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Evaluation of Hydrogen Source/Sink Parameterizations in a Regional Model

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Modelling tropospheric molecular hydrogen (H_2) requires a description of atmospheric hydrogen chemistry as well as information on hydrogen surface sources and sinks. In particular on regional scales large uncertainties still exist in the parameterizations of the surface source and sink signatures. In order to further constrain these parameterizations the simulation results of the regional model REMO are compared to observations of atmospheric H_2 at several European sites, which are performed in the framework of the European research project EuroHydros.

The primary sources for hydrogen in Europe are combustion processes. As hydrogen and carbon monoxide (CO) are produced essentially by the same processes with rather well-defined emission ratios, the H_2 combustion sources are estimated from CO emission inventories, usually available as annual mean values for certain reference years. Comparisons at polluted sites, however, reveal that it is crucial to include also seasonal, weekly and diurnal cycles in these emissions in order to reproduce the observed temporal variations in H_2 concentrations.

Parameterization of the soil sink is probably the major challenge in modelling atmospheric hydrogen. Soil chamber measurements at different locations indicate spatial as well as temporal variations in the major parameters governing soil uptake of hydrogen. In particular the results from field studies conducted in the EuroHydros project provide important input allowing systematic investigation of the dependence of the H_2 soil sink on various soil and climate parameters. Different parameterizations of H_2 deposition velocity depending on soil type, soil moisture and other additional parameters to describe the spatial and temporal patterns are tested in the regional model and discussed.