

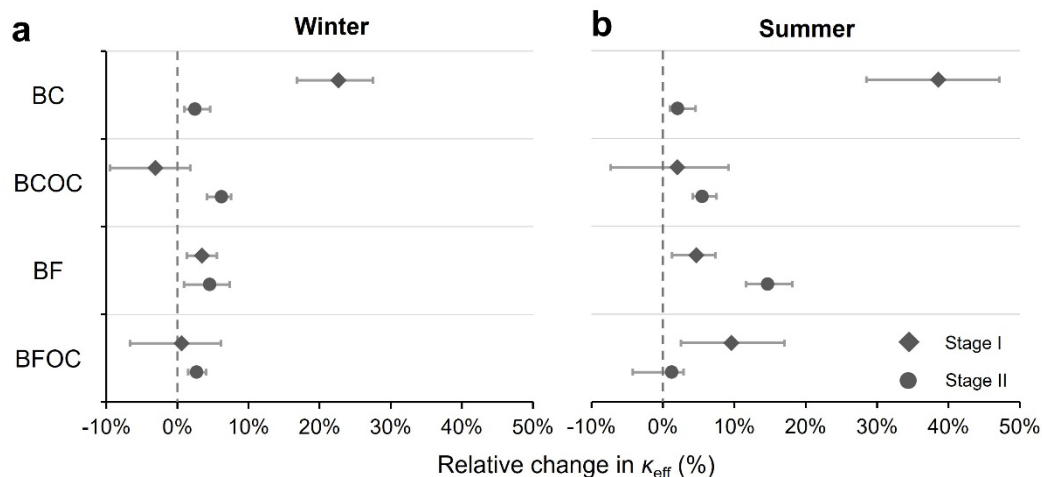


Figure S1. Sensitivity analysis of stage-specific relative changes in inferred effective hygroscopicity parameter (κ_{eff}) for four particle classes in winter (a) and summer (b). Diamonds and circles represent the baseline estimates for Stages I and II, respectively. Horizontal bars show the ranges obtained from four combinations of the lower and upper hygroscopicity values for ammonium sulfate and ammonium nitrate listed in Table S3. The dashed line denotes zero change; ranges crossing zero indicate that the direction of change was not consistent across the tested parameter combinations.

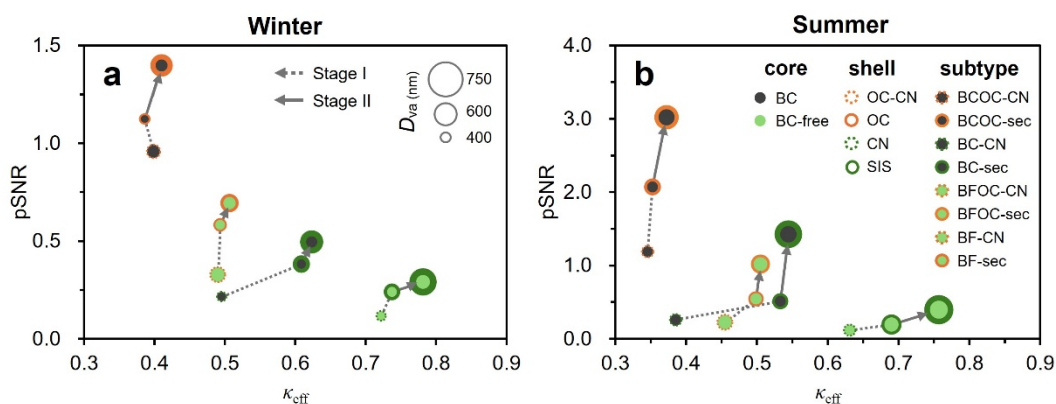


Figure 4. Conceptual framework for the co-evolution of particle-phase sulfur-to-nitrogen ratio (pSNR) and inferred hygroscopicity (κ_{eff}) among particle classes during winter (a) and summer (b). Particles are represented by core-shell schematics. The inner circle indicates BC-containing (dark gray) or BC-free (light green) particles, and the outer ring indicates coatings dominated by organic carbon (OC, orange) or secondary inorganic species (SIS, green). Dashed and solid rings denote fresh-like and aged-like populations, respectively. Marker size scales with vacuum aerodynamic diameter (D_{va}). Shell thickness estimates from the Dva of aged-like and fresh-like particles. Dotted and solid arrows indicate aging relationships during Stage I in normal periods (NPs) and additional Stage II processing in emission control periods (ECPs), respectively.”