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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 #2

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Overview

The manuscript by Sogacheva et al. gives a comprehensive description of the transport patterns and meteorological characteristics associated with nucleation and non nucleation days. The goal is to investigate if there are typical directions of transport or certain meteorological features associated with new particle formation events observed at the San Pietro Capofiume measurement site in Po Valley, Italy. The authors further adopt a simple modelling approach to estimate the relative contribution SO₂ at the receptor site, using available emission inventories. The study is extensive and includes three years of size distribution data. The authors found that the air associated with

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new particle formation events more frequently is associated with stronger subsidence, higher temperature, lower precipitation and lower relative humidity close to the receptor site compared to non-event days. The origin of air masses favouring nucleation is identified.

General comments

The article gives highly detailed description meteorological conditions associated with event and non event days. The methodology is clearly outlined and the approach is easy to follow. The investigation merits from analysis of long data series and addresses important issues relating to new particle formation in the boundary layer. I think this is a potentially good MS. However, I think some additions are required to reach all the way. In its current form the MS suffer from an imbalance between the presentation and analysis of the data. Large effort is put on describing the different (meteorological) parameters associated with/ potentially favouring nucleation, but only minor effort is put on analyzing the potential connections of the studied parameters to new particle formation events. Some of the parameters studied such as temperature and relative humidity could have a significant impact on the nucleation rate it self. Additionally, several of the parameters discussed affect the particle size distribution properties in terms of both condensation and coagulation sink associated with the pre-existing aerosol prior the nucleation event (e.g. precipitation through wet deposition, relative humidity, temperature and vertical mixing) and therefore also affect the probability of detectable nucleation events at the measurement site. For example, the authors mention that event trajectories are associated with higher than average precipitation during transport, but lower than average precipitation during the day of nucleation which e.g. implies the importance of wet deposition in reducing the condensation sink prior detectable nucleation events. These types of possible relations provide a good basis for discussion of the results. Therefore I would like to see in the revised manuscript a discussion on how the different parameters are expected to influence the “nucleation event potential” of the air and how the history of air is relevant for this study. In this way the conclusions of

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the paper will be more general and more useful to the reader. Ideally, the typical meteorological and transport characteristics associated with events and non events in this study could also possibly also be compared to key parameters such as condensation sink.

Specific comments

Page 11210, line 7: Change “form” to “from”

Page 11211, line 6: Change “the trajectory analysis” to “trajectory analysis”

Page 11229, line13: Change “form” to “from”

Page 11229, line 16: “Trajectories” To which trajectories does the author refer; event, non-event or all?

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

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