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Geoscientific Model Development Discussions

Interactive comment on "Source apportionment using LOTOS-EUROS: module description and evaluation" *by* R. Kranenburg et al.

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First of all, thanks for your comments. The issues raised have been addressed, and are discussed below point by point.

- Introduction: How does this procedure compare to other tagging methods, such as:Grewe, V.: Technical Note: A diagnostic for ozone contributions of various NOx emissionsin multi-decadal chemistry-climate model simulations, Atmos. Chem. Phys.,4, 729–736, doi:http://dx.doi.org/10.5194/acp- 4-729-200410.5194/acp-4-729-2004,2004.

Dahlmann, K., Grewe, V., Ponater, M., and Matthes, S.: Quantifying the contributions of individual NOx sources to the trend in ozone radiative forcing, Atmos. Environ., 45,

2860–2868, 2011.

Grewe, V., Tsati, E., and Hoor, P.: On the attribution of contributions of atmospheric trace gases to emissions in atmospheric model applications, Geosci. Model Dev., 3, 487–499, doi:http://dx.doi.org/10.5194/gmd-3-487- 201010.5194/gmd-3-487-2010, 2010.

Butler, T.M., Lawrence, M. G., Taraborrelli, D., and Lelieveld, J.: Multi-day ozone production potential of volatile organic compounds calculated with a tagging approach, Atmos. Environ., 45, 4082–4090, 2011.

Emmons, L. K., Hess, P. G., Lamarque, J.-F., and Pfister, G. G.: Tagged ozone mechanism for MOZART-4, CAM-chem and other chemical transport models, Geosci. Model Dev., 5, 1531-1542, doi:10.5194/gmd-5-1531-2012, 2012.

Tagging methods have also been developed for ozone by Emmons et al.,∼(2012), Butler et al.,∼(2011), Grewe et al.,∼(2010) and Wang et al.,∼(2009). In these methods the model description is extended with duplicate tracers and chemical reactions, also substantially increasing computation time. These studies are mentioned in the introduction. In our approach, the chemical transformations are tracked by storing the reacted mass per reaction and combining that with source attribution of the reactant. Hence, we do not duplicate tracers or reactions.

The tagging methods for ozone (Grewe, 2004), (Butler et al., 2011), (Dahlmann et al., 2011), (Grew et al., 2012). required to assume a NOx of VOC limited chemical regime. With the same assumptions our methodology could also be used for ozone. As the chemical limitation varies across Europe, a sensible application is not straightforward and therefore not pursuit here. This is discussed in section 3.5

- 2. In Section 3, please be more specific about which modeled compounds are "labeled". Is it all species for a type of source, or for a specific region? Or is a single species traced at one time? It is not clear how many "labels" there can be in a single

simulation. A few more explicit examples would be helpful.

In section 3.2 we have added more detail about the possibilities to choose the labels. For example, emissions from road transport, from a specific country during daylight can be labeled. As one is mainly interested in the source contribution of the anthropogenic sources, the natural emissions (seasalt, biogenic NMVOC and windblown dust) are treated separately and obtain a separate label. In the current application and system environments, the number of labels in restricted to 35. With this amount of labels, the runtime and the output will still be feasible. - 3. Perhaps the transport process "Adjust" should be called "Adjustment", to use a noun as for the other processes.

We agree, that this is a good idea and give a more unified text. - 4. The Fig.8 caption includes some extraneous text (referring to upper left, etc.). And what is the BOP-campaign? That should be described in the text.

As a result of the other referee, we changes the content of Figure 8. With this change the purpose of section 5 and figure 8 is clarified and the BOP-campaign is irrelevant - 5. There are a number of grammar or typo errors that should be corrected. For example: . . ...

Thanks, we have found some more and corrected those in the text.

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