A Hierarchical Bayesian Approach to Model Extreme Precipitation Risk

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Precipitation risk is possibly one of the most important threats from climate change. No matter it falls as snow or rain, it can greatly increase the flood risk and cause huge social and economic losses. A natural approach to model such extreme spatial events is through max-stable processes which are extensions of multivariate extreme value theory into stochastic process setting. One limitation of using such approach is that the joint likelihood of max-stable processes is usually analytically intractable, making likelihood inference a nontrivial task. In this paper, we propose a hierarchical Bayesian model which can handle spatial dependence while leading to a max-stable process in the limiting case. Simulations are performed to demonstrate the effectiveness of the Bayesian approach in modeling the spatial extremes. Precipitation data in Greater China region are analyzed using our proposed model to assess extreme precipitation risk.

Key Words: Bayesian analysis, environmental risk, max-stable processes, spatial data