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Ocean Science Discussions

Interactive comment on "The open boundary equation" *by* D. Diederen et al.

Anonymous Referee #1

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The paper presents an equation describing the hydrodynamics in infinitely long estuaries under the influence of a tidal forcing. The proposed equation is a simple relationship between partial derivatives of water level and velocity. It is formally derived for a progressive wave in a frictionless, prismatic, tidal channel with a horizontal bed. A large number of numerical simulations, where an open boundary condition is posed at a certain distance landward, is performed, suggesting that, under some hypothesis, the equation can also be considered accurate in some more natural case of converging estuaries with nonlinear friction and a bed slope. The authors argue the equation provides a practical tool for evaluating tidal wave dynamics, by reconstructing the temporal variation of the velocity based on local observations of the water level, providing a fully local open boundary condition and allowing for local friction calibration. This work satisfies all requirements of a publishable manuscript as listed on the OSD peer review guide and I think deserves to be published, however, I would suggests the following mi-

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nor revision before publishing. Mainly, I think a discussion section on the model limits, including those arising from Figure 4, is completely missed. Furthermore, in practice dealing with infinitely long tidal channels, means dealing with estuaries, which are typically characterised by the presence of a river discharge. Could the Authors provide any discussion on the possible implications of the above neglected effect? Finally, the Authors provide a practical tool for reconstructing the temporal variation of the velocity based on local observations of the water level, but do not show any application of the above method in the field. Hence, I would suggest them at least to mention an existing site where the method could be applied in a satisfactory way.

Specific remarks:

1) Page 930, line 16, specify that also Zx=0.

2) Page 932, modify line 21. I think that the Appendix shows that some approximate analytical progressive wave solutions also satisfy eq(22), rather than derives equation (22) from simple analytical approximations.

3) Page 934, equations (26) and (27). Explain the advantage of deriving equations (26) and (27), which is not clear at this point of the paper. Indeed, Eq. (26) and (27) have to be solved numerically exactly like equations (1) and (2).

4) Page 934, line 20, give some details concerning the way the open landward boundary condition is imposed in the numerical model. Which are the limits of the chosen approach?

5) Page 935, line 1, explain that the given parameters (tidal period, inlet width, ect...) are common to all the simulations while bed, convergence lengths and friction have been varied.

6) Figure 1 is never cited in the text.

7) Page 935, line 11, figure 2a seems to suggest the term containing bed slope (light blue line) is negligible compared with the others. Give some comments on the chosen

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parameter values (small bottom slope and relative tidal amplitude). Are non-linear effects relevant in this case?

8) Figure 2: It could be interesting to add a second figure showing the same comparison in a different estuary location (for example x/L=0.8).

9) Figure 4: Explain the meaning of the different colors.

10) Page 936, Last sentence section 3.2: Which kind of numerical errors? The boundary condition effects seem to be excluded as figure 4 includes only results in the range 0.2<x/L<0.8.

11) Page 936, discuss the validity limits of equation (22).

12) References: 8 over 17 references are self-citation!

Interactive comment on Ocean Sci. Discuss., 12, 925, 2015.