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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric nanoparticle observations in the low free troposphere during upward orographic flows at Izaña Mountain Observatory" *by* S. Rodríguez et al.

Anonymous Referee #1

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The authors present an extensive and highly interesting data set from a mountain top site situated in the Canary Islands. Given the uniqueness of the data, the paper should be of considerable interest and a valuable contribution to research into new particle formation. ACP publication is appropriate once the arguments relating to the data analysis are further clarified.

The authors point out early in the paper that the observation of elevated nano-particle concentrations (3 to 10 nm diameter particles in this case), depend on two factors, the formation of new stable particles (ie, homogeneous nucleation) and growth to de-

tectable sizes, which is greater than ∼3 nm. I believe the authors should be more precise in the extensive data interpretation presented in the paper. What exactly is meant when they use the term new particle formation (NFP)? Is this the formation of a new particle from vapors, or the formation of a 3nm or larger particle that can now be detected. The physics and specific chemical compounds involved in these two processes may be different. For example in the last line of the conclusions it is stated that, quote: although sulphuric acid participates in 3-10 nm particle formation, other vapours are involved in the particle formation during at least one of the two types of events segregated, end quote. What does particle formation mean in this case? Can it be stated from this data set that compounds, such as organic species contributed to the process of homogeneous nucleation, or was the role in a condensational growth process? An example of an implication of this is the effect of temperature discussed in the paper in Section 4.4.4. Is the temperature effect mainly playing a role in either the homogeneous nucleation process, as stated in the paper (e.g., sulfuric acid +water + whatever else), or in the condensational growth of a newly formed stable particle (e.g. partitioning of some oxidized organic), or both? Another example, page 10923, line 26, etc is not clear: conditions that favour the formation of 3-10nm particles necessary for the growth process resulting from NPF episodes. I believe a clarification on this throughout the paper is warranted.

A general observation on Type 1 vs Type II events: Maybe a fundamental difference between Type I and Type II events is mainly photochemical age. If my understanding is correct, Type II occurred later in the day whereas Type I was in the morning. This would explain the high SO2 in Type I -less time to react away to sulfuric acid, and low SO2 in Type II -most SO2 converted to H2SO4, and also the slightly higher NOy in Type II. The authors also suggest that Type I involves NPF upwind of the site (lower elevations) and Type II as in situ. Does the size distribution data (DMA data) provide any evidence to support this?

It might be worth discussing in more detail the clear linear relation between SO2 and

N3-10 given that homogeneous nucleation via some mechanisms is very nonlinear in H2SO4. Could it be that the SO2 is just related to growth, which may be directly related to H2SO4 concentration.

On the discussion on page 10929, second bullet, regarding the role of clouds and particle surface area. Don't the clouds need to be precipitating for a reduction in the aerosol particle surface area in an air mass passing through the cloud?

Page 10930 lines 21 to 24, second last line: is it true that particle chemistry significantly matters in the uptake of H2SO4. That is, having an aerosol of equal surface areas, mineral dust will significantly scavenge more H2OS4 than say liquid drops?

Minor editorial suggestions.

Page 10927 line 22, I would change: onto sulphuric acid droplets or clusters. . . to onto sulphuric acid-containing droplets or clusters. . .

In many cases I found the graphs difficult to read. Placing symbol labels within the graph may help.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 10913, 2009.