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

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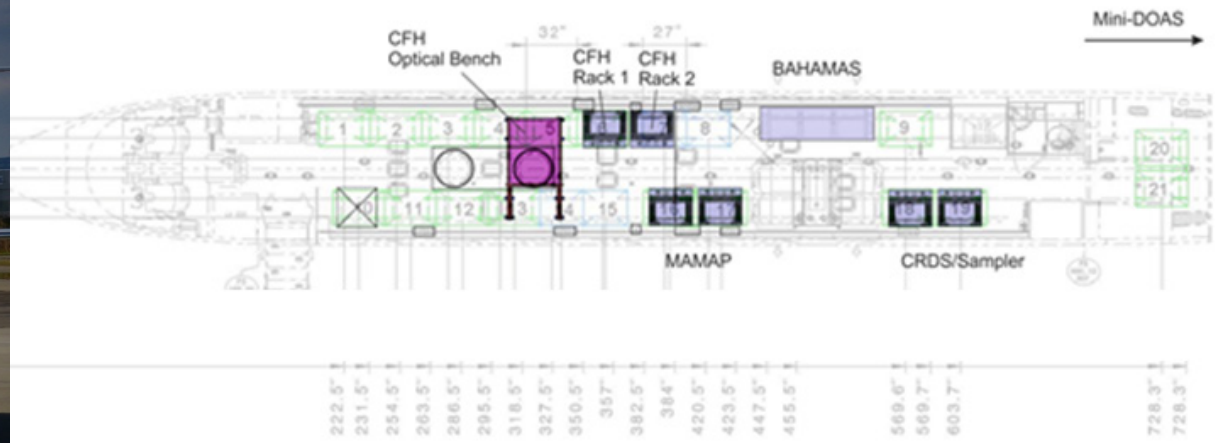
Introduction

- 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



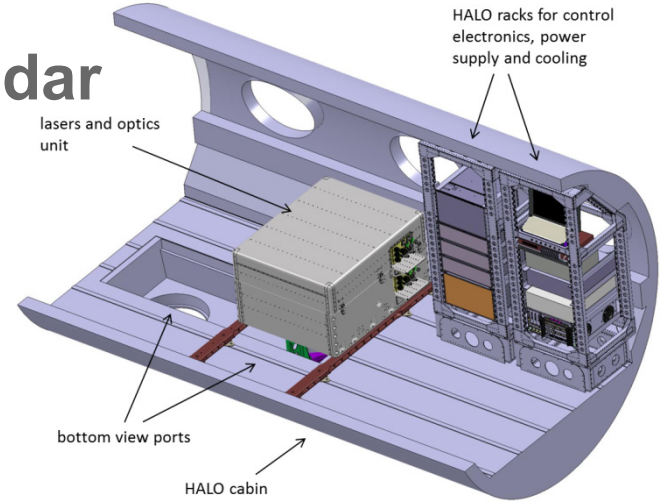
Active + Passive Remote Sensing + in-Situ

Payload: ~ 1.200 kg

	Active Remote Sensing/Lidar	Passive Remote Sensing	In-Situ
Core Instruments	CHARM-F	MAMAP	CRDS, Flask Sampler
Ancillary Instruments (see Poster!)		mini-DOAS	Attitude, p, T, rel. hum. dropsondes

A payload consisting of such suite of active, passive and in-situ instruments is unique

CHARM-F: DLR`s Greenhouse Gas Lidar



Measurement principle

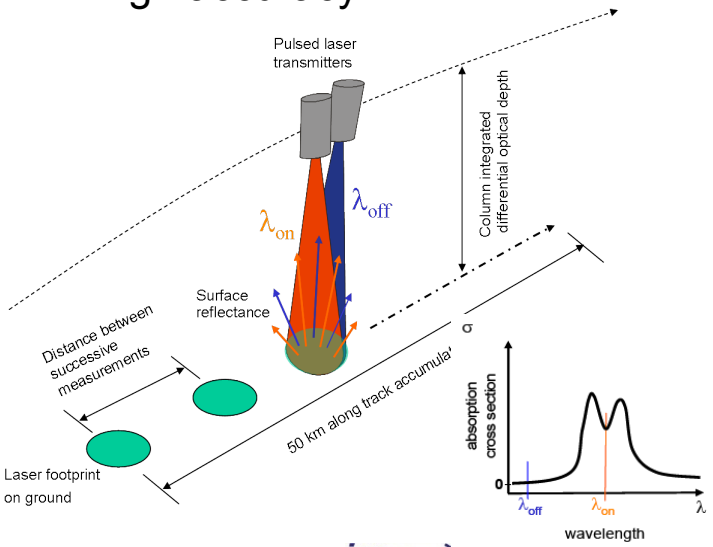
Integrated Path Differential Absorption Lidar

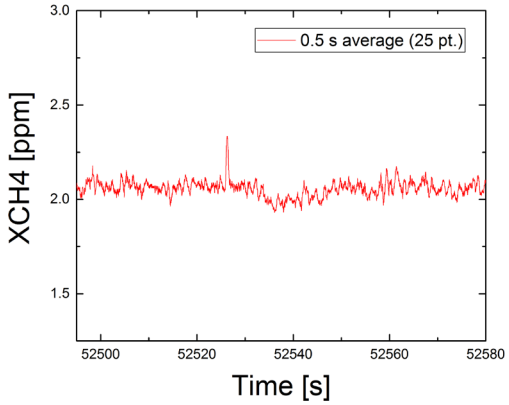
Main data product

XCH_4 (@1.64µm); (XCO_2@1.57µm)

Advantages:

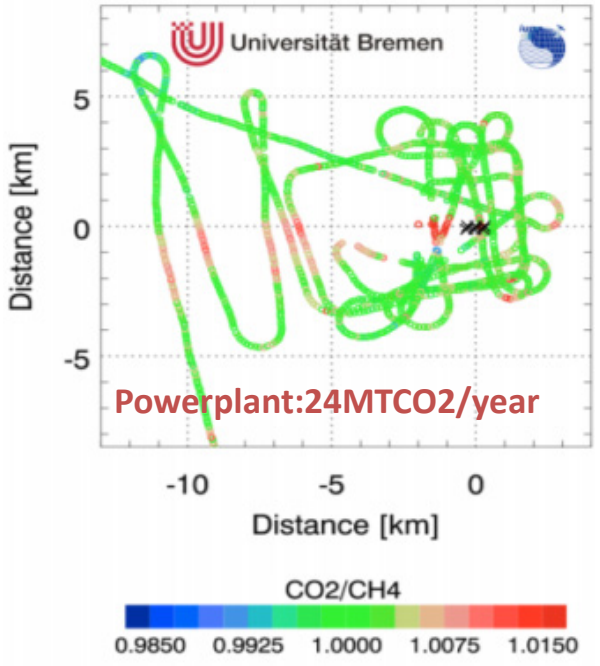
- independent of sunlight
- not affected by thin clouds and aerosol
- high accuracy





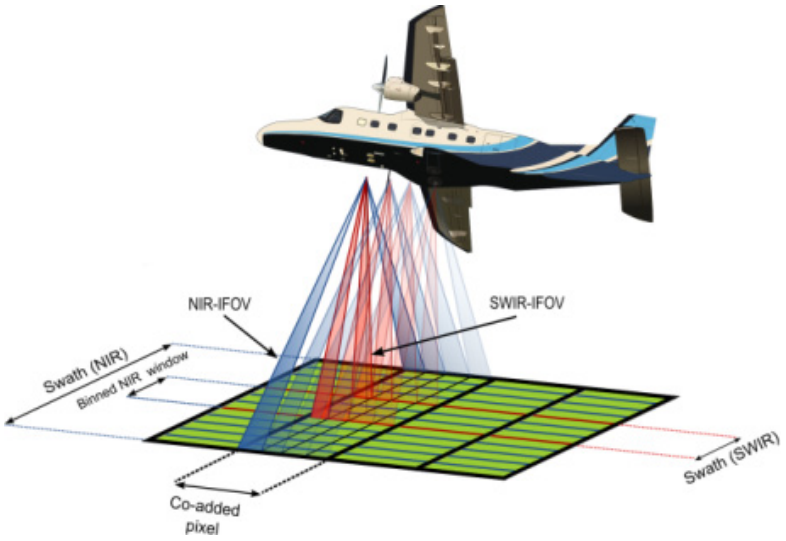
CHARM-F is certified for operation on HALO and was recently flown for the first time

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 O_2) 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_2O and uses H_2O 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

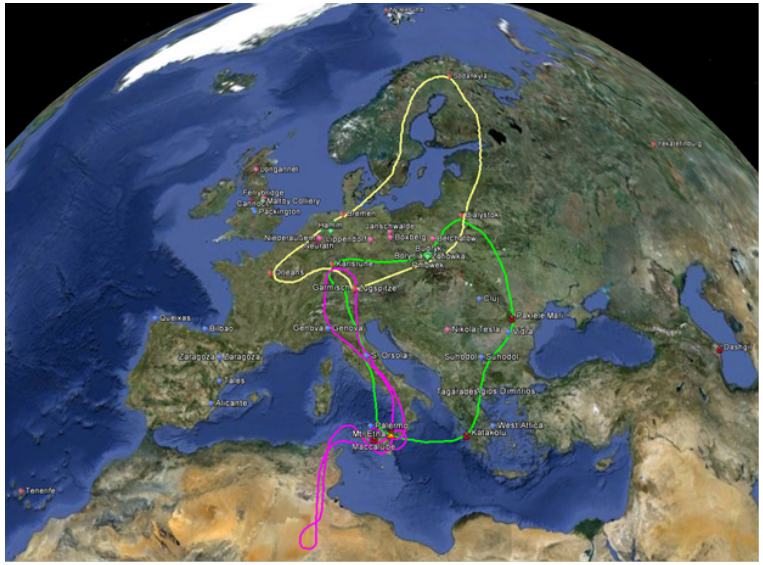
Main data product

- CO2, $^{13}CO2$, ^{18}OCO
- CH_4, $^{13}CH_4$, CH_3D
- N_2O, CO, H_2, SF_6

Status

- Under development

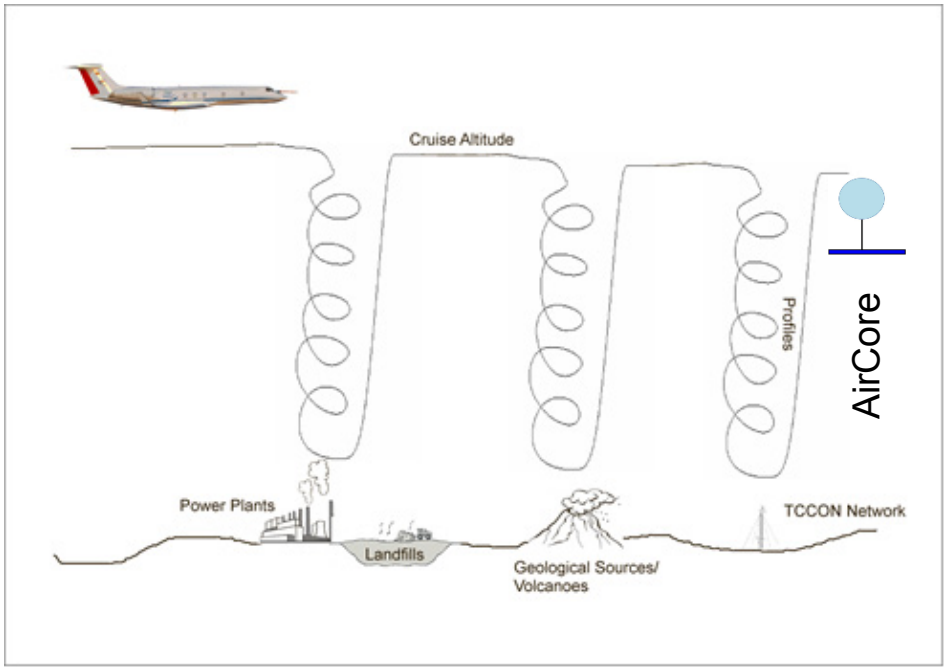
Measurement Strategies and Tentative Flight Patterns



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

CoMet HALO

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