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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Analytical and numerical study of the salinity intrusion in the Sebou river estuary (Morocco). Effect of the "Super Blood Moon" (total lunar eclipse) of 2015" *by* Soufiane Haddout et al.

Anonymous Referee #2

Received and published: 16 August 2016

This work takes the opportunity to capture the effects from an extreme event (super moon total eclipse). The rarity of this event, in terms of the tidal power, comes from two factors: the moon is at its closest distance to earth (super moon), and the exact line up of the sun, the moon and the Earth (total eclipse). Comparing both analytical and numerical models to field measures taken right during the event gives significance to this work. The results clearly show the power of relatively simple model (1D) and the effectiveness of previously developed theoretical and empirical methods for estimating essential parameter values. Model outputs nicely agree with field measurements during the extreme event, which causes abnormally higher tidal amplitude, etc., demon-

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strating significant salt intrusion which requires attention from the management side. The manuscript has rich contents but need some work to refine.

Major Comments: ————

1. Given that the manuscript focus on the effect of "Super-blood-moon", it is necessary to give a clear statement (perhaps a few sentence) to briefly explain the factors from the "super-moon" as well as the "blood-moon". These are separate events, which coincidently happened together on Sep. 28 2015. The effect on tides from the "blood-moon" comes from the alignment of Sun-Earth-Moon, indicated by the total eclipse. But the effect on tides from the "super-moon" comes from the minimum distance between Earth and Moon, which gives extra gravitational pulling. In this sense, the first paragraph of the introduction should be reorganized to reflect both points, and later in sect. 7 "Total lunar eclipse impact", the first sentence needs to be revised as the eclipse is mismatched with the statement of "a moon closest to the earth". Actually, since lunar eclipse only occurs right around full moon, and supermoon traditionally refers only to new moon or full moon at closest point, the "blood-moon" itself is repetitive concept here - but I guess it is just a minor issue and can be ignored.

2. In Sect.2, the authors provided a detailed, yet lengthy review on the analytical and numerical models. The efforts putting in listing and organizing the derivation of equations are definitely appreciated - it is understandable that keeping track of all the variables must be a difficult task. However, I'm afraid that it is necessary for the authors to provide a nomenclature to make it easier for the readers as well as to avoid errors of giving the same physical parameter two different names (such as Qf and Q, and the one of manning's coefficient pointed out by the other referee). Another request, is to have a definition for each symbol when it first appears in the text, such as "a" in equation (4). Between sect.2 and sect.5, it would be nice to directly refer to the equations in sect.2 by number when discussing the results in sect.5. This is also to make sure that the listing of equations in sect.2 is not too excessive - in fact I think some equations can be removed from the text if they are not directly connected to the

modeling work later.

3. Perhaps I have not fully understood the meaning of "predictive" power of the analytical models - as it seems to me the calibration (and optimization of parameters) is applied to all the data, including the normal tides and the supermoon eclipse. The Levenberg-Marquardt method applied here essentially fit the curves to the measured salinity data. Then the question is: how is this able to provide prediction if it needs to be calibrated for each event (change of tidal amplitude, etc.) using measured data? On the other hand, the authors did a nice job explaining the power of the numerical model, by calibrating the model using only one day of measurements within the 3-day data, and validated the model with the other two days' data. Please at least comment on how the analytical models can apply to other extreme events for which no direct measurements are available. And, a brief comment on the difference between the curves produced from computed parameter values (Eq.8,9) and produced with optimized values would be helpful to further demonstrate the power of analytical models.

4. Following the points above, can the authors expand a little bit on the application to other extreme events? Seems that the effect on salinity change comes from abnormally high tides caused by the celestial event, how would these model be applied to those events? Most importantly, could the authors comment on how and where to obtain the necessary information/data to calibrate the model?

5. This manuscript contains a lot of good work, but the grammar and format need a thorough improvement. A few key things include: - The section/sub-section numbers are wrong, e.g. section 2 starts with subsection 1.2, which should be 2.1 I assume. - The "product" symbol (the dot) in the equations are in the wrong format. Also please be careful to unify the format of all mathematical symbols in the text, e.g. all in italic, etc. - There are too many parentheses in the text - some should be removed and some would read better if the text in the parentheses is re-written into the main text. I point out a few places in the technical corrections below. - Please check up the text carefully in the revision to minimize mis-spelling, etc.

Minor Comments: ———— Page 1, Line 18 The parenthesis around Savenije theory should be removed.

Page 3, Line 26 "downstream" should be replaced by "seaward".

Page 3, Line 27 "where" should be removed.

Page 4, Line 19 The parenthesis around "equation (2.38)" should be removed.

Page 8, Line 17 "hydrodynamic radius" should be "hydraulic radius". Hydrodynamic radius is a completely different concept that describe particles moving through solute.

Page 8, Line 22 Remove ", n is the"

Page 10, Line 21 please provide the source/reference of the bathymetry data.

Page 11, Line 6 "the depth gradually increases", in which direction. Also the same paragraph is confusing to read.

Page 11, Line 9 A comment on how these stations are chosen would be great. Was it for the availability or it has taken into account the best location for model calibration/validation?

Page 11, Line 21 Remove parentheses around "spring tide"

Page 12, Line 11 Remove parentheses around "07th-...2015".

Page 12, Line 29 As pointed out by the other referee, "dumping" should be "damping".

Page 13, Line 15 Please explain the meaning of "predictive uncertainty of these equations" (refer to main comment #3).

Page 14, Line 13-15 The source of data for plotting Fig.13 is unclear - please provide a brief explanation.

Page 15, Line 1 "valided" should be "validated"

Page 15, Line 13-21 These two paragraphs should be merged and remove repetitive

statements. Instead of saying "of a selected system parameter", directly stating "of the dispersion coefficient" and removing the sentence in Line 15 will make the text more streamlined and easier to follow.

Page 17, Line 15 The statement is inaccurate. The impact of eclipse should be coming from the lineup of earth, sun and moon, that Earth is exactly in the middle of the moon and the sun. "supermoon" refers to a moon closest to the Earth, which is a separate event. Although in 2015 the concurrence of the two phenomenon is very rare.

Page 17, Line 16-18 Please give the specifics (describe in words, perhaps a few sentences listing key points) of the "significant impact".

Figure 6 It would be nice to have a scale for the inset figure on the right side.

Figure 9 The symbols in the figures in the center row are very difficult to tell apart.

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