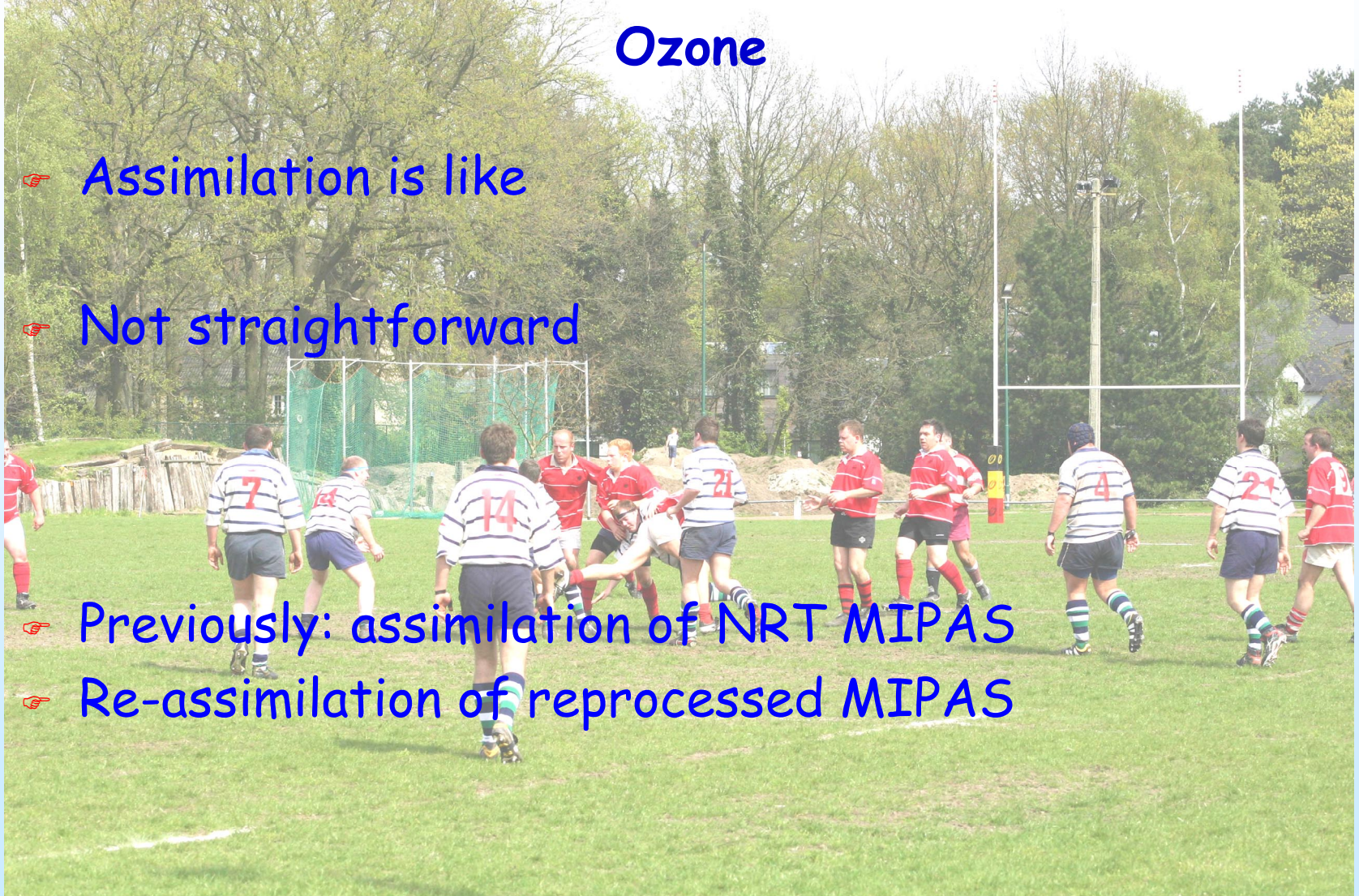


**MIPAS ozone  
ACVT MA  
D. Fonteyn  
BIRA - IASB**

**K. Wargan, GMAO,  
A. Dethof, ECMWF,  
W. Lahoz, A. Geer DARC**

## Ozone

- ➔ Assimilation is like
- ➔ Not straightforward
- ➔ Previously: assimilation of NRT MIPAS
- ➔ Re-assimilation of reprocessed MIPAS



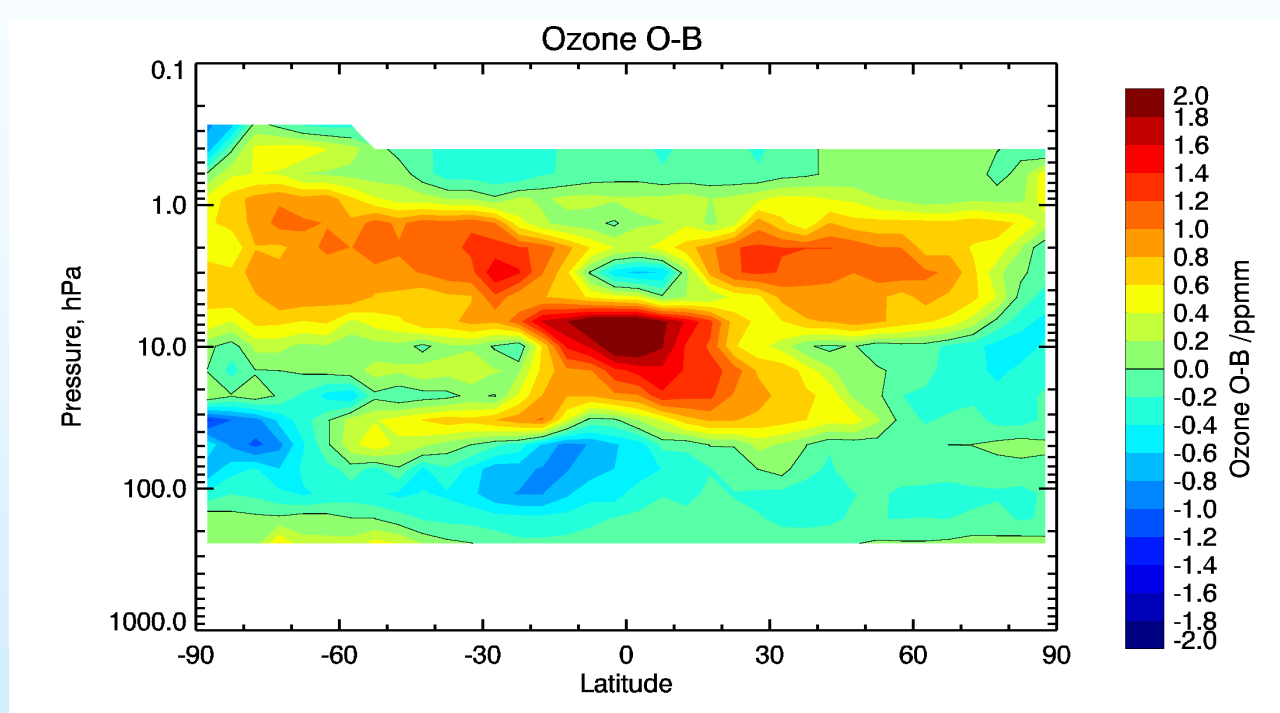
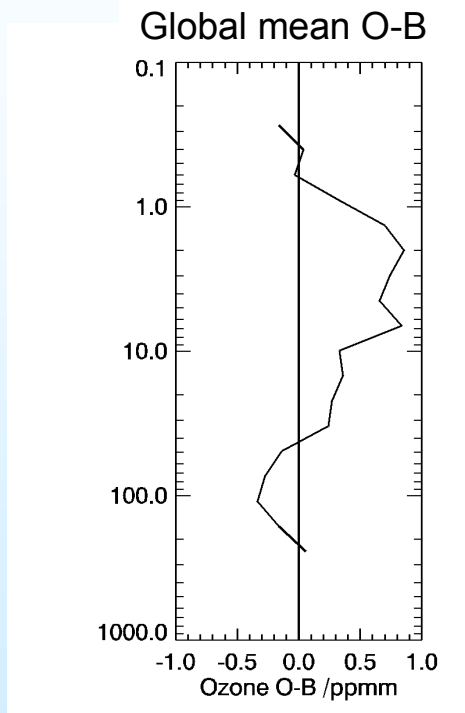
## Ozone

- ECMWF: GCM (our Ground Segment failed, [summary here](#))
- DARC: GCM (UM Met. Office) reprocessed
- GMAO: GCM reprocessed
- BASCOE: 4D - VAR around 3D - CTM (57 species), NRT

## Ozone, summary

- Assimilation of reprocessed MIPAS: Sept. 12 - 28, 2002 in addition to SBUV data for ozone
- Key findings:
  - Ozone profiles: better agreement with ozone sondes
  - Total column ozone: better agreement with TOMS
  - Better agreement with similar experiment (GOME RAL ozone profiles)
  - Better quality than NRT
  - Fewer signs of cloud contamination

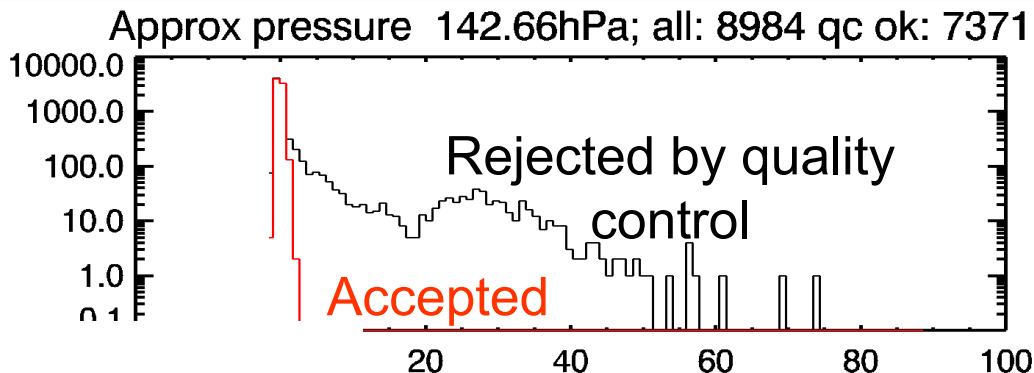
## O-B statistics for MIPAS L2 ozone - DARC analyses, 12-17th September 2002



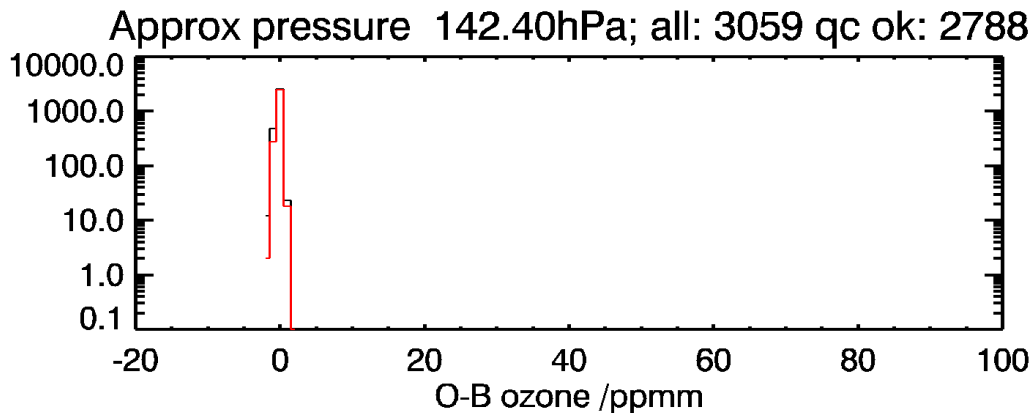
- MIPAS ozone typically well within +/-2 ppmm of the background forecast
- Obvious features in upper stratosphere between 15°S and 15°N are explainable by UM problems (too fast vertical transport of ozone)
- Further work needed to interpret other features

Cloud clearing improvement near tropopause (corresponding approximately to 15km MIPAS retrieval level)

Original NRT data



Reprocessed Cal/Val data

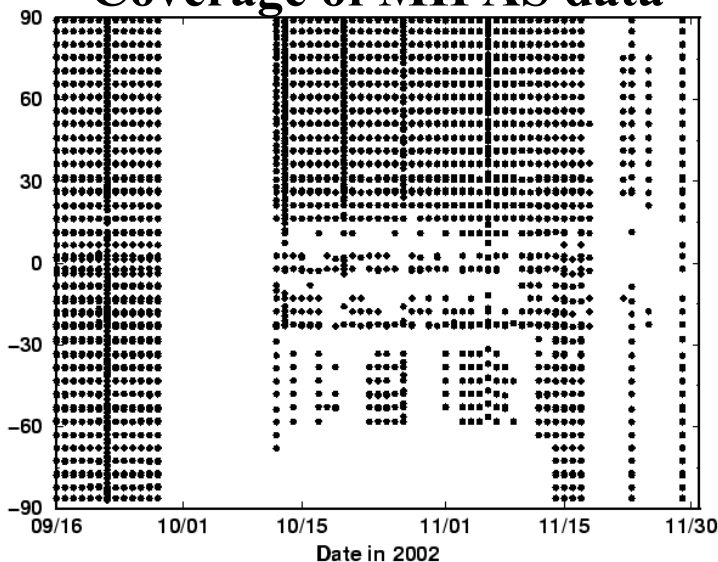


...but note that extended retrievals at levels 12km and below do show some signs of possible cloud contamination.

## Assimilation:

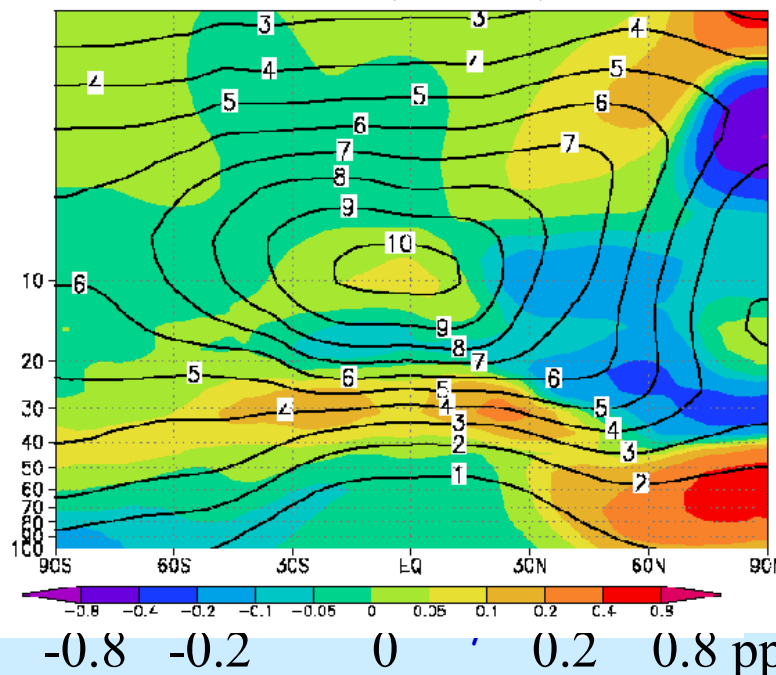
- On-line ozone transport within GEOS-4 GCM.
- Tropospheric chemistry: production and loss rates from GEOS-CHEM
- “Cold tracer” scheme
- SBUV/2 total & partial columns assimilated

### Coverage of MIPAS data



## Impact of inserting MIPAS stratospheric profiles (13 levels from 100 – 0.1 hPa) into assimilation:

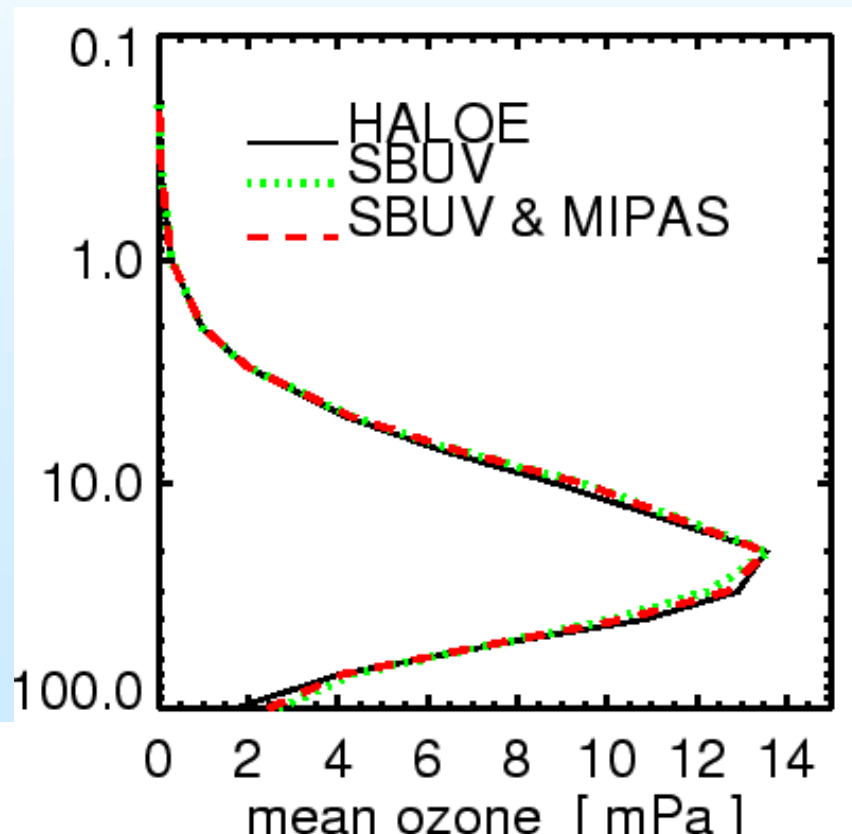
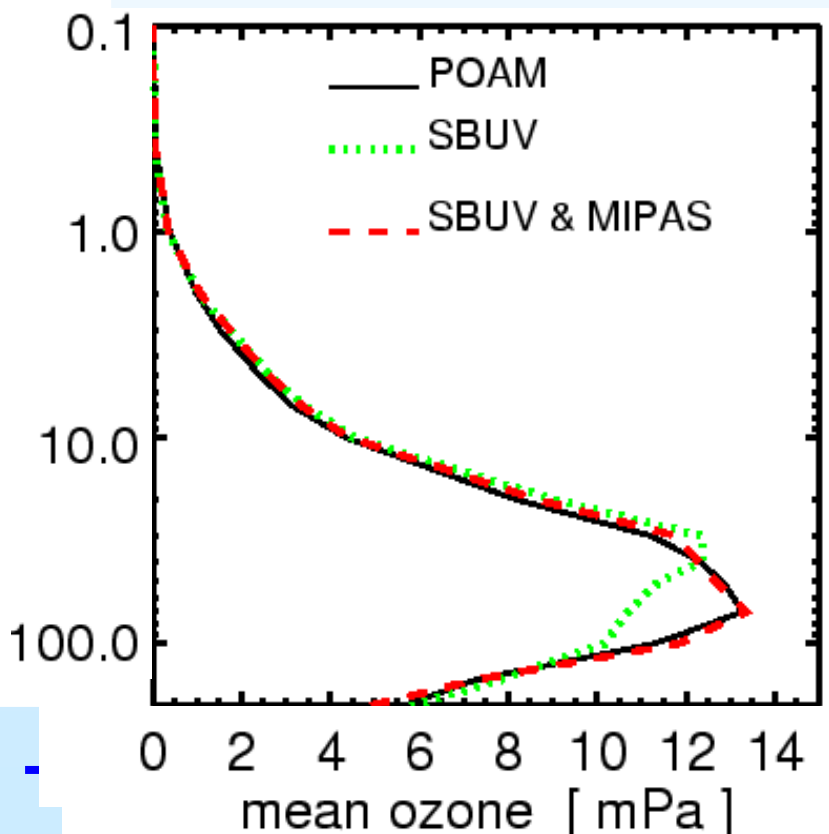
Zonal-mean ozone, Nov 2002  
 SBUV assimilation (contours),  
 MIPAS&SBUV minus SBUV  
 assimilation (shaded)



↑  
 SBUV/2 on NOAA16.  
 Total column & 9 layers from 64 hPa up

144 profiles from the Polar Ozone and Aerosol Measurement (POAM III) instrument, 65N – 69N. Large improvement in O<sub>3</sub> around 70 hPa. Note: MIPAS has better coverage in high latitudes.

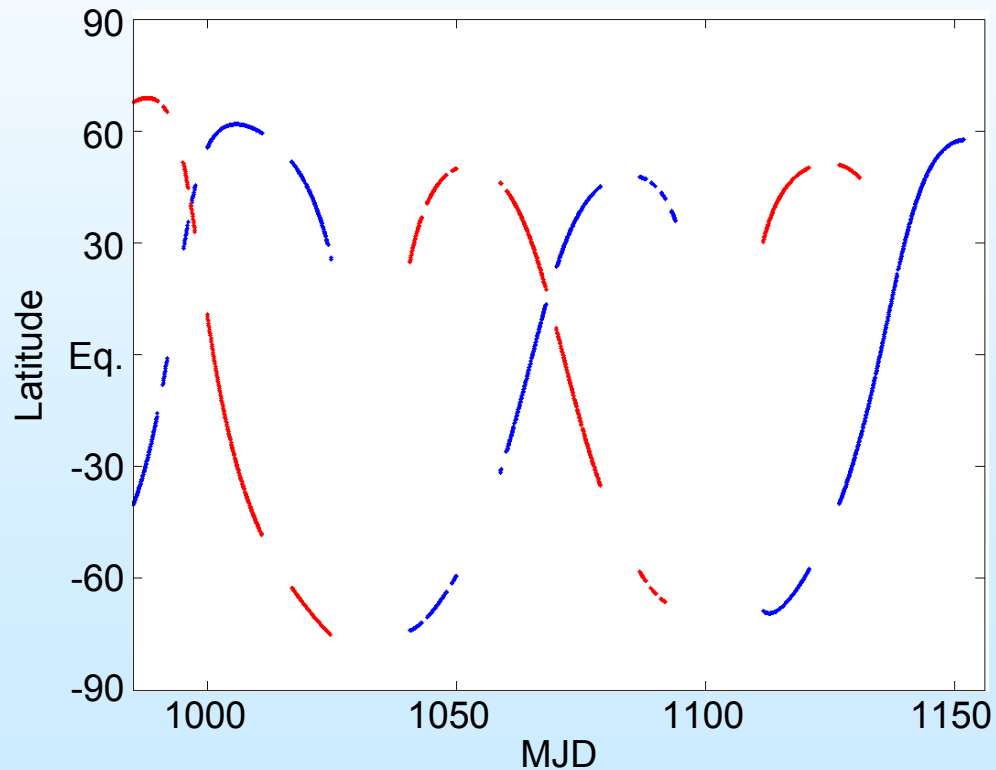
69 profiles from the HALogen Occultation Experiment instrument, 30S – 30N. MIPAS data yield a small increase of O<sub>3</sub> in the lower stratosphere.



## (HALOE - ANALYSIS)/ANALYSIS

UARS/HALOE: 1356 **sunrise** & 1666 **sunset** occult. from Sep. 2002 to Mar. 2003

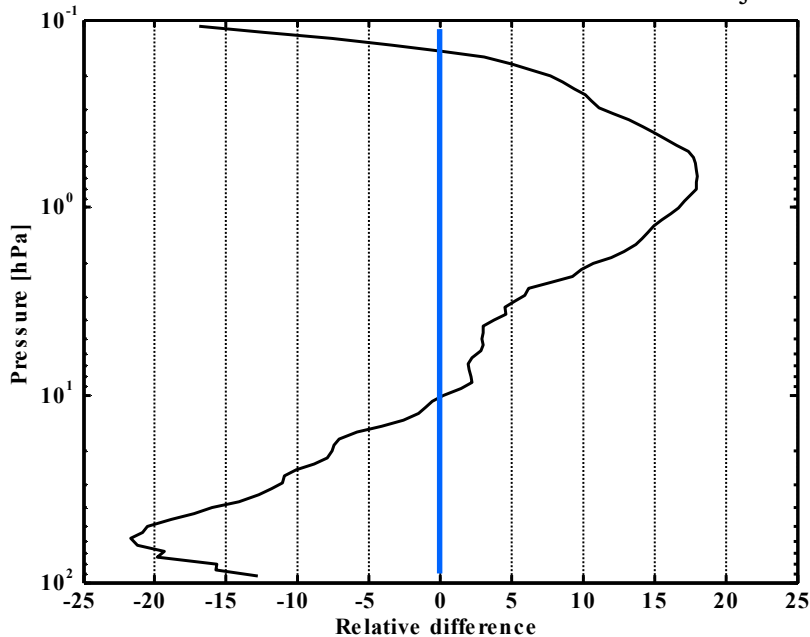
- observed species: O<sub>3</sub>, H<sub>2</sub>O, CH<sub>4</sub>, NO and NO<sub>2</sub>



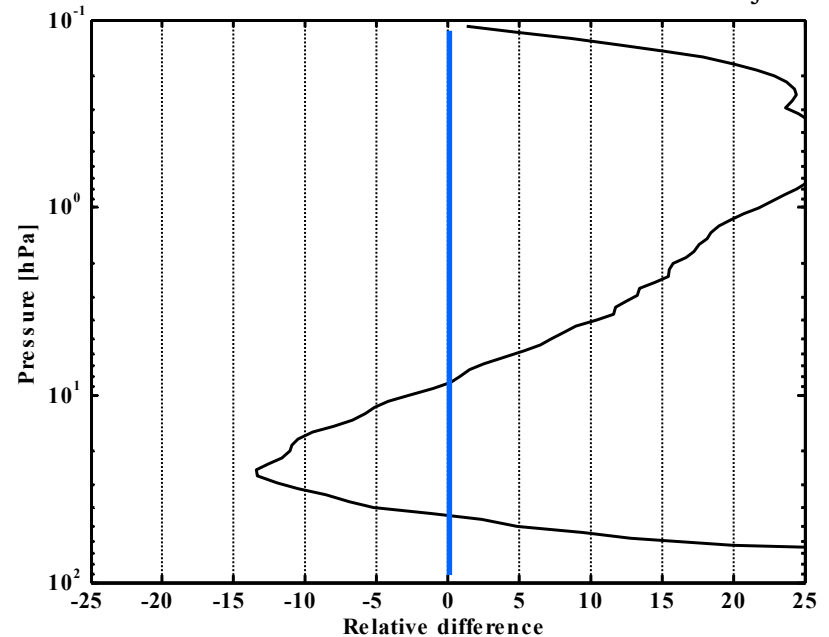
# Ozone: (HALOE - ANALYSIS)/ANALYSIS

## HALOE sunrise & sunset comparison consistency

Rel. diff. w.r.p to analysis for date range: 20020901 20021111 : O<sub>3</sub> sunrise

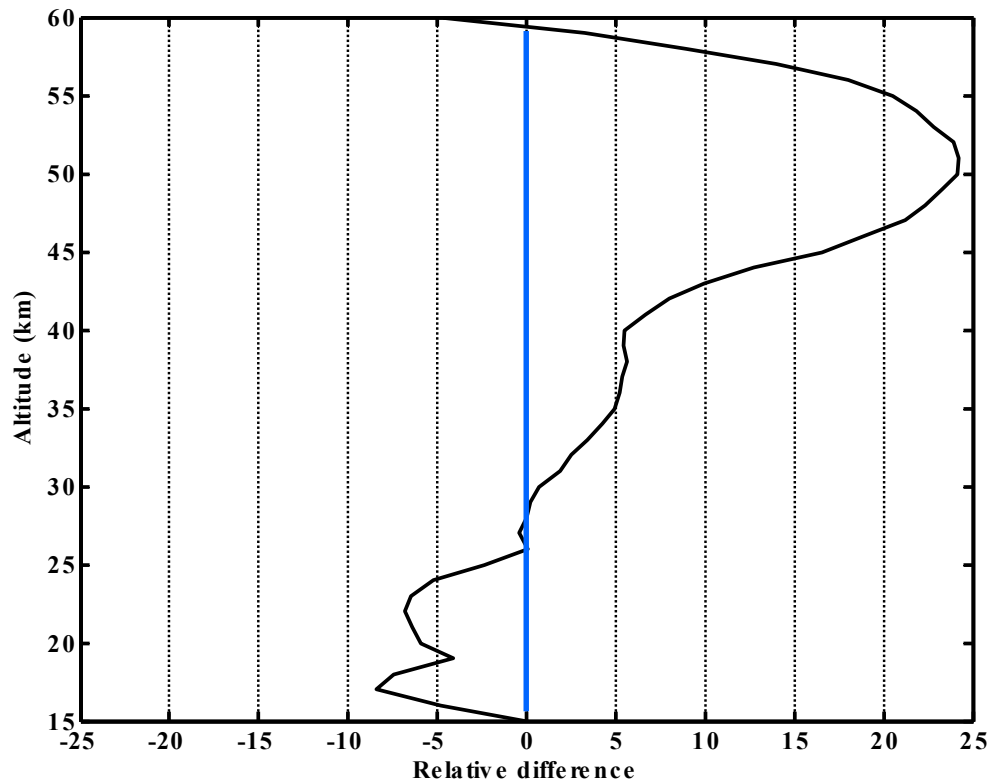


Rel. diff. w.r.p to analysis for date range: 20020901 20021111 : O<sub>3</sub> sunset



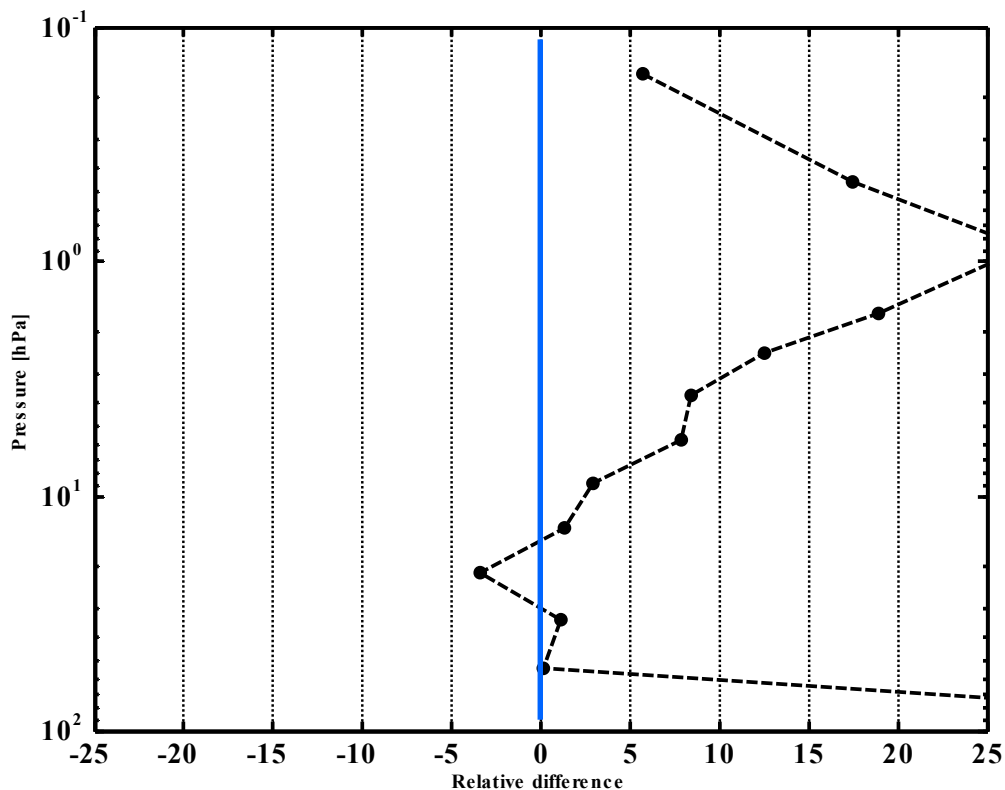
# Ozone: (POAM - ANALYSIS)/ANALYSIS

## POAM Northern Hemisphere same structure as HALOE



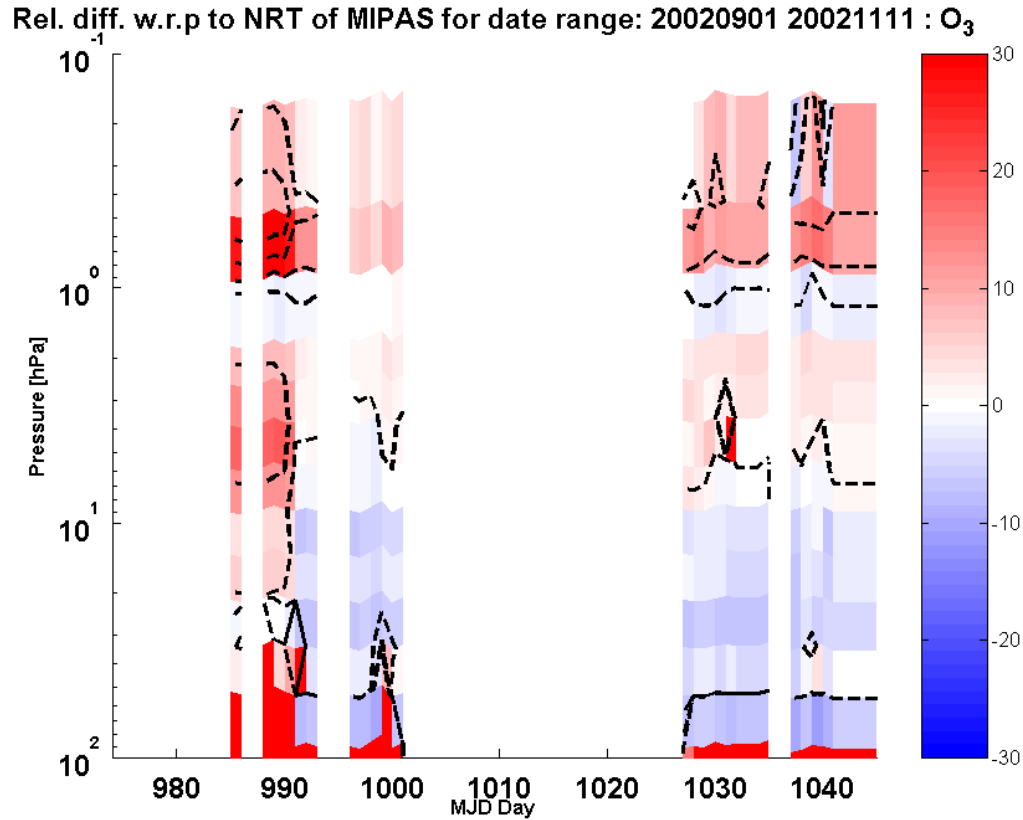
# Ozone: (OFFLINE\_MIPAS - ANALYSIS)/ANALYSIS

Rel. diff. w.r.p to analysis of MIPAS for date range: 20020901 20021111 : O<sub>3</sub>



- ☞ HALOE comparison:
  - ☐ Similar structure of difference for sunrise & sunset events.
  - ☐ HALOE > ANALYSIS: 0.1 hPa < pressure < 10 hPa
  - ☐ HALOE < ANALYSIS: 10 hPa < pressure < 100 hPa
- ☞ OFFLINE comparison:
  - ☐ OFFLINE > ANALYSIS: 0.1 hPa < pressure < 10 hPa
  - ☐ OFFLINE ≈ ANALYSIS: 10 hPa < pressure < 100 hPa
- ☞ Qualitative conclusion

## Ozone: (OFFLINE\_MIPAS - NRT)/NRT



## Conclusions

- Added value of reprocessed or offline MIPAS ozone
  - ECMWF
  - GMAO
- Reprocessed data set better quality than NRT data set
- “BIASES” OZONE OFFLINE MIPAS w.r.t HALOE:
  - Lower stratosphere: pressure > 10 hPa MIPAS:  
5 - 10 % higher than HALOE
  - Middle and upper stratosphere: pressure < 10 hPa MIPAS:  
better agreement with HALOE/POAM
- Precision of INSTRUMENT species, work in progress
- Accuracy of INSTRUMENT species, work in progress