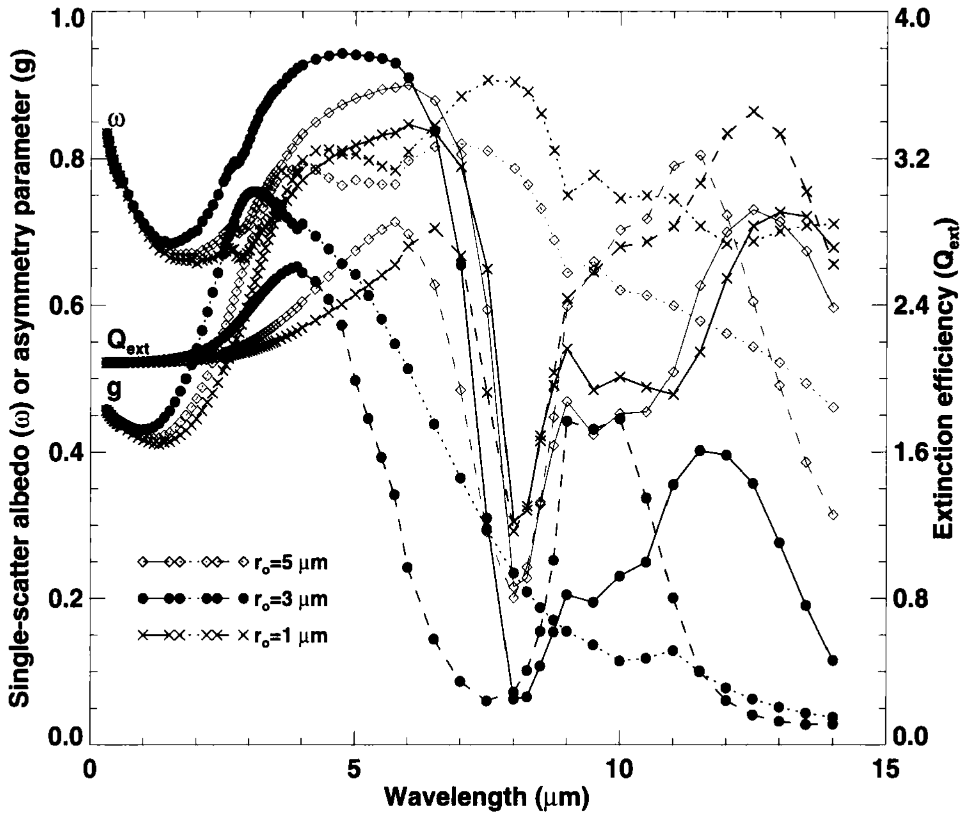


Figure 9. Optical parameters: single-scatter albedo, $\omega$, extinction coefficient, $Q_{ext}$, and asymmetry parameter ($g$) for the andesite volcanic ash cloud model. The wavelength range is 0.3 $\mu$m to 14.5 $\mu$m and results for three mean particle radii ($r_o$) are shown.

using the Mie program discussed earlier. Figure 9 shows the variation of single-scatter albedo ($\varpi$), extinction coefficient ($Q_{ext}$), and asymmetry parameter ($g$) for wavelengths ranging from 0.3 $\mu$m to 14.5 $\mu$m, the range most commonly used in remote sensing of the earth's atmosphere. The results for a model ash cloud with mean particle radii of 1, 3, and 5 $\mu$m are shown.

### (*b*) *Visible and near-infrared detection algorithm*

Table 2 shows that ash absorbs more at visible wavelengths (0.63–0.68 $\mu$m) than both water and ice, and that the imaginary part of the refractive index of ash is almost five orders of magnitude greater than water and ice at these wavelengths. At near-infrared wavelengths, ash absorbs more strongly than ice and water, and ice absorbs more strongly than water. We argue therefore, that a ratio of visible to near-infrared reflectances, or vice versa, should provide a means of distinguishing clouds predominantly of ash from those predominantly of water/ice. The purpose of using the ratio is to eliminate, to a large degree, variations in illumination and viewing conditions and provide an objective discriminator.

In order to verify this reasoning, radiative transfer calculations were performed for the ATSR-2 0.67 $\mu$m and 1.61 $\mu$m channels using the water/ice cloud models of Stephens (1979) and the ash cloud model developed in this work.