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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Particle number concentrations over Europe in 2030: the role of emissions and new particle formation" *by* L. Ahlm et al.

Anonymous Referee #2

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This paper is well written and authors discussed well the results of the model in scientific ways addressing domain wide results and relating them to specific receptor sites. It would be more clear for the future readers if the followings are clearer.

1.In section 3.2, authors mention that the Pan–European anthropogenic Particle Number Emission Inventory (Kulmala et al., 2011) is used for the particles whose diameters range 10-300 nm, and for the larger particles, the Pan-European Carbonaceous Aerosol Inventory (Kulmala et al., 2011) used for PM2.5 emissions. Is this appled regardless of types of PM2.5 speices? How authors treat particle distribution from boundary condition. This might be important when dust emission plays an important

role in Europe.

2.From Fig. 1 and Fig. 3, the west Spain and East Europe including Bulgaria and Greece are staying higher level of Ntot while emission levels are reduced. I think that authors mention that it is due to reduction of condensational sink, and they relate this to the receptor sites of Ispara and Cabauw. I think that it is good and strong points of this paper. Readers can understand well about the results of Ntot. But I am curious about why high level of N100 is kept to be maintained around the area of the south east England, Belgium, and Netherland while emission is reduced. It looks this area is high-lightened while other area N100 level went down along the reduction of emission level. Is this because there are strong sea-salt emissions whose diameter is bigger than 100 nm around these region or any other direct PM2.5 emissions? I hope authors also discuss the N100 patterns shown in the Figures.

3.From Fig. 4 (median diurnal cycle) and Fig. 5 (total number distribution probability distribution curves), authors relate the nucleation events indirectly. They address impact of nucleation to the budget of Ntot, N10, and N100 in Fig. 6. To dig out further the role of emissions of each species, authors report Table 3 and conclude that SO2 contributes most of particle number concentrations followed by PM2.5 in Europe. This result is a quite contrast to the sensitivity result of Gaydos et al. (2005). Authors in the paper found that reducing SO2 increases a number of nucleation events in Pittsburgh, PA in July as it reduces ammonia by forming ammonia sulfate. They saw that NH3 plays an important role in the nucleation events in summer in Pittsburgh, PA. It looks most of Europe has abundant ammonia than Pittsburgh from this work. I hope authors mention the general level of ammonia in Europe so that readers can get a sense of why nucleation in Europe is different from Pittsburgh, PA, United States.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 8769, 2013.