Geophysical Research Abstracts,
Vol. 11, EGU2009-10331, 2009
EGU General Assembly 2009

Suspended Particulate Matter as an Indicator for Turbulent Diffusion due to Ocean Surface Waves

A. Pleskachevsky (1,2), M. Dobrynin (1,3), and A. Babanin (4)

(1) GKSS Research Centre, Geesthacht, Germany (Andrey.Pleskaschevsky@gkss.de), (2) Institute for Chemistry and Biology of the Sea (ICBM), University of Oldenburg, Germany, (3) Centre for Ocean and Ice, Danish Meteorological Institute, Copenhagen, Denmark, (4) Swinburne University of Technology, Melbourne, Victoria, Australia

Sometimes modelled Suspended Particulate Matter (SPM) shows large deviations from measurement. These problems may be related to insufficient model physics or incorrect parameterizations. On the other side, the large sensitivity of SPM to external forcing and internal processes makes it a perfect marker to study turbulence in the ocean, because the vertical distribution of SPM depends on settling velocities and turbulence, which propagate material from bottom up to the surface in shallow seas.

Satellite observations in the North Sea show that the SPM concentration at the surface grows rapidly during a storm and builds plume-shaped structures. The satellite data reveal also that SPM concentration decreases rapidly after the wave height decreases, justifying the hypothesis that strong turbulence created by surface waves is a major contributor to the SPM dynamics.

In this paper, the impact of the surface waves on the turbulent mixing in the North Sea is studied. The wave-induced turbulence is parameterized and implemented into the General Ocean Turbulence Model (GOTM) as an additional source of turbulent kinetic energy (TKE). A number of tests experiments are carried out in order to reproduce experiments in a water tank and observations in the North Sea.

In a tank ink is injected into water of 1 m depth. Experiments with 0,667 Hz frequency waves of different amplitudes (no winds, no currents) are done. If the amplitude is less than 2 cm, the ink is moving along the wave orbits. The patch stays unchanged for minutes. The motion is clearly laminar. For amplitudes of about 3 cm some vortexes become visible eroding the upper parts of ink pattern. For amplitudes greater than 4 cm the motion is obviously turbulent and the ink is completely dissolved within seconds. The extended GOTM model reproduces these observations.

In the North Sea the data from the satellites MOS (Modular Optoelectronic Scanner) and MERIS (MEdium-spectral Resolution Imaging Spectrometer) are used to derive the SPM concentration at the surface. The circulation model HAMSON and the wave model WAM are applied to reconstruct the hydrodynamics and sea state. Erosion and sedimentation processes taken from the Suspended Particulate Mater Transport model (SPMT), developed in the GKSS Research Center and German Federal Maritime and Hydrographic Agency (BSH), are combined with the extended GOTM model.

Results will be shown demonstrating the importance of waves for the vertical mixing processes in the Southern North Sea during storm situations. This mixing is most significant in the upper layers and strongly influences the SPM patterns.