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Instability of vorticity filaments in 2D turbulence

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Coherent vortices in two-dimensional turbulence induce far-field effects that stabilize vorticity filaments and inhibit the generation of new vortices. We show that the large-scale energy sink often included in numerical simulations of statistically stationary two-dimensional turbulence reduces the stabilizing role of the vortices, leading to filament instability and to continuous formation of new coherent vortices. This counter-intuitive effect sheds new light on the mechanisms responsible for vortex formation in forced-dissipated two-dimensional turbulence and it has significant impact on the temporal evolution of the vortex population in freely-decaying turbulence. The time dependence of vortex statistics in the presence of a large-scale energy sink can be approximately described by a modified version of the scaling theory developed for small-scale dissipation.