Using Geostatistical Methods to Improve Radar Rainfall Estimates

Accuracy

Beibei Yu a, Xuesong Zhang b and Hongjie Xie a

a Laboratory for Remote Sensing and Geoinformatics, Department of Geological Sciences, University of Texas at San Antonio, Texas 78249, USA
b Graduate Research Assistant, Spatial Sciences Laboratory, Department of Ecosystem Sciences and Management, Texas A&M University, 1500 Research Pkwy, Ste.B223, College Station, TX 77845, USA

Abstract. Rainfall is one of the major inputs of many hydrological models. Generally, rain gauges are able to provide accurate measurement of precipitation at a certain point, however, the spatial variability of the precipitation often failed to be captured. On the contrary, rainfall estimation using satellite data can provide spatially distributed rainfall map, but it is characteristically subject to both random and systematic errors. In this study, three geostatistical methods: simple Kriging with local means (SKlm), Kriging with external drift (KED), and regression Kriging (RK) and one simple ratio corrected (RC) method are used to improve the accuracy of the NEXRAD MPE estimates. After applying each method to Guadalupe River Basin (Central Texas), cross-validation is used to evaluate their performance. Four statistical parameters: coefficient of correlation ($\rho$), R-square, absolute difference (AD), Nash-Sutcliffe efficiency ($E_{ns}$), and relative mean absolute error ($RMAE$) are used for evaluation. Overall, SKlm showed the best performance, followed by RK and KED. The rainfall map interpolated by SKlm technique captured the spatial variability well; however, the RK and KED interpolated rainfall map changed the distribution of the rainfall. SKlm estimates have the highest $E_{ns}$, R-square and $\rho$ and lowest $RMAE$ and AD. RK has similar performance as SKlm, but KED does not perform well. Ratio Corrected method increase the $E_{ns}$ to a certain extent compared to the original NEXRAD estimates. SKlm can serve as an effective method to correct the radar estimates and create a relatively accurate and spatially distributed rainfall map.

Keywords. Geographic Information System, Geostatistics, Interpolation, Kriging, Spatial Precipitation.