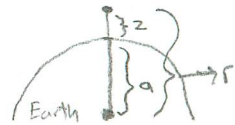


Gravitational Force Derivation

if, a = radius of Earth

z = distance from mean sea level



derive the expression:

$$g^* = \frac{g_0^*}{(1 + z/a)^2} \quad \text{where } g_0^* = -\frac{GM}{a^2} \left(\frac{\vec{r}}{r} \right)$$

for the force exerted on the atmosphere by the gravitational force.

1) start w/ general gravitational force equation and substitute $r = a + z$.

$$g^* = \frac{GM}{(a+z)^2} \left(\frac{\vec{r}}{r} \right)$$

2) Expand the term $(a+z)^2$ and factor out a^2

$$g^* = \frac{GM/a^2}{\left(1 + \frac{2az}{a^2} + \frac{z^2}{a^2}\right)} \left(\frac{\vec{r}}{r} \right) \rightarrow g_0^*$$

3) Simplify ----

$$g^* = \frac{g_0^*}{1 + 2z/a + z^2/a^2}$$

4) Note that $1 + 2z/a + z^2/a^2 = (1 + z/a)^2$

$$\boxed{g^* = \frac{g_0^*}{(1 + z/a)^2}} \rightarrow \text{b/c } z \ll a \rightarrow \boxed{g^* = g_0^*}$$