BAROMETER

CALIBRATION

GUIDELINES

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Requirements and Development Division
Center for Operational Oceanographic Products and Services
National Ocean Service
National Oceanic and Atmospheric Administration

For New Barometer Installations

Here is a step by step guide for doing the calculations and deriving the new barometer coefficient 2 using Solomons Island as an example.

(1) The PBM at Solomons Island is 7330 A 1978 and is 5.172 m above Station Datum (SD). This value is obtained from RDD, as listed in the annual Project Instructions. For new stations, contact RDD.

(2) Determine the barometer height above PBM. (Obtained as four decimal places from the level abstract and/or tape measurement.) The value at Solomons Island was -0.9569 m.

(3) Adding the values from step 1 and 2 gives the barometer height above SD:

(5.172 m) + (-0.9569 m) = 4.215 m (Round to three decimal places)

(4) MSL above SD is obtained from the same method listed in step 1, or by contacting RDD. For Solomons Island that value is 1.292 m.

(5) Subtracting the step 4 value from the step 3 value provides the barometer height above MSL.

(4.215 m) - (1.292 m) = 2.923 m.

(6) The height correction for the barometer above MSL is derived by multiplying the step 5 value with 0.1214.

0.1214 mb/meter x 2.923 meter = 0.35 mb. (Round to two decimal places)

This correction value generally does not change unless the barometer elevation changes. Verify the barometer elevation every five years unless the barometer is relocated.

(7) The field barometer was reading 1027.14 mb at Solomons Island and the barometer coefficient 2 was set at 800 which is the factory default. For new barometer installations, or installations where the height correction has not been calculated or is not included in the coefficient 2, compare the reading directly with the handheld barometer at the same elevation as the sensor.

(8) The portable barometer reading was 1027.1 mb. The portable barometer shows the true value at the instrument height, provided it is calibrated correctly with the barometer standard at the FOD shop.

(9) Compare the portable barometer reading with field barometer reading, making sure that the portable barometer and the field barometer are reading at the same horizontal elevation i.e. hold the portable barometer at the same level as the field barometer. This is very important, otherwise minor height errors might be introduced.

Determine the difference between the portable barometer and the field barometer readings.

Difference = portable barometer reading - field barometer reading

For the initial installation of the barometers, which includes barometers which have been installed and for which we are performing an initial calibration, we are adjusting the barometer sensor to compensate for differences that may arise due to the characteristics of the individual DCP. The cable resistance, 5 volt DC difference, MUX channel characteristics, and temperature are some of the characteristics for which we are compensating during the ***initial*** calibration. Therefore a difference of +/- 5 mb is allowed. Remember anytime a new DCP is installed, or a new barometer is installed/replaced; the +/- 5 mb difference is allowable.

Return the barometer to the field shop if the difference exceeds this value so that it can be recalibrated in the shop environment. Otherwise use the barometer and compute the calibration portion of the correction as follows.

Let us determine the difference between portable barometer and field barometer now.
The portable barometer reading 1027.1 mb - field barometer reading 1027.14 mb = -0.04 mb (Round to two decimal places).

This represents the calibration correction portion of the total correction.

(10) New barometer coefficient 2 = raw barometer coefficient 2 + height correction + (calibration correction)
Thus, the new barometer coefficient 2 = 800 + 0.35 + (-0.04) = 800.3 (Rounded to one decimal place)

Store 800.3 as the new barometer coefficient C2 for Solomons Island during this year's annual inspection, so the barometer values recorded in the DCP are directly related to MSL. Record the calculations and barometer coefficient value rounded to two decimal places on the site report because these values will be needed next year for the barometer check.

For Existing Barometer Installations

Here is a step by step guide for doing the calculations and deriving the new barometer coefficient 2 for stations that have the barometer installed and coefficient 2 stored correctly in the past, again using Solomons Island as an example.

If the height correction was determined previously and it has been less than five years since the barometer height above MSL was determined, then go to step 7; otherwise start with step 1 to compute the height correction, if it has been five years or more since the barometer height above MSL was determined, or the barometer has been relocated.

(1) The PBM at Solomons Island is 7330 A 1978 and is 5.172 m above Station Datum (SD). This value is obtained from RDD, as listed in the annual Project Instructions. For new stations, contact RDD.

(2) Determine the barometer height above PBM. (Obtained as four decimal places from the level abstract and/or tape measurement.) The value at Solomons Island was -0.9569 m.

(3) Adding the values from step 1 and 2 gives the barometer height above SD:

(5.172 m) + (-0.9569 m) = 4.215 m (Round to three decimal places)

(4) MSL above SD is obtained from the same spreadsheet mentioned in step 1, or by contacting RDD. For Solomons Island that value is 1.292 m.

(5) Subtracting the step 4 value from the step 3 value provides the barometer height above MSL.

(4.215 m) - (1.292 m) = 2.923 m.

(6) The height correction for the barometer above MSL is derived by multiplying the step 5 value with 0.1214.

0.1214 mb/meter x 2.923 meter = 0.35 mb. (Round to two decimal places)

(7) Let's say, the portable barometer reading was 1027.1 mb at the same horizontal elevation as the field barometer was located. The portable barometer shows the true value at the instrument height, provided it is calibrated correctly with the shop barometer standard at the FOD shop. Since the field barometer is recording values at MSL, we need to compare both - the portable barometer and the field barometer - at the same height. So we can compare both at MSL level or at tide house level where field barometer is located. The easier method is to compare at MSL.

The height correction which was computed last year and recorded on the site report must be added to the value displayed by the portable barometer **on paper** so that the value will be at the MSL level.

Note that this height correction value should be added on paper only and portable barometer

should not be tampered in the field once it is calibrated in the shop with the barometer standard.

The height correction from the past year was 0.35 mb which should be listed on the appropriate Site report.

So portable barometer would have read 1027.1 + 0.35 = 1027.45 mb at the MSL.

(8) Determine the difference between the portable barometer and the field barometer readings.

Difference = portable barometer reading - field barometer reading

If this difference exceeds +/- 1 mb then the field barometer must be replaced and the old barometer must be sent to FOD shop to be recalibrated in the shop environment. If the difference is less than +/- 0.2 mb, no calibration correction is required, but sensor drifting check must be investigated as listed in step 9 below. If the difference exceeds 0.2 mb and is less than 1 mb, then this value represents the calibration correction to the barometer coefficient 2 for this year, provided the difference meets the sensor drifting check as listed in step 9 below.

Let us determine the difference between the portable barometer and the field barometer now.

So portable barometer reading @ MSL 1027.45 mb - field barometer reading @ MSL 1027.90 mb = -0.45 mb (Round to two decimal places)

This represents the calibration correction portion of the total correction. Remember, since this value is more than 0.2 mb, we **do need to** add this value and height correction to the raw barometer coefficient 2 to find the correct barometer coefficient 2. Also we need to check if the field barometer is drifting, and if so, by how much, which is done in the next step. Also if records are kept in the field folder (or site report) then, we would know the initial setting of the barometer coefficient 2. Generally, in most cases the initial factory default setting may be 800.

(9) New barometer coefficient 2 = raw barometer coefficient 2 + height correction + (calibration correction, if applicable). The height correction is always positive whereas calibration correction needs to be added algebraically (i.e. with proper +/- sign)

The value for height correction is as previously calculated, unless levels were run to the field barometer this year. If this is the case, use the new height correction in the calculation below.

Thus, new barometer coefficient 2 = 800 + 0.35 + (-0.45) = 799.9 (Rounded to one decimal place).

Now let us check the sensor (calibration) drifting since the field barometer was installed.

Drifting of the field barometer = New C2 - Original C2

Thus, in this case drifting of the field barometer = 799.9 - 800.3 = -0.4 mb
If this difference exceeds +/- 1 mb then the field barometer must be replaced and the old barometer must be sent to FOD shop to be recalibrated in the shop environment.

If the drifting of the sensor is less than 1 mb, then continue with the next step.

(10) Store 799.9 as new barometer coefficient C2 for Solomons Island during this year's AI, so that values recorded in the DCP by the barometer are directly related to MSL. Record the calculations and barometer coefficient value rounded to two decimal places on the site report because you will need that value next year for the barometer check.