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Continuous Measurements of H2 for the Estimation of anthropogenic Sources

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Molecular hydrogen (H2) is one of the most abundant trace gases in the atmosphere. However, only little attention has been paid until now to investigate the sources and sinks as well as the role of H2 that it plays in atmospheric chemistry. At present, more and more ideas evoke that praise the hydrogen economy (the use of hydrogen to store and carry energy) for replacing the fossil fuel energy system. Before the hydrogen economy becomes reality, the impact of the different emissions on the whole atmosphere has to be investigated in detail and understanding the current budget is a necessity.

Since November 2002, continuous measurements of H2 and carbon monoxide (CO) are performed in Duebendorf, Switzerland, at a road site near Zurich. This study aims at obtaining a reliable data set for the modelling of actual emissions related to fossil fuel burning and especially road traffic. A commercial gas chromatograph is used to measure molecular hydrogen and carbon monoxide by hot mercuric oxide reduction and UV absorption detection.

The time series of H2 and CO are strongly correlated reflecting similar sources (predominantly traffic) at this sampling site. The diurnal cycle of H2 shows a bimodal pattern with peaks during the morning and evening rush hours. In addition, measurements of H2 emissions from vehicles were undertaken in a highway tunnel (Gubrist tunnel) near Zurich in October and November 2002. Close correlations of H2 and CO were also observed in the tunnel. The mean slope of the H2 to CO correlation

of around 0.5 ppm H2/ppm CO agrees well with the data recorded at Duebendorf (showing a slope of the morning values of 0.4 ppm H2/ppm CO) confirming the major influence of traffic emissions in Duebendorf.

The seasonal cycle reveals lowest values in autumn in agreement with published data. We measured remarkably low concentrations in autumn 2003 after an exceptionally dry summer. As soils are the strongest H2 sinks and enhanced uptake rates under dry conditions are reported in the literature, this effect could be probably related to more pronounced net sink strengths.