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Development of Flood Inundation Analysis System By Applying Weather Radar Data

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Among various input data to hydrologic models, rainfall measurements arguably have the most critical influence on the performance of hydrologic model. Traditionally, hydrologic models have relied on point gauge measurements to provide the areal-averaged rainfall information. However, rainfall estimates from gauges become inadequate due to their poor representation of areal rainfall, especially in situations with sparse gauge network. Alternatively, weather radar that covers much larger areas has become an attractive instrument for providing areal-averaged precipitation information.

Despite of the limitation of the QPE(Quantitative Precipitation Estimation) using weather radar, we can get the better information of spatial variability of rainfall fields. Also, rain-gauges give us the better quantitative information of rainfall fields. Therefore, we developed improved methodologies to estimate rainfall fields using an ordinary cokriging technique which optimally merges radar reflectivity data into rain-gauges data. A fast and efficient procedure for CAPPI composite data has been developed which allows the systematic interpolation of reflectivity(PPI scan data) from Polar coordinate into Cartesian coordinate. Rainfall linked weather radar has been used hydrologic information data and runoff analysis.

Two-dimensional flood inundation model was developed to evaluate the impact of levee failure for flood analysis. The mathematical formulation of suggested model incorporates two-dimensional shallow water equations for flood inundation analysis. The model was applied to analyze the inundation flow from the levee break of Gamcheon river during the typhoon Rusa on October 31 through September 1, 2002.

To verify the simulated results, wide range field surveys have been performed including the collection of GIS database, land use condition, flooded area, and flow depths. Velocity distributions and inundation depths were presented to demonstrate the robustness of the model. Simulation results have good agreements with the observed data in terms of flood level and flooded area. Methodologies considering radar-rainfall estimation, rainfall-runoff analysis and inundation analysis in this study will contribute to the establishment of the nationwide flood disaster prevention system.