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Comment on acp-2021-106

Anonymous Referee #3

Referee comment on "First insights into northern Africa high-altitude background aerosol chemical composition and source influences" by Nabil Deabji et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-106-RC2, 2021

This paper presents results from 12-hour PM10 filter samples taken on a newly established high-altitude site (AM5) in Morocco in the middle Atlas. The filters were analyzed for inorganic and organic constituents of particulate matter. The analysis takes into account the meteorological situation like backward trajectories and wind speed.

Such data sets are very important for the scientific community, because information on aerosol composition at such remote sites are sparse. The technical aspects of filter analysis are not my field of expertise, but I believe that such a well know institute as TROPOS knows very well how to conduct filter analysis properly. Overall I think the manuscript deserves publication, although I have some concerns about the further data analysis (after the chemical analysis of the filters) and presentation of the results. Since my suggestions include re-structuring of the manuscript, I list them as “major revisions”:

- I suggest to re-structure the results section as follows:

Start with 3.1 (Variation of PM10 mass), then continue with 3.4. (Characterization of aerosol chemical composition for the complete measurement period). Then 3.3 (Air mass classification), then 3.7. (day-night), then 3.6 (dust vs non-dust) and only then 3.2 (Aerosol composition under remote background conditions). Thus, I mean ordering the sections from “robust classification” down to “less well-defined” classification. Furthermore, I suggest to make the same type of plots (bar graphs or pie charts) for all these classifications. It makes comparisons between different separation criteria much easier.

- Air mass classification

Please give more details on trajectory treatment. Line 456/457 says "The air mass origins were classified into four major categories, as showed in Fig.5.". But how exactly was that done? Did you check whether a trajectory crossed a certain latitude-longitude range? How many points were used to assign a trajectory to a certain category? Did you use a clustering algorithm? Did you consider the vertical motion? It makes a big difference if a trajectory crosses the desert at 2000 m or at 200 m altitude.

What exactly is shown in Figure 5? How many trajectories of sample times are not shown here? The caption says "PM10 mass concentration are given in parentheses" but only a percentage value is given.

Did you check how the local orography is represented in the model? 2000 m starting point may be too high if the model landscape smoothes the actual mountain range down to lower altitudes. HYPLSIT offers the option "above ground level", so initializing the trajectories with "10 m above ground level" might be a good sensitivity test.

- Definition of "background".

The definition of the background conditions ("mass concentration lower than 20 µg/m3 and low wind speeds less than 4 m/s.") is not clear to me and seems artificial.

More data analysis is required for such a classification. For example, create a PDF (probability density function) of mass concentrations and wind speeds to show that the chosen thresholds are reasonable. Trajectory information may also be used (see comments above) so check whether the air masses touched the boundary layer or travelled only in the free troposphere. A classification based on solid, statistical relevant criteria is needed for this section.

Further comments

Section "3.1.2 comparison with other stations" and (Table 3):

I miss Jungfaujoch and other GAW stations. There is a data base of the GAW stations:

https://gawsis.meteoswiss.ch/GAWSIS/#/

Figure 6: Background shading type is too coarse, hard to recognize

Table 5: First row “mass load NOA”: should it read “109”?

Data availability: Please make the data publicly available through a data base or repository. The data set should be easy to handle (a simple table with date, time, concentration of compounds) for everybody.