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Interactive comment on “New particle formation and ultrafine charged aerosol climatology at a high altitude site in the Alps (Jungfraujoch, 3580 m a.s.l., Switzerland)” by J. Boulon et al.

Anonymous Referee #1

Received and published: 26 May 2010

This paper investigates the process of new particle formation at an alpine site based on one year of data from a neutral aerosol and atmospheric ion spectrometer (NAIS) (although I believe other data were available). In my view the paper needs more work and should not be published in its present form. Some of the analysis is overly simplistic, it seems to mainly just repeat what has been done with this instrument at other sites, no ancillary data is presented to support the NAIS data (the instrument description is minimal), and major conclusions are reached based solely on speculation.

Some details.

Introduction: My understanding is that there is still some conflicting views on the impor-

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tance of ion or neutral species on NPF as a function of location based on both model simulations and measurements. A summary of current findings/views on this would help place the results presented in this paper in a better context.

The description of the NAIS, the instrument on which the entire paper seems to be based, is very thin. At a minimum a quantitative discussion of measurement uncertainties in sizing and counting particles is needed. How does the instrument compare with the SMPS data at the site for overlapping sizes? Overall, this paper would be significantly improved if other data recorded at the site was included in the analysis (if that is possible).

Section 2.2.4 (and subsequent sections that refer to air mass origin. What is special about the air mass location 3 days prior, why not 5 or 10 days prior. In the analysis of data by air mass classification in later sections there is no discussion on the path or variation in altitude of the air mass to the measurement site, can't this affect the air mass characteristics that are important to NPF? The air mass analysis and interpretation of data seems overly simplistic. Maybe a map showing trajectories for the various air masses would clarify this issue.

Pg 11370 lines 19 and 20, updrifted, replace with drifted up, and typo, aroud

Pg 11372, line 10, what about January – why does it not follow the trend?

Pg 11372, on the role of clouds and NPF events. If my understanding is correct, in this paper clouds mean the measurement site is within a cloud (ie the RH is above 0.96), but this classification says nothing about clouds in the vicinity or if air masses reaching the site passed through clouds. This needs clarification and more discussion. I do not find it that surprising that few NPF events are observed in clouds due to scavenging – was the particle surface area measured (was there opc data, or at least look at the SMPS data), if it was I think the authors would reword “cloud droplets which COULD remove clusters or/and condensable vapours”. (is there any question about this?) I am not sure why the authors make a big deal about this, am I missing something, is there

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any references to in-cloud NPF? There are references to nucleation in the vicinity of clouds.

Pg 11373 lines 7-13. Can the authors give a physical explanation why or how it is possible that growth rates vary over differing ranges of nanometer sized particles. Given the uncertainty with these calculations, is there a real difference between say 5.3 and 7.8 nm/h? (ie maybe include error estimates for each mean growth rate size range and event category).

Pg 11374 line 26, reword J2 was less than four time bigger than J2+- . Maybe give the actual difference, eg, change to: on average J2 was (give the exact number) times bigger than J2+-.

Pg 11375 lines 20-23. If nucleation is occurring at sizes significantly smaller than 3nm what does the comparison of two measurement techniques for measuring 3nm particles say about nucleation rates? It only provides info on the formation rate of 3 nm particles.

Pg 11378, line 19, is the Metzger et al paper published?

Page 11379, line 1 states . . . was related to the updraft of surface layer air parcels rich in preexisting particles and ion sources such as radon from the valley during the day. As far as I can tell there is no data in this paper to support that statement, it seems to me that all data on which this is based is circumstantial. There is really also no support for line 3, that radon was found to be the main cluster ion source at the station. Radon was never measured.

Pg 11380 line 4-6 (last line of conclusions). Again a conclusion is reached based on zero data. The authors have little justification to make the statement that “this result confirms that the nucleation process at Jungfraujoch depends on the presence of condensable vapours which allowed clusters to grow rather on nucleation of new cluster (should it be: rather then nucleate a new cluster?).

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