Atmos. Chem. Phys. Discuss., 9, S1391–S1394, 2009
www.atmos-chem-phys-discuss.net/9/S1391/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "A multimethodological approach to study the spatial distribution of air pollution in an Alpine valley during wintertime" *by* R. Schnitzhofer et al.

Anonymous Referee #3

Received and published: 11 April 2009

This paper is a very nice illustrative example about how the Alpine valley meteorology influences the distribution of pollutants. It also shows very nicely how well pollution measurements can be used to assess meteorological features. Novel in this paper is the study of the pollutant dispersion during winter time and the very nice illustration of the asymmetric distribution of pollutants in the valley. I agree with the reviewer Andreas Stohl that the aspect of the vertical pollution export might not be discussed correctly. The lidar data is suggesting that there is actually an export which is really interesting. Along the sunlit slopes, also in winter, export of rather deep Alpine valleys seem to be possible. Besides a new discussion of the pollution and air mass export, I would suggest to show different aerosol parameters and I am missing a few references of

studies in the Swiss Alps as outlined below. After taking these points into account suggest that this nice dataset and study gets published in ACP.

Specific comments:

- Last sentence of the abstract not clear. The amount of pollution export and air renewal can probably not be quantified in this study

- p3986, lines 7-12 : Henne et al. (2004) should be cited here as well.

- p3987, lines 9-10 : Important are not only the height of the mountains but also the crest heights (actually the lowest crest heights). These are especially important for the pollution export. In Figures 9, 10, these crest heights seem much lower than 2500 masl making it more likely that pollution export is possible. Deeper valleys with higher lowest crest heights (like some valleys in Switzerland) might not have any export in winter.

- p3989 Why were acetone and benzene chosen to be shown here. Some measurements and concentration levels could be compared to Gaeggeler et al. (2009) who also showed that wood burning is important for many VOCs in trafficated Alpine valleys during winter.

- Chapter 3.2.1 : One could mention that the features of the diurnal cycle are similar to previous observations in summer in Alpine valleys (Prevot et al. (2000b)

- p3991, lines 27-28: I cannot see that the relative benzene contribution increases with altitude. The change with altitude might not only be due directly to difference in the lifetime of the VOCs but in general due to different features of the free tropospheric VOC composition compared to the composition at the valley floor (which surely is also connected to VOC lifetimes).

- chapter 3.2.2. The feature of the vertical VOC gradients might be compared to the gradients in Prevot et al. (2000a).

- p3993, line 5: more relevant for air quality would be the PM1 volume and not the

ACPD

9, S1391–S1394, 2009

aerosol number which will be dominated by the two lowest channels of the OPC.

- p3995, line 1: here the aerosol surface concentration rather than the number of particles would be more relevant to compare to the scattering. One might discuss somewhere that in the updrafts probably also the relative humidity is enhanced. An increase in humidity and growth of hygroscopic particles yields higher aerosol number (because smaller particles grow into the range of the OPC) but also higher aerosol surface and volume. Relative humidity data should be available from the aircraft data.

- p3995, line 13: as mentioned above I do not believe that there is no pollution export. I find it rather interesting that there is likely pollution export even in winter but this surely depends finally strongly on the depth of the valley. Henne et al. (2005) did not find any increase in water vapor above 2000 masl using climatological data of radio soundings north and south of the Swiss Alps. In valleys with lower minimum crest heights, pollution export might be possible. Increased humidity layers might be found downwind of the Alps at lower altitudes in winter between 800 and 2000 masl.

- p3996, line14: it is not clear what the authors mean by very shallow slope wind layer. I would expect an even shallower slope wind layer during the night. During the day it should depend on the inversion strengths. The stronger the inversion strength in the middle of the valley, the shallower should the slope wind layer probably be. Such slope winds might be in general difficult to be detected by the aircraft. So I guess it is difficult to say how shallow the slope wind layer really is.

Henne et al. (2004) Quantification of topographic venting of boundary layer air to the free troposphere, Atmos. Chem. Phys., 4, 497-509.

Henne et al. (2005) Climatology of mountain venting-induced elevated moisture layers in the lee of the Alps, J. Appl. Meteorol., 44, 620-633.

Gaeggeler et al. (2009) Residential wood burning in an Alpine valley as a source for oxygenated volatile organic compounds, hydrocarbons and organic acids, Atmos.

ACPD

9, S1391–S1394, 2009

Environ., 42, 8278-8287.

Prevot et al. (2000a) see reference in text.

Prevot et al. (2000b) Diurnal variations of volatile organic compounds and local circulation systems in an Alpine valley, Atmos. Environ., 34, 1413-1423.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 3983, 2009.