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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Determining slack tide with a GPS receiver on an anchored buoy" *by* M. Valk et al.

Anonymous Referee #1

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The authors propose a novel method for the estimation of the slack tide phase, via real time high frequency sampling of buoy GPS position. The core of this method is based on the following assumptions:

a) under no net force on the buoy-chain system, the chain is completely relaxed as shown in Fig.4 (position labelled as 2), and

b) zero net flux (slack tide) coincides with zero net forces on the buoy-chain system.

One may notice that there exist an infinite number of equivalent positions (on the line of principal extension) in which part of the chain is arranged vertically below the buoy,

and the rest on the sea-floor. Anyhow, these rest configurations (together with null velocity of the system) are due to zero forces of the fluid on the body, and reversely, on the fluid. That is, the condition of zero net forces on the system does probably occur as the buoy starts to recover (one of) its rest position(s). Can the authors give a proof for assumptions a)?

If the system were dominated by the chain, then zero net vertical flux would traduce in zero net force on a vertical chain. But, due to the non negligible draft of the buoy (1 meter at page 15 lines 18-19), the system appears dominated by the buoy. That is to say that the integral of the pressure on the buoy should have much more importance than that on the chain. Can the authors prove that the draft of the buoy has no incidence on the assumption b)?

Besides that, follow some notes on the manuscript.

- On page 2 line 9, the authors claim an accuracy of 10 min of slack tide prediction, it would be worth to mention the actual uncertainty of tidal models in predicting the zero flux phase.

- P.13 Eq.2. According to previuos lines notation, no dot is expected in matrix multiplication.

- P.16 l.1. Probably the word "*Variance*" stands for *Uncertainty*

- P.16 ll.6-12. Error spreading given by Eq.5 does hold if e = $x_{gps} \pm x_{bd} \pm e_{st}$ which is a nonsense. The slack-tide extension (namely e_{st}) is not involved in the

evaluation of the extension e. Therefore, the extension uncertainty is only due to the measurements and the PCA, from which a suitable cumulate uncertainty might be defined.

- P.16 l.8. What does the author mean with the words "*buoy-dynamics*"?

- P.16 ll.21-28. The evaluation of the buoy position uncertainty might be revised. The sampling frequency is declared to be $1\,Hz$, thus every movement above this frequency is undefined. Below $1\,Hz$ it is only a matter of GPS accuracy. Thus, besides the GPS capability there's no uncertainty in the buoy position.
  If the authors do mean that they would like to estimate the uncertainty on the position of the buoy centre of mass (for example), then how do they determine the time window mentioned in Fig.6?
  Probably the authors would like to compare the sea state at that time window with the ("*ramdom*"?) motion of the buoy. It could be worth to cite the relevant buoy's dimension.
  In other words, can the author ensure that this uncertainty evaluation suffices for all weather conditions?

- P.18 ll.17-18. Unless demonstration is provided, this "*total standard deviation*" has no meaning. What is known are the uncertainties on e_{st} and, when estimated, on extension e. These two should be representation of two separate *pdf*s.

- P.19 ll.11-12. The authors do not show how they estimate the "*detection delay*".

- P.20 ll.3-4. The authors do not show how they build the *cdf*, named as γ.

- P.20 l.14. Probable typing error: "*tag*".

- P.21 ll.18-19. What do the authors mean with: "*The standard deviation . . . is likely to be better than this*". Please motivate.

- P.21 L.21. How is the buoy velocity smoothed?

- P.21 ll.26-27. Would the authors support these statements providing an example of non-smoothed velocity?

- P.22 ll.15-16. It would be worth to show an $east - north$ trace of the section, and the projection of the buoy in the section plane.

- P.23 ll.21. Please motivate the sentence:"*...therefore the moment...even better accuracy,...*"

- P.23 l.27. There's no *demonstration* in the paper.

- P.24 l.2. What does the authors mean with "*dm-level*"?

- It would be worth to show some grid in the plots.

- In Fig. 6, variables should report the subscript bd. In the legend of top panel, the red lines indicate $\mu_{bd} \pm \sigma_{bd}$.

- Fig. 8. How are these data derived?

- Fig. 9. How are these data derived?

- Fig. 12. Please, provide a label for the abscissa.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 13743, 2013.