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## **Integrated Analyses of Multiple Worldwide Aerosol Mass Spectrometer Datasets for Improved Understanding of Aerosol Sources and Processes and for Comparison with Global Models**

The AMS is the only current instrument that provides *real-time, quantitative, and size-resolved* data on submicron non-refractory aerosol species with a time resolution of a few minutes or better. The AMS field data are multidimensional and massive, containing extremely rich information on aerosol chemistry, microphysics and dynamics—basic information that is required to evaluate and quantify the radiative climate forcing of atmospheric aerosols. The high time resolution of the AMS data also reveals details of aerosol dynamic variations that are vital to understanding the physico-chemical processes of atmospheric aerosols that govern aerosol properties relevant to the climate. There are two primary objectives of this 3-year project. Our first objective is to perform highly integrated analysis of dozens of AMS datasets acquired from various urban, forested, coastal, marine, mountain peak, and rural/remote locations around the world and synthesize and inter-compare results with a focus on the sources and the physico-chemical processes that govern aerosol properties relevant to aerosol climate forcing. Our second objective is to support our collaboration with global aerosol modelers, in which we will supply the size-resolved aerosol composition and temporal variation data (via a public web interface) and our analysis results for use in model testing and validation and for translation of the rich AMS database into model constraints that can improve climate forcing simulations. Several prominent global aerosol modelers have expressed enthusiastic support for this collaboration.

The specific tasks that we propose to accomplish include 1) to develop, validate, and apply multivariate analysis techniques for improved characterization and source apportionment of organic aerosols; 2) to evaluate aerosol source regions and relative contributions based on back-trajectory integration (PSCF method); 3) to summarize and synthesize submicron aerosol information, including composition, concentration, size distribution and (inferred) shape and mixing state in various environments and their regional and seasonal variations within the context of regional and global modeling; and 4) to quantitatively evaluate important processes in various atmospheric environments and during different seasons, focusing on acid-catalyzed SOA formation, new particle growth, and photochemical processes of atmospheric organic aerosols (i.e., SOA production and POA oxidation). We will also examine the correlations and compile the ratios between important pairs of aerosol and gas phase species using region-specific and season-specific correlations and as a function of photochemical age and compare them with the ratios produced by various models. To enable our collaborations with the modelers, we will supply (via a public web interface) AMS data and our analysis results for use in model testing and validation and facilitate the use of the AMS information to constrain calculations of radiative forcing. Model output and AMS measurements and derived parameters will be compared with a focus on regional variability of model/measurement discrepancies and their causes. Finally we will share results, insights and data mining algorithms through peer-reviewed publications, presentations/tutorials at conferences/workshops, and web dissemination of analysis results and in-house developed software packages.