Geophysical Research Abstracts,
Vol. 11, EGU2009-7650, 2009
EGU General Assembly 2009

Measuring the variation of the isotopic composition of H2 in the atmosphere

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As molecular hydrogen (H_2) is expected to become an important energy carrier in the future, emissions of H_2 to the atmosphere are likely to rise as a result of the inevitable leakage during production, storage and distribution of H_2. The associated rise of atmospheric H_2 levels may affect methane lifetime and stratospheric ozone depletion. Unfortunately, large uncertainties still exist in the global H_2budget.

Due to the large relative mass difference between deuterated hydrogen (HD) and 'ordinary' hydrogen (HH), large isotope effects occur in the H_2 cycle. The different sources and sinks have very distinct isotopic signatures and fractionation coefficients, respectively. For this reason, measurements of isotopic composition are a promising tool to gain insight into H_2 source and sink processes and to constrain the terms in the global budget. With the GC-IRMS system at the IMAU (similar to *Rhee et al.* [2004]), the concentration and the deuterium content of atmospheric H_2 can be determined routinely and precisely.

Within the 'EUROH$_2$YDROS' project a European Network has been initialized for hydrogen observations. Weekly to monthly air samples from 6 EUROH$_2$YDROS stations are now measured on a regular basis in the IMAU isotope lab in collaboration with Heidelberg University, Germany, LSCE, France and MPI Jena, Germany. The longest weekly time series is the Alert series (Canada), containing approximately weekly samples stretching over 1.5 year. More than two full seasonal cycles (with monthly sampling) are available from Neumayer (Antarctica). Sampling from more stations is planned; first samples from Kasprowy Wierch (Poland) and Cabauw (The Netherlands) have already been measured, and sampling in Korea is in preparation.

These time series show the variation of the isotopic composition of H_2 with latitude and season, and allow investigating the effects of the different sources and sinks. A clear seasonal cycle is observed in Alert for both the H_2 concentration and its deuterium content. The two quantities vary out-of-phase, which is in accordance with the large role of soil uptake in the Northern Hemisphere (*Rhee et al.* [2006]). Average deuterium content is higher in the Southern Hemisphere than in the Northern Hemisphere, in agreement with *Gerst and Quay* [2000]. A selection of these measurements will be presented on this poster.

References

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