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Multi-year inversion of molecular hydrogen using the RAMCES and EUROHYDROS network data

Camille Yver, Philippe Bousquet, Martina Schmidt, Isabelle Pison, and the Eurohydros project Team
LSCE/IPSL, laboratoire CEA/CNRS/UVSQ, France (camille.yver@lsce.ipsl.fr)

Molecular Hydrogen (H2) is one of the most abundant trace gases in the atmosphere with a mean ratio of 530 ppb. Its role in the cycle of greenhouse gases such as methane via the reaction with the radical OH could dramatically affect the atmospheric lifetime of this gas, thus making H2 a secondary greenhouse gas. Moreover, the prospect of its use as energy carrier and the resulting atmospheric leakages has invigorated the interest in the comprehension of the budget of this gas.
Since 2005, H2 is monitored at 19 stations of the RAMCES global network. Within the European project EUROHYDROS, a network of 28 stations (10 from RAMCES network), run by 14 laboratories using the same calibration scale and analysis protocol, was built up. The data of these 37 stations are used in a 4D-variationnal inversion model (PYVAR-LMDZ) to optimize the hydrogen sources and sinks. This model uses a simplified chemistry scheme based on methane oxidation chain. Several inversions have been performed optimizing either total H2 flux or the different sources and sinks of H2 separately. Sensitivity tests have been performed with different soil deposition velocity maps. Finally, hydrogen isotopes have been implemented in order to add constraints on the partition of H2 fluxes between biomass burning, fossil fuel, photochemical production and other minor sources of H2.

Both the observations from the RAMCES network and the EUROHYDROS network, and their assimilation in a 4D-VAR inverse framework are presented in this talk. The results from the sensitivity tests and from the first multi-year inversion are also analyzed in details.