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Runoff Analysis Considering Orographical Features Using Dual Polarization Radar Rainfall

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Recently, the necessity for rainfall estimation and forecasting using the radar is being highlighted, due to the frequent occurrence of torrential rainfall resulting from abnormal changes of weather. Radar rainfall data represents temporal and spatial distributions properly and replace the existing rain gauge networks. It is also frequently applied in many hydrologic field researches.

However, the radar rainfall data has an accuracy limitation since it estimates rainfall, by monitoring clouds and precipitation particles formed around the surface of the earth(1.5-3km above the surface) or the atmosphere. In a condition like Korea where nearly 70% of the land is covered by mountainous areas, there are lots of restrictions to use rainfall radar, because of the occurrence of beam blocking areas by topography.

This study is aiming at analyzing runoff and examining the applicability of (R(Z), R(Z_{DR}) and R(K_{DP})) provided by the Han River Flood Control Office(HRFCO) based on the basin elevation of Nakdong river watershed.

For this purpose, the amount of radar rainfall of each rainfall event was estimated according to three sub-basins of Nakdong river watershed with the average basin elevation above 400m which are Namgang dam, Andong dam and Hapcheon dam and also another three sub-basins with the average basin elevation below 150m which are Waegwan, Changryeong and Goryeong. After runoff analysis using a distribution model, Vflo model, the results were reviewed and compared with the observed runoff.

This study estimated the rainfall by using the radar-rainfall transform formulas, (R(Z), R(Z,Z_{DR}) and R(Z,Z_{DR},K_{DP}) for four stormwater events and compared the results with the point rainfall of the rain gauge. As the result, it was overestimated or underestimated, depending on rainfall events. Also, calculation indicates that the values from R(Z,Z_{DR}) and R(Z,Z_{DR},K_{DP}) relatively showed the most similar results.

Moreover the runoff analysis using the estimated radar rainfall is performed. Then hydrologic component of the runoff hydrographs, peak flows and total runoffs from the estimated rainfall and the observed rainfall are compared. The results show that hydrologic components have high fluctuations depending on storm rainfall event. Thus, it is necessary to choose appropriate radar rainfall data derived from the above radar rainfall transform formulas to analyze the runoff of radar rainfall.

The simulated hydrograph by radar in the three basins of agricultural areas is more similar to the observed hydrograph than the other three basins of mountainous areas. Especially the peak flow and shape of hydrograph of the agricultural areas is much closer to the observed ones than that of mountainous areas.

This result comes from the difference of radar rainfall depending on the basin elevation. Therefore we need the examination of radar rainfall transform formulas following rainfall event and runoff analysis based on basin elevation for the improvement of radar rainfall application.

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