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Interactive Comment

Interactive comment on "Technical note: Recursive rediscretisation of geo-scientific data in the Modular Earth Submodel System (MESSy)" *by* P. Jöckel

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Many thanks to Sebastian Rast and the two anonymous referees for their constructive comments. I appreciate much that all three asked for more mathematical precision. In the following I address the suggestions one by one:

1. S. Rast, Eq. (22) and Referee 1, 4680/16: I completely agree and revise the formulation to "...whereby the bullet (•) indicates the multiplication of the sub-matrix elements P_{n_i,m_i} corresponding to the vector indices $\vec{n}$ and $\vec{m}$."

2. S. Rast, section 2 and Referee 1, 4675/24: The first paragraph of section 2 is completely revised following the suggestions of Referee 1. For this I need to

introduce some more symbols, since the suggestions of Referee 1 are still not entirely correct. It is important to distinguish between "domain" and "grid". It is now mathematically more precise, however, probably less readable.

3. S. Rast, measure: The measure is indeed the Lebesgue measure. This is added in the revised version.
4. Referee 1, 4674/20: It is not a "convex combination of hybrid levels", since $h_a(i) + h_b(i) \neq 1$.
5. Referee 1, 4677/9-14: Indeed the proper mathematical proof is induction. A note is added in the revised version.
6. Referee 1, 4679/16: The formulation is probably misleading. The point here is simply that the codomain of F is a subset of $\mathbb{Z}$ instead of $\mathbb{R}$. This is changed in the revised version.
7. Referee 2, section 3: The point is that the analysis in section 2 is valid for all kind of possible grid-decompositions, independent of the specific *shape* of the "grid-boxes" (note that I replaced "form" by "shape" in the revised version to make this clearer). In practical cases, however, the grid-boxes are mostly rectangular boxes and the overlap fractions along the orthogonal axes can be calculated separately for each dimension. The multi-dimensional overlap fraction between two grid boxes can then be calculated recursively, whereby the algorithm to calculate the overlap calls itself as long as neither the overlap fraction along one dimension gets zero, or the dimension k is reached. Some more information on the implementation can be found in the electronic supplement. In the revised version the text is changed slightly for clarification: I added "...since then the overlap calculation can be separated into a multiplication of 1-dimensional interval overlaps along the orthogonal axes." and changed "the algorithm is called" into "the algorithm calls itself".

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8. Referee 1, Referee 2, Comparison with alternative methods: I am not aware of the documentation of similar rediscretisation methods in the peer-reviewed literature. Unfortunately Referee 2 was not very specific about what she/he meant with “mass conserving regridding of emissions”. Here, I would have appreciated very much a reference.

   Therefore in the “Conclusions” section of the manuscript, I only compare the presented “rediscretisation” method with standard point-to-point interpolation methods (such as for instance linear-, bilinear-, or spline-interpolation methods). The point-to-point interpolation methods have 3 major drawbacks: First, they are strictly speaking only applicable for intensive quantities; second, the result depends on the chosen interpolation method (e.g., the order of the interpolating polynomial); and third, they do by construction not necessarily conserve integral moments of the distribution. In contrast to this, the presented algorithm is applicable to intensive and extensive quantities, it is unambiguous, and it conserves integral moments.

   For clarification, in the revised version the “Conclusions” section is slightly extended, and a reference (Numerical Recipes) for the point-to-point interpolation methods is added.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 4673, 2006.