Calculation of Local Pressure From Mercury Barometer Column Height

The following are the equations for calculating the local pressure in inches of mercury from the height of the column of mercury as measured in your mercury barometer (Reference: WBAN Manual of Barometry, 1963).

Suppose the following data:

1. The mercury column height H is 29.323 inches.
2. The barometer temperature T is 73.3 degrees F.
3. Your latitude is L 41.93 degrees (north or south).
4. The terrain elevation at your location E is 601 feet above sea level.
5. Your altitude above the ground A is 119 feet.
6. The calibration term C_C for your barometer is +0.005 inches of mercury. The calibration term may have been provided with your barometer or may be determined by comparison with another calibrated pressure value.

First, calculate the temperature correction term C_T:

$$C_T = -\frac{(90.8T - 2599.6)}{1000000\big(1 + 0.000101(T - 32)\big)}H$$

Using the actual values:

$$C_T = -\frac{(90.8\times 73.3 - 2599.6)}{1000000\big(1 + 0.000101(73.3 - 32)\big)}29.323$$

Solving,

$$C_T = -0.118 \text{ in Hg}$$

Second, calculate the local acceleration due to gravity:

$$g = 980.616\Big\{1 - 0.0026375\cos(2L) + 0.000059\big(cos(2L)\big)^2\Big\}$$
$$+0.00003408(E + A) - 0.00009406A$$

Using the actual values:

$$g = 980.616\left\{1 - 0.0026375\cos(2\times41.93) + 0.000059\left(cos(2\times41.93)\right)^2\right\} \\ +0.00003408(601 + 119) - 0.00009406\times119$$

Being sure to use the cosine function for angles in degrees, we get:

$$g = 980.340 + 0.0245 - 0.0112$$

or

$$g = 980.353\ cm/sec^2$$

Third, calculate the gravity correction term:

$$C_G = \frac{g - 980.665}{980.665}\times H$$

Using the calculated value of g:

$$C_G = \frac{980.353 - 980.665}{980.665}\times29.323$$

or

$$C_G = \text{-}0.0093$$

The value of C_G doesn't change from reading to reading unless the barometer is moved.

The Local Pressure P is then calculated as:

$$P = H + C_C + C_T + C_G$$

Substituting the calculated values:

$$P = 29.323 + 0.005 - 0.118 - 0.0093$$

or

$$P = 29.200 \text{ in Hg}$$

You can see the advantage of doing the calculation in a spreadsheet, it's too tedious to do by hand for every barometer reading.