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Exponential decay of a passive tracer variance in a two-dimensional Navier-Stokes flow FARID AIT CHAALAL, California Institute of Technology — We study numerically the decay of a passive tracer in a dynamically consistent flow solution of the two-dimensional Navier-Stokes equation and in the limit of small diffusion. We observe that the decay of the variance becomes quickly exponential, as previously observed in simple chaotic maps, like the well-studied renewing sine flow proposed by Pierrehumbert in the early nineties. However, after a few tens of large-eddy turnover times, the decay rate changes. We interpret this result in light of theories developed for mixing in simple ergodic flows, in particular local Lagrangian stretching theories. It is found that they only can explain very partially the phenomenology we observe. In particular, they cannot capture the rôle of coherent vortices which is crucial, particularly in the very long-term decay, and might explain the decay rate change.

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