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Interactive comment on "A comprehensive evaluation of water uptake on atmospherically relevant mineral surfaces: DRIFT spectroscopy, thermogravimetric analysis and aerosol growth measurements" *by* R. J. Gustafsson et al.

Anonymous Referee #2

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The main stated objectives of this work are to provide a comparison of three methods of determining water uptake isotherms on aerosol material and to apply these methods to assessing the differences between two aerosol materials of intrinsically different hydrophilicity. This work is significant as a comparative evaluation of three commonly used methods for characterizing water uptake. It should also prove helpful to those interested in studying the effect of water uptake on processing of atmospheric trace gases by aerosols under varying conditions of relative humidity.

The method of conditioning the samples is appropriate for production of material that should be characteristic of aerosol particles under very low humidity atmospheric conditions. However, it may be misleading to suggest that conditioning at 120 degrees under helium for one hour removes any species adsorbed on the surface. It is unlikely that surface bound OH would be entirely removed in this way (see for example Al-Abadleh and Grassian, Langmuir, 2003, 19, 341). Although one might argue that surface bound OH is chemically bound, not adsorbed, the extent of coverage by surface bound OH is likely to alter the adsorption properties of the aerosol.

The FTIR spectrum between 3000 and 3700 wavenumbers certainly does provide a useful tool for monitoring adsorbed water. However, the shape of this broad absorption is a result of multiple vibrational modes attributable to water clusters (e.g. Cantrell and Ewing, J. Phys. Chem. B, 2001, 105, 5434 and Estrin et al., J. Phys. Chem., 1996, 100, 8701, as well as the reference to Al-Abadleh and Grassian above). The absorption band in Figure 1 is similar to those seen for adsorption of water on mica and alumina, for example, and in both cases the role of clusters has been discussed in relation to the shape of both the absorption spectrum and the BET isotherm. In the case of mica in particular, it has been argued that the surface still has vacant adsorption sites at quite high relative humidities in spite of adsorption of a sufficient quantity of water to amount to multilayer adsorption if the water were to adsorb as individual molecules rather than as clusters. This clustering is discussed to some extent on the last two or three pages of the manuscript but the authors still refer to monolayer adsorption. I wonder how meaningful the concept of a monolayer is under clustering conditions. The effect of clustering becomes particularly problematic in the argument at the very end of the results section where the molecular diameter of water is used.

I have a few very minor technical corrections. Line 4 on page 7198; I think Fig. 3 should be Fig. 2. Line 15 on page 7198; the sentence should read Ě..at higher RH due to non-linearitiesĚ.. Line 25 on page 7199; the word “at” should be removed after consider. Line 27 on page 7199; “water are well understood” should read “water is well understood”

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 7191, 2005.

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