

Technical Note 13

Manual Barometric Correction

Glenn Carlson, Technical Support, In-Situ Inc.

May 26, 2005

Background

Certain monitoring applications may require the use of instruments with absolute (non-vented) level sensors. Barometric pressure fluctuations may cause errors in level data unless barometric pressure is also recorded and used to make corrections to level readings. This error can be on the order of 3 to 8 cm from day to day, or up to 20 cm or more as strong weather systems move in and out of an area over the course of long-term studies. It is not possible to import barometric data from another source into Win-Situ for use in making such corrections. This can be done in a spreadsheet, however. If a user wishes to manually correct water level data for barometric pressure fluctuations, then there are a few points to consider.

Source of barometric data

Barometric data from weather stations often do not represent the true ambient barometric pressure. Instead, weather data typically includes barometric pressure value that are normalized to sea level. All other things being equal, air pressure decreases as elevation above sea level increases because there is less atmosphere. To make weather reporting consistent, it is common for weather stations to report what the barometric pressure would be if the location was at sea level (corrected for elevation). As an example, the average true barometric pressure in the mountains of Colorado is about 22 inches of mercury (about 740 milliBars). A broadcast weather report, however, will indicate a barometric pressure of around 30 inches of mercury (1015 milliBars) because a correction is made for elevation. The true air pressure is what affects water level readings from an absolute pressure instrument. Errors will result if altitudinally adjusted barometric data are used to make corrections. When correcting data files from absolute pressure

instruments it is critical that one uses the true air pressure and NOT values that have been corrected for altitude. The In-Situ baroTroll records the true ambient barometric pressure at a site. Whatever instrument is being used to gather a barometric record, do not use any user supplied reference value when recording barometric pressure. Instead, record just the raw pressure values (e.g. – psi, milliBars).

Data format

Without proper forethought, the most time consuming step in manual correction of level data will be the editing of a spreadsheet file to make barometric readings in one column match up with corresponding level readings in another column, or interpolating barometric data if time stamps do not match up with level data time stamps. Win-Situ handles all of this automatically when merging level and barometric data, but this can be an arduous task when done by hand. Before actually collecting data sets, it is advisable to adjust sampling schedules so that level and barometric readings are taken simultaneously. A bit of planning ahead of time can save much effort later, especially if the data sets will be large. For the following instructions, we will assume that time stamps of barometric data match the time stamps of level data in your spreadsheet file.

Importing data

To manually make barometric corrections to level data, do the following:

1. Export the absolute pressure level data to a spreadsheet application such as Microsoft Excel (see the Win-Situ manual for assistance).
2. Create another column in the spreadsheet that contains the barometric data..

3. Make one more column that has the barometric data converted to the same units as the water level data (for example, meters of water).
 4. If the water level data were collected using a reference (either Level - Surface Elevation or Level – Depth to Water mode), then you will need to create yet another column in the spreadsheet. This column will report the CHANGE in barometric pressure since the time the reference was set in the instrument. You want the barometric pressure change to equal zero at the time the level reference was set. For example, if the instrument was set to apply the level reference at the start of the log/test (first data point), then for your new column of barometric change you would subtract whatever the barometric pressure was at the time of the first level reading from all later barometric pressure values. If a level reference was set some time prior to the start of a log/test, then you will need to know the barometric pressure at that time and subtract that value from all barometric readings.
- C. **Level / Surface Elevation mode** – First, convert barometric data to the same unit that was used for water level measurement (e.g. - meters of water). Create a new column that shows the CHANGE in barometric pressure since the water level reference was set in the submerged instrument (see above). Subtract the values in the barometric change column from the water level readings.
 - D. **Level / Depth to Water mode** – First, convert barometric data to the same unit that was used for water level measurement (e.g. - meters of water). Create a new column that shows the CHANGE in barometric pressure since the water level reference was set in the submerged instrument (see above). ADD the values in the barometric change column to the water level readings.

Making corrections

Add or subtract the converted and adjusted barometric pressure (your final column from above) from the water level data. Whether you add or subtract will depend on which recording mode you used for the level data.

- A. **Pressure mode** – This is the easiest case. Simply convert the barometric pressure to the same unit as was used for the level readings, then subtract barometric readings from corresponding level readings.
- B. **Depth mode** – This is almost as easy as Pressure mode. First, convert barometric pressure to the same unit as was used for water level measurement (e.g. - meters of water, centimeters of water). Subtract the converted barometric readings from the water level readings.

Conclusions

For general use, In-Situ recommends vented instruments and cables that automatically produce level data, which are corrected for barometric pressure changes. However, specific circumstances of an installation may require the use of non-vented instruments, and In-Situ offers such instruments to meet these needs. Level data collected using absolute pressure instruments do not always require correction (short term studies such as slug tests or vertical profiling typically do not, for example). When barometric correction is required, though, following the rules outlined above will provide a sound framework for data processing procedures.

For more information contact In-Situ Inc.

221 East Lincoln Avenue
Fort Collins, CO 80524
Toll-Free 1-800-446-7488 (U.S. & Canada)
Internet: www.in-situ.com