Ocean Sci. Discuss., 10, C992–C994, 2014
www.ocean-sci-discuss.net/10/C992/2014/


Ocean Science
Discussions
Open Access



# *Interactive comment on* "On the tides and resonances of Hudson Bay and Hudson Strait" *by* D. J. Webb

**D.J. Webb**

djw@soton.ac.uk

Received and published: 19 March 2014

I would like to thank the reviewer for his thoughtful comments. Concerning his general points:

1. The reviewer states that it is necessary to read earlier papers as some of the material is not fully reviewed in the present paper. I understand but I also feel that it is important not to bulk up a paper with material that has already been published. In the introduction to the final paper I'll add a bit more detail about the previous work.

2. "Webb has simplified this by linearising the friction". "It would be good if the author would discuss how the linearisation of friction may limit the solution.

First on the large scale, the tides always always appear to be approximately linear. If



Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

this was not so the non-linear constituents in the harmonic analysis of the tides would not be usually so small.

However the place where non-linearities are usually greatest is on the shallow continental shelf and in estuaries. Unfortunately the continental shelf is also the place where resonances are largest. What I suspect saves the situation is the fact that although bottom friction is a strongly non-linear function of tidal velocity, if one subtracts off the mean linear coefficient at each location, as the reviewer suggests, the remaining non-linear terms are again small.

This point does need further study but that will need a further paper.

3. "Near amphidromes the current amplitude will be at a maximum and the tuning of friction might perhaps move these locations".

That is possible but my experience with these models is that changing friction has a large effect on decay times but only a small effect on wavelength. (See Webb, 2011, eqn. 8 and fig. 11). When validating the present model against observations, I did try varying the overall friction coefficient, but although this changed amplitudes far from the open boundary it had little effect on the phase.

4. I did not check the effect of moving the position of the open boundary. In terms of validation this is only likely to have an effect if the phase speed of long waves in deep water is wrong. In terms of the model response, the Flather radiation condition is not fully realistic, in that it assumes that the outgoing wave is propagating at right angles to the boundary. Thus changing the boundary position is likely to have a (small?) effect.

This again would need further study.

5. Concerning the open boundary conditions, the open boundary velocities were treated as in Webb (2013). An Arakawa-C grid is used and the open boundary defined by lines of sea level points. Neighbouring velocity points within the model are treated as normal model variables.



OSD

10, C992–C994, 2014



However between each pair of boundary sea level points there is also a tangential velocity point. This was not initialised in the validation run, neither was it involved in the radiational boundary condition. Instead in all cases it was set equal to the corresponding velocity one grid point in from the boundary.

Concerning the specific points:

1. Water depth does affect wavelength and so affects the position of amphidromes and resonance frequencies. A simple sensitivity study could be started but the results are likely to also be simple - i.e. shallower depths give shorter wavelengths. An alternative would be to carry out an inverse study - i.e. "what bathymetry would give the best agreement with the Foxe Bay observations?", but there are only a few openly published observations from the region, they are for short periods and may contain significant errors.

2. I don't really think of resonances as a response to periodic forcing - rather they are the inherent (or natural) modes of a physical system. Also they individually contribute to the system's response to any type of forcing.

Concerning the technical corrections:

Thanks for these. I'll make sure the corrections are made and, where required, points are explained in more detail.

References:

Webb, D.J., 2011. Notes on a 1-D Model of Continental Shelf Resonances. Research and Consultancy Report 85, National Oceanography Centre, Southampton, http://eprints.soton.ac.uk/171197 .

Webb, D.J., 2013. On the shelf resonances of the English Channel and Irish Sea, Ocean Sci., 9, 731-744, doi:10.5194/os-9-731-2013.

Interactive comment on Ocean Sci. Discuss., 10, 2053, 2013.