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Extracting transport barriers and coherent structures

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Barriers to transport in geophysical flows can be rendered using separation indicators, such as relative dispersion, finite-time Lyapunov exponents (FTLE), finite-size Lyapunov exponents (FSLE), and mixing or leakiness rates. These methods provide a geometrical description of passive particle transport and recent developments extend this framework to finite-size particles, buoys, and underwater vehicles.
In most methods, the barriers are rendered as ridges of the stretching indicator. I will describe a technique to process the indicator field and to convert the ridges into extractable level sets. The objective is to automate the identification of the coherent structures and to eliminate the need for visual inspection. Automation makes it also possible to increase the resolution dynamically and to render complex barriers at an acceptable computational cost.