

Validation Activities

At Forschungszentrum Jülich

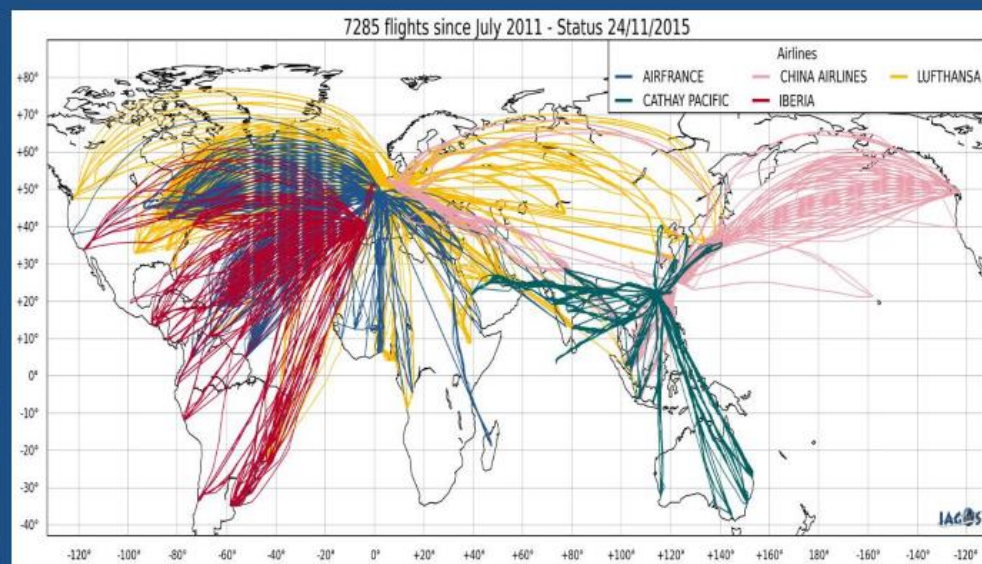
Airborne systems: IAGOS and GLORIA

March 2016 | Jörn Ungermann

IAGOS



In-service Aircraft for a Global Observing System



- 16 partners from science, industry and meteorological services
- up to 20 equipped long-haul a/c + 1 flying lab
- Global coverage (> 200 airports worldwide)
- Long-term deployment envisaged (20 years)

- Near real time data provision
- Open data policy (CAMS/GEO/GEOSS)
- Longest time series for
 - H₂O, O₃ (20 yrs) and
 - CO (12 yrs)

IAGOS

Data services



IAGOS data products

Institutes / Calibration Centres



IAGOS Data Centre
hosted by AERIS
(CNES-CNRS/INSU)
in Toulouse

NRT

Lufthansa D-AIGT



CORE-1, July 2011

Cathay Pacific B-HLR



CORE-4, Aug 2013

IBERIA EC-GUQ



CORE-5, Feb 2014

China Airlines B-18806



CORE-2, June 2012

Air France F-GLZU

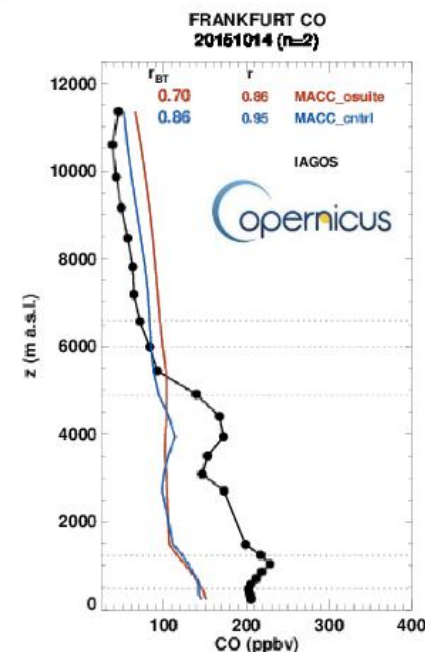
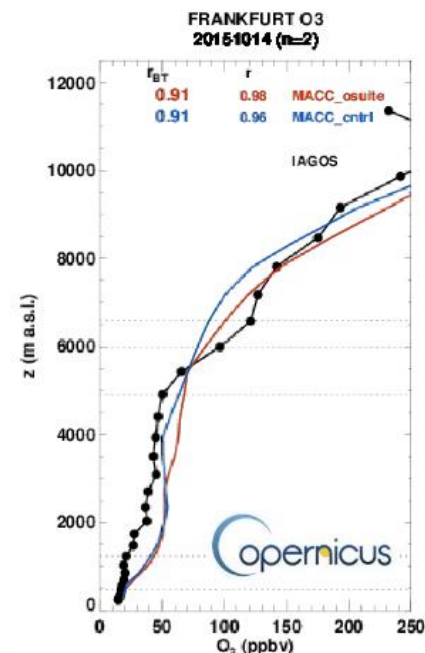


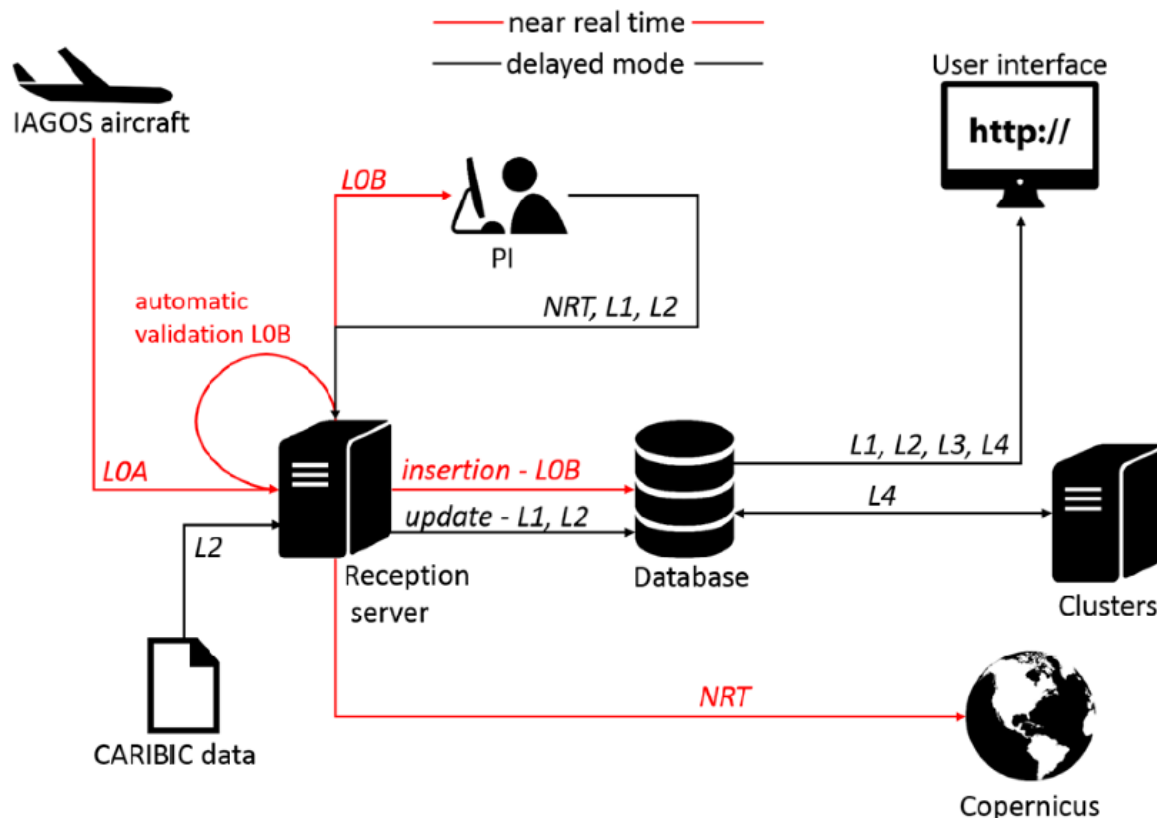
CORE-3, June 2013

Lufthansa D-AIKO



CORE-6, March 2015

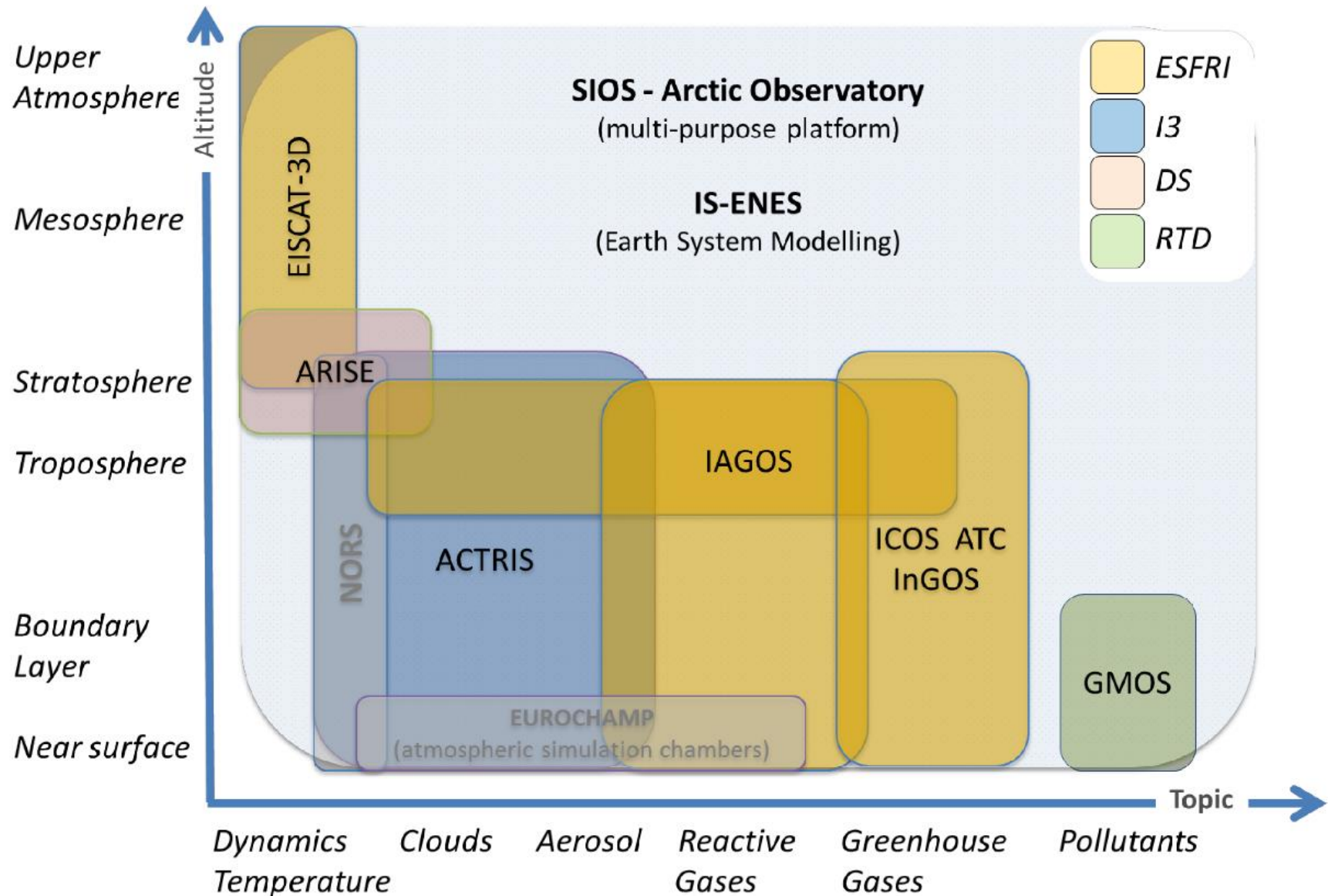




Level	Description
L0A	raw data
L0B	automatically validated data
NRT	NRT for Copernicus use, bad data removed
L1	data validated by PI (preliminary data)
L2	calibrated data (final data)
L3	averaged data and climatologies
L4	added-value products

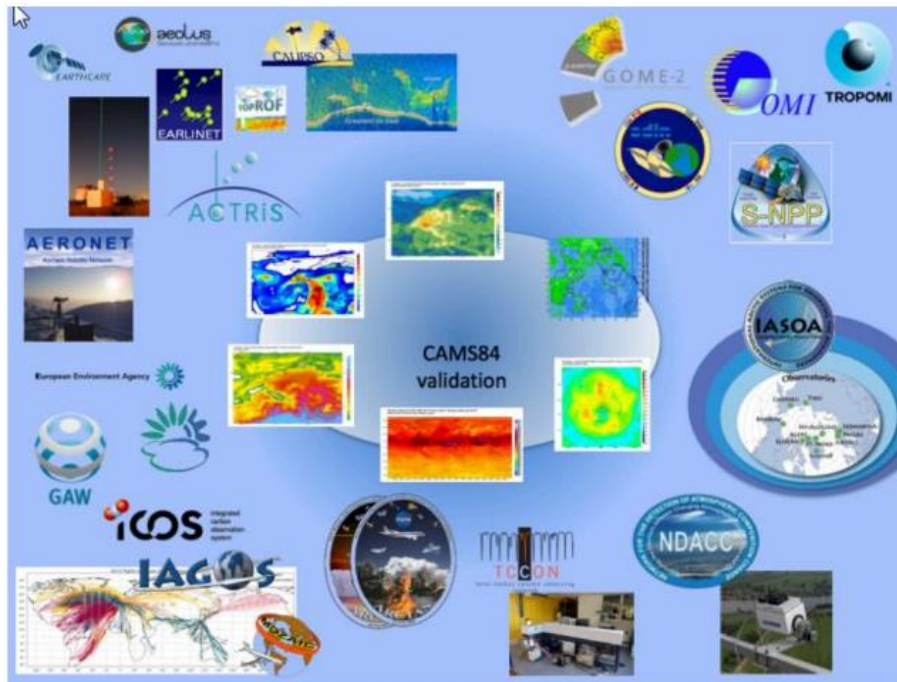
The IAGOS central database is hosted by AERIS (CNES-CNRS/INSU) in Toulouse. Data access is free and open, the database can be accessed at www.iagos.org

The Atmospheric Domain Landscape

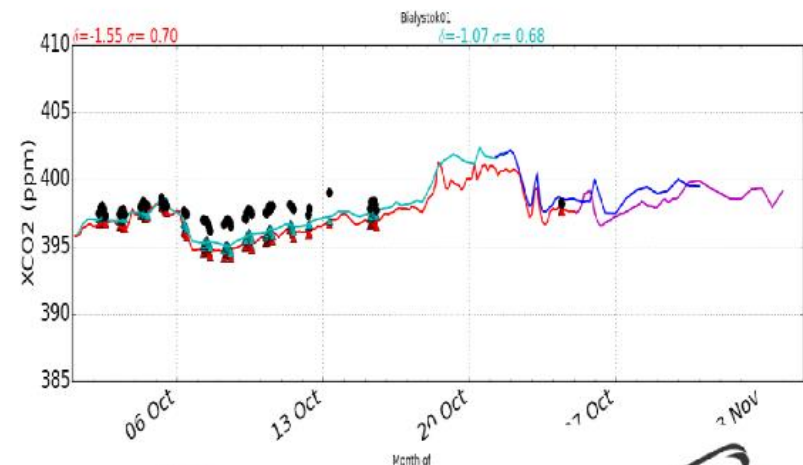


Today : Model Validation in Near Real Time

Copernicus Atmosphere Monitoring Service uses data from AC&RIS, ICOS and IAGOS for global and regional a posteriori validation



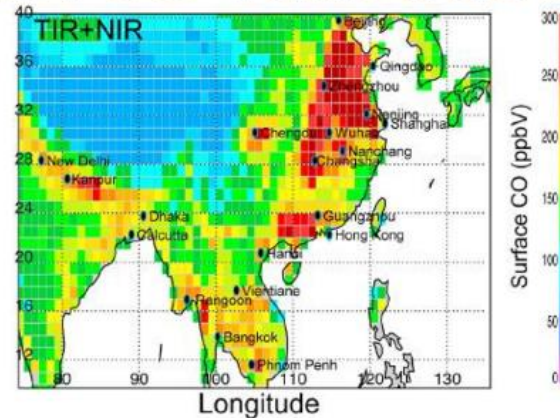
NRT column-averaged abundance of CO₂, CH₄ and CO



EU CAMS project
[2015-2019]



MOPITT total column CO validation with MOZAIC/IAGOS

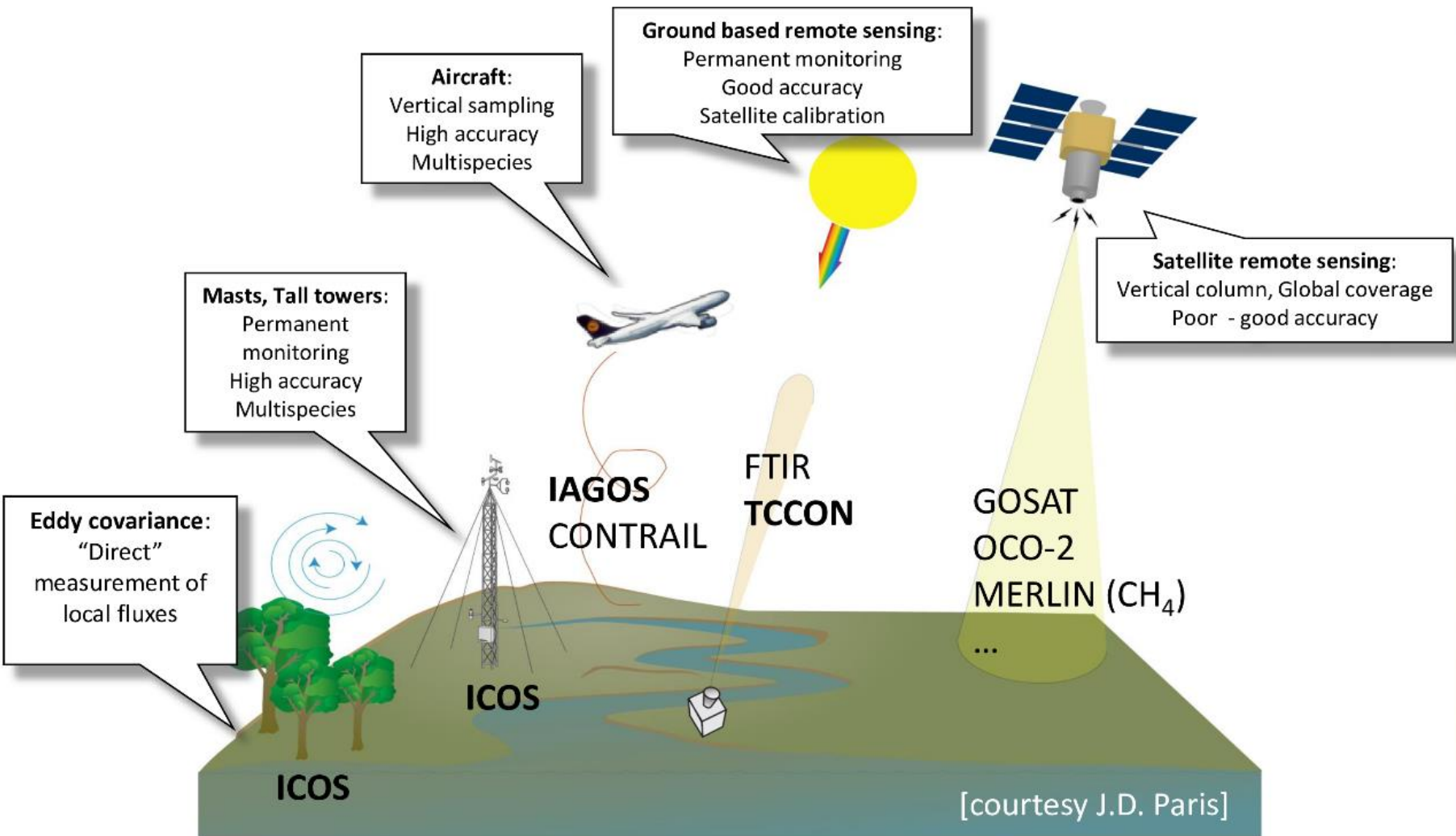


- MOPITT launched in dec. 1999 (EOS-TERRA), still operational !!
here : 2002-2010 MOPITT-v5 comparison with MOZAIC
- By far longest CO record from space
- MOPITT (SWIR) overall uncertainty < 10% total column
- MOPITT spatial resolution 20x20 km²
- Serves as a good preparation for TROPOMI CO validation (7x7 km², <15% total column)

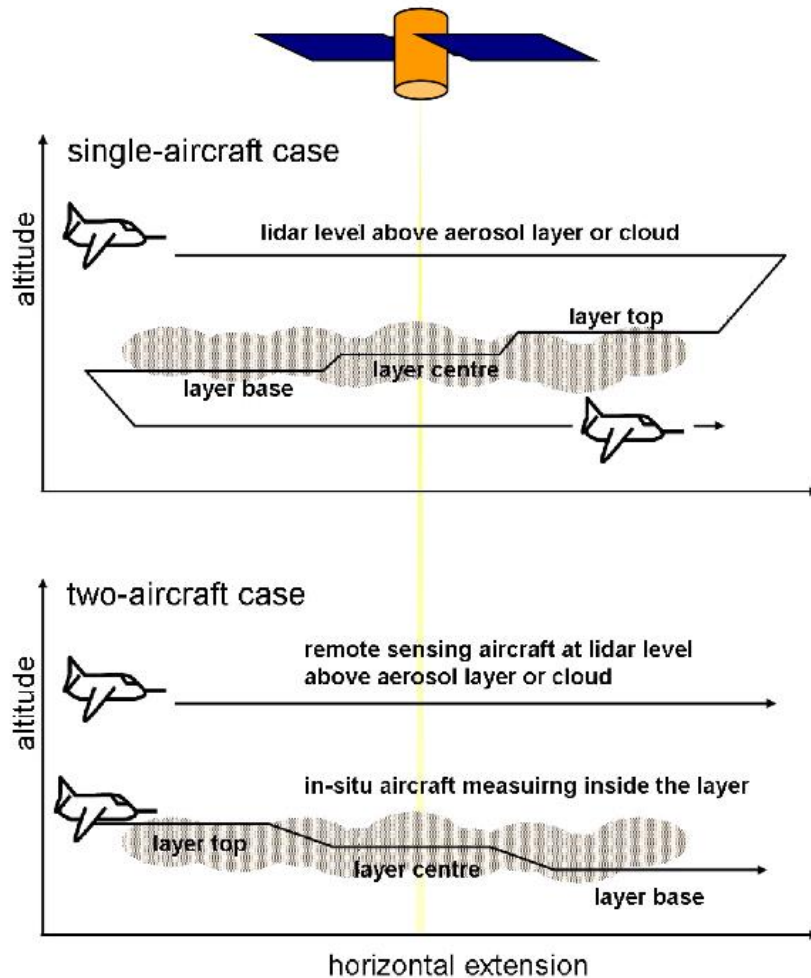
MOPITT

Ilse Aben, SRON

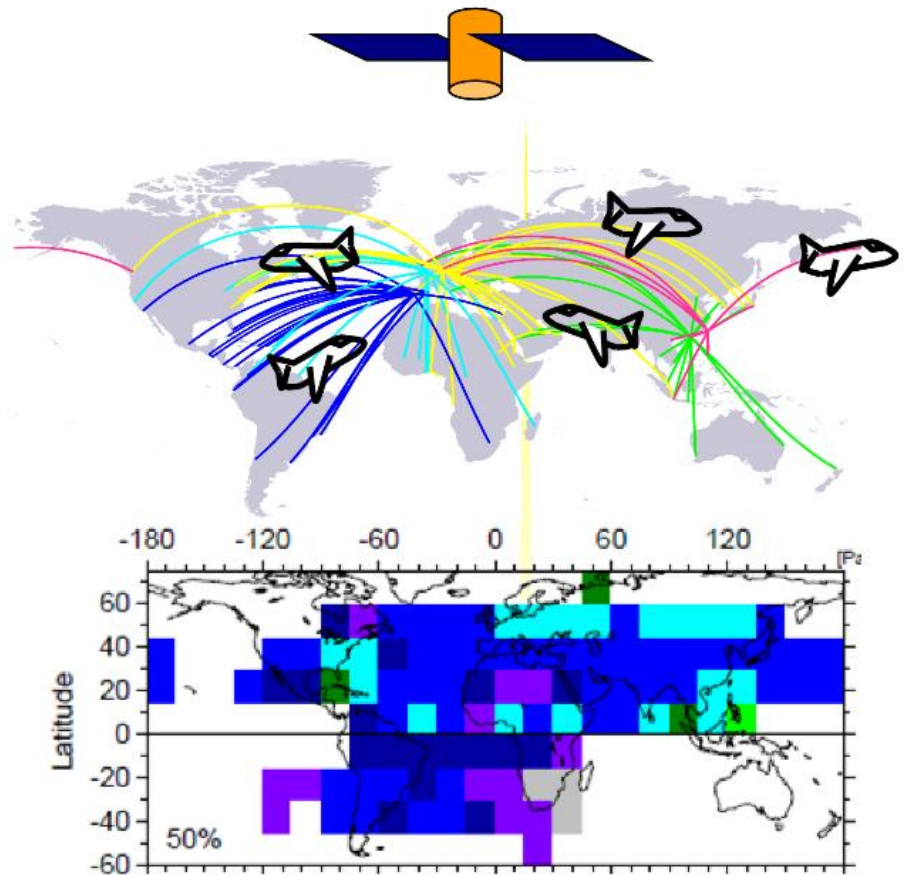
ENVRI^{PLUS} Integrated Carbon and GHG Observations



ENVRI^{PLUS} Research Infrastructures for Cal-Val



CAL: Collocated field studies



VAL: monitoring
 ⇒ global UTLS fields
 ⇒ tropospheric profiles

FIELD CAMPAIGNS AND GLORIA

Validation with field-campaigns

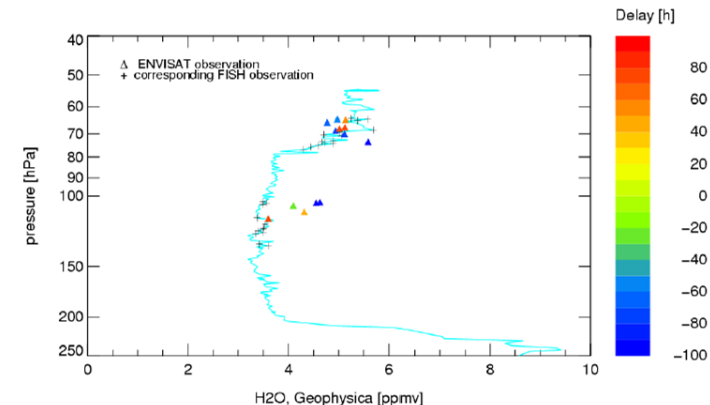
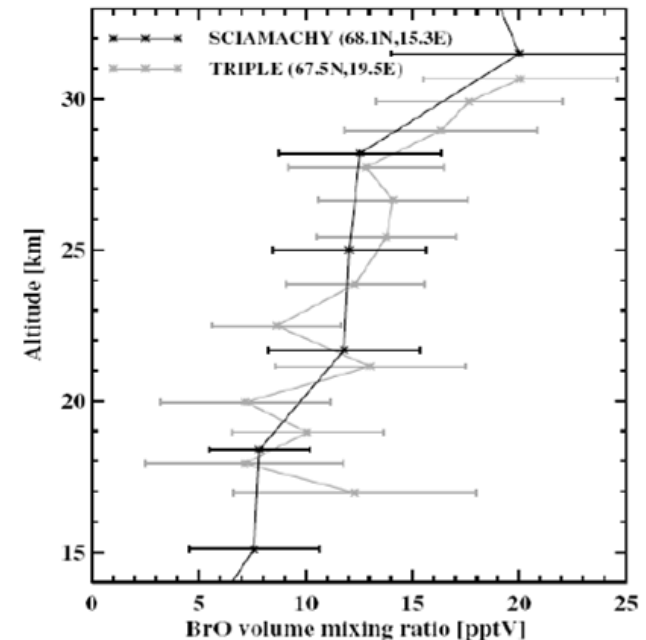
- Carriers:
stratospheric balloons, aircraft
- In-situ instruments:
 - precise
 - Independent measurement method
 - Traceable
 - Spatially highly resolved
- Remote Sensing:
 - Similar measurement method
 - Spatially higher resolved and 2-D coverage
 - Similar measurement geometry



ENVISAT Validation

ENVIVAL-LIFE

- **SCIAMACHY** Level-2 BrO validation
- **MIPAS** validation
- Balloon measurements (2002, 2003, 2009, 2011)
 - ClO/BrO, ClONO₂
 - H₂O
- Airborne measurements with stratosphere aircraft M55-GEOPHYSICA (2002, 2003, 2005, 2007, 2010, 2011):
 - ClO/BrO, ClOOCl
 - H₂O



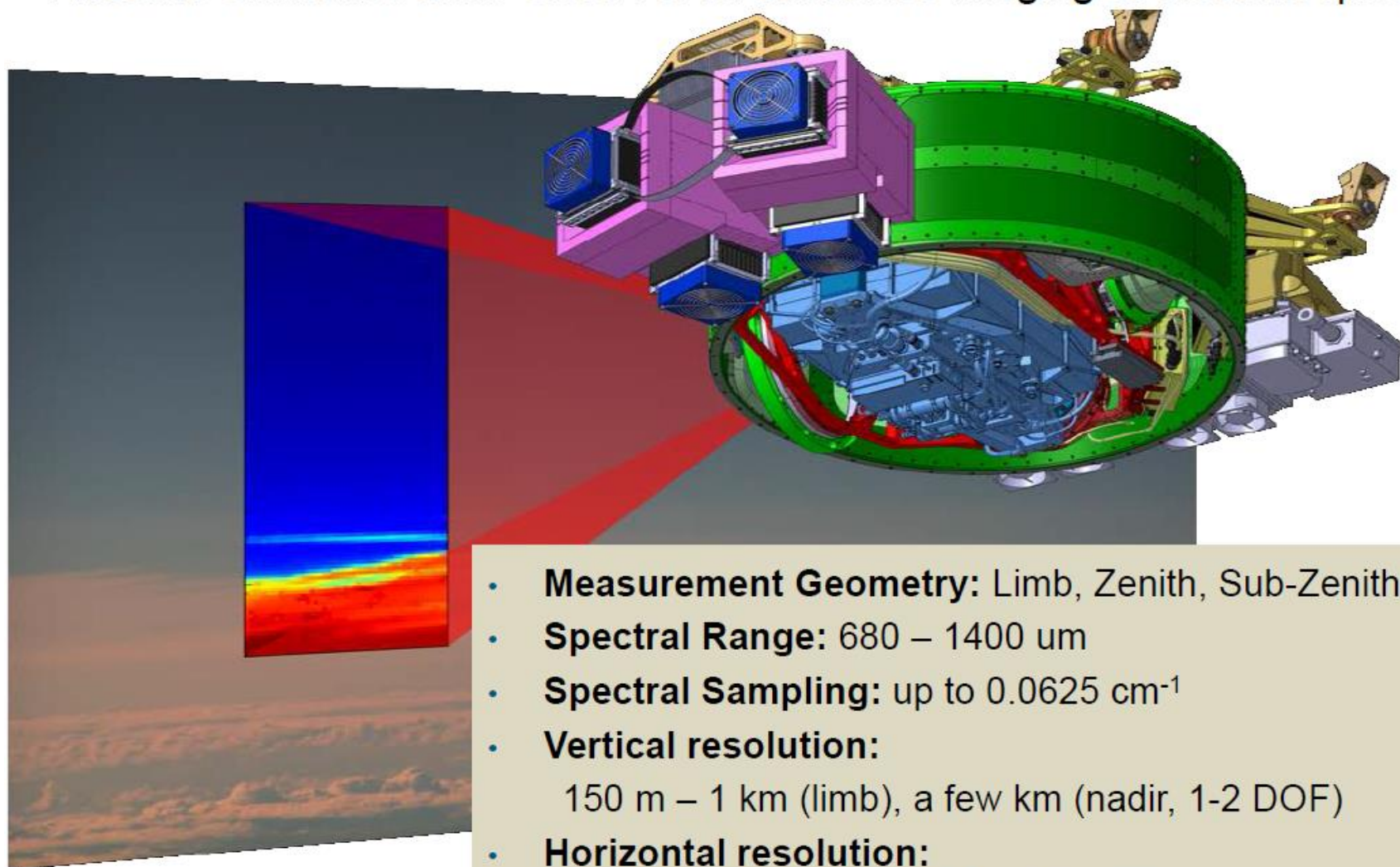
GASVal

GLORIA for Sentinel 5P Validation

- **Ozone validation of free troposphere and lower stratosphere during operational phase of S5P**
- Determination of UTLS ozone column
- Validation of S5P retrieval (optimal estimation) by comparison of independent data with very high vertical resolution within the UTLS
- Estimation of cloudiness, cloud distribution and thickness (infrared aerosol cloud indice), as well as cloud top altitude

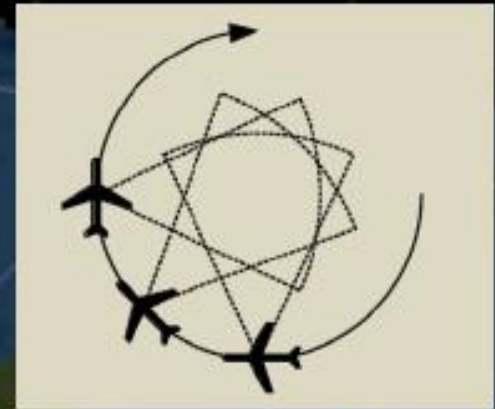
GLORIA Instrument

Airborne Gimballed Limb Observer for Radiance Imaging of the Atmosphere

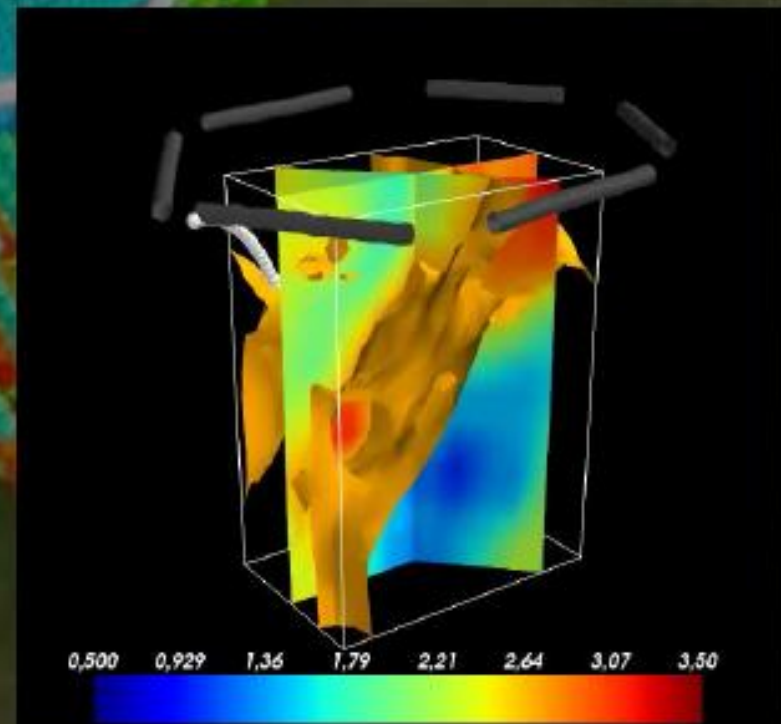


- **Measurement Geometry:** Limb, Zenith, Sub-Zenith
- **Spectral Range:** 680 – 1400 μm
- **Spectral Sampling:** up to 0.0625 cm^{-1}
- **Vertical resolution:**
150 m – 1 km (limb), a few km (nadir, 1-2 DOF)
- **Horizontal resolution:**
20 km x 20 km (limb), $< 1 \text{ km}^2$ (nadir)

GLORIA Tomography



Diameter 100 – 300 km



Next GLORIA campaigns

