Geophysical Research Abstracts
Vol. 20, EGU2018-1280, 2018
EGU General Assembly 2018

The effect of spatial correlation in regional flood frequency analysis: a comparison between Generalized Least Squares and Top-Kriging

Simone Persiano (1), Josè Luis Salinas (2), Jery Russell Stedinger (3), Alberto Viglione (2), Günter Blöschl (2), and Attilio Castellarin (1)

(1) Department of Civil, Chemical, Environmental and Materials Engineering (DICAM), University of Bologna, Bologna, Italy (simone.persiano2@unibo.it), (2) Vienna University of Technology, Institute of Hydraulic Engineering and Water Resources Management, Vienna, Austria, (3) School of Civil and Environmental Engineering, Cornell University, Ithaca, New York, USA

A common assumption in regional flood frequency analysis is that flood data from different river cross-sections are independent. However, streamflow series are usually spatially correlated, and the aforementioned assumption is violated in many real hydrological applications. In particular, the inclusion of spatial information in predictive models for flood quantiles is justified only if the cross-correlation is associated to real differences in hydrologic processes, while if it is due to extreme rainfall events in the same region, it may have a negative effect on the precision of the estimator of the flood quantiles. The present study investigates the impact of spatial correlation in flood data on the prediction accuracy of two reference regionalization procedures: Generalized Least Squares (GLS) regression, the reference method used by the Geological Survey in the USA, and Top-kriging (TK), a geostatistical approach developed in the mid 2000's, and increasingly used in Europe. GLS and TK have a completely different way of taking cross-correlation among flows into account: while GLS accounts for sampling variability and cross-correlation among concurrent streamflows, TK exploits spatial correlation structure to produce the estimate. Despite its importance, a detailed analysis of this aspect has never been performed in literature, to the best of the knowledge of the authors. The present study refers to a database of 23 annual maximum flood series for a region in North-Eastern Italy, whose estimated regional GEV distribution is assumed to be the parent distribution for a Monte Carlo simulation framework. A total of 10,000 synthetic regions are generated under different cross-correlation scenarios. For each region and cross-correlation scenario, GLS and TK are applied to obtain predictions of at-site flood quantiles (return periods equal to 10, 30, 50 and 100 years) in a leave-one-out cross-validation scheme. Finally, the performances of GLS and TK are evaluated with reference to both parent and synthetic at-site quantiles. We expect different efficiencies of the two methods in predicting at-site quantiles in the different cross-correlation scenarios. In particular, we expect TK to have better efficiencies in predicting the expected sample estimates of the quantiles, while GLS would theoretically predict better the regional values (looking behind the cross-correlation).