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Measured and modelled profiles of near surface temperature

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A simple analytical/numerical model has been developed for computing the evolution, over periods of up to a few hours, of the current and temperature profile in the upper layer of the ocean. The model is based upon conservation laws for heat and momentum, and employs an eddy diffusion parameterisation which is dependent on both the wind speed and the wind stress applied at the sea surface. Other parameters such as the bulk−skin surface temperature difference and CO_2 flux are determined by application of the Molecular Oceanic Boundary Layer Model (MOBLAM) of Schlüssel and Soloviev. A similar model, for the current profile only, predicts a temporary increase in wave breaking intensity and decrease in wave height under conditions where the wind speed increases suddenly, such as, for example, during gusts and squalls.

The model results are compared with measurements from the lagrangian Skin Depth Experimental Profiler (SkinDeEP) surface profiling instrument made during the 1999 MOCE-5 field experiment in the waters around Baja California. SkinDeEP made repeated profiles of temperature within the upper few metres of the water column.

Given that no tuning was performed in the model, and that the model does not take account of stratification, the results of the model runs are in rather good agreement with the observations. The model may be suitable as an interface between time-independent models for processes very near the surface, and larger-scale three-dimensional time-dependent ocean circulation models. A straightforward extension of the model should also be capable of making time-dependent computations of gas concentration in the near-surface layer of the ocean.

We also give a discussion of the advantages and disadvantages of our model formulation with respect to more conventional mixed layer, eddy viscosity, and turbulence

closure methods.