Physical parameter	Notation	Units	Definition	Comments
Snow absorption coefficient	κ_{abs}	m^{-1}	$N\bar{C}_{\mathrm{abs}}$	N – number of snow grains in unit volume (m^{-3}) $\bar{C}_{\mathrm{abs}}$ – average absorption cross section of grains (m^2)
Snow extinction coefficient	κ_{ext}	m^{-1}	$N\bar{C}_{\mathrm{ext}}$	N – number of snow grains in unit volume (m^{-3}) $\bar{C}_{\mathrm{ext}}$ – average extinction cross section of grains (m^2)
Probability of photon absorption	β	–	$\kappa_{\mathrm{abs}}/\kappa_{\mathrm{ext}}$	$\beta \ll 1$ in the approximation studied
Snow single-scattering albedo	ω_0	–	$1-\beta$	Close to 1 in the approximation studied
Snow asymmetry parameter	g	–	$g=\frac{1}{2}\int_0^{\pi} p(\theta)\sin\theta\cos\theta d\theta$	$\frac{1}{2}\int_0^{\pi} p(\theta)\sin\theta d\theta = 1$ θ is the scattering angle (equal to π in the exact backward-scattering direction) $p(\theta)$ is the conditional probability of photon scattering in a given direction specified by the angle θ (phase function)
Bulk ice absorption coefficient	α	m^{-1}	$\frac{4\pi\chi(\lambda)}{\lambda}$	$\chi(\lambda)$ – imaginary part of bulk ice refractive index λ – wavelength
Volumetric absorption coefficient of pollutants	K	m^{-1}	$\bar{C}_{\mathrm{abs}}^{\mathrm{pol}}/\bar{V}_{\mathrm{p}}$	$\bar{C}_{\mathrm{abs}}^{\mathrm{pol}}$ – average absorption cross section of impurities in snow (m^2); $\bar{V}_{\mathrm{p}}$ is their average volume (m^3). K is *proportional* to the bulk absorption coefficient of impurities if they are much larger than the wavelength (and weakly absorbing) or much smaller than the wavelength (so-called Rayleigh scatterers). The coefficient of proportionality (absorption enhancement factor) depends on the shape of particles and real part of their complex refractive index.
Effective absorption length	l	m^{-1}	$\frac{\ln^2 r_{\mathrm{s}}}{\alpha}$ (for clean dry snow)	$r_{\mathrm{s}}=\exp(-\sqrt{\alpha l})$ r_{s} – spherical albedo α – bulk ice absorption coefficient This definition holds for clean dry snow only The general definition for dry snow is given by Eq. (17)
Reflectance	$R(\mu_0,\mu,\varphi)$	–	$I^{\uparrow}(\mu_0,\mu,\varphi)/I_{\mathrm{Lamb}}^{\uparrow}(\mu_0)$	Ratio of intensity of light reflected from a given snowpack to that of an ideal Lambertian surface with albedo 1.0 (μ_0,μ,φ) – cosine of the solar zenith angle, cosine of viewing zenith angle and relative azimuth, respectively
Plane albedo	$r(\mu_0)$	–	$2\int_0^1 \bar{R}(\mu_0,\mu,\varphi)\mu d\mu$	$\bar{R}=\frac{1}{2\pi}\int_0^{\pi} R(\mu_0,\mu,\varphi)\varphi d\varphi$ – reflectance averaged with respect to the azimuth, black-sky albedo
Spherical albedo	r_{s}	–	$2\int_0^1 r(\mu_0)\mu_0 d\mu_0$	White-sky albedo
Volumetric concentration of grains	c	–	$N\bar{V}$	N – number concentration of grains $\bar{V}$ – average volume of grains c – fraction of unit volume occupied by ice grains (usually around 0.3)
Mass concentration of grains (snow density)	ρ_{s}	gm^{-3}	$N\bar{m}$	N – number concentration of grains $\bar{m}=\rho_{\mathrm{i}}\bar{V}$ – average mass of grains ρ_{i} – bulk ice density $\rho_{\mathrm{s}}=\rho_{\mathrm{i}}c$ (for dry snow)
Bulk ice density	ρ_{i}	gm^{-3}	–	$\rho_{\mathrm{i}}=916.7\,\mathrm{kg\,m^{-3}}$ at 0 °C
Bulk pollutant density	ρ_{p}	gm^{-3}	–	
Volumetric concentration of impurities	c_{p}	–	$N_{\mathrm{p}}\bar{V}_{\mathrm{p}}$	N_{p} – number concentration of pollution particles $\bar{V}_{\mathrm{p}}$ – average volume of pollution particles c – fraction of unit volume occupied by impurities
Normalized volumetric concentration of impurities	$\mathbb{C}$	–	c_{p}/c	$\mathbb{C}=\frac{\rho_{\mathrm{i}}}{\rho_{\mathrm{s}}}c_{\mathrm{p}}$ ρ_{i} – bulk ice density ρ_{s} – snow density c_{p} – volumetric concentration of impurities
Effective diameter of grains	d	m	$\frac{3\bar{V}}{2\bar{S}}$	Equal to the diameter for the collection of spherical grains of the same size $\bar{V}$ – average volume of grains $\bar{S}$ – average cross section of grains (perpendicular to incident light beam)