We would like to thank referee #1 for his insightful comments and the positive feedback, which we have received. Below we reply to the comments in detail.

1. About the maximization or minimization of the power.
   It is a very relevant question whether dP/dD maximizes or minimizes the power. Within the community that tries to apply thermodynamic principles to the Earth system there is also debate whether some sub-systems operate at maximum or minimum dissipation. Moreover, in this case, it is not so easy to determine whether the extreme is a maximum or a minimum. The second derivative of the power (i.e., salinity gradient, as in equation (9)) with regard to the dispersion coefficient $\frac{\partial}{\partial D}\left(\frac{\partial S'}{\partial D}\right) = \frac{1}{D'}\left(\frac{S''}{D'} - \frac{S'D''}{(D')^2} + \frac{S'}{aD'} - \frac{(S-S_f)D''}{a(D')^2} - \frac{S'}{D} + \frac{(S-S_f)D'}{D^2}\right)$ appears to equal zero when $\frac{dP}{dD} = 0$, and this is the same for the third and fourth derivative. So it is a pity that we can't reply to the comment by a mathematic approach.

   However, it is believed that whether a sub-system tunes to maximum or minimum power depends on the degree of freedom in the system. It is assumed that when the degrees of freedom are limited, a sub-system operates at minimum dissipation, but when the system has a large degree of freedom, such as the mixing in estuaries where a myriad of different mixing mechanisms are at play, the power is maximized. Whether this is correct is not certain, but intuitively it appears reasonable. Mixing of fresh and saline water increases the entropy of a system. In an estuary there are many degrees of freedom to that effect. The salinity gradient can be depleted by gravitational circulation, tidal trapping, tidal pumping, tidal shear, and ebb and flood channel shear. These mechanisms are dominant in different parts of the estuary and at different times, but also overlap. Surprisingly, the constellation of these different mechanisms appears to function as if there was only one mechanism at work. It would not be logical that the combination of different mechanisms, all contributing to mixing, would minimize the mixing of salt and fresh water. If there is an extreme, then it should be the maximum.

2. About the kinetic energy of the river water.
   The kinetic energy of the river water lies outside the saline domain. In alluvial estuaries, the contribution of the river flow to the tidal dynamics is minor, particularly in the saline region during low flows, when well-mixed salt intrusion occurs. In the domain of interest, the kinetic energy of the river is minor. Further upstream, where the estuary becomes riverine, there can be a residual backwater, where kinetic energy is absorbed by friction, but in the saline area, this contribution is negligible compared to the kinetic energy of the tide. The kinetic energy of the tide, in turn, is dissipated by bottom friction. The exponential shape of alluvial estuaries is a manifestation of this. In the so-called ideal estuary (with exponential width and no bottom slope), the tidal amplitude is constant along the estuary axis and there is a balance between amplification due to convergence and dissipation due to friction. As a result, the kinetic energy per unit area and the dissipation of kinetic energy per unit area are equally distributed over the estuary.

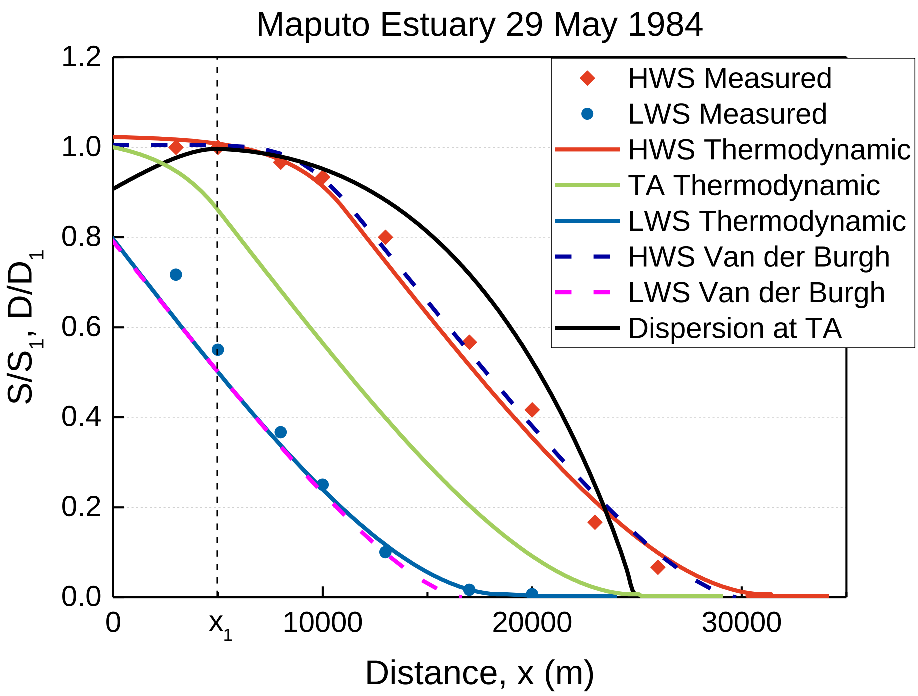
3. About the step from equation (9) to (10).

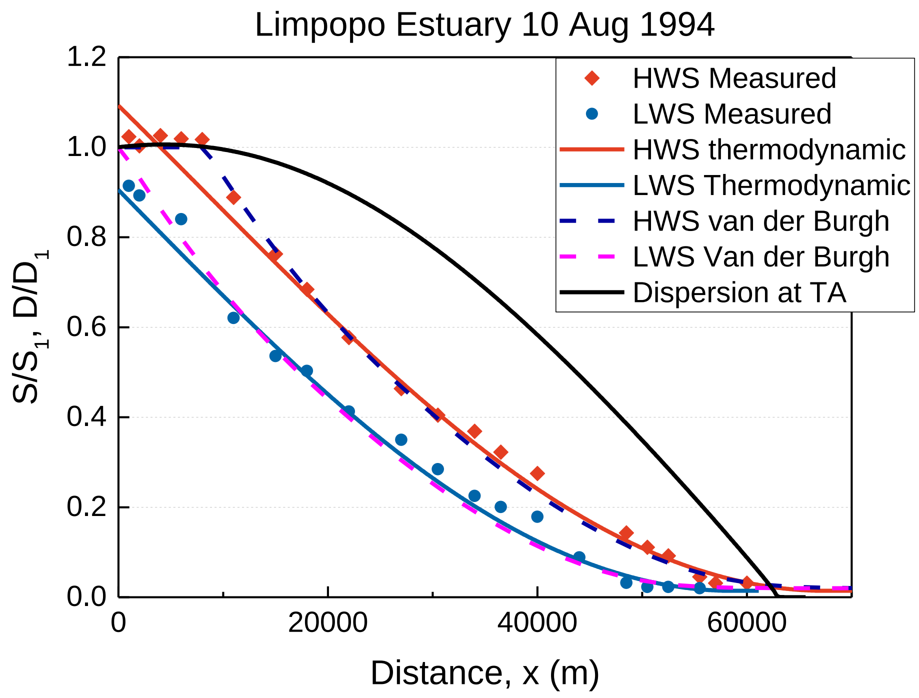
The parameters (i.e. A, D, and S) in this research are all tidal-averaged, and they are a function of x only. The chain rule then implies that $\frac{dA}{dD} = A'/D'$

About the example the referee mentioned, $\frac{\partial A}{\partial \eta} \neq \frac{A'}{\eta'}$ because $\frac{dA}{dx} = \frac{\partial A}{\partial \eta}\frac{d\eta}{dx} + \frac{\partial A}{\partial x}$.

About the suggestions made. In the salinity intrusion area (see the supplement of the compilation of the geometry), the depth may increase or decrease slightly, but is constant in most cases. So we think it is proper to use a flat bottom.

Below we present the comparison between the new thermodynamic model and the previous Van der Burgh model (Zhang and Savenije, 2017) including the longitudinal variation of $D(x)$ for the Maputo and Limpopo estuaries. In the Maputo the boundary condition lies at $x_1 = 5000$ (m) and in the Limpopo at $x_1 = 0$.





The values of *R square* after the regression between the simulated salinity and observations are:

Estuary	Thermodynamic	Van der Burgh
Maputo	0.98896	0.98978
Limpopo	0.99331	0.99145

As we can see, the thermodynamic equation works equally well, or even a bit better, than the previous model with a constant Van der Burgh coefficient.