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Spiral Eddies in the Ocean Surface; Topology, Patterns and Scaling

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The improvement in resolution of satellite imagery, nowadays allows identification of vortical features and velocity and vorticity topology of the ocean surface[1-3], the spectral and pattern analysis of these, such as spiral eddies is studied using statistical and fractal methods [2,4] Radar SAR and ASAR (Advanced Synthetic Aperture Radar) detection of the ocean surface, either near the coastline or directly at open sea, is independent of the cloud cover and now it is also possible to study pollution and to combine different satellites to improve the statistics on the number and size of the occurrence of vortices, which are detected as spiral structures or as sheared, upwelling or convective events. SAR images show white centres and streaks if debry dominates, while if tensioactive or oil seeps are acumulated in the spiral arms and appear black to Radar reflectance[5,6]. Sea accidents provide most of the largests detected pollution events. Since the Clean Seas EU project in 1995[4,6] Major oil pollution from sea-based sources does not seem to decrease. On the other hand routine smaller ships operations can still lead to many traces of slicks.

Several methods of compilation of local eddy diffusivity maps from satellite image information should give estimates of the spatial and temporal non-homogeneities (and intermittencies in the Kolmogorov sense), here the size and persistence of different cyclonic and anticyclonic vortices[1,3] are important locally. Also from structure function analysis[2,4] these values are used to parameterise sea surface turbulence or even the atmospheric turbulence at a variety of scales.

It is possible that fractal dimensions may be due to different levels of intermittency (and thus different spectra, which are not necessarily inertial nor in equilibrium)[5,8]. These techniques are helpful in providing realistic estimates of spatial and temporal variations of dispersion in the environment, wich reflect the influence of the structure and number of eddies[2,3] as well as the angles of their arms and spectral energy distribution on the local diffusivity of any solute or floating debry, in terms of a Generalized Richardson's Law[4,7].

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