Review of revised manuscript: **Inference in hydrology from entropy balance considerations**

Although this is officially a revised manuscript, the content is so different from the initial one that I will review it as being a first submission.

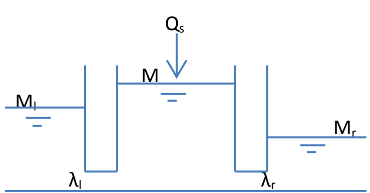
In this paper the author shows how the entropy balance can be used for inference of macroscopic fluxes and forces by knowing the microscopic fluxes and forces. This has been illustrated by a couple of examples of increased complexity for groundwater flow of which the boundary conditions are known. This an interesting approach, but I do have some doubts about the usefulness of the method, which have to be clarified before publication:

The main approach of the author is basically that in steady state, the internal entropy production σ equals the entropy current. Here is $\sigma = \sum qf$ and the entropy current is given as JM where q and f are the microscopic flux and force and J and M the macroscopic flux and force. In the whole analysis, the author assumes that q and f are known (and/or retrieved) for each 'grid cell' by running a detailed groundwater model. This may be true for homogenous lab setups, but in the field this is not true at all. First of all, there are only limited measurements of the soils permeability, while macroscopic structures such as macropores or other preferential flow paths are not included in the permeability measurements. I would even argue that in practice, the macroscopic force and macroscopic flux are measured, which can subsequently be used to infer the microscopic parameters (which is done by calibrating a model). Since this is generally an ill-posed problem, I do not immediately see how the method described in this manuscript is useful.

For the following, I assume – just as the author – that q and f are known everywhere in the model domain. I remain with mainly some suggestions to clarify the manuscript a bit more:

1) I fully agree with the statement in line 303-308. However, I suggest to move this part to the end of example 1 (personally, I was a bit annoyed after reading example 1 (and before I read the statement in line 303-308) because λ could be obtained in a much easier way here).

2) It may be helpful for the reader to add next to each example (figure) another one to show the macroscopic model concept. For Fig. 4 it may be a figure looking like:



3) Due to the many different parameters, the formulas are sometimes difficult to follow.

- I suggest to repeat the meaning of the parameters every now and then
- Is it possible to skip a couple of parameters? E.g. instead of using S_i', always use $\int \sigma$ or $\int \sum qf$?
- use $\frac{1}{x}$ instead of x^{-1}?
- is the macroscopic mass change rate Θ' the change of mass over time? And what does Θ represent in Eq. 36a?

4) Line 279: "S' and can be": a symbol is missing.

5) Line 59-61: I wouldn’t say it is interestingly that those studies calculated the entropy exchange with the outside instead of calculating the internal entropy production. They rather used a different approach to obtain an effective macroscopic conductance, namely, assuming that entropy production is maximum.