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Aerosols from tailpipe to countryside - A look at the early part of the life cycle of anthropogenic aerosols

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Anthropogenic aerosols are emitted from a large variety of sources, e.g., vehicles, industrial and power plants, and biomass fires. Each of these sources produces a different mix of particles by primary processes, including soot and organic particles, soluble inorganic salts, and insoluble mineral phases. Following their emission into the ambient atmosphere, these particles interact with each other and with compounds in the gas phase. On time scales of hours to a day and distance scales of a few 100 km, urban aerosols are thus transformed into regional pollution haze. Typically, they are also likely to undergo one or more cloud cycles during this time. As a result of this processing, the particles may loose or gain mass, their numbers and size distributions change, and their optical and cloud-nucleating properties are modified.

In this presentation, we will compare the chemical, optical, and cloud-nucleating abilities of very fresh, near-source particles from urban pollution and biomass burning with those of regional pollution hazes that have evolved over times from minutes to a few days. Our results suggest that in most cases the aerosol evolves quite rapidly towards a particle population that behaves to a large degree like an internal mixture, especially with regard to its CCN properties. In particular, there is little evidence for the presence of a significant fraction of insoluble particles in the size range larger than about 50 nm, i.e., the size class typically associated with CCN, even after only a very short aging time. This has important consequences for the wet scavenging lifetime of combustion aerosols and for their climate impact via the indirect effects.