

# **In-Situ Validation of the SCIAMACHY BrO Data Product**

Fred Stroh, Marc von Hobe,  
Serhiy Hrechanyy, and Ulf Winkler

ICG-I, Forschungszentrum Jülich GmbH,  
52425 Jülich, Germany

email: [f.stroh@fz-juelich.de](mailto:f.stroh@fz-juelich.de), phone: +49-2461-614307

# Relevance of Chlorine and Bromine Species in the Stratosphere

- Increase in stratospheric total chlorine is about to level and reverse soon while total bromine is still increasing. Effect of short lived Cl compounds on UT/LS region is not clear.
- Major part of the anthropogenic stratospheric ozone loss is attributed to the catalytic action of chlorine and bromine radicals. ClO and BrO are a direct measure of the halogen based ozone destruction potential in a given air mass.
- Validation of respective satellite measurements by independent techniques is crucial to reliably measure and monitor the development of the stratospheric abundances of these species.

# Validation Strategies

## TRIPLE Balloon Payload



- Validation of vertical profiles of BrO
- Altitude coverage: 15 - 35km

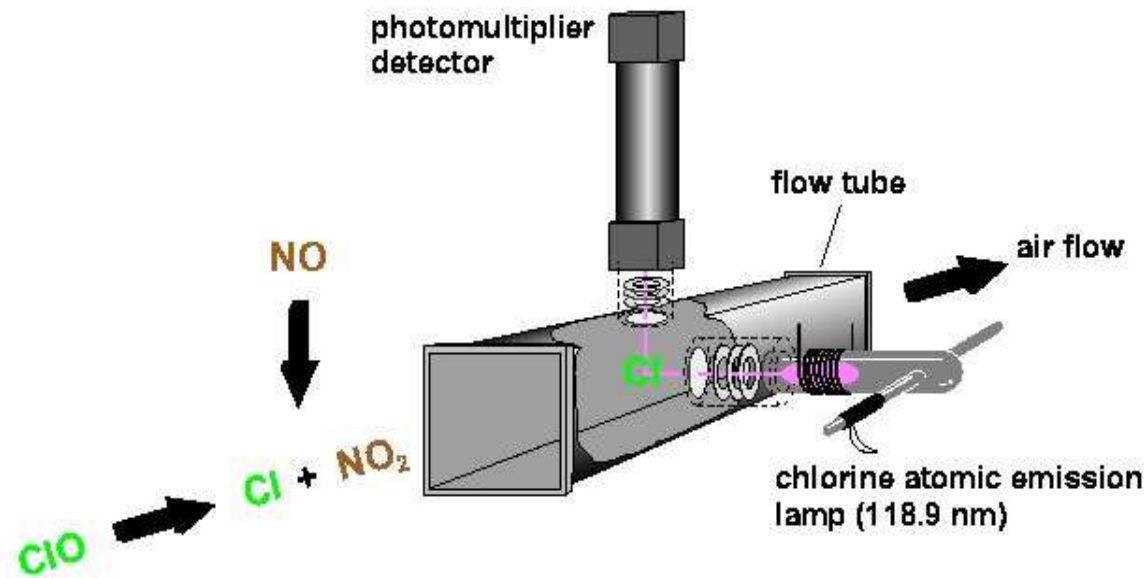
## M55-Geophysica Aircraft



- Validation of horizontal gradients and vertical profiles of BrO
- Altitude coverage: 15 – 20km
- Horizontal coverage: 1500km

# Measurement Technique

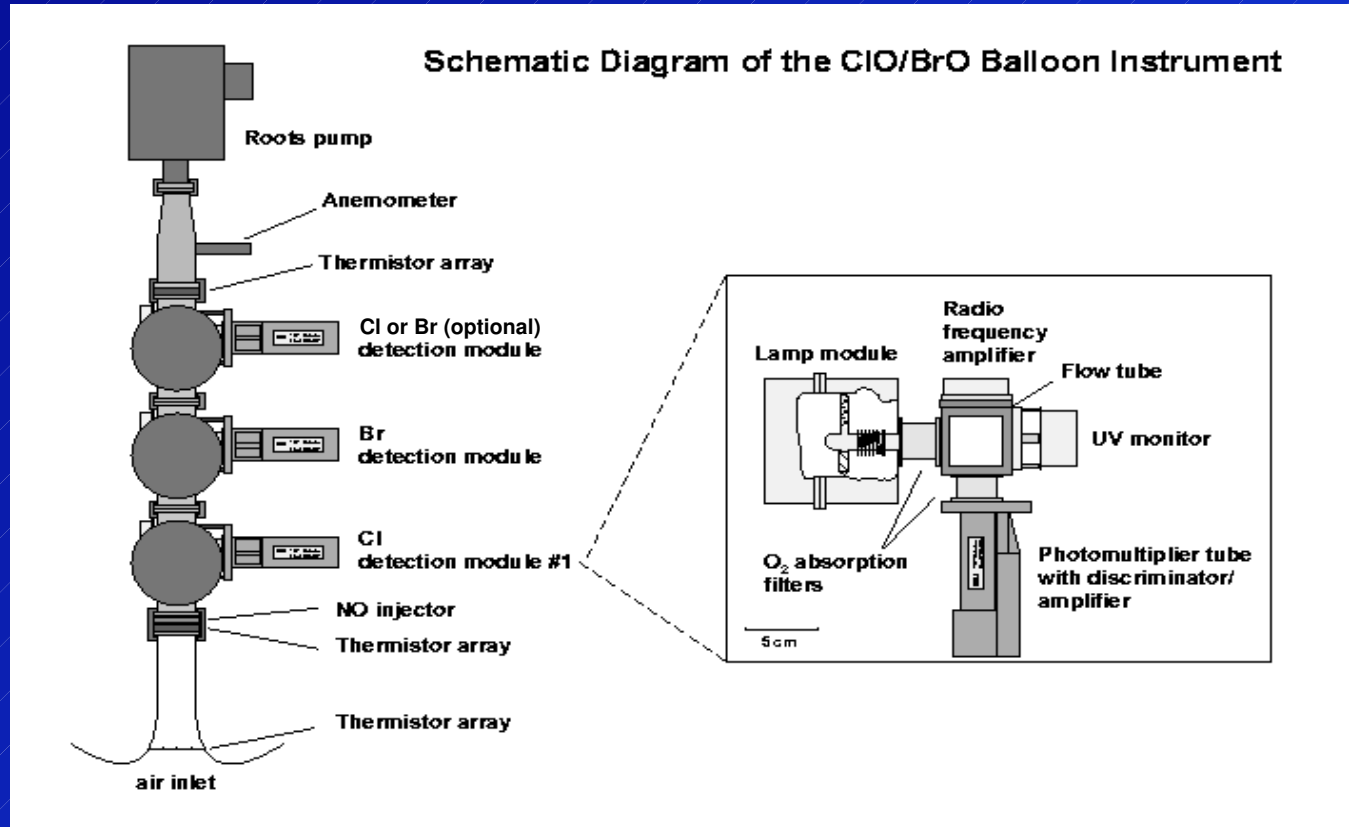
## Chemical Conversion Resonance Fluorescence (CCRF) Technique



Brune et al., JGR 94, 1989

BrO: Accuracy ca. 35%, Precision up to 10%  
Altitude range 15-35km

# The ClO/BrO Balloon Instrument on the TRIIPLE Payload

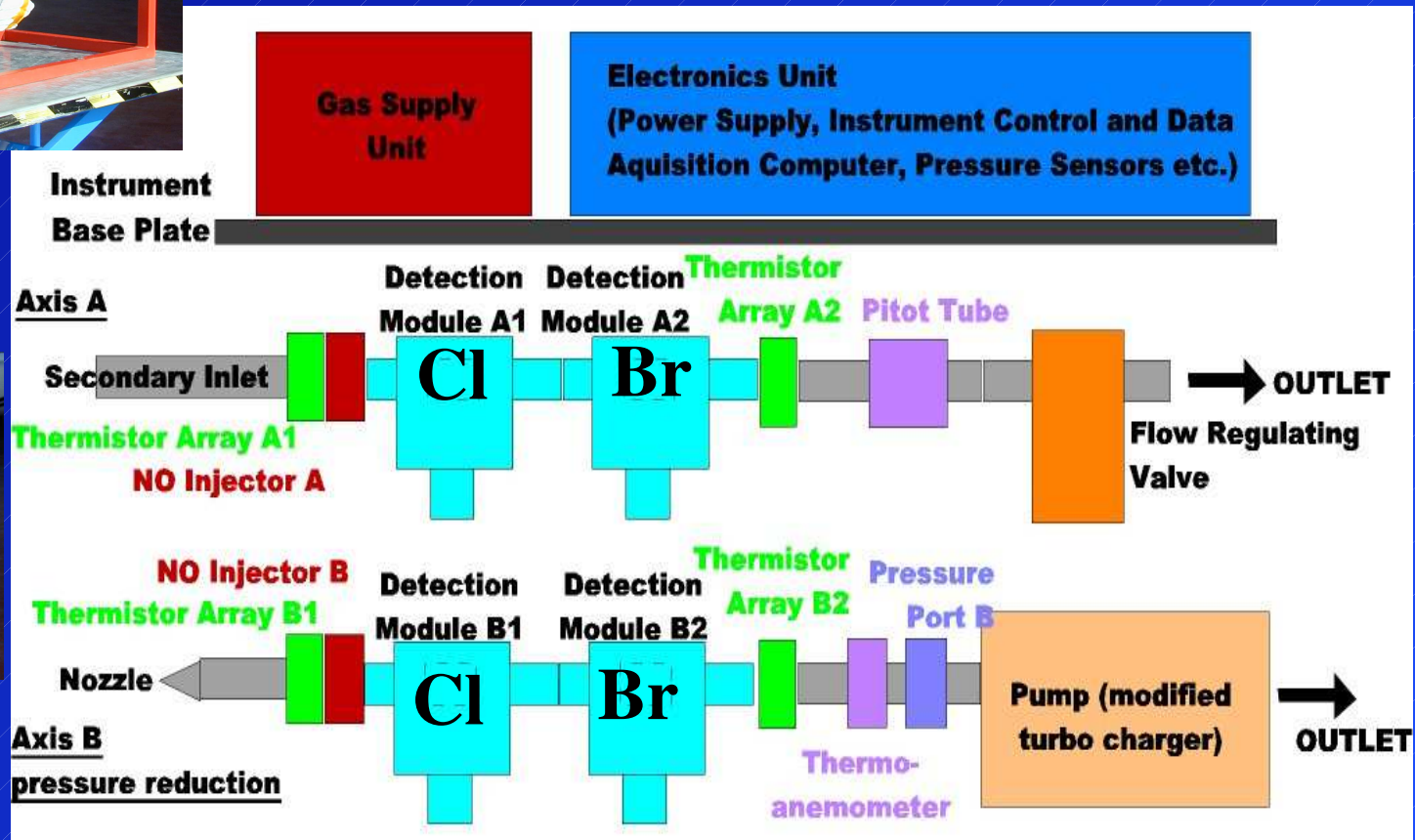
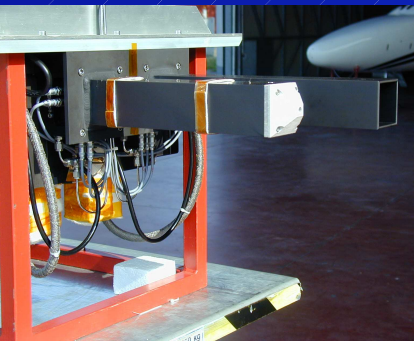
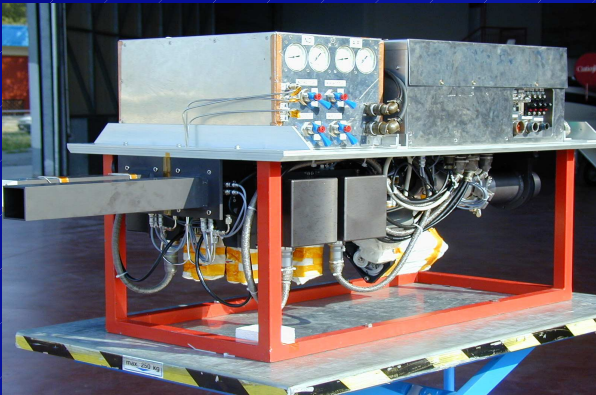


Single duct measurement in the configuration  
Cl – Br – Br



# The HALOX Instrument onboard M55-Geophysica

Simultaneous measurement in two parallel measurement ducts yields two independent Cl and Br measurements.

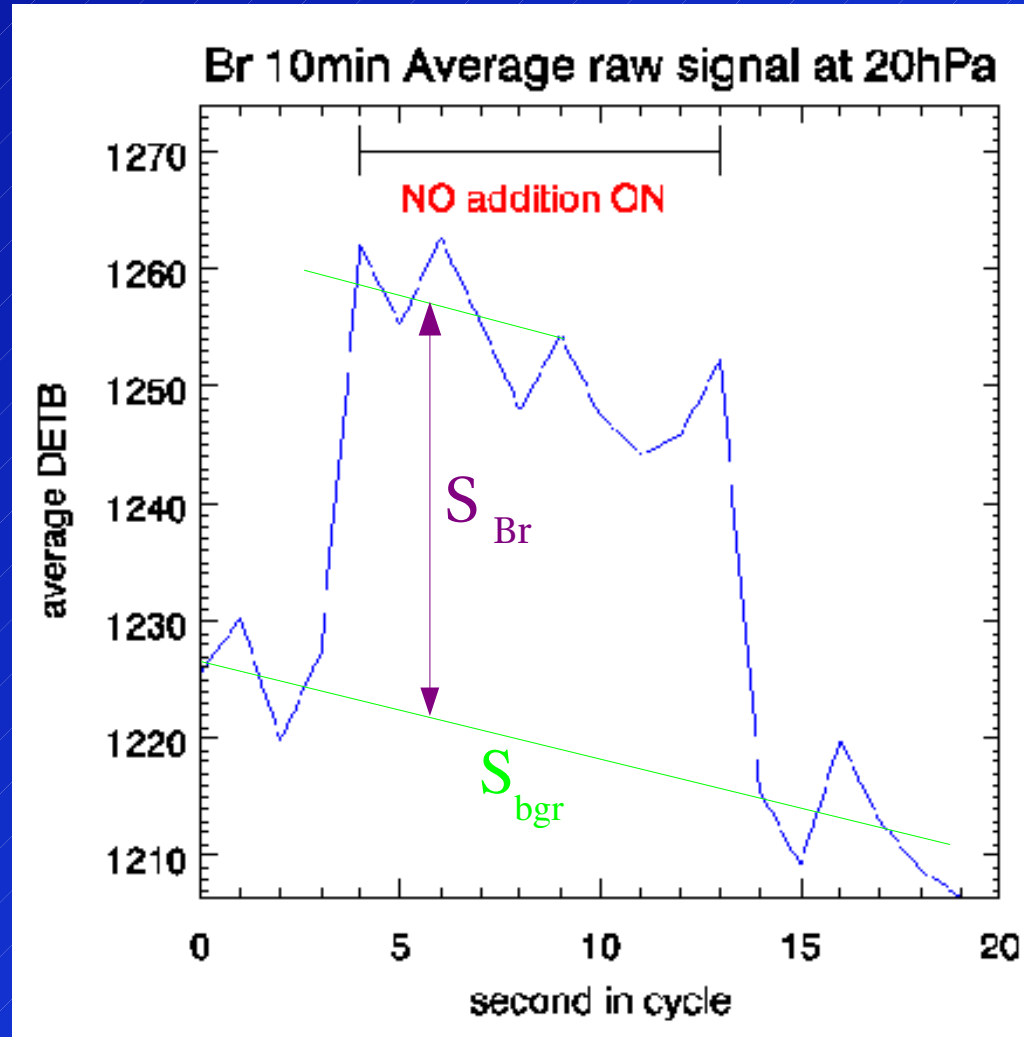


# CCRF Br Measurement Raw Signal

Kiruna 09.03.2003

$$[\text{Br}] = S_{\text{Br}} / (K * S_{\text{bgr}})$$

(tilt results from increasing pressure)



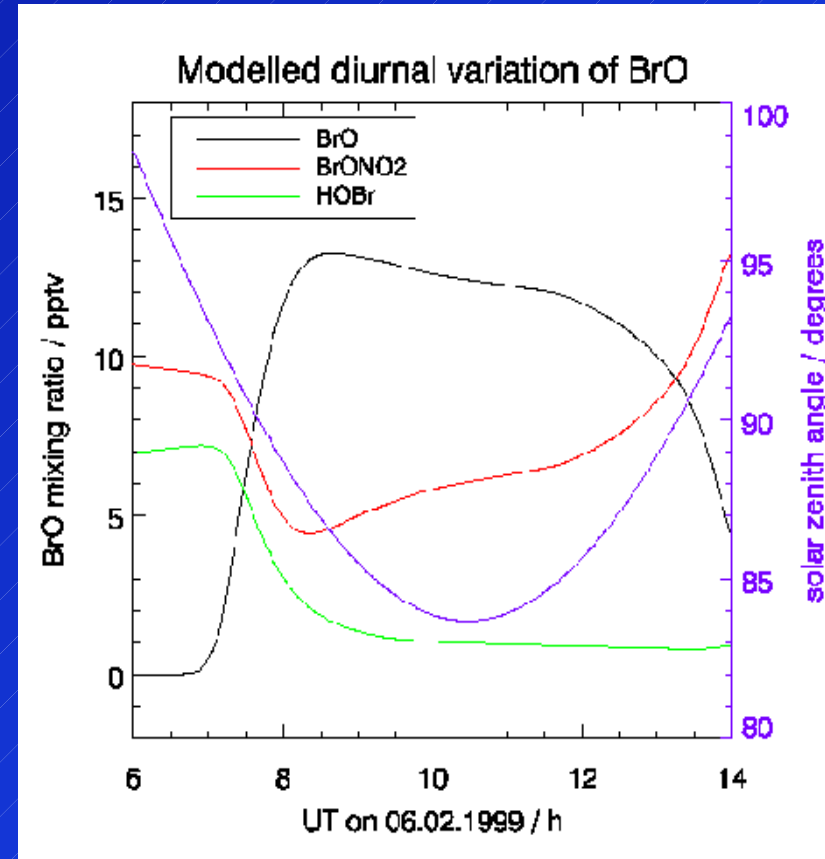
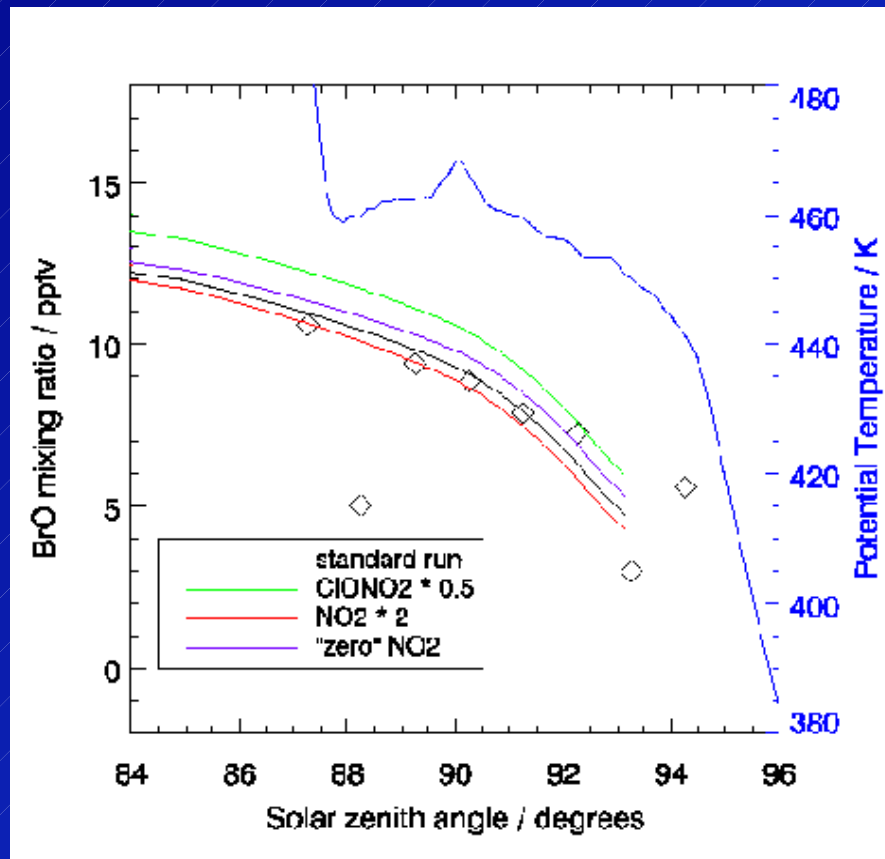
# TRIPLE CCRF BrO Measurement Specifications

- Altitude Range: 15 – 35 km (100 -5 hPa)
- Accuracy: 35%
  - $S_{Br}$ , Br difference counts: 20-30%
  - K, Calibration factor normalized to background scatter: 20% (Cl: ca. 15%)
  - $S_{bgr}$ , Background in flight: 5%
  - Conversion Kinetics: 10%



# Diurnal Variation of BrO in the Stratosphere

Model study based on Kiruna flight of 06. Feb. 1999  
(„mid-latitude conditions“)



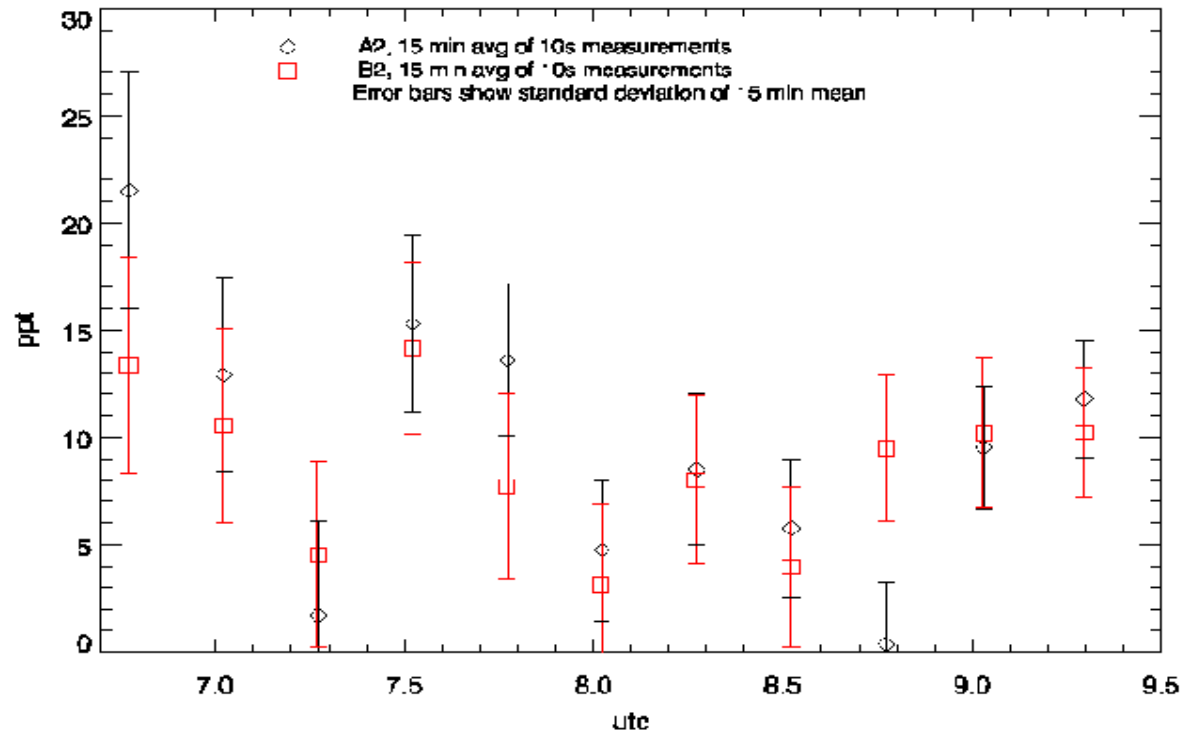
However, detailed SCIA intercomparisons need photochemical modelling!

# Validation Measurements to Date

- Balloon:
  - 24.09.2002 Aire sur l'Adour, France
  - 06.03.2003 Kiruna, Sweden
  - 09.06.2003 Kiruna, Sweden
- M55-Geophysica
  - 4 Test Flights in July 2002 from Forli (Italy)
  - 7 Flights in October 2002 from Forli (Italy)
  - 15 Flights in January/February/March from Kiruna (EU-Project EUPLEX and ENVISAT-Validation)

# HALOX BrO Time Series Measurements

M55-Geophysica Flight on 16.03.2003

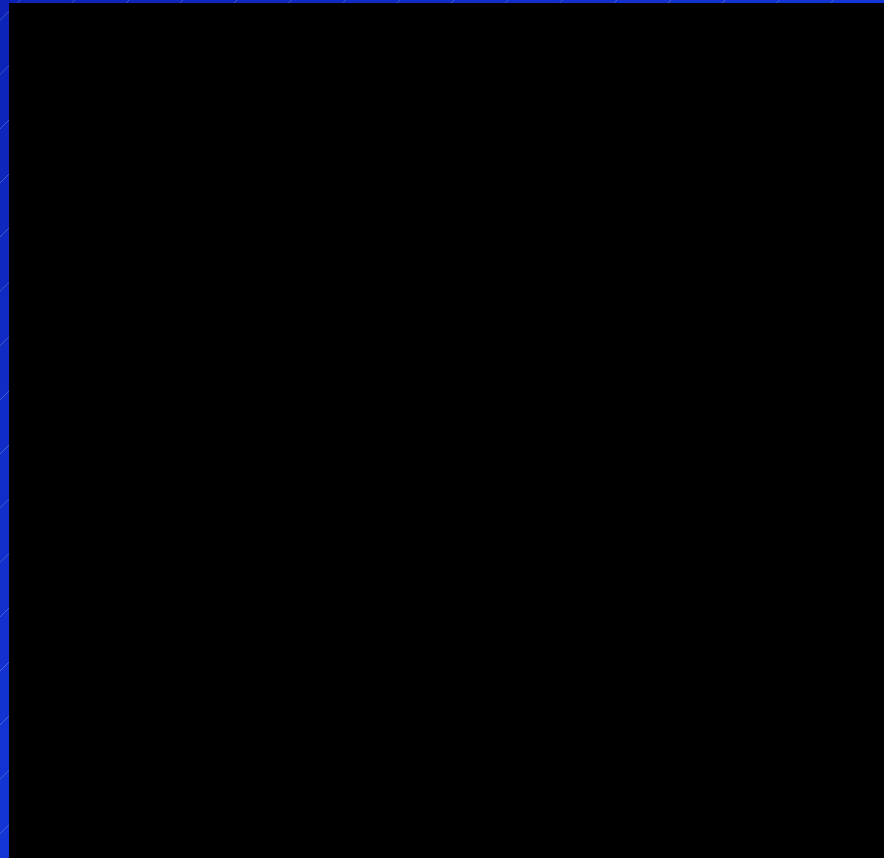
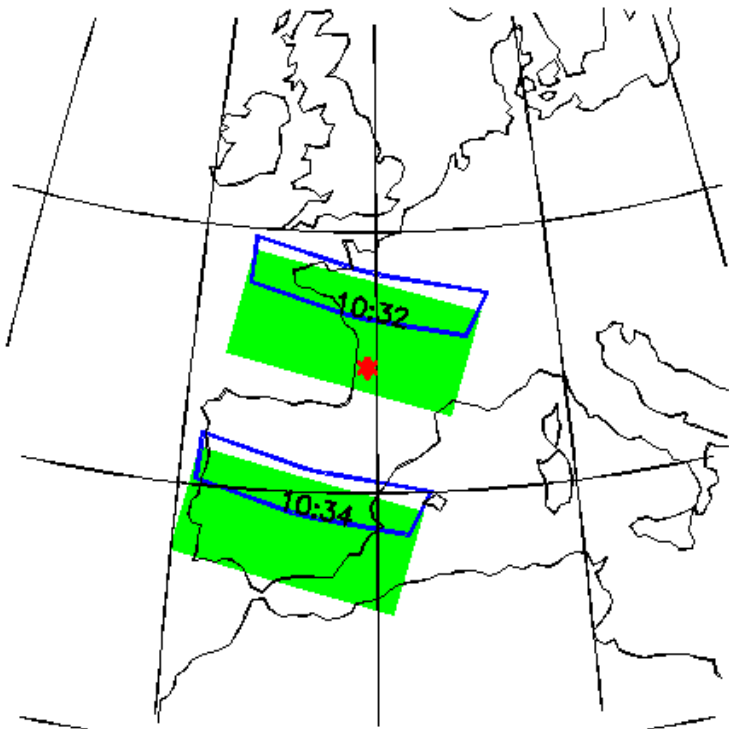


--> Good overall agreement of two independent detection modules

# TRIPLE Profile Measurements at Mid-Latitudes

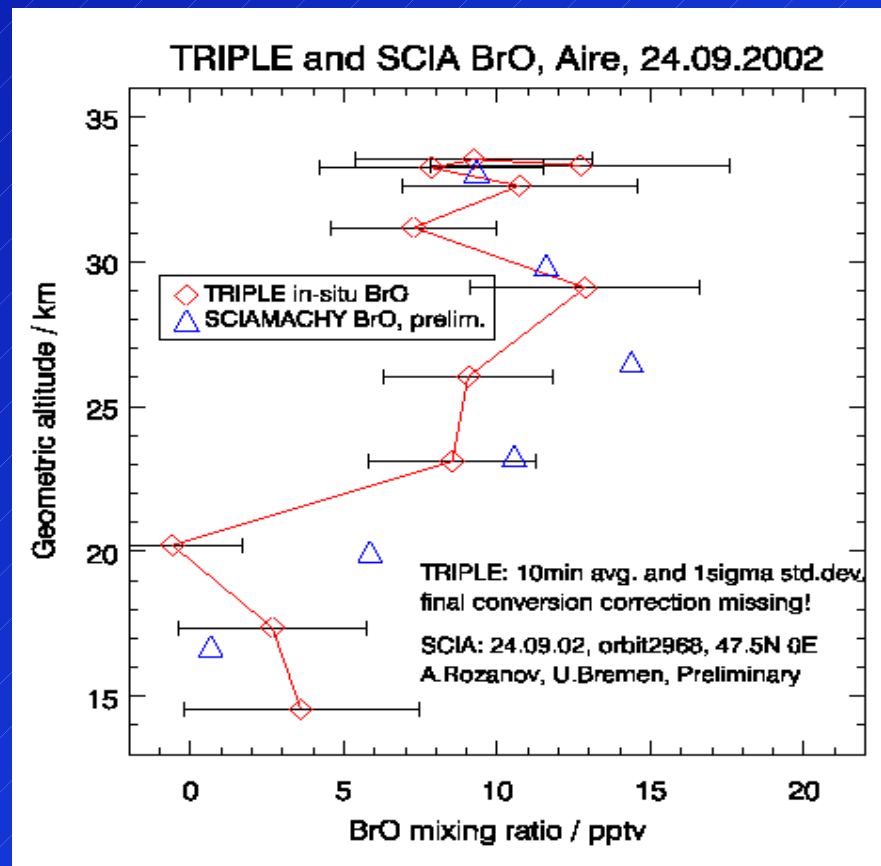
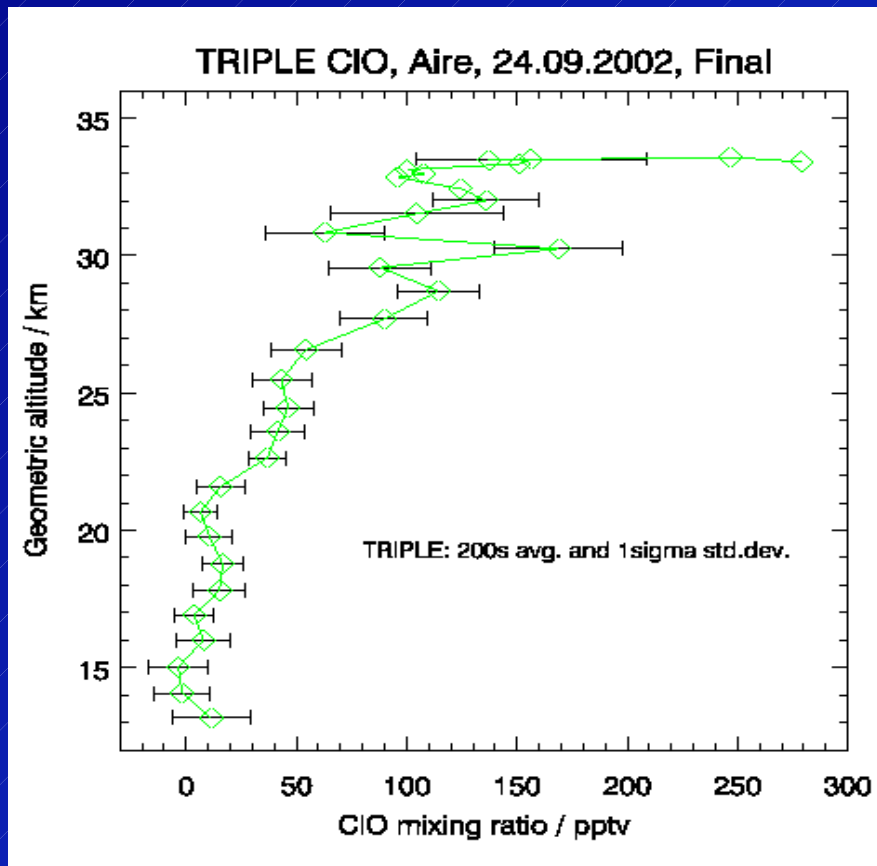
Aire sur l'Adour, France, 24.09.2002, Orbit 2968

SCIAMACHY overpasses on 24-SEP-2002



# TRIPLE Profile Measurements at Mid-Latitudes

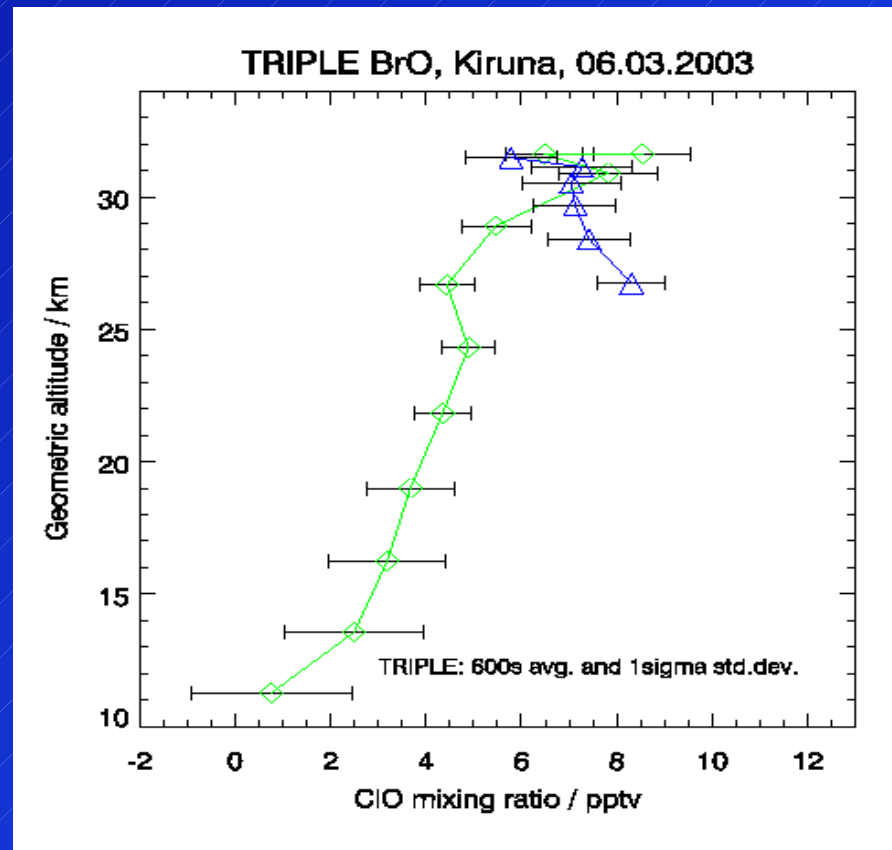
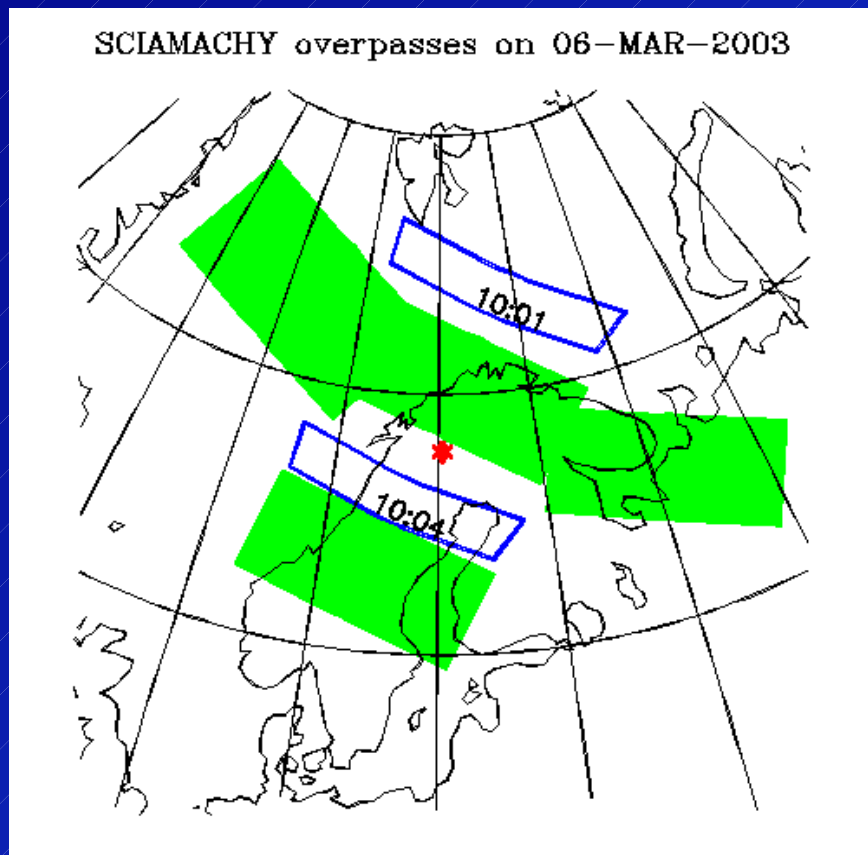
Aire sur l'Adour, France, 24.09.2002, Orbit 2968



--> ODIN validation

# TRIPLE Profile Measurements in the Arctic Winter Stratosphere

Kiruna 06.03.2003, Orbit 5301

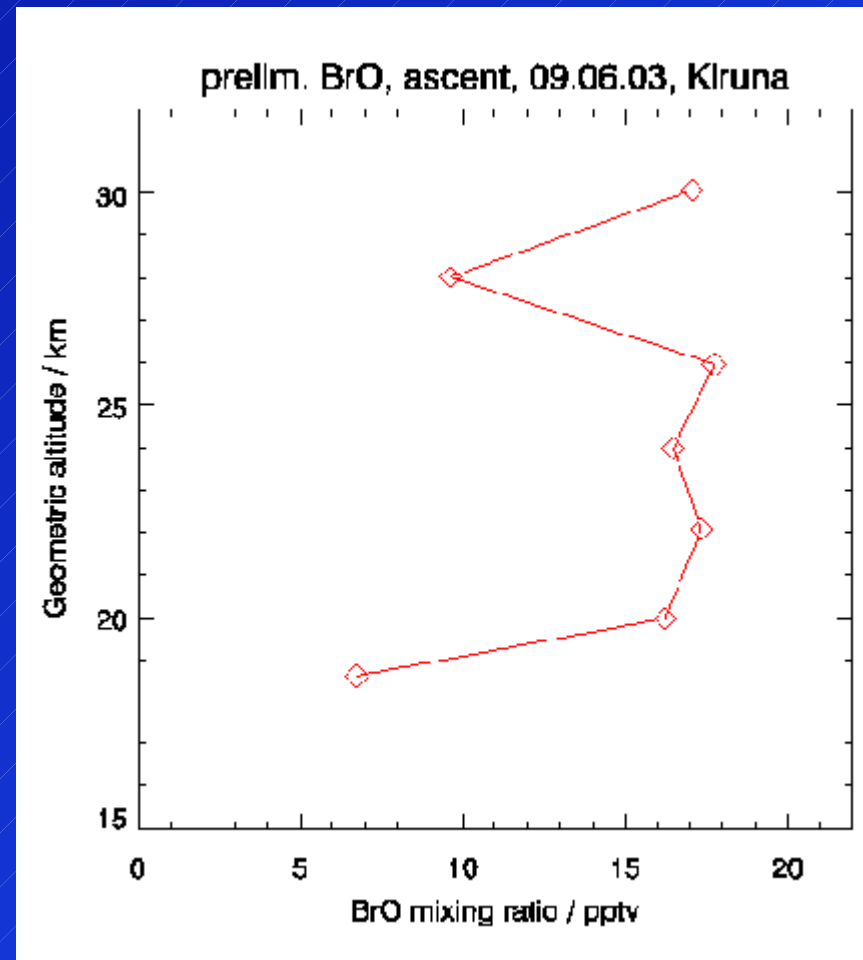
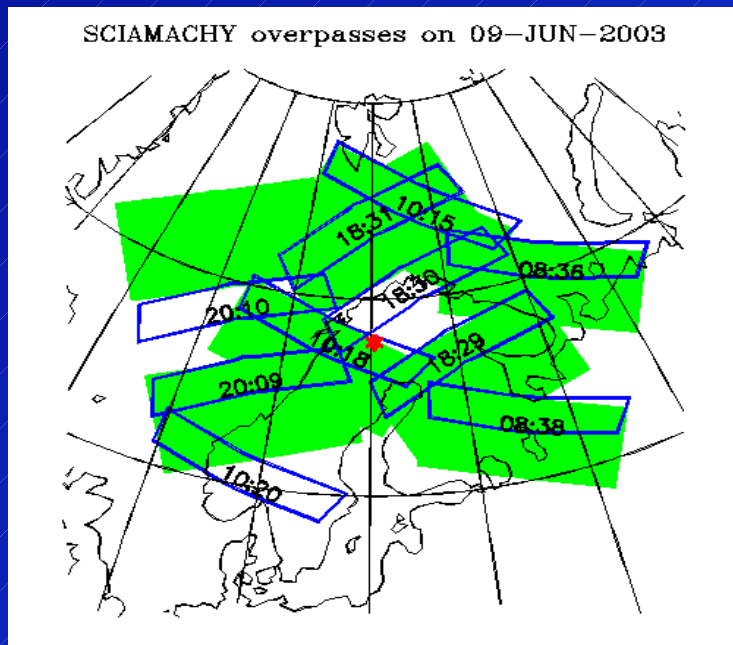


Calibration still uncertain, final profile in 2 months



# TRIPLE BrO Measurement in the Arctic Summer Stratosphere

- Kiruna 09. June 2003
- Very preliminary!
- Great SCIA Match



# Summary

- Wealth of BrO in-situ data – vertical profiles and horizontal distributions - available for validation of ENVISAT-SCIAMACHY BrO retrievals.
- Preliminary BrO profile intercomparisons for mid-latitudes in Sept. 2002 look promising.
- TRIPLE BrO measurements from March and June in Kiruna yet to be finalized.
- Effect of BrO photochemistry (diurnal variation) and (back) trajectory studies have been started.
- This can also yield values for consistency checks of SCIA-OCIO

# Upcoming Activities

- **January-March 2004:** M55-Geophysica campaign to investigate tropical convection and clouds (TROCCINOX) plus ENVISAT validation component.
- **Spring 2004 (?):** TRIPLE balloon flight within ILAS validation (Kiruna).
- **2004(?):** TRIPLE balloon flight in the frame of the ENVISAT tropical validation (Terressina, Brazil).
- **2005(?):** TRIPLE balloon flight at mid-latitudes (Aire-sur-l'Adour, Gap).
- **2005(?):** M55-Geophysica campaign to investigate tropical convection etc. (tbd.).