

***Interactive comment on “Size distributions of dicarboxylic acids, ketoacids,  $\alpha$ -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.***

**S. Agarwal et al.**

aggarwalsg@nplindia.org

Received and published: 28 May 2010

Response on comments raised by Referee #2

(Note: The revised version of MS is attached as supplement document)

The manuscript of Agarwal et al. presents detailed size-segregated chemical analysis  
C3295

of aerosol in North Japan, indicating the importance of Siberian biomass burning, Asian pollution and marine aerosol on the aerosol properties of the Pacific rim. Size-resolved methods show how biomass burning samples especially will impact the region. This hypothesis is well-supported with tracers and back trajectory analysis, and literally has far reaching effects, as North America and the Arctic have recently shown sensitivity to Siberian biomass burning. Overall, I recommend minor grammar revisions and the need to address two points as follow:

- Much of the argument depends on 10-day back trajectories. Many studies have used 10-days, but a significant amount of uncertainty is introduced with every day back the model is run. If the authors are suited to use 10-days, they must state why it is justified to the readers and briefly explain this caveat. Also, the dynamic requirements should be stated (i.e. are they isobaric or isentropic, so future studies can repeat the tests)

Response: As the atmospheric life time of aerosols are believed to be from a week to 10 days (Lim et al., 2003), we consider that it is reasonable to use 10 day back trajectory analyses to better understand the aerosol source origins in a study in which long-range transport of aerosol is discussed. On the other hand if we stretch the days of back trajectory analysis, uncertainties related to pathways and origin are increased. However, in our case, we used tracer compound for the source identification of aerosol particles together with air mass back trajectory analyses to strengthen the conclusion of the source analysis. As suggested, the reason for the selection of 10 days back trajectory analysis is now given in the revised manuscript. Please see Lines 181 to 182 in the revised MS.

We use calculated backward trajectories for air masses starting from the sampling site (with sampling ending time) at 500 m height using the vertical velocity method (model vertical velocity) and reanalysis data. In the model there are three options under “Vertical Motion”: 1. Model vertical velocity, 2. Isobaric, 3. Isentropic. In which we selected Model vertical velocity, which is mentioned in the revised manuscript as suggested. Please see Lines 184 to 185.

- The marine influence was briefly described, but deserves more attention as recent studies, especially Russell et al 2010 (PNAS) have identified sugars and polysaccharides in sea salt spray. This source of OM might not be observed or relevant in Japan, but these results should be put in context with other marine OM (O'Dowd, Leck and Bigg) studies. Is it possible that the sugars the authors claim are from dust and soil are from marine dissolved organic matter in the water?

Response: Following the comment, the possible source of sugars and OM from ocean bubble bursting is briefly discussed in the following sections as follows.

In section 3.3 Size distributions of sugar compounds “Recently, Russell et al. (2010) reported the prevalence of sugar compounds in ocean aerosols via bubble bursting processes.” Please see Lines 389 to 390.

In section 3.5 Size distributions of WSOC, OC and EC “A considerable amount of WSOC is also observed in marine influenced samples (#5 and #6), indicating that ocean bubble bursting may be a potential source of polar organics in marine aerosol (Russell et al., 2010).” “As discussed above, possible source of sugars is soil resuspension (microorganisms and plant debris) and ocean bubble bursting (especially in marine influenced samples)” Please see Lines 493 to 496, 501 to 503.

- many errors in grammar were noted, and were uploaded as a pdf. By addressing these points and fixing grammar, this paper should be suitable for publication.

Please also note the supplement to this comment: <http://www.atmos-chem-phys-discuss.net/10/C1238/2010/acpd-10-C1238-2010-supplement.pdf>

Review comments of :Agarwal et al. (ACPD)

Size distributions of dicarboxylic acids, ketoacids,  $\alpha$ -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

Page 6715: Line 5: I assume size bins are diameter, but should you say  $D_p < 1.1$  etc. . .

C3297

Response: “ $D_p$ ” has been incorporated. Please see Line 27 in the revised MS.

Line 8: can say back trajectory? Response: In revised manuscript “back trajectory” and “back trajectories” have been changed to “backward trajectory” and “backward trajectories”, respectively. Please see Line 31.

Line 9: grammar mistake “air masses were arrived” should say “air masses arrived” Response: Corrected. Please see Line 32.

Line 23: grammar: “episodes in Siberian region” needs article or plural Response: Corrected. Please see Line 45.

Page 6716: Line 10-11: grammar: “can lead to alter” should say “can alter” Response: Corrected. Please see Line 56.

Line 12: grammar: article needed before “Asian continent” Response: Corrected. Please see Line 58.

Line 18: grammar “are flown from Asian continent” could change to “transported from Asia to. . .” Response: As suggested by the other reviewer also, it has been corrected as “The western North Pacific rim is a receptor region for anthropogenic and mineral dust aerosols originating from the Asian continent.” Please see Line 63.

Page 6717: Line 9: grammar: article: “on THE molecular level” Response: Corrected. Please see Line 88.

Line 11: grammar: article: “ especially THE southern area” Response: Corrected. Please see Line 90.

Page 6718: Line 2: grammar: article: “during THE campaign” Response: Corrected. Please see Line 110.

Line 16: are aerodynamic cut sizes a diameter? Response: Corrected as “using an Andersen high-volume impactor sampler with 50% cutoff diameters of 1.1, 2.0, 3.3 and 7.0  $\mu\text{m}$ .” Please see Line 124.

C3298

Line 21: capital letter error: "At" Response: Corrected. Please see Line 129.

Line 22:23 : "8 to 11" August should be "8-11 August" Response: Corrected. Please see Line 130.

Line 24: say "local time" instead of "LT" Response: Corrected. Please see Line 131.

Page 6719: Line 23: what is hcl? Is this HCl? Response: Corrected. Please see Line 156.

Page 6720: Line 2: nahco3 should be NaHCO3? Response: Corrected. Please see Line 162.

Line 16: 10-day back trajectories are a long time? Is it valid to use such long simulations considering the uncertainties that compound in time? Also, are these isentropic or isobaric? This needs to be stated. Response: As clarified above, the cause of the use of 10-day backward trajectories is incorporated in the revised manuscript. Also, we have mentioned the details of the trajectory analysis conditions. Please see Lines 181 to 185.

Page 6721: Line 7: Awkward sentence, verb tense disagreement? Response: Corrected as "The trajectories showed that air masses arriving at Sapporo originated from Siberia (8-9 August), China (9-10 August) and the East China Sea/Sea of Japan (10-11 August)," Please see Lines 195 to 197.

Line 23: "8 August and 8-9" seems redundant Response: Corrected. Please see Line 210.

Page 6724: Line 9: Important hypothesis! Response: Thank you !

Page 6731: Line 8-12: Important finding! Response: Thanks!

Line 13:25: comment – what about sea spray sugars? Russell et al 2010? Response: As mentioned above, the potential source of sugars from ocean bubble bursting has been discussed in the revised manuscript giving the reference of Russell et al., 2010.

C3299

Please see Lines Lines 389 to 390, 493 to 496, 501 to 503. .

Page 6731: Line 9: grammar: "this sample may be considered" Response: Corrected. Please see Line 519.

Page 6733: Line 25:27: Important finding! Response: Thanks!

OVERALL COMMENTS: Relevant findings, analysis seems sound, clear, concise must consider OC from marine organics, or at least refer to recent articles by O'Dowd et al and Russell et al 2010 regarding a sea spray component of sugars in fine aerosol, and maybe coarse? Be careful of grammar, especially using articles.

Response: All corrections have been done.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/10/C3295/2010/acpd-10-C3295-2010-supplement.pdf>

---

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