Research Opportunities
HALO/Falcon Data Base

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Structure of HALO/Falcon Data base

![Diagram of HALO/Falcon Data base architecture]

- **Webserver** (Apache) communicates with **Perl Application** (Catalyst, MVC)
- **HTML and XML** exchanged between the webserver and the application
- **Database** (PostgreSQL)
- **Backup**:
  - 8 daily
  - 5 weekly
  - 3 monthly
- **File Archive** for Primary Data
- **HALO database**
  - [https://halo-db.pa.op.dlr.de](https://halo-db.pa.op.dlr.de)

**HALO-DB User** interacts with the **IAGOS** database through the webserver.
Data archived and data access

WHAT IS THIS?
This is HALO-DB, the web platform of a data retrieval and long-term archiving system. It was established to hold and manage a wide range of data based on, or related to observations of the HALO research aircraft. The HALO-DB may also be used for sharing data of scientific missions involving other DLR aircraft or in-situ instruments.

Please see the introduction to learn more.

WHAT KIND OF DATA WILL BE ARCHIVED?
HALO-DB is open to datasets with the following characteristics:

→ Target fields related to geosciences, see introduction
→ Observed and modeled data
→ Data above processing level 1B (see glossary)
→ Currently supported data formats: GTE, NASA Ames, NetCDF

ACCESS TO HALO-DB
The metadata (see glossary) of uploaded datasets are publicly available.

The primary data (see glossary) of uploaded datasets are available to all registered members of the particular mission. They may become publicly available after a waiting period (see glossary).

Please see the introduction to get more information about upload and download access.
## List of missions

You see the available missions in HALO-DB.

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<thead>
<tr>
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<th>Start</th>
<th>End</th>
<th>No. of associated datasets</th>
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Showing 1 to 75 of 75 rows
MISSION: OMO

DESCRIPTION

Full mission name: Oxidation Mechanism Observations

Description:

Oxidation Mechanism Observations in the extratropical free TS.

MAP OF THE MEASURING AREA

FLIGHTS

<table>
<thead>
<tr>
<th>Flights</th>
<th>Category</th>
<th>Start</th>
<th>Stop</th>
</tr>
</thead>
<tbody>
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<td>HALO</td>
<td>2015-07-25 08:54:08</td>
<td>11:09:06</td>
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</tbody>
</table>

MISSION INFO

→ Start: 2015-07-21
→ Stop: 2015-08-26
→ Region: Asia

DATA ORIGIN

Genesis of the data (see glossary).

INSTRUMENTS

1. Platform HALO
   → Instrument PerCEAS
   → Instrument CPC
   → Instrument TRIHOP
   → Instrument HKMS
   → Instrument CI-ITMS
   → Instrument BAHAMAS
   → Instrument HALO-SR-A
   → Instrument SOFIA
   → Instrument LITE
   → Instrument FAIRO-CI
   → Instrument not specified.

MODELS

1. Model type GCM
### FLIGHTS

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</table>

*Table 1: Flights*

### AVAILABLE DATASETS

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</table>
Data base: \(\text{SO}_2\) aircraft measurements (2004 – 2015)

15 field campaigns (Falcon, HALO), ~ 800 measurement hours
SO$_2$ Composites (8 – 15 km, 5°X 5°Bins)
SO$_2$ Composites (8 – 15 km, 5°X 5°Bins)

Map showing the distribution of SO$_2$ composite data with markers for DC3, INTEX, TROCCINOX, GW-LCYCLE, ACCESS, ESMVal, DeepWave, OMO, and SCOUT-O3. The map includes a color scale indicating SO$_2$ concentration in pptv.
Relative frequencies (%) of WCB trajectories

(Madonna et al. 2014)

MACCity anthropogenic SO₂ emissions (December 2013)
Sampling of East-Asien pollution in the Arctic UTLS on 03 Dec 2013

(a) 11000
   10000
   9000
   8000
   7000
   6000
   5000
   4000
   3000
   2000
   1000
   0
   altitude / m

   Q6
   Q5
   Q2
   Q7
   Q1
   Q3
   Q4

   Q1: leg at 7.3 km
   Q2: 7.9 - 9 km
   Q3: 5.6 - 7.7 km
   Q4: 5.5 - 6.1 km
   Q5: 7.9 - 9.2 km
   Q6: leg at 9.2 km
   Q7: 7.3 - 8.3 km
   Q8: 0.5 - 3.3 km

(b) 71
   70
   69
   68
   67
   latitude / N.

   0 20 40 60 80 100
   SO₂ / pptv

   Q5: 7.9 - 9.2 km
   Q6: 9.2 km
   Q7: 7.3 - 8.3 km
   Q8: 0.5 - 3.3 km

   Q2: 7.9 - 9 km
   Q7: 7.3 - 8.3 km

   Q1: 7.3 km

   Arctic Circle: 66.5°N

   Kiruna, Sweden

   Flight B
   Flight A

   DLR

   ACAM

   Atmospheric Composition Analysis Munich
Backward trajectories from air masses with enhanced SO$_2$ in the Arctic UTLS

Source regions: Japan and China
SO$_2$ Composites (8 – 15 km, 5°X 5°Bins)
Asian Tropopause Aerosol Layer (ATAL)

Vertical transport of aerosol or aerosol precursors (likely of anthropogenic origin) in the AM anticyclone regularly lead to formation of an “Asian Tropopause Aerosol Layer” detected by CALIPSO and SAGE-II. ATAL may constitute a primary source of non-volcanic aerosol for global UT and LS.

Vernier et al., GRL, 2011
OMO flight routes

(a) 13.08.2015
(b) 15.08.2015

150 hPa
200 hPa

CO (nmol/mol)

50.0 70.0 90.0 110.0 130.0 150.0

DLR
ACAM
Measurements in the ASM Anticyclone during OMO in Aug. 2015

F 13: August 6th  up to 100 ppt, 12.6 km

F 19: August 13th  up to 164 ppt, 13.3 + 12.4 km

F 20: August 15th  up to 226 ppt, 13.3 km
HALO measurements of SO$_2$, and Aitken particles in ASM anticyclone
Backward trajectories from air masses with enhanced SO$_2$ and CN
Conclusions

• The HALO/Falcon data bank includes unique measurements related to ACAM

• SO₂ pollution transport into the UTLS by WCBs and AS monsoon from main SA & EA SO₂ source regions observed

• sulfate aerosol is formed in WCB plume and ASM anticyclone represents surface for heterogeneous reactions (e.g. N₂O₅ hydrolysis: NOₓ → HNO₃) and may affect UT cirrus