



Effect of Aerosol Size and Hygroscopicity on Aerosol Optical Depth in the Southeastern United States

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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 the southeastern United States in the daytime in summer 2013. We use these observations to constrain a simple 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.