

***Interactive comment on* “Connections between atmospheric sulphuric acid and new particle formation during QUEST III–IV campaigns in Heidelberg and Hyytiälä” by I. Riipinen et al.**

Anonymous Referee #1

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The authors describe field measurements (H_2SO_4 , particle number) for new particle formation and growth recorded either at a rural site (Hyytiälä) or an urban site (Heidelberg) as well as comprehensive analysis of resulting data. Analysis for new particle formation rates covers different approaches using power-laws for H_2SO_4 including loss terms and a time lag for particle formation. A main result is that new particle formation can be described with a power-law for H_2SO_4 with an exponent of 1 - 2 for both measurement sites. This point is in line with former findings from Weber et al. (Weber, 1996) derived from measurements in Mauna Loa and Idaho Hill. This paper is very valuable for the Atmospheric Science community. Nevertheless, I would suggest few changes/additions:

1) The authors point at the possibility describing atmospheric new particle formation by an activation mechanism or by a kinetically controlled mechanism being second order for H₂SO₄. For the latter, lab studies in the pure system H₂O/H₂SO₄ show new particle formation for H₂SO₄ concentrations of 10(10) cm⁻³. What is a possible third body being responsible for the observed particle formation at both sites? Weber et al. (Weber, 1996) considered NH₃ as a candidate. As a result of simultaneous NH₃ measurements in Hyytiälä the authors stated at page 10848: " ... new particle formation would not be here limited by the ammonia concentration." What does it mean? Is the NH₃ concentration in a saturation range or, generally, ternary nucleation H₂O/H₂SO₄/NH₃ does not work?

2) For the days with NH₃ measurements a comparison of experimentally determined particle numbers with model predictions using the actual ternary nucleation rate should be possible, like plot 3b or 4a for the H₂SO₄ power-law. This comparison helps to elucidate the possible role of NH₃.

3) The overall nucleation process is expected to be strongly temperature-dependent and, therefore, at least the fitting parameters A and K are a function of temperature. The measurements span a relatively long time range during winter- and spring-time. Is a T-dependence visible for A and K in the whole data set?

4) The measurements in Hyytiälä have been done during april - may connected with starting biogenic activity in the forest. A statement is needed for the importance of organics for the growth process.

R. J. Weber et al., (1996), Chem.Eng.Comm., 151, 53-64.

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