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Removing pollutants: Flow capture in a model chaotic flow MENGYING WANG, JULIO OTTINO , RICHARD LUEPTOW, PAUL UMBANHOWAR , Northwestern University — To better understand and optimize pollutant capture in complex geophysical flows, we study the simpler, but still chaotic, time-dependent double-gyre flow model. For a range of model parameters, the domain consists of a chaotic region, characterized by rapid mixing, interspersed with non-mixing islands in which trajectories are regular. Pollutant particles are assumed to be passive scalars that drift with the flow and are captured with 100% efficiency upon reaching a capture unit. To predict the flow capture capability of unit at a fixed location in the flow, we track the movement of the non-mixing islands through the domain and characterize the fraction of time that each point in the domain is in each flow region (i.e., chaotic or non-mixing). With this information, we can predict bounds on the ultimate capture capability of a unit placed at an arbitrary location, and therefore determine where to place capture units for optimal results. We also study the time-dependence of the capture process and demonstrate that extending the flow capture time scale is not necessarily efficient for better capture result depending on the flow parameters and capture unit location.

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