

Interactive comment on “The role of atmospheric ions in aerosol nucleation – a review” by M. B. Enghoff and H. Svensmark

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The manuscript is very similar in subject, scope, and structure to “Tropospheric new particle formation and the role of ions” [[Kazil et al. \(2008\)](#)]. A few comments here:

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... Udelhofen and Cess (2001) found that cloud cover in the United States for the last 100 years correlated with solar activity.

While this is correct, [[Udelhofen and Cess \(2001\)](#)] also point out, referring to their analysis of the US cloud cover, that

“The cloud cover variations are in phase with the solar cycle and not the GCR.”

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This is just the opposite of how a possible connection between GCR and clouds that proceeds by ions growing to aerosol particles and cloud droplets would be thought to present itself.

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... the amount of atmospheric ions is changing on timescales of hours to millennia ...

Is there a work addressing the variation of atmospheric ionization on the time scale of millennia?

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... where the standard nucleation rate J (new particles formed per volume per time unit) is defined as:

$$J = Ce^{\frac{-\Delta G^*}{kT}} \quad (1)$$

This is less a definition and more the result of considerations regarding the probability of occurrence of a critical nucleus as a state with a given energy within the energy spectrum of the system [[Volmer and Weber \(1926\)](#)].

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... sulphuric acid ... 10^7 cm^{-3} which corresponds to atmospheric levels (Kazil et al. 2006).

I recommend using a more authoritative reference for atmospheric H_2SO_4 concentrations, such as [[Weber et al. \(2001\)](#)].

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Atmospheric observations indicate that binary homogeneous nucleation cannot explain some significant nucleation events, and ions may be the key.

Laboratory studies indicate that ammonia [[Marti et al. \(1997a\)](#), [Kim et al. \(1998\)](#), [Ball et al. \(1999\)](#)] and organic molecules [[Zhang et al. \(2004\)](#), [Kulmala et al. \(2006\)](#),

Burkholder et al. (2007)], may be responsible for or contribute to neutral atmospheric nucleation events, in addition to sulfuric acid and water, and while there is still a fair amount of uncertainty and controversy [Marti et al. (1997b), Janson et al. (2001), Anttila et al. (2005), Sellegri et al. (2005), Yu (2006), Kurtén et al. (2007)], mentioning these compounds in the summary would seem appropriate.

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The fact that the exact mechanism for the nucleation is not known makes it difficult to obtain reliable observations ...

Shouldn't the observations help identifying the exact mechanisms for nucleation?

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... since it is uncertain which parameters should be observed.

At least two observables can be named that can help identifying the nucleation mechanisms responsible for atmospheric new particle formation: Charging state [Kerminen et al. (2007)], and composition of the nucleating particles. While the latter cannot be yet analyzed for the smallest of particles, the corresponding methods [Voisin et al. (2003)] are being continuously improved.

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Please check the references to works authored/co-authored by R. G. Harrison, in some of them this author's name is misspelled.

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