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Turbulent advection can mask limit-cycle behavior in marine ecosystems

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We discuss the impact of turbulent advection on the dynamics of a marine ecosystem model undergoing limit-cycle behavior. Oceanic advection is represented in a simplified way by quasi-geostrophic turbulence and ecosystem dynamics is assumed to be governed by a three compartment (NPZ) model. We find that the action of advection can mask the presence of limit-cycle behavior in Eulerian measurements. This may explain the absence of limit cycle behavior in measured time series, as well as in the data generated by coupled ocean circulation - ecosystem models. On the other hand, our results indicate that, if present, limit-cycle dynamics should be visible in Lagrangian measurements of phytoplankton abundance.