Calibration of the Wave Loggers

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Summary

The wave loggers measure the pressure in volts. This corresponds to a certain pressure. In this report is explained how the calibration is conducted. The relation between the output in volt and the corresponding water depth is found. This relation is as follows:

$$P(V_m) = A \cdot V_m + B$$
$$where:$$
$$A = calibration\ parameter$$
$$B = calibration\ parameter$$
$$V_m = measured\ Volts$$

The wave logger is placed at certain known depths. Together with the known density of the water, it is possible to find the calibration values from a regression analysis. See Figure 1. The calibration parameters are presented in Table 1.
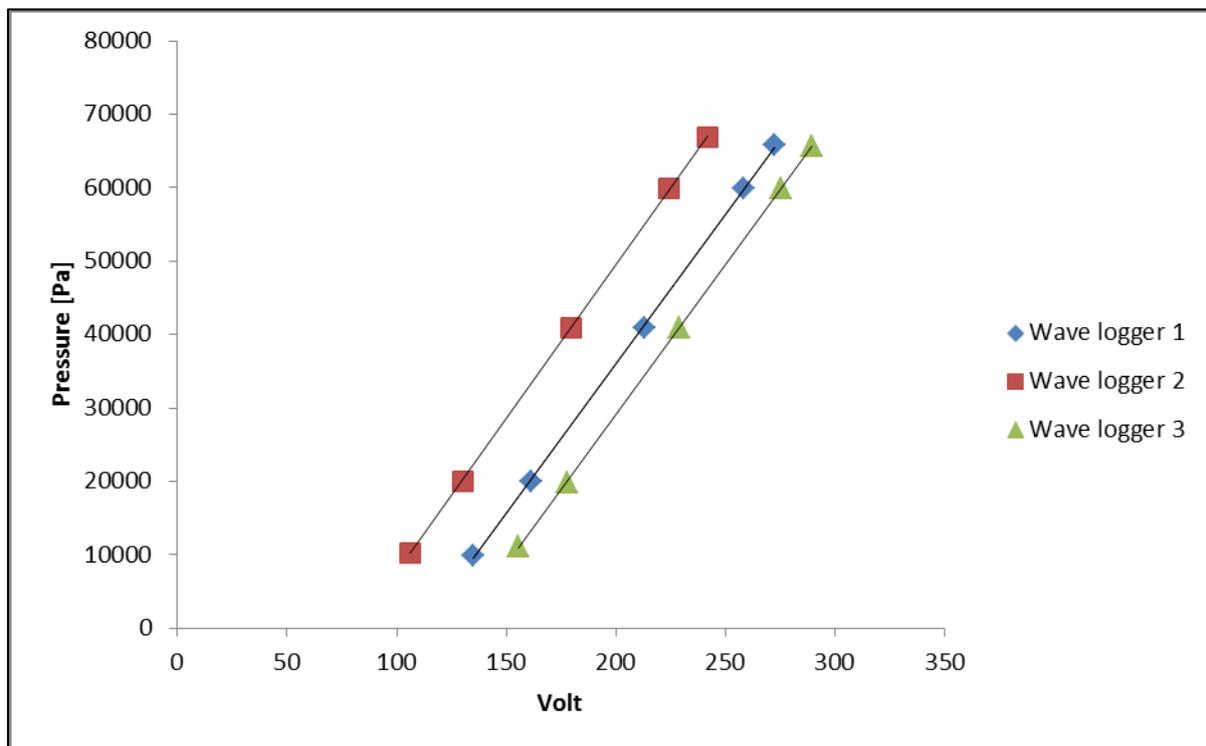
Figure 1 regression lines though output values of the wave logger at a known depth

	Wave logger 1	Wave logger 2	Wave logger 3
A	408.7	419.36	408.29
B	-45693	-34342	-52541

Table 1 calibration values

Contents

Introduction

Before the wave loggers are used they need to be calibrated. The output of the pressure meter is a voltage. This voltage can be interpret as a pressure. But first, the relation between this voltage, and pressure head needs to be found.

To calibrate the wave loggers, they are tested in still water. The wave logger is placed at a multiple known depths. Thereafter, the relation between the voltage and pressure head can be found.

Location & setup

A location with still water is found in the harbour, between two berthed barges. Only very little movement in the water is present, which is estimated to be around 1 centimeter. This is acceptable, and can be filtered out when processing the results.

The depth is 7 meter. To calibrate the wave logger, it will be placed on multiple depths; around 1 meter, 2 meter, 4 meter and just above the bottom at 7 meter. The wave logger is attached to a measuring tape, so the depth can be found easily. Note that the measuring tape is attached under the cap of the wave logger (close to the location of the pressure sensor itself), so this will be the reference point when determine the depth of the logger. At the other end of the wave logger a weight is attached to the logger.

The depth is measured from the top of the logger, where the pressure sensor is located.

Figure 2 measurement location

Figure 3 setup of the calibration measurements

Results

The output of the logger is presented in this section. For each logger, a plot of the output is presented, with the corresponding water depth. The logger is place at a constant depth for around 5 minutes. Another plot is presented with a regression line. The calibration values are obtained from this regression line. The density of the seawater is 1018 kg/m^3. A linear relation can be found between the measured Volts and the corresponding pressure.

$$P(V_m) = A \cdot V_m + B$$
$$where:$$
$$A = calibration\ parameter$$
$$B = calibration\ parameter$$
$$V_m = measured\ Volts$$

For each logger the calibration values are found via the regression line. The relation between the observations and regression line is very strong, which is satisfying.

Wave logger I
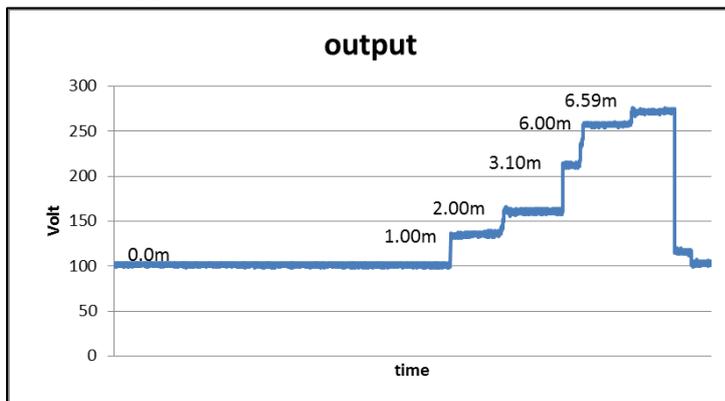
depth [m]	output [Volt]	pressure [Pa]
1	135	9987
2	162	19973
4.1	213	40945
6	258	59919
6.59	272	65812
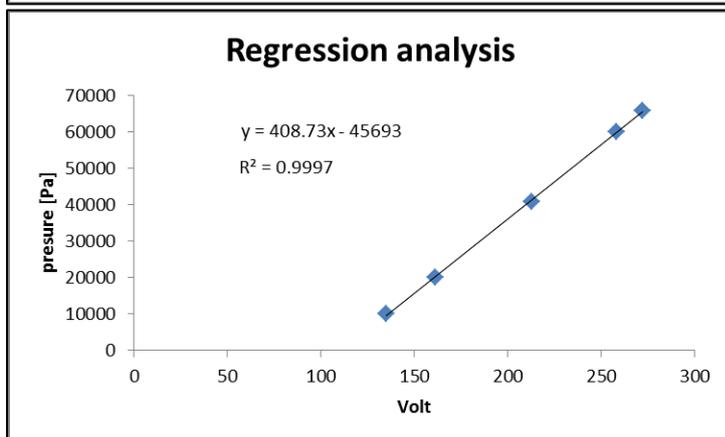
Calibration values wave logger 1	
A	408.7
B	-45693

Wave logger II
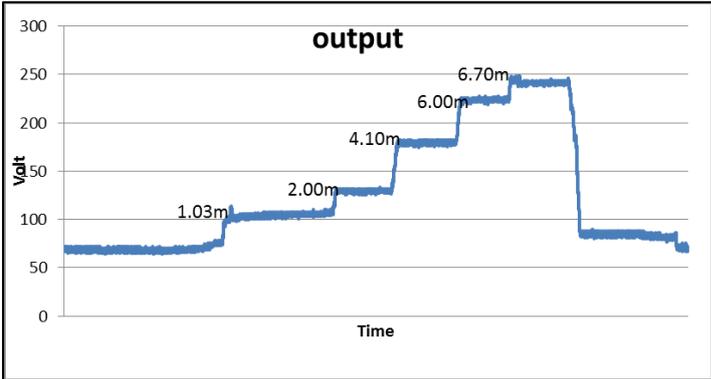
depth [m]	output [Volt]	pressure [Pa]
1.03	106	10286
2	130	19973
4.1	180	40945
6	224	59919
6.7	242	66910
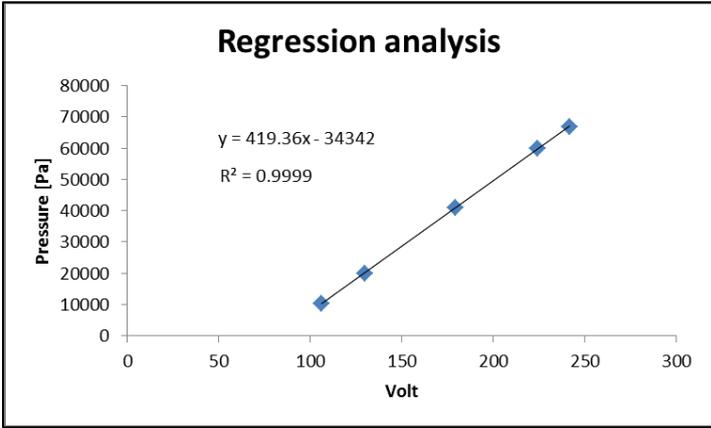
Calibration values wave logger 2	
A	419.36
B	-34342

Wave logger III
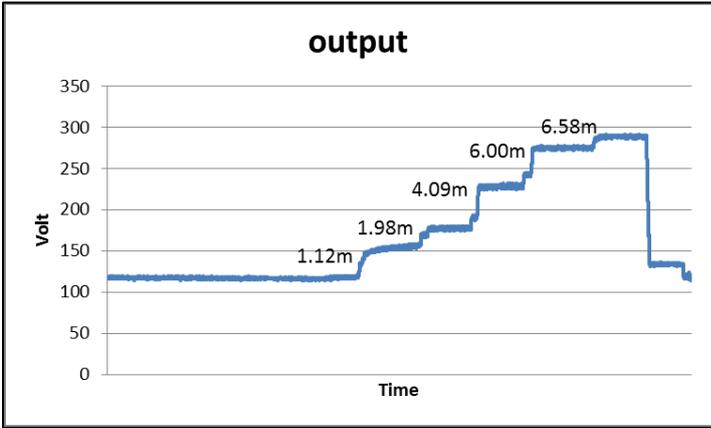
depth [m]	output [Volt]	pressure [Pa]
1.12	155	11185
1.98	178	19773
4.09	229	40845
6	275	59919
6.58	289	65712
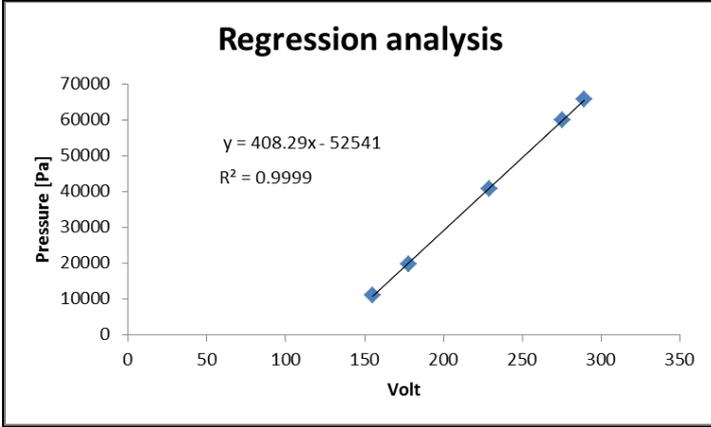
Calibration values wave logger 3	
A	408.29
B	-52541