

Interactive
Comment

Interactive comment on “Modelling wave–current interactions off the east coast of Scotland” by A. D. Sabatino et al.

Anonymous Referee #2

Received and published: 4 February 2016

This is an interesting manuscript describing the wave-current interaction with the commercial model MIKE21. My main comments are:

1) Wave-current interaction is a topic that has received much attention lately (e.g. Onorato M., Proment D., Toffoli A., 2011. Triggering rogue waves in opposing currents. *Phys. Rev. Lett.*, 107, 184502, doi: 10.1103/PhysRevLett.107.184502 and Toffoli, A., Waseda, T., Hidetaka, H., Cavaleri, L., Greaves, D., Onorato, M., 2015. Rogue waves in opposing currents: an experimental study on deterministic and stochastic wave trains. *J. Fluid Mech.*, 769, 277-297, doi:10.1017/jfm.2015.132. and Toffoli, A., Waseda, T., Houtani, H., Kinoshita, T., Collins, K., Proment, D., Onorato, M., 2013. Excitation of rogue waves in a variable medium: An experimental study on the interaction of water waves and currents. *Phys. Rev. E*, 87, 051201(R), doi:10.1103/PhysRevE.87.051201

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Interactive Discussion

Discussion Paper



and Shrira, V. I. & Slunyaev, A. V. 2014 Nonlinear dynamics of trapped waves on jet currents and rogue waves. *Phys. Rev. E* 89, 041002 and Ma, Y., Ma, X., Perlin, M. & Dong, G. 2013 Extreme waves generated by modulational instability on adverse currents. *Phys. Fluids* 25 (11), 114109 and reference therein). The interaction with an adverse current gradient (i.e an accelerating opposing current or a decelerating following current) steepens the wave profile by shrinking the wavelength and increasing the wave height. This has important consequences on wave dynamics as it triggers nonlinear quasi-resonant interactions, which are responsible for spectral changes (downshifting of the spectral peak) and eventually the generation of rogue waves. I believe that recent studies on this topic should be discussed in the introduction

2) Current hydrodynamic models do not include nonlinear quasi-resonant interactions. Therefore, I would expect that model predictions of wave period can worsen in the presence of the current. It would be interesting to see what is the model performance in terms of wave periods in the validation process.

3) The Authors mentions that calibration and validation of MIKE3FM led to errors as big as 10-15%. This values look quite significant to me. Is this the best tuning possible?

4) Hindcast of selected storms is interesting. However, I am not sure that contour plots convey the right message. I would be more in favour of plots like Fig. 9, where time series with and without the WCI are presented. It would also be interesting to see graphs for the wave period. If, by any chance, field data are available during these events, a comparison with model data could also add value.

5) I do not quite understand the discussion on crossing seas as these sea states have nothing to do with wave-current interaction.

Interactive comment on *Ocean Sci. Discuss.*, 12, 3099, 2015.