



A comparative assessment of statistical methods for extreme weather analysis

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Extreme weather exposure assessment is of major importance for scientists and practitioners alike. We compare different extreme value approaches and fitting methods with respect to their value for assessing extreme precipitation and temperature impacts. Based on an Austrian data set from 25 meteorological stations representing diverse meteorological conditions, we assess the added value of partial duration series over the standardly used annual maxima series in order to give recommendations for performing extreme value statistics of meteorological hazards. Results show the merits of the robust L-moment estimation, which yielded better results than maximum likelihood estimation in 62 % of all cases. At the same time, results question the general assumption of the threshold excess approach (employing partial duration series, PDS) being superior to the block maxima approach (employing annual maxima series, AMS) due to information gain. For low return periods (non-extreme events) the PDS approach tends to overestimate return levels as compared to the AMS approach, whereas an opposite behavior was found for high return levels (extreme events). In extreme cases, an inappropriate threshold was shown to lead to considerable biases that may outperform the possible gain of information from including additional extreme events by far. This effect was neither visible from the square-root criterion, nor from standardly used graphical diagnosis (mean residual life plot), but from a direct comparison of AMS and PDS in synoptic quantile plots. We therefore recommend performing AMS and PDS approaches simultaneously in order to select the best suited approach. This will make the analyses more robust, in cases where threshold selection and dependency introduces biases to the PDS approach, but also in cases where the AMS contains non-extreme events that may introduce similar biases. For assessing the performance of extreme events we recommend conditional performance measures that focus on rare events only in addition to standardly used unconditional indicators. The findings of this study are of relevance for a broad range of environmental variables, including meteorological and hydrological quantities.