

Geosci. Model Dev. Discuss., referee comment RC1  
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## **Comment on gmd-2020-410 --> very good comparison**

Richard Kranenburg (Referee)

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Referee comment on "Comparison of source apportionment approaches and analysis of non-linearity in a real case model application" by Claudio A. Belis et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-410-RC1>, 2021

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This paper gives a very good overview on the usage of two source apportionment methods (tagged species(TS) and Brute Force modelling (BF)). Different usage and goals for both methods are well described, while synergy and understanding differences is essential to use the best of each method. I have two questions/suggestions which can lead to a broader synergy between both methods and thus a better usage of both.

Section 3.1. In the TS approach, agriculture has a relative small contribution to PM because it only accounts for the ammonium part, while traffic and industry accounts for the (heavier) nitrate and sulphate part. A redistribution of sources of NH<sub>4</sub>NO<sub>3</sub> on molar basis will give a higher (and more fair, because NH<sub>3</sub> is needed for formation) share to agriculture. This will also lead to a better agreement with BF scenarios because parts of the nitrate are now also accounted to agriculture. Please consider to report this issue in the discussion/final remarks.

Section 3.4 Please consider to add a map with gas-ratios. Especially, if it is possible to use this map to calculate a maximum ERL until which extent the chemical regime will stay the same in (almost) the full domain. With this calculation, the method is easy to implement on different areas and an indication can be given until which ERL the non-linearities are small and thus neglectable.

Further I will mention a few technical corrections

line 158: --> In this study the interactions between .. are analysed

line 285: In Figure 5 the annual interaction ... are mapped

Section A1.1 and A1.2 are intended, while A2.1 and A2.2 are not