Understanding and Quantifying CO_2 and CH_4 Greenhouse Gas Fluxes on the Regional Scale: The Project CarboCount CH

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The project, CarboCount CH, investigates human-related emissions and natural exchange between atmosphere and biosphere of the two most important long-lived greenhouse gases, carbon dioxide (CO_2) and methane (CH_4), in Europe, particularly in Switzerland. In addition to performing long-term simulations of CO_2 exchange fluxes and their response to climate variations in Europe during the past 30 years, the project combines measured and simulated concentrations in an inverse modeling framework to better quantify CO_2 and CH_4 fluxes at the regional scale. For this purpose, four new measurement sites have been established in Switzerland including one tall tower (210 m), all equipped with Picarro instruments for continuous measurements of CO_2, CH_4, and partially CO. Weekly $^{14}CO_2$ samples at the tall tower site will provide valuable insights into the contributions from fossil fuel emissions. Two separate atmospheric transport and inverse modeling frameworks are being developed within the project. The first one uses the new tracer transport module of the regional numerical weather prediction model COSMO, together with the CarbonTracker inversion scheme. The second framework is based on backward simulations with the Lagrangian transport model FLEXPART-COSMO and a Kalman filter. Anthropogenic a priori emissions are taken from newly developed high-resolution (500 m x 500 m) inventories of CO_2 and CH_4 emissions in Switzerland. Atmosphere-biosphere exchange fluxes of CO_2 are simulated with the coupled system COSMO-CLM2 (i.e. COSMO coupled to the Community Land Model).

Here we will present a general outline of the project, the setup of the measurement network and of the different modeling components and inverse methods. First simulations and an analysis of model performance in comparison with observations at the different CarboCount CH sites will also be demonstrated.

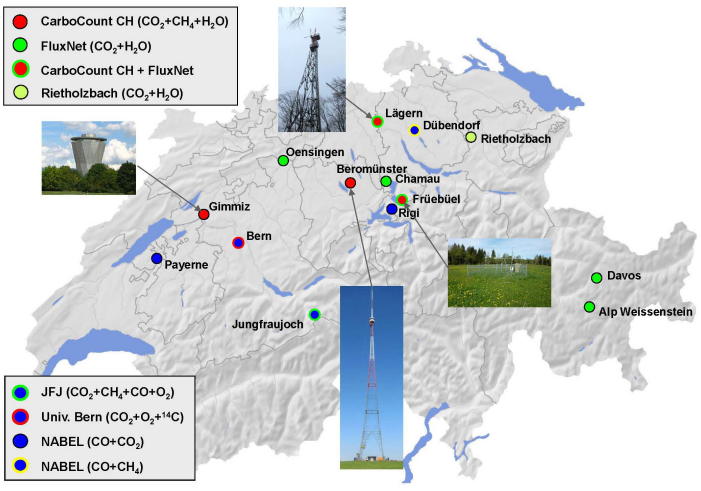

Figure 1. The CarboCount CH observation network. The filled red circles denote the 4 new sites. Blue and green circles are measurements from complementary networks including Swiss Fluxnet with Eddy covariance sites and further sites with continuous CO_2 and CH_4 measurements including Jungfraujoch.