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Relative dispersion in the Algerian Basin as derived from satellite-tracked surface drifters

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Relative dispersion in the Algerian Basin (Western Mediterranean Sea) is analyzed using surface drifter pairs deployed in the Western Basin during the period from 1986 to 2016. The results of relative dispersion (D2), relative diffusivity and characteristic time dispersion show the four well-known regimes. The first regime, characterized by an exponential increment of the relative dispersion (Lundgren regime), corresponds to the chaotic advection at small scales and lasts for a few days. In the second regime, extending from 3 to roughly 13 days and 1-3 km of initial distance, D2 increases as time cubed (Richardson regime). For initial distances of 5-10 km and 15-20 km, D2 increases quadratically with time (Ballistic regime). The forth regime corresponds to long time scales (larger than 25 days for initial distances of 1-3 km and 17 days of 5-10 km) with a linear increase in time of D2 (diffusive regime). The relative diffusivity and characteristic time dispersion exhibit also three different phases based on the initial pair separations. In first phase, defined as the enstrophy cascade range, the diffusivity is about D2 for distances smaller than 20 km and initial separation distances of pairs between 5 km and 10 km; whereas it is smaller than 30 km for initial separation distances of pairs between 15 km and 20 km. Relative diffusivity and characteristic time dispersion are approximately constants for initial separation distance of pairs larger than 35 km. In the second phase, the diffusivity and characteristic time dispersion increase with growing distances following the 4/3 and 2/3 power laws, respectively, for scales ranging between 3 km and 15 km and initial distances smaller than 3 km; the above mentioned behavior is consistent with an inverse energy cascade. In the third phase, the pair velocities are decorrelated and both relative diffusivity and characteristic time dispersion are approximately constants.