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# Extremes Return Levels for Precipitation in Colorado

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Quantification of extreme values is important for planning purposes. To aid with the understanding of flooding along Colorado's Front Range, we develop a map of extreme precipitation return levels for the region.

To perform this task, we rely on the theory of extreme values. Specifically, we use the generalized Perot distribution (GPD) to model precipitation above a high threshold at 56 weather stations throughout the region. Using a Bayesian hierarchical model, we pool the data from all the stations which helps to overcome the lack of data in an extreme value analysis. In the hierarchy, the spatial structure is modeled via the stations' GPD parameters. This strategy yields parameter and return-level estimates which have more spatial consistency. The parameter estimates also take into account the available covariates on the spatial field. Model inference is obtained using a straightforward MCMC method, which also produces measures of uncertainty at each station. We then use a spatial interpolation process to produce the map of return levels along with a map of uncertainty measures.

The flexibility of the Bayesian hierarchical structure allows us to test different models which are then compared using the deviance information criterion. The model testing and comparison process provides meteorologists insight into how extreme precipitation behaves in Colorado.