A regional and nonstationary model for partial duration series of extreme rainfall

Regional extreme value models for estimation of extreme rainfall intensities are widely applied, but their underlying assumption of stationarity is challenged. Many recent studies show that the rainfall extremes worldwide exhibit a nonstationary behavior. This paper presents a spatiotemporal model of extreme rainfall. The framework is built on a partial duration series approach with a nonstationary, regional threshold value. The model is based on generalized linear regression solved by generalized estimation equations. It allows a spatial correlation between the stations in the network and accounts furthermore for variable observation periods at each station and in each year. Marginal regional and temporal regression models solved by generalized least squares are used to validate and discuss the results of the full spatiotemporal model. The model is applied on data from a large Danish rain gauge network for four durations ranging from 10 min to 24 h. The observation period differs between stations, and the number of stations with more than 10 years of observations has increased over the years. A spatiotemporal model for the threshold is suggested, applying the mean annual precipitation and time as the explanatory variables in the regional and temporal domain, respectively. Further analysis of partial duration series with nonstationary and regional thresholds shows that the mean exceedances also exhibit a significant variation in space and time for some rainfall durations, while the shape parameter is found to be constant.

General information
Publication status: Published
Contributors: Gregersen, I. B., Madsen, H., Rosbjerg, D., Arnbjerg-Nielsen, K.
Pages: 2659-2678
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Water Resources Research
Volume: 53
Issue number: 4
ISSN (Print): 0043-1397
Ratings:
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.39 SJR 2.296 SNIP 1.555
Web of Science (2017): Impact factor 4.361
Web of Science (2017): Indexed yes
Original language: English
Electronic versions:
Gregersen_WRR_accepted.pdf. Embargo ended: 01/12/2017
DOIs:
10.1002/2016WR019554
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review