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Identifying air pollution hotspots from vehicular emissions in complicated urban configuration: Observed cross-intersection ultrafine particle profiles and application of CFD-Chem coupled with highly-resolved emission factors

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A long list of adverse health effects, including asthma, autism, cardiovascular diseases, cancer, and more, has been attributed to exposure to traffic emissions by numerous epidemiological and toxicological studies in recent decades. Due to high spatial heterogeneity of pollutants distributions from complicated road networks in urban areas, people staying at air pollution hotspots even for a short time can be exposed to highly elevated pollutant concentrations and this relatively short-time exposure can contribute to a large fraction of daily exposure.
This presentation consists of two main parts: (1) Observations of ultrafine particles (UFP) concentrations across the trafficked intersections and implications for exposure of transit-users to UFP hotspots and (2) identification of traffic related air pollution hotspots based on CFD-Chem simulations coupled with highly spatially resolved emission factors in complicated urban areas.
The first part covers how UFP vary as distance increases from the center of intersections (one of the air pollution hotspots) in various urban environments based on mobile measurements. Additionally, we discuss how transit-users can benefit from moving bus-stops to the optimal location with regard to exposure levels to UFP.
The second part discusses the way how to identify air pollution hot spots using highly resolved three dimensional distributions of air pollutants simulated with CFD-Chem coupled with highly spatially resolved emissions in real urban environments. This part also discusses the effects of the location of representative air quality monitoring station (AQMS) on determining the air pollution level of the community, and suggests the location of AQMS should be carefully selected based on the specific purpose (e.g., exposure vs. background levels) and microenvironments (including built and topographic).