An Investigation of Australian Rainfall using Extreme Value Theory

Extreme rainfall and associated flooding cause major socio-economic disruptions to communities. Some of the worst impacts include loss of life and infrastructure damage. To help mitigate these potential impacts, we require an understanding of the risk of these events. In particular, we need to be able to estimate the probability that an extreme rainfall event will impact nearby locations within a region, not just a single point location. With this in mind, we use methods from extreme value theory to fit statistical models for Australian daily rainfall extremes. We build upon the existing literature by helping to create a bridge between technical statistical ideas and applications in a climate setting. In the first part of this talk, we provide an overview of the applications considered in this thesis.

In the latter part of the talk, we present a regionalisation of Australia based on the dependence of rainfall extremes. The regions are formed using hierarchical clustering and a distance measure based on bivariate extremal dependence, that is estimated using the F-madogram. Using the F-madogram is powerful, as no information about climate or topography is needed to form spatially homogeneous clusters. Additionally, we are free from distributional assumptions as the F-madogram distances can be estimated non-parametrically from raw maxima. Developing this regionalisation has improved our understanding of local dependence of rainfall extremes and helped to ensure the validity of common assumptions used when modelling spatial extremes.