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Interactive comment on "Transport of Po Valley aerosol pollution to the northwestern Alps – Part 2: Long-term impact on air quality" *by* Henri Diémoz et al.

Anonymous Referee #1

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General Comments The paper evaluates the impact of trans-regional transport of aerosol from the Po Plain to the Aosta Valley (north-western Italian Alps), by means of both the analysis of experimental data and numerical simulations. The paper is complete, well-written and can be of interest for the community. Therefore in my opinion it is worth publishing in Atmospheric Chemistry and Physics, after a few minor comments are addressed.

Specific Comments 1) Meteorological model: the Authors say (pag. 8, line 7) that "we used a nudged, high-resolution variant, called COSMO-I2, covering Italy". However, in my opinion 2.8 km is not high-resolution in complex terrain. The floor of the Aosta

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Discussion paper

Valley is 2-3 km wide, so meteorological phenomena triggered by the orography may be not well resolved by the model at this resolution, also considering the fact that the actual model resolution is 6-8 times the grid cell (Skamarock 2004). In fact authors say that the model surface altitude of Aosta urban area is 900 m a.s.l., whereas the actual altitude is 600 m a.s.l. For example Schmidli et al. (2018) showed that at 2.2-km resolution the COSMO model poorly simulates valley winds, while at 1.1-km resolution the diurnal cycle of the valley winds is well represented. Similarly, Giovannini et al. (2014) showed that 2-km resolution can be considered as the limit for a good representation of valley winds in narrow Alpine valleys. 2) Building on the previous consideration, it is not easy to evaluate the performance of the chemical model without a validation of the meteorological model. The Authors attribute most of the discrepancies with respect to measurements to deficiencies in the boundary conditions of the chemical model. However, this statement is difficult to be demonstrated without a complete validation of the modelling chain. Moreover, increasing the boundary conditions by a factor 4 reduces the mean bias, but does not reduce the RMSE (Table 3). So it seems that there is still a compensation of underestimations and overestimations. 3) In Figure 17 it would be interesting to see also a normalized mean bias (i.e. a mean bias normalized by the average concentration measured for each class).

Technical remarks Page 1, line 4: . . .3-year period. . . Section 4.3: The two final sentences begin with “Finally”. Page 36, line 18: . . .this regular air mass transport. . .

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