James F. Morrissey

ATMOSPHERIC SOUNDING TECHNIQUES

NOTES

ts,

1. General Equations:

Since the atmosphere is a gas, it is described by the equation of state

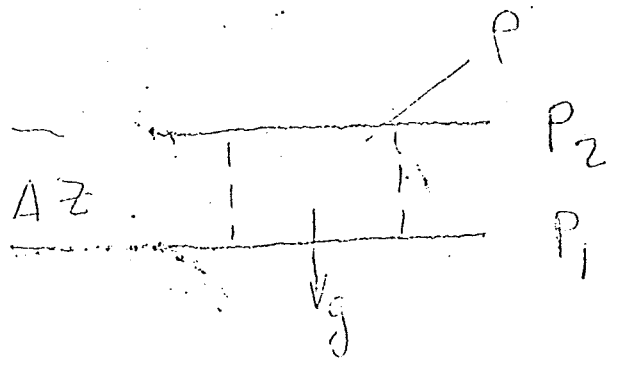
(1) $$\rho = \frac{MP}{RT}$$

ρ = Density

M = Molecular Weight

R = Gas Constant

T = Temperature



From the Figure we can write

$$P_2 = P_1 - \rho g \Delta z$$

$$\Delta P = P_2 - P_1 = \rho g \Delta z$$

or in differential for

(2) $$dp = -\rho g dy$$

This is the hydrostatic equation combining equations (1) and (2) and rearranging

(3) $$\frac{dp}{p} = -\frac{mg}{RT}\, dz$$

g is a function of height which can be found in any of the standard atmospheres, but for most sensing requirements can be approximated by

(4) $$g(z) = g_o \frac{r^2}{(r + z)^2}$$

if equation 4 is expended

(5) $$g(z) = g_o \left(1 - 2\frac{z}{r} + \ldots\ldots\right)$$

This form is useful for computation and usually of sufficient accuracy.