Supplementary Material: Aerosol radiative forcing from the 2010 Eyjafjallajökull volcanic eruptions

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1 Optical properties of non-spherical particles

We derived optical properties for a variety of non-spherical ash particles using the T-Matrix scattering code [*Mishchenko and Travis*, 1998], available at: `http://www.giss.nasa.gov/staff/mmishchenko/t_matrix.html`. Tables S1–S3 show the mass absorption cross-section, single-scatter albedo, and scattering asymmetry parameter for spheres, oblate spheroids with different aspect ratios (labeled a/b), prolate spheroids with different aspect ratios, and Chebyshev shapes with polynomial degree 5 and deformation factor of +0.1. Properties are shown for sphere-equivalent particle radii of 0.1 µm and 1.0 µm, and wavelengths of 0.55 µm (mid-visible) and 11 µm (the peak of 263 K Planck emission). All particles in each row have the same volume. Refractive indices are those applied for the central scenarios of radiative forcing, and are $1.54 + 0.0042i$ at $\lambda = 0.55$ µm and $2.24 + 0.4295i$ at $\lambda = 11.0$ µm.

Table S1: Mass Absorption Cross-Section of Different Equal-Volume Shapes

r_e (µm)	λ (µm)	Sphere	Oblate S. ($a/b = 1.2$)	Oblate S. ($a/b = 1.6$)	Oblate S. ($a/b = 2.0$)	Prolate S. ($b/a = 1.2$)	Prolate S. ($b/a = 1.6$)	Prolate S. ($b/a = 2.0$)	Chebyshev (5, +0.1)
0.1	0.55	46.5	46.5	46.2	45.8	46.5	46.3	46.3	46.5
0.1	11.0	74.6	75.4	80.0	86.3	75.4	79.9	86.2	78.9
1.0	0.55	63.9	64.8	66.8	67.7	64.9	67.3	68.2	68.8
1.0	11.0	122.6	123.4	128.0	134.0	123.4	128.2	134.9	126.6

Table S2: Single-Scatter Albedo of Different Equal-Volume Shapes

r_e (µm)	λ (µm)	Sphere	Oblate S. ($a/b = 1.2$)	Oblate S. ($a/b = 1.6$)	Oblate S. ($a/b = 2.0$)	Prolate S. ($b/a = 1.2$)	Prolate S. ($b/a = 1.6$)	Prolate S. ($b/a = 2.0$)	Chebyshev (5, +0.1)
0.1	0.55	0.96895	0.96893	0.96866	0.96822	0.96893	0.96868	0.96828	0.96883
0.1	11.0	0.00077	0.00077	0.00077	0.00077	0.00077	0.00077	0.00077	0.00075
1.0	0.55	0.90655	0.90561	0.90525	0.90745	0.90550	0.90516	0.90856	0.90348
1.0	11.0	0.32442	0.32459	0.32496	0.32438	0.32457	0.32478	0.32403	0.32336

Table S3: Asymmetry Parameter of Different Equal-Volume Shapes

r_e (μm)	λ (μm)	Sphere	Oblate S. ($a/b = 1.2$)	Oblate S. ($a/b = 1.6$)	Oblate S. ($a/b = 2.0$)	Prolate S. ($b/a = 1.2$)	Prolate S. ($b/a = 1.6$)	Prolate S. ($b/a = 2.0$)	Chebyshev (5, +0.1)
0.1	0.55	0.46340	0.46259	0.45872	0.45398	0.46266	0.45991	0.45798	0.46215
0.1	11.0	0.00239	0.00239	0.00235	0.00232	0.00239	0.00237	0.00238	0.00233
1.0	0.55	0.71891	0.71155	0.69310	0.71035	0.70967	0.66956	0.66033	0.68448
1.0	11.0	0.22243	0.22110	0.21344	0.20335	0.22127	0.21610	0.21118	0.21783

References

Mishchenko, M. I., and L. D. Travis (1998), Capabilities and limitations of a current FORTRAN implementation of the T-matrix method for randomly oriented, rotationally symmetric scatterers, *Journal of Quantitative Spectroscopy and Radiative Transfer*, *60*(3), 309–324.