Average tropospheric gradient is $\gamma \sim 6,5\ K/km$, but in first 2-3 km is vertical gradient lower than in higher throposphere. It is caused by inversion during night and winter (especially in arctic and antarctic). Critical gradient, when density rise with height is $\gamma_c = 34,06\text{-}34,24\ K/km$, dry-adiabatic gradient with constant potential temperature θ is $\gamma_d = 9,693\text{-}9,801\ K/km$ (c_p for dry air is $1009\text{-}1003\ J{\cdot}kg{\cdot}K^{-1}$, and gas constant for dry air is $R = 287,10\ J{\cdot}kg^{-1}{\cdot}K^{-1}$, gravity is $9,78\text{-}9,83\ ms^{-2}$). Gradient γ_s (H=100%) depend on water vapour pressure e, and it strongly depend on temperature. Saturated gradient is lower than dry adiabatic gradient. Three gradients are:

$$\gamma_C = \frac{g}{R}, \quad \gamma_D = \frac{g}{c_p}, \quad \gamma_s = \frac{\frac{1}{c_{pm}} \frac{m_s g L}{(1+m_s) R_m T} + \frac{g}{c_{pm}}}{1 + \frac{1}{c_{pm}} \frac{m_s L^2}{(1+m_s) R_V T^2}} \simeq \gamma_d \cdot \frac{1 + \frac{L m_s}{R_n T}}{1 + \frac{L^2 m_s}{c_{pd} R_V T^2}} \tag{1}$$

γ_c is critical gradient, γ_d is dry adiabatic gradient, γ_s is saturated gradient, g is graity, L is latent heat of vapour, m_s is absolute air humidity, c_{pm} is isobaric capacity of moist air, c_{pd} is isobaric capacity of dry air, c_{pn} is isobaric capacity of saturated air, R_d is gas constant of dr air, R_m is gas constant of moist air, R_n is gas constant of saturated air ($H=100\%$).

Virtual temperature T_V:

$$T_V = T\left(1 + 0,378 \frac{e}{p - 0,378\, e}\right), \quad T_V = T\left(0 + 0,608\, m_s\right) \tag{2}$$

Potential temperature θ:

$$\theta = T \left(\frac{P_2}{P_1}\right)^{\frac{R}{c_p}} \tag{3}$$

Equivalent potential temperatuture θ_E:

$$\theta_E = T \left(\frac{P_2}{P_d}\right)^{\frac{R_d}{(c_{pd} + r_t c)}} H^{-r_v R_v / (c_{pd} + r_t c)} e^{\left[\frac{L_r r_c}{(c_{pd} + r_t c) T}\right]} \tag{4}$$

Homogenic atmosphere:

$$H = \frac{kT}{m \cdot g} = \frac{\Re T}{M_{mol}\, g} = \frac{RT}{g} \tag{5}$$

Isothermal atmosphere:

$$P = P_0 \cdot e^{\frac{-g \cdot z}{R \cdot T}}, \quad R = \frac{\Re}{M} = \frac{k_B}{m}, \quad \Re = k_B \cdot A, \quad R = c_P - c_V \tag{6}$$