Predator prey oscillations in a simple cascade model of drift wave turbulence

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A reduced three shell limit of a simple cascade model of drift wave turbulence that emphasizes nonlocal interactions with a large scale mode is considered. It is shown that this model describes both the well known predator prey dynamics, involving drift waves and zonal flows and it reduces to the three wave interaction equations when the linear terms are dropped. Here, this model is considered as a dynamical system with interesting characteristics. The analytical solutions for the purely nonlinear limit are given in terms of Jacobi elliptic functions. The fixed points of the system are determined, and the behaviour around these fixed points are studied. The system is shown to display periodic solutions corresponding to limit cycle oscillations, as well as apparently chaotic ones. The relation between the average zonal flow and drift wave levels are discussed in the case when the solutions are oscillatory. The period doubling route to transition to chaos is examined numerically by using amplitude and frequency maps.

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