Asmi et al, Aerosol decadal trends (II): In-situ aerosol particle number concentrations at GAW and ACTRIS stations.

acp-2012-586

Reply to reviewers

We thank both of the reviewers for their comments and observations on the manuscript. The suggested corrections have on our opinion improved the manuscript and pointed out some of the features not mentioned in the analysis earlier.

The corrected manuscript will be submitted shortly, with the changes highlighted in red.

Notable change is the addition of one additional DMPS measurement time series from Southern Sweden (Vavihill). This does not change any of the conclusions in the paper, as VHL dataset seems to behave generally quite similarly as other Nordic DMPS datasets.

Detailed answers on comments (our reply in blue):

Referee #2

Minor points
P20878, L10-14. Please clarify what is meant by "negative effects".
This is the warming effect which they identified with decreasing of SO2 emissions. Now mentioned as "warming effect".

P20870. It might be useful to discuss in the context of Tai et al. (2012) who used longterm PM observations to help understand the meteorological variables driving aerosol mass.
One paragraph discussion is added

P20871, L5. I think it would be the trend in nucleation rate (not N) that would be dependent on temperature. Previous work has demonstrated that sensitivity to N is less than the sensitivity to nucleation rate, suggesting a reduced sensitivity of N to temperature.
We agree. The nucleation rates most likely will have much higher sensitivity than N, as N has many other properties affecting it also. Some sentences on this have been added.

P20871, L20. It is possible that interactions between T, BVOC and aerosol number may be more complicated than suggested here. The impact of changes to BVOCs on aerosol number will depend on the role of these compounds in controlling particle growth rates and particle formation. If oxidation products of BVOCs do play a role in atmospheric nucleation (e.g., Metzger et al., 2010) then the sensitivity between BVOC and N should be greater. In contrast, increases in BVOC and biogenic SOA will act

to increase the condensation sink which would act to suppress nucleation. This would result in an opposite relationship to that suggested in the paper. Therefore it is not clear to me whether increasing BVOC should lead to increased aerosol number. A short discussion on these points might be useful.

We added some discussion on other, compensating processes. Naturally, looking to such compensating drivers is outside of the scope of such simplified analysis, but will be studied in more detail in future CTM and GCM studies

P20872, L16. Please re-word this sentence.
Done

P20872, L21. Precipitation will mostly remove larger particles, so an increase in precipitation could lead to reduced condensation sink, increased nucleation and an increase in particle number (N). Please dicuss.
We included some discussion also on this compensating process

P20871, L5. What is the spatial resolution of these datasets? Did you apply some spatial averaging as done for emissions?
The spatial averaging was from the published dataset. We did not do any additional averaging.

P20873, L21-L23. Please explain the statement "quantitative agreement in the trends between FT temperature and N is evident". Do you mean qualitative agreement?
Yes, you are correct. This has been now corrected.