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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Black carbon concentration and deposition estimations in Finland by the regional aerosol-climate model REMO-HAM" *by* A. I. Hienola et al.

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We thank the referee for good comments. Below, we present some initial responses, more thorough replies will be submitted later.

REFEREE: This paper compares modeled BC in Finland against measurements, and concludes that there are problems with the inventory. On reading the paper I suspect that there are major problems with the model setup, and a lack of knowledge (or at least discussion) of other studies of BC in Europe, including those from Finland. The main model problem seems to be its small domain. Actually, the model description is rather unusual in not giving any information on the model domain and its vertical resolution

at all. All maps show Finland only, so early on in the manuscript one starts to suspect that the domain covers only this one country, with the domain being that shown in Fig.1. This impression is strengthened when reading the text concerning wind-direction and attempting to ascertain sources. Notably, the possible source area to the south-west of Hyytiala is said to be Tampere. I would have suspected Germany, Poland, the Benelux or other countries.

ANSWER: The figure attached shows the whole model domain together with average annual BC concentrations (\mug/mˆ3) in the lowest model layer. We will include the figure and improve the description of the model domain in the paper. Concerning the effect of close-by sources vs long-range transport, it can be clearly seen from Fig 1. that the concentrations are strongly elevated close to major sources. Regarding the effect of Tampere just a few tens of km away from Hyytiälä vs. Central Europe, one expects that the BC arriving from Tampere is strongly peaked in one wind direction, whereas the long-range transported BC should be associated with a much broader wind-direction distribution. Nevertheless, we will perform backtrajectory analysis as suggested by the referee.

REF: The possibility of transport from outside Finland is not even mentioned, something which is unacceptable in my opinion. It has been known for decades that air pollution over the Nordic countries can be strongly affected by neighboring countries. BC particles have a low dry-deposition rate, and the potential to travel 100s or even 1000s of km is well known. The Finnish Meteorological Institute has in fact published many very good papers (e.g. Saarikoski et al., Atmos. Env. 2007, Saarnio et al., Sci. Tot. Env., 2010, Aurela et al., Atmos. Env., 2011), on long-range transport of pollutants to Finland - why do the authors ignore such evidence? The use of wind-direction as an indicator of sources areas is also not acceptable, trajectory methods are needed for anything other than very local transport.

ANSWER See above.

REFEREE: The paper claims that no other regional model studies regarding black carbon have been conducted in recent years. This is clearly wrong. Schaap et al (JGR, 2004) studied EC over all of Europe, including results for Hyytiala. Simpson et al. (JGR, 2007) and Tysro et al. (JGR, 2007) presented results for Finland also. The issues surrounding BC deposition to snow are again addressed lightly, with no comparison to other relevant studies (e.g. Skeie et al., ACP, 2011).

ANSWER: We will add discussion of the mentioned literature.

REFEREE: The possibility of uncertainty in the emissions is of course real (though not demonstrated here), which makes it also worrying that the authors do not discuss the more recent BC inventories for Finland produced by Kupianen and Klimont (Atmos. Env., 2007) and the EUCAARI project. There is no demonstration, or discussion of, this model's ability with any pollutant, so we are left with the possibility that the lack of model agreement might be emissions, or domain size, or vertical dispersion or a combination of these and many other factors.

ANSWER: We will perform backtrajectory analyses for the measurement data, and make sensitivity experiments with the model (by e.g. disabling the Finnish BC sources) in order to better characterize the influences of close-by sources vs long range transport. Regarding vertical dispersion, we will present the model results as well as model and measured BC concentrations in connection to BL height. A new and more comprehensive emission inventory for Finland is an ongoing project and will be presented in a future article.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24395, 2012.

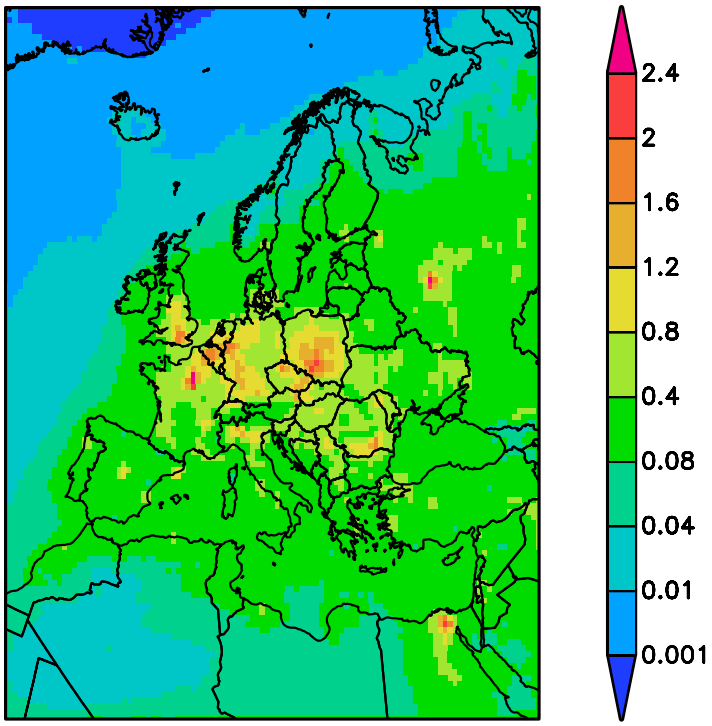

Fig. 1. Model domain and BC mean concetration (\mug/m^3)