# List of Symbols

| | |
|---|---|
| $\bar{\mathbf{j}}$ | Current density of vapour mass |
| $\bar{\mathbf{j}}_h$ | Current density of heat |
| $\ddot{z}$ | Acceleration of drop |
| $\delta\rho$ | Air density perturbation |
| $\delta P$ | Pressure perturbation |
| $\epsilon$ | Ratio of gas constants for dry and moist air = 0.622 |
| $\eta$ | Viscosity of air. |
| $\hat{\mathbf{k}}$ | Unit vector in vertical direction. |
| $\lambda_0$ | Slope parameter for exponential fit (m$^{-1}$) |
| $\rho_0$ | Reference air density |
| $\rho_v$ | Mass of water vapour per unit volume of air |
| $\rho_{v,\infty}$ | Vapour density at infinite distance from drop |
| $\rho_{v,a}$ | Vapour density on drop surface |
| $\tau$ | Residence time of salt particles in atmosphere |
| $\mathbf{v}$ | Wind velocity vector field |
| $\theta_{q,sat}$ | Wet equivalent potential temperature (K) |
| $a$ | Drop radius |
| $a$ | Radius of salt water drop |
| $A_c$ | Albedo of a liquid layer cloud (fraction) |
| $A_c$ | Albedo of a liquid layer cloud (fraction) |
| $A_E$ | Area of Earth's surface |

$a_i$      Average radius of ice crystals

$a_l$      Average radius of liquid drops

$A_p$      Planetary albedo

*ALMR*   Adiabatic liquid water mixing ratio $kg/kg$

$C$      Capacitance of an ice crystal

$C_0$      Capacitance of a thin circular disk: $\frac{2a}{\pi}$

$C_D$      Drag coefficient of sphere falling in air

$c_i$      Specific heat capacity of ice

$c_p$      Heat capacity of dry air = $1005 \text{Jkg}^{-1}\text{K}^{-1}$

$c_p$      Specific heat capacity of air

$c_w$      Heat capacity of liquid water = $4187 \text{Jkg}^{-1}\text{K}^{-1}$

$c_w$      Specific heat capacity of liquid water

$D$      Particle diameter

$D_v$      Diffusivity of water vapour in air

$e$      Vapour pressure

$E(D, d)$   Collision efficiency between drop of diameter $D$ and $d$

$e_\infty$      vapour pressure at infinite distance from drop

$e_v$      Vapour pressure at surface of drop

$e_{s,drop}$   Vapour pressure at surface of drop

$e_{sat,l}$    Saturation vapour pressure over liquid water

$e_{si}$      Saturation vapour pressure over flat liquid water surface

$e_{sw}$      Saturation vapour pressure over flat ice water surface

$F$      Average solar irradiance

$F_0$      Solar flux at top of the atmosphere

$f_1$      Fraction of Earth's surface covered by ocean

$f_2$      Fraction of Earth's oceans covered by marine clouds

$f_3$      Fraction of marine clouds that are seeded

$F_{diabatic}$   Processes changing $\theta$ that are not adiabatic.

$f_{H-M}$   Temperature dependent function for H-M multiplication.

$g$      Gravitational field strength

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$H$      Depth of boundary layer

$J$      Homogeneous nucleation rate of ice in supercooled water

$k$      Thermal conductivity of air

$L_f$      Latent heat of fusion

$L_s$      Latent heat of sublimation for water, $\sim 2.82 \times 10^6$ J kg$^{-1}$

$L_v$      latent heat of vapourisation for water $\cong 2.5 \times 10^6$J kg$^{-1}$

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$M_0$      Zeroth moment of a size distribution

$M_2$      Second moment of a size distribution

$M_3$      Third moment of a size distribution

$m_{rime}$   The mass of rime accreted

$N$      Concentration of cloud drops in seeded cloud

$N$      Particle number density

$N_0$      Concentration of cloud drops in un-seeded cloud

$n_0$      Intercept parameter for exponential fit (m$^{-4}$)

$N_c$      Number concentration of activated CCN

$N_i$      Number concentration of ice crystals

$N_l$      Number concentration of liquid drops

$N_{IN}$      Number concentration of ice nuclei

$n_{spray}$   Number of drops sprayed

$P$      Pressure

| | |
|---|---|
| $P$ | Total pressure |
| $P_0$ | Reference pressure |
| $P_1$ | Temperature of air at cloud base, $K$ |
| $P_2$ | Pressure of air above cloud base, $Pa$ |
| $P_c$ | Pressure difference over drop interface |
| $P_{H-M}$ | Production rate of ice due to H-M multiplication. |
| $Q$ | Total water mixing ratio (vapour plus liquid) kgkg$^{-1}$ |
| $R'$ | Gas constant for dry air = 287Jkg$^{-1}$K$^{-1}$ |
| $R_a$ | Specific gas constant for air |
| $R_v$ | Specific gas constant for water vapour |
| $Re$ | Reynolds number $Re = \frac{ud\rho_a}{\eta}$ |
| $S_i$ | Supersaturation over ice |
| $s_i$ | saturation over ice |
| $S_l$ | Supersaturation over liquid water |
| $S_l$ | Supersaturation over liquid water |
| $s_l$ | saturation over liquid water |
| $T$ | Temperature |
| $T_1$ | Temperature of air at cloud base, $K$ |
| $T_2$ | Temperature of air above cloud base, $Pa$ |
| $T_\infty$ | Temperature at infinite distance from drop |
| $T_a$ | Temperature at the surface of drop |
| $T_c$ | Temperature in degrees celcius. |
| $u$ | Velocity of sphere falling in air |
| $V_{spray}$ | Total volume of sea spray |
| $w$ | Ascent velocity of parcel |
| $w$ | Vertical wind speed |

$w_i$      Ice water mixing ratio

$w_l$      Liquid water mixing ratio.

$w_l$      Liquid water mixing ratio

$w_s$      Saturated vapour mixing ratio $\mathrm{kgkg^{-1}}$

$w_v$      Water vapour mixing ratio

$y$      Maximum displacement between drop centres which may result in collision