



## **An investigation into dust mixing state and thermodynamic conditions in East Asia.**

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In this study  $\sim 3.5$  min average bulk aerosol composition data recorded from aircraft during ACE-ASIA C130 Flight #6 are used to investigate the extent of fine particle (diameters nominally less than  $1.3 \mu\text{m}$ ) mixing among various inorganic aerosol particle constituents. In this case study, dust-laden air masses are mixed with urban air pollutants over the Beijing and Tianjin region and subsequently recorded in the marine boundary layer over the Yellow Sea during the ACE-ASIA mission. An analysis of correlations and molar ratios between cations and anions suggest that dust particles are largely composed of  $\text{CaCO}_3$  (i.e., the dust particles are fresh), and that  $\text{NH}_4^+$  and  $\text{K}^+$  are likely associated with  $\text{SO}_4^{2-}$  and  $\text{NO}_3^-$ . The results point to an external mixture of mineral dust and urban pollutant particles. Aerosol simulations carried out assuming various degrees of internal mixing (by  $\text{Ca}^{2+}$  mass) between dust and urban particles indicate the observed  $2\text{NH}_4^+ - \text{SO}_4^{2-}$  association only exists when most of the fine-mode dust particles exist externally to  $\text{SO}_4^{2-}$ . In this case, the degree of external mixing (by  $\text{Ca}^{2+}$  mass) is estimated to be larger than 70%.