1.132 Variability in the mixing state of black carbon aerosols observed in Asian outflow in the spring of 2016.

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Abstract:

Black carbon (BC) aerosols strongly absorb solar visible radiation and can affect the radiative balance of the atmosphere on regional and global scales. The mixing state of BC, which can be significantly altered by condensation, coagulation, and cloud processing, is a key parameter for estimating the radiative impacts of BC. We have developed a new method to quantify the mass of sulfate and nitrate aerosols internally and externally mixed with BC: the laser induced incandescence - mass spectrometric analyzer (LII-MS). The LII-MS is based on the tandem connection of a LII analyzer and the particle trap laser desorption mass spectrometer (PT-LDMS). The LII analyzer is used to selectively remove BC-containing particles by laser-induced evaporation and the PT-LDMS is used to analyze the chemical compositions of aerosol particles downstream of the LII analyzer. The LII-MS was successfully deployed during a field experiment conducted at a surface site in Gwangju, Korea in the spring of 2016. Backward trajectory analysis shows that air parcels observed at the site were frequently affected by regional-scale air pollution transported from the Asian continent. We have observed large temporal variability in the mass concentration of sulfate, nitrate, and BC aerosols and the mass fraction of sulfate and nitrate internally mixed with BC. The internally-mixed fraction for sulfate tended to be lower in highly polluted air masses (high sulfate concentrations) originating from the continent and higher in clean air masses (low sulfate concentrations) originating from the free troposphere. Possible mechanisms affecting the variability in the mixing state are discussed.