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Ocean Science
Discussions

Interactive comment on "Coupling of wave and circulation models in coastal-ocean predicting systems: a case study for the German Bight" *by* J. Staneva et al.

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The paper presents an informative study of wave-current interaction in the shallow coastal area of the North Sea with emphasis on the Wadden Sea. The numeric experiments presented show that tidal currents in this area have a strong impact on wave mean period, and and sea surface elevation is affected by wave-induced stresses. Using observations from tide gauges and hydrographic stations, the authors show that errors in the numeric models are reduced by considering the two-way interaction between the hydrodynamic ocean circulation model and the statistical wave model.

I recommend to accept the manuscript for publication in OS. The used numerical mod-

els seem to be thoroughly set up, and the observation clearly show that the implemented wave-current interaction enhances model results. I am also glad to see that this paper is kept short with regard to theoretical background and model development, as many previous papers already cover this part extensively. Instead, the authors focus on the validation of a coupled model system using measurements and the discussion of the effect of the implemented wave-current interactions in the study region. The paper includes a well written introduction with appropriate references to literature on the needed theoretical background.

Please refer to Wahle et al.: "Response of the..." as "in preparation/under review", unless it is accepted for publication before you submit your final manuscript.

I further recommend to take the following points into account if you decide to revise this manuscript:

The measurements clearly show that wave fields and sea surface elevation benefit from the implementation of wave-current interaction. In fact, Fig. 3e and Fig. 5 suggest that the effect of wave-current interactions may still be underestimated in this model system. Do you agree with this view? If so, do you have any suggestion why?

As wave-current interaction scheme, a radiation stress formalism is chosen despite the fact that this scheme produces an unrealistic offshore transport, as the authors discuss in their introduction. Even though the produced errors may be small in the study region (small bottom slopes), the authors should discuss why the radiation stress formalism is chosen, and what the possible limitations for their conclusions are. I would not consider the choice of the radiation stress formalism critical for this paper because the measurements support the numeric results, but it would be good to discuss the consequences of this choice.

Would you recommend to continue using the radiation stress formalism for coupling, or do you expect that the vortex force or generalized Lagrangian mean formulation for wave-current interaction may give better results in this, or other regions?

Fig. 2, caption: I don't fully understand what quantity is plotted here. Is this the difference between the control run and the coupled run? It may be useful to give an equation for how the presented quantities are calculated.

p.4, line 3: Since the focus in this paper is not the parameterization, but the implication of wave-current interaction on the coastal predictions, it would be good to give some references to experiments in other regions. The introduction covers a lot of background on the parameterization & coupling techniques, but little on wave-current interaction experiments in other regions, i.e. Michaud et al. 2012, Zodiatis et al. 2015.

p10, line 21: The effect of wave-current interactions on Lagrangian particle transport has been investigated in Röhrs et al. (2012, 2014).

References

Michaud, H.; Marsaleix, P.; Leredde, Y.; Estournel, C.; Bourrin, F.; Lyard, F.; Mayet, C. & Ardhuin, F. Three-dimensional modelling of wave-induced current from the surf zone to the inner shelf. Ocean Sci, 2012, 8, 657-681

Röhrs, J.; Christensen, K. H.; Hole, L. R.; Broström, G.; Drivdal, M. & Sundby, S. Observation-based evaluation of surface wave effects on currents and trajectory forecasts. Ocean Dynam., 2012, 62, 1519-1533

Röhrs, J.; Christensen, K. H.; B., V. F.; Sundby, S.; Saetra, &O. & Broström, G. Wave-induced transport and vertical mixing of pelagic eggs and larvae. Limnol. Oceanogr., 2014, 59(4), 1213-1227

Zodiatis, G.; Galanis, G.; Kallos, G.; Nikolaidis, A. & Christina Kalogeri, Aristotelis Liakatas, S. S. The impact of sea surface currents in wave power potential modeling. Ocean Dynam, 2015, 65, 1547-1565

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