CALIBRATION PROCEDURE FOR A LICOR LI-820 CO2 ANALYZER.

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Abstract—Here is written the procedure proposed for the periodic calibration of a CO2 gas concentration analyzer.

Index Terms—CO2, LICOR LI-820, OBSEA, LabView, air pollution, ocean acidification.

I.

I. INTRODUCTION

HE measurement of the atmospheric CO2 concentration is very important due to the close relationship between the growing of this gas concentration in the atmosphere (mostly caused by the anthropogenic activity) and the constant acidification of the oceans [1]. Measurements in the Mauna Loa volcan, in the Hawaii Island, shows a permanent rising of CO2 concentration [2] since 1960 when observatory started its activity and due to the importance of this measurements they developed and autonomous measurement station that can calibrate the measurement instrument using 3 known reference gasses[3] that are compared every hour to instrument derives. In the OBSEA Observatory we started a project of ocean acidification measurement called "Nuevas tecnologías para el seguimiento de la acidificación marina en el espacio natural Costa del Garraf ES5110020" [4] where has been developed an autonomous measurement platform for the CO2 concentration using as a core of the system the LICOR LI-820 analyzer.

II. BACKGROUND

OBSEA cabled observatory description

The OBSEA (www.obsea.es), the first Spanish underwater cabled observatory (Lat. 41°11'N; Long. 1°45'E) was set up on May 19, 2009 by the SARTI (Sistemas de Adquisición Remota y Tratamiento de la información [Remote Acquisition and Information Treatment Systems]) research group of the UPC (Universitat Politècnica de Catalunya), with the collaboration of the UTM (Marine Technology Unit) of the CSIC (High Commission for Scientific Research). It is prototype node that will allow the Spanish and international scientific community to test the correct operation of its equipment in shallow waters. The OBSEA station is a low cost yet very capable observatory that enables the research and development of marine technology. The data received from the observatory is being stored and used for scientific studies but in addition is transmitted in real-time to interested customers who have research projects related to sea observation and climate change. Figure 1 shows the location of the observatory in respect to the coast.

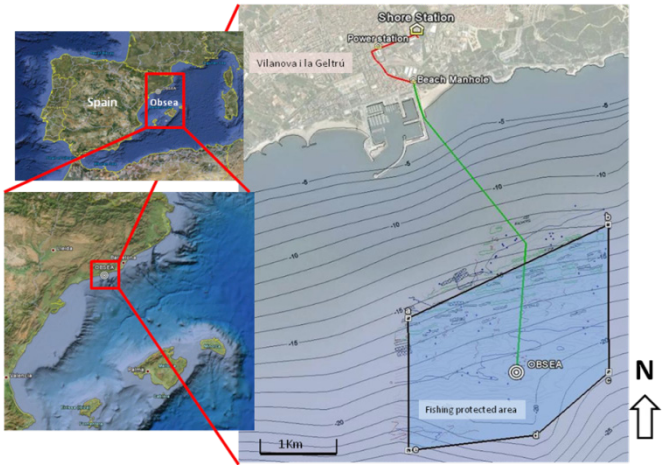

Fig. 1. Location of the OBSEA observatory

The project that monitors the ocean acidification developed inside the OBSEA contains 2 parts: one is the pH measurement of the sea water and the other is the CO2 concentration measurement in the atmosphere. The LI-820 that is being used to obtain the CO2 concentration is an economical high performance, non-dispersive infrared gas analyzer designed to be used for a wide variety of applications. This instrument can have an unknown drift of its accuracy for what it's recommended to perform a periodical calibration using a standard gas with known CO2 concentration similar to the gas that will be measured.

III. MATERIAL AND METHODS

For the periodical calibration of the LI-820 analyzer it has been used a bottle N2 pressurized gas with a CO2 concentration of 386ppm. The gas was measured in the beginning of the project in an external laboratory to certify the gas concentration and was used to calibrate manually the LI-820 approximately every month. Due to the inconvenience to perform manually this calibration and viewing the strong dependence of the result with the method used by the operator the calibration method has been automatized using a custom computer program developed with the LabView from National Instrument programing software (Fig.2). The software is controlling the gas while the calibration is being done to assure the stability of the measurement and automatizes the process to avoid de dependence of the operator.

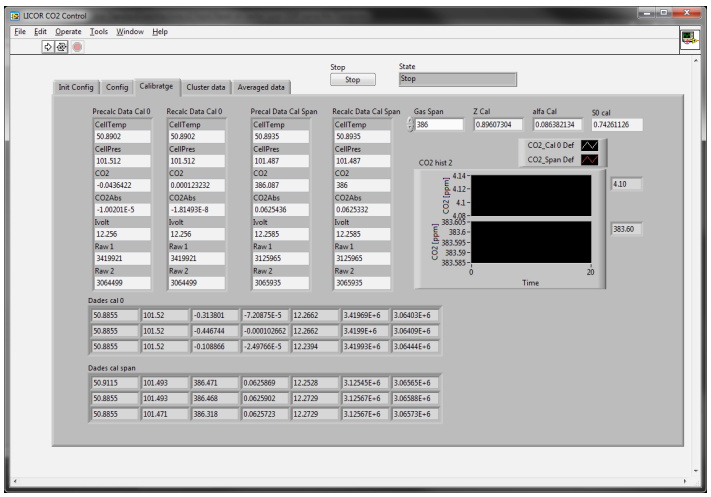

Fig. 2. View of the LabView software that controls the LI-820 analyzer

The software takes the measurements obtained with the LI-820 analyzer to store it locally and once per week starts a subprogram that performs the calibration in two points: at 0ppm of CO2 and 386ppm. The 0ppm concentration is achieved using the same 386ppm gas filtered with a CO2 absorbent. The calibration is

done in 7 parts:

1. Stops the atmospheric air pump and opens known concentration gas valves
2. Configure the LI-820 to measure every 0,5 seconds without filter
3. Waits for 60 seconds to stabilize the measurement
4. Continue measuring calculating using last 100 points until is achieved a standard deviation in all the variables inferior than a cer tain value
5. Using the average of this 100 points the software calculates the calibration variables CO2Kzero or CO2KSpan depending if it is measured the 0ppm of CO2 gas or the 386ppm. This calculus is using the equations provided by the manufacturer in the user manual.
6. Repeats the calibration with the LI-820 calibration instruction and verifies that the result is the same and stores the calibration variables in the LI-820 memory
7. Stops the known gas and starts the atmospheric gas

Fig. 3. LI-820 analyzer mounted with the automatic calibration system

IV. CONCLUSION

To conclude with this paper we can resolve that the automation of a periodic calibration allows to minimize the drift effect of the LI-820 analyzer and can improve the precision and accuracy of the measurements. In any case, an external laboratory with certified traceability should calibrate the analyzer every 2 years to verify the proposed method.

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