

EGU2020-6998

<https://doi.org/10.5194/egusphere-egu2020-6998>

EGU General Assembly 2020

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Examining the extremal dependence structure of precipitation in Norway

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Extreme precipitation can lead to great floods and landslides and cause severe damage and economical losses. It is therefore of great importance that we manage to assess the risk of future extremes. Furthermore, natural hazards are spatiotemporal phenomena that require extensive modelling in both space and time. Extreme value theory (EVT) can be used for statistical modelling of spatial extremes, such as extreme precipitation over a catchment. An important concept when modelling a natural hazard is the degree of extremal dependence for the given phenomenon. Extremal dependence describes the possibility of multiple extremes occurring at the same time. For the stochastic variables X and Y , with distribution functions F_X and F_Y , the measure

$$\chi = \lim_{u \rightarrow 1} P(F_X(X) > u \mid F_Y(Y) > u)$$

describes the pairwise extremal dependence between X and Y . If $\chi = 0$, then the variables are *asymptotically independent*. If $\chi > 0$, they are *asymptotically dependent*. Thus, extremes tend to occur simultaneously in space for processes that are asymptotically dependent, while this seldom occurs for asymptotically independent processes. It is a general belief that extreme precipitation tends to be asymptotically independent. However, to our knowledge, not much work has been put into analysing the extremal dependence structure of precipitation. Different statistical models have been developed, which can be applied for modelling spatial extremes. The most popular model is the *max-stable process*. Unfortunately, this model does not provide a good fit to asymptotically independent processes. Other models have been developed for better incorporating asymptotic independence, but most have not been extensively applied yet. We aim to examine the extremal dependence structure of precipitation in Norway, with the ultimate goal of modelling and simulating extreme precipitation. This is achieved by examining multiple popular statistics for extremal dependence, as well as comparing different spatial EVT models. This analysis is performed on hourly, gridded precipitation data from the MetCoOp Ensemble Prediction System (MEPS), which is publicly available from the internet: <http://thredds.met.no/thredds/catalog/meps25epsarchive/catalog.html>.