Sentinel 5P validation by CoMet HALO (SNITCH) #28632

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Knowledge for Tomorrow
Introduction

• In April/May 2017 the partners have planned an airborne field campaign called CoMet (Carbon Dioxide and Methane Mission for HALO)

• The goal of CoMet is to measure gradients of the dry-air columns of both CH$_4$ and CO$_2$
  ➔ use measurements to estimate local, regional, and sub-continental scale fluxes with inverse modelling
  ➔ identify and quantify local and regional sources of greenhouse gases (e.g. power plants, landfills, city plumes, geological sources, wetlands)
  ➔ prove that the proposed payload constitutes an adequate instrumentation for validation of spaceborne greenhouse gas missions such as S5P, MERLIN, CarbonSAT, …)

• For the S5P validation activities the team proposes to generate synergy make use of the gathered CH$_4$ data from this campaign.
  ➔ related to Phase E2, i.e. routine exploitation phase
### CoMet Instrumentation

#### Active + Passive Remote Sensing + in-Situ

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<td>MAMAP</td>
<td>CRDS, Flask Sampler</td>
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<td>mini-DOAS</td>
<td>Attitude, p, T, rel. hum. dropsondes</td>
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A payload consisting of such suite of active, passive and in-situ instruments is unique
CHARM-F: DLR`s Greenhouse Gas Lidar

Measurement principle
Integrated Path Differential Absorption Lidar

Main data product
$X_{CH_4}$ (@1.64µm); ($X_{CO_2}$@1.57µm)

Advantages:
• independent of sunlight
• not affected by thin clouds and aerosol
• high accuracy

CHARM-F is certified for operation on HALO and was recently flown for the first time
MAMAP/MAMAP2D (U Bremen): Methane Airborne MAPper

**Measurement principle**
- absorption spectroscopy using scattered/reflected solar radiation (as SCIAMACHY, OCO, GOSAT)

**Main data product**
- XCH4 (and XCO2) via proxy approach with typical uncertainty of 0.3% or better

**Status**
- Planned extension with a 2-dim imaging SWIR and NIR (for O₂) channel → MAMAP2D
- MAMAP flew on various aircraft, but not yet on HALO
- Certification required
- Funding is pending
In-Situ Instruments (MPI Jena)

**JIG: Jena Instrument for Greenhouse Gases**

**Measurement Principle**
- Cavity Ringdown Spectroscopy

**Main data product**
- Measures profiles of CH$_4$, CO$_2$, CO, H$_2$O and uses H$_2$O to convert to dry air mole fractions

**Status**
- Certified for HALO
- Heritage from IAGOS
- Successful HALO test flights with CHARM-F performed
- Measurement Examples → Poster

**Precision/Accuracy:**
- CH$_4$: 2ppb
- CO$_2$: 0.1ppm
- CO: 2ppb
- Time resolution: ~ 2.3 s

**JAS: Jena Air Sampler**

**Measurement Principle**
- Flask sampler for laboratory analysis

**Main data product**
- CO$_2$, $^{13}$CO$_2$, $^{18}$OCO
- CH$_4$, $^{13}$CH$_4$, CH$_3$D
- N$_2$O, CO, H$_2$, SF$_6$

**Status**
- Under development
Measurement Strategies and Tentative Flight Patterns

40-60 flight hours,
~8 flights
~4-6 weeks duration

TCCON sites
Power plants
Coal mines
Landfills
Volcanoes
S5P satellite tracks
Funding Situation

• Funding is needed for additional flight hours / and certification

• It was attempted to receive funding from
  • German Space Agency (MERLIN framework, on hold)
  • German Federal Ministry or Science and Technology (rejected at this stage)
  • DFG Priority Program HALO (pending, new operation model)

• MAMAP needs funding
  • Fly MAMAP2D on HALO CoMet
  • high schedule risk for a CoMet mission in the first half of 2017 due to still unclear funding situation (but we may aim for a 2D SWIR-1 system only ...)
  • Fly MAMAP1D (as is) on HALO CoMet
  • Fly MAMAP on a small aircraft

• DLR and MPI have some internal money
  • (enabling a down-scaled CoMet campaign)
Co-operation is highly appreciated

- TCCON Related Proposals
- AirCores
- Other Aircraft Activities

- More Information on Poster