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Islisberg-2011 - measurements of vehicle emissions in a highway tunnel: CO_2, CO, H_2, N_2O, O_2/N_2; stable isotopes of CO_2, CO and H_2

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A measurement campaign of vehicle emissions took place in the summer of 2011 in the Islisberg highway tunnel in Switzerland. The purpose was to characterize the present vehicle fleet in terms of emission rates of H_2, CO, CO_2 and N_2O; emission ratios O_2:CO_2, CO:CO_2 and H_2:CO, and isotopic signatures in CO_2, CO and H_2. The tunnel has a separate bore for each traffic direction, and no active ventilation, thus offering an ideal setting for measuring large traffic signals without significant interference of other sources or sinks.

Two RGA analyzers were installed at the entrance and at the exit of the tunnel for continuous, in-situ measurements of H_2 and CO. This in-situ dataset allows to determine the CO and H_2 emission rates and the H_2:CO emission ratios for different traffic conditions and vehicle types (traffic count data are also available). Additionally, a large number of flask samples were filled at both entrance and exit and were distributed for various measurements at three institutes. Some of the flasks were analyzed at MPI-BGC (Jena, Germany) for CO_2, CO, N_2O, H_2, O_2/N_2 and ^{13}C and ^{18}O in CO_2. A second flask batch was analyzed at EMPA (Switzerland) for H_2 and CO, and at IMAU (Utrecht, Netherlands) for the corresponding H_2 and CO isotopes. A third flask batch travelled to all three institutes for a complete set of measurements, serving also as a consistency check.

We will present the initial results, discussing the following points:
- H_2 and CO emission rates, and H_2:CO ratios of vehicle emissions;
- H2 and CO isotopic composition;
- CO:CO_2 ratios;
- O_2:CO_2 ratios;
- ^{13}C and ^{18}O in CO_2.