 24 hours are purposely assembled and closely monitored for the operation of the Rainstorm and Landslip Warnings. With such a linkage between forecasting and warning systems, the resultant benefits become even more pronounced. Case studies demonstrating the QPF algorithms in action are shown and overall performance in terms of the algorithms' effectiveness for rainstorm and landslip warnings is presented.

Down the years, the warning systems themselves have also gone through several evolutionary and refining cycles. Nowadays, the warning systems are increasingly reliant upon forecasting systems such as SWIRLS for technical input. This in turn provides an incentive for new forecasting systems or techniques to be developed. By working closely with the stakeholders and other long-term collaborators and adopting an "end-to-end" approach in the warning process, forecast information can be speedily translated into appropriate response actions. The involvement of stakeholders, who tend to be more conscious of the changing social needs, provides a built-in impetus for the forecast-warning systems to evolve, thus connecting the two ends and closing the loop. The application of "end-to-end" approach for early warning of rainstorms and landslips in Hong Kong will be discussed in this paper.