EGU22-2210
https://doi.org/10.5194/egusphere-egu22-2210
EGU General Assembly 2022

Investigation of the applicability of rainfall generators for the estimation of the rainfall erosivity for ungauged locations

Nejc Bezak[1], Ross Pidoto[2], Hannes Müller-Thomy[3,4], Bora Shehu[2], Ana Callau-Beyer[5], Katarina Zabret[1], and Uwe Haberlandt[2]

[1]University of Ljubljana, Faculty of civil and geodetic engineering, Ljubljana, Slovenia (nejc.bezak@fgg.uni-lj.si)
[2]Institute of Hydrology and Water Resources Management, Leibniz University Hannover, Germany
[3]Leichtweiß Institute for Hydraulic Engineering and Water Resources, Department of Hydrology, Water Management and Water Protection, Technische Universität Braunschweig, Brunswick, Germany
[4]Institute of Hydraulic Engineering and Water Resources Management, Vienna University of Technology, Austria
[5]Institute of Horticultural Production Systems, Leibniz University Hannover, Germany

Rainfall erosivity is one of the main inputs for soil erosion modelling. Long high-resolution rainfall time series are needed for the estimation of rainfall erosivity but these are likely to be lacking at many locations around the globe. An alternative approach could be the generation of synthetic rainfall time series using stochastic rainfall models. In this study, four methods for estimating the rainfall erosivity were evaluated at ungauged sites:

i) estimation from regionalised observed 5 minute rainfall time series,

ii) direct regionalisation of the rainfall erosivity estimated from observations,

iii) estimation from 5 minute rainfall time series disaggregated from daily observations,

iv) estimation from rainfall time series generated by a regionalized stochastic rainfall model.

Data from 159 stations from Lower Saxony, Germany, were used to evaluate the performance of different methods. All tests were performed using the leave-one-out cross validation method. Additionally, we also analysed the minimum time series length necessary to adequately estimate the rainfall erosivity.

The results indicated that the direct regionalization of the mean annual rainfall erosivity yielded the best performance in terms of relative bias followed by the regionalization of the 5 minute rainfall data. However, the main advantage of the rainfall generators is that they can generate long synthetic time series and can also provide estimates of other rainfall erosivity characteristics such as number of erosive rainfall events, etc. Applying the alternating renewal model indicated that more than 60 years of data are needed to obtain a stable estimate of rainfall erosivity and that rainfall erosivity estimations using 5 years of data can lead to significant uncertainty. Moreover, it was also found that the rainfall erosivity calculations are sensitive to the resolution of the input data.

Acknowledgment: The results of the study are part of the bilateral research project between Slovenia and Germany “Stochastic rainfall models for rainfall erosivity evaluation” (BI-DE/18-19-008).