

***Authors' response to comments by anonymous referee #1:***

8. Line 330-333. While levoglucosan is non deliquescent, the ERH of AS was found to shift to HIGHER RH when the mass fraction of levoglucosan increases. This appears to be a contradiction to the **Non** deliquescent nature of levoglucosan. Any explanation?

**Reply:** We thank the referee #1 for raising this concern. Here we would like to clarify that the observation that the presence of (liquid, dissolved) levoglucosan affects the ERH of AS, in one case by causing crystallization of AS at a higher RH than in the pure AS case, is not a contradiction to the non-deliquescent nature of levoglucosan. Since the liquid solution with all of AS dissolved exists as a metastable state below the DRH of AS during dehumidification, in principle, crystallization could occur at any RH below the DRH in complete agreement with thermodynamic theory. Crystallization of AS from the supersaturated solution (below its DRH for the given mixture) is essentially a stochastic process. It is more likely to occur towards higher supersaturation (lower RH), but is possible also at a higher RH than in the case of homogeneous nucleation of AS crystals in pure AS particles. Levoglucosan may inhibit crystallization (as seen for the mixtures with higher levoglucosan mass fraction) or it may promote it, which may depend on its mass fraction in the solution, which impacts the mixtures viscosity as well as the ion activity product of AS at any particular RH.

The misunderstanding concerns the text on Page 12 line 330-333 in the first version of the manuscript. A clarification will be added to the revised manuscript text.

**Related additions and changes included in the revised manuscript:**

Page 12 line 330-333: we clarify: “When the concentration of levoglucosan is low (25 wt %), a clear efflorescence signature of AS found, within the ERH shifting to a higher RH (40 % - 45 %) in comparison to the ERH of pure AS occurring at 33 %-35 % RH (Fig.3a). A similar phenomenon has been found for the certain mixtures of NaCl and Nordic Aquatic Fulvic Acid (NAFA), in which the crystallization of NaCl shifted to higher RH by mixing with NAFA at a mass ratio of 1:1 (Chan and Chan. 2003). With increasing mass fraction of levoglucosan (i.e., 50 wt % and 75 wt %), the mixtures release water gradually and no crystallization of AS was observed. Although a small step in the growth factor curve might have occurred (indicative of the crystallization of AS), it cannot be detected with sufficient certainty by our measurement setup.”