

Interactive comment on “On the use of satellites to obtain information on the occurrence of natural and anthropogenic aerosols over the boreal eurasian forest” by G. de Leeuw et al.

G. de Leeuw et al.

gerrit.leeuw@fmi.fi

Received and published: 15 November 2011

We thank both referees for their comments regarding our manuscript “On the Use of Satellites to obtain Information on the Occurrence of Natural and Anthropogenic Aerosols over the Boreal Eurasian Forest” published in Biogeosciences Discussions. Below we give our answers to the referee comments and indicate what has been changed in the manuscript. Our reply is shown in italics.

A general response to both reviewers is that we agree that the manuscript “did not merit publication in its present form”. We realize that the reviewers have come to this conclusion because we have failed to clearly present what we want to contribute with

C4444

this MS and included too much material which we don't use. In the revised version we will correct this and present our case more clearly. The goal is not to present a quantitative comparison between satellite and ground-based data and results from a chemical transport model, but rather to show how these can be used as different and complementary sources of information on the occurrence of aerosols over Eurasia, taking Finland as an example. Air which is ‘clean’ at one site (Hyytiälä) may be ‘dirty’ some distance away, but only a dense network would reveal this spatial variation, unlike satellites which give a snapshot of a larger area.

We also realized that the title was too broad and propose to change it too “Preliminary studies on the use of satellite data to discriminate between anthropogenic and natural aerosols over the Eurasian Boreal forest.” Short title: “Aerosol over Eurasian Boreal forest”

Anonymous Referee #2 Received and published: 18 October 2011 General comment This article presents a brief literature study on how to potentially use a combination of satellite products, ground based observations and modeled data to distinguish between natural and anthropogenic aerosols. The motivation for such studies is evident, and this is also clearly highlighted by the authors. The abstract seem to promise interesting reading and results, with new insights on the applicability of satellites to provide information on the topic indicated by the title. After spending some time reading the manuscript, although piecewise informative, it is clear that the authors fail to fulfill these expectations. The actual data analysis presented is limited and does not reflect the discussion presented previously in the article.

Overall, the manuscript seems rushed and to some degree randomly composed. It is thus my opinion that the manuscript cannot be published in its current form. My recommendation is to reject publication.

We have addressed these points, which are well taken, in the general response to both reviewers.

C4445

The more specific issues that caught my attention are outlined below: The authors suggest the use of several different methods to discriminate between natural and anthropogenic aerosols, and the expectations are built up. However, the presented analysis seems superficial and clearly does not explore the potential approaches that are discussed. The quality of the article would be significantly improved by deepening the analysis including e.g. patterns of HCHO and glyoxal. In its current form, the study more resembles a project proposal than scientific study.

Several different methods for remote and in situ observations are performed, and but the discussion on how they should be integrated is fairly limited.

Regarding the results: With the risk of appearing ignorant, I have to ask what is new here and what are the conclusions drawn from this analysis that merit publication? The authors show that the high satellite retrieved AOD coincide with observations of high in situ observations of aerosol number and mass. These findings are further corroborated by modeling results (or rather vice versa). It is certainly not novel to compare AOD retrievals with in situ observations and the additional comparison with GLOMAP model results is extremely limited. The analysis seem to be done in a hurry, and it is furthermore not at all clear how the presented analysis would help/aid in the discrimination between natural and anthropogenic aerosols. What is shown in the analysis is that high retrieved AOD (usually) coincide with observations of large aerosol number and mass and that low retrieved AOD usually coincide with in situ observations of low particle number and mass. In other words dirty air is dirty and clean air is clean. Even if it would be the first time these satellite products were presented in the literature, the analysis performed would be far too limited to merit publication.

These points have been addressed in the general comments

Specific comments: Page 8453, line 15-18: This sentence seems a little out of track. The aerosol-cloud effect must certainly be included in "human induced aerosol impact".

This is certainly true and the sentence was intended to include this. We have reformu-

C4446

lated the sentence.

Page 8454, line 19: As written now it seems that boreal forests are main source of SOA from BVOC oxidation. A few lines below it is stated that boreal forests only contribute with 5-10% of global BVOC. There seem to be a disagreement here. Or is the boreal region so much more efficient in producing SOA compared to e.g. tropics?

This paragraph has been removed in response to general comments

Page 8454, line 28: Maybe should replace "are crucial" to "could be crucial" or "are likely crucial" or similar which are more adequately supported by the conclusions given in the paper. Same goes for previous statement that monoterpenes "dominate" which would be better changed to "could dominate".

This paragraph has been removed in response to general comments

Page 8455, lines 12-14: Sentence does not read well.

This paragraph has been removed in response to general comments

Page 8455, line 20-21: Add reference.

This paragraph has been removed in response to general comments

Page 8455, line 26-29: It sounds as the availability of quality assured data from these networks is limited to Finland. Clarify.

We use Hyytiälä as an example. We have changed the sentence to make this more clear.

Page 8456, lines 20-21: How? It is not clear to me how the abovementioned methods should be applied to discriminate between natural and anthropogenic aerosols. Please specify and or expand the discussion. The paragraph seems a bit contradicting.

We have changed the paragraph

Page 8460, lines 1-2: Do the authors suggest HCHO to be an aerosol precursor? I

C4447

guess it should say HCHO could be used as an indication of VOC oxidation and thus potentially also SOA formation.

No, HCHO is not an aerosol precursor but indeed an indicator of VOC oxidation as was mentioned in the original version. Although we have substantially shortened this para, this statement has been retained because the satellite retrieved formaldehyde and glyoxal columns have been used by Vrekoussis et al. (2010) to classify the sources of these oxygenated volatile organic compounds according to biogenic and/or anthropogenic emissions.

Page 8460, lines 1-2: Is HCHO and glyoxal preferentially formed by BVOC or from VOC in general? The suggested connection is not evident. Suggest to add the Vrekoussis reference here to avoid confusion.

This para has been re-written

Page 8460, lines 7-9: Repetition

This para has been re-written and repetition was removed

Page 8460, lines 14-15: This sentence seems to be a little out of place as the general discussion in this paragraph seem to relate to HCHO and glyoxal.

We agree with the reviewer and the sentence was moved to earlier in the section.

Page 8461, figure 1: The presentation of these stations as “boreal zone stations” is not adequate. According to my knowledge, the only stations that should be considered boreal would be Hyytiälä, Kuopio, Värriö, Sodankylä and Pallas. Helsinki would potentially qualify as a boreal zone station although it is located in a coastal city. The Arctic stations are definitely not located in the boreal zone. Tiksi is borderline, and Aspvreten is pretty much located in the southern rim of the boreal zone. Vavihill and Danish stations are also not to be considered boreal. Figure caption and text should be revised accordingly.

C4448

Figure 1 has been removed

Page 8464, line 6: I do not follow. Please re-write.

These sentences have been re-written. Indeed there was no logic in the sequence of presentation.

Page 8465, line 15-17: I do not understand the motivation of just using Hyytiälä data here. Certainly the gradient between stations must be of high interest to investigate the accuracy of the satellite prediction on larger scales.

The spatial gradients follow from the satellite. However, the reviewer is correct that it is of interest that these gradients are confirmed by the ground-based measurements. To underline this point, we have added a figure to show the good correlation between the satellite-retrieved AOD and the AERONET AOD.

Page 8466, line 7: “ullustrated”!“illustrated”

Done

Page 8466, line 19: “has”!“showed” or similar.

replaced with “... AOD in the cloudy area was between ...”

Page 8468, line 12-14: Is it really proper to say that the model support the observations. It is usually the other way around I would say.

The reviewer is right, we have removed this part of the sentence

Interactive comment on Biogeosciences Discuss., 8, 8451, 2011.

C4449