Atmospheric
Chemistry
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Discussions

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Interactive comment on "Refined classification and characterization of atmospheric new particle formation events using air ions" *by* Lubna Dada et al.

Anonymous Referee #1

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This paper is an improvement of the Dal Maso et al. (2005) classification of New Particle Formation (NPF) days. That classification was limited to particles about 3 nm in mobility diameter and gave three classes: events, non-events and undefined days. In this paper a new proposal based on the ions participating in the nucleation is given and four classes can be obtained, excluding the undefined days. Other improvements have been incorporated, like the identification of regional and transported events. It has been applied to a large database and compared with the traditional manual procedure obtaining good results.

My main concern is that it uses NAIS data, an instrument not very spread in the com-

munity. This could limit the application of this new methodology. Anyway, this new method to classify NPF could be very useful in the near future. The results are discussed in an appropriate and balance way and the paper is well-structured. It is a significant work, concise and clearly written. I recommend publication in ACP and include some comments.

Specific comments:

Abstract: please, include the instrument used to obtain the data.

Line 69: "The station has accumulated 22 years..." Although the station is 22 years old, the dataset used in this paper is shorter, 11 years, please, indicate this here.

Lines 116-117: "To decide whether the particle growth is observed, particle concentrations in the size range of $7 - 25$ nm are examined. These particles represent the growth phase of freshly-formed clusters." Is not there any other possibility? For example, could they come from bigger particles that have suffered shrinkage? It has been observed in some sites particles below 20 nm after shrinkage.

Point 2.4: In order to evaluate the improvement reached with this automated method, how long time do you need to classify a year using your method? And using the manual one?

Lines 219-222: "The peak times of the events had the most frequent occurrence at 5 to 6 hours after sunrise, which is between 10:30 and 11:30 local time, complementing our previous assumption that NPF peaks before noon. Finally, the ending times of the events had the most frequent occurrence at 10 hours after sunrise." Do these times depend on the season? Is this possible dependency seen in the data spread shown in the figure 6?

Lines 230-231: "For example, 65% of the originally-classified event days ... were found to be RE, 10% were TE and 14% were IB". I don't understand how an event day obtained by the traditional method (Dal Maso et al. 2005) can be an ion burst event with

the new methodology. These IB events are characterized by not particle above 7 nm, so they should be considered non-event day by Dal Maso. Is there any reason for this?

Minor comments:

Check how the references are introduced in the text, sometimes not clear enough. Examples can be found in lines 35 and 48.

Line 40: Merikanto et al., 2009 is not included in the reference list

Line 41: Idem for Salma et al., 2016

Line 111: Idem for Rose et a., 2018

Line 118: Idem for Yli-Juuti et al., 2011

Lines 81-82: It is "the mobility distributions of charged and neutral aerosol particles and clusters in the size range of 0.8–47 nm and 2–42 nm, respectively, were measured with a Neutral cluster and Air Ion Spectrometer". I think it should be "the mobility distributions of neutral and charged aerosol particles and clusters..." to correlate with instrument list.

Line 165: "For 10 years of data (2006 – 2016)..." Previously it has been said from 2006-2015, I think the right period is until 2016, please, unify the dates.

Lines 243-244: "Also, the growth can be interrupted by a sudden appearance of a cloud (Baranizadeh et al., 2014;Dada et al., 2017)." This idea already appears two lines before. Remove one of the sentences

Line 302: the DeSerio (2008) reference is incomplete

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