5.054 What Controls Aerosol Optical Depth in Continental Airmasses in Summer?.

Presenting Author:
Charles Brock, NOAA Earth System Research Laboratory, Boulder, CO USA, charles.a.brock@noaa.gov

Co-Authors:
Nick Wagner, NOAA Earth System Research Laboratory and CIRES, University of Colorado, Boulder, CO USA
Timothy Gordon, Handix Scientific, Boulder, CO USA

Abstract:

Aerosol optical depth (AOD) is affected by the size, optical characteristics, and hygroscopicity of particles, confounding attempts to link remote sensing observations of AOD to measured or modeled aerosol mass concentrations. In situ airborne observations of aerosol optical, chemical, microphysical and hygroscopic properties were made in summer 2013 in the southeastern United States in the daytime when fair-weather cumulus clouds were present. These conditions are typical of midlatitude, moderately polluted airmasses. We use these observations to constrain a simple aerosol model that is used to test the sensitivity of AOD to the various measured parameters. As expected, the AOD was found to be most sensitive to aerosol mass concentration and to aerosol water content, which is controlled by aerosol hygroscopicity and the ambient relative humidity. However, AOD was also fairly sensitive to the mean particle diameter and the width of the size distribution. These parameters are often prescribed in global models that use simplified modal parameterizations to describe the aerosol, suggesting that the values chosen could substantially bias the calculated relationship between aerosol mass and optical extinction, AOD, and radiative forcing. Further efforts to systematically characterize the aerosol characteristics within different airmasses are needed to reduce both modeling and remote sensing uncertainties, and should lead to improved confidence in estimates of the direct aerosol radiative effect.