**Supplemental Information**

**Figure S1:** Comparison of aerosol hygroscopicity from both UHSAS and CCN measurements ($\kappa_{CCN}$) and AMS bulk chemical composition ($\kappa_{AMS}$).

**Figure S2:** Predicted droplet number ($N_d; \text{cm}^{-3}$) versus measured $N_d (\text{cm}^{-3})$ for all flights used in this work for which $w^*$ was available (Table 1). Error bars in the $N_d$ reflect the range of observed $N_d$, while the predicted $N_d$ variability corresponds to one standard variation of the observed size distribution during each flight – when propagated through the droplet parameterization.

**Figure S3:** Predicted droplet number ($N_d; \text{cm}^{-3}$) plotted against measured aerosol number ($N_a; \text{cm}^{-3}$) for the entire flight of RF03. $N_d$ levels off above $N_a \approx 1000 \text{ cm}^{-3}$, which is where we derive $N_d^{lim}$.

**Figure S4:** Predicted maximum supersaturation (%) as a function droplet number ($N_d; \text{cm}^{-3}$) plotted against measured aerosol number ($N_a; \text{cm}^{-3}$) for all flights used in this work.
Figure S1
Figure S2
Figure S3
Figure S4