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Assessment of wave-current interactions on the Mediterranean Sea dynamics

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The latest NEMO version (v4.2-RC, Release Candidate) has been updated to include new processes related to wave-current interactions. This study is assessing the impact of those new developments, especially the effect of the wave-induced mixing in the Mediterranean sea dynamics. A set of sensitivity experiments are performed using the hydrodynamic model NEMO v4.2-RC coupled with the spectral wave model WaveWatchIII (WW3) v6.07 through the OASIS library. The configuration is based on the operational Copernicus Marine Service Mediterranean forecasting physical system (MedFS). Both models are implemented at 1/24° resolution and are forced by ECMWF 1/10° horizontal resolution atmospheric fields. The models are one-way coupled therefore the wave model is sending fields every hour to the hydrodynamic model. Two-year (2019–2020) numerical experiments are carried out in both uncoupled and coupled mode. In order to validate the system, numerical results are compared with in-situ and satellite data. This study is focused on the impact of the coupling on upper-ocean properties (such as temperature, salinity and surface currents) and mixed layer depth, at mesoscale. The sensitivity of the ocean dynamic to the wave-current interaction is also evaluated during a specific extreme event. Numerical simulations show a global decrease of the wind stress in the Mediterranean Sea due to the interaction with waves. The wave-induced drag coefficient leads only to minor improvements in the circulation fields. The shear of the current in the upper meters is almost due to the Stokes-drift as the mixing by waves is reducing the shear of the mean current. The modifications of the Turbulent Kinetic Energy vertical closure scheme and the inclusion of the Langmuir turbulence lead to an increase in the mixing in specific areas, thus helping to deepen the Mixed Layer Depth.