CoMet: Carbon Dioxide and Methane Mission for HALO

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Following a series of missions dedicated to cloud microphysics, chemistry or atmospheric dynamics, the CoMet mission, scheduled for April-May 2017, is the first HALO mission targeted to investigate the sources and sinks of the main anthropogenic greenhouse gases (GHG), carbon dioxide (CO_2) and methane (CH_4), and their impact on Climate Change.

There are still significant deficits in the knowledge about the budgets of these two major greenhouse gases, which contribute to ~ 81% of the anthropogenic radiative forcing, such that the ability to accurately predict our future climate remains substantially compromised. Different feedback mechanisms which are insufficiently understood have significant impact on the quality of climate projections. In order to accurately predict future climate of our planet and support observing emission targets in the framework of international agreements (e.g. COP21 Paris Agreement), the investigation of sources and sinks of the greenhouse gases and their feedback mechanisms is indispensable.

The goal of CoMet is to combine a suite of the best currently available active (lidar) and passive remote sensors as well as in-situ instruments to collect new data sets and knowledge about the variability of CO_2 and CH_4 on a subcontinental scale. The flights will be concentrated on Europe since the European continent is characterized by a very strong overlap between anthropogenic and biogenic sources. This will not only allow identifying local sources of emissions but also providing important input for the inverse models to infer regional budgets. Through analyzing the CoMet data set the knowledge about the carbon dioxide and methane cycle shall be improved and new insight gained about the spatial and temporal variations of the GHGs. Moreover, the project also aims at developing new methodologies for the measurement of GHGs and shall promote the development of technologies for future generations of Earth observing satellites.

For CoMet, an intensive measurement period of 4 weeks is planned in April-May 2017. Within approximately 65 hours of flight operation, optimized research flights on HALO will comprise:

- Extended latitudinal transects to capture the GHG gradients
- Flights over one of the largest methane sources in Europe (e.g. Polish hard coal mining area)
- Comparison overflights over the ground–based remote sensing sites of the TCCON network.

A significant part of the HALO flights will be performed in coordination with two small Cessna aircraft that carry a passive remote sensor (MAMAP) and a suite of in-situ instrumentation and that will concentrate on areas with strong localized sources.

Currently, a successor mission is being planned that will extend the CoMet study to the highly relevant arctic and tropical wetlands and validation of the German-French climate mission MERLIN.

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