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Modelling of the Mediterranean circulation using atmospheric fields from the WRF model at different space-time resolutions

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In the framework of the MORCE-MED project, a two-way ocean-atmosphere coupling is developed between the Weather Research and Forecasting (WRF) atmospheric model and the NEMO ocean model over the Mediterranean basin. The future ocean-atmosphere coupled system is part of the future regional numerical platform including also the modelling of the continental superficial layers, atmospheric chemistry and marine biogeochemistry. Forced by global reanalyses or by the global climatic numerical system outputs, the whole regional coupled model aims to study the impacts of the climate change over the Mediterranean basin.
Before applying the full two-way interactive coupling between the ocean and atmospheric regional models for long-term simulations over the Mediterranean, the forcing mode is considered through a sensitivity study. The downscaling of the NCEP reanalyses over the full Mediterranean basin with a 20-km resolution has been done with the WRF model between August 1998 and July 1999. The daily atmospheric fields obtained are then used to drive the NEMO model (with a 6-8 km resolution) over the Mediterranean Sea in a perpetual mode during a spinup of 8 years. Then, three experiments are done for a period of 4 years. The first experiment (or control experiment) is the continuity of the spinup. In the second experiment, a higher temporal resolution is used and the frequency of the forcing is 3 hours, which allows a good representation of the diurnal cycle and of the extreme air-sea exchanges that occur with a short duration during severe meteorological events. In the third experiment, a finer spatial resolution of the forcing is applied over the Gulf of Lions area in order to approach the ocean model resolution and to well represent the channelling of the Mistral and Tramontane. The benefit of increasing the space-time resolutions of the atmospheric forcing is estimated by a comparison of the ocean model performances to represent the general Mediterranean circulation as the characteristics of the mixed layer, of the deep convection and of the upwellings between the control experiment and the two sensitivity experiments, and by a comparison of our experiments to observations and climatologies.