Appendix B

Acronyms, Symbols, and Constant Values

Comment [01]: Missing the many acronyms from the reanalysis data sources. See those tables in chapter 2. Such as AIREP, ACARS, AMDAR, ASDAR, TAO, TRITON, PAOBs, beta, cap U, k_sub beta, GPS/MET, LIMS, TCPW, RMS, See website list at bottom of table 2.1, WMO, more in Table 2.3 and 2.4

Purpose: Defines acronyms and symbols used throughout the book. Where relevant, the value of the constant is provided

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A	albedo
A	available potential energy
AMIP	Atmospheric model intercomparison project
amc	angular momentum conserving
a_Λ	absorptivity at electromagnetic wavelength Λ
a_{SA}	shortwave absorptivity of 'glass' atmosphere
a_{SG}	shortwave absorptivity of ground
a_{LA}	longwave absorptivity of 'glass' atmosphere
a_{LG}	longwave absorptivity of ground
C_p	specific heat of dry air at constant pressure, = 1004 J K^{-1} kg^{-1}
C_{sd}	specific heat estimate for dry soil, ~800 J K^{-1} kg^{-1}
C_{sw}	specific heat estimate for wet soil, ~1500 J/(kgK)
C_v	specific heat of dry air at constant volume, = 717 J K^{-1} kg^{-1}
C_w	specific heat for water, ~4200 J K^{-1} kg^{-1} varies with temperature. This value for T~280K
CTW	cloud-track winds
c	speed of light (3 x 10^8 m/s)
c_B	Boltzmann constant (1.38 x 10^{-23} J/K)
c_d	drag coefficient (3x10^{-3} over land, 10^{-3} over ocean; see surface stress, τ)
c_h	Planck constant (6.625 x 10^{-34} Js)
D_T	total diabatic heating rate per unit mass, = D_J / C_p (units K/s)
D_J	total diabatic heating rate in units J s^{-1} kg^{-1} (see C.3)
D_{NM}	diabatic heating rate from processes other than net changes of water state (K/s units)
DOE	(U.S.) Department of Energy
DSE	dry static energy, = $C_pT+\Phi$
$d\omega$	solid angle incrementω
ECMWF	European Centre for Medium-range Weather Forecasts
ERA-40	ECMWF 40 year reanalysis datasets
ERA-Interim	ECMWF reanalysis dataset successor to ERA-40
E_w	evaporation of liquid water
E	radiance
E_i	radiance from layer i

Comment [RG2]: Consider using D instead of Q

E_Λ	radiance (at wavelength Λ)
e	vapor pressure
e_s	saturation vapor pressure
F	friction
f	Coriolis parameter, $= 2\Omega\sin\varphi$
f_o	constant value of Coriolis parameter at latitude φ_o, $= 2\Omega\sin\varphi_o$
g	acceleration of gravity, = 9.81 m s^{-2}
h	elevation, Montgomery Stream function (appendix C)
H	scale height, = g/(RT) where T has usually been averaged in some way
HCBE	hypothetical boundary between atmospheric regions where Hadley Cells dominate versus baroclinic eddies.
i	square root of -1
i	(bold) unit vector pointing eastwards
I	irradiance (over all wavelengths)
I_A	irradiance from atmosphere in glass slab model
I_G	irradiance from ground in glass slab model
I_i	irradiance from layer i
I_{IN}	irradiance input into glass slab model
I_S	annual and global average solar radiation spread over the Earth ($=I_{Sol}/4$)
I_{Sol}	solar constant (1356-1370 Wm^{-2}, 1365 used here)
$I_{\_sol}$	solar radiation at the TOA incident upon a latitude averaged over a day
I_Λ	irradiance (at wavelength Λ)
ISCCP	International Satellite Cloud Climatology Project
ICZ	intertropical convergence zone
K	kinetic energy
j	(bold) unit vector pointing northwards
k	(bold) unit vector pointing locally outwards (i.e. ‘upwards’)
k_a	mass extinction coefficient for absorber a
k_H	horizontal viscosity coefficient for second order friction
k_R	viscosity coefficient for Rayleigh friction
k_z	vertical viscosity coefficient for second order friction
k_β	transitional wavenumber for jets versus eddies
L	latent heat of vaporization, $= 2.5\times10^6$ J kg^{-1} at 0 C.
LHF	latent heat flux
lw	longwave (radiation) (~5 to 200 µm wavelength)
lw_t	total longwave radiation from the Earth (atmosphere + surface contributions)
M	angular momentum per unit mass, $=R_c (R_c \Omega + u)$
MSE	moist static energy, $= C_pT+\Phi+Lq$
N^2	Brunt-Väisälä frequency, $= \frac{g}{\theta_s}\left(\frac{\partial\theta_s}{\partial z}\right)$ in height coordinates for an ideal gas
NCEP	(U.S.) National Centers for Environmental Prediction
NDRA2	NCEP-DOE (AMIP-II) reanalysis datasets
nr_t	TOA net radiation (sw_t – lw_t)
O_a	optical depth of absorber a
P_w	precipitation of any solid or liquid form of water
P_{QG}	quasi-geostrophic potential vorticity

Comment [RG3]: Reserve ‘E’ for radiance instead of ‘e’

Comment [RG4]: Try I for irradiance instead of ‘E’

P_{SWE}	shallow water equations potential vorticity, $= \frac{\tilde{\zeta}_g + f}{\tilde{h}}$
p	pressure
p_{oo}	reference pressure, typically set to 10^5 Pa
Q_E	potential vorticity in isentropic coordinates (see C.49)
Q_{QG}	quasi-geostrophic potential vorticity (see C.47)
Q_{QGy}	meridional gradient of quasi-geostrophic potential vorticity
QG	quasi-geostrophic
q	specific humidity
R	gas constant for dry air, = 287 J K^{-1} kg^{-1}
R_v	gas constant for water vapor, = 461 J K^{-1} kg^{-1}
R_c	r cos(φ)
R_o	Rossby number, $=U/f_oL_s$, where U and L_s are speed and horizontal length scales.
r	mean radius of the solid earth, 6370 km
rms	root mean square
S_a	enthalpy, = C_p T
S_o	entropy, $dS_o = C_p$ dln(θ)
SHF	sensible heat flux
SLHF	surface latent heat flux
SLP	sea level pressure
SSHF	surface sensible heat flux
sw	shortwave (radiation) (~0.4 to 5 µm wavelength)
sw_a	shortwave radiation absorbed by the atmosphere
sw_s	shortwave radiation absorbed by the Earth's surface
sw_t	shortwave radiation absorbed by atmosphere and surface
SWE	shallow water equations
T	temperature
T_A	atmospheric temperature
T_G	surface temperature
T_{sa}	skin temperature of atmosphere (radiative models)
TOA	top of atmosphere
t	time
U_{amc}	a zonal wind component conserving angular momentum
U_s	wind speed
u	zonal component of the wind
u_{ag}	zonal component of the ageostrophic wind, $= u - u_g$
u_g	zonal component of the geostrophic wind, $= -\frac{1}{f}\frac{\partial Z}{\partial y}$ in pressure coordinates
V	vector wind, 3 dimensional unless otherwise stated
v	meridional component of the wind
v_{ag}	meridional component of the ageostrophic wind, $= v - v_g$
v_g	meridional component of the geostrophic wind, $= \frac{1}{f}\frac{\partial Z}{\partial x}$ in pressure coordinates
$[v_R]$	meridional component of the zonal average residual circulation
w	vertical velocity in height coordinates
w_d	mixing ratio, equivalent to saturation mixing ratio at dewpoint temperature

WBC	western boundary current
X	distance
x	longitudinal distance (depends on coordinate system)
Z	geopotential height
z	elevation
α	specific volume, = $1/\rho$
α_v	specific volume for water vapor, = 1/e
β	meridional derivative of the Coriolis parameter
ε_Λ	emissivity?
ε_f	efficiency factor?
Λ	wavelength of electromagnetic radiation
λ	longitude or azimuth based on context
μ	$=\sin(\varphi)$
ρ	density
ρ_a	density of absorber
ρ_w	density of fresh water. = 10^3 kg/m^3
θ	potential temperature
θ_e	equivalent potential temperature
σ	Stefan-Boltzmann constant, = $(2\pi^5 c_B{}^4)/(15c^2 c_h{}^3) = 5.67\times10^{-8}\,W\,m^{-2}\,K^{-4}$
τ	surface stress by wind
τ_λ	surface stress in zonal direction ($=\rho\, c_d\, \lvert V\rvert\, u$)
υ_Λ	electromagnetic frequency at wavelength Λ
Ω	angular rotation rate of the earth, 7.292 x 10^{-5} rad/sec
$\mathbf{\Omega}$, $\vec{\Omega}$	(bold or with arrow) angular rotation vector for the earth, = (0 **i**, $\Omega\cos(\varphi)$ **j**, $\Omega\sin(\varphi)$ **k**)
ω	(vertical) pressure velocity. $\omega = dP/dt$
$[\omega_R]$	(vertical) pressure component of the zonal average residual circulation
Φ	geopotential, $d\Phi = g\,dz = -RTdp/p$ (for hydrostatic balance)
φ	latitude or zenith angle based on context
ζ	vertical component of relative vorticity, = $\vec{k}\bullet\vec{\nabla}\times\vec{V} = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}$
ζ_a	vertical component of absolute vorticity, = ζ+f
ζ_{ay}	meridional gradient of vertical component of absolute vorticity
$\vec{\zeta}$	three dimensional vorticity, $=\vec{\nabla}\times\vec{V}$
Ψ or ψ	streamfunction

Comment [RG5]: What to do about absorptivity versus specific volume?

Comment [RG6]: Emissivity versus efficiency factor?