An Extreme Precipitation Return Level Map for Colorado's Front Range

Daniel Cooley[1, 2], Doug Nychka[2], and Philippe Naveau[3]
Department of Statistics, Colorado State University

Abstract. A common tool used by flood planners to assess a location's potential for extreme precipitation are return-levels maps. The n-year return level is the (precipitation) amount which is exceeded on average once every n years. The maps supply information about potential extreme preciptation by providing return level estimates for locations in the study region. Traditionally, these maps have not provided uncertainty estimates with the return levels.

There is a current effort by the National Weather Service (NWS) to produce updated return levels maps. Using the Regional Frequency Analysis (RFA) methodology of Hosking and Wallis, the NWS has produced return levels maps and uncertainty estimates for two regions in the US.

We have developed an alternative methodology to produce precipitation return levels maps along with uncertainty estimates. Using this methodology, we have produced a precipitation map for the Front Range region of Colorado.To develop the map, we have relied on the theory of extreme values. Specifically, we have used the generalized pareto distribution (GPD) to model precipitation above a threshold at 56 weather stations throughout the region. By constructing a Bayesian hierarchical model which relates each station's GPD parameters to a spatial model we are able to pool the data from all the stations and obtain parameter and return-level estimates which have more spatial consistency. The parameter estimates also take into account the available covariates we have for the model.

In this talk I will outline our methodology and discuss the results we have obtained. I will also discuss the differences between our Bayesian framework and the RFA methodology.

[1] Department of Statistics, Colorado State University

[2] Geophysical Statistics Project, NCAR, Boulder, CO

[3] Laboratoire des Sciences du Climat et de l'Environnement, IPSL-CNRS, Gif-sur-Yvette, France