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Analysis and modelling of spatio-temporal properties of daily rainfall over the Danube basin

F. Serinaldi (1,2) and C.G. Kilsby (3)

(1) School of Civil Engineering and Geosciences, Newcastle University, Newcastle Upon Tyne, UK (francesco.serinaldi@ncl.ac.uk), (2) Willis Research Network, London, UK, (3) School of Civil Engineering and Geosciences, Newcastle University, Newcastle Upon Tyne, UK

Central and Eastern Europe are prone to severe floods due to heavy rainfall that cause societal and economic damages, ranging from agriculture to water resources, from the insurance/reinsurance sector to the energy industry. To improve the flood risk analysis, a better characterisation and modelling of the rainfall patterns over this area, which involves the Danube river watershed, is strategically important. In this study, we analyse the spatio-temporal properties of a large data set of daily rainfall time series from 15 countries in the Central Eastern Europe through different lagged and non-lagged indices of associations that quantify both the overall dependence and extreme dependence of pairwise observations. We also show that these measures are linked to each other and can be written in a unique and coherent notation within the copula framework. Moreover, the lagged version of these measures allows exploring some important spatio-temporal properties of the rainfall fields. The exploratory analysis is complemented by the preliminary results of a spatio-temporal rainfall simulation performed via a compound model based upon the Generalized Additive Models for Location, Scale and Shape (GAMLSS) and meta-elliptical multivariate distributions.