RELATIVE DISPERSION IN THE GULF OF MEXICO

J. H. LaCasce and C. Ohlmann
Norwegian Meteorological Institute

We examine the relative motion of pairs and triplets of surface drifters in the Gulf of Mexico. The mean square pair separations grow exponentially from the smallest resolved scale (1 km) to 40 – 50 km, with an e-folding time scale of 2 – 3 days. Thereafter, the dispersion exhibits a power law dependence on time with an exponent of between 2 and 3 (depending on the measure used) up to scales of several hundred kilometers. The pair velocities are correlated during the early and late phases and the relative displacements significantly non-Gaussian, consistent with coherent advection.

The triplet results likewise suggest two growth phases. During the early phase, the mean area and the longest triangle leg grow exponentially in time, with rates consistent with the two-particle results. The areal growth during the early phase may stem from random drifter displacements (e.g. Ekman drift or windage effects). During the late period, the triangles grow and their aspect ratios systematically decrease.

The results are in broad accord with theoretical and numerical results concerning two-dimensional turbulence. So we would infer an enstrophy cascade at scales below the deformation radius (40 – 50 km) and possibly an inverse energy cascade to larger scales. We do not resolve an upper bound on the latter (i.e. we do not observe an ultimate diffusive stage). The results also imply that, if anything, the enstrophy cascade is a local rather than a non-local phenomenon. And the three particle statistics are in general agreement with recent theoretical work concerning multi-point scalar correlations.