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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Technical Note: Frenkel Halsey and Hill analysis of water on clay minerals: Toward closure between cloud condensation nuclei activity and water adsorption" *by* Courtney D. Hatch et al.

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The subject of this paper is reconciliation of water vapor adsorption and CCN activation measurements of clay minerals in terms of the FHH adsorption theory. The subject matter of the paper is important, and I recommend publication, in spite of the fact that the main message of the paper – that the FHH parameters should be determined by fitting the theory to the multilayer portion of the adsorption isotherm, rather than to the complete isotherm – is rather trivial. However, I have some issuess that I believe should be discussed in the paper.

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Discussion paper

First, I am not completely convinced about the correctness of the FHH fitting to the montmorillonite data. Montmorillonite swells as RH is increased, up to 72% RH (Cases et al., 1992). In other words, the true multilayer portion of the adsorption isotherm occurs at higher relative humidities. In Laaksonen et al (Sci. Rep. 2016), the fitting was done to the high RH portion of the data of Hung et al (2015). The FHH plot can be seen in the supplement of Laaksonen et al, and there is a clear change of slope at around 70% RH. Also, the FHH plot of the data of Mooney et al. (JACS, 1952) shows a similar (in fact, even clearer) change. The present data is somewhat noisy, and there are only two data points at sufficiently high RH, so I understand that fitting to those two data points would not be feasible. But the matter should definitely be discussed.

Secondly, the surface fractal dimension (D) approach of Laaksonen et al. (Sci. Rep. 2016) is mentioned briefly in the end of the paper. Laaksonen et al. gave D-values for illite based on two different techniques that make use of nitrogen adsorption. Applying those D-values to the present B-parameter of illite would lead to corrected B values that are between 0.7-1.3 (I don't think there is much point to apply the montmorillonite D-values to the present data as the FHH fit is so uncertain). It should, however, be kept in mind that the data used in Laaksonen et al. (2016) was based on clays from different sources than in the current paper, and the clays may have been heat treated before the measurements, which can influence the D-values. Therefore it would be ideal if the D values could be calculated from the BET analyzer measurements mentioned in Hatch et al (2012). In any case I would suggest expanding the discussion related to the surface fractal dimension somewhat.

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