Comparison of Model Predictions of Aerosol Radiative Properties with Long-Term Measurements

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Long-term measurements of aerosol radiative properties at a wide range of locations reveal systematic dependencies on aerosol loadings. Aerosols in the cleanest air at any given location tend to be more highly absorbing and more effective at scattering radiation back to space, i.e., they have the lowest single-scattering albedos and the highest hemispheric backscattering fractions. One hypothesis for this behavior is that the cleanest air is a result of scavenging by clouds followed by removal by precipitation. Field studies in a number of locations have shown that the unscavenged particles in clouds indeed have lower single-scattering albedos and higher backscattering fractions than the particles in adjacent, cloud-free air. As a further test of the hypothesis, the statistical behavior of aerosol radiative properties calculated with a global chemical transport model are compared with the long-term observations at sites representative of Arctic, rural continental, marine, and free tropospheric aerosols. The calculations use a version of the GFDL AM2 model, modified to include online aerosols and nudged with the NCEP re-analysis. The results of this measurement-model comparison will be discussed and examined for their implications that the observed systematic dependence of aerosol radiative properties on aerosol amount is caused by cloud scavenging and removal.

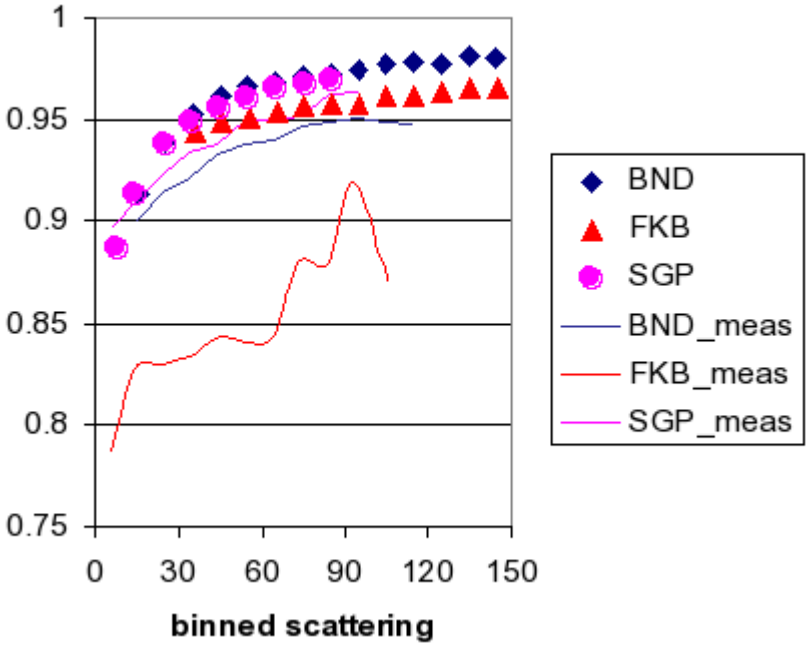

Figure 1. Comparison of systematic relationship between aerosol single-scattering albedo and aerosol amount (light scattering) at three continental sites, measured (solid lines) vs. model results (symbols). The model reproduces the systematic behavior, but not the value of the single-scattering albedo.