



Airborne in-situ measurements of CO₂ and CH₄ and their interpretation using WRF-GHG: results from the HALO CoMet 1.0 campaign

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During May and June 2018, an intensive campaign (CoMet: Carbon dioxide and Methane mission) made atmospheric measurements of greenhouse gases over Europe. CoMet aimed to characterise the distribution of CH₄ and CO₂ over significant regional sources with the use of a fleet of research aircraft, as well as to validate remote sensing measurements from state-of-the-art instrumentation installed on-board against a set of independent in-situ observations.

Here we present in-situ measurements of CO₂ and CH₄ mixing ratios made during flights performed with the German research aircraft HALO with a cavity ring-down spectrometer. We also present laboratory analyses of air samples collected throughout the flights, which include information on isotopic composition of CH₄. Emphasis is placed on the data collected in the atmosphere over the Upper Silesian Coal Basin (USCB, southern Poland), one of the strongest methane-emitting regions in the European Union, which is responsible for emissions of between 0.4 and 1.5 Tg CH₄ annually.

In order to link the observations to emission sources, high-resolution simulations with WRF-GHG v 3.9.1.1. (10 km x 10 km Europe + nested 2 km x 2 km domain over USCB), driven by short-term meteorological forecasts from the ECMWF IFS model and chemical forecasts from CAMS MACC for initial and lateral tracer boundary conditions were performed. Biogenic fluxes of CO₂ were calculated online using the VPRM model driven by MODIS indices. Anthropogenic emissions over Europe were taken from the database of TNO, Department of Climate, Air and Sustainability (7 km x 7 km) and from the internal emission database of CoMet.

Detailed information about the location and strength of the most important point sources within the USCB allowed for tagged tracer simulations for selected sources to be performed. The results of source partitioning of the predicted signals are presented and compared against observations performed during the campaign.