Imaging Atmospheric Aerosols: Past, Present, and Future

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Atmospheric aerosols can effect global climate change both by direct scattering and absorption of solar radiation as well as indirectly by influencing the formation and properties of clouds. Black carbon, soot, is critically imporant because it is strongly absorbing. Understanding how different components (black carbon, organic carbon & inorganics) are mixed within individual aerosol particles is critical for modeling aerosol affects on global climate change. The variation in soot, depending upon combustion source, its complex morphology, whether it is coated by organics and how these properties evolve as a function of transport and aging are the focus of this research. Fortuitiously, the size range of carbonaceous aerosols (sub-micron to micron) is ideal for chemical speciation using soft x-ray scanning transmission x-ray microscopy. Equally important in this research has been the devlopment of a framework for examing a sufficient number of samples for the results to be physically meaningful. This type of process will be essential for scientists examining other natural samples such as soils, plants, bacteria, and cells. Here, results focussed on carbonaceous aerosols from several field campaigns will be used to show the evolution of the mixing state, and particle morphologies.

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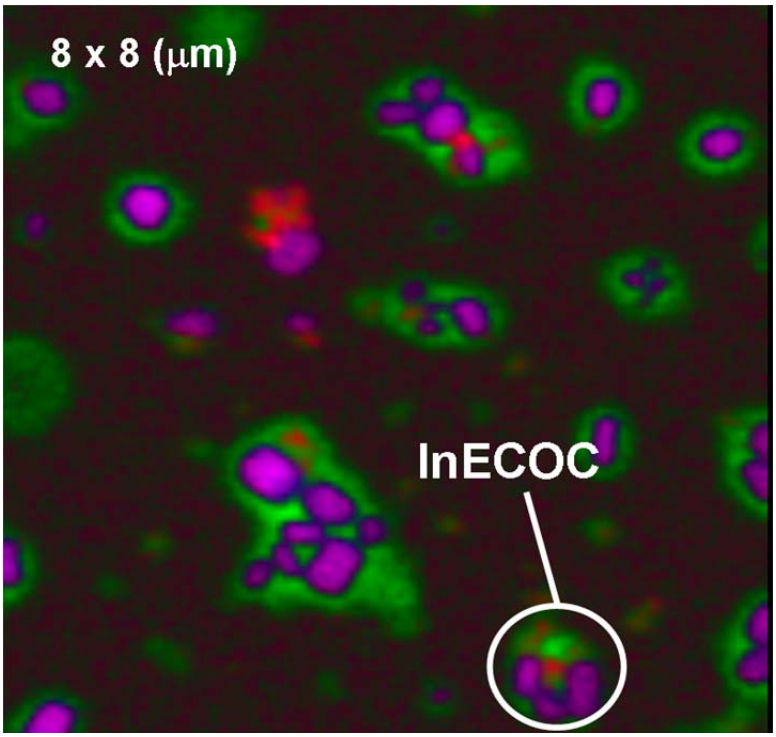
This Figure is a component map of aerosols collected from the industrial region of Mexico City. Purple is the inorganic contribution-In (obtained from the carbon pre-edge absorption), red is the sp^2 hybridized carbon-an indicator for soot shown as EC, and green is the organic component shown as OC. Hence, the particle labled InECOC contains inorganics, soot, and organic carbon. Understanding how these mixtures changes as a function of age and then incorporating that into process models is one of the objectives of this research.