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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size distributions of dicarboxylic acids, ketoacids, α-dicarbonyls, sugars, WSOC, OC, EC and inorganic ions in atmospheric particles over Northern Japan: implication for long-range transport of Siberian biomass burning and East Asian polluted aerosols" *by* S. Agarwal et al.

Anonymous Referee #1

Received and published: 26 March 2010

General comments:

This manuscript deals with a comprehensive characterization of the organic and inorganic composition of size-segregated aerosols that were collected in Northern Japan during a 2005 summer episode and are affected by air masses from different origins, including Siberia, the Asian continent, and seas surrounding Japan. An important re-

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sult is that the organic chemical composition is heavily affected by biomass burning that is going on in the Siberian boreal forest region. Detailed and valuable information is provided on the organic acid composition of the carbonaceous aerosols, allowing one to draw important conclusions about the aging of the aerosols. It is clearly shown that short-chain dicarboxylic acids such as oxalic acid have high loadings in the fine size mode and that their contribution to the OC mass is enhanced in the biomass burning-affected samples, due to chemical processing of their organic precursors during long-range transport. The manuscript needs to be improved with regard to clarity, and English grammar and style.

Specific comments:

6717 – l. 7: with regard to the sources of saccharidic compounds, I suggest to mention in a first instance that they originate from fungal spores and plant material; it is well known that arabitol, mannitol and trehalose are characteristic for fungal spores (Lewis and Smith, 1967; Bieleski, 1982), while monosaccharides such as fructose, glucose and inositol are characteristic for plant material such as pollen, fruit, and fragments (Bartolozzi et al., 1997; Baker et al., 1998; Pacini, 2000). In a second instance, soil dust (as an aerosol source) and biomass burning should be mentioned. Soil dust probably contains fungal spores, and plant pollen and debris, while biomass burning of plant material may also release substantial amounts of sugar compounds.

Refs:

Baker, H. G., Baker, I., and Hodges, S. A.: Sugar composition of nectars and fruits consumed by birds and bats in the tropics and subtropics, Biotropica, 30, 559–586, 1998.

Bartolozzi, F., Bertazza, G., Bassi, D., and Cristofori, G.: Simultaneous determination of soluble sugars and organic acids as their trimethylsilyl derivatives in apricot fruits by gas-liquid chromatography, J. Chromatogr. A, 758, 99–107, 1997.

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Bieleski, R. L.: Sugar alcohols, in: Encyclopedia of Plant Physiology, volume 13A, Plant Carbohydrates, volume I, Intracellular Carbohydrates, Loewis, A. and Tanner, W. (Eds), Springer-Verlag, Berlin, 158–170, 1982.

Lewis, D. H. and Smith, D. C.: Sugar alcohols (polyols) in fungi and green plants: 1. Distribution, physiology and metabolism, New Phytol., 66, 143–184, 1967.

Pacini, E.: From anther and pollen ripening to pollen presentation, Plant Sys. Evol., 222, 19–43, 2000.

6719 – l. 13: essential details need to be provided about the trimethylsilylation procedure. Was pure BSTFA used or did it contain 1% trimethylchlorosilane as a catalyst? Was the reagent diluted with pyridine? It is known that the use of BSTFA alone without catalyst results in an incomplete derivatization of levoglucosan.

Ref.:

Zdráhal, Z., Oliveira, J., Vermeylen, R., Claeys, M., and Maenhaut, W.: Improved method for quantifying levoglucosan and related monosaccharide anhydrides in atmospheric aerosols and application to samples from urban and tropical locations, Environ. Sci. Technol., 36, 747–753, 2002.

6719 – l. 8: The GC detection technique should be mentioned. I assume it was flame ionization detection.

6722 – l. 10: earlier in the paper (page 6721 – l. 13) it was already mentioned that sulfate can have a marine or anthropogenic origin. I suggest to simply write here: “Moderate concentrations of sulfate were found in the 10 and 10-11 August samples (Fig. 2), suggesting an influence of marine and local anthropogenic origin.”

6726 – l. 24: There is recent literature data indicating that levoglucosan is not as stable as originally thought (Hoffmann et al., 2010). I am also aware of on-going studies on the photochemical degradation of levoglucosan (poster by A. Robinson from Carnegie-Mellon, Pittsburg, at the 2009 AGU Fall Meeting).

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Ref.:

Hoffmann, D., Tilgner, A., Iinuma, Y., and Herrmann, H.: Atmospheric stability of levoglucosan: A detailed laboratory and modeling study, Environ. Sci. Technol., in press, 2010; doi:10.1021/es902476f.

6727 – l. 15: Here again, I would in a first instance mention that the primary saccharides are derived from fungal spores (which are airborne or become airborne due to biomass burning) and plant material, and only in a second instance by surface soil and unpaved road dust.

Technical corrections:

The manuscript needs to be carefully checked for English grammar and style (relating to the correct use of articles, plural/singular, tenses, etc. . .). The list below is far from complete (except for the abstract):

6715 – l. 4: . . .. an Andersen impactor . . ...

6715 – l. 6: . . ... molecular composition of . . .. . .

6715 – l. 8: . . .. . . backward trajectories . . .. . .

6715 – l. 9: . . .. . . during the campaign, the air masses arrived from . . ...

6715 – l. 16: . . .. aerosols transported from Siberia . . ..

6715 – l. 17: . . ... aerosols originating from China . . ..

6715 – l. 21: . . ... in the fine mode,. . ..

6716 – l. 10: The changes in the chemical composition can alter the optical and microphysical . . ...

6716 – l. 17: The western North Pacific rim is a receptor region for anthropogenic and mineral dust aerosols originating from the Asian continent. (too much repetition of "Pacific region")

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6717 – l. 13: However, the size distributions . . .. (Mochida et al., 2007). This information is important because it allows one to gain important information on the sources and . . ..

6719 – l. 4: Briefly, a part of the filter . . .. (instead of “aliquot”)

6719 – l. 23: 2 M HCl

6720 – l. 2: . . .. eluent of 2 mM Na2CO3 + 1.7 mM NaHCO3 ????

6721 – l. 6: The trajectories showed that air masses arriving at Sapporo originated from . . ...

6721 – l. 10: . . ... aerosols originating from . . ...

6724 – l. 17: This suggests that biomass burning . . ...

6725 – l. 1: . . .. in the coarse mode . . ...

6725 – l. 13: . . ... aerosol particles have a marine influence.

6728 – l. 14: Bauer et al. (2002)

6735 – l. 13: Bauer, H., ...

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 6713, 2010.