8-1-2014

Comparison Of Interpolation Technique For Rain Gauge Data Through The Distributed Rainfall-Runoff Model

Byung-Jin So

Ji-Young Yoo

Hyun-Han Kwon

COMPARISON OF INTERPOLATION TECHNIQUE FOR RAIN GAUGE DATA THROUGH THE DISTRIBUTED RAINFALL-RUNOFF MODEL

BYUNG-JIN SO (1), JI-YOUNG YOO (1), HYUN-HAN KWON (1)
(1): Department of Civil Engineering, Chonbuk National University, 664-14Ga Deokjin-Dong, Jeonju-si, 561-756/Jellabuk-do, South Korea

Precipitation estimated from different measuring techniques such as rain gauge, radar and satellite have some similarities [1], but there are also differences among them. For example, techniques based on radar and satellite data underestimate rainfall than those using rain gauge data. [2,3] In addition, many different interpolation techniques have been used to measure spatial pattern of precipitation but it is still difficult to have an accurate pattern by any one of them.[4,5,8,9] The differences between the rainfall estimates from different techniques vary seasonally as well as regionally so that the radar or satellites are not directly applied into hydrologic analysis.[6,7] In this regard, a main objective of this study is to develop a systematic way to interpolate ground rain gauge using discharge data from distributed rainfall-runoff model The spatial rainfall patterns estimated from the interpolation methods will be evaluated with the object function to minimize the difference between observed and estimated discharge. In other words, this study seeks to identify the optimal spatial pattern in rain field that can generate a similar pattern of observed discharge through the distributed rainfall-runoff model. This study will compare the spatial pattern from different types of climate systems and different seasons derived from different interpolation methods may help to validate the proposed algorithms.

METHOD AND APPLICATION

This study employed Affdef model which is a spatially-distributed, DEM based, continuously (in time) simulating rainfall-runoff model, written in Fortran programming language. Affdef is raster-based. It takes as input the digital elevation model (DEM of the basin in raster form, as a rectangular matrix covering the all basin. The cells of the DEM can be of any size. It needs also in input rainfall and temperature data collected in an arbitrary number of termometers and rain gauges. The model computes the local contribution at the surface runoff by applying a modified CN method. In order to compute the soil storativity, the users needs to provide a matrix of CN numbers for any given Dem cell. The local contribution to the surface runoff and the groundwater flows are transferred to the basin outlet by using a Muskingum-Cunge model with variable parameters. Affdef is not deemed to be a sophisticated model, since priority was given to provide a model which is able to perform very long river flow simulations in a limited computing time. Therefore a number of conceptual schemes were used in modelling

the rainfall-runoff transformation and the model cannot be considered physically-based in the strict sense. Although it can be used for any kind of basin, it should be noted that Affdef models in a simplified solution the contribution of groundwater flows. Therefore it is best suited for basins where the runoff production is mainly due to infiltration excess.[10] In this study, we seeks to identify the optimal spatial pattern in rain field that can generate a similar pattern of observed discharge through the distributed rainfall-runoff model as shown in Figure 1. This study will compare the spatial pattern from different types of climate systems and different seasons derived from different interpolation methods may help to validate the proposed algorithms.

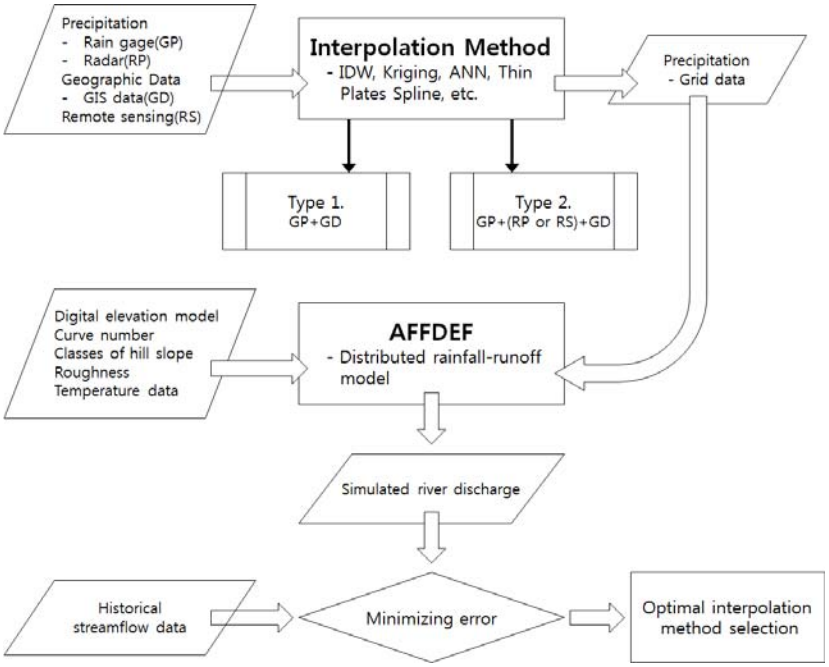

Figure 1. Flow chart of research

Acknowledgments

This research was supported by a grant (13SCIPA01) from Smart Civil Infrastructure Research Program funded by Ministry of Land, Infrastructure and Transport (MOLIT) of Korea government and Korea Agency for Infrastructure Technology Advancement (KAIA).

REFERENCES

[1] Bloemink H. “Precipitation type detection Present Weather Sensor: final report”, *Technical report*, KNMI Publications, (2004).

[2] Dinku T., Ceccato P., Grover-Kopec E., Lemma M., Connor S. J. and Ropelewski C. F. “Validation of satellite rainfall products over East Africa's complex topography” *International Journal of Remote Sensing*, Vol. 28(7), (2007), pp 1503-1526.

[3] Holleman I. “Bias adjustment of radar-based 3-hour precipitation accumulations”, *Technical report*, KNMI Publications, (2006).

[4] Rajeevan M., Bhate J., Kale J. D. and Lal B. “Development of a high resolution daily gridded rainfall data for the Indian region”, *Met. Monograph Climatology*, No. 22, (2005), pp 1-26.
[5] Schuurmans J.M., Bierkens M.F.P. and Pebesma E.J. “Automatic Prediction of High-Resolution Daily Rainfall Fields for Multiple Extents: The Potential of Operational Radar”, Journal of Hydrometeorology, Vol. 8, (2007), pp 1204-1224.
[6] Sluiter R. “Interpolation methods for climate data”, *Technical report*, KNMI Publications, (2012).
[7] Soenario I. and Sluiter R. “Optimization of Rainfall Interpolation”, *Internal report*, KNMI Publications, (2010).
[8] Ware E.C. “*Corrections to radar-estimated precipitation using observed rain gauge data.*” , Diss. Cornell University, (2005).
[9] Wang S., Huang G.H., Lin Q.G., Li Z., Zhang H. and Fan Y.R. “Comparison of interpolation methods for estimating spatial distribution of precipitation in Ontario, Canada”, *International Journal of Climatology*, DOI: 10.1002/joc.3941, (2014).
[10] Moretti G. and Montanari A. “AFFDEF: A spatially distributed grid based rainfall-runoff model for continuous time simulations of river discharge”, *Environmental Modelling and Software*, vol. 22, (2007), pp 823-836.