

Interactive comment on “Overview of the synoptic and pollution situation over Europe during the EUCAARI-LONGREX field campaign” by T. Hamburger et al.

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We thank the reviewer for her/his valuable comments on the manuscript. The reviewer's comments are in regular type and our responses are outlined in italic type.

General Comments

This paper provides an overview of the LONGREX (LONG Range EXperiment) component of the EUCAARI intensive observational period. It aims to put the extensive observations of the aerosol distribution across Europe into the context of the

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meteorological situation during the campaign. This is a difficult task but essential to give the new observations and deductions from them a wider applicability, both in time and space. Although not presenting innovation in measurements (since covered in related papers) or modelling and analysis techniques, the paper represents an important synthesis that will be of interest to many researchers across Europe and worldwide.

The paper is well written and the figure quality is good. The main value of the paper is to link together the temporal coverage of 6 ground stations taking aerosol profile measurements with the spatial coverage obtained by in situ measurements of aerosol number concentration and composition from two aircraft. Knowledge of the aerosol distribution is sparse, so even the average numbers obtained for aerosol concentration within the boundary layer and free troposphere during blocked or unblocked flow regimes is of great value.

My primary criticism is that the ground-based profiling and aircraft measurements are not assimilated together to estimate a spatial distribution of some key aerosol properties. The ideal way to do this would be using a model together with a data assimilation scheme. I realise that aerosol measurements are very heterogeneous (both in quantities measured and coverage), but the attempt would be very valuable for a variable which is comparable between measurement platforms, such as total particle number concentration or accumulation mode particle number concentration. Clearly there is sufficient data to produce Fig. 13 for example. As it stands, a free-running model is used to illustrate the distribution (e.g., Fig. 3 showing black carbon column amounts) but the data is only shown in time series, isolated profiles or scatter plots. It has not been integrated together to estimate a distribution, even if only some smooth pattern averaged over the two distinct flow regimes of the campaign.

The reviewer is correct in pointing out the missing discussion of average spatial

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distributions merging together model simulations and measured data. While we do not want to turn the paper into a major model study with respect to the assimilation aspect (our expertise rather lies on the observational aspect), we agree it is useful to include information on model simulations using FLEXPART. We have added the following text and Fig. S1:

FLEXPART simulations are used to analyse the average horizontal BC-mass distributions over Europe for period (a) and period (b) that result from European anthropogenic emissions. They are compared to the average BC-mass concentrations measured at the ground stations during the respective period. As discussed above an increase of BC-mass concentration goes along with an increase of accumulation mode number concentration in most cases that were observed at the ground stations. Thus, regions of increased BC-mass concentrations can be associated with regions of increased particulate matter. Fig. xx shows the average BC distribution above Europe at 10 m a.g.l. The average values were calculated for period (a) and period (b) from FLEXPART simulations on a 1x1 grid. The circles indicate the position of the ground stations and the colour shade the average BC-mass concentration measured at the ground stations during period (a) and (b). Maximum BC-mass concentrations greater than $0.7 \mu\text{g m}^{-3}$ can be found above the Benelux States, North-east France, the English Channel, and England. A second maximum can be found above southern Poland. Compared to period (b), the regions of maximum BC-mass concentrations have a larger horizontal extension. In contrast, BC-mass concentrations greater than $0.7 \mu\text{g m}^{-3}$ were mostly limited to urban regions like London, Paris or Rotterdam. The FLEXPART simulations also show that the anticyclonic transport associated with the high pressure system centred over the North Sea and Denmark led to a transport of anthropogenic pollution towards the Atlantic and the Norwegian Sea. The average values retrieved from the FLEXPART simulations agree well with the observed temporal averages and lie within 25 % of the measured BC-mass concentrations.

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My recommendation is to accept the paper subject to minor revisions. The revisions should include some attempt to marry together the spatial distributions implied by models and the measurements obtained during the campaign at isolated time or locations. This need not be in terms of a rigorous data assimilation approach but at least in terms of a model-data comparison in aerosol number concentration above the profiling stations. It is essential to give some form of appraisal on whether the data collected during EUCAARI is sufficient to constrain the regional distribution estimates. Are there obvious deficiencies in model simulations which appear to be systematic (i.e., biases in column amounts, average vertical profile shapes, the range of temporal variations and other such coarse-grained measures)?

The detailed comparison of measured aerosol number concentrations with modelled number concentrations is a very interesting and valuable task but out of the scope of the paper. This paper aims at presenting meteorological overview for the measurement flights of BAe-146 and DLR Falcon 20 during the EUCAARI-LONGREX campaign along with a first and broad analysis of the situation based on measured particle properties. The time series measured at the ground stations give a temporal framework for the airborne measurements performed in the vicinity of the respective ground station. Thus, the comparison of model data with measurement data and the subsequent evaluation of the accuracy of the model results go beyond the scope of this paper.

A detailed comparison of measured aerosol number concentration with an aerosol model using data measured at several EUSAAR ground stations and aboard the DLR Falcon 20 is realized in an upcoming paper by Reddington et al., in which our data will be used.

To give real value to the EUCAARI experiment it would be excellent to widen the discussion in this paper. What needs to be done next, given the results from EUCAARI? Are more routine aerosol profiling stations required to infer distributions? If

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so, what spacing would be a minimum requirement? Is another campaign warranted? Is data assimilation of aerosol number concentration now feasible?

Again the reviewer raises important questions but we feel that answering these questions is out of the scope of this particular paper, which is only one of several papers dealing with the results of the EUCAARI-LONGREX campaign. A synthesis paper is indeed in preparation in this moment.

Technical Corrections

1. p.19136, l.16: remove the word “inducing” and replace with “The ridge associated with high pressure ...”. Similarly, cyclones do not “induce” easterly flow. It would be more precise to say that the easterly flow on the northern flanks of these cyclones was ...

The sentence will be corrected in the revised manuscript.

2. p.19137, l.25: Please make clear in this sentence that the “high pressure” group is a subset of the “anticyclonic flow pattern” group.

The sentence will be clarified in the revised manuscript.

3. p.19149, l.19: Do you mean “above and west of Munich” which would be downwind of Munich during easterlies (and closer to OBF)?

We thank the reviewer for spotting this and will correct this in the revised manuscript to “east of Munich”.

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Please also note the supplement to this comment:
<http://www.atmos-chem-phys-discuss.net/10/C11475/2010/acpd-10-C11475-2010-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 19129, 2010.

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