Geoscientific
Model Development
Discussions

Interactive comment on "Evaluation of oceanic and atmospheric trajectory schemes in the TRACMASS trajectory model v6.0" *by* Kristofer Döös et al.

Kristofer Döös et al.

doos@misu.su.se

General comments

1. As detailed here, and in the earlier literature, the TRACMASS approach performs an analytic integration of the trajectory within a grid cell. This point is emphasized in the present manuscript. Importantly, this integration is enabled by an **assumption** that the subgrid scale velocity components are linear functions of their corresponding directions: [u(x), v(y), w(z)]. Surprisingly, this critical assumption is not explicity noted in the present manuscript. It should in fact be emphasized and defended.

How/where will it break down? As written, words such as "the trajectory solutions are exact" (pg 5, line 10) make it look like TRACMASS is performing magic. Instead, it is following an exact treatment based on the assumption of subgrid [u(x), v(y), w(z)].

Answer: We have added a few sentences on this in the first paragraph of section 2 and section 2.2 to better highlight this key assumption. We agree that the use of the word "exact" may mislead readers, and have rewritten a few sentences such as p5, line10 to emphasise that the trajectories are solutions to a differential equation, and that there is nothing magical about it.

2. The differential equations for the position within a grid cell are given by equation (17) for the stationary case, and equation (26) for the time-dependent case. Both equations are offered to the reader as if they should be an obvious consequence of something a priori. However, both equations need more build up to motivate and rationalize. The only statement to suggest where equation (17) comes from is line 19 on pg 5: "The transport and position within the grid box are now related by U = dr/dx...". However, this is a statement that offers no motivation nor a derivation. What is the basis for this relation?

So as written, equations (17) and (26) seemingly appear from no where, and the reader is left scratching his/her head. Sans shared intuition, these equations remain mere black boxes to the reader, which is of no use to the reader.

Answer: We have rewritten the first paragraphs of section 2.2 (stationary scheme) and 2.4 (time-dependent scheme) to better lead up to the differential equations that we use to calculate trajectories. We hope this is clearer to the reader.

3. At the end of Section 2, I found myself wanting to see a clear schematic to summarize the stationary method and the time-dependent method. Likely these schematics appear in the basic literature. But given that you are rederiving the methods here, it would serve the reader well to have such schematics presented again, perhaps in an updated manner. These schematics could offer far more conceptual understanding than the maths presented in Section 2.

Answer: A very good point and we have both added a paragraph at the end of section 2 and a figure, summarising the resulting differences between the schemes within a time-space cell.

4. The word "this" is used many placed without qualifying. The reader is often left wondering what "this" referes to. Please be more careful with letting the reader know what "this" refers to. It is important to do so in order not to lose the reader, especially the novice.

Answer: We have rewritten a number of sentences in order to remove "this".

Minor comments

- page 1, line 24: perhaps good to define what"s meant with a "grid cell" here. A model grid cell?

Answer: Yes and we have now written "model grid cell".

C3