

Dear Anonymous Referee#2,

We are very much grateful for your valuable and fruitful comments to improve our manuscript (hess-2017-76). The referee comment is given in blue font and the answer in black font.

1. The method presented is based on the salt intrusion theory for a “normal” estuary and missed an essential physical process in a salt plug estuary, i.e. evaporation. Without evaporation the inverse salinity gradient in a salt plug estuary cannot be generated. Evaporation has the effect that the residual discharge Q is no more constant along the estuary and will even turn it to be landwards directed in the part with inverse salinity gradient. In the manuscript Q is presented as constant along the estuary. This means that the results from the analysis cannot be used, especially for dry season. I would recommend the authors carrying out the analysis again after determining the spatially varying Q (residual discharge) by taking into account evaporation and precipitation.

Answer:

The salt pug results from strong evaporation in tropical estuary. However, the salt plug in our study area does not result from the evaporation but from the intrusion of saline water from a tributary (Shaha and Cho, 2016).

The changes of salinity by evaporation and precipitation are negligible in our estuary. The evaporation rate (e) in the salt plug area ($A \sim 40 \text{ km}^2$) of the Pasur river estuary (Shaha et al., 2017; Shaha and Cho, 2016) is ranged between 0.02 and 0.04 cm day^{-1} in the dry season (Fig.1) with a minimum value of about $0.025 \text{ cm day}^{-1}$ in wet season (August). This yields an estimated loss of water by evaporation ($E=eA$) (Ribbe, 2006; Wolanski, 1986). The river discharge is greater than the evaporation loss in the salinity maximum zone (Fig. 2 and 3).

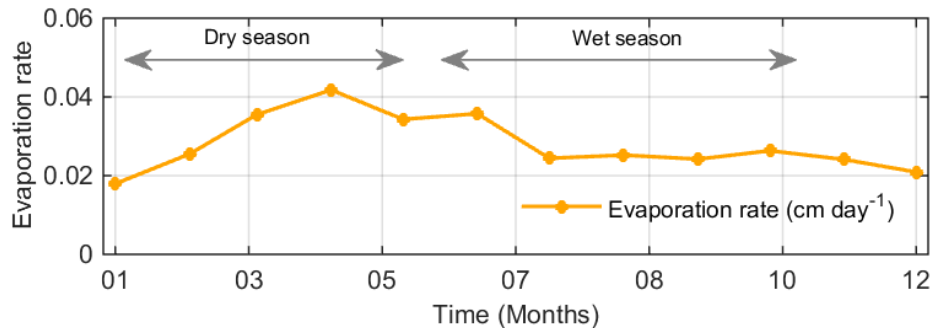


Fig. 1. Monthly average evaporation rate (e) from the year 2013 to 2014.

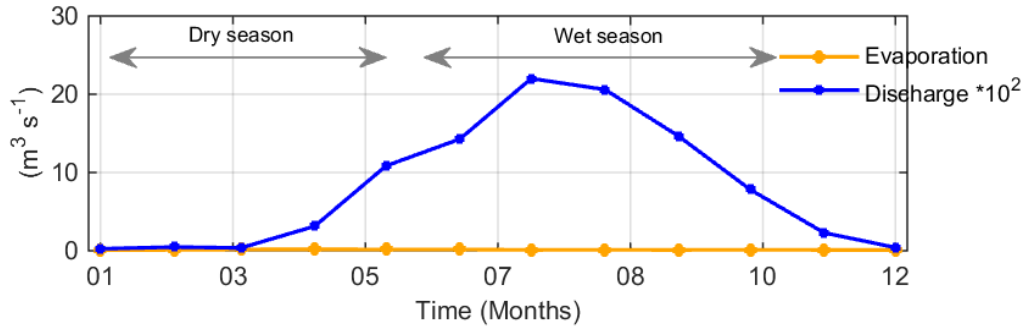


Fig. 2. Monthly average Evaporation (E) from the year 2013 to 2014.

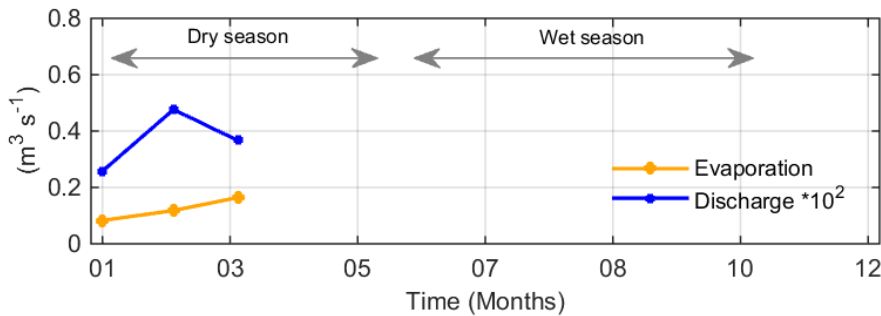


Fig. 3. Monthly average Evaporation (E) for the dry season. The volume of river discharge is larger by about 300 times than the evaporation during the dry season.

2. On line 84 just below Eq. (3), the expressions between brackets are fluxes, and not dispersion coefficients as suggested.

Answer:

D_t is horizontal diffusive (=tide driven) dispersion (Savenije, 2005, Eq. 4.31, Page no. 134).

We will correct it in the revised version.

3. Why is S_0 instead of $S(x)$ used in Eq. (4)?

Answer:

This is a typo. This will be corrected in the revised version following Shaha and Cho (2011).

4. What is the motivation from Eq. (6) to Eq. (7)? The authors refer to their paper in (2011), but I could not find the motivation in that paper either. That there seems to be a paradox with the relation between K and (resulting is $K > 1$) was already pointed out by Savenije (2005). Using the exponential function of indeed solves the paradox, but what is the rationale behind this solution?

Answer:

Savenije (2005) showed an equation $K=I/v$ (page 135, below eq. 4.33). We first calculated $v(x)$ from Eq. (4) and then calculated K from Eq. (6). Prior to this calculation, K was calculating using a predictive equation 5.71 (page 169, Savenije 2005) which is constant value along the estuary. In addition, the K values calculated from Eq (6) does not lie between 0 and 1. If we use an exponential function with the proportion of tidal dispersion to total dispersion following the theory of McCarthy (1993), we can limit the range between 0 and 1 as well as the values express the relative contribution of salt transport mechanism (Savenije, 2006) along an estuary. For example, (Shaha and Cho, 2011) found a spatial variation of different salt transport mechanisms in the Sumjin estuary where the salinity varied from 31 psu at mouth to 1 psu at 25 km upstream from mouth with a salinity gradient of about 1.4 psu km^{-1} .

5. I wonder why the authors do not just determine K directly by first determining $D(x)$ from $S(x)$.

We first determined $D(x)$ to calculate $v(x)$ using Eq. (4). As the equation $D(x)$ has shown after Eq.(6) and it makes confusion to reader, we will revise it in the final version and put it after Eq. (4) to avoid this confusion.

References

- Ribbe, J.: A study into the export of saline water from Hervey Bay, Australia, *Estuarine, Coastal and Shelf Science*, 66, 550-558, 2006.
- Savenije, H. H.: Comment on “A note on salt intrusion in funnel-shaped estuaries: Application to the Incomati estuary, Mozambique” by, *Estuarine, Coastal and Shelf Science*, 68, 703-706, 2006.
- Shaha, D. and Cho, Y.-K.: Determination of spatially varying Van der Burgh's coefficient from estuarine parameter to describe salt transport in an estuary, *Hydrology and Earth System Sciences*, 15, 1369-1377, 2011.
- Shaha, D. C., Cho, Y.-K., Kim, B. G., Sony, M. R. A., Md, S. R. K., and Islam, F.: Spatiotemporal Variation of Van der Burgh's coefficient in a salt plug estuary, 2017. 2017.
- Shaha, D. C. and Cho, Y. K.: Salt Plug Formation Caused by Decreased River Discharge in a Multi-channel Estuary, *Scientific Reports*, 6, 2016.
- Wolanski, E.: An evaporation-driven salinity maximum zone in Australian tropical estuaries, *Estuarine, Coastal and Shelf Science*, 22, 415-424, 1986.