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Global 2-D intercomparison of sectional and modal aerosol modules

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Abstract. We present an intercomparison of several aerosol modules, sectional and modal, in a global 2-D model in order to differentiate their behavior for tropospheric and stratospheric applications. We model only binary sulfuric acid-water aerosols in this study. Three versions of the sectional model and three versions of the modal model are used to test the sensitivity of background aerosol mass and size distribution to the number of bins or modes and to the prescribed width of the largest mode. We find modest sensitivity to the number of bins (40 vs. 150) used in the sectional model. Aerosol mass is found to be reduced in a modal model if care is not taken in selecting the width of the largest lognormal mode, reflecting differences in sedimentation in the middle stratosphere. The size distributions calculated by the sectional model can be better matched by a modal model with four modes rather than three modes in most but not all situations. A simulation of aerosol decay following the 1991 eruption of Mt. Pinatubo shows that the representation of the size distribution can have a signficant impact on model-calculated aerosol decay rates in the stratosphere. Between 1991 and 1995, aerosol extinction and surface area density calculated by two versions of the modal model adequately match results from the sectional model. Calculated effective radius for the same time period shows more intermodel variability, with a 20-bin sectional model performing much better than any of the modal models.

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