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Coupling of Wave and Circulation Models in the Atlantic European North-West Shelf Predicting System

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This study addresses the coupling between wind wave and circulation models on the example of the Atlantic - European North-West Shelf (NWS). This topic reflects the increased interest in operational oceanography to reduce prediction errors of state estimates at coastal scales. The uncertainties in most of the presently used models result from the nonlinear feedback between strong tidal currents and wind-waves, which can no longer be ignored, in particular in the coastal zone where its role seems to be dominant. Coupled circulation (NEMO) and wave model (WAM) system was used to study the effects of surface ocean waves on thermohaline distribution and ocean circulation at the NWS. Four scenarios - including Stokes-Coriolis force, sea-state dependent energy flux (additional turbulent kinetic energy due to breaking waves), sea-state dependent momentum flux and the combination of the three wave-induced forcing were performed to study the role of the wave-induced processes on model simulations. The individual and collective role of those processes is quantified and the results are compared with the NWS circulation model results without wave effects as well as against various in-situ measurements. The performance of the forecasting system is illustrated for the cases of several extreme events. The improved skills resulting from the new developments in the forecasting system, in particular during extreme events, justify further enhancements of the coastal operational systems. The study is performed in the frame of the COPERNICUS CMEMS Service Evolution Projects Wave2NEMO and OWAIRS.