Soluzione profilo verticale della pressione

a) e b)

eq. equilibrio idrostatico $\frac{\partial p}{\partial z} = -\rho g$

eq. stato $p = \rho R T$

eq. stato $\Rightarrow \rho = \frac{p}{RT}$

$$\frac{\partial p}{\partial z} = -\rho g \Rightarrow \frac{dp}{p} = -\frac{g}{R}\frac{dz}{T}$$

a)

$$\int_{p_0}^{p} d(\ln p') = -\frac{g}{R}\int_{z=0}^{z}\frac{dz'}{T} = -\frac{g}{R}\left\langle\frac{1}{T}\right\rangle z$$

$$\boxed{p = p_0\, e^{-\frac{g}{R}\left\langle\frac{1}{T}\right\rangle z}}$$

$g = 9.81\ m s^{-2}$ $R \simeq 288\ J kg^{-1} K^{-1}$ $\left\langle\frac{1}{T}\right\rangle = \frac{1}{270\ K}$

b)

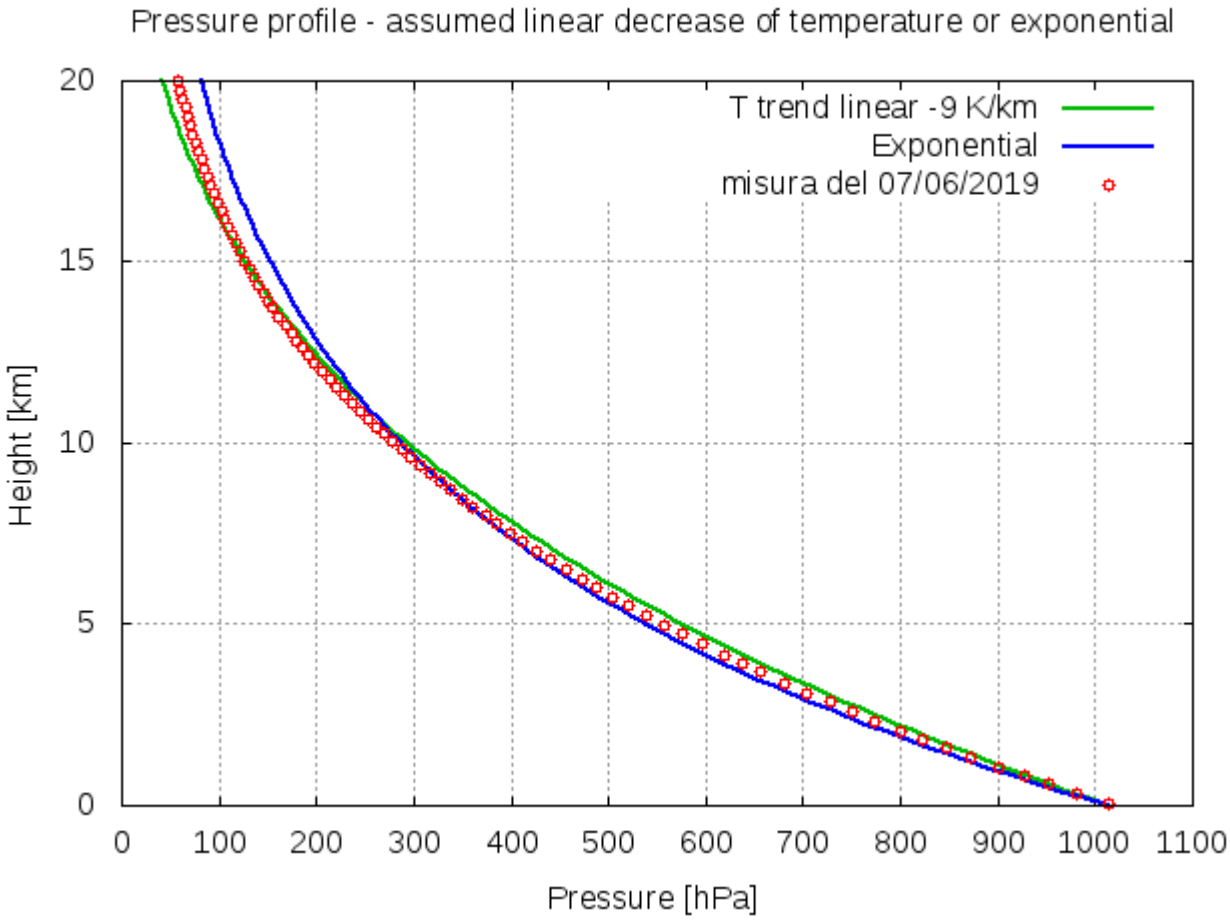
$$\int_{p_0}^{p} d(\ln p') = -\frac{g}{R}\int_{z=0}^{z}\frac{dz'}{T} = -\frac{g}{R}\int_{z=0}^{z}\frac{1}{T_0+\Gamma z'}dz'$$

$\Gamma = -9\ K/km$ $T_0 = 300\ K$

$$\int_{p_0}^{p} d(\ln p') = -\frac{g}{R\Gamma}\int_{z=0}^{z} d\ln(T_0+\Gamma z')$$

$$\ln\frac{p}{p_0} = \ln\left(\frac{T_0+\Gamma z}{T_0}\right)^{-\frac{g}{R\Gamma}}$$

$$\boxed{p = p_0\left[\frac{T_0+\Gamma z}{T_0}\right]^{-\frac{g}{R\Gamma}}}$$


Pressure profile - assumed linear decrease of temperature or exponential
T trend linear -9 K/km
Exponential
misura del 07/06/2019
Height [km]
Pressure [hPa]
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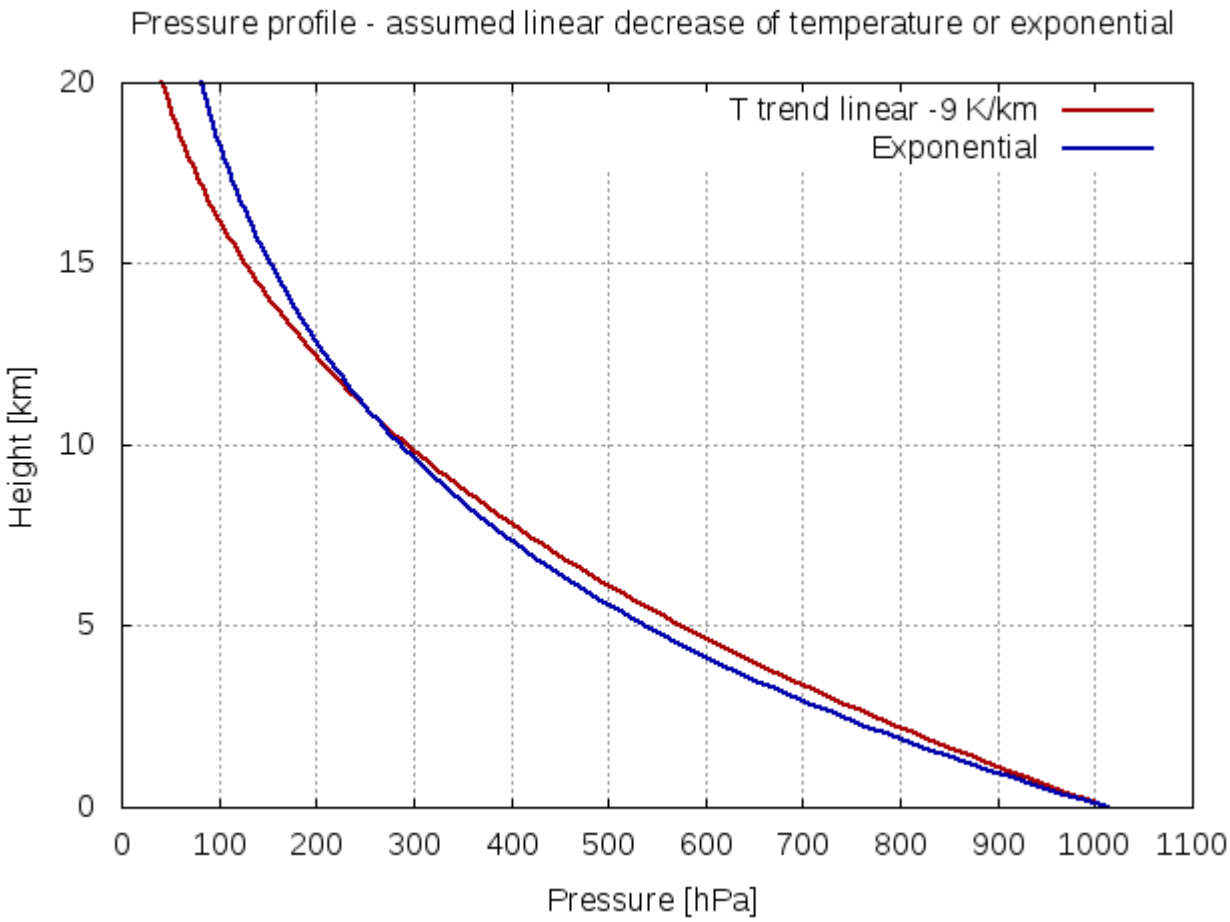
Pressure profile - assumed linear decrease of temperature or exponential
T trend linear -9 K/km
Exponential
Height [km]
Pressure [hPa]
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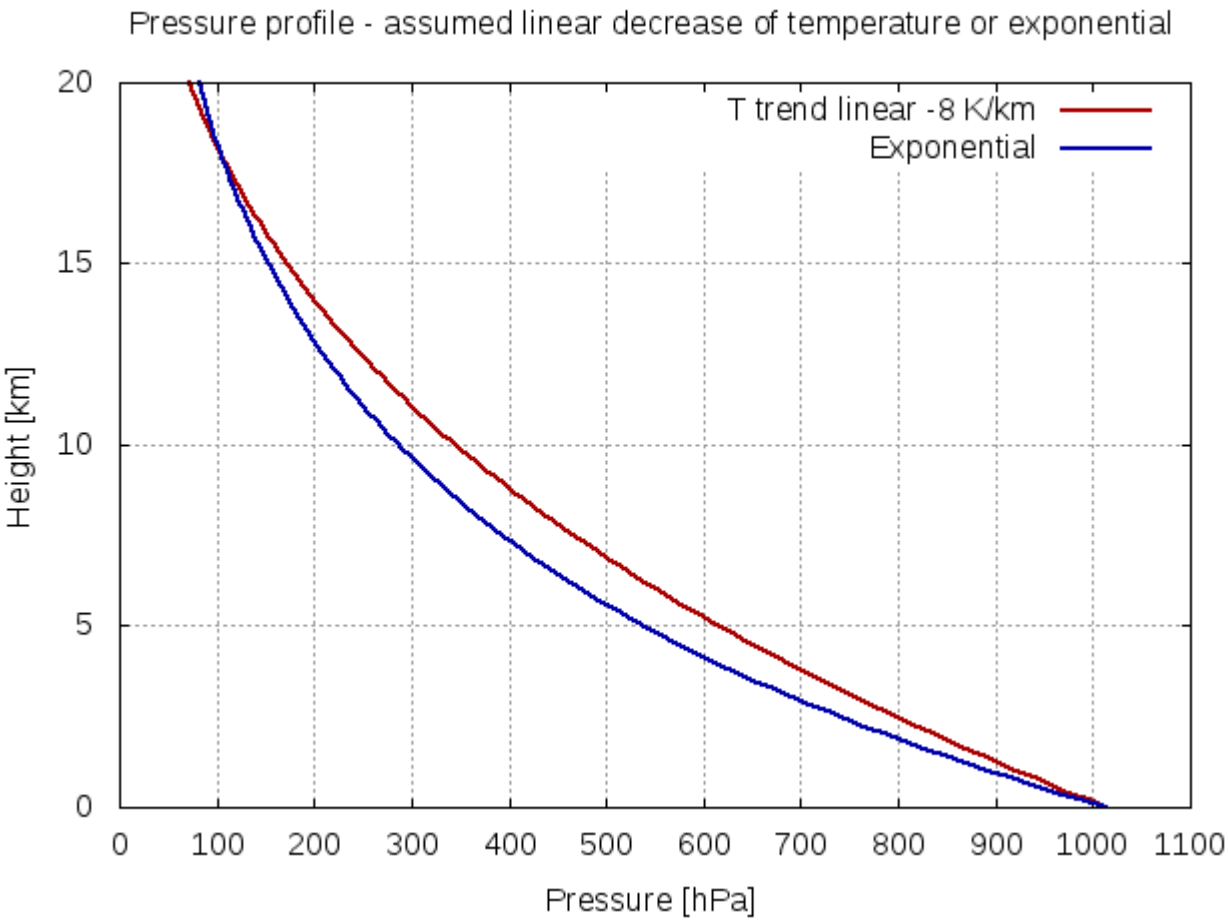
Pressure profile - assumed linear decrease of temperature or exponential
T trend linear -8 K/km
Exponential
Height [km]
Pressure [hPa]
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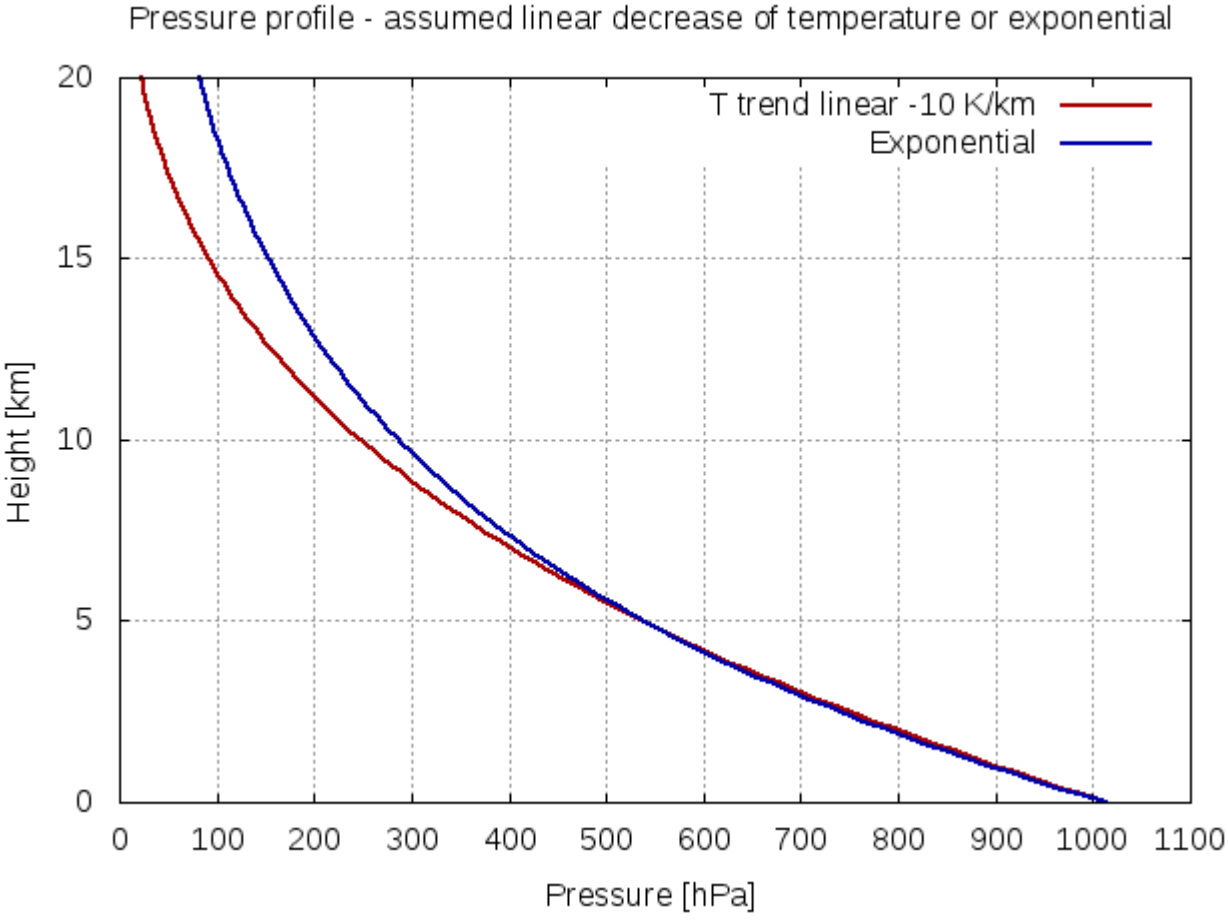
Pressure profile - assumed linear decrease of temperature or exponential
T trend linear -10 K/km
Exponential
Height [km]
Pressure [hPa]
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100
200
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1100