

## ***Interactive comment on “Analytical approach for determining the mean water level profile in an estuary with substantial fresh water discharge” by H. Cai et al.***

**Anonymous Referee #2**

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This manuscript applies an analytical framework to determine the mean water level profile in the Yangtze estuary. The manuscript overlaps significantly with a previous publication by the same authors; therefore, it is unclear to me what is new. In the abstract the authors state that the influence of river flow, tides, and their interaction to the mean water level is not completely understood but fail at showing how the analytical approach yields new insight about this problem. The authors should show the approach is generic across various tidal rivers, or should provide new understanding on the dynamics of river-tide interaction in the Yangtze case.

The abstract is not very informative. The opening sentence is suggestive of a problem

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that is not worth studying. Midway the abstract, the authors speak of a method but it is unclear how this is made possible in practice; the same applies to the extreme frequency analysis.

Beginning of section 2.2, this sentence is not very clear, is this fact or simply expectation?

The manuscript should include an appendix explaining the parameters employed throughout. For instance, how can the dimensionless river discharge ( $\phi$ ) be obtained? What is the range of values  $\phi$  takes on?

In section 2.2, should show the behavior of  $p_0$ ,  $p_1$ ,  $p_2$ , and  $p_3$  as a function of  $\phi$ . That way is easier to compare to Godin's work (by the way, the friction term in Godin's approach is not linear with velocity).

Section 2.3 should state how to arrive at the equation (i.e. by means of neglecting certain terms in the momentum equation).

The approach in equation 19 is prone to error as the uncertainty in any of the terms will propagate upstream.

Section 3.3, it is unclear what the hydrodynamic model is and how calibration is performed. Also, should provide more details about the data used in the paper. Are these gauges vertically referenced? How do you obtain the tidal amplitudes? What is the zig-zag on the amplitudes in Fig. 6 and 8?

Figure 7 is unclear with regards to what is being plotted there. If it contains station data for different stations you should then indicate which stations are there, and display the data with different symbols or colors.

Section 3.4, since the friction term is non-linear, in general, it is not true that average friction over varying tidal amplitudes equals the friction at the average tidal amplitude; Figure 9 suggests so.

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Section 3.5 has little to do with the goal set by the paper. The extreme analysis will be very much dependent on the details of the tide upstream, which is dependent on high frequency harmonics. Since the present approach ignores asymmetries and such other phenomena, its applicability, and particularly the accuracy, cannot be warranted.

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