

Interactive comment on “Determination of spatially varying Van der Burgh’s coefficient from estuarine parameter to describe salt transport in an estuary” by D. C. Shaha and Y.-K. Cho

Anonymous Referee #1

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In this paper, the authors advocate an extended use of Van der Burgh’s coefficient by

- relating it to the estuarine parameter ν ;
- allowing for spatial variations of K

There is no doubt that this objective is interesting. However, there are some theoretical issues that need to be clarified first.

The first issue is that a clear definition of K must be given. It is clear that multiple interpretations of K can be made in various simplified contexts. In order to go further

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and extend its use, a basic definition must be provided. Is K **defined** by (1), *i.e.*

$$\partial D \partial x = K Q A \quad ?$$

Is it defined using (7), *i.e.*

$$\left(\frac{D}{D_0} \right) = \left(\frac{S}{S_0} \right)^K$$

or as the ‘relative weights of the tide-driven and density-driven mixing mechanisms’ ? In order to be able to extend the use of K , a definition independent on the particular geometry must be given. This is not the case. Such a definition can perhaps be found in Savenije (2005), but, for all those who do not have access to this reference, it remains a mystery.

Also, such a definition must be provided in order to justify the alleged acceptable range of 0 to 1, which seems also to be enforced by equation (6). As such, I do not have any clue about why K should lie in this interval. In particular, while I understand that large values of K are associated with a dominance of density-driven transport, I cannot rule out the possibility of having $K > 1$.

The estuarine parameter ν has such a clear definition, it is the ratio of the upstream tidal diffusion flux to the total upstream flux (tidal + gravitational advection). The definition has been extended as spatially variable coefficient in a previous publication by the same authors.

Now, equation (5) introduces a strong relationship between K and ν . This relation has no theoretical justification. The hypotheses are unclear and the value of K computed in that way does not add any additional information that was not already known from ν . In that respect, the figures 3-5 just repeat in a different way the results already published in Shaha et al. (2010). Also, the fact that spatial variations of ν would provide a better description of the transport in the estuary translates here in terms of K . So what’s the point ?

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Two last minor comments. It is really confusing to read (around eq. (2)) that ν is 'the proportion of the diffusive upstream salt flux associated with tidal dispersion to the total salt flux advected seaward with the river discharge'. The estuarine parameter ν must be defined as the ratio of the upstream tidal dispersion flux to the total upstream flux, including the transport by gravitational circulation. Also, the expression "total dispersion" should not be used to refer to the upstream transport by tidal dispersion and estuarine gravitational circulation. The latter is basically an advection process.

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