SAUNA

Sodankylä Total Column Ozone Intercomparison

Bojan R. Bojkov

GEST/NASA GSFC

SAUNA campaign

- Organized by NASA, FMI and ESA
- Hosted by the Finnish Meteorological Institute Arctic Research Center at Sodankylä, Finland
- Boreal climate, Arctic atmosphere
- 30+ Scientists from 10 Institutions and 9 Countries:
  NASA-GSFC (USA), FMI-ARC (Finland), ESA-ESRIN (Italy), BIRA-IASB (Belgium), CNRS-SA (France), DWD-MOHp (Germany), INM-Izana (Spain), KNMI (Netherlands), MSC (Canada), NOAA-ESRL (USA)
- Funding/Sponsors:
  NASA-HQ, FMI, and ESA
  EOS-Aura Project Science Office
  National contributions from Canada, France and Spain

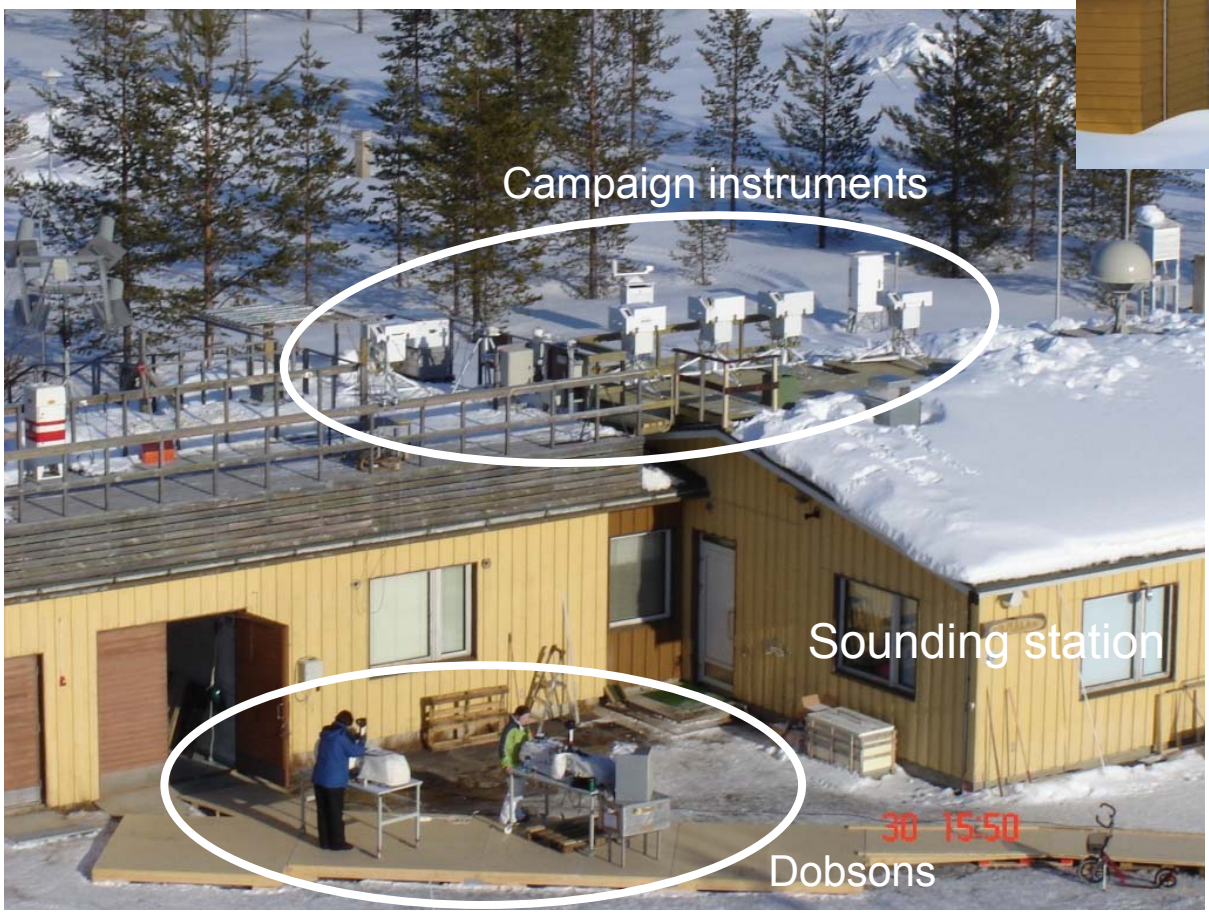
Driving issue:

- Why do total column ozone measurements from groundbased and satellite instruments and their respective retrieval algorithms continue to differ at mid and high latitudes, and where large solar zenith angles and high total ozone amounts are typical?

Campaign instruments

Instrument	Principal Investigator	Affiliation
Brewer (single monochromator at FMI-ARC)	*E. Kyrö*	*FMI-ARC (Finland)*
Brewer: 1 single (World standard), 1 double	*T. McElroy*	*MSC (Canada)*
Brewer: double	*A. Cede/R. McPeters*	*NASA GSFC (USA)*
Brewer: 1 double (European Standard)	*A. Redondas/E. Cuevas*	*INM-Izaña (Spain)*
Dobson (Traveling standard)	*R. Evans*	*NOAA-ESRL/GMD (USA)*
Dobson (European standard)	*U. Koehler*	*DWD-MOHp (Germany)*
DOASs: 1 UV, 1 vis, 1 miniDOAS	*M. van Roozendael*	*BIRA-IASB (Belgium)*
miniDOAS	*E. Brinksma*	*KNMI (Netherlands)*
SAOZ (permanently located at FMI-ARC)	*F. Goutail*	*CNRS-SA (France)*
STROZ-Lite LIDAR (NDSC standard)	*T. McGee*	*NASA-GSFC (USA)*
Ozonesondes	*R. Kivi* *B.R. Bojkov* *E. Brinksma*	*FMI-ARC (Finland)* *NASA-GSFC (USA)* *KNMI (Netherlands)*

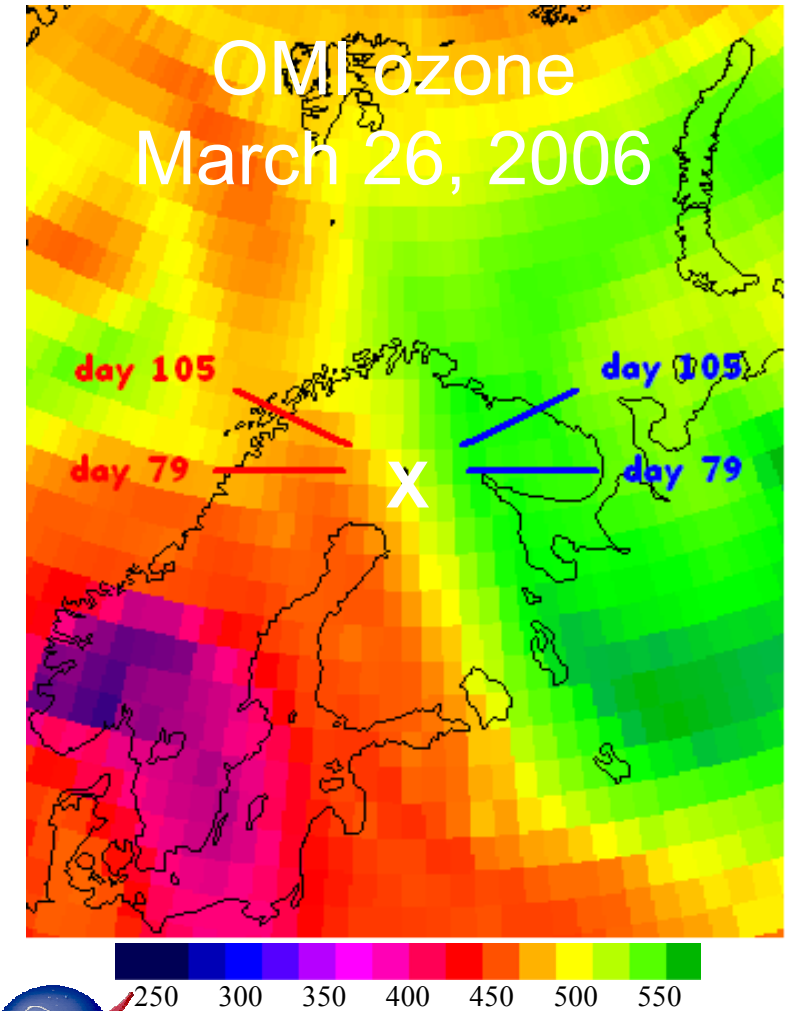
FMI-ARC facilities during SAUNA



Bojan.Bojkov@gsfc.nasa.gov

http://fmiarc.fmi.fi/SAUNA/

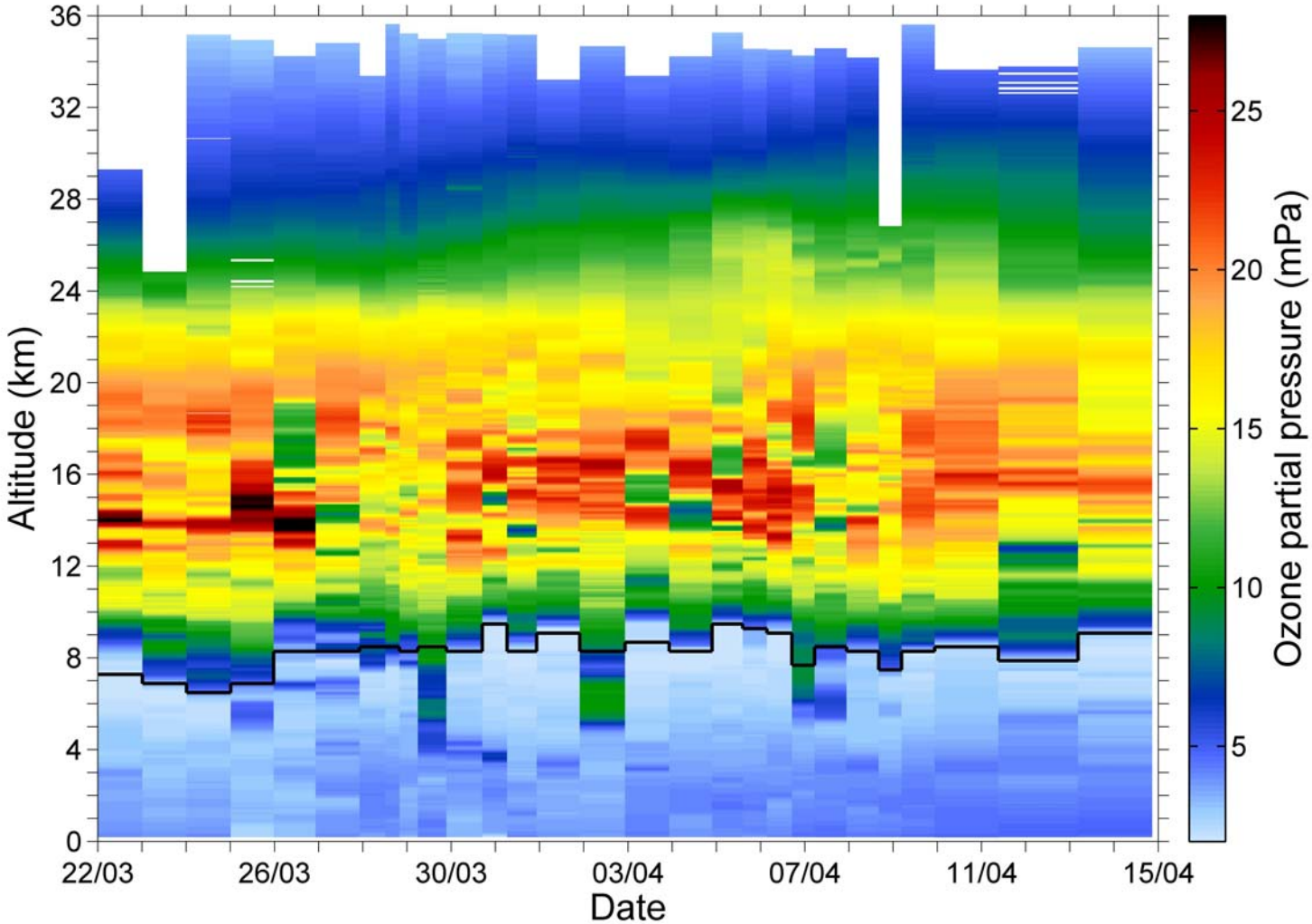
March 26-April 13, 2006



- March/April did provide:
  - » *Total ozone columns in the range 400DU to ~520DU*
  - » *High variability/strong gradients*
  - » *12-16 hour measurement days*
  - » *Minimum solar zenith angle of 65 degrees*
  - » *75% clear sky (12 of 18 good days!)*

- Up to 3 overpasses for swath instruments

Ozone layer variability



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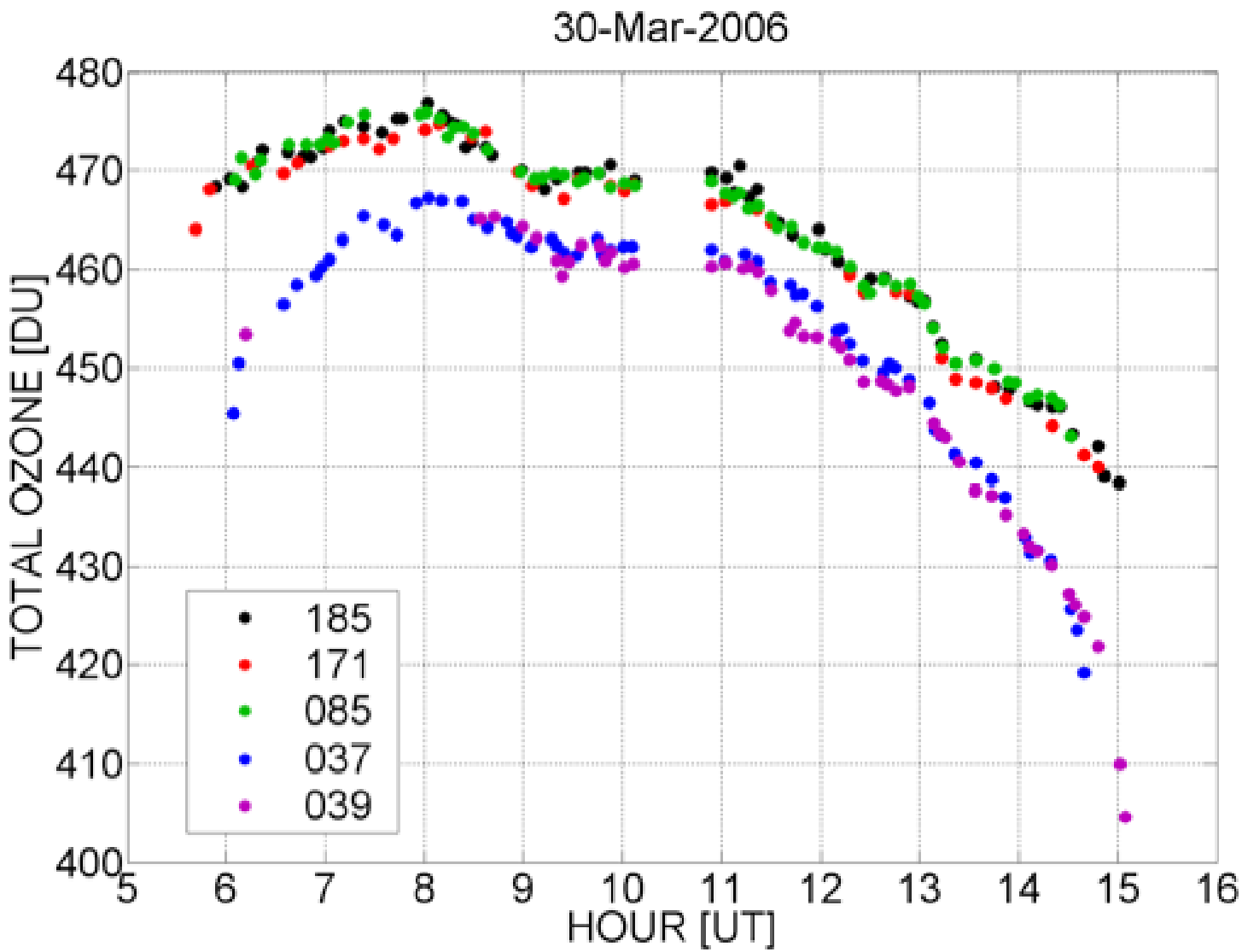
Brewers

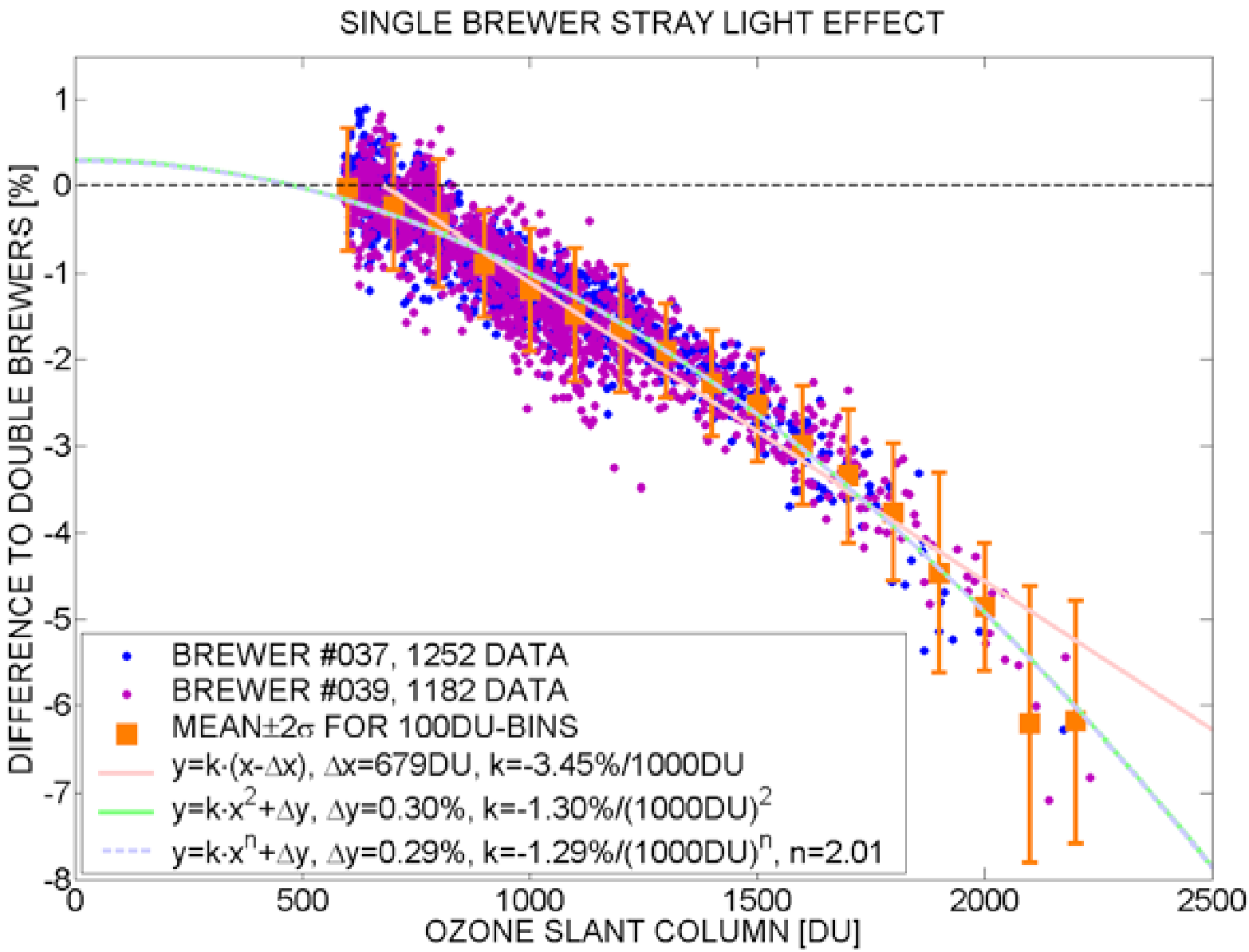
- ~100 coincident clear day 5 instrument measurements
  - » *Measurement range: 400-520DU*
  - » *Slant column range: 900-2200DU*
  - » *0.5% accuracy and 0.3% precision (combined dataset)*

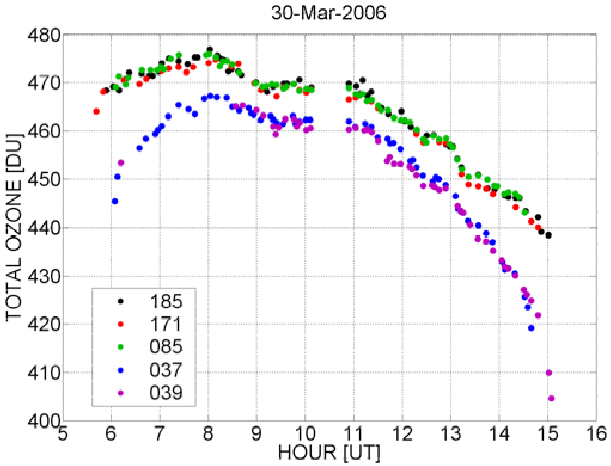
- Result: stray light corrections for single Brewers
  - » *Single shows ~1% error at 1000DU slant column and ~5% error at 2000DU*
  - » *Correction for measurements when slant column > 900DU*
  - » *Critical for satellite validation*

Photo: E. Brinksma, KNMI

Typical Brewer day during SAUNA

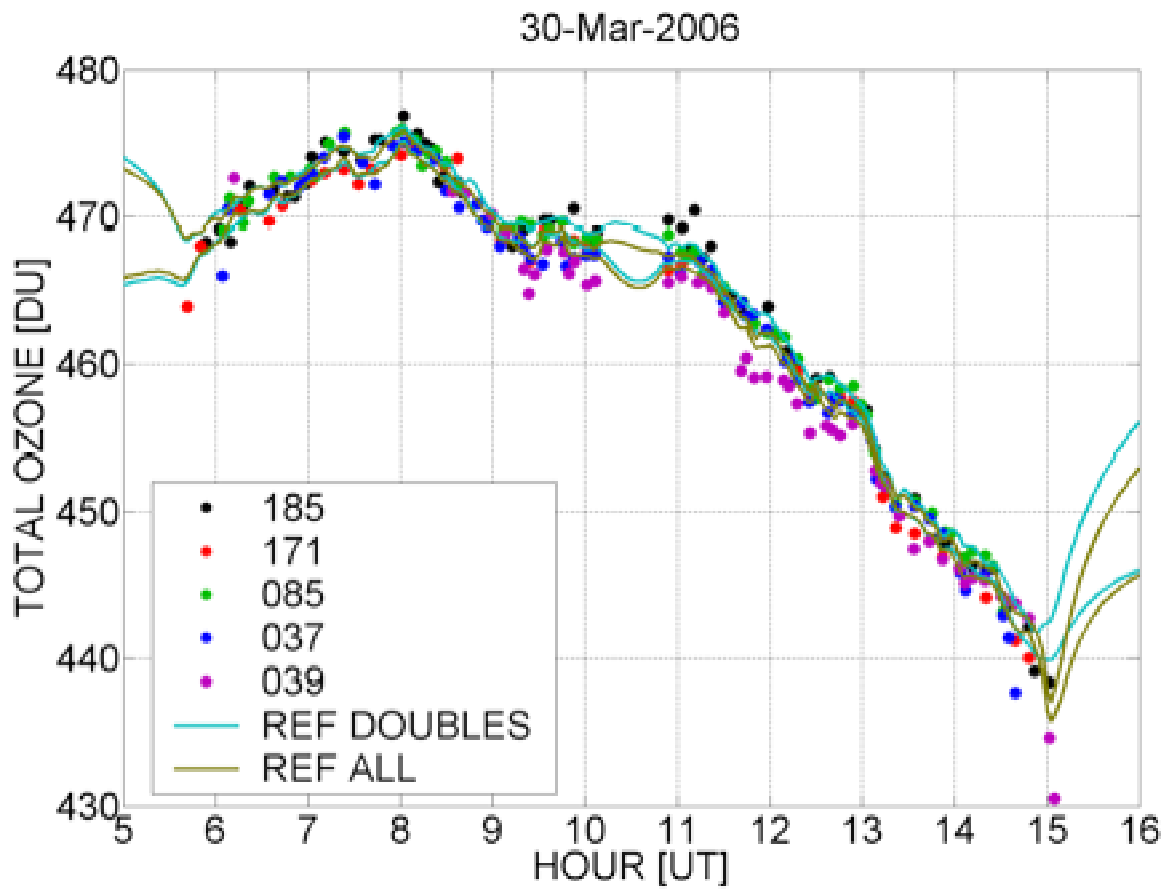



SINGLE BREWER STRAY LIGHT EFFECT
DIFFERENCE TO DOUBLE BREWERS [%]
OZONE SLANT COLUMN [DU]
1
0
-1
-2
-3
-4
-5
-6
-7
-8
0
500
1000
1500
2000
2500
BREWER #037, 1252 DATA
BREWER #039, 1182 DATA
MEAN±2σ FOR 100DU-BINS
y=k·(x-Δx), Δx=679DU, k=-3.45%/1000DU
y=k·x^2+Δy, Δy=0.30%, k=-1.30%/(1000DU)^2
y=k·x^n+Δy, Δy=0.29%, k=-1.29%/(1000DU)^n, n=2.01



"Measured" data

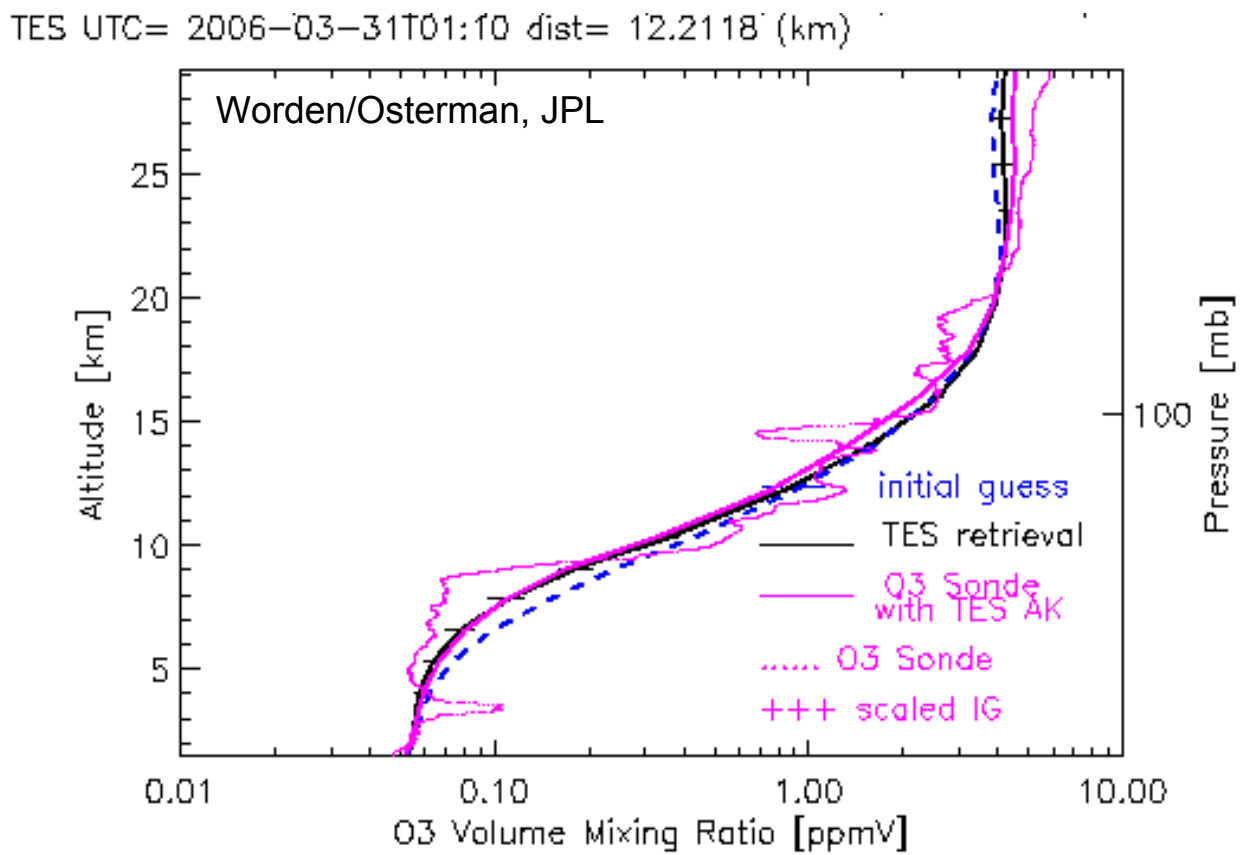
Stray-light corrected data



Bojan.Bojkov@gsfc.nasa.gov

Satellite profile comparisons

- Comparison to be performed with LIDAR and sonde data
- 4 AURA instr.
  - » *Focus on TES and HIRDLS*
- ENVISAT
  - » *GOMOS, MIPAS and Sciamachy*
- NOAA SBUV/2s



Conclusions

- Exceptional efforts and organization by all SAUNA teams, and in particular the local hosts at FMI-ARC
- Very interesting results
  - » *Single Brewer stray-light correction*
  - » *Good coincidence with Aura instruments*
- Continued investigations ongoing
- SAUNA workshop at Tenerife (November 2006)

Participants, Contributors and Co-authors

- NASA GSFC
  - » *B. Bojkov, R. McPeters, A. Cede, D. Haffner, J. Herman, T. McGee, D. Silbert, G. Sumnicht, M. Yan*
- FMI
  - » *E. Kyro, R. Kivi, O. Aulamo, P. Heikkinen, J. Kahru, T. Koskela*
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  - » *C. Zehner*
- BIRA-IASB
  - » *M. van Roozendael, C. Fayt, C. Hermanns, J.-C. Lambert, G. Pinnardi*
- CNRS-SA
  - » *F. Goutail, D. Ionov*
- DWD-MOHp
  - » *U. Koehler, B. Hassler*
- INM-Izana
  - » *A. Redondas, E. Cuevas, C. Guirado, C. Torres*
- KNMI
  - » *E. Brinksma*
- MSC
  - » *T. McElroy, V. Savastiouk, D. Tarasick*
- NASA-JPL
  - » *G. Ostermann*
- NOAA ERL GMD
  - » *R. Evans, B. Walsh*

Photo: F. Goutail