Answer to comment of Reviewer 2

M.I.García (corresponding author)
isabel.garalv@gmail.com

We thank the comments of the Reviewer 2 (#C9322), which contributes to improve our work. All these comments and suggestions have been considered in the revised version of the manuscript.

REFEREE: Authors should also mention in the introduction the work of Metzger et al. (2010) on organic & sulphuric acid nucleation experiments.

AUTHOR: this study is cited in the revised version of the manuscript.

REFEREE: Since SO2 data are available, authors could use the statistical proxy from Mikkonen et al. (2011) to estimate the sulphuric acid concentration. Therefore, they could conduct a deeper analysis on the conditions that promote the detection of NPF whether or not sulphuric acid is enough to explain the observed growth assuming a kinetic regime or if another condensable vapour is needed to explain what is observed. This analysis would be interesting in the frame of the one published by Kuang et al. (2012).

AUTHOR: Thanks, this is a very good suggestion. Following your proposal, new parameters were determined in the manuscript: sulphuric acid proxy, condensation sink (CS), source rate (Q), concentration of condensable vapour (Cv) and theoretical growth rate of sulphuric acid as condensing vapour (GR). These data were used for studying if sulphuric acid may accounts for the observed growth rates. These and other new analysis are included in section 3.4.2.

REFEREE: If I remember correctly, Manninen et al. (2010) did not actually provide data for the puy de Dôme. I think Venzac et al. (2007) is the first work on NPF analysis at this French station. Also I think a long term analysis of NPF event is available in Boulon et al. (2011) and could complete your bibliographic analysis and fill the empty space in table 3. Similarly an interesting work by Jung, Miyazaki and Kawamura has also been published in 2013 in ACP.

AUTHOR: Thanks very much for providing these details about data provided by each publication: (1) We have checked the paper of Manninen et al. (2010), and confirmed that they provided data of Puy de Dôme (see section 2.1 Measurement sites; 2.1.10 Puy de Dôme), (2) The paper of Venzac et al. (2007) only provides GR for ions, not for the aerosol size range we have measured, (3) we have introduced in Table 3 the data of Puy de Dôme provided by Boulon et al. (2011). (4) We have checked the paper of Jung et al. (2013). It provides data for an urban site and a deciduous forest site, so this reference was not included for the discussion. However, we saw the reference of a study in a remote high elevation site that was not in our bibliography. We have completed Table 3 and discussion with this mountain-top observatory (Hallar et al., 2011).

REFEREE: p12, l10 – l13: I think this statement does not agree with the one found in Boulon et al. (2011). Please check.

AUTHOR: The statement was based on data in preparation (Boulon et al., 2010). We have searched that article, but it seems that has not still been published. Thus, we have reworded the sentence following the referee suggestion: '...at Puy de Dome station the maximum of events frequency was found during early spring and early autumn (Boulon et. al. 2011)'.

REFEREE: p14, l5 – l9: About this ratio analysis, do the authors compare the "all period data" during the same daytime period than NPF occur ? In other words, NPF is in general triggered between 9am and roughly 2pm. The ratios only have a meaning if they are all compute within the same time period, i.e. betwenn 9am and 2 or 3pm, to avoid noise due to changing conditions during the rest of the day.

AUTHOR: This is a very interesting suggestion, we fully agree. New ratios were calculated. Now the ratios during the formation and growth steps to No Events days in the period 11:00 to 16:00 GMT were calculated. The selected new period represent the mean start (11:00) and end (16:00) times of the events (Fig 7C). Thanks for this suggestion.

REFEREE: The growth rate is strongly size dependant. At what size growth rate calculations have been performed ?

AUTHOR: Growth and Formation rates were performed for the nucleation mode (Dp < 25 nm). This is described in section 2.3.2 and is the standard calculation performed in a number of publications.

REFEREE: Authors observed two different nucleation modes. On figure 12, bottom panel, it seems that the first mode do not evolve while the so-called second grow. No explanation are proposed which is a bit frustrating. At least, propose some assumptions, some simple model might help.

AUTHOR: We agree with the referee that this is really a very interesting observation. We observed that the two modes may exhibits different behaviour in different events; in some cases, only one mode evolves (the first or second, depending on the event), whereas the two modes evolves in other episodes. A study of these events will require a deeper data analysis with a different methodology. This will be subject of a future paper, now it is out of the scope of the study. In this article, we simply decided to cite that these events were identified, since it may help to other researchers.
