EGU2020-9570
https://doi.org/10.5194/egusphere-egu2020-9570
EGU General Assembly 2020

Spatial conditional extremes via the Gibbs sampler.

Adrian Casey and Ioannis Papastathopoulos
Edinburgh, Mathematics, Statistics, United Kingdom of Great Britain and Northern Ireland (s1790629@sms.ed.ac.uk)

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Adrian Casey, University of Edinburgh

January 14, 2020

Conditional extreme value theory has been successfully applied to spatial extremes problems. In this statistical method, data from observation sites are modelled as appropriate asymptotic characterisations of random vectors **X,** conditioned on one of their components being extreme. The method is generic and applies to a broad range of dependence structures including asymptotic dependence and asymptotic independence. However, one issue that affects the conditional extremes method is the necessity to model and fit a multi-dimensional residual distribution; this can be challenging in spatial problems with a large number of sites.

We describe early-stage work that takes a local approach to spatial extremes; this approach explores lower dimensional structures that are based on asymptotic representations of Markov random fields. The main element of this new method is a model for the behaviour of a random component X_i given that its nearest neighbours exceed a sufficiently large threshold. When combined with a model for the case where the neighbours are below this threshold, a Gibbs sampling scheme serves to induce a model for the full conditional extremes distribution by taking repeated samples from these local (univariate) distributions.

The new method is demonstrated on a data set of significant wave heights from the North Sea basin. Markov chain Monte-Carlo diagnostics and goodness-of-fit tests illustrate the performance of the method. The potential for extrapolation into the outer reaches of the conditional extreme tails is then examined.

Joint work with Ioannis Papastathopoulos.