

## **Review-ACPD: doi:10.5194/acpd-15-16775-2015**

**Title:** On measurements of aerosol–gas composition of the atmosphere during two expeditions in 2013 along Northern Sea Route

**Author's:** S. M. Sakerin, A. A. Bobrikov, O. A. Bukin<sup>2</sup>, L. P. Golobokova, Vas. V. Pol'kin, Vik. V. Pol'kin, K. A. Shmirko, D. M. Kabanov, T. V. Khodzher, A. N. Pavlov, V. L. Potemkin<sup>3</sup>, and V. F. Radionov

Accept with **Minor Revisions** (to see the revised manuscript)

The manuscript presents the results of atmospheric measurements in the Russian Arctic during two ship cruises between July and September 2013. The presented data are unique due to the fact, that information on the aerosol, Black Carbon and chemical composition along the Northern Sea Route are extremely limited. But for the understanding of the processes and changing conditions in the Arctic the measured information from this area are very important and extremely helpful for modeling activity. Different aerosol loading from the Barents Sea up to Pacific area (coast of Kamschatka) situation is discussed. The output is extremely relevant for a broader scientific community. The scientific quality of the manuscript is good and readability and interesting also for non-specialist. I propose here a publication, but minor revision is needed. The text should be a little bit restructured and the figures and tables should be partly revised to explain much more clearly the new findings and scientific output.

The requests and comments are summarized in follows:

### **1) Introduction:**

It is missing the linkage and discussion between long-range transported aerosol loading and local pollution and it would be great to discuss here a little bit this aspects, based on the paper from Law et al (Law, Kathy S., Andreas Stohl, Patricia K. Quinn, Charles Brock, John Burkhardt, Jean-Daniel Paris, Gerard Ancellet, et al. "Arctic Air Pollution: New Insights From POLARCAT-I PY." Bull. Amer. Meteor. Soc. (May 7 2014): 140507132833005. doi:10.1175/bams-d-13-00017.1.) and Roiger et al (A. Roiger, Jennie L. Thomas, H. Schlager, Kathy S. Law, J. Kim, et al.. Quantifying Emerging Local Anthropogenic Emissions in the Arctic Region: The ACCESS Aircraft Campaign Experiment . Bull. Amer. Meteor. Soc., 2015, 906 (3), pp.441-460. 10.1175/BAMS-D-13-00169.1). Special aspects should be consider, the different components of BC loading, which was discussed by Stohl et al. (A. Stohl, Z. Klimont, S. Eckhardt, K. Kupiainen, V. P. Shevchenko, V. M. Kopeikin, and A. N. Novigatsky, Black carbon in the Arctic: the underestimated role of gas flaring and residential

combustion emissions Atmos. Chem. Phys., 13, 8833–8855, 2013  
doi:10.5194/acp-13-8833-2013)

## **2) Characterization of expedition measurements**

Table 1 should include all systems, which are used for the discussion. The table is not complete (see page 16781 – line 6. In page 16783 – line 2 is mentioned the filter pack and later on also the impactor (page 16783 - line 24, LIDAR (page 16784 – beginning line 13), Metsystem AMK-03 (page 16785 – line 2) etc., but not specified in table 1.

## **3) Atmospheric AOD and boundary layer height**

In table 2 and in page 17786 – line 5 should be better specified, where the measurements were done – at ground-based station and on which ship.

## **4) Aerosol and black carbon contents in the near ground atmospheric layer**

It is unclear, why only 4 regions are discussed (region A, B K, F, see table 4 and page 16793 line 9 -12) and not the detail areas, which are mentioned in Figure 1 and Table 3. Maybe it is enough to explain better, why special areas were summarized.

The comparison with old BC data are very interesting (see page 16795), but recent paper from Sharma et al (S. Sharma, M. Ishizawa, D. Chan, D. Lavoué, E. Andrews, K. Eleftheriadis, S. Maksyutov 16-year simulation of Arctic black carbon: Transport, source contribution, and sensitivity analysis on deposition, JGR, DOI: 10.1029/2012JD017774) and Stone et al (R. S. Stone, S. Sharma, A. Herber, K. Eleftheriadis, D. W. Nelson, A characterization of Arctic aerosols on the basis of aerosol optical depth and black carbon measurements, DOI 10.12952/journal.elementa.000027) are not considered in the discussion.

End of page 16799 and page 16800 – line 1, also table 10 is discussed the comparison between measurements and model results. Please introduce or specify here the model and discuss it more carefully. In the present form it is to unspecific.

## **5) Chemical composition of the atmosphere on the route of RV Akademik Fedorov and 6) ... of RV Professor Khljustin**

On page 16802 to 16809 and on page 16809 – 16816 is discussed totally separate the chemical composition, measured during both cruises. This is a very lengthy discussion and partly total independent from the first part of the

manuscript. I propose here to shorten both chapters, reduce the number of tables and figures with the aim to try to reduce the information on differences and typical concentration of chemical components. The main intention for this finally combined chapter should be to characterize the typical summer situation along the Northern Sea route. It is still missing, how strong is the influence of local pollution due to shipping activity and exploration. Table 6 to 13 could be modified in only few tables, like ion composition, gaseous impurities, water soluble substances and vertical flux information of gaseous, but not for each cruise. It should be mentioned finally the differences between European Arctic, Central Russian Arctic and Far East area...

## **7) Conclusion**

The conclusion is also very lengthy and should concentrate on the highlights and findings of the analysis of the ship measurements under Arctic summer conditions, like typical aerosol loading (AOD data), see page 16816 – beginning line 21, boundary layer height, see page 16817 – beginning line 8 aerosol composition and black carbon, see page 16817 – beginning line 17. Point d, see page 16818 – beginning line 15 has to reduce. The point's e and f have to combine to one highlight and it is here mandatory to reduce it substantially.