Relative dispersion in the Liguro-Provencal basin: from sub-mesoscale to mesoscale

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Abstract

Relative dispersion in the Liguro-Provencal basin (a subregion of the Mediterranean Sea) is investigated using clusters of surface drifters deployed during two Marine Rapid Environment Assessment (MREA) experiments covering different months in 2007 and 2008 respectively. The clusters have initial radii of less than 1 km, or an order of magnitude below the typical deformation radius (approximately 10-20 km). The data set consists of 45 original pairs and more than 50 total pairs (including chance ones) in the spatial range between 1 km and 200 km. Relative dispersion is estimated using the mean square separation of particle pairs and the Finite Scale Lyapunov Exponents (FSLEs). The two metrics show broadly consistent results, indicating in particular a clear exponential behavior with an e-folding time scale between 0.5 -1 days, or Lyapunov exponent λ in the range of 0.7-1 days^{-1}. The exponential phase extends for 4-7 days in time and between 1 km and 10-20 km in separation scale. To our knowledge, this is only the third time that an exponential regime is observed in the world ocean from drifter data. This result suggests that relative dispersion in the Liguro-Provencal basin is nonlocal, namely controlled mainly by mesoscale dynamics, and that the effects of the sub-mesoscale motions are negligible in comparison. NCOM model results are used to complement the data and to quantify errors arising from the sparse sampling in the observations.

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