

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.

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This paper presents a nice description of a campaign studying the vertical structure of air pollution in an Alpine valley in winter. The paper does not reveal any really new or surprising results and probably does not constitute a big step in understanding pollution transport in valleys. However, the chosen case study is illustrative, the data shown (ground-based, balloon borne, in-situ and remote sensing from aircraft) is comprehensive and of high quality and the paper is generally well written. I find the asymmetric distribution of the pollution in the valley atmosphere (though it is not unexpected) most interesting, since this has probably not been demonstrated before with data of such

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quality and for winter. Thus, the authors may want to put even more emphasis on this aspect than they already do. I am not fully convinced of the conclusion that there was no export of pollution from the valley atmosphere (see my point below) and the authors should re-evaluate this point. They may also want to take my other comments below into account (even though most of them are of a rather minor nature). Given that the authors address my concern about the pollution export, I recommend the paper to be published in ACP.

Specific points

Section 3.2: When describing the synoptic situation, adding a weather map would be a good idea.

P3990, L15: You mention 10 vertical VOC profiles but Fig. 4 suggests there were only 4.

P3990, L26: You say that pollutants are trapped in cold pools. However, is there a cold pool at the observation site? Is it located in a topographic depression?

P3994, L16: You mention titration of O_3 by NO. Have you plotted $O_x = O_3 + NO_2$? This quantity should be conserved in the presence of titration.

P3996, L14 and conclusions: you say that pollutants did not significantly overshoot the main crest and, thus, pollution was not exported from the valley atmosphere. Is this really true? The lidar backscatter signal shown in Fig. 10 does show that enhanced backscatter can be found also above the crest. The signal appears weaker than at lower levels, however, this is to be expected even when substantial export does occur. According to Henne et al. (2004), there can be an injection layer just above crest height (see their Fig. 13), which is influenced by the synoptic flow. Even though their picture is more valid for summer-time conditions, if slope winds are active (as you show), it may exist also in winter. Wind speeds in this layer should be much higher than in the valley atmosphere. Thus, as soon as pollution is injected into this layer by the

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slope winds, there would be rapid dilution by the stronger winds aloft and this would reduce the lidar backscatter signal above crest height compared to the signal seen lower down. However, the weaker signal does not necessarily mean that the mass flux out of the valley was low! You could probably estimate mass fluxes by looking at pollutant concentrations near crest height and the wind speeds at these altitudes.

The conclusion that there was no pollution export at all from the valley is probably wrong in any case because the aircraft in-situ data and, especially, the lidar data does show some enhancements near and above crest height on the sun-exposed side of the valley.

Fig. 3: Explain why the benzene and acetone data are missing during the intensive campaign periods. I assume the PTRMS was used for the balloon but it is somewhat irritating that data are missing exactly in the periods you are most interested in.

Language:

P3985, L10: in Tyrol IN THE YEAR 2005.

P3986, L15: in France IN THE YEAR 2003

P3988, L23: downward-LOOKING

P3989, L13: cold fronts passage -> cold front passage

P3989, L18: condition -> situation

P3991, L14: reverse -> reversal

P3993, 18: in 150 m -> at 150 m (similar at other places)

P3993, L19: lost in strength -> weakened.

Caption Fig. 9: this times -> these times, or the same times.

Reference:

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

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

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