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A hybrid surface layer parameterization scheme for the two-way fully coupled atmosphere-ocean wave system WEW

Petros Katsafados (1), Anastasios Papadopoulos (2), George Varlas (1,2), and Gerasimos Korres (3)

(1) Harokopio University of Athens, Dpt. of Geography, Athens, Greece (pkatsaf@hua.gr), (2) Institute of Marine Biological Resources and Inland Waters, Hellenic Centre for Marine Research, Greece, (3) Institute of Oceanography, Hellenic Centre for Marine Research, Greece

The two-way fully coupled atmosphere-ocean wave system WEW has been recently developed in order to study the factors that contribute to the air-sea interaction processes and feedbacks. The coupled system consists of two components: the atmospheric component which is based on the Workstation Eta non-hydrostatic limited area model and the ocean-wave component which is based on the fourth generation OpenMP (OMP) version of the WAM model.
The WEW has been already evaluated in a number of high-impact weather and sea state events where generally a more realistic representation of the momentum exchanges in the ocean wind-wave system has been shown However, the new developed wind-wave parameterization scheme reduces both the near surface wind speed and the significant wave height as a response to the increased aerodynamic drag considered by the atmospheric model over rough sea surfaces. Such behavior is mainly attributed to the surface layer parameterization scheme of the atmospheric component which is based on the Mellor-Yamada-Janjic (MYJ) scheme. It is noted that this scheme has been adjusted to support independent atmospheric simulations.
Therefore, we proceed to develop a new hybrid surface layer parameterization based on the MYJ and the Janssen schemes that operate in the atmospheric and ocean wave components of the WEW, respectively. In this case the roughness length depends on the wave age instead of the Charnock parameter following the formulation proposed by Vickers and Mahrt. The spatial variability of the wave age is estimated at each ocean wave component time step and it is directly provided to the MYJ scheme. The parameterization of the viscous sublayer and the universal functions for the estimation of the near surface wind speed have been also revised accordingly.
In this study, a test version of the new hybrid scheme of WEW has been statistically evaluated against a number of buoys and satellite retrievals over the Mediterranean Sea in a case study of high-impact weather and sea state event. The implementation of the new scheme reduces the underestimation and the root mean squared error for both the near surface wind speed and the significant wave height.