Geosci. Model Dev. Discuss., 8, C1913–C1918, 2015
www.geosci-model-dev-discuss.net/8/C1913/2015/

Geoscientific Model Development
Discussions
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Interactive comment on "A fully coupled Atmosphere–Ocean Wave modeling system (WEW) for the Mediterranean Sea: interactions and sensitivity to the resolved scales and mechanisms" *by* P. Katsafados et al.

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Received and published: 7 September 2015

A) This paper presents a coupled atmosphere-ocean wave limited area model setup for the Mediterranean Sea. Although the topic is an important one and one which I consider of general interest to the readers of GMD, unfortunately, I cannot recommend publication in its present form. The work presented is sloppily put together with little regard for the work which has been done earlier in this ïňĄeld. Indeed, the work is wholly based on the work by Peter Janssen and his co-workers at ECWMF, but the only reference is to his earlier work (Janssen, 1991). The fact that ECMWF has operated a

coupled atmosphere-wave forecast system since 1998 is not mentioned, and I ïňĄnd this inexcusable.

Reply:

It was not our intention to exclude or ignore the work done by ECMWF research team (P. Janssen and co-workers) on coupling the atmospheric with the wind wave models in their IFS system. It is true that no proper reference was given in the previous version of the manuscript on this issue. The paragraph describing the work which has been done in ECMWF has been extended in the revised paper.

B) What is more important for the general reader is that the system presented does not appear to provide much (if any) improvement over the uncoupled model (Fig 12). Although I can understand the need for publication of a new model setup, even one which offers only marginal improvement, I do not think it is ready in its current form.

Reply:

In general, the coupling between the atmospheric and the wave models offer a progressively more realistic representation of the atmosphere-ocean system in terms of the momentum (mainly), heat and moisture exchanges at the air-sea interface. In our paper we present the newly developed technique for the fully coupling between WAM and the ETA atmospheric model. The versions of the models used in this study, constitute numerical components of the POSEIDON forecasting system. On the basis of a long operational period (since 1997) the POSEIDON forecasting system has been evaluated demonstrating its ability to describe quite satisfactorily the sea-state and weather conditions (Papadopoulos et al., 2008). In the current work and as a proof of the proper coupling of the two numerical components we present an evaluation of the coupled system for a high-impact weather and sea state event, in which an overall RMSE improvement of 11% has been achieved for the wave forecasts, while less but not a marginal improvement has been also accomplished for the wind field. This is in agreement with the results of Bao et al. (2000), Desjardins et al. (2000) and

Lionello et al. (2003) who also reported limited improvements. This may be partially attributed to the location of the buoys, since the majority of the Mediterranean buoys are lying near the coast, where both the atmospheric and the ocean wave models have difficulties to simulate local circulations and the shallow water waves especially in complex coastal areas. Moreover, we would like to note that the majority of the surface layer parameterization schemes in atmospheric models have been configured using formulas with a constant Charnock coefficient. In the new coupled modeling system we introduce the use of the spatiotemporal variability of the Charnock coefficient. To derive a physically-based variation of this parameter, the WAM model-generated field of Charnock coefficient is ingested into the atmospheric model at every WAM model timestep. Furthermore, and beyond the aim of the current study we are working on the development of a new hybrid surface layer parameterization based on the Mellor-Yamada-Janjic (MYJ) and the Janssen schemes that operate in the atmospheric and ocean wave components of the WEW respectively (Katsafados et al., 2015). In this work, we attempt to investigate if better results can be obtained when the roughness length depends on the wave age instead of the Charnock parameter, following the formulation proposed by Vickers and Mahrt (1997).

C) Figures are generally of poor quality and should be redone with more intelligible captions.

Reply:

The entire figures follow the standards of GMD discussions (300dpi, jpg format).

D) To salvage this paper I would want to see a much more thorough discussion of the quality of the control and coupled runs. This may require a longer integration.

Reply:

The main aim of this manuscript is to present a newly developed, fully coupled atmosphere-ocean wave model. The sensitivity of the new model and the resolved

air-sea interactions are also tested in a case study of a high impact weather and wave event. The incident of 4–11 January, 2012 (7 days) has been selected due to the severity of the prevailing atmospheric conditions characterized by an explosive cyclogenesis over the Ligurian Sea. In this phase of the development, longer integrations could not considered as useful ones in order to exploit the impact of coupling in the aerodynamic drag over rough sea surfaces or how it modifies the roughness length. We believe that the impact of the new coupling system should be assessed in a metocean case study including high and time-varying winds. Monthly or even longer integrations include a sufficient number of calms, in which the sea surface stress is negligible, making difficult to figure out the coupling efficiency. However there is a plan of a daily integration of the system in the framework of the next operational POSEIDON forecasting system at HCMR. This would provide the opportunity to investigate the performance of the system in multiple cases.

E) Proper referencing of earlier work, especially by the group at ECMWF is mandatory. The English needs to be corrected by someone proïňĄcient in professional English.

Reply:

A paragraph acknowledges the work which has been done at ECMWF is now included in the revised manuscript. Additionally the use of English in the original manuscript has been substantially refined.

F) p 4088 l 18: Unintelligible formula involving sin φ

Reply:

Sanders and Gyakum (1980) defined an extratropical cyclone as a meteorological bomb when the mean sea-level pressure of its center falls by at least 1hPa per hour for 24 hours at 60°N. An equivalent rate is obtained for a latitude φ by multiplying this rate by the dimensionless number sinφ/sin60. Sanders and Gyakum (1980) denote this threshold rate as one bergeron. It is also clarified in the revised manuscript.

G) Fig 12: No explanation to what is found in the various sub panels (a and c). Are these different buoys?

Reply:

The first panel (a and b) displays the scatter plots of the near surface wind speed and the significant wave height against the relevant measurements from the network of the Mediterranean buoys presented in the Fig.8. On a similar way, the second panel (c and d) displays the scatter plots of the near surface wind speed and the significant wave height against the remote sensed retrievals. The caption of Fig.12 is corrected accordingly.

On behalf of the authors,

Petros Katsafados

List of the works cited in our reply

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Lionello, P., Martucci, G., Zampieri, M.: Implementation of a Coupled Atmosphere-Wave-Ocean Model in the Mediterranean Sea: Sensitivity of the Short Time Scale Evolution to the Air-Sea Coupling Mechanisms, Glob. Atmos. Ocean Syst., Vol. 9, Iss.

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Interactive comment on Geosci. Model Dev. Discuss., 8, 4075, 2015.