

Interactive comment on “Aerosol decadal trends (I): In-situ optical measurements at GAW and IMPROVE stations” by M. Collaud Coen et al.

M. Collaud Coen et al.

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We thank the second reviewer for his careful and encouraging review and for all his suggestions that allow us to improve the paper. All suggestions have been taken into account in the revised version.

Specific comments:

1. “The abstract could do with less general information in favour of more quantitative information on the trends and their differences in Europe and the US.”

- The abstract was modified and now includes the mean slopes in %/yr for the stations with statistically significant scattering and absorption coefficient trends, the Mauna Loa results and a sentence on the difference between EU and US. This is the end of the abstract:

“No significant trends were found for the three continental European sites. Statistically significant trends were found for the two European marine sites but the signs of the trends varied with aerosol property and location. Statistically significant decreasing trends for both scattering and absorption coefficients (mean slope of -2.0 %/year) were found for most North American stations, although positive trends were found for a few desert and high-altitude sites. The difference in the timing of emission reduction policy for the EU and US continents is a likely explanation for the decreasing trends in aerosol optical parameters found for most American sites compared to the lack of trends observed in Europe. No significant trends in scattering coefficient were found for the Arctic or Antarctic stations, whereas the Arctic station had a negative trend in absorption coefficient. The high altitude Pacific island station of Mauna Loa presents positive trends for both scattering and absorption coefficients.”

2. “In some instances, the different statistical methods yield contradictory results on trends obtained from identical data sets. The discussion on the reasons for the discrepancies should be expanded and at least some indication which of the results are the more robust ones should be given.”

- The authors agree that it can be quite misleading if the different methods lead to different trend results. To try to give general information on these cases without discussing each specific case in detail, the following sentences were added to the second § of point 2.5:

“In this analysis, there is no method that is completely satisfactory for answering all difficulties raised by the studied datasets. The MK method has been taken as the reference method since it seems to be the most sensitive to small trends and the slope determination does not suffer from any statistical restriction. For scattering and absorption coefficients, the LMS method working with monthly instead of daily values clearly seems to miss some trends. For b and \hat{a} , the MK method detects fewer s.s. trends than found by the other 2 methods. This could be attributed to the distributions of these parameters being closer to the normal distribution than the scattering and absorption coefficients; it is well-known that MK sensitivity is lower than other statistical methods for normal distributions.”

3. "p. 20792: Check spelling of Leibensperger et al. in the text

- This was corrected as requested

4. "p. 20795, last line: is there a reason to suspect "trends in RH"?"

- The authors have no direct reason to suspect trends in RH at all or at some particular stations. However, it is not possible to avoid this discussion point in order first to compare the scattering trends measured by the OPTEC and TSI nephelometers and second to be able to attribute the measuring scattering trend to aerosol properties and not to ambient water vapor content for the OPTEC instruments.

5. "p. 20796: give indication why inlet changes do not affect the aerosol properties"

- The reviewer is completely right assuming that inlet changes should usually affect the aerosol properties. We were not precise enough, saying that we analyzed only the datasets for which the inlet changes did not affect the aerosol optical properties, as it is the case for HPB, JFJ and PAL. For some other stations (i.e. BRW, MLO) the inlet changes did induce a break point and in these cases only the measurement with the most recent inlet were taken into account. The manuscript was modified to remove this imprecision:

"Another factor, aside from RH, that can affect σ_{sp} and to a lesser extend σ_{ap} is particle size. Size effects can happen in several ways such as changes in inlet properties or length of pipes. Inlet changes are documented in the station descriptions in supplementary material. Only datasets for which inlet changes reported by data providers did not appear to have a noticeable effect on the measured aerosol optical properties have been used. When the inlet changes induced break points in the analyzed parameters, only data from the most recent inlet were utilized in the analysis."

6. "p. 20796, last two sentences: discuss truncation errors in the statement that the measured scattering will be lower than the true scattering when large particles are present"

- The information that the truncation error becomes greater for larger particles with references has been added in p. 20796:

"Thus, for times when enhanced amounts of large diameter ($D_p > 1 \mu\text{m}$) particles are present, the measured scattering will be lower than true scattering by a significant amount because the truncation correction increases with particle size [Anderson and Ogren, 1998, Molenaar et al., 1997]."

7. "Figure 2 contains too much information - maybe part of it could be moved to an additional figure. The blue lines are difficult to attribute to data points in some instances."

- Figure 2 has been slightly modified by removing the circles corresponding to trends with 90% confidence level. In Fig. 2b, it is quite possible that all confidence limits (blue lines) cannot be easily attributed to data points, but the purpose of this figure is only to show that datasets of too short duration may often lead to dubious results. We do not think that it is worth adding a new figure to include 5-years trend analysis that are not otherwise described in the paper.