CoMet: An airborne mission to simultaneously measure CO2 and CH4 using lidar, passive remote sensing and in-situ techniques

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In order to improve our current knowledge on the budgets of the two most important anthropogenic greenhouse gases, CO2 and CH4, a co-ordinated measurement campaign in the Central European region was successfully carried out in May/June 2018 with the German research aircraft HALO and two smaller Cessna aircraft as its main experimental platforms. The goal of CoMet is to combine a suite of state-of-the-art airborne active (lidar) and passive remote sensors (spectrometer) with in-situ instruments to provide regional-scale data about greenhouse gases (GHGs) which are urgently required for their accurate modelling.

During the intensive observation period, HALO research flights were performed along extended latitudinal transects to capture GHG gradients, over known regions of strong emissions, and over the ground-based remote sensing sites of the Total Carbon Column Observing Network (TCCON). While HALO provides a larger scale picture, the two Cessna aircraft concentrated on a region of prime interest: the Upper Silesian Coal Basin in Poland, which, due to hard coal mining activities, is one of the hot spots of anthropogenic methane emissions in Europe. Here, a variety of ground-based instruments additionally supported the CoMet mission: FTIR spectrometers, wind lidars, mobile vans and small drones provided valuable information to e.g. quantify CH_4 emissions from coal mining activities.

A model infrastructure (regional inverse modelling, chemistry-climate modelling with regional refinement) has been employed in forecast mode to optimize flight strategies and will be used to hindcast the campaign period to evaluate GHG fluxes and transport.

The CoMet mission is also part of validation activities for existing passive remote sounding GHG satellites (GOSAT, Sentinel-5P, and OCO-2) and preparation of the first active CH4 satellite mission MERLIN. For that reason, the CHARM-F lidar developed at DLR as an airborne MERLIN demonstrator was one of the key instruments. In addition, CoMet is intended to investigate methodologies for the synergistic combination for GHG measurements using lidar and passive remote sensing.

This contribution will present preliminary findings from CoMet with an emphasis on lidar remote sensing of the GHGs.