

Interactive comment on “Relation of air mass history to nucleation events in Po Valley, Italy, using back trajectories analysis” by L. Sogacheva et al.

Anonymous Referee #1

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General Comments (technical comments will follow):

Three years of particle measurements in San Pietro Capofiume (SPC) in Po Valley are analyzed in terms of nucleation events and the formation of particles with subsequent growth. Air mass history was investigated for so-called “event and non-event days” with help of four-day back trajectories.

The occurrence of ultrafine particles is a phenomena observed at nearly all major field research stations with aerosol measurements. The question under which meteorological conditions this processes take place is still an open and widely discussed question and due to the high impact of aerosol on climate this is definitively an important issue.

To investigate the air mass history in terms of sources for particle load and precursor gases back trajectories analysis is a widely used method. However, this method has some limitations and under some circumstance errors using this analysis become pretty large.

Therefore, my main concerns with this work is the reliability of four-day back trajectories for air masses arriving in 100 m height. I wonder if this air masses are mainly influenced by local effects and boundary layer dynamics especially in such inhomogeneous terrain as the Po Valley with its surrounding mountains. In the first paper describing this data set by Hamed et al. 2006 (ACPD) it was mentioned that the preferential “seasonal pattern” for nucleation events at SPC are just the opposite to that found in Ispra at the northern edge of Po Valley. If this is true one might wonder if local flows and conditions are much more important for nucleation than the air mass history of four days? This point has to be discussed in much more detail. Furthermore, I strongly suggest to include more back trajectories which arrive at SPC in different heights - for example 500 and 1500 m - and which are therefore less influenced by local terrain. Such an analysis would improve the reliability on this data and the conclusions drawn from this analysis.

Finally, I understand the importance of the air mass history in terms of particle load and precursor gases for nucleation but why should it be of major interest which type of weather this air masses experienced let's say three or four days before the nucleation event? From my point of understanding the thermodynamic conditions are important for the nucleation process itself but not the history. This part of the discussion is somehow puzzling for me and should be clarified. You should give a few strong reasons why the weather conditions up to 96 hours before the nucleation event play an important role.

Specific Comments:

Section 2 “Site description”: You describe the typical synoptic conditions during winter times with related problems of ventilation and therefore air pollution but you tell us

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nothing about the other three seasons.

Section 4 “Classification of the new particle formation events”: The definition of “undefined days should be more precise. For me your definition is somehow arbitrary.

The first part of Sec. 7 “Meteorology along the trajectory” should be moved to Sec. 5 since it is more technical description of the model. I wonder if the vertical wind speed (see line 21 in Sec. 7) is a useful parameter to describe “the influence of underlying areas to air parcel properties”, in fact I am not sure if I understand what you want to mention with this statement. Are you sure that the vertical wind speed (around zero in average) could be well described with back trajectory analysis?

§ 11218, line 5: this is a trivial statement and should be removed. I do not really understand the following points. You describe typical conditions during a high-pressure period but there is no new information important for new particle formation. The significance of your observations is not clear for me. Why should it be important at which height an air parcel “starts” its journey 96 hours before? During four days an air parcel is undergoing four boundary layer developments with convective transport and all these issues.

I have serious concerns about the significance of these findings for an improvement of our understanding of new particle formation.

§ 11219 line 10 and following: The discussion about the relative and absolute humidity and temperature is trivial since the all parameters are depending on each other; especially the statement at line 15 should be removed. I suggest to remove the discussion about the vertical velocity completely also. First of all for all classes shown in Fig. 5b the general structure is similar. The differences for the four cases is only about 5 mm/s which should be of minor importance.

Section 8: I feel that the analysis in this section is much more important compared with the previous section and gives some useful hints for the reader. I strongly suggest to

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focus more on these topics compared with the discussion about the weather situation.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 11209, 2006.

ACPD

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