SOLINST TECHNICAL BULLETIN

Barometric Compensation and the Importance of Barometric Data

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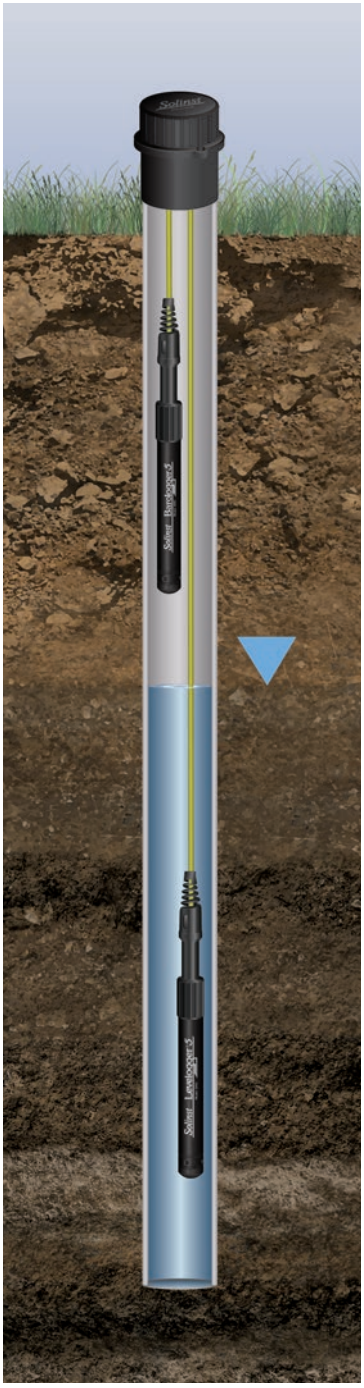


Barometric Compensation

Leveloggers measure total pressure (water column equivalent + barometric pressure). In order to accurately determine the true changes in water level only, barometric pressure fluctuations must be removed from the data.

The simplest method to accomplish this is by the use of a Barologger suspended above high water level in one well on site. The approximate site compensation coverage is 30 km (20 miles). This records ambient barometric fluctuations over time and allows quick and accurate barometric compensation using the data files from both the Barologger and any Leveloggers in the area.

The algorithms programmed into the Barologger are strictly for use in air, making this instrument extremely accurate. The barometric data is then used, along with a software Data Wizard, to compensate the Levelogger data and provide true water level readings. To increase the accuracy of barometric compensation data, it is recommended the Barologger and Leveloggers be programmed with the same recording times.

Once the Levelogger and Barologger data is downloaded to Solinst Levelogger Software, the Data Wizard can be used to barometrically compensate the data, and adjust it to depth measurements. Multiple Levelogger files can be barometrically compensated at once using one Barologger file.

You can view your data directly, or it can be exported in a standard .csv or .xml format for use in any hydrologic software for further analysis and interpretation.

If you did not have a Barologger on site, page 2 of this document discusses manual barometric compensation.

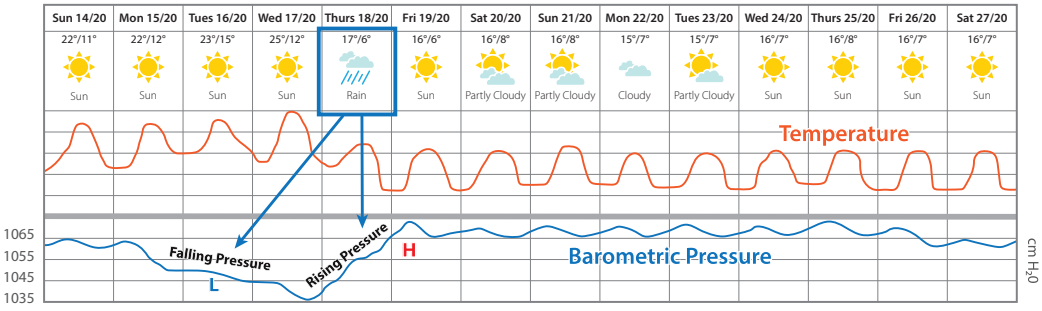
Barometric Data

When analyzing barometric data it is important to keep in mind that storm events commonly reduce total atmospheric pressure by about 1.7% from pre-existing high pressure conditions. 1.7% converts to approximately 0.2 m or 0.6 ft of water level equivalent barometric fluctuation, see graphic below.

Raw data can be useful information for calculating barometric efficiency, which can be very significant in tight, deep, confined aquifers, when the investigator has a choice not to compensate the readings.

The use of vented cable technology to provide barometric compensation can be suitable for shallow applications, however, vented pressure sensors assume 100% barometric efficiency, which is a fair assumption in shallow conditions, but the lack of barometric data can make it difficult to confirm if the vented transducer is recording correctly.

It was found that, for many applications, recorded barometric data provided the necessary barometric compensation data our clients require. The absolute pressure method also provides the separate barometric data of local air pressure and ambient air temperature, which can be analyzed to ensure the Levelogger transducer is recording properly.



An Example of How a Storm Event Can Affect Barometric Pressure

...continued overleaf

Barometric Compensation and the Importance of Barometric Data

Manual Barometric Compensation

If an on-site Barologger is not available, your data can be compensated using alternate barometric data (e.g. from a local weather station).

To accomplish an accurate manual barometric compensation, the atmospheric pressure station should **not be greater than 30 km (20 miles) away.**

You should **include the elevation difference between the weather station and Levelogger** in your calculation (Step 1 below). As elevation increases, barometric pressure decreases at a rate of approximately 1.21/1000 ft or meters. This rate can be shown as Elevation/826.

In addition, **the date and time of the barometric data should cover the range of data** collected by the Levelogger.

Next, your **Levelogger data and barometric data must be in the same units** (Step 2 below), and assure that any offsets or normalization values are accounted for.

Although not shown in our example, it is also important to remember that weather station barometric data will often contain a different offset or normalization. Manual data conversion and barometric compensation should account for any variation of the normalization or offset used between the barometric data sourced and Solinst Leveloggers.

Once the final calculated barometric pressure values are obtained, they are subtracted from the Levelogger data set (Step 3 below). Since the Levelogger data can be easily exported as a .csv or .xml file using Levelogger Software, all manual corrections can be performed in external programs.

Pressure Conversion Factors		
Barometric Unit	FEET Water Column Equivalent	METRES Water Column Equivalent
1 psi	2.30666	0.703070
1 kPa	0.334553	0.101972
1 mbar	0.0334553	0.0101972

Water Column Equivalents to Common Barometric Units

Example Calculation:

1) Elevation Difference: $\frac{\text{Elevation of Levelogger} - \text{Elevation of Weather Station}}{826}$

$$\frac{800 \text{ ft (ASL)} - 500 \text{ ft (ASL)}}{826} = +\frac{300}{826} = +0.3632 \text{ ft}$$

Therefore, add 0.3632 ft to your Levelogger data set

2) Conversion from psi to feet of water column equivalent:

15 psi x *2.30666 ft/psi = 34.5999 ft head

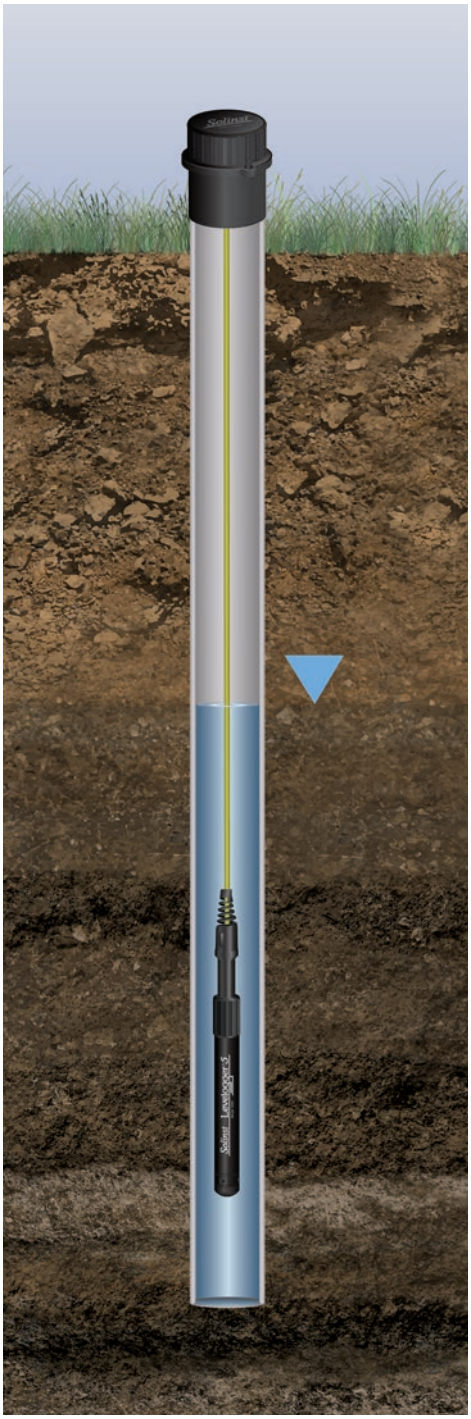
Therefore, subtract 34.5999 ft from your Levelogger data

** Value denotes pressure conversion factor from table above*

3) Manual Barometric Compensation:

Where the uncompensated Levelogger 5 data is a water level of **41.1700 ft,** from the calculations above, the manual compensation would be:

(41.1700 ft + 0.3632 ft) – 34.5999 ft = 6.9333 ft



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High Quality Groundwater and Surface Water Monitoring Instrumentation

Solinst®

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