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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effect of biomass burning over the western North Pacific Rim: wintertime maxima of anhydrosugars in ambient aerosols from Okinawa" *by* C. Zhu and K. Kawamura

Anonymous Referee #3

Received and published: 31 October 2014

Dear Editor,

this MS presents an interesting assessment of anhydrosugars in ambient air in Okinawa, aiming to identify their origin and the impact of biomass burning emmissions on air quality as a function of back-trajectories and ratios between the sugars. The paper is well written and interesting for the general scientific community. I have only one major concern, which is the discussion on the degradability of levoglucosan over time. Almost all of the interpretations in the MS depend on the assumption that lev-

oglucosan is mostly stable in the aerosol phase, such as source region analysis (with back-trajectories) and ratios between anhydrosugars. However, there is no discussion (or very little reference) to whether levoglucosan is stable or not in the atmosphere, and under which conditions. I therefore would suggest publication after this issue is duscussed in detail.

Some specific comments:

- line 1, page 25582: "compositions" should be "composition".

- page 25583, line 28: this is the first reference to the issue of the stability of levglucosan. The discussion is too short, and should be improved considering the implications for the analyses presented in the following sections.

- page 25584, line 24: "grassland and savanna burning", just for information, are these natural or man-made fires?

- page 25587, line 22: if major WSIIons were determined using IC, why wasn't K+ determined? Why was an indirect measure should be "are probably associated"through Na+ used?

- page 25589, line 19: "although" should be "where", given that the statement "dense fire spots were detected" is not a consequence of the prior statement.

- page 22590, line 11: "galactosan did not show such a trend", please provide an explanation for this. Given that they originate from the same source, wouldn't a similar trend be expected?

- same page, line 16: "the primary cause... levoglucosan and mannosan...", what about galactosan? What are the sources/processes affecting galactosan?

- page 22591, line 11: "... largely contributes" should be "may have largely contributed", given that at this point this is only a hypothesis, there is no evidence to support this statement.

ACPD
14, C8692–C8695, 2014

- same page, line 19: same here, "are associated"

- section 323: a discussion of the degradation of levoglucosan should be included somewhere in the results section, to assess whether it may be transported over such long distances.

- same page, line 28: "background level", same here, if levoglucosan degrades over time during transport, what can be the regional background concentration?

- page 25592, line 8: interesting. Can the authors estimate approximately the max distance which levoglucosan may travel in their region in summer before degradation? Basically, I think the readers would be interested to know is whether levoglucosan emited in Mongolia or Russia may be detected in Okinawa in winter.

- same page, line 18: what is the distance between Okinawa and Philipines? If the authors state in line 1 of this page that levoglucosan in Okinawa in summer originates from background aerosols from Chichijima, but also that levoglucosa, decomposes from Philipines to Okinawa, isn't this contradictory? Again, it would be useful to estimate the max distance which levoglucosan may travel in summer before it decomposes or it is removed by wet/dry deposition.

- section 324: the data presented in this section are not results from this study, I'd suggest to move them to the introduction.

- same page, line 23: "patterns", the authors detected fires in MNA in winter on page 25589, lines 10-14. Do their results coincide with the literature patterns?

- page 25593, line 15: please provide sone interpretation of this, even if only hypothesizing.

- same page, line 22: how does NOx evolve to NH4+? Please provide the pathway.

- same page, last line: why does the correlation (r) increase from winter to summer? I would have expected higher values in winter, when the source is strongest. How do

ACPD
14, C8692–C8695, 2014

the authors explain this trend, or the difference between seasons?

- page 25594, line 10: "significanlty" hould be "partly", given that the r values are very low.

- same page, line 11: after "such relations" please add something like "and fossil fuel is most probably a more significant source of EC i terms of mass in this region".

- section 3.4: again, these ratios may be altered if levoglucosan or mannosan degrade with transport along such distances. Please discuss this. The ratios are probably not stable over time.

- page 25597, line 25, "significantly affects" should be "may significantly affect". Also, regarding this statement, please claryfy over what period of time may BB burning affect air quality in Okinawa? Days? Weeks?. At the end of the sentence "air quality in Okinawa", please add "mostly during specific episodes", given that on an annual basis the contribution is rather low, 2.9% of OC.

- conclusions: please add a comment on the degradation of levoglucosan and its implications regarding the results presented here.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 25581, 2014.