

Transmission resolving of three-dimensional typhoon moisture field for prediction of surface precipitation hyetograph

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The purpose of this study can be divided to three sections: (1) resolve the triggered transmission factor of three-dimensional typhoon moisture field resulting from horizontal vortex, vertical wind shear and turbulence mixing, cumulus convection, gravity wave drag, and interaction between typhoon rain band, terrain, and monsoon; (2) formulate and derive the analytical governing equation (G.E.) of moisture field and surface precipitation hyetograph; and (3) couple the analytical signal processing feature and the G.E. to develop a methodology for prediction. The typhoon moisture field measured by radar-based remote sensing and the observed surface precipitation are resolved by signal processing and data mining technique (e.g. principle component analysis etc.). The G.E. can be manifested by convective term and external adjunction term. The typhoon moisture field and surface precipitation are simulated and predicted by finite difference-based and moving dynamic-based approach with the consideration of typhoon atmospheric field structure and exponential function-based pressure-wind distribution. This study discovers the nature profound mystery at the Shihmen Reservoir basin, Taiwan. Results show that the typhoon rain band on the studied basin would mainly dominated by the interaction between vortex-based wind field and terrain lifting when typhoon center locates within the influence radius. In addition, the studied basin would suffer cloudburst attack because of circumfluent convection and monsoon co-movement effect while typhoon center pass the extend line with connecting to the basin centroid which is orthogonal to the monsoon and mountain chain direction. Furthermore, the developed methodology can predict surface precipitation hyetograph effectively and accurately with the full consideration of natural cause of formation.

Keywords: typhoon moisture field, prediction of surface precipitation hyetograph, transmission resolving, signal processing, circumfluent convection, monsoon co-movement effect