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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Absorption, scattering and single scattering albedo of aerosols obtained from in situ measurements in the subarctic coastal region of Norway" *by* E. Montilla et al.

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This comment addresses the concerns raised by Anonymous Referee #2. We wish to thank the Referee for his comments on the manuscript. The follow is a point by point response in which we intend to show how we had addressed each item mentioned in the review.

General comments

The main concern of the Reviewer is related with the lack of information to support our

interpretations of the optical analysis. We would like to point out that, when we said in the manuscript that "the main goal of the campaign was to acquire a comprehensive physical and chemical characterization of local aerosol", we didn't mean that we had actually measured chemical properties, which we didn't. What we mean was that we intend to infer any possible information about the composition of the particles from the measured optical data. We don't have any chemical data measured *in situ*. We changed this affirmation of the manuscript, as it obviously was causing confusion and both reviewers were induced to think that we measured *in situ* chemical parameters.

Except for this, we included on the manuscript the other information suggested: we added information on the meteorological situation as suggested by the Reviewer and a full study of the air mass origins is now presented.

The remaining suggestions and corrections pointed by the Reviewer were also accepted or are explained and detailed as follow.

Specific comments

1. *pg2162, line 5-7:*
   This sentence was corrected to: "The extended three months campaign was part of the POLAR-CAT Project of the International Polar Year (IPY-2007-2008), and its goal was to characterize the aerosols of this sub-Arctic area which frequently are transported to the Arctic region."

2. This is done in the final version of the manuscript. The air masses were classified for the campaign period and their correlation with the optical properties of the particles is presented.

3. This is one of the conclusions of the study, since no previous measurements of this kind have been done before on that station nor any near place. However we completed the abstract by adding information about the new section of the paper,

where we classified the air masses and study the correlation of each sector with the optical parameters.

4. The last paragraph of the introduction is complemented with new information; new references and results were added: Collaud Coen et al. (2004); Pereira et al. (2011); Russell et al. (2010); Montilla et al. (2011); Mogo et al. (2005).

5. *pg2164, line 16:*
Our goal with this paper was to infer as much as possible from the optical data. The work is directed to the radiative properties of the particles and not to make an exhaustive characterization of the local aerosol. Other papers were planned for this campaign, which are also submitted or under revision, as is the case of: *Rodríguez et al., Aerosol characterization at the sub-Arctic site Andenes (69°N, 16°E), by the analysis of columnar optical properties.*, submitted to the Quarterly Journal of the Royal Meteorological Society.

6. *pg2169:*
The scattering coefficients are comparable to those in other polar regions, such as those presented by Delene and Ogren (2002), Aaltonen et al. (2006) and Quinn et al. (2007), it is only the scattering Ångström exponent that presents some hourly means with higher values. Only some values are higher, the average is in the same range as measured by those authors for polar regions. Actually Aaltonen et al. (2006) has also registered high values for the Pallas station in Northern Finland (0.8-3.9, average 1.8). A large value of the scattering Ångström exponent implies an aerosol dominated by smaller particles. This is usually the result of transport from other regions, as can be confirmed now, looking at the sector analysis of air masses origins. Higher scattering Ångström exponents are measured when the air masses are transported from sectors 1(S), 2(SE) and 3(E). See Fig.8 in the final version of the manuscript.

7. *pg2170:*

Fig.5a is just an other way to represent the scattering Ångström exponent and can be used to infer information about the size of the particles. Our assumption about the origin of the larger and the smaller particles, to be maritime and continental is now confirmed by back trajectory analysis. It does not limit the study to distinguish any further situations as it should be used together with Fig.5b,c,d, and Fig.6a,b, for a complete study of typical situations. During our campaign in ALOMAR, two situations were possible to identify for that station, but we think that a larger data set would allow the identification of more situations.

8. *pg2170, line 13:*
We provided an explanation for e and R as follows:
"For the Ångström exponents calculated, we determined the fit error, e, and the quality of the fit through the R parameter. The fit error was calculated as the standard error of the slope of the best fitting line for the observed data $\sigma \times \lambda$, its mean value is 23%. The R parameter was computed as the fraction of the total variation of the σ values of data points that is attributable to the assumed fitting line. It was used only qualitatively to evaluate the fit. Both, e and R were used to evaluate and clean the data set."

9. *pg2170:*
A new section is included in the manuscript: 3.3. Air mass origins by back trajectory analysis. The data from the two regions is separated and its relation with geographical sectors is established.

10. *pg2171:*
The conclusions are improved now to accommodate final comments about the relation of the optical parameters with the typical air masses. It is made clear that the optical parameters can be related with typical air masses.

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