2D-C probe data for particle sizes between 25 and 900 μm and the 2D-P probe data for 900–4000 μm. We have not accounted for the potential underrepresentation of small crystals in the 2D-C data. Averaged single-layer cloud model size distributions are determined from Eq. (4). Particle habit distributions were derived from visual examination of SPEC, Inc., CPI data. Virtually all of the particles were bullet rosettes with an average of five bullets per rosette. Larger particles were aggregates of rosettes.

c. Single-scattering properties

An extensive library of single-scattering properties has been prepared that encompasses five randomly oriented crystal habits, 27 size bins, and 10 subbands within each of the MODIS band numbers in Table 2. The crystal habits are solid hexagonal columns, hexagonal plates, hollow hexagonal columns, two-dimensional bullet rosettes, and moderately rough aggregated columns. Because the columnar crystals in the King Air slide collections and in the replicator data are hollow, all columnar crystals are treated as being hollow columns. The size bins span a maximum dimension range of 3–3500 μm.

The single-scattering calculations are derived using a combination of the improved geometric optics method (GOM2) and the finite-difference time domain (FDTD) techniques discussed in Yang and Liou (1996a,b). The FDTD is applied to particles having a size parameter smaller than 20, whereas GOM2 is employed for size parameters larger than 20. Calculated properties include the extinction coefficient, single-scattering albedo, fraction of delta-transmitted energy, asymmetry parameter, and scattering phase function.

d. Atmospheric absorption

For this study, we have focused our attention upon the creation of correlated k-distribution routines for the spectral regions corresponding to the MODIS channels. Because these correlated k-distribution routines have been formulated specifically for the MODIS channels rather than being adapted from other studies, we can be assured that the routines correctly represent the observed radiative impact due to molecular absorption within these spectral bands. Although our correlated k-distribution routines could be applied to an assessment of the state of the molecular inventory within the atmosphere, we have used these routines to remove the molecular signal from the data, thereby allowing for an analysis of the radiative impacts of other aerosols, clouds, surface conditions, and so on.

A major advantage of using the correlated k-distribution method is that it can be incorporated directly into multiple scattering routines used to consider scattering as well as absorption by clouds and aerosol particles (Lacis and Oinas 1991). Kratz (1995) provides an in-depth description of the method used to create the correlated k-distribution routines. For both that study and our investigation, the derivation of the correlated k distributions has been based upon an exponential sum fitting of transmissions technique (Wis-