Biogeosciences Discuss.,
doi:10.5194/bg-2016-118-AC2, 2016

Biogeosciences Discussions

Interactive comment on "Depth-averaged instantaneous currents in a tidally dominated shelf sea from glider observations" *by* L. Merckelbach

L. Merckelbach

lucas.merckelbach@hzg.de

Received and published: 25 November 2016

Response to Interactive comment on "Depth-averaged instantaneous currents in a tidally dominated shelf sea from glider observations" by Anonmous Referee #4.

I very much appreciate the comments and suggestions from the Referee. Two general comments were given. The first comment suggests a fuller discussion on the filter design. I have chosen to keep the focus on Butterworth filters only, mainly because they are fairly simple and used ubiquitously. Discussing elliptic or more exotic formulations would bring no benefit to sorting the problem of eliminating the non-tidal current signal from the measurements. The question why not using a lower order filter that has also a lower group delay is a valid one that I took at heart. In fact, I looked at it in the early stages of the project, and concluded that the reasoning given in the manuscript lead

Printer-friendly version

Discussion paper

to the better filter of the ones discussed. Until I looked at the issue again and found a programming error that, when fixed, to my shock, changed the results significantly. For the better, fortunately. Therefore, I have expanded the section on the filters, to include other settings, and chose a first order filter with a cut-off freuquency of 1/24 cph. This filter produces significantly better results compared to the one I used in the previous version. I have updated the new results throughout the manuscript, and felt that it might be convenient to summarise those in a table for a quick overview. I have devoted another paragraph and graph to the discussion, where I address the question why I chose this particular filter setting and showed that other settings produce inferior and some similar results.

Sections modified: 3.1 inclusion of different filters, chosing a different filter than in previous manuscript 4.2 updated the numerical results/graphs 5 idem 6 added paragraph on the influence of the filter setting.

The second general comment is meant to add a discussion of a generalisation of the approach. This, to extent the potential readership. I did not follow this up and I will try to explain why. The problem at hand is that due to the way the glider navigates, time averaged current estimates are available. Because of the averaging, information on the variability during the dive is lost. In case of a tidal sea, as in this work, the tidal motion is responsible for a big part of the variability of the currents during the dive. And since the tidal motion lets itself model well, a Kalman filter can be constructed from this model to recover most of the information lost. As such, this idea is very general: use a model/Kalman filter to improve the knowledge of the state of a system. However, to broaden the scope of the paper and discuss how this can be applied to a situation that is non-tidal but has a significant variability on time scales that are less than the subsurface times, and is easy to model, seemed not so straight-forward. I, at least, could not find a convincing example. Perhaps when a glider would be deployed in a lake where seiches occur.

Specific comments

P.3 line 26-27 : I removed the mention as suggested. P4. 2-4, 13-14: rephrased as requested. P5. eqs 2-6. : I have included an explanation of the stepwise execution of the filter. That is, each time a measurement becomes available, the eqs 2-6 are computed. It is explained for each step what it does and why, including the estimation of the initial conditions. (next point) P6 eqs 7,8 see previous item. P8. lines 11-18: reworded P8 28-29: The same point was raised by referee #3, and already addressed. P9, 6-7. The motivation was already implicit in the manuscript. A clarification is added to make that explicit. Previously, there is a small discussion on how accurate a depth-time-averaged current measurement can be, depending on the errors of GPS and the subsurface time, and navigation model errors. The estimate is some 1 cm/s. See also equ 19.

p10 line 3. The forward filter does not remove all the tidal signal, and causes a delay. This is now mentioned explicitly. Also the stress on the delay is reduced a bit, because of the different filter setting used now, the delay is not that significant anymore. Still visible though. P11, line 4. Thee error margin is put into context to how much the position can be forcasted for a 3 hour dive, also the topic of the section on virtual ais. P11, l13-14. I left this section out, as it is confusing. P16, lines 1-3. This also confused referee#3 and was already addressed. Basically, no connection to mixing is made anymore.

Technical comments:

The use of odd-padded is removed. It is basically an option in a filter call, that has only marginal effect if any. Leaving out, or using a different option would not give any different results or conclusions.

Other technical comments have been applied, and last techincal commetn P14, l18 has been clarified. With responses is meant how the glider reacts to the environment. Reworded accordingly.

The comments of this reviewer have given me quite a bit of extra work, but I am very

Printer-friendly version

Discussion paper

thankful for that, as it greatly improved the results of this manuscript.

Lucas Merckelbach

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-118, 2016.

Printer-friendly version

Discussion paper