Geophysical Research Abstracts, Vol. 7, 01172, 2005
SRef-ID: 1607-7962/gra/EGU05-A-01172

Ensemble stochastic modelling and WEof analysis of processes: study of internal tides in the Bay of Biscay

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The Bay of Biscay is a place of strong thermohaline forcing and strong tidal amplitudes. At the shelf edge, interactions of the tides with the topography and the thermohaline stratification are responsible for the generation of large internal tides that propagate both shoreward and seaward. In these areas, the presence of internal waves and for a large part of internal tides can increase the mixing and therefore lead to biological growth. Moreover, internal tides can play an important role in suspended particulate matter exchanges between the shelf and the slope.

In order to understand the behaviour of this process in a scale oriented modelling, we combine wavelet analysis for both time and frequency localization with principal component analysis for physically consistent structure identification. This method, called WEof analysis, is an efficient tool for the recognition and the extraction of frequency localized dynamical processes. An application to the study of internal tides propagation characteristics in a case of multi-tidal forcing allows separating diurnal, semi-diurnal and quart-diurnal components. We give a description of the associated wavelengths, phase velocities and propagation rays. Through an Ensemble modelling we also investigate internal tides generation characteristics and their propagation depending on the thermohaline stratification. More than a hundred of simulations are statistically investigated based on an Evensen perturbation of different stratifications. Large differences appear near the generation area. Results are then compared with in situ data.

These techniques give important insights in ocean physics and could be of great interest in other research areas such as biological studies associated with non linear processes (population evolution, biological growth...).