Geophysical Research Abstracts
Vol. 13, EGU2011-10832, 2011
EGU General Assembly 2011

Ocean response to storm "Klaus" in the Bay of Biscay from numerical simulations and in situ observations.

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"Klaus" storm has stroken the Western Europe on 23-24 January 2009. This extra-tropical cyclone, similar in strength to a category 1 hurricane, crossed over the south of the Bay of Biscay from west to east with gusts of up to 198 km/h. In this study, we examine the upper ocean's response to the "Klaus" storm to understand the role of extreme meteorological events on ocean stratification.

The dynamical and thermal response of the ocean during and after the passage of the storm Klaus is analysed using: (i) a numerical simulation from the SYMPHONIE coastal model in a realistic configuration of the Bay of Biscay, (ii) observations from moored buoys (from Puertos del Estado, Météo France) and (iii) hydrological profiles from the EN3 dataset of the Met Office Hadley Centre. The model has 43 generalized sigma levels and 3 km horizontal resolution. It is forced at ocean surface with the Météo-France ALADIN atmospheric fields (10km resolution, 3 hours time frames) and at lateral open boundaries with MERCATOR products plus FES2004 tidal solution. In addition to in situ observations, comparisons with a Bay of Biscay's numerical simulation developed at MERCATOR-Océan (Maraldi et al., in preparation), using the NEMO model in a similar configuration, are conducted.

We examine the ocean's response to atmospheric forcing on variables such as temperature, salinity, sea level (storm surge) and mixed-layer depth. We also analyse the changes in surface and subsurface circulation, in particular over the slope off the northern Iberian coasts and over the Landes and Armorican shelf. An expected response to storm forcing is a wind-induced stronger turbulence and a deepening and slight cooling of the mixed layer. Here, we focus on the variability of the mixed layer and its characteristics and investigate the role of the vertical mixing in temperature and salinity distribution at small scale. The contribution of the inertia waveband to the kinetic energy, vertical motion and current shear are also analysed. Finally, in order to explore the sensitivity of the model to meteorological forcing, we perform another simulation forcing the SYMPHONIE model with ECMWF analyses. We then analyse the differences between both SYMPHONIE simulations in oceanic response observed during the storm.