**Responses to comments by Reviewer #1**

(Reviewer’s comments are shown in *Italic*)

**Dear Reviewer #1,**

Thank you very much for your helpful review. We have carefully studied the comments and suggestions and revised our paper accordingly. The following are our point-by-point responses to the general and specific comments. We hope that our responses adequately address the comments. Below is our response to the issues raised in the review.

*The revisions have improved the paper by focusing more toward the prediction of salinity intrusion length, which is perhaps the most significant variable for management and withdrawal purposes.  Of particular interest in the revised writeup are the regressions of salinity intrusion as a function of both flow and tidal range.  However, given that both flow and tidal range appear to be reasonably well correlated with intrusion length, it presents several questions:  (1) would a multi variable regression, which incorporated both driving variables be even more effective at predicting intrusion length? and/or (2) why is flow rate so well correlated with tidal range?*

**Our reply:** Thank you for this comment. Some clarification about this very interesting point:

We know that the salinity varies with both tidal stage and tidal elevation. In a tidal cycle, salinity is at a maximum at approximately the time of high slack water and at a minimum at approximately the time of low slack water. When sea level, or mean tidal elevation, is high, salinities are greater than when sea level is low. Changes in the physical shape of the estuary also cause changes in the discharge-salinity relation. The movement of salinity in the estuary is the result of a mixing process controlled by tidal movement. Both correlations equations showed in this paper (flow rate and tidal range) indicate that the salinity intrusion length is very sensitive to flow rate (or tidal range) variations.

In our policy management a rapid estimation of intrusion length is searched by managers. The both regression equations can estimate the intrusion length and river discharge (or tidal range) quickly and simply, which provide a decision-making basis for quick response to deploy the corresponding preventive measures to minimize disasters when the salt intrusion happened. In a first consideration, it cannot be better than equation incorporated both driving variables. Also, from our view point, it is methodologically correct to start with the simplest description of the phenomena under study and to evaluate the limits of this approximation before investigating more complications. On the other hand, these sample predictive equations is an effective tools to analyze the salt intrusion length and freshwater discharge (or tidal range) in Sebou region. And each one can be applied for specific management purpose (e.g., in tidal zone is difficult to estimate the flow rate).

In terms of accuracy the correlation coefficient was greater than 0.9 in both cases. A multivariable regression, which incorporated both driving variables ***(L=g(Q, H)***) be even more complicated at predicting intrusion length if data of one parameter is not available, or not well estimated. Additionally, we agree with Reviewer comment we can propose an equation for the salinity intrusion length based on multivariable regression and we think will be effective at predicting intrusion length.

A simple function that can consider is the variability of the governing parameters assuming constant depth, roughness, tidal period and density difference is as follows:

 (1)

Equation (1) may be reduced in terms of a set of dimensionless parameters as:

 (2)

A power law form of equation is as follows:

 (3)

where a is the coefficient and b and c are the exponents of the equation (You can obtained by a nonlinear multivariable regression) , h is the depth, and A is the cross-sectional area. This power law form is also supported by the previous findings (e.g., Prandle 2004; Zahed et al. 2008).

*-Prandle D (2004) Saline intrusion in partially mixed estuaries. Est Coast Shelf Sci 59:385-397.*

*-Zahed F, Etemad-Shahidi A, Jabbari E (2008) Modeling of salinity intrusion under different hydrological condition in Arvand River Estuary. Canadian J Civil Engrg 35:1476-1480.*

*In addition to these technical questions, I feel the paper still contains some gaps in attempting to recast itself as a management paper.  A more informed discussion of the importance of good predictions of salinity intrusion to management practices, local economics, etc. would be essential to demonstrate the value of this approach.*

*Overall, I believe that the paper is improved, but still requires a more focused and detailed discussion of current management practices (including current management challenges) and how the proposed algorithms could enhance management techniques in the future, by addressing the defined challenges.  A strong discussion along these lines would move the manuscript well towards acceptance for publication as a management focused contribution.*

**Our reply:** We would like to thank Reviewer#1 for their comments.

**This part is integrated in revised MS.**

**Water resources development and management**

Water resources are necessary for the development of human societies. This development, mainly in the industrial and agricultural sectors, increasingly affects these resources at many levels. Lack of water is considered as a limiting factor of socio-economic development of a country. A major objective is to establish policies for sustainable management and governance rules of water resources so as to ensure their durability. In Morocco, conventional water resources are very limited and irregular. The consequence of population and economic growth, accentuated by an increased variability and scarcity of water resources, is the growth of requirements for the quantity and quality of water, their more intensive and comprehensive use. The emphasis in Moroccan development planning has been for the last five decades on maximizing the capture of the country’s surface water resources and providing for their optimal use in irrigated agriculture, potable water supplies, industrialisation and energy generation on a sustainable basis. Additionally, in this planning imposes to look for other water resources, not yet exploited, as water available in Moroccan estuaries. Estuarine water is constantly influenced by salinity coming from the ocean. On the other hand, estuaries are complex hydro-systems whose management needs information on several scales, as we will see through the study of the Sebou estuary. This area is a coastal zone with an important agricultural and is becoming one of the most important industrial zones in Morocco. Additionally, this estuary supports industrial practices (At Kenitra City) and navigation activities. Water is diverted for irrigation purposes mainly for peanut production in the upper course of the Sebou estuary. However, high water salinity limits the development of these activities. Therefore, determination of the salinity distribution along this estuary is the main interest for water managers in Morocco. Also, it is methodologically correct in management context to start with the simplest description of the phenomena under study and to evaluate the limits of this approximation before investigating more complications.

Meanwhile, this paper provides simple equations (i.e., vertical average salinity and intrusion length) that are useful to provide ﬁrst estimates of intrusion length and vertical average salinity (at Kenitra station) in the Sebou estuary, which can be obtained by a simple desk study without the use of every measurements day; and as a starting point in many management projects in Morocco relating to recreational, agricultural, commercial activities, and safe water supply. Additionally, these formulas are completely transparent and practical, allowing direct assessment of the parameters (i.e., flow rate and tidal range) on the salt intrusion. For example, as long as we get the data of the discharge at upstream of the estuary and salt value at the river mouth, the length of the salt intrusion can be calculated by power-law regression equation for the discharge-salt intrusion relationships. On the contrary, according to the length of salt intrusion, the minimum daily discharge to prevent the salt water can be predicted. The regression equations can estimate the salinity intrusion and river discharge (or tidal range) quickly and simply, which provide a decision-making basis for quick response to deploy the corresponding preventive measures to minimize disasters when the salt intrusion happened. These sample predictive equations is an effective tools for water resources development in this area; and to assist the future management plans.

***Thank you very much for your consider review of our manuscript.***

***Affectionately, The authors***