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A diagnostic for (sub-)mesoscale isopycnal stirring

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We propose a diagnostic for the quantification of isopycnal stirring in the ocean. The method is based on the combination of forward and backward Lyapunov calculation and has been previously introduced for detecting isentropic stirring in the stratosphere and is here applied to isopycnal mesoscale eddies in the Mediterranean sea and in NE Atlantic. Contrary to the common vision of a uniform stirring region at eddy periphery, the Lyapunov method identifies very localised sub-mesoscale mixing regions, corresponding to the regions of more intense lobe formation and connected by mixing barriers. The mixing intensity is also shown to be very dependent on the time-variability of the mesoscale eddies. The connection of these results on stirred biogeochemical tracer like plankton and temperature are discussed.