EGU22-11717
https://doi.org/10.5194/egusphere-egu22-11717
EGU General Assembly 2022

Impacts of Sea Spray in a coupled ocean-wave-atmosphere model : Mediterranean Sea case studies

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With the flourishing of offshore wind projects there is a new socio-economic interest to better our knowledge and forecasting ability of winds within the coastal marine atmospheric boundary layer (MABL). Air-sea fluxes of enthalpy and momentum greatly influence the turbulent and mean winds in the MABL. Already at moderate but certainly at high winds, wave breaking is a key driver of air-sea fluxes and the sea spray generated by whitecaps is thought to be a crucial component when modelling air-sea interactions. Most studies so far have focused on the role of sea spray in enhancing tropical cyclone intensity. Here we investigate its impacts on the MABL under strong orographic wind forcing. A coupled model framework was developed within the scope of the CASSIOWPE project aiming at characterizing the physical environment in the Gulf of Lion (NW Mediterranean Sea) in the prospective of future floating wind farms development. It consists of the non-hydrostatic mesoscale atmospheric model of the French research community Meso-NH, the 3rd generation wave model WAVEWATCH III®, and the oceanic model CROCO. Sea-spray physics were incorporated into the Meso-NH's surface model SURFEX. Added parametrizations will be detailed and a series of test cases will be presented to illustrate how sea spray alters the MABL under Mistral and Tramontane winds. Several sea-state dependent sea spray generation functions (SSGF) are considered in the present study. The variability in simulated fields linked to the choice of wave forcing or coupling will be showcased to evaluate their suitability in varying fetch conditions. Sea spray production remains to be adequately quantified. Existing measurement derived SSGFs span several orders of magnitude resulting in uncertainties in simulated fields which will be discussed.