Title:	Emergence of extreme events in networks of parametrically coupled chaotic populations
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Abstract:	We consider a collection of populations modelled by the prototypical chaotic Ricker map, relevant to the population growth of species with non-overlapping generations. The growth parameter of each population patch is influenced by the local mean field of its neighbourhood, and we explore the emergent patterns in such a parametrically coupled network. In particular, we examine the dynamics and distribution of the local populations, as well as the total biomass. Our significant finding is the following: When the range of coupling is sufficiently large, namely, when enough neighbouring populations influence the growth rate of a population, the system yields remarkably large biomass values that are very far from the mean. These extreme events are relatively rare and uncorrelated in time. We also find that at any point in time, exceedingly large population densities emerge in a few patches, analogous to an extreme event in space. Thus, we suggest a new mechanism in coupled chaotic systems that naturally yield extreme events in both time and space. Extreme events have generated a lot of research attention due to their large impact in phenomena ranging from weather to traffic flows. These recurrent unusually large (or small) values of dynamical variables are very important, as they signal occurrences of catastrophic significance. A question of vital importance is the search for generic mechanisms that naturally yield such extreme events. Here, we explore the emergence of extreme events in networks of coupled chaotic systems. Specifically, we focus on chaotic systems relevant to population dynamics and demonstrate how networks of such parametrically coupled populations are capable of generating extreme values when the coupling neighborhoods are large. In particular, we find a significant propensity for extreme events in the variation of the total biomass in time, namely, the collective population density of the network exhibits recurrent aperiodic large deviations from its mean value. We also find that at any point in time, a few sites display extremely large population densities. This explosive growth in a small number of isolated patches is analogous to an extreme event in space. This suggests that parametric coupling of chaotic systems offers a general mechanism for the marked emergence of spatiotemporal extreme events.
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