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A conceptual model of the atmosphere driven by different processes: Extreme events and snapshot attractors

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In a low-order chaotic model of global atmospheric circulation the effects of driving (noisy, chaotic, and periodic) are investigated. We use two frameworks of investigation: a single trajectory and a trajectory ensemble framework. The main focus is on the cyclonic activity in the model, concerning its time-evolution and also the kurtosis of its distribution. Within the trajectory ensemble framework, natural measures of snapshot attractors and kurtosis of snapshot distributions with respect to cyclonic extreme event probability are determined as functions of time. In both frameworks we find that when the characteristic time of the driving is comparable to that of the undriven system, an effect of amplified variance shows up with all drivings. The amplification is the stronger, the driving is the more regular. For very fast drivings we find just a slight departure from the undriven system, which is also the case with white noise driving. Extreme value statistics is pursued by the method of block maxima, and found to follow Weibull distributions, which is confirmed by return time plots.