EMS Annual Meeting Abstracts
Vol. 15, EMS2018-677, 2018

A North Sea-Baltic Sea regional models: coupling of ocean and atmosphere a through a dynamic wave interface

Joanna Staneva, Corinna Schrum, and the GCOAST Team
HZG, Institute for Coastal Research, Geesthacht, Germany (joanna.staneva@hzg.de)

The coupling of models is a commonly used approach when addressing the complex interactions between different components of earth system. In climate and forecasting research and activities, advanced models are needed and there is an urge towards the use of coupled modelling. This study presents the developments and implementation of a high-resolution, coupled model system for the North Sea and the Baltic Sea, as a part of the Geestacht COAstal model SysTem GCOAST. We focus on 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. Ocean waves influence the circulation through number of processes: (1) The Stokes-Coriolis forcing; (2) Sea state dependent momentum flux; and (3) Sea state dependent energy flux. The proposed wave-atmosphere coupling parameterizations account for the feedback between of the upper ocean on the atmosphere by accounting for the effects the sea surface roughness. Sensitivity experiments are performed to estimate the individual and collective role of different coupling components. The performance of the coupled modelling system is illustrated for the cases of several extreme storm events. The model comparisons with data from new satellite (SENTINEL) and in-situ observations showed that the use of the coupled models reduces the errors, especially under severe storm events. For example, the inclusion of wave coupling leads to decreases strong winds through wave dependent surface roughness or changes sea surface temperature, the mixing and ocean circulation; leading to better agreement with in-situ and satellite measurements, especially in the coastal areas. The wave-induced forcing in the circulation model leads to surge simulations closer to observations during extremes. All this justifies the further developments and implementation of the wave model component in coupled model systems for both operational and climate research and development activities.