Review of "Classification of Alpine South Foehn based on five years of km-scale analysis data", by Lukas Jansing et al.

The authors present a climatological analysis and classification of Alpine South Foehn, focusing on Altdorf, Switzerland, which is one of the Alpine-wide "hot spots" for the occurrence of foehn. The study takes benefit from a five-year history of operational 1-km COSMO analysis data generated at MeteoSwiss, providing a reasonable resolution of local foehn characteristics at least in some larger Alpine valleys. I agree with Reviewer #1, who happened to be slightly faster than me, that the paper is very well written and should be published after some minor revisions. In the subsequent list of specific comments, issues already raised by Reviewer #1 will not be repeated.

Specific comments

The most surprising result for me is the weak stratification on the Alpine South side during Shallow Foehn, remembering that most of the Shallow Foehn Cases observed and investigated during MAP were characterized by very high stability over the Po Valley. Although this aspect is briefly discussed on page 32, it would be interesting to elaborate a bit more on this apparent discrepancy: How many the MAP Shallow Foehn cases would be classified as Shallow and Gegenstrom, respectively, according to the criteria applied in this study? If the majority is indeed Shallow, then the seasonality argument would be corroborated.

p. 17, discussion of Dimmerfoehn: I remember from the Dimmerfoehn event of 14–16 November 2002 that phases of particularly strong precipitation spillover were preceded by shallow cold front passages north of the Alps, reducing the lee-side subsidence related to the foehn flow and temporarily interrupting the foehn at low-elevation sites like Altdorf. It would be interesting to know if this type of interaction was just specific to this case (which was unusual in several aspects) or can be observed in a significant fraction of Dimmerfoehn events. Obviously, a far penetration of the foehn flow into the Alpine foreland will be inhibited by such cold front passages, and the variability of the foehn penetration distance may be correlated with or even controlled by the presence of low-level cold air in the foreland.

p. 20/22, discussion of diabatic cooling for cluster 3 trajectories: it appears quite surprising that diabatic cooling can keep subsiding trajectories at approximately constant temperature. Evaporation of precipitation entering from above would at best be able to maintain a moist adiabatic gradient, and more fundamentally, frontal lifting would typically not be associated with a dry layer between altitudes of 3 and 4 km. Likewise, the presence of strong turbulent vertical mixing would require weak stratification, which in turn would render strong cooling along subsiding trajectories unlikely. My hypothesis would be that the accuracy of the cluster 3 trajectories is not as good as for clusters 1 and 2. The latter pass over the Po Valley plain, whereas a significant fraction of the cluster 3 trajectories pass at low levels over the Alps, where the terrain-following coordinate surfaces are heavily distorted. The authors should include this aspect in their discussion. This also pertains to the middle paragraph on p. 35.

Minor/editorial comments

p. 6 / Eq. 1: UU is quite an unusual notation for relative humidity. Why not using RH?

p. 11 / l. 290: "overlap of Dimmer Foehn and Gegenstrom Foehn hours ..." might be misunderstood in the way that the classification yields ambiguous results for these foehn types. "match" would fit better than "overlap"

Caption of fig. 5: I think it should read "Arrows pointing to the *right* correspond to eastward winds".

l. 464, last word: “effect” → “affect”?

l. 537: I don’t see any cluster 1 signatures in Fig. 11d above 3 km. Should it read cluster 3?

l. 571–579: To explain the reduced wind speeds for Dimmerfoehn, it could be mentioned in addition that precipitation spillover increases (by latent cooling) the leeside stratification and thus reduces the foehn penetration close to the Alpine crest.

l. 760: “loose” → “lose”

l. 825/826: “Clusters 1 and 2” should probably read “Clusters 2 and 3”

l. 832: same as for l. 537