M. Giordano Desert Research Institute Reno
Nevada EPSCoR Annual Meeting 2023 Carson City Nevada

Title: **Updates on Global Aerosol Studies: Identifying, Expanding the Classification Scheme, Updating a Global Aerosol Compendium, and Re-Mapping - based in NASA's AERONET Sunphotometer Data**

Abstract: An ongoing pursuit by researchers across differing scientific agencies is the accurate development of a robust global bulk columnar aerosol (BCA) typology. NASA's global sunphotometer network (AERONET) is used for its geographic expanse, and the tractability of analyzing its historic data archive. We pursue a goal of reducing uncertainty in modeled aerosol radiative forcing, by making direct use of retrieved intrinsic aerosol optical properties. The result is a database linking a specific set of aerosol optical properties, an aerosol typology (i.e. labeled sub-type of aerosol observed), and geo-located coordinates over an expanded 25 year history. We implement an aerosol typology based in AERONET inversion products from 1993-2018. Originally we identified 5 globally ubiquitous BCA types: dust, biomass burning, maritime, urban/industrial and mixed. The present discussion involves the expansion of this set to 6, 7, and 8 aerosol types. Our model returns values of specific optical properties at specific geolocations, to be used as target reference types in the classification scheme. Aerosol classifications obtained by this strategy are useful in calibration/validation studies of satellite aerosol retrievals. By averaging individual AERONET retrievals by classified aerosol type, and determining the most frequent classified aerosol type at each AERONET site during each historic month, we determine the *Historic Monthly Dominant Aerosol Type* (HMDAT). Applying the results of our global seasonal aerosol typology onto the global AERONET grid, results in maps of *historic seasonal aerosol climatologies* by historic month. The database of HMDAT is reposited in an open archive. Database users can link AERONET associated locations, and the optical property values associated with the reported HMDAT - without AOD-based inferences on extensive aerosol properties. We aim to understand the relationship between ground-based BCA, and satellite-retrieved layered aerosol data products; explore the comparability of optical property derived aerosol typologies based in passive-received ground data, to those of satellite aerosol classification algorithms; and provide a tool for integration to NASA PACE data products. This work aims a ground-based *Global Seasonal Aerosol Climatology* toward a spatio-temporally, typologically-resolved *3-D global seasonal aerosol climatology*. To achieve this we must resolve the vertical structure of the aerosol profiles. We present a strategy for the example of *Biomass Burning* aerosols, to obtain vertical profiles to be used in a *radiative transfer* (RT) model, constructing profiles of aerosol heating rates.