

Interactive comment on “Quantification of topographic venting of boundary layer air to the free troposphere” by S. Henne, et al.

Anonymous Referee #2

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General Comments

The paper investigates the important issue of the vertical transport of pollutant in mountain terrain. In particular the mechanisms connected with exchanges of air masses between the Atmospheric Boundary Layer (ABL) and the Free Troposphere (FT). The analysis is conducted by mean of a mass budget analysis based on air flight measurements, using aerosol lidar measurements, radio sounding, and a forward trajectory model. While the analysis of the lidar results and the forward trajectories are interesting, as well as the conceptual model presented in Fig. 13, the mass budget analysis need to be discussed more critically and some aspects need to be clarified (see following points).

Specific Comments

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1) From the text and the figure captions it seems that the mass flux measurements at the two sections of the valley were taken at two hours distance one from the other. The authors say that the stationarity assumption is justified because the ground measurements oscillate around 16% of the value. On the other hand, they state that the valley flow layer depth changes between the two hours, meaning that there is a time-evolution of the flow structure. These two statements seem in contradiction. Please clarify, and analyze more critically. 2) The measurements presented in Fig. 2 and 3., do not cover the lower 500m of the valley. How did the authors consider this layer in their budget analysis? Did they neglect the flow in this part of the valley? 3) The authors confuse in the text the net vertical mass flux, with the amount of valley air leaving the valley. To be clear,

net vertical mass flux = upward flux (e. g. by slope winds or thermals) - downward flux (e g. sinking in the center of the valley).

The amount of air leaving the valley (which is what is interesting for air pollution studies) is linked only with the flux due to upward motions. The net vertical mass flux can give only a lower limit to this value. This should be discussed in the text. 4) It is impossible to generalize the conclusion from the mass flux analysis to all the Alps (as it is done in section 4). Firstly because the budget analysis gives only the net mass flux, and NOT the amount of valley air leaving the valley atmosphere, and second, because measurements recorded in other Alpine Valleys show different patterns. In some cases with a divergence along the valley axis (downward net vertical flux of mass, Freytag, 1987). Even if the phenomena described in the paper are certainly very important, I think it is very dangerous to generalize (in a quantitative way) to all the Alps results obtained for two specific valleys. 5) The paper can be better structured. I suggest to add a paragraph at the end of section one explaining explicitly how the measurements will be used in the following, in order to build the scheme of Fig. 13, and the role of the modeling trajectory study.

Minor Comments In some places the terminology used by the authors is not standard.

Even if the meaning is clear, it is suggested to adopt the standard terminology (e. g. Sup-valley wind, instead of valley breeze).

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 5205, 2003.

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