Application of the weather radar-based quantitative precipitation estimations for flood runoff simulation in a dam watershed

*Younghyun Cho[1], Joon-Woo Noh[1], Eul-Rae Lee[1]

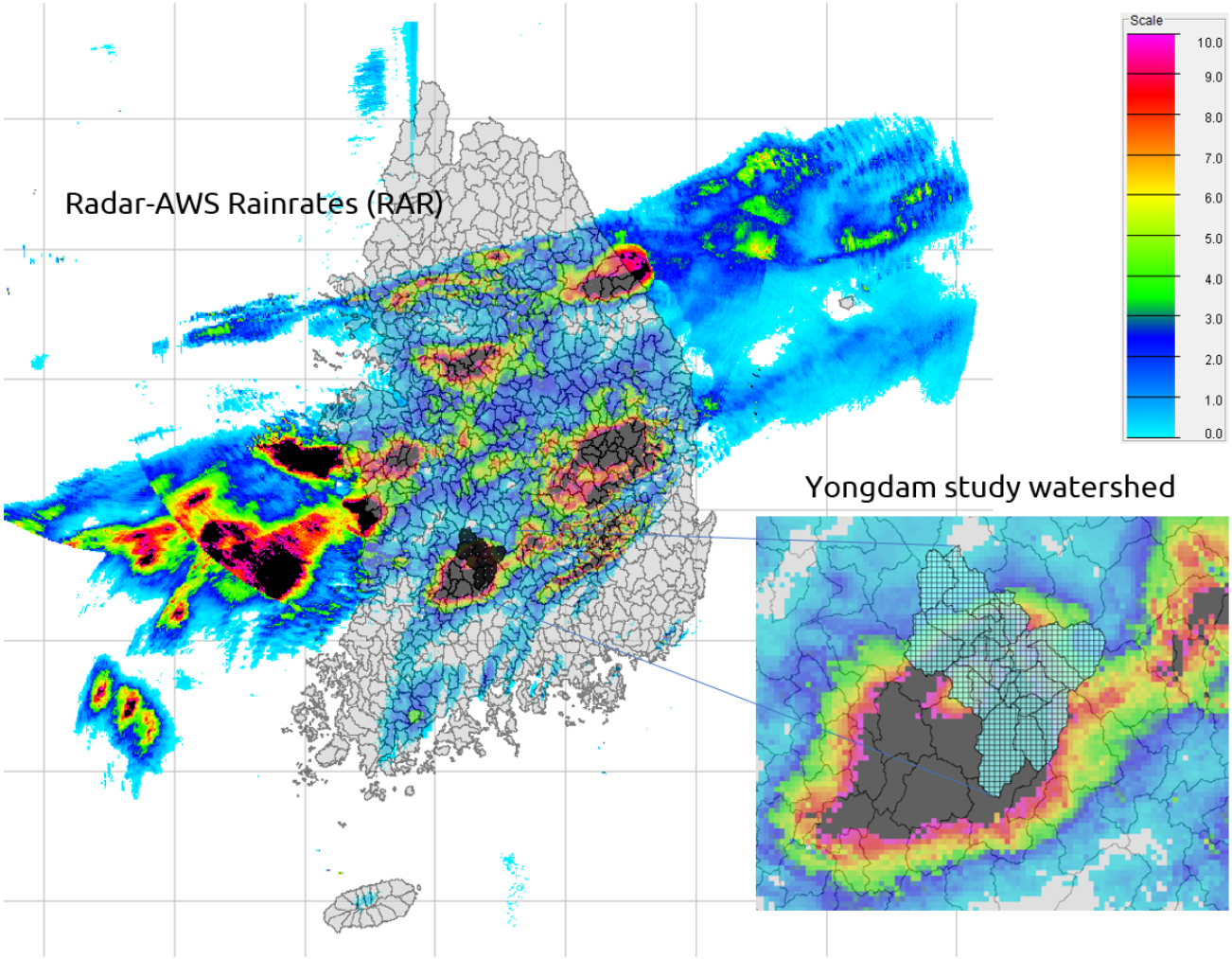
1. K-water Research Institute, K-water (Korea Water Resources Corporation)

Since most of South Korea is consisted of mountainous areas (about 65%), the spatial distribution of precipitation during rainfall storm event is highly variable. Especially, in the dam watershed, which is a typical mountainous terrain, the shape and pattern of rainfall and the resulting changes in the outflow show complicated characteristics. Therefore, it is often unlikely to use the areal rainfall, which is estimated by averaged method (e.g. Thiessen polygon) with gauge observations, for flood runoff analysis and the introduction of the radar-based spatially distributed rainfall is required for hydrological simulation. Recently, the Korea Meteorological Administration (KMA) has continuously improved the "Radar-AWS Rainrates (RAR)" data production technology to provide more accurate radar-based precipitation estimations, showing considerable accuracy compared to the ground observations.

In this study, we applied the RAR, weather radar-based quantitative precipitation estimations, to the Yongdam study watershed, which is a representative area of the mountainous terrain in South Korea and has a relatively large number of monitoring stations (water level/flow) and data compared to other dam watershed, in order to perform the flood runoff simulation and calculate the inflow of the dam during flood events through an accurate analysis of the time and space variability of rainfall in the mountainous dam watershed using hydrologic model. HEC-HMS, which is a relatively simple model for adopting spatially distributed rainfall, was applied to the hydrological simulations with one or two independent flood events (yearly) that occurred during the last five years (2014 to 2018). Although HEC-HMS is typically classified as a lumped hydrologic model and does not mainly use inputs of spatially distributed data such as radar rainfall, it is possible to construct a model that can associate the grid-based spatially distributed rainfall using HEC-GeoHMS and ModClark method. The simulation results were evaluated by comparing with those of outputs using spatially averaged rainfall and it was tried to analyze the flood characteristics of the mountainous dam watershed more accurately.

In addition, the ModClark-based flood runoff simulations are limited to the interpretation of flood routing considering the catchment-to-grid ratios of travel times in each sub-basins, so the recently developed hybrid hydrologic model (Distributed-Clark) is also planned to be introduced and applied to the same watershed using RAR.

Keywords: RAR QPEs, flood runoff simulation, HEC-HMS, ModClark, Yongdam study watershed


Radar-AWS Rainrates (RAR)
Yongdam study watershed
Scale
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0