Analytical solutions for the advective-diffusive ice column in the presence of strain heating, Moreno-Parada et al.

This is a significantly different manuscript to the previous version, so my comments are starting afresh. As a general note, the paper is over-long, and if the editor's decision is another round of revisions, would benefit from a full re-write with a more systematic layout and less repetition in both set-up and description of results.

In this work the authors calculate some steady states and some examples of the time-evolution of a temperature profile in a column of ice, subject to imposed profiles of vertical advection and, at times, internal heat sources and/or surface insulation.

I am not sold that this study is novel or valuable. In part this is because the structure of the paper, in particular the introduction, makes it difficult to understand what precisely is being done in this work, and where the gaps in the literature previously existed. As I understand it, the manuscript claims three points of distinction from previous work: considering surface insulation and internal heating (i.e. different forcing for the advection-diffusion equation, and dropped in section 6 - I don't feel this is enough for a paper unless the output is notable), including time-evolution (unclear from both the introduction and analysis if this would have much impact on realistic ice sheet dynamics, and only included in section 5), and sticking to analytic solutions of a highly simplified model.

By seeking analytical solutions (although the calculation of the eigenvalues, and the evaluation of the constituent functions must be done numerically, so it is more semi-analytic), the authors claim to avoid having to assess the 'accuracy and consistency' of numerical models. However, by limiting to solutions in 1D where analytic results can be obtained, they are also in a regime where numerical solvers for advection-diffusion equation have been validated for decades. I do agree that analytical results have value, e.g. for easily extracting characteristic timescales as functions of parameters, but this has not been done and instead the work presented here, inspecting the solutions by eye, could have been based on purely numerical results with no difference in the discussion. I think this speaks volumes to the lack of real depth in the analysis.

I won't make too many specific points about the analysis as I feel my concerns are broader, but some illustrative examples:

- Around l.255 it is stated that there are two different timescales visible in the results. One way to quantify this would be to relate these timescales to the different eigenvalues (which are the exponential decay rates). This is not done.
- Figure 5 is just thrown in to the mix with no attempt to explain the trends. In general there is no quantification of results based on the dimensionless parameters, only demonstration of output.
- Figure 6 claims to show a favourable comparison to the EISMINT results for $m = 1.5$. I would expect to see the EISMINT results actually plotted on the same graph.

I also have major concerns about the set-up of the equations:

- The idea of upwards advection (from ice being created at the base?) is unreasonable, yet presented throughout as though it is one of the two equally plausible regimes.
- The strain-heating term dependent on u_x should, by the incompressibility of Stokes flow, also be expressible in terms of w_z - a quantity which is explicitly calculable from the vertical advection profiles $w(z)$ - yet is instead taken as constant throughout the paper and then is neglected completely in section 7, when w_z varies in depth.

- There is no reason why advection of temperature should appear as a uniform source term in this model (the paper cited depth-integrates variables, but the present manuscript only considers the vertical structure, which depth-integration wipes out). Gratingly, in the discussion section the authors extol their inclusion of horizontal advection.
- Please stop calling the surface boundary condition 'sophisticated' - it's not that exciting.

Finally, there are consistent spelling and grammatical errors throughout the manuscript, and the discussion section needs editing for clarity.