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Response of water temperature to surface wave effects in the Baltic Sea: simulations with the coupled NEMO-WAM model

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The effects of wind waves on the Baltic Sea water temperature has been studied by coupling the hydrodynamical model NEMO with the wave model WAM. The wave forcing terms that have been taken into consideration are: Stokes-Coriolis force, seastate dependent energy flux and sea-state dependent momentum flux. The combined role of these processes as well as their individual contributions on simulated temperature is analysed. The results indicate a pronounced effect of waves on surface temperature, on the distribution of vertical temperature and on upwelling′s. In northern parts of the Baltic Sea a warming of the surface layer occurs in the wave included simulations. This in turn reduces the cold bias between simulated and measured data. The warming is primarily caused by sea-state dependent energy flux. Wave induced cooling is mostly observed in near coastal areas and is mainly due to Stokes-Coriolis forcing. The latter triggers effect of intensifying upwellings near the coasts, depending on the direction of the wind. The effect of sea-state dependent momentum flux is predominantly to warm the surface layer. During the summer the wave induced water temperature changes were up to 1 °C.