Geophysical Research Abstracts,
Vol. 11, EGU2009-809, 2009
EGU General Assembly 2009

Seasonal variability of soil sink for atmospheric hydrogen: a case study from southern Poland

J. Bartyzel, M. Pycia, J. M. Necki, and K. Rozanski

AGH – University of Science and Technology, Faculty of Physics and Applied Computer Science, Krakow, Poland

Although hydrogen is rarely mentioned as a greenhouse gas, it is expected that elevated concentrations of this gas in the atmosphere in the coming decades, associated with massive anthropogenic emissions may lead to longer residence time of atmospheric CH_4 and associated enhancement of the greenhouse effect. The global average mixing ratio of atmospheric H_2 amounts at present to approximately 500 ppb. The sources and sinks of hydrogen are not well quantified. In particular, little is known about the strength and spatial and temporal variability of hydrogen uptake by soils. The EU 6th Framework Project EUROHYDROS is aimed at initialising European monitoring capability for atmospheric hydrogen, including the ability to derive isotope ratios and to use these observations, together with studies on sinks and sources of H_2 and modelling work, to improve the understanding of hydrogen budget on the global scale.

As a part of EUROHYDROS project, a dedicated study aimed at quantifying seasonal variability of soil sink for atmospheric hydrogen is being conducted in southern Poland. The experimental site is located on the outskirts of Krakow, a large city with numerous anthropogenic sources of H_2. To quantify the soil sink for H_2, a dedicated equipment has been constructed, based on the inverted cap principle.

To quantify the uptake of H_2 by soils, a 20-liter chamber made of stainless steel and plexiglas is placed on the soil surface and concentration of hydrogen inside the chamber is measured in regular time intervals in order to quantify the dynamics H_2 removal via enzymatic reactions taking place in the upper soil layers. The concentration of hydrogen was measured in samples of air collected under the chamber in specified time intervals. A commercially available instrument (Peak Performer 1, Peak Laboratories, USA) equipped with RGA detector was used for this purpose. The measurements were performed regularly every two weeks. Apart of hydrogen concentrations, also several other field parameters (soil and air temperatures, soil water content) were measured during each sampling campaign.

The results of the field experiment available do date indicate that H_2 flux into the soil generally increases with rising soil temperature, although this trend is apparent only for the lower range of the observed soil temperatures, between ca. 3.5 and 12^{o}C. In the upper range, between ca.13 and 20^{o}C, the influence of soil temperature on H_2 flux seems to be negligible, if any. The H_2 uptake generally decreases with increasing water content in the soil, although the available data suggest that when the soil moisture drops below a certain threshold, the H_2 uptake is reduced. Seasonal fluctuations of soil temperature and water content lead to a distinct seasonality of the H_2 uptake observed at the experimental site; the H_2 flux into the soil changes from ca. 30 μmolh^{-1}m^{-2} during summer months to values close to zero during winter.

Acknowledgements:

This work was supported by EU project EUROHYDROS and by the statutory funds of the AGH University of Science and Technology (project No.11.11.220.01).