

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

**Anonymous Referee #1**

Received and published: 6 December 2012

The paper summarizes a new development of a source labelling technique. The technique is overall well presented. The technique is relevant to many applications and it fits well into the scope of GMD. However there are a couple open questions, which should be clarified before considering publication:

- Formulas should be written more precisely and include the units in the text. (see below)
- Some processes presented in Section 3 are not explained in detail. (see below)
- Figures: Labels are far too small, hard to read.
- Section 4.3: Since the brut force method is not valid as a benchmark, which has  
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been shown nicely by Emmons et al., 2012 (GMDD), Grewe et al. (2010,2012) (GMD and Atmos. Environm.), it is not clear whether this part is of relevance. Please consider a revision of the objective.

- Section 5 includes a major draw back of this method. This has to be addressed in more detail. It is not clear, why this source is not labelled additionally. Taking into account the agricultural emissions change the results totally.
- How does this technique compare to Emmons et al., 2012 (GMD), Grewe et al., 2010, (GMD) and Wang et al., 2009; J. Geophys. Res., 114, D21206.
- For tracking reasons it would be good to have a module name and version number (also in the title).
- I propose to include a supplementary material, which describes the input, etc. some sort of a handbook.

Specific comments:

**Abstract** Please clarify the wording "origin": A contribution can originate from an emission source, like road traffic or from a location.

**3962/17** "shows comparable performance to other European models": Please give a more quantitative summary.

**3964/11** please explain what  $fr_{emis} \gg (l)$  means  $fr$ =fraction of emission and what is " $l$ "? (Explanation is coming a couple of lines later, but should occur earlier)

**3964/15** The notation seems to be inconsistent.  $c_f$  is a concentration change (l 12)  $c_0$  is a concentration,  $f_a$  fraction? " $l$ " is missing and probably " $dt$ " and shouldn't be dependent on the concentration? Further: shouldn't be  $c_0$  the concentration at time step  $n-1$ ? (I assume  $n$  is the time step?)  $\rightarrow fr_n^c(l) = (fr_{n-1}(l) * c_{n-1} + fr_{emis}(l) * c_f * dt) / c_n$

**3964/16** Please indicate the units of each variable. Eg.  $c_n$  in (mol/mol).

**3965/02** Please mention explicitly that advection is principally a linear operator.

**3965/17** " $F_{in}$  are taken from the donor cell," Since the flux is related to one cell only, shouldn't the equation include the sum over all neighbouring cells?

**Section 3.4** Can you explain how re-evaporation of rain is treated. Since this is a complex non-linear process this seems to be difficult for labelling. I.e. if rain is form in a column but not reaching the ground water from different levels with different concentrations and fractions might be released at one level.

**3966/22** What is meant with "concentrations of all species". Why all? I thought "c" is an arbitrary but specific species. Again inclusion of units would be helpful CI in (1/s) or 1/timestep. Please change "c(t)" into "c" or include "(t)" for all variables.

**3968/19** "PAN is taken from both precursor species (C2O3 and NO2)." Please explain in detail how this is done. Is it the same mechanism as in Grewe et al., (2010) GMD? What is about reaction like  $\text{NO}_2 + \text{NO}_3 \rightarrow \text{N}_2\text{O}_5$ . Either species might have a different fractions?

**Section 3** The details described here do not reflect 1 by 1 the list at page 3963. How is diffusion treated?

**3970/22** "shows" "show"

**3971/18** "separate countries" or "all mentioned regions?"

**3984** Please increase the font of the numbers - Hard to read.

**Section 4.3** "In principle, it is impossible to validate the functioning of the labeling routine for a full chemistry simulation as the chemistry scheme is non-linear." Why?

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If you have tracers which have an isotope contribution this actually can be measured. Still a validation can be difficult, but in principle possible. See Gromov et al., GMD. I understand that a comparison between labeled species and a scenario run leads nowhere. So what is the relevance of section 4.3. Please re-consider the objective of this Section.

**Section 4.4** : Please explain the sharp decrease for a few labels.

**3975/18** Please indicate that you discuss Fig. 8 here.

**3975/26** Fig. 1? -> Fig. 9.

**3976/27ff** But then the results are changed even qualitatively: From largest contribution from transport sector to agricultural sector. Why not labelling this source in addition? What is the use of the labelling, if the method is missing most of the effects?

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Interactive comment on Geosci. Model Dev. Discuss., 5, 3957, 2012.

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