

## ***Interactive comment on “The effect of H<sub>2</sub>O adsorption on cloud-drop activation of insoluble particles: a theoretical framework” by R. Sorjamaa and A. Laaksonen***

### **Anonymous Referee #1**

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#### General Comments

The submitted manuscript presents a method for addressing the cloud activation of a nanoparticle that is wettable but insoluble. The authors suggest a theoretical treatment, applying Kohler theory where the water activity term is replaced with an isotherm for multilayer adsorption. Two isotherm models are assessed by the authors. The authors find that the Frenkel, Halsey, and Hill model give reasonable critical supersaturations using numerical values for the tunable parameters that are within the range of the values listed in the literature.

The problem of predicting and explaining the activation of these types of particles is

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both vexing in a theoretical sense and relevant to the atmospheric climate modeling community. The authors' contribution provides an alternative model for this problem, one with interesting potential. It is unfortunate that so little experimental data for surface adsorption relevant to this work exists, which makes testing this theoretical framework difficult at this time.

## Specific Comment

The authors selected two isotherm models for assessment. However, other models exist. Is there a physical basis for the selection of the BET and FHH isotherms? Should others be tested?

## Technical Corrections

Abstract, p 8142, line 3: suggest “happens” or “occurs” instead of “to happen”. Introduction, p 8144, line 16: prefer “possible” instead of the double negative phrase “not entirely impossible” Theory, p 8146, lines 3-5: suggest that the introduction to the FHH isotherm (eq 2) should not be written as a contrast to the BET in equation 1. Theory, p 8146, line 11: the term for supersaturation,  $S$ , was defined in line 1 of the same page. There is no need to define it again here. Theory, p 8146, line 15: “molecular weight”, not “molar weight” Theory, p 8146, line 20: insert a comma after “...e.g. the FHH adsorption isotherm” to the parenthetical phrase Results, p 8148, line 1: Suggest “found” or “calculated” instead of “got” Results, p 8148, line 12: insert “the” after “...is described with” and before “FHH isotherm...” Conclusions, p. 8149, line 27: remove “out” Figure 4: suggest ordering the legend text in the same direction as the isotherms in the graph

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