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Statistical properties of the extreme events in an intermediate order atmospheric model displaying deterministic chaos.

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The classical theory of extremes focuses on events that can be considered as independent identically distributed variables. With this assumption and under certain continuity conditions and appropriate scaling, the distribution of extremes converges asymptotically to one of the three universality classes, known as the GEV distributions.

Recently it has been shown that in simple deterministic dynamical systems displaying complex dynamics the properties of extreme value statistics may be at variance with the ones suggested by the classical theory. In the present work, we investigate this problem in the framework of a realistic atmospheric model displaying deterministic chaos, still sufficiently simple to allow for very long integrations (200,000 years).

First, the statistical properties of the local extremes of temperature as a function of the time window of observation T are investigated. It turns out that even for very long T (up to 50 years), the statistical properties of extremes do not converge toward a well-defined GEV distribution (with stable shape parameter), suggesting that the asymptotic convergence is extremely slow. Second, the properties of the joint distributions of extremes located at different sites are presented, with emphasis on their interdependences. The role of the time window T on these dependences is also discussed.