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Interactive comment on "An online emission module for atmospheric chemistry transport models: Implementation in COSMO-GHG v5.6a and COSMO-ART v5.1-3.1" *by* Michael Jähn et al.

Anonymous Referee #2

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The paper describes a new strategy for anthropogenic emissions management in chemistry-transport models. This strategy seems, in its principle, applicable to any CTM, but the processing tool proposed by the authors has been applied to two COSMO extensions (ART and GHG) but, as the authors acknowledge, would need additional work to be really usable with other CTMs. Their strategy essentially consists in splitting the emission processing in two steps, with horizontal redistribution performed offline, and vertical and time redistributions performed online, by the CTM itself.

The authors present essentially one python preprocessing module, emiproc, which performs essentially horizontal redistribution of the emissions from three types of invento-

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ries onto COSMO (rotated) lat-lon grids, and the developments they have performed inside COSMO to enable online calculation of emissions. They convincingly show that the results of their model is not affected by this new approach.

Their manuscript is clear and very well written even though some points lack explanations. It contains no scientific novelty (nor does it pretend to do so), but in my opinion the methodology they propose and implement is clearly valuable and interesting for other teams and needs to be published.

I have four comments that in my opinion need to be adressed before publication.

1. The authors do not explain how they take into account the distinction between land and sea. No discussion is provided on that point. Lines 11-12, p. 6 suggest that the emission for any, possibly coarse, cell of the input inventory will be assumed to be evenly distributed within this cell, and thereafter evenly redistributed between all the intersecting model cells according to the intersection area. In the common case when model cell is smaller than inventory cell, this would lead to emissions of a clearly continental nature (e.g. traffic, residential heating) ending up in part in purely oceanic model cells, and shipping emissions ending up in part in purely continental cells. The authors should either explain how they avoid this problem, or acknowledge this point as a serious limitation of their tool that needs to be adressed in its future versions.

2. Similar to point 1 (but less hindering), accounting for landuse differences to have a meaningful distribution of emissions among model cells is also possible (e.g. the emiSURF emission preprocessing tool described in Mailler et al., 2017, "CHIMERE-2017 : from urban to hemispheric chemistry-transport modeling"). From a computational point of view this would be the same as accounting for land/ocean difference, but less critical. If the inventory is, e.g., 10x10km, one inventory cell could very well contain one area with forest and one city, and taking this information into account when generating emissions at the, say, 1x1km resolution of the model is clearly useful. Same as for point 1., if this is done the authors should explain how, and if not they should

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acknowledge this point as a limitation compared to other tools.

3. I can take the word of the authors that it does not generate major errors, but the areas in square degrees are not really convincing. An "area" in squared degrees is not an area, and is not even proportional to the geometric area (that would depend on the orientation of the considered area, zonally or meridionally elongated). It would probably not be more difficult to work with real geometric areas on a sphere. The meaning of an area in squared degrees in really unclear to me, in particular if either the inventory or the model grid is not a regular lat-lon grid. What is a square degree close to the pole for example ? I feel unconfortable with this point which more or less prevents a clear and physical writing of the equations for horizontal redistribution of the emissions, which are the key points of the tool they propose. In my opinion, the code should be slightly modified to deal with real geometric areas in squared meters.

4. The country-dependance of time profiles is mentioned in the text but not in the equations. As a consequence, the management of cells that are at the border of two or more countries is not really made clear : does teh CTM have, for these cells, yearly amount of pollutant per snap sector *and per country* ? This problem is not major, but the authors should make clear how they deal with this issue.

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