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Extreme events statistics in a two-layer quasi-geostrophic atmospheric model

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Extreme events statistics provides a theoretical framework to analyze and predict extreme events based on the convergence of the distribution of the extremes to some limiting distribution. In this work we analyze the convergence of the distribution of extreme events to the Generalized Extreme Value (GEV) distribution and to the Generalized Pareto Distribution (GPD), using a two-layer quasi-geostrophic atmospheric model, and compare our results with theoretical findings from the field of extreme value theory for dynamical systems. We study the behavior of the GEV shape parameter by increasing the block size and of the GPD shape parameter by increasing the threshold, and compare the inferred parameters with a theoretical shape parameter that depends only on the geometrical properties of the attractor. The main objective is to find out whether this theoretical shape parameter can be used to evaluate extreme event analysis based on model output. For this, we perform very long simulations. We run our system with two different levels of forcing determined by two different meridional temperature gradients, one inducing a medium level of chaos and the other one a high level of chaos. We analyze in both cases extremes of energy variables.