Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-1155-AC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of Sulfate Aerosols over Austria: A Case Study" *by* Camelia Talianu and Petra Seibert

Camelia Talianu and Petra Seibert

camelia.talianu@gmail.com

Received and published: 25 March 2019

Dear referee,

Thank you very much for the comments to our paper.

Here are the answers to your comments. In the following: "RefC" is the comment from Referee, "AuthR" is the author's response and "AuthCM" represents the author's changes to the manuscript. Page and line number refer to the page and line number in the version submitted for discussion.

Printer-friendly version

Discussion paper

Specific Comments

Comment 1.

RefC: "Section 2 (Methodology) is rather lengthy and very detailed. Some parts could perhaps be moved into an Appendix Section."

AuthR: Due to the complexity of the synergy between remote sensing instruments, in situ monitors and modelling, we would prefer to provide the methodology in one section, in the article, even if it is indeed lengthy and very detailed. Splitting it in a short(er) version in the article and details in the Appendix could make it difficult to follow.

AuthCM: none

Comment 2.

RefC: "The authors should avoid to mention Trade Names or direct references to companies and commercial instruments, unless absolutely necessary for the understanding of the methods deployed."

AuthR: The trade names of the instruments were deleted from the text. Please note that PollyXT and RALI are the names of the instruments, as used by EARLINET to identify the instruments at the corresponding station, not trade names.

AuthCM: Page 3, Line 21 "a Thermo Scientific Model 43i SO_2 Analyzer" was changed to "a SO_2 analyzer"

Page 3, Line 22 - Line 23 "Optical Particle Counter GRIMM Dust Monitor Model EDM180," was changed to "optical particle counter"

Page 3, Line 23 - Line 24 "a Thermo Environmental Instruments Ozone Analyzer, model TEI 49C," was changed to "an ozone analyzer,"

Page 4, Line 4 "Jenoptik ceilometers CHM15kx" was changed to "ceilometers"

Comment 3.

RefC: "Since the trajectories in Fig.5 indicate sources processes from almost all over Europe (understandable, especially in the lower & mid levels), but also very distant sources (mostly in elevated layers), the authors should show the relevant meteorological maps for the study period (850, 700, 500, 300 & 200 or 250 hPa circulation) to provide physical evidence for 'conflicting' circulations in some of the layers, and especially for the 'outlying regions'. Of course, FLEXTRA ingests the upper air data from ECMWF, but a cross-verification with 'real meteorological data' will make the cases more convincing."

AuthR: There is no reason to not trust the FLEXTRA calculations. However, seeing weather maps may help to understand the prevailing synoptic pattern. Therefore, a few weather maps are now provided in the Supplement.

AuthCM: Added weather maps as supplement.

Comment 4. Part A

RefC: "P10 / L27 & 28: - 'No contributions from Europe are seen for these layers.' This may be true for the period in April, as there may not have been any deep convection. However, it would be interesting to also study a summer period with strong convective activity over Central Europe (obviously, in a separate paper !)."

AuthR: The summer periods for the years 2014 – 2017 are under study, and a paper is under preparation.

AuthCM: Page 11, Line 28 Added text: "The spring period studied in this paper is characterized by low, if any, deep convection. For the summer period, one expects however to have a strong convective activity over Central Europe. A study of the summer periods for the years 2014–2017 for the same region was also performed; the results will be presented in a separate paper."

Comment 4. Part B

RefC: "P10 / L27 & 28: "I am still a bit skeptical about the long-range transport of pollutants - there would be a significant dilution factor . . .! Unless there are major sources emitting ? An indication of such sources would make your findings more convincing."

AuthR: Flexpart simulates not only the transport due to the large-scale winds but also turbulent diffusion and mixing by subgrid-scale mesoscale motions (A. Stohl et al., 2005). Furthermore, it has implemented the treatment of all loss processes, including dry and wet deposition of gases or aerosols, gravitational settling of particles (S. Eckhardt et al., 2017). Flexpart also has implemented a deep convection scheme. Comprehensive validations of Flexpart were performed for intercontinental air pollution transport, see e.g. [A. Stohl et al Atmos. Environ., 32, 4245–4264, 1998], [A. Stohl and T.Trickl, Geophys. Res., 104, 30,445–30,462, 1999], [N.Kristiansen et al., Geophys. Re. Lett. 42, 588-596, doi 10.1002/2014GL062307, 2015]. Thus, there is no reason to doubt the results.

For the case study presented in this paper, the major sources of SO_2 are coal power plants and other industrial facilities (refineries, chemical industry, etc), present in the regions mentioned: Central Europe 'Black triangle', industrialized cities from Morocco, Eastern part of US (e.g. Ohio, New Jersey), Southeastern part of US (e.g. Louisiana,

Alabama). An exhaustive list of US sources is mentioned in the report "U.S. EPA 2014 NEI Version 1.0" [https://www.epa.gov/sites/production/files/2017-04/documents/2014neiv1_profile_final_april182017.pdf] A recent study on SO_2 sources worldwide is published in (Y. Yang et al, 2017), which was added to the references.

AuthCM: added references (A. Stohl et al., 2005) to Page 3, Line 4 and (S. Eckhardt et al., 2017) to Page 3, Line 2 for Flexpart and (Y. Yang et al, 2017) to Page 2, after Line 14 for SO_2 sources.

Technical corrections

Comment 5.

RefC: "Figs. 4 & 13 - Key for variables needs to be enlarged P8 / L20 - Height of layers 'amsl' or 'AGL' (also in tables)"

AuthR: The recommended corrections were done in the two figures. AGL was added to text and to the caption for the two figures. No AGL added to the tables, I think it is enough to mention in the text and to add to figure.

AuthCM: Page 3, Line 11: changed to "as ground-level altitudes (AGL)."; added AGL to the caption of the new Figs.4 & 13

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-1155, 2018.

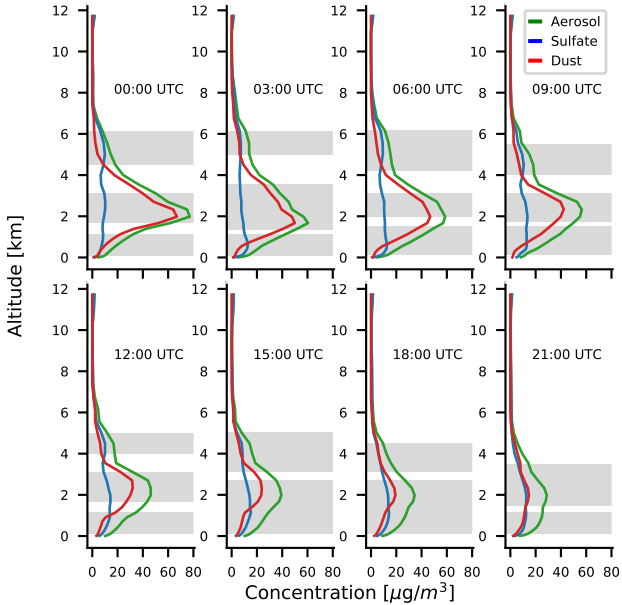

Fig. 1. CAMS total aerosol, sulfate and dust profiles for 02 April 2014, Pillersdorf. Grayed area represents the identified sulfate layers. Altitudes are given in km AGL. Local time is UTC+2

Printer-friendly version

Discussion paper

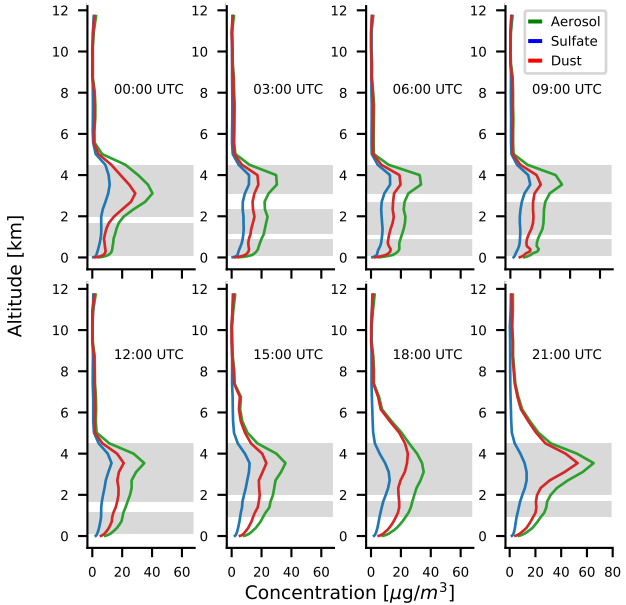

Fig. 2. CAMS total aerosol, sulfate and dust profiles for 04 April 2014, Pillersdorf. Grayed area represents the identified sulfate layers. Altitudes are given in km AGL. Local time is UTC+2

Printer-friendly version

Discussion paper