



VALIDATION OF TRACER MEASUREMENTS BY THE ENVISAT CHEMISTRY INSTRUMENTS BY MEANS OF IN SITU OBSERVATIONS FROM BALLOON AND AIRCRAFT

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Conclusion, Summary and Outlook



The TRIPLE Gondola and its instruments

Independent in-situ measurements

Three main instruments:

- ✦ **Cryogenic Whole air sampler BONBON**
- ✦ **Lyman - alpha Hygrometer FISH**
- ✦ **Chemical Conversion Resonance Fluorescence BrO/ClO**

Guest instrument for SCIA validation flight:

- ✦ **Tunable diode laser instrument CHILD**



Planned and Realised Balloon Observations

Date	Launch site	comment
24.09.2002	Aire sur l'Adour, France, (44°N, 0°W)	succesfull mid latitude flight, up to 33 km
06.03.2003	Esrangle, Kiruna Sweden 68°N, 21°E	succesfull high latitude flight, up to 32 km
09.06.2003	Esrangle, Kiruna Sweden 68°N, 21°E	succesfull high latitude flight, up to 32 km
Fall 2004	tropics	launch site and date under discussion



Cryosampler BONBON on the TRIPLE Gondola





Analytical work and characterisation

- ✍ Main Problem with retrieving **high accuracy** measurements is the characterisation of the detector response. For ECDs this is often a non-linear function of the amount of the respective compound.
- ✍ Response may also be influenced by co-elution and doping effects.
- ✍ Unproblematic for CH₄ and CO₂ (FID is highly linear).
- ✍ Non-linearity of ECD response for CFCs can be characterised by a dilutions series
- ✍ N₂O is non-linear and may cross interfere with the amount of CO₂ in the sample (internal doping)

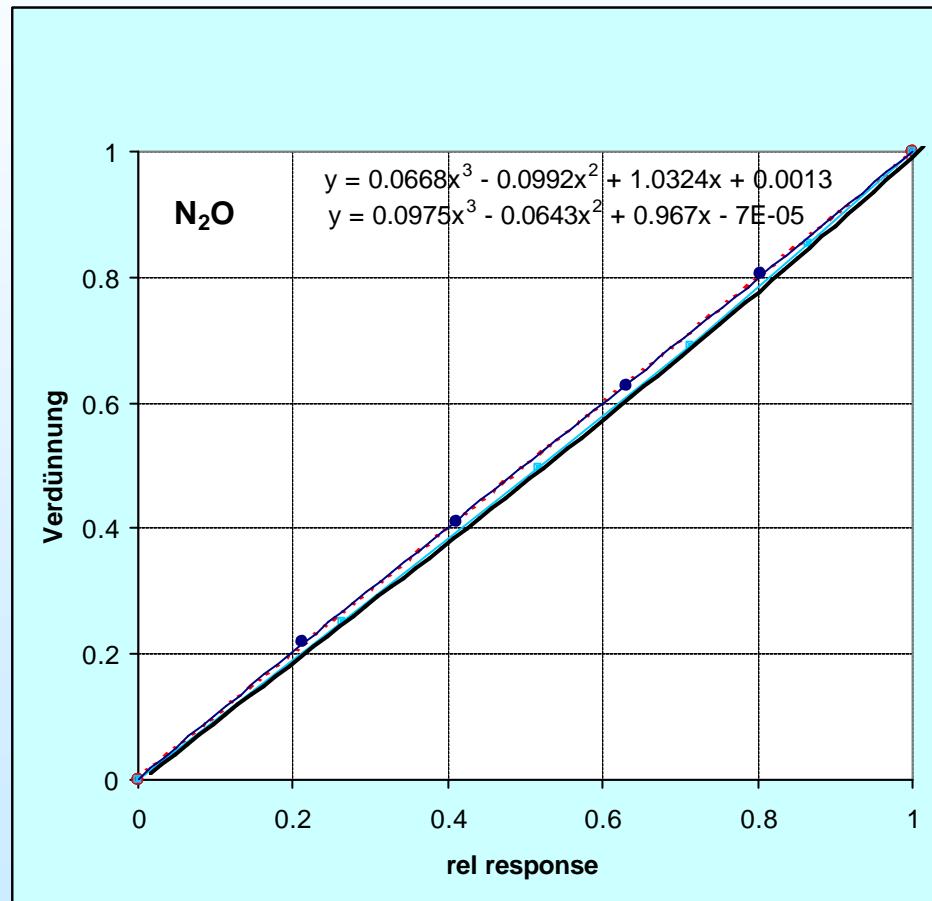


Comparison of N₂O non-linearity tests

Blue squares:
constant CO₂
dilution series

turquoise points:
CO₂-diluted
dilution series

differences of up to
5 ppb between three
independent N₂O
measurements remain



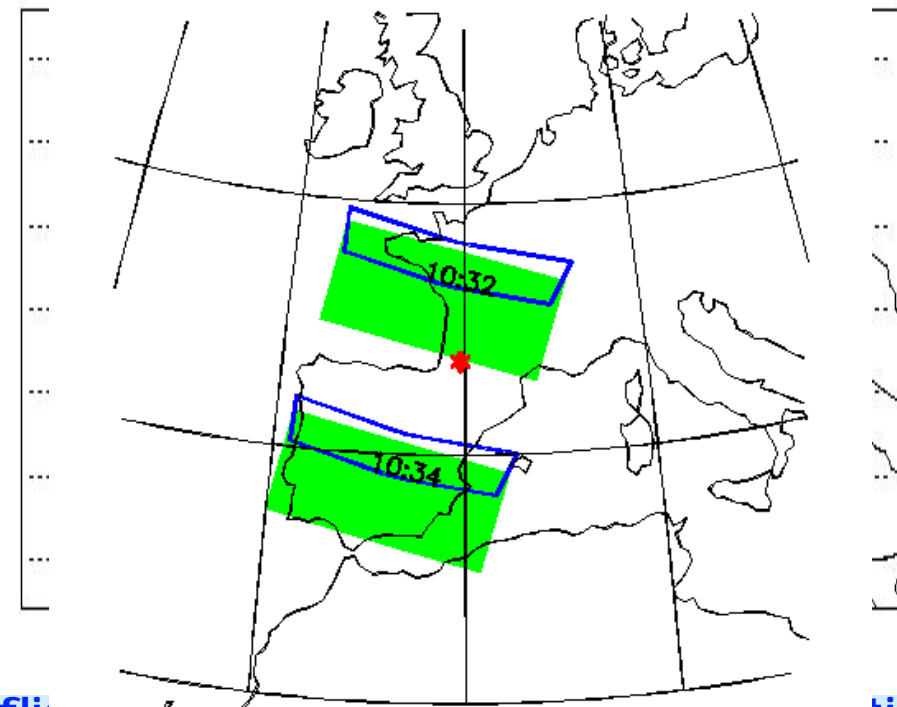


Balloon Flight on
24.9.2002

CO LOCATION
SCIAMACHY - LIMB

good co-location with
orbit 2968

SCIAMACHY overpasses on 24-SEP-2002



Back and Forward Trajectories started along flight

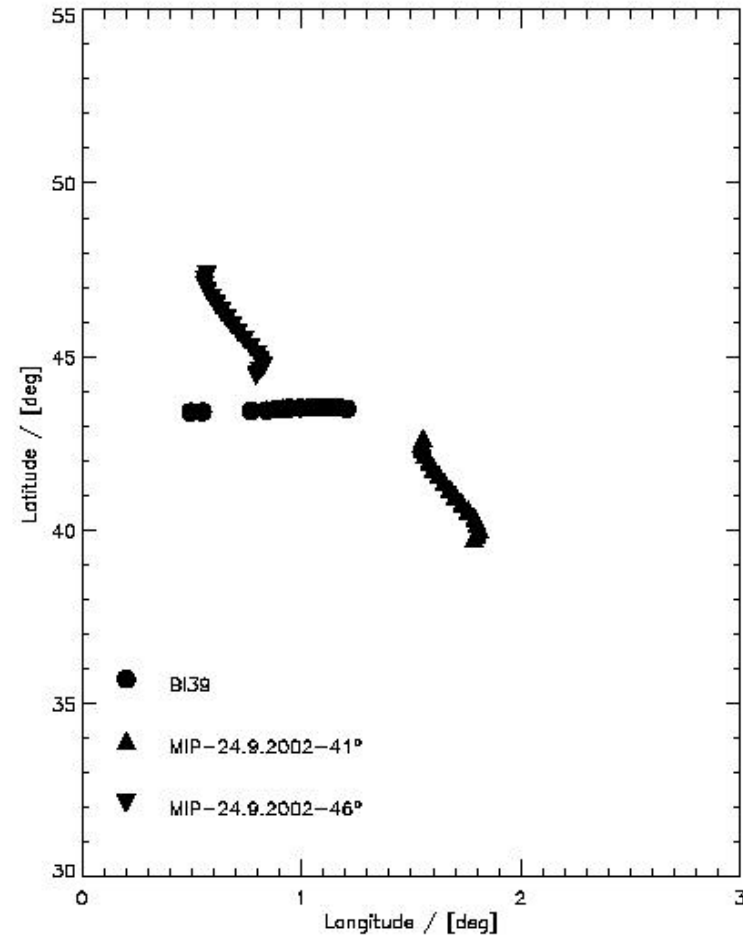
altitude



Balloon Flight on 24.9.2002

CO LOCATION
MIPAS - E
orbit 2975
12 hrs time delay

much better timely match
with orbit 2968





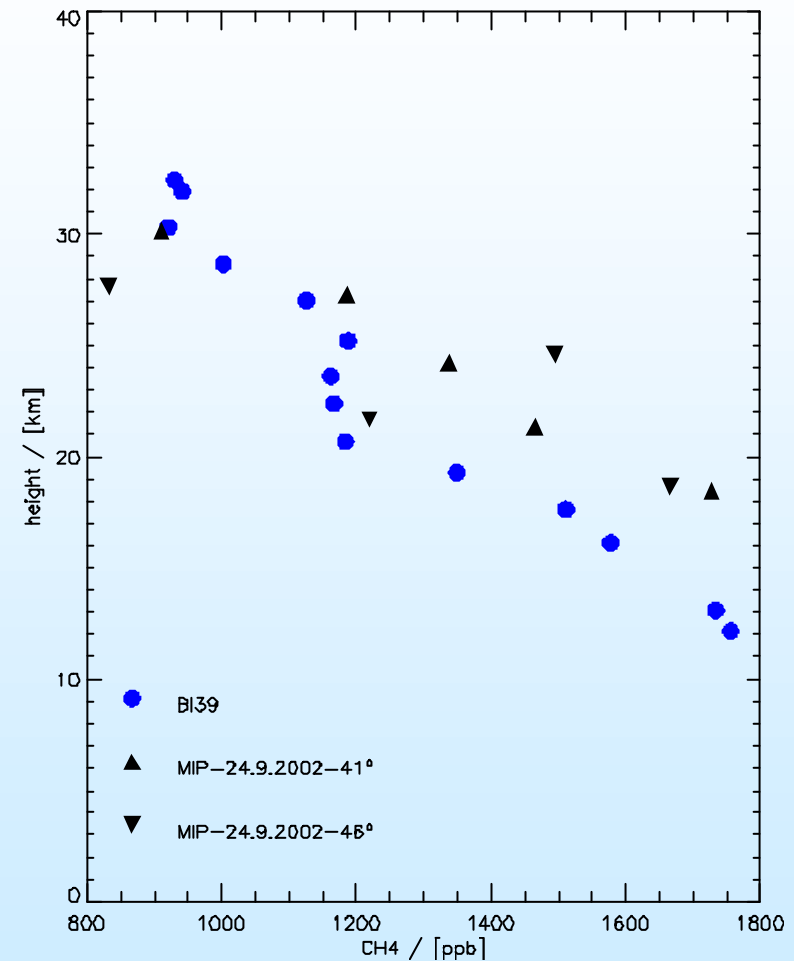
DATA INTERCOMPARISON:

24.9.2002

Methane

MIPAS: triangles
(orbit 2975)

TRIPLE (BONBON): dots





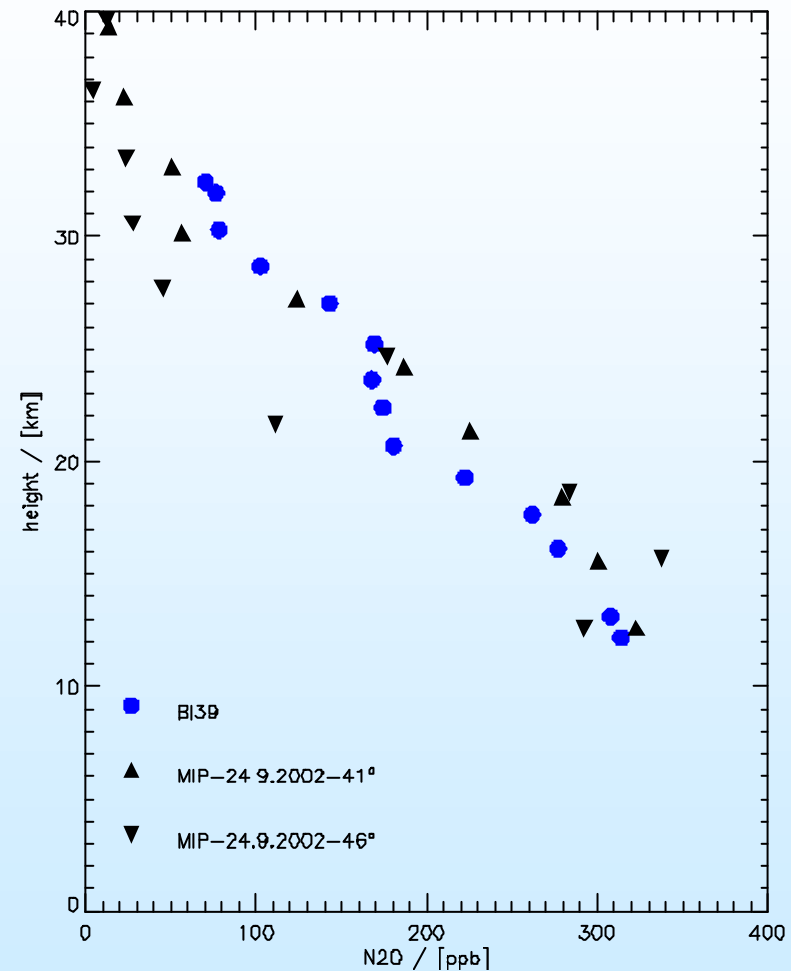
DATA INTERCOMPARISON:

24.9.2002

N_2O

MIPAS: triangles
(orbit 2975)

TRIPLE (BONBON): dots





TRIPLE Validation Flight on 6.3.2003

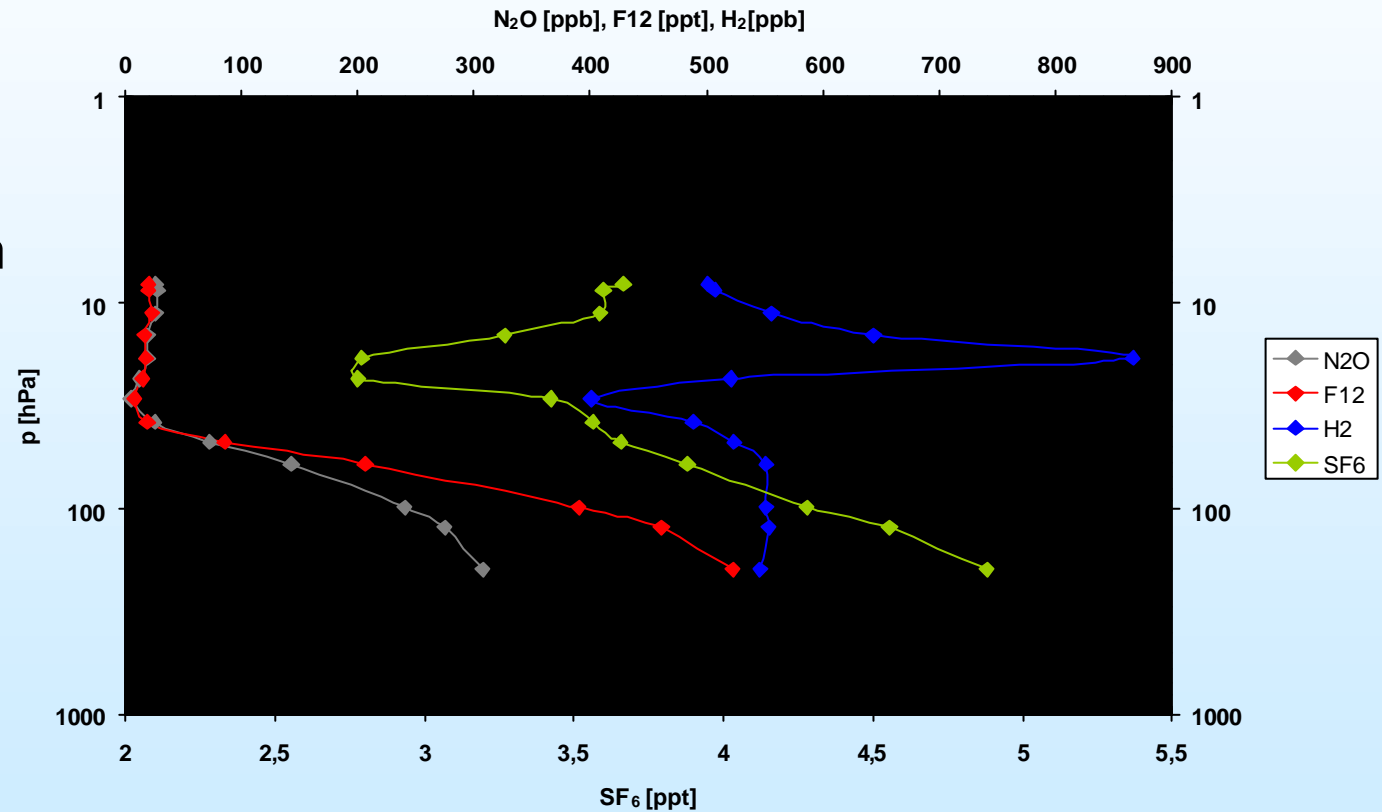
No Satellite
Data available

Good co-location with
MIPAS-E and SCIA

inside vortex
measurements

SF₆ loss

mesospheric air





Further Validation Activities

- ✍ Tropical validation flight envisaged for fall 2004
- ✍ Long-term validation to be determined.
- ✍ Validation time schedule depending on data availability
- ✍ intercomparisons to be enhanced by mapping (ongoing activity)
 - ✍ balloon trajectories have been transferred to FU Berlin
 - ✍ list of satellite matches (+/- 5 days) will be produced
- ✍ ongoing work in characterisation of representative response functions for GC/ECD system



Conclusions and Summary

Generally reasonable co-locations in time and space with SCIAMACHY and MIPAS-E for all three balloon flights.

No SCIAMACHY limb data available so far

MIPAS-E CH₄ and N₂O data show much larger scatter than the BONBON in situ observations.

MIPAS-E CH₄ profiles exhibit mostly a high bias (up to 30%) below 25 km compared to BONBON

MIPAS-E N₂O profiles show mostly reasonable (~15%) agreement with the in situ data, but exhibit a significant low bias compared to midlatitude BONBON data above 22km on Sept. 24, 2002.