Atmos. Chem. Phys. Discuss., 14, C7006–C7008, 2014
www.atmos-chem-phys-discuss.net/14/C7006/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of rapid aerosol optical depth enhancements in the vicinity of polluted cumulus clouds" *by* T. F. Eck et al.

T. F. Eck et al.

thomas.f.eck@nasa.gov

Received and published: 12 September 2014

We thank Referee #2 for his/her useful and constructive comments and careful reading of the manuscript.

Minor comments: p.18809. l.25-50, presents some interesting results on chemical effects (organics, inorganics). Could you please elaborate?

Yes, in response to your comment further elaboration is provided as follows: The previous sentence was: The analysis of the aerosol chemical composition show a strong increase of the water-soluble organic carbon (WSOC) by a factor of 2 (up to 6 μgm$-$3 after the cloud formation) within the layer from 1 to 2.5 km, while the sulfate and nitrate concentration do not show any significant evolution. The new sentences replacing

this sentence is: The analysis of the aerosol chemical composition shows a strong increase of the water-soluble organic carbon (WSOC) by a factor of 2 (up to 6 μgm$-$3 after the cloud formation) within the layer from 1 to 2.5 km. According to previous studies (Blando and Turpin, 2000, Ervens et al., 2011), the formation of SOA through cloud processing is highly plausible. Hennigan et al. (2008) found that the fraction of WSOC in the particle phase increases sharply with RH. The positive correlation with liquid water rather than with organic matter (Hennigan et al., 2009) suggests that aqueous reactions was the dominant SOA formation process rather than gas-phase reactions. Moreover, the inorganic analysis, integrated over a 3-5 minutes period (limited to few data point per profiles), show an increase by a factor of 1.5 of the sulfate concentration (from 1.6μgm$-$3 before the cloud formation up to 2.5 μgm$-$3 after the cloud formation), while the nitrate concentration do not show any significant evolution. This study case could be used to test the new schemes described by Lim et al. (2010), which take into account the wet processes for SOA formation, and improve numerical models to better take into account the cloud processing products in this particular area.

Blando, J.D. and B.J. Turpin, Secondary organic aerosol formation in cloud and fog droplets: a literature evaluation of plausibility, Atmos. Environ., 34 (10), 1623-1632, doi: 10.1016/S1352-2310(99)00392-1, 2000.

Hennigan, Christopher J., Bergin, Michael H., Dibb, Jack E., and Weber, Rodney J., Enhanced secondary organic aerosol formation due to water uptake by fine particles, Geophys. Res. Lett., 35 (18), L18801, DOI: 10.1029/2008GL035046, 2008.

Hennigan, C. J., Bergin, M. H., Russell, A. G., Nenes, A., Weber, R. J., Gas/particle partitioning of water-soluble organic aerosol in Atlanta, Atmospheric Chemistry And Physics, 9 (11), 3613-3628, 2009.

Lim, Y. B., Tan, Y., Perri, M. J., Seitzinger, S. P., Turpin, B. J., Aqueous chemistry and its role in secondary organic aerosol (SOA) formation, Atmospheric Chemistry And Physics, 10 (21), 10521-10539, doi: 10.5194/acp-10-10521-2010, 2010

It could be mentioned in the conclusions that this data set would be ideally suited to test models in case studies.

This is an excellent suggestion and we have now done so at the end of the Conclusions section.

Point 6 of the conclusions could mention that this may have led to underestimation of AOD in AERONET and satellite retrievals.

We also agree with this suggestion and have added this to Point 6 of the conclusions.

Some of the figures are too small (should be improved in ACP publication).

We will consider this in the final figure preparation.

The text is full of abbreviations, which is not a problem, but untrained readership could be helped by an appendix listing them.

We agree that this is not a problem, and choose not to include an appendix.

Please check for typos:

We have found and corrected all of the typos/mistakes that the Reviewer #2 has identified below:

p.18788, l.23, meteorological p.18789, l.4, Lelieveld; l.12, within minutes p.18797, l.6, as a consequence p.18800. l.9, near solar noon p.18801, l.3, retrievals of the p.18809, l.25, shows p.18815, l.22, slight p.16616, l.2, in –> from C5898

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 18785, 2014.