Characterization of tropospheric aerosols with polarization lidar

Sharon P. Burton*, Johnathan Hair, Richard Ferrare, Chris Hostetler, Mark Vaughan, and Ali Omar

NASA Langley Research Center, Hampton, VA 23669, USA

*Presenting author (sharon.p.burton@nasa.gov)

The impacts of tropospheric aerosols on climate and air quality depend on the amount, vertical distribution, source, type, size and optical properties of the aerosols. Therefore, knowledge of vertically resolved aerosol properties is important for assessing aerosol radiative forcing, source attribution, air quality applications, and model verification. Lidar is unique among remote sensing measurement techniques for providing full vertically-resolved profiles of tropospheric aerosols and aerosol properties. Both qualitative and quantitative retrievals of aerosol abundance and microphysical properties are routinely made using ground-based, airborne, and satellite-borne lidar data, with the amount of information content varying among different types of lidar instruments. Lidar measurements characterize both extensive properties – those that vary with the amount of aerosol, including aerosol extinction and backscatter – and also intensive properties, which do not depend on aerosol abundance, but instead indicate microphysical properties like aerosol shape, size or absorption. In this talk we survey the ways that lidar measurements of extensive and intensive properties are used to characterize tropospheric aerosols, with a specific focus on the measurement of particle depolarization. Particle depolarization at one or more wavelengths, along with other intensive lidar measurements, has been used for such applications as distinguishing different aerosol types such as dust and smoke; identifying atmospheric dust and tracking the transport of dust aerosols across the globe; calculation of mixing between different aerosol types; and assessment of particle size.