Program of Bengt-Olof Drugge

With this program I do a attempt to describe the how the pressure in the atmosphere is varying. I suppose that the pressure is near zero in a high about 100 km. The model is setting up that I add a 1 m staple of air and calculate new density of the further predicted pressure. And use Daltons law to predict the total pressure and I guess the initial value of atomosphere pressure of air. Then I sum the partial pressures. When I got the pressure 101300 Pa in the end, I have guess patm correct. (patm init=0.34555997 (Pa) with 1 m gas stapel, 100 km atm). This is only a mathematical model I have figured out, I do not say that this solution is correct to calculate how the atmosphere pressure varies in the height.

$\rho j := 1.3$	Density of air at the ocean at 0 degrees
$g := 9.81$	Gravity constant
$pearth := 101300$	The amosphere pressure (Pa)
$Te := 273.14$	Temperature at normalatmosphere pressure and 0 degrees
$p = \rho \cdot g \cdot h$	The hydromecanic law Bernoulli's

$atmos(\rho j, g, pearth) :=$

$patm \leftarrow 0.34555997$	Set the patm to a small error
$h \leftarrow 1$	Set the staple hight
$\rho \leftarrow 0$	Set density to zero in beginning
for $j \in 0..999$	Loop a loop in 1000 step of 100 step
for $i \in 0..99$	
$patm \leftarrow patm + h \cdot g \cdot \rho$	Adding the partial pressures
$\rho \leftarrow \frac{patm \cdot \rho j}{pearth}$	Calculating the new density
$A_{999-j,0} \leftarrow \rho$	
$A_{999-j,1} \leftarrow patm$	Put the Data to 1000x2 matrix
A	

$i := 0..999$

$\rho := atmos(\rho j, g, pearth)^{\langle 0 \rangle}$

$patm := atmos(\rho j, g, pearth)^{\langle 1 \rangle}$

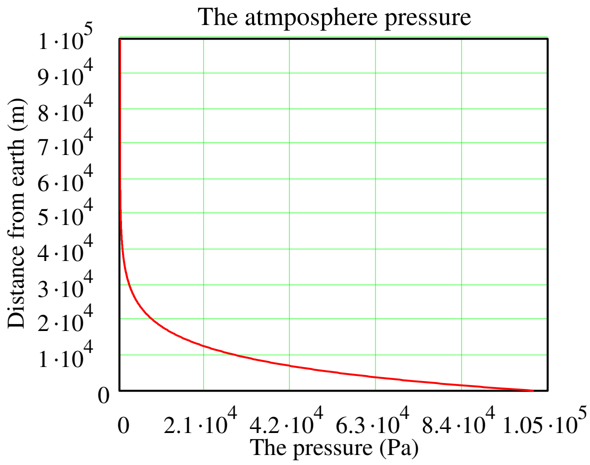
Set the calculated data to ρ,patm,T

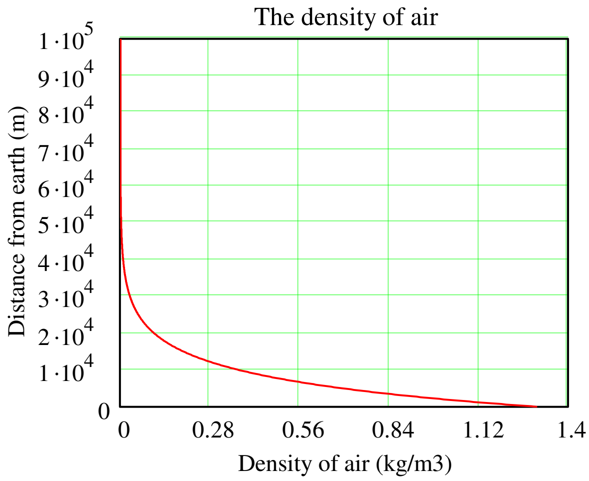
$T := \frac{Te \cdot \rho}{\rho j}$

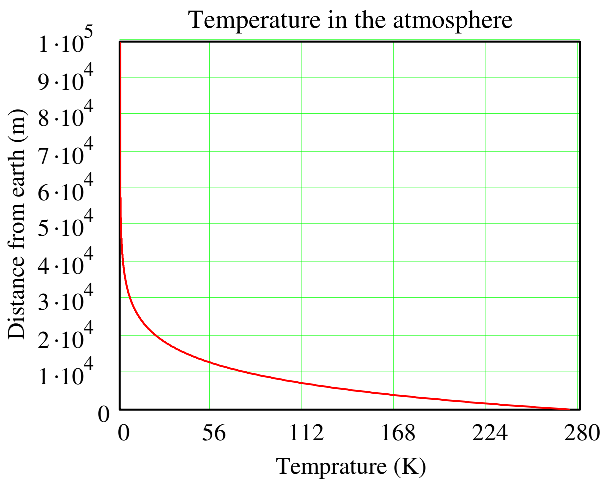
$\rho_0 = 1.3$

$patm_0 = 101299$

Density and pressure at the ocean.


The atmposphere pressure
Distance from earth (m)
1·10^5
9·10^4
8·10^4
7·10^4
6·10^4
5·10^4
4·10^4
3·10^4
2·10^4
1·10^4
0
0
2.1·10^4
4.2·10^4
6.3·10^4
8.4·10^4
1.05·10^5
The pressure (Pa)


The density of air
Distance from earth (m)
1·10^5
9·10^4
8·10^4
7·10^4
6·10^4
5·10^4
4·10^4
3·10^4
2·10^4
1·10^4
0
0
0.28
0.56
0.84
1.12
1.4
Density of air (kg/m3)


Temperature in the atmosphere
Distance from earth (m)
1·10^5
9·10^4
8·10^4
7·10^4
6·10^4
5·10^4
4·10^4
3·10^4
2·10^4
1·10^4
0
0
56
112
168
224
280
Temprature (K)

Here I want to determine how much the troposphere is weighting, with respect to the total mass of the atmosphere. In the handbook the say that troposphere is weighting about 80% of the total weight of the atmosphere. The length of the troposphere is varying about 17 km to 7 km from the ekvator to the poles. A mean value, when you calculate the area of an ellipse and transform it to a circle is about 12 km. Then if I do a function of the density and integrate it from 0 to 12 km. Then I divide the further integral with the total mass, witch I integrate from 0 to 100km. Then I qot a quote who tell me how mush the percetial mass of the atmosphere the troposphere is. At a hight of 50 km you got the total mass qoute is near 100%. When I calculated the quote I got a the toposohere of a weight of 78% of the total atmosphere mass, with a high of a 12 km. Maby this model of the atmosphere is correct.

$h_i := i \cdot 100$ Defining a high vector

$vr := \text{cspline}(h, \rho)$ Draw a cubic spline thru the futher calculated data (x=h,y=ρ)

$\rho(s) := \text{interp}(vr, h, \rho, s)$ Defining a function of ρ who is varying with respect to the high

$a := 0$

$end := 100000$

The integration limits

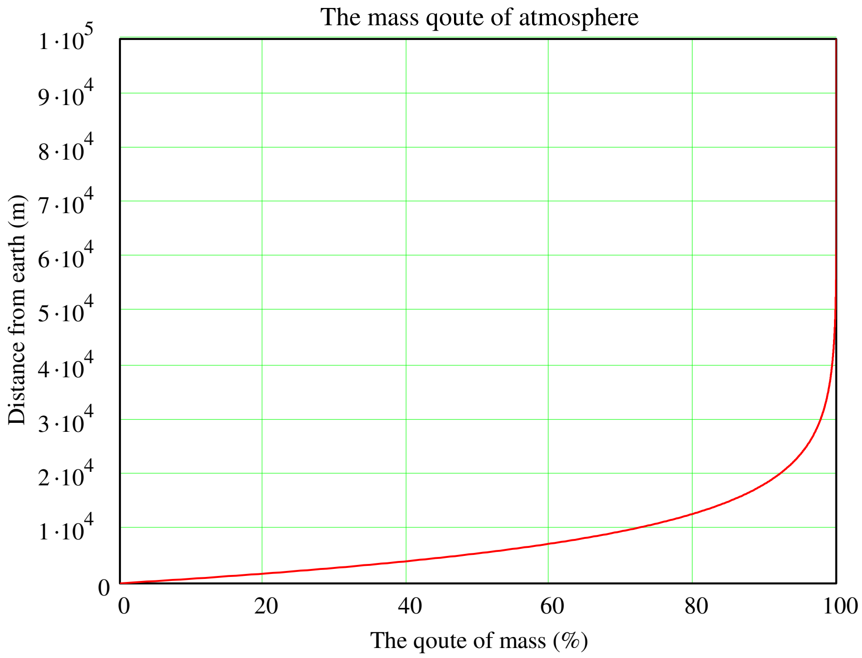
$$mk(s) := \frac{\int_0^s \rho(s)\, ds}{\int_0^{end} \rho(s)\, ds} \cdot 100$$

Defining a function who states the mass quote with respect to the high s. The answer is given in percent.

$\text{root}(mk(s) - 78, s, 0, end) = 12028$

$s := 0, 100 .. end$

Find the root when a weighting the troposphere, and I got the high, when the quote is 78 percent. The high is about 12 km. The same as the high of the troposphere.



Here I do a mathematical model of how a steel sphere of 10 cm in diameter is burning up, when I suppose to drop it from 100 km high from the earth. I use the function above, who describes the density of air and put it into the differential equation in below. Then I solve how the falling high varies with respect to gravitation and air resistance. The effect that I put into the sphere is the effect of air resistance. I derivate s(t) and a get the speed, who I set into the dynamic pressure and multipicate that with the area on the sphere and cw value, then I get the force. The force mutlipicated with the speed is the effect. After 82 to 154 s (or 70 km to 1.5 km) the sphere is over 1600 degrees K in the surface, and between that times the sphere is burning. Max temperature on the sphere is 11238 degrees K at 129 s or 20 km up over the ocean.

$acc := 9.81$ — The gravity constant

$A := 0.007854$ — Area on the sphere

$cw := 0.2$ — cw value a sort of shape factor on the sphere

$time := 160$ — The time for the sphere to fall 100 km

$m := 4.2$ — The mass on the sphere in kg

$Am := 0.05^2 \cdot \pi \cdot 4$ — The matel area of the sphere in m^2

Given

$$\frac{d^2}{dt^2}s(t) = acc - \frac{\rho(end - s(t)) \cdot A \cdot cw \cdot \left(\frac{d}{dt}s(t)\right)^2}{2 \cdot m}$$

The differential equation who describes the falling sphere. The density ρ is varies of the cubic spline, defined on the further side.

$s(0) = 0 \qquad s'(0) = 0$ — The initial values

$s := odesolve(t, time)$ — Solves the diff about 160 s

$s(160) = 1.005 \times 10^5$ — The sphere has falling about 100 km at 160 s

$$P(t) := \frac{\rho(end - s(t)) \cdot A \cdot cw \cdot \left(\frac{d}{dt}s(t)\right)^3}{2}$$

Calculating the breaking effect using the formula that describes the dynamic pressure.

(1) $\Delta T = \frac{P}{Am \cdot \alpha}$

α is here the convection constant (W/(m^2*K)).
I assume that it varies and depends on the density and the speed of air, in the equation below.

$$T(t) := \frac{P(t)}{Am \cdot 7.15 \cdot \left(\rho(end - s(t)) \cdot \frac{d}{dt}s(t)\right)^{0.79}}$$

The temperature rise on the steelsphere, when you assuming the theory of convection. If you use the theory of convection then the sphere is burned up in the atmosphere, between 70 to 1.5 km over the ocean.

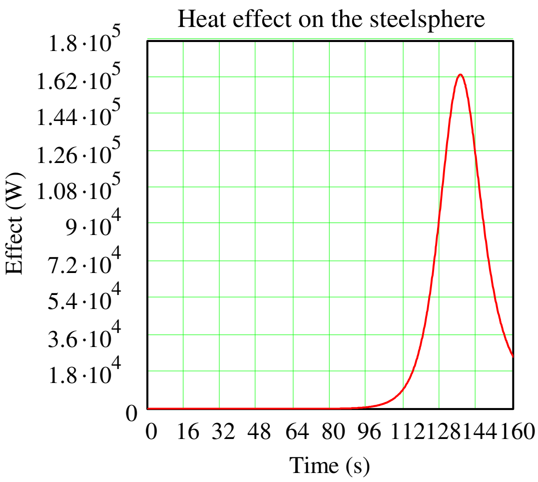
$P(137) = 1.634 \times 10^5$

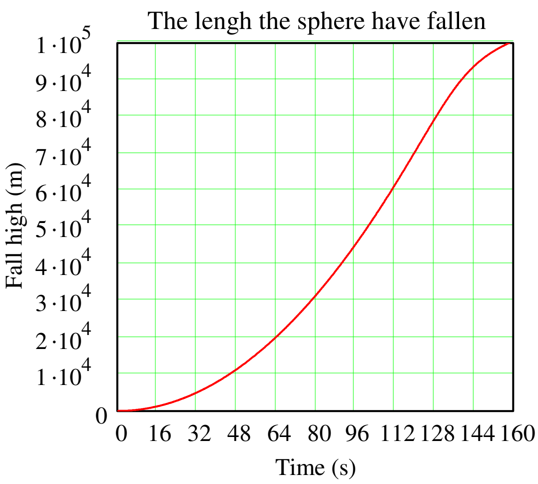
$s(137) = 8.835 \times 10^4$

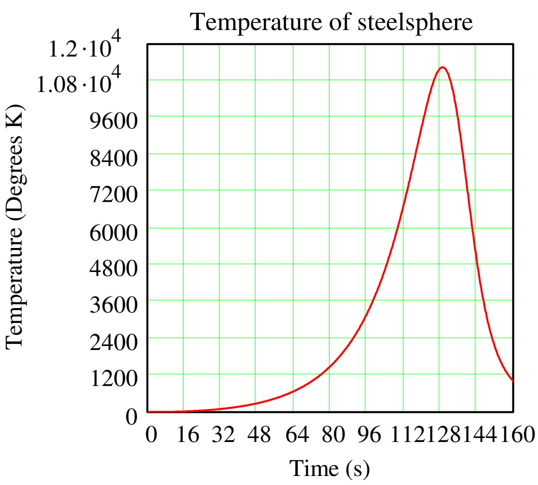
Calculate the max effect who you put into the sphere and wicht high the sphere has falling. At the time 137 s.

$T(129) = 11238$

1600 degrees K the temperature Iron melds, the sphere is melding in the atmosphere. Max temp on the sphere after 129 s who is 11238 degrees K.







Here you see that the max temperature are about 20 km over the ocean. And it is depending on the mantel area of the object and the solution of the differtialequation above. If you increase the mantel area on the falling object and minimize the weight the temperature on the object is decreasing.