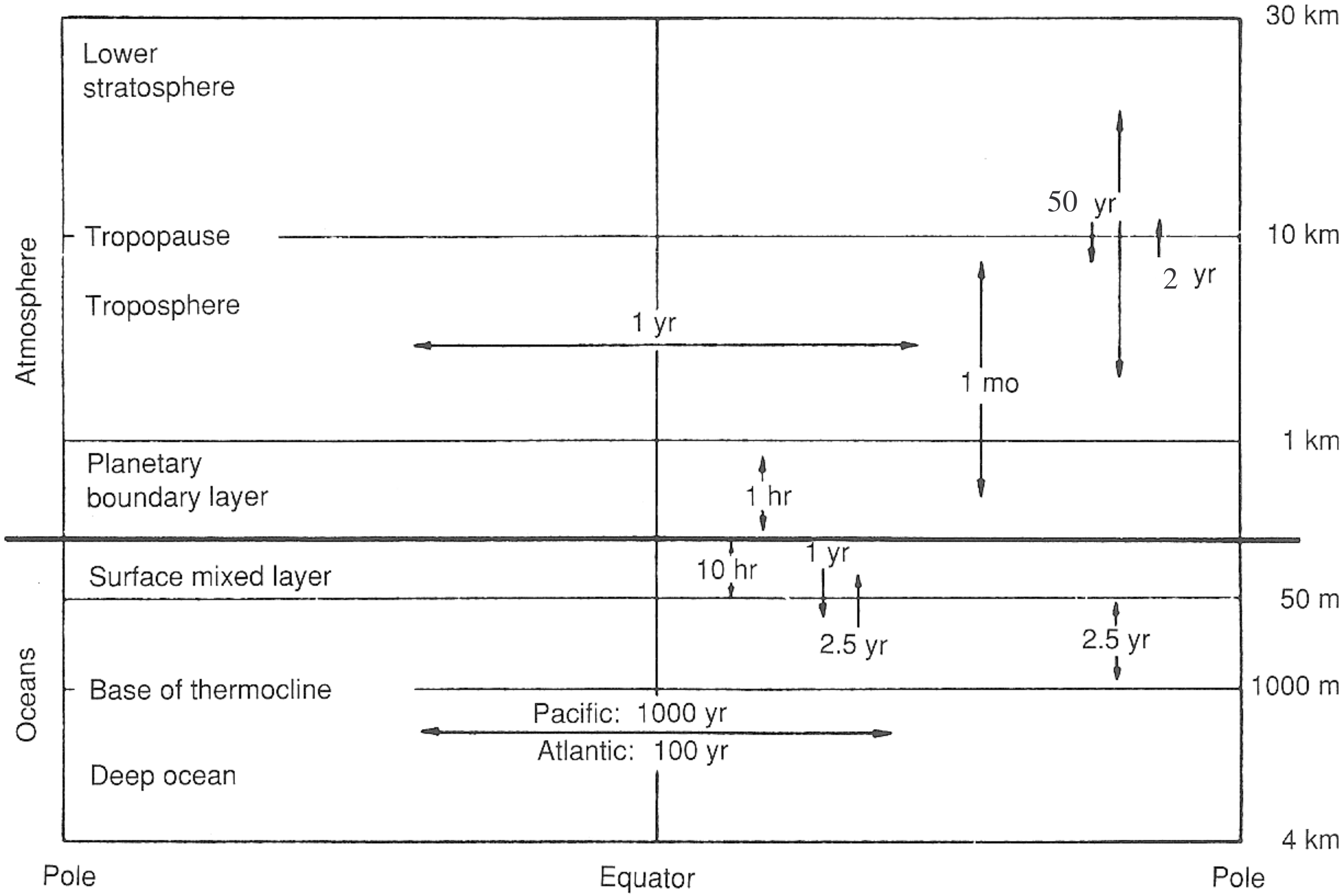
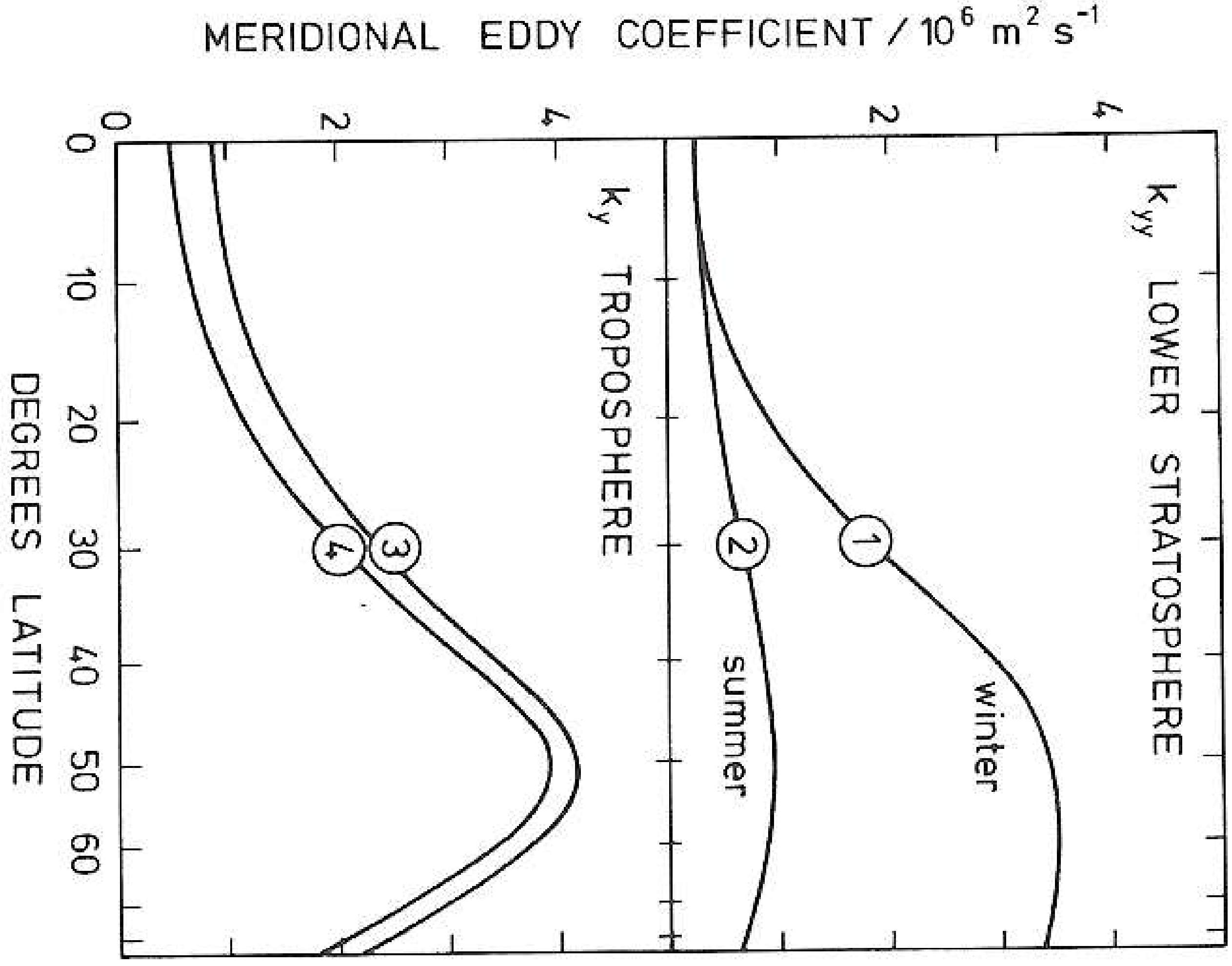
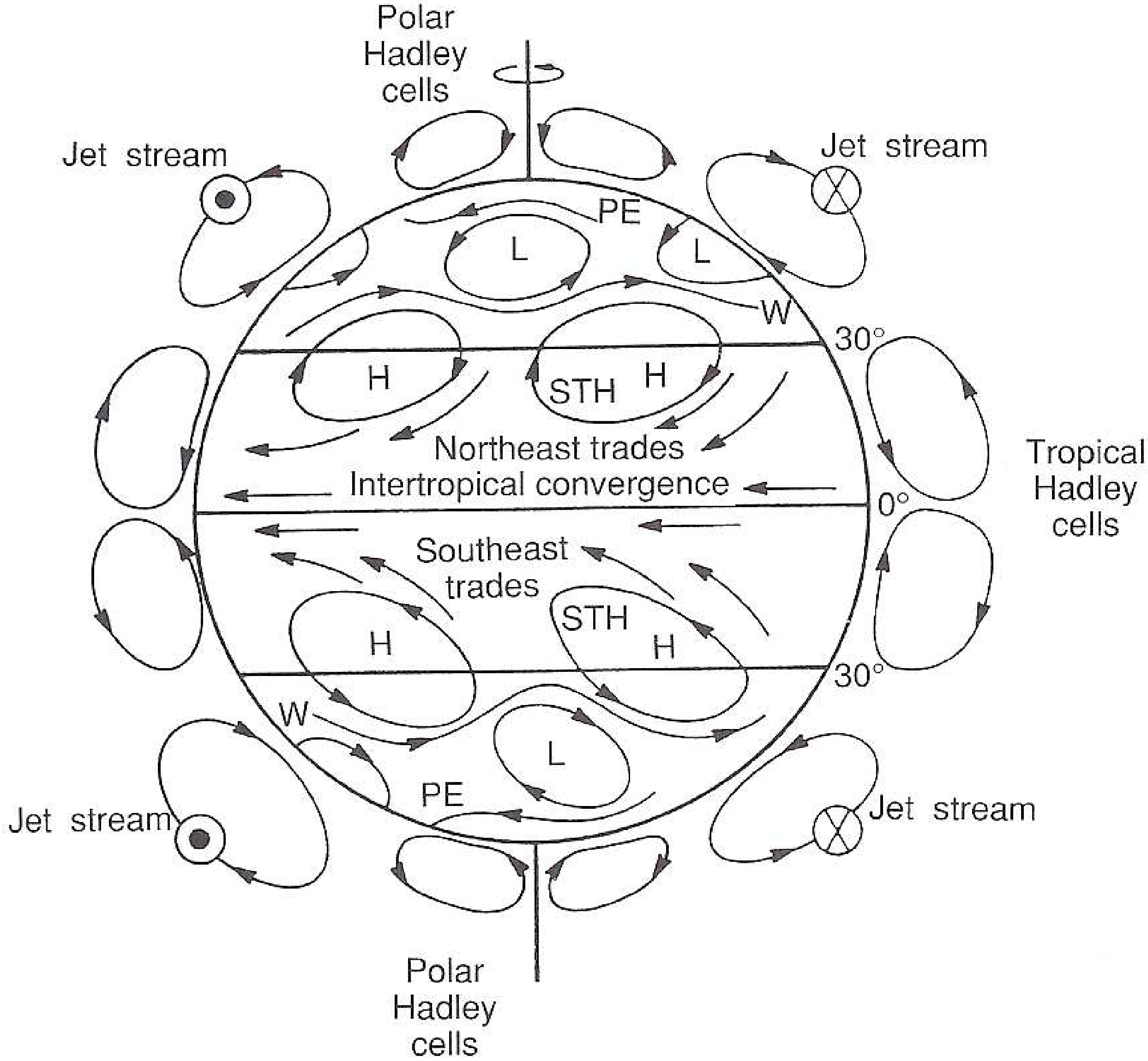

30 km
Lower
stratosphere
50 yr
Tropopause
10 km
2 yr
Troposphere
Atmosphere
1 yr
1 mo
1 km
Planetary
boundary layer
1 hr
Surface mixed layer
10 hr
1 yr
50 m
2.5 yr
2.5 yr
Base of thermocline
1000 m
Oceans
Pacific: 1000 yr
Atlantic: 100 yr
Deep ocean
4 km
Pole
Equator
Pole

TABLE 1.8 Time Constants for Horizontal and Vertical Transport by Atmospheric Mean Motions and Eddy Diffusion (Northern Hemisphere)[a]

	Horizontal transport					Vertical transport				
Altitude level	y_c (km)	$\bar{u}_y$ (m s^{-1})	τ_{trans} (months)	K_{yy} (10^6 m^2 s^{-1})	τ_{trans} (months)	z_c (km)	$\bar{u}_z$ (m s^{-1})	τ_{trans} (months)	K_z (m^2 s^{-1})	τ_{trans} (months)
Troposphere (800 hPa, 2 km)	3300	0.20 w 0.05 s	6 25	1.8 w 0.5 s	1.8 6.6	8.5	0.00015	20	15	1.2
Stratosphere (100 hPa, 16 km)	3300	0.20 w 0.12 s	6 10	3.0 w 0.6 s	1.1 5.5	6	0.00012	19	0.4	27

[a] Data for $\bar{u}_y$, $\bar{u}_z$, and K_{yy} were taken from Hidalgo and Crutzen (1977) for 40° northern latitude. w = winter, s = summer.


MERIDIONAL EDDY COEFFICIENT / 10^6 m^2 s^{-1}
K_{yy} LOWER STRATOSPHERE
K_y TROPOSPHERE
winter
summer
1
2
3
4
0
2
4
0
10
20
30
40
50
60
DEGREES LATITUDE


Polar
Hadley
cells
Jet stream
Jet stream
PE
L
L
W
30°
H
STH H
Northeast trades
Intertropical convergence
0°
Tropical
Hadley
cells
Southeast
trades
STH
H
H
30°
W
L
PE
Jet stream
Jet stream
Polar
Hadley
cells

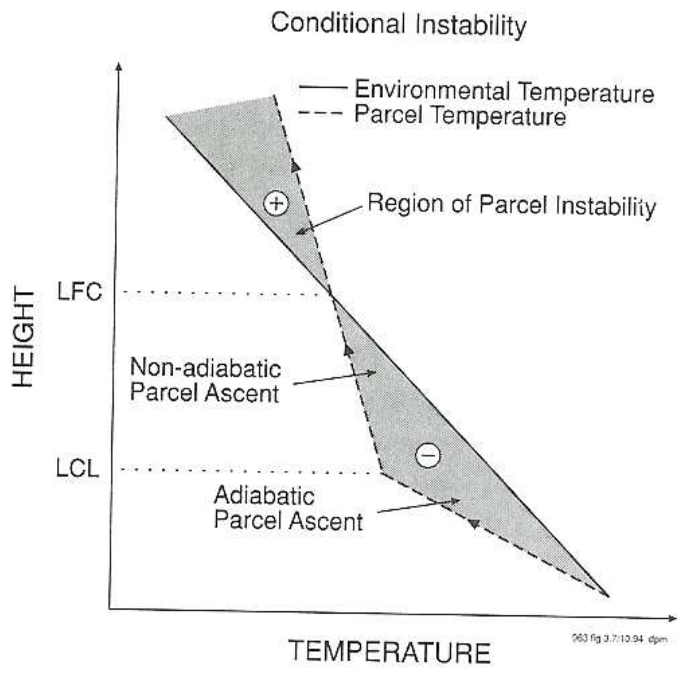


Figure 2.21. The solid line shows the background temperature structure and the dashed line shows that of an air parcel displaced vertically. The parcel temperature decreases adiabatically until the air is saturated (at the lifting condensation level - LCL). Above the LCL latent heat is released; so the parcel temperature decreases much more slowly than the adiabatic rate. If lifting continues as far as the level of free convection (LFC), where the parcel becomes warmer than the environment, the parcel will become buoyant and continue rising (after Wallace and Hobbs, 1977).

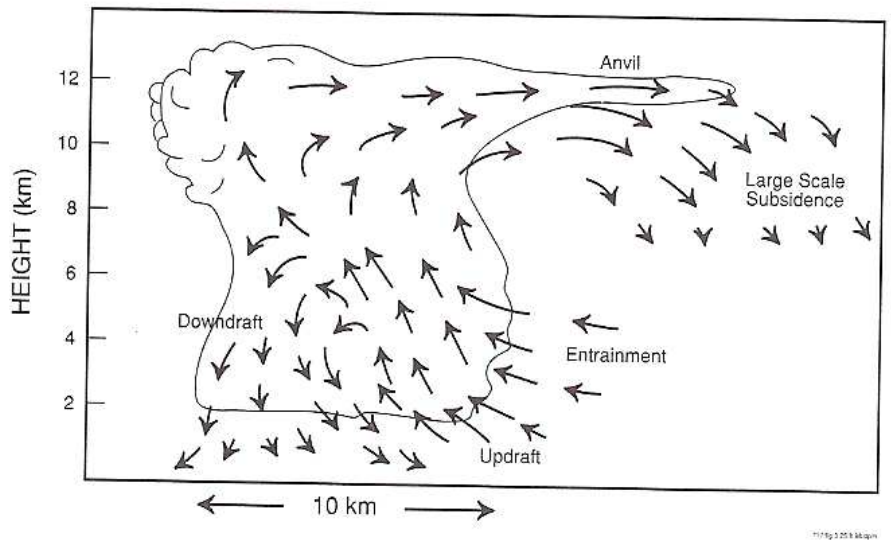


Figure 2.22. Schematic diagram of the mass fluxes in a convective cloud.