PARHyS System: a new approach to H2 concentration measurements in the subsurface

Maria Rosanne [*1], Fabian Rupin [1], Louis Gorintin [1], Julio Aguilar [1], Hélène Buee [1], Julien Werly [1], Olivier Lhote [2], Jan Mertens [2]

[1] Lab Nanotechnology, Sensors & Wireless, ENGIE-CRIGEN, France
[2] Key program natural H2, ENGIE research, France

Surface H2 concentration data can help to detect sites of interest for a better understanding of the natural H2 phenomenon.
ENGIE-CRIGEN has developed a technology for continuous hydrogen measurement: PARHyS system enable to analyze gases pumped in the soil at a depth of 1 m.
The core of the PARHyS system is composed of an Hydrogen selective miniature sensor, with a soil gas sampling unit associated with humidity and temperature compensating sensors and a radio frequency transmitter, allowing data acquisition from the sensors via a LoRa concentrator. The data should then be collected on any remote location thanks to a satellite connection.
As for all sensors, the direct measurement of the H2 concentration provided by the H2 sensor is dependent on temperature (and possibly humidity) and so need to be calibrated.
It is therefore important to check that the calibration of the H2 sensors done internally is sufficiently accurate: tests were carried out by an third party laboratory which characterized 3 PARHyS systems for concentrations equal to 100 and 800 ppm. The global dynamic of the system is from 10 to 2000 ppm.
The results show a full-scale dispersion of 0.3 for the temperature range between 15 and 35°C and a relative humidity between 40 and 90% and were not-temperature dependent. The accuracy can be optimized in a targeted temperature range.
Indeed, if we focus on temperatures between 20°C and 32°C for wet gases, we can observe that dispersion does not exceed 0.23 regardless the concentrations and deviation could reach overestimation by 0.2 for 100 ppm and underestimation by 0.3 for 800 ppm.
Additionally, there is no interference to CH4 and CO2 on H2 concentration measurement and no obvious correlation between H2 concentration and gas relative humidity from 40 and 70%HR as expected according to the manufacturer's specifications.
The continuous field measurements carried out in Brazil over a period of 5 months (from September 2019 to May 2020, where the sensors were exposed to extreme weather conditions, show good robustness and highlight potential ways to optimize PARHyS system.

Mots-Clés : Natural H2 measurement, Sub surface, PARHyS sensor

Merci de ne rien inscrire dans cette zone et ne pas modifier les marges des pieds de page et entêtes.