Geoscientific
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Discussions

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Interactive comment on "Trends of inorganic and organic aerosols and precursor gases in Europe: insights from the EURODELTA multi-model experiment over the 1990–2010 period" *by* Giancarlo Ciarelli et al.

Anonymous Referee #1

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General and Specific Comments

The manuscript describes the trends in simulated atmospheric concentration of several gas and particulate pollutants across Europe and compares them to observed concentration at long-term monitoring EMEP sites, along with emissions of major species. Simulated concentrations proceed from 5 different Chemical Transport Models within the joint effort EURODELTA-Trends, whose results and main description was previously presented by Colette et al. (2017).

The study aims to reply to a question of main interest for the scientific community, i.e. the main drivers of the variation in atmospheric composition over the two decades 1990 – 2010. The paper is clearly written, the material is well presented and most of the analysis is solid. However some comments and margin of improvement can be explored.

1. Unless the authors would identify suitable ground stations in regions IP, FR, MD for the comparison of the trends in these large areas of the continent, a comment about the limited number of sites for trend comparison would be needed: for some species (e.g. TNO3), more than half of the continent could not provide any data, constraining the spatial validity of the results presented.

2. The trend analysis is extremely basic. Several methods, which are often ready-to-use in several software packages, can provide the uncertainty bands for these trends and a better estimate of their significance. It is not clear whether the trend analysis was applied on daily, monthly or annual data, although the slope and the significance of a trend is highly dependent on the autocorrelation of the data, mainly for Theil-Sen's and the Mann-Kendall methods (see Collaud-Coen, 2013).

3. There is no indication about the performance of these CTMs, neither in this manuscript nor in Colette et al. (2017), notwithstanding the several indications in the scientific literature or by the FAIRMODE initiative (https://fairmode.jrc.ec.europa.eu/). A brief summary of the "quality" of the simulation output should be included, which is something different, but complementary, from the scatter plots for trends.

4. The data available to the authors through EURODELTA-Trends could be explored to understand why in some circumstances one scheme is better than another: part

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of this analysis has been performed for the Secondary Organic Aerosol (SOA). There is a potential to perform a similar analysis also for the species presenting the largest variability among the models (e.g. TNO3 over P2): some hints and guidance about this point could be useful for the modelling community.

5. In page 11, line 12 the authors suggest that the simulated results for NO2 could be driven by an "overestimated negative trends in national emission data bases". There is no indication about the version of the COPERT model used for the emission factor of transportation, although the last part of the investigated period is included in the "emission scandal". This point should be considered.

Minor comments

- p. 5, l . 33: wrong parenthesis "can be found in Colette et al. (2017)"

- p. 9, l. 38: why exactly 7 μg/m^3 was chosen? Please explain

- p.11 sub-paragraph 3.2.1: Please organize it in order along with the title "...SO2 and NO2 concentration trends": therefore it should be organized with relative trends for SO2 first and then relative trends for NO2. This is already done for the second part of the sub-paragraph about the significance.

- p.12, l. 15: full stop is missing "... influenced by different factors. First ..."

- p.15 l. 21: ASOA and BSOA acronym were defined only in the abstract and not in the main text

- p. 16 l. 3: misspelling terpene as singular? "i.e. isoprene and terpenes"

- p. 16 l. 18: misspelling of plays "could also play"

- p. 17 l. 37: maybe you meant "latter" instead of "later"

- p. 18 l. 13: maybe you meant "monoterpenes"?

- p. 18 l. 14: this is the first comment about the influence of the change in Land Use, it is better to mention this in the discussion paragraph

- Range of y-axis for figure 14 and 15 maybe set to 4 μg/m^3, actually figure 15 could be reduced to 3 μg/m^3: this would slightly improve its readability.

References

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