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Objective identification and tracking of eddies in altimetry data

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Recently, Haller and Beron-Vera (2012) developed a new theory for the objective (i.e. frame-independent) localization of key material curves, commonly referred to as Lagrangian Coherent Structures or LCS, that shape global mixing patterns in a two-dimensional flow. In the new theory the LCS emerge from a predominantly turbulent flow as least stretching material curves. Unlike previous approaches to LCS, which relied on visually inspecting the ridges of scalar fields, in the new theory the LCS satisfy an ordinary differential equation and thus follow as parametric curves. In particular, the new theory leads to a class of LCS given by simply closed material curves along which shear is maximized. As such, these LCS provide means for unambiguously identifying eddy boundaries and tracking the evolution of eddies. Using altimetry measurements in the South Atlantic, it is demonstrated that, unlike SSH- and vorticity-based methods, the new LCS theory it is capable of correctly locating and tracing coherent rings shed from the Agulhas Current.