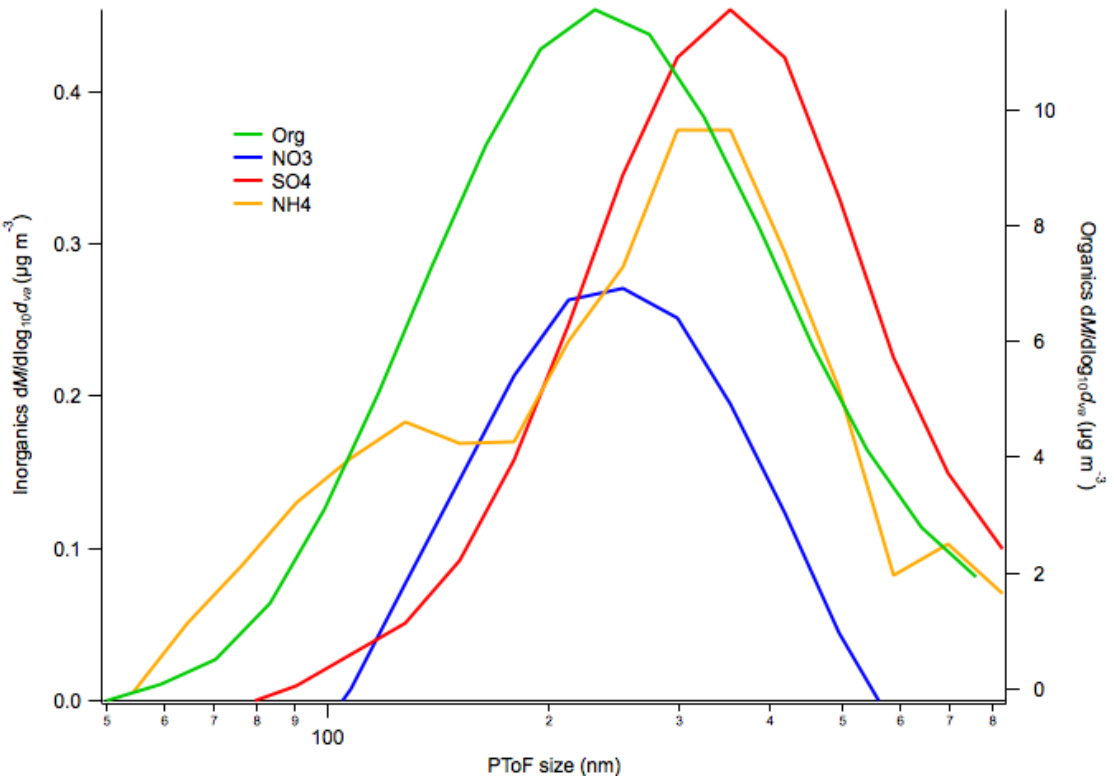
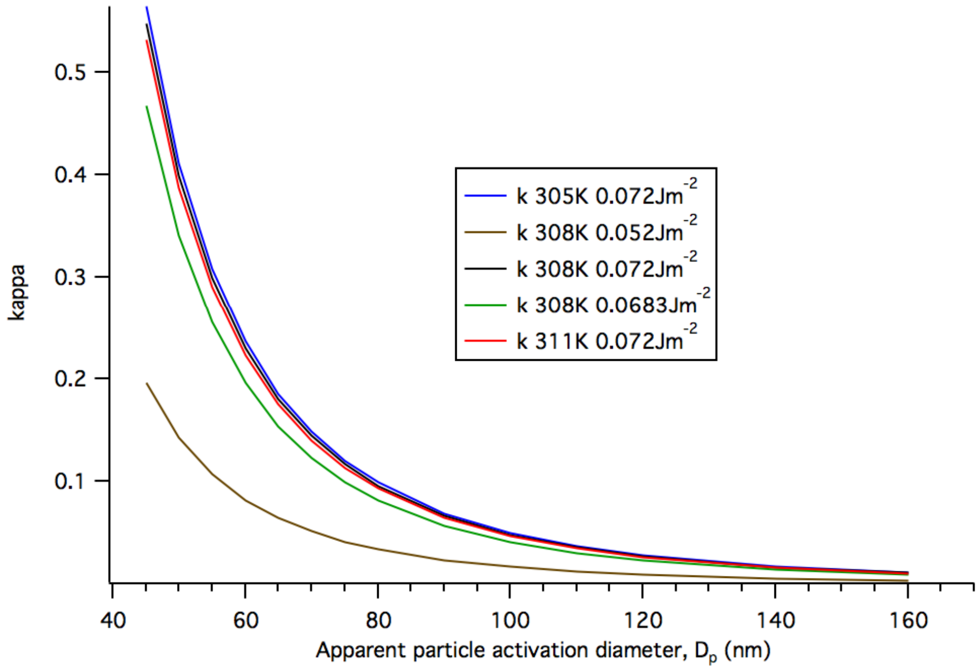
Supplementary

Supplementary Figure S1 shows the average PToF size distribution for each species measured by the cToF-AMS. While the mode of organics (right axis) and nitrates was at an aerodynamic diameter of ~250 nm, the mode of ammonium and sulphate species was higher at 350 nm. Because of this, the size-resolved composition between 100 nm and 200 nm was used, as this is most relevant for CCN activation.

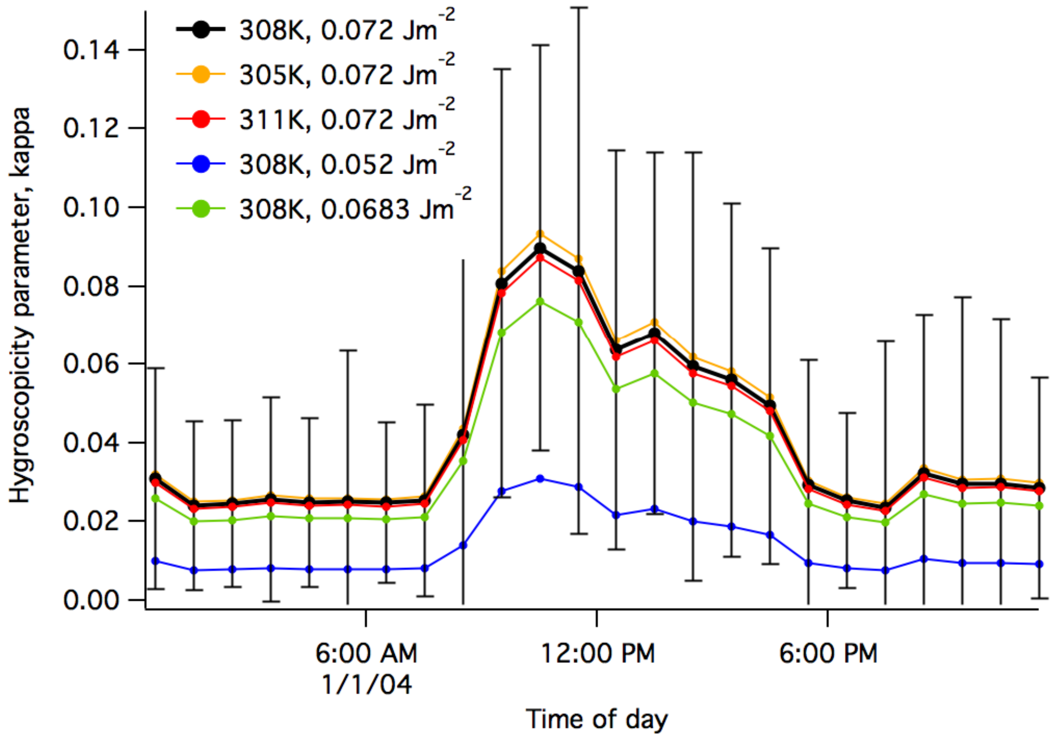


Supplementary Figure S1 The average size-resolved chemical composition for the entire sampling period.

Figure S2 shows the sensitivity of temperature and the contribution of surface tension effects on the calculated hygroscopicity parameter, κ. The temperature in the CCN counter during the sampling period was 308K ± 3K. The surface tension of 0.072 Jm^{-2} is that of pure water while 0.0683 Jm^{-2} and 0.052 Jm^{-2} are the surface tensions observed in BBA from a woody fuel (Asa-Awuku et al., 2008) and a suggested lower estimate for carbon-containing aerosol (Mircea et al., 2005), respectively. The temperature variations of ± 3K had a negligible impact on the calculated κ. Taking the slightly smaller surface tension of 0.0683 Jm^{-2} resulted in only a minor reduction in the hygroscopicity parameter, suggesting that it is the solubility of the BBA components primarily responsible for water uptake rather than reductions in surface tension. This value of surface tension, although observed previously for BBA, is not necessarily applicable for the BBA observed in this campaign as different fuel loads and burn conditions lead to different BBA composition. Mircea et al., (2005) found that the surface tension is a function of dissolved organic carbon concentration with values ranging from 0.072 Jm^{-2} for low dissolved organic carbon concentrations to 0.052 Jm^{-2} for dissolved organic carbon concentrations at and above 0.1 moles l^{-1}. Taking this lower estimate value of surface tension resulted in a large reduction in the calculated κ.



Supplementary Figure S2 The hygroscopicity parameter, κ, as a function of the critical diameter, D_p, for different temperatures and surface tensions. Temperatures of 305K and 311K were investigated as 308K was the average temperature within the CCN counter with a standard deviation of 3K. 0.072 Jm^{-2} is the surface tension of pure water, while 0.0683 Jm^{-2} and 0.052 Jm^{-2} are the surface tension of previously observed BBA (Asa-Awuku et al., 2008) and a suggested theoretical minimum surface tension (Mircea et al., 2005), respectively.



Supplementary Figure S3 The diurnal trends of the hygroscopicity parameter, κ, when assuming different temperatures and surface tensions, as discussed in Figure S3.