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Design of rain gauge network using radar and road network

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Uncertainty in the gauged network can lead to inaccuracies in dam operations. Entropy is a well-known measurement of uncertainty. Goesan Dam has a small basin area and is affected by a small amount of precipitation, and Hwacheon Dam is contained outside the territory of South Korea, making it difficult to observe the water flow. The observed gauged precipitation and radar data on rainy days were considered between 2018 and 2019. Choosing appropriate radar were performed based on the priority of the rainfall gauge network using conditional entropy. This is because the rainfall gauge network is the actual precipitation and it can only cover certain points. However, the radar is the cloud reflectivity of a large area. Therefore the location of additional rain spots was selected through conditional entropy of highly consistent radar data. Nevertheless, there might be difficulties in installing gauged equipment in reality. So the optimal rainfall network was designed in consideration of the road network. As a result, the uncertainty of precipitation in Goesan Dam and Hwachoen Dam could be decreased by 63.3% and 67.9% respectively when three additional potential rain points were operated without any restriction. The uncertainty in the Goesan Dam basin and Hwachoen Dam would be reduced up to 55.3% and 65.0% when three additional potential rain points were installed nearby the road network. Therefore, through the proposed method, an optimal rainfall network can be designed by balancing cost and uncertainty.

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