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# Diffusion in coastal and harbour zones, effects of Waves,Wind and Currents

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As there are multiple processes at different scales that produce turbulent mixing in the ocean, thus giving a large variation of horizontal eddy diffusivities, we use a direct method to evaluate the influence of different ambient parameters such as wave height and wind on coastal dispersion. Measurements of the diffusivity are made by digital processing of images taken from from video recordings of the sea surface near the coast. The use of image analysis allows to estimate both spatial and temporal characteristics of wave fields, surface circulation and mixing in the surf zone, near Wave breakers and inside Harbours.
The study of near-shore dispersion [1], with the added complexity of the interaction between wave fields, longshore currents, turbulence and beach morphology,
needs detailed measurements of simple mixing processes to compare the respective influences of forcings at different scales. The measurements include simultaneous time series of waves, currents, wind velocities from the studied area.
Cuantitative information from the video images is accomplished using the DigImage video processing system [3], and a frame grabber. The video may be controlled by the computer, allowing, remote control of the processing. Spectral analysis on the images has also used n order to estimate dominant wave periods as well as the dispersion relations of dominant instabilities. The measurements presented here consist mostly on the comarison of difussion coeficients measured by evaluating the spread of blobs of dye (milk) as well as by measuring the separation between different buoys released at the same time.
We have used a techniques, developed by Bahia(1997), Diez(1998) and Bezerra(2000)[1-3] to study turbulent diffusion by means of digital processing of images taken from remote sensing and video recordings of the sea surface. The use of image analysis allows to measure variations of several decades in horizontal diffusivity values, the comparison of the diffusivities between different sites is not direct and a good understanding of the dominant mixing processes is needed. There is an increase of diffusivity with wave height but only for large Wave Reynolds numbers. Other important factors are wind speed and tidal currents. The horizontal diffusivity shows a marked anisotropy as a function of wave height and distance from the coast.
The measurements were performed under a variety of weather conditions conditional sampling has been used to identify the different influences of the environmental agents on the actual effective horizontal diffusion[4].

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