Geosci. Model Dev. Discuss., 8, C155–C157, 2015
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Geoscientific Model Development Discussions
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Interactive comment on "An updated interparcel mixing algorithm in the Lagrangian advection scheme with shape matrix (LASM) v0.2" *by* L. Dong et al.

Anonymous Referee #2

Received and published: 13 March 2015

1 General comments

The paper describes some interesting updates of the Lagrangian LASM transport scheme, which was introduced in Dong et al. (2014). It is (correctly) argued that interparcel mixing must be introduced in fully Lagrangian models. The main update of the scheme as compared to the original LASM is a modification of the inter-parcel mixing. One could have hoped that the updated mixing was derived from more physically based arguments than in the original LASM. However, I have troubles to see that this is generally the case. There seems to be a number of parameter settings that a set on an ad-hoc basis.

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Another major issue is the cost of the scheme and in particular the cost of identifying the computional grid (or procedure) needed to perform the interparcel mixing. How can this parallelize on modern computers? How is the multi-tracer efficiency? A discussion of these issues is requested.

Regarding parcels: It is stated that the neighboring parcel shapes are unaffected by the mixing with them. But from a physical point of view one should expect that any mixing will tend to make the shape of the neighboring (as well as the actual) parcel more isotropic, i.e., the shape is actually influenced by the mixing.

A mass fixer is introduced. It should be discussed in a little more datail how this works. I presume it is only relavant for the Eulerian representation (i.e. on a regular grid) and not in the Lagrangian space of the parcels?

Finally, the English should be improved considerably.

2 Specific comments

Page 767, Line 10: "... except for the global mass fixer on the mesh". This comes a little abrupt since the reader has not yet been informed about any fixer. It is proposed to change to "... except for a global mass fixer on the Eulerian mesh"

Page 767, Line 10-20:It is unclear why a mass fixer in the grid representation is influencing the mass in parcel space. Couldn't one just fix the mass in Eulerian space without affecting that in parcel space. Or maybe I misunderstood. Please explain in more detail.

Page 768, Equation (9): This transition equation should be moved down after the present Eq. (11).

Page 768, Line 20: "...with the deformation scale, ..." Please explain or define.

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Page 769, Line 5: "... spherical distance on the sphere ..." change to "... spherical distance ..."

Page 769, Line 19-20: "... and respects the local flow properties". But the ATTILA mixing also respects local flow properties in terms of local deformation rate?

Page 770, line 5: "...along the vertical direction." I guess you mean "... along the orthogonal direction." (i.e. orthogonal to the major axis)

Page 770, line 11ff: The re-shaping takes place after the mixing, and is independent of the degree of actual mixing. But what if no or insufficient mixing has actually occured for parcel i because there were no or only rather distanct neighbors. Then the parcel is re-shaped (to be more circular) even without being mixing. This seems physically inconsistent. If no mixing has taken place the physical parcel should keep its irregular shape until it can actually be mixed.

Section 2.2 in general: it could help with some drawings explaining intuitively how the mixing works.

Page 772: Section 2.4 should be moved down before section 4, as a kind of additional outlook discussions section. The section should not be included, however, in its present form since it is just a wish-list. Some specific formulations and ideas, including potential issues, must be included if this section should survive.

Page 773: The $gamma_m$ value of 5 is apparently chosen on an ad-hoc basis. Such a large value implies that the domain of influence of a parcel is also large.

Page 774, lne 15: It is unclear what is learnt from the right panel in Fig. 4. It could be deleted.

Interactive comment on Geosci. Model Dev. Discuss., 8, 761, 2015.