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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying horizontal and vertical tracer mass fluxes of a daytime valley boundary layer" *by* Daniel Leukauf et al.

Anonymous Referee #1

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This paper describes the results of a series of idealized large eddy simulations to quantify the vertical and horizontal transport of tracers within various layers of the daytime valley atmosphere. While the results are not very surprising, the paper is interesting and overall well-written but some clarification is needed in certain locations. Some comments are provided below.

1) When reading the paper, I had the impression that there was quite some overlap with previous papers published by the Innsbruck group. Some clear(er) explanations on how the current study follows up on these previous papers and in what respects it is similar, would be desirable.

2) The introduction states the general broad aim of this paper but a strategy on how to address the goals of the paper appears to be missing in the Introduction.

3) line 67: remove 'a' in 'a complex interactions"

4) line 90: "...the role...have..." should be ...the role...has..."

5) line 90: in terms of what has the role of intrusions been evaluated before?

6) line 111: Misleading sentence. The valley is not really 17 km broad, the model domain is. Rephrase.

7) line 119: runs for 12 hours, not run.

8) line 124: Define A_shf

9) line 123-130: for clarity/reference, it would be good to include a table with the listing of the various simulations

10) line 131: is the passive tracer released at every gridpoint?

11) line 142: "over 41 minutes". Seems like a weird number. Why 41 and not e.g. 30 or 60 minutes?

12) line 156: fourth volume, not forth

13) line 166: "It is useful to....". Explain why it is useful.

14) line 185 and following: I had to read the explanation how F23 is calculated several times and it is still not very clear. Any way the authors can make the explanation clearer would be appreciated.

15) section 2.4: it is very good the authors pay attention to their definition of CBL heights over valley and slope. I am not convinced though that the slope wind layer is synonymous as the slope CBL as the authors suggest. Better would be to just call it slope CBL rather than slope wind layer.

16) section 3.1 seems rather qualitative. Include some more quantitative information including e.g. the speeds and height of the slope flows.

17) line 378: "For simulations with different than..." sounds awkward. Rephrase.

18) line 450: the authors mention the export heat here. This made me think whether the authors could address, perhaps in the discussion section, if they expect heat and moisture to be transported in a similar way as the passive tracers. The evolution of temperature and humidity profiles in the valley could address this issue.

19) I like the discussion of some issues/limittaions with the idealized simulations in the discussion section. I can think of many more than the authors discuss but I realize that discussing/mention these may weaken the study. Some mentioning of the limitations in the abstract would also be appropriate.

20) line 562: It is defined "as", not "between"

21) line 568: the single parameter does not describe the total export of tracer mass, it rather is indicative of the total export.

22) Fig. 3: Include the unit of the numbers in color bar

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