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The estimation of M4 processes with geometric moving patterns

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Abstract There are many parameters in multivariate maxima of moving maxima processes—or M4 processes. However, the more parameters there are, the more difficult it is to estimate them. It is not just an issue of numerical stability, of course. The statistical precision of the estimates will be poor if the number of parameters is too large. We consider asymmetric geometric structures which correspond to special moving patterns of extreme observations in observed time series. We study the model identifiability and propose parameter estimators. All proposed estimators are shown to be consistent and asymptotically joint normal. Simulation study and real data modeling of North Sea wave height data are illustrated.

Keywords Multivariate nonlinear time series · Max-stable process · Multivariate maxima of moving maxima · Extreme value theory · Empirical distribution · Parameter estimation