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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Gaseous, $PM_{2.5}$ Mass, and Speciated Emission Factors from Laboratory Chamber Peat Combustion" *by* J. G. Watson et al.

Anonymous Referee #2

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This manuscript presents measurement results from a laboratory combustion study of peat from different regions around the world. Detailed chemical speciation of both gas-phase and particulate smoke components is provided as a function of fresh vs simulated aged emissions, with a special focus on nitrogen species. The results presented in this paper are helpful to better understand the properties of biomass combustion source emissions and improve emissions inventories. Specifically, the authors presented a very nice detailed, yet concise description of the experimental set-up and procedures. The manuscript is well suited for publication in ACP, and only a few comments and suggestions are given below for the authors to consider in their revised version of the paper.

Specific comments:

1. Line 148-151: What was the rationale for heating the fuels to such a relatively high temperature and reducing the moisture content to such low levels? As the authors point out, some volatile fuel components may have gotten lost during this preparatory step. Has the chosen heating temperature been applied in other similar studies as well?

2. Lines 151-155: The authors may want to add a cautionary statement regarding the re-hydration procedure. According to studies conducted by the USFS Fire Science Lab, it is very difficult to re-hydrate biomass fuels once most of the water has been removed. And even after adding a certain amount of moisture back to the fuel, the physio-chemical properties are not the same as the original ones prior to the drying procedure. Would a potential alternative method be gradual drying to the desired moisture level, and thus maintaining the original water bonding structure?

3. Lines 378-381: Aside from lower OC emission factors, an increase in the WSOC fraction is expected due to the higher degree of oxygenation of the aged organic smoke components, isn't it?

4. Lines 410-411: Could the authors comment on possible degradation pathways that might occur during OFR treatment and potential reaction products of levoglucosan?

5. Lines 433-442: As the authors point out, higher fuel moisture content usually results in lower MCE, and consequently often increases PM emissions. However, the opposite pattern was observed in this study. Could this possibly be related, at least partly, to the re-hydration procedure which may not have restored the original conditions of the wet fuel (see comment No. 2 above)?

6. Lines 487-489: Can the authors add some speculations regarding the "missing" nitrogen, i.e., whether it's due to unidentified nitrogen species, measurement uncertainties, or other reasons?

Technical corrections:

1. Please use consistent spacing between temperature numbers and the degree sym-

bol throughout the manuscript.

2. Line 67-69: Additional field studies by Behera et al. (ESPR, 2014) and Engling et al (ACP, 2014) specifically addresses the effects of peat burning emissions in Southeast Asia.

3. Line 178: Omit the indefinite article at the beginning of the sentence.

4. Line 215: The degree symbol is not needed for temperatures expressed in K units.

5. Line 258: When the authors state the "concentrations were high", it would be helpful for the reader to know a reference point, i.e., "compared to".

6. Lines 313-314: Isn't the low correlation coefficient indicating different emissions characteristics of the fresh vs. aged smoke, and not just a variability between tests?

7. Line 453: Add "volatile" before "carbon".

8. Lines 495-496: The statement regarding the nitrogen content in this sentence is not clear.

9. Lines 510-511: What do the authors mean with "average Russian peat"?

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