Atmospheric, Oceanic and
Planetary Physics, Oxford

MIPAS Precision

C. Piccolo, A. Dudhia, V. Payne
AOPP, Oxford

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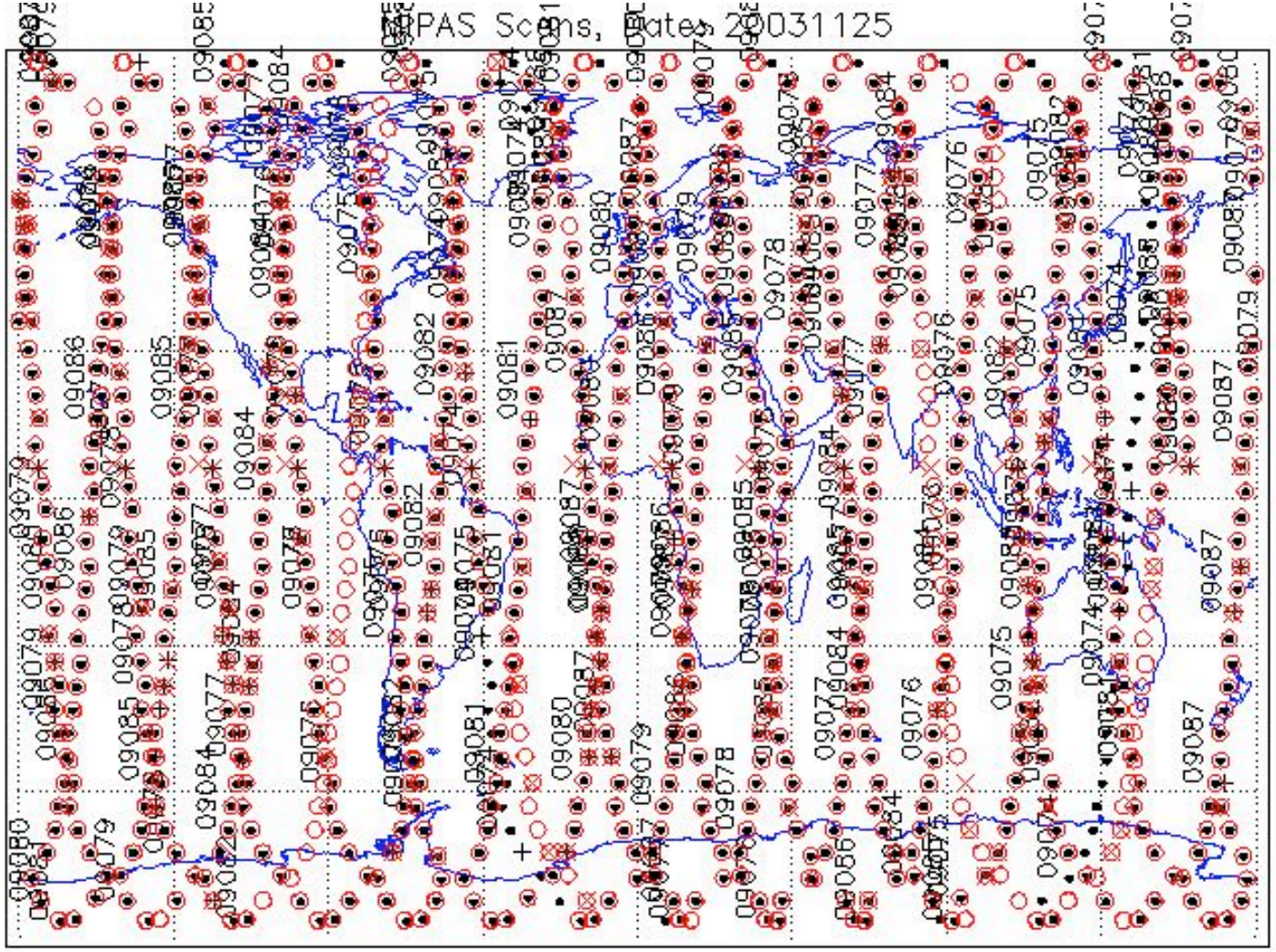
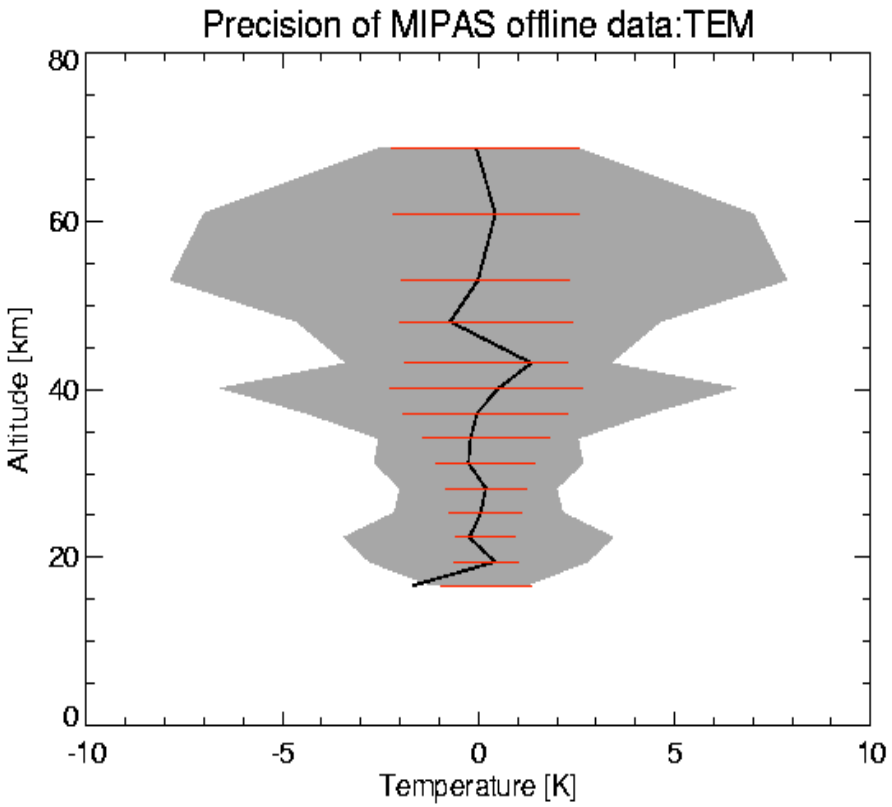
Precision strategy

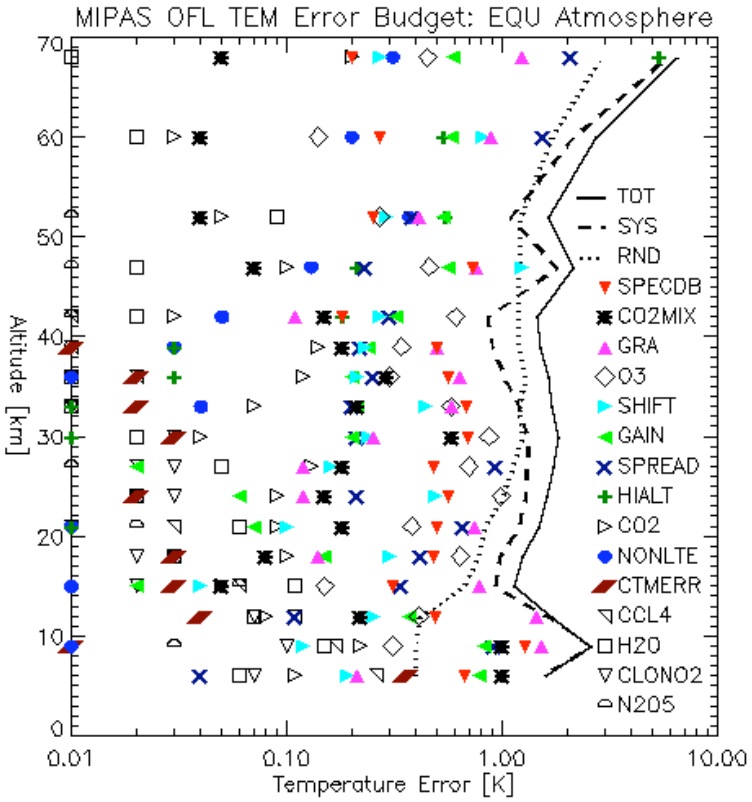
- Crossing points of adjacent orbits
  - Every 6036 seconds
  - Shortest distance between two points on the geoid < 2.5 km
- Bias, rms spread w.r.t the bias
- OFL data from 20031125
  - Complete 14 orbits (version 4.61)
  - 12 coincidences at 10.5N
- Comparison between rms spread w.r.t the bias and the averaged retrieval error

OFL 20031125 scans

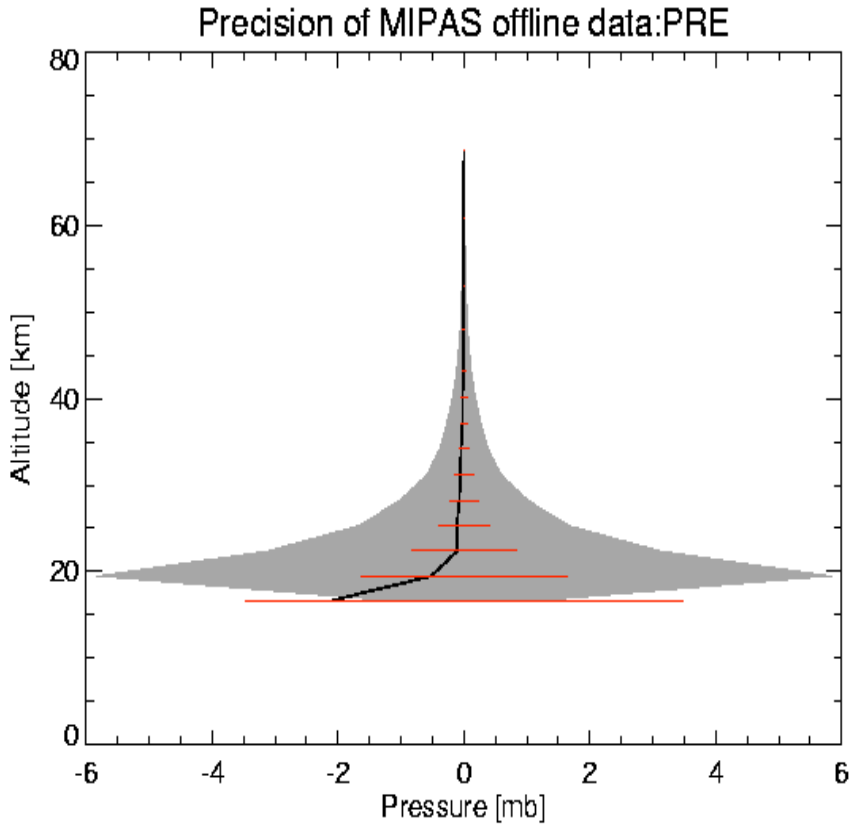


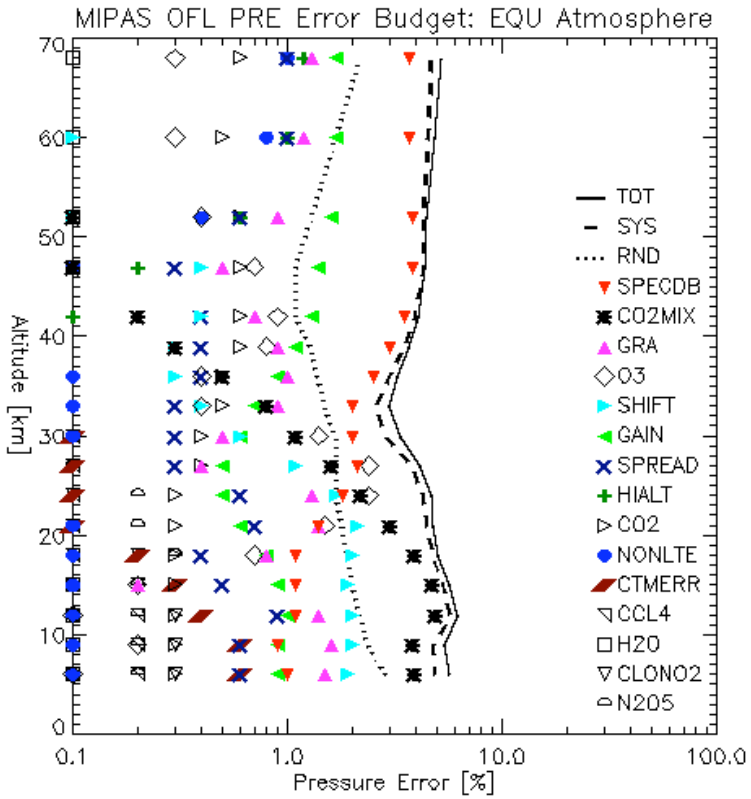
Temperature



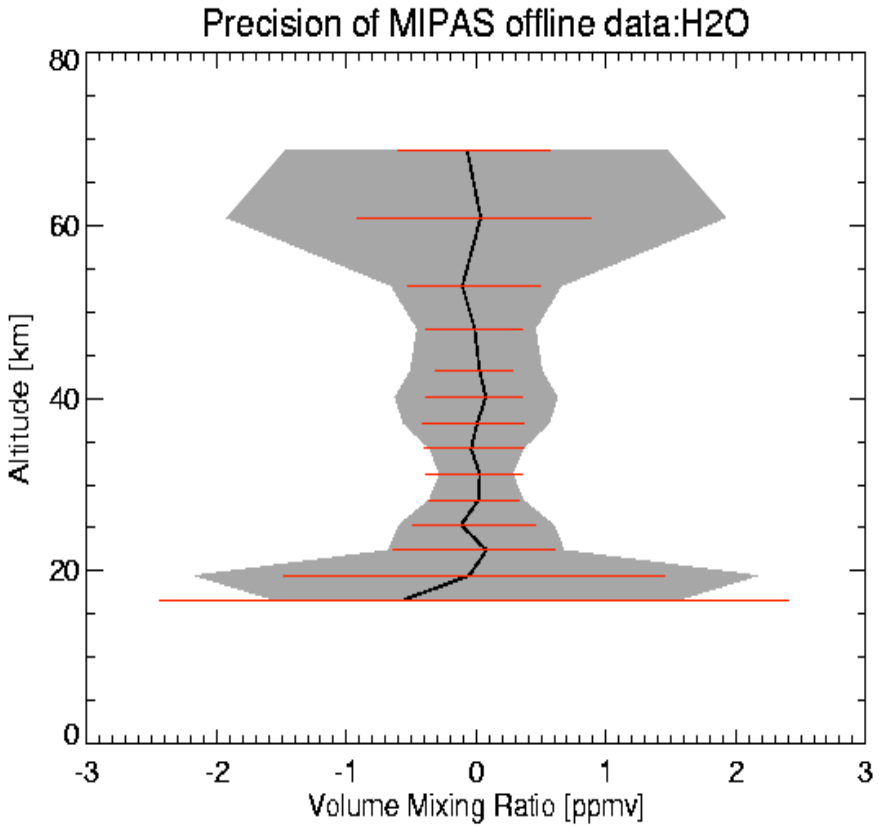


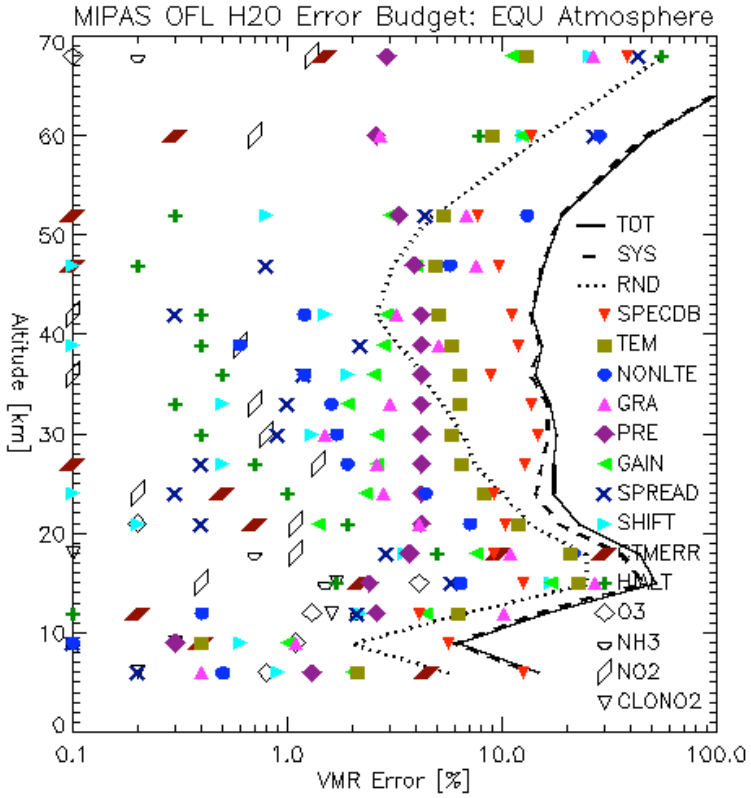
Pressure

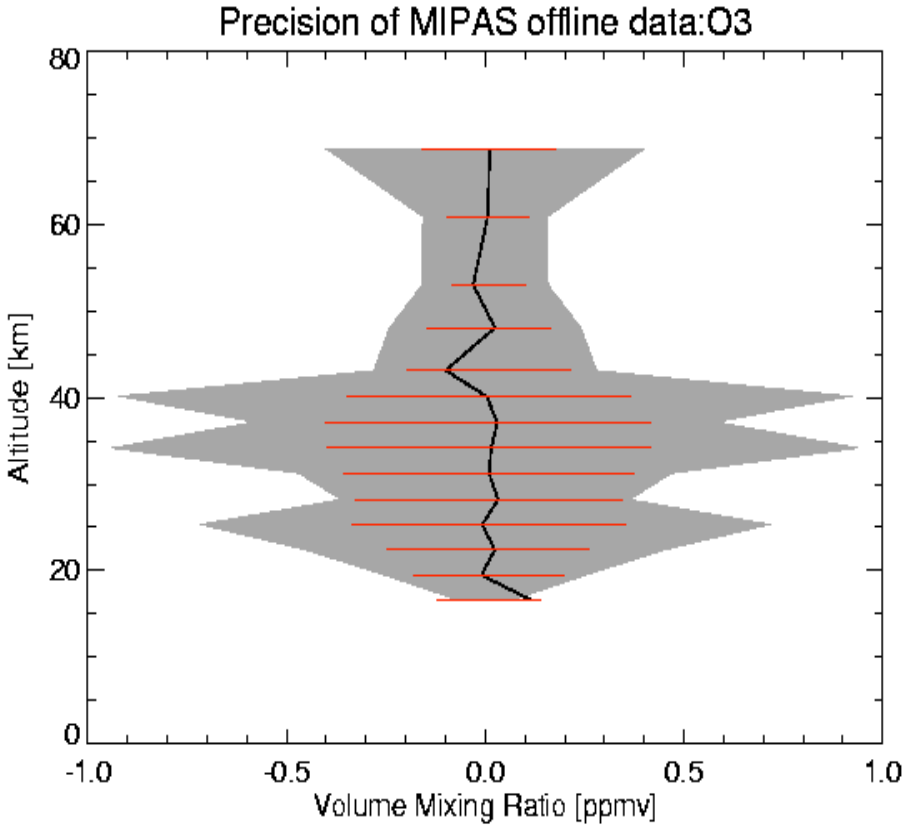

Precision of MIPAS offline data:PRE
Altitude [km]
Pressure [mb]
80
60
40
20
0
-6
-4
-2
0
2
4
6

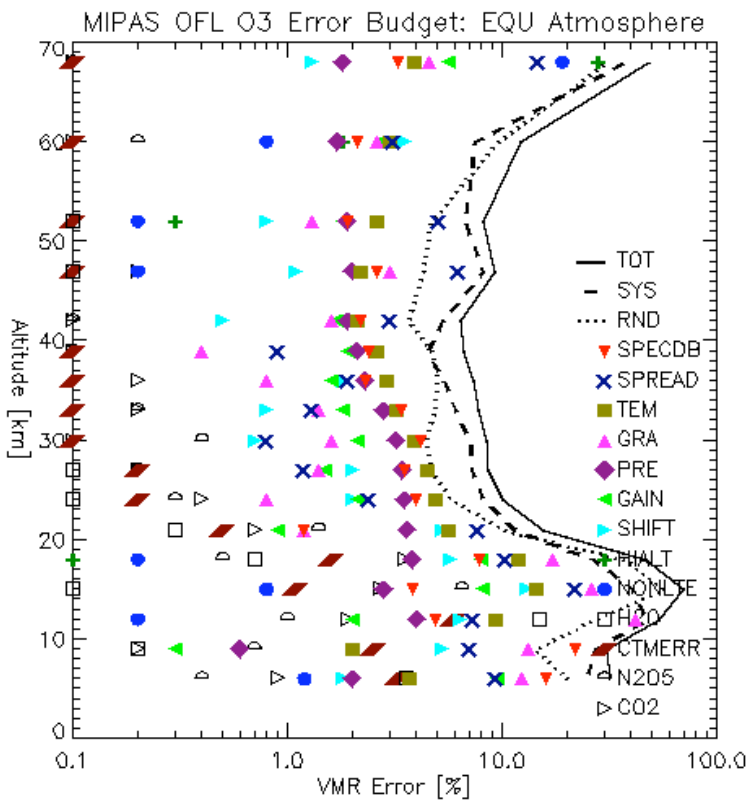

MIPAS OFL PRE Error Budget: EQU Atmosphere
Altitude [km]
Pressure Error [%]
0.1
1.0
10.0
100.0
TOT
SYS
RND
SPECDB
CO2MIX
GRA
O3
SHIFT
GAIN
SPREAD
HIALT
CO2
NONLTE
CTMERR
CCL4
H2O
CLONO2
N2O5

H_2O

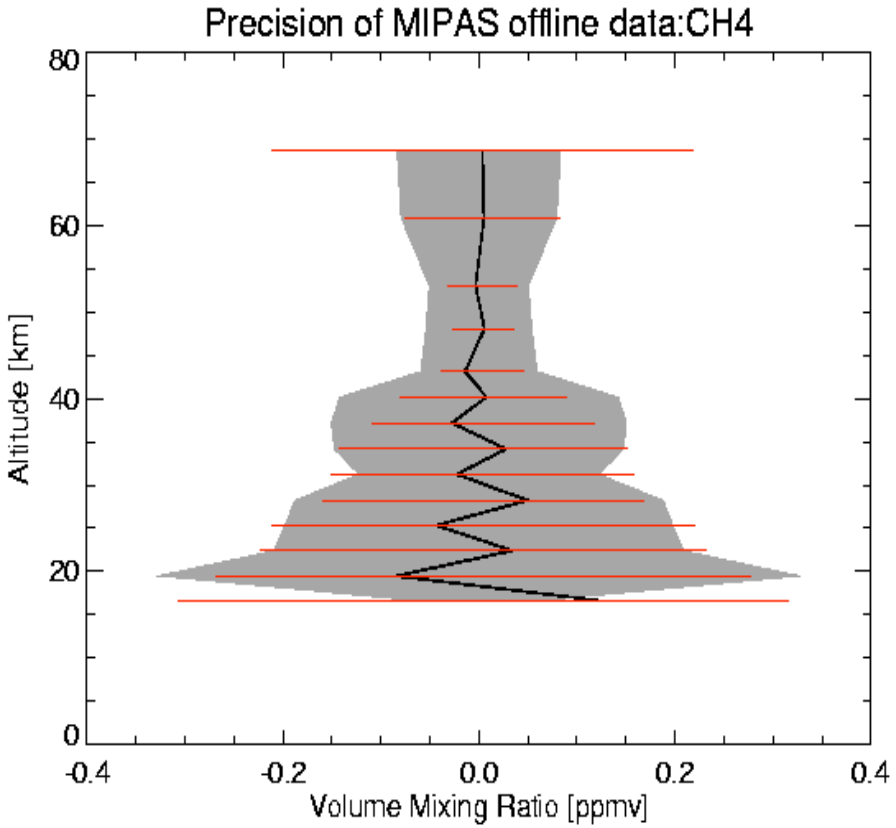

Precision of MIPAS offline data:H2O
Altitude [km]
Volume Mixing Ratio [ppmv]
0
20
40
60
80
-3
-2
-1
0
1
2
3

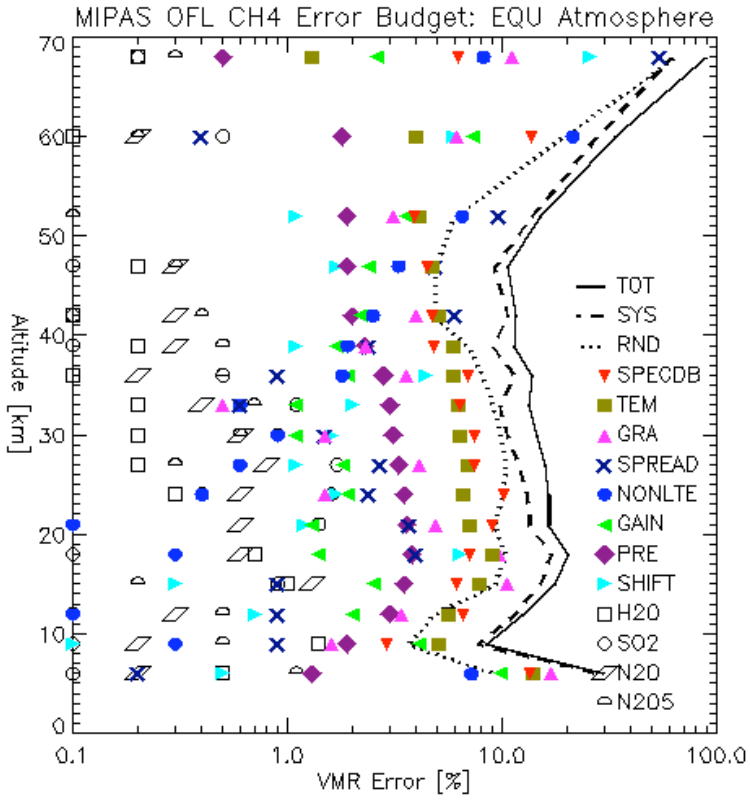

MIPAS OFL H2O Error Budget: EQU Atmosphere
Altitude [km]
VMR Error [%]
0.1
1.0
10.0
100.0
TOT
SYS
RND
SPECDB
TEM
NONLTE
GRA
PRE
GAIN
SPREAD
SHIFT
PTMERR
HNLT
O3
NH3
NO2
CLONO2


Precision of MIPAS offline data:O3
Altitude [km]
Volume Mixing Ratio [ppmv]
0
20
40
60
80
-1.0
-0.5
0.0
0.5
1.0

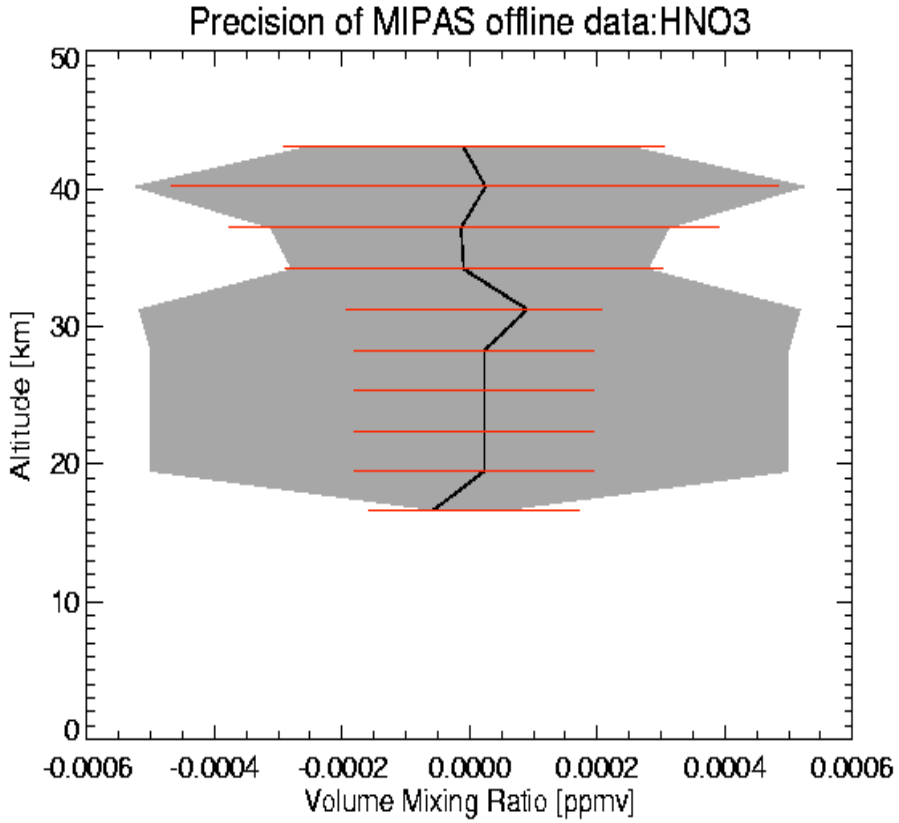

MIPAS OFL O3 Error Budget: EQU Atmosphere
Altitude [km]
VMR Error [%]
0
10
20
30
40
50
60
70
0.1
1.0
10.0
100.0
TOT
SYS
RND
SPECDB
SPREAD
TEM
GRA
PRE
GAIN
SHIFT
PHALT
NONLTE
H2O
CTMERR
N2O5
CO2

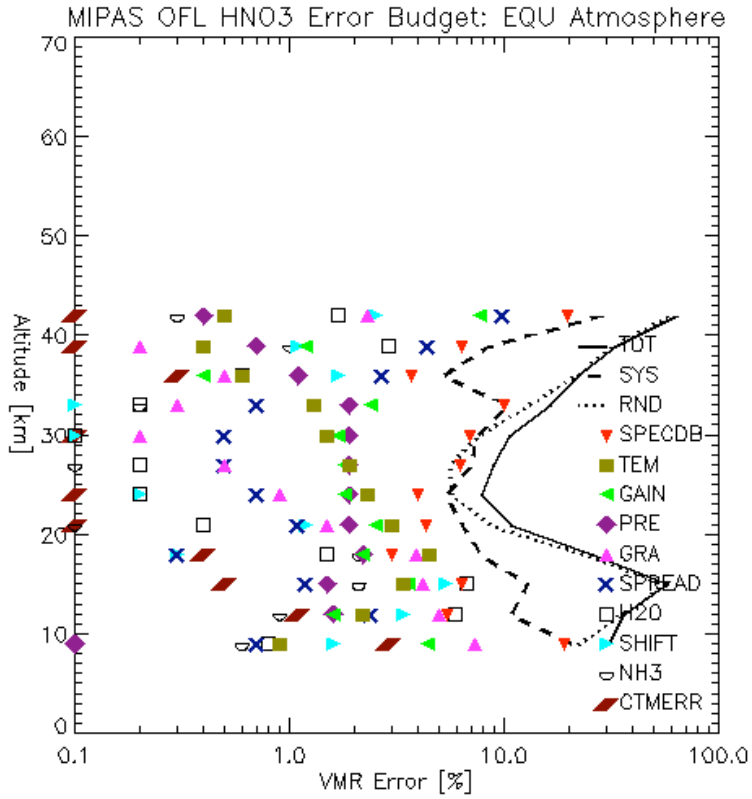
CH_4


Precision of MIPAS offline data:CH4
Altitude [km]
Volume Mixing Ratio [ppmv]
0
20
40
60
80
-0.4
-0.2
0.0
0.2
0.4

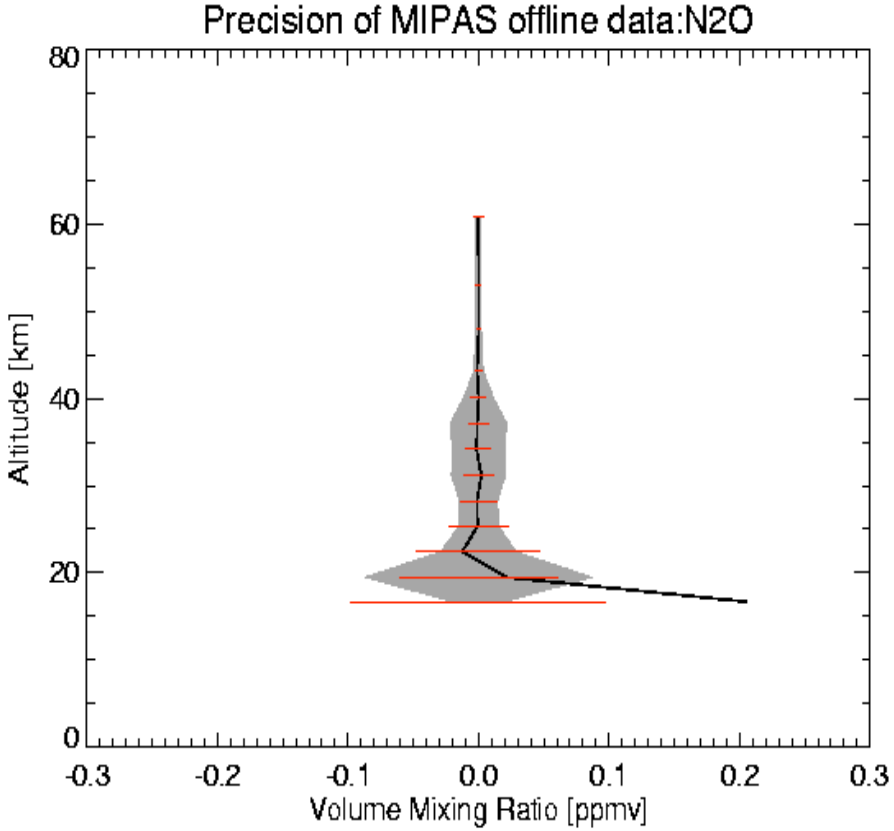

MIPAS OFL CH4 Error Budget: EQU Atmosphere
Altitude [km]
VMR Error [%]
0
10
20
30
40
50
60
70
0.1
1.0
10.0
100.0
TOT
SYS
RND
SPECDB
TEM
GRA
SPREAD
NONLTE
GAIN
PRE
SHIFT
H20
SO2
N20
N205

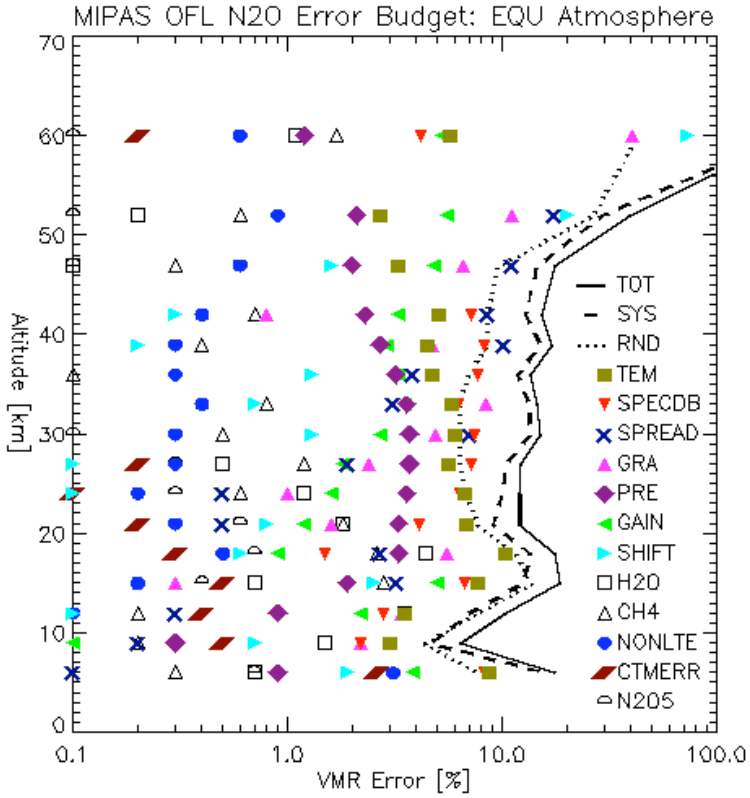
HNO_3


Precision of MIPAS offline data:HNO3
Altitude [km]
Volume Mixing Ratio [ppmv]
50
40
30
20
10
0
-0.0006
-0.0004
-0.0002
0.0000
0.0002
0.0004
0.0006

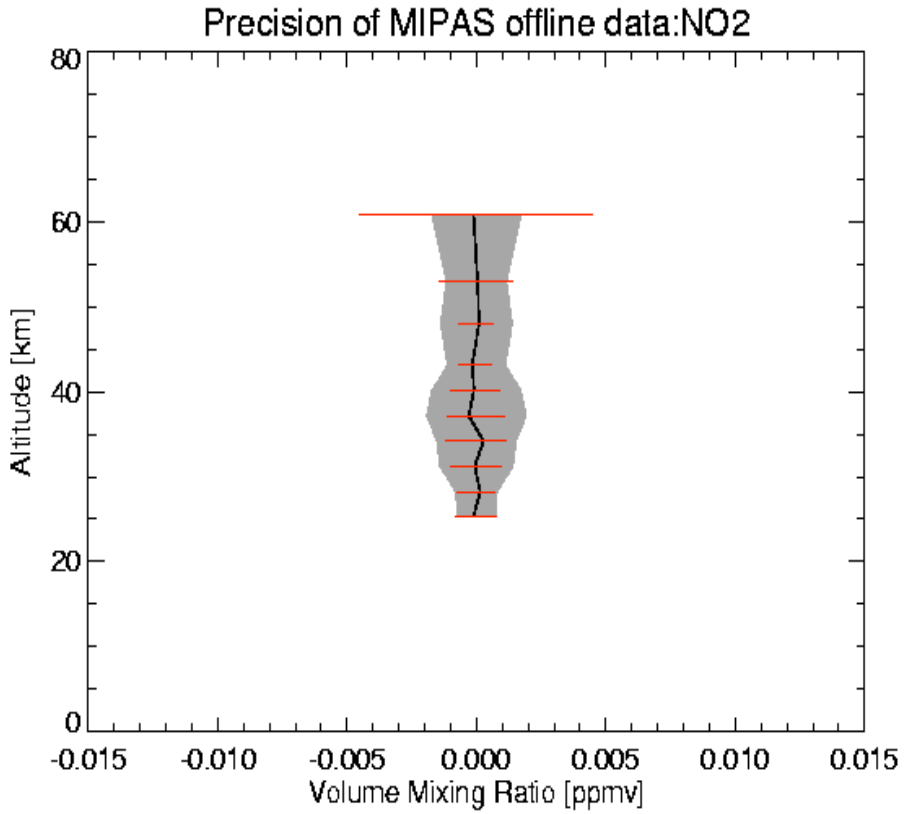

MIPAS OFL HNO3 Error Budget: EQU Atmosphere
Altitude [km]
VMR Error [%]
70
60
50
40
30
20
10
0
0.1
1.0
10.0
100.0
TOT
SYS
RND
SPECDB
TEM
GAIN
PRE
GRA
SPREAD
H2O
SHIFT
NH3
CTMERR

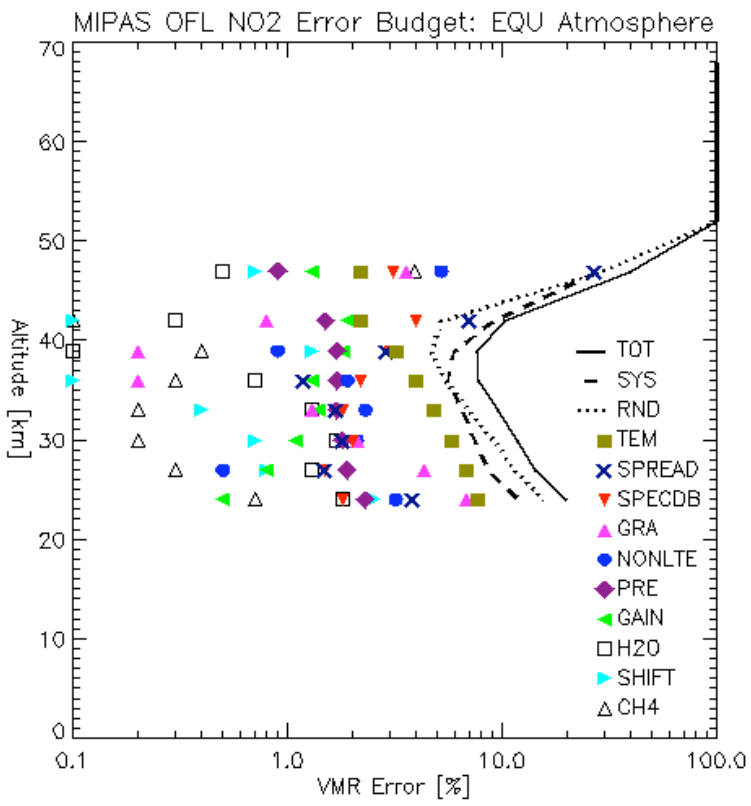
N_2O


Precision of MIPAS offline data:N2O
Altitude [km]
Volume Mixing Ratio [ppmv]
0
20
40
60
80
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3


MIPAS OFL N2O Error Budget: EQU Atmosphere
Altitude [km]
VMR Error [%]
0.1
1.0
10.0
100.0
TOT
SYS
RND
TEM
SPECDB
SPREAD
GRA
PRE
GAIN
SHIFT
H2O
CH4
NONLTE
CTMERR
N2O5

NO_2


Precision of MIPAS offline data:NO2
Altitude [km]
Volume Mixing Ratio [ppmv]
0
20
40
60
80
-0.015
-0.010
-0.005
0.000
0.005
0.010
0.015

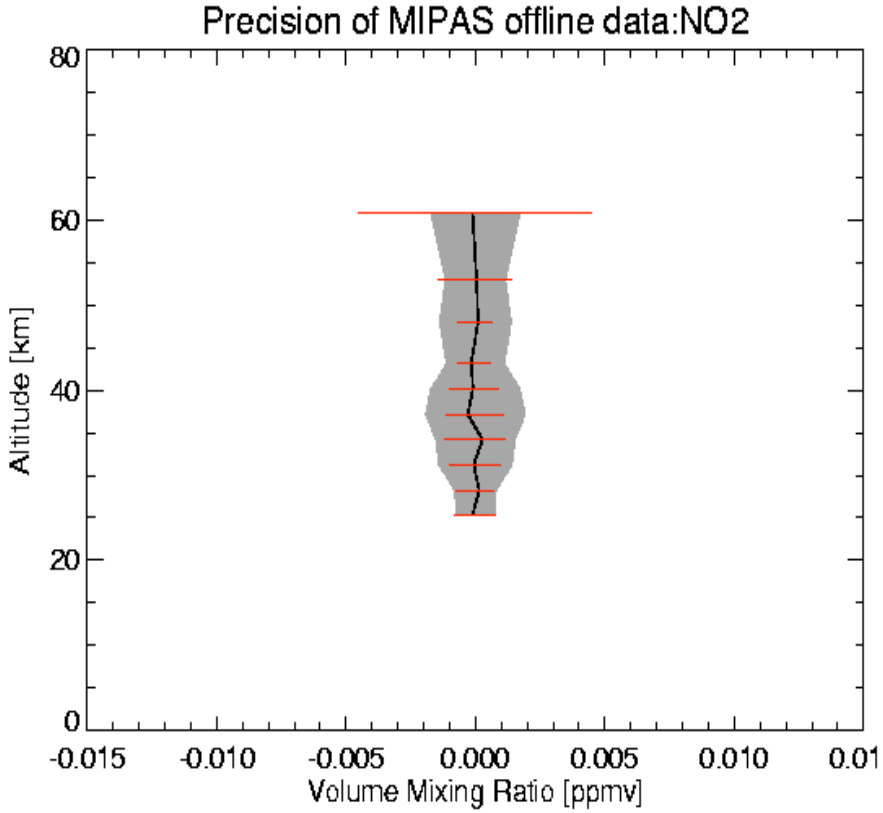

MIPAS OFL NO2 Error Budget: EQU Atmosphere
Altitude [km]
VMR Error [%]
0
10
20
30
40
50
60
70
0.1
1.0
10.0
100.0
TOT
SYS
RND
TEM
SPREAD
SPECDB
GRA
NONLTE
PRE
GAIN
H2O
SHIFT
CH4

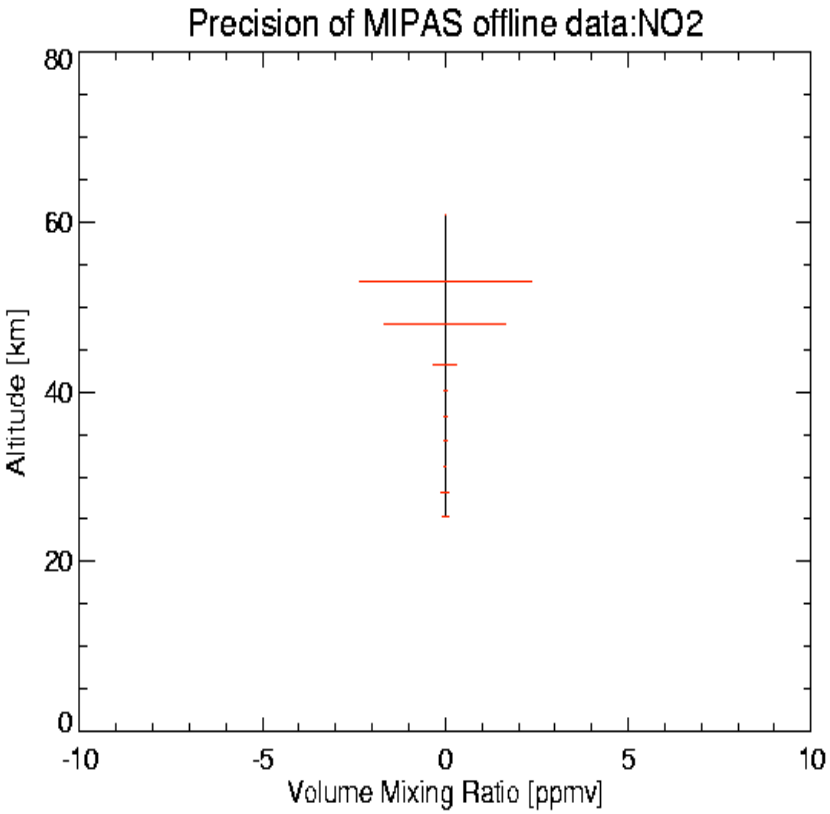
pT error VCM

FIELD 14: pT error VCM

- Square matrix (N_{par} x N_{par}) not symmetric
  - e.g. NO2 has a row of zeros and unrealistic values
- why is it not save as a triangular matrix as all the other covariances?
- no units in the documentation and in the Enviview help online (not clear what kind of covariance it is)
- NRT matrices have reasonable values, but still no units and not symmetric
- FIELD 13: flag indicating used approach for pT error propagation ('E' or 'S' or 'N'), while it is '69'
  - 'S' case should include also reference profiles (?)

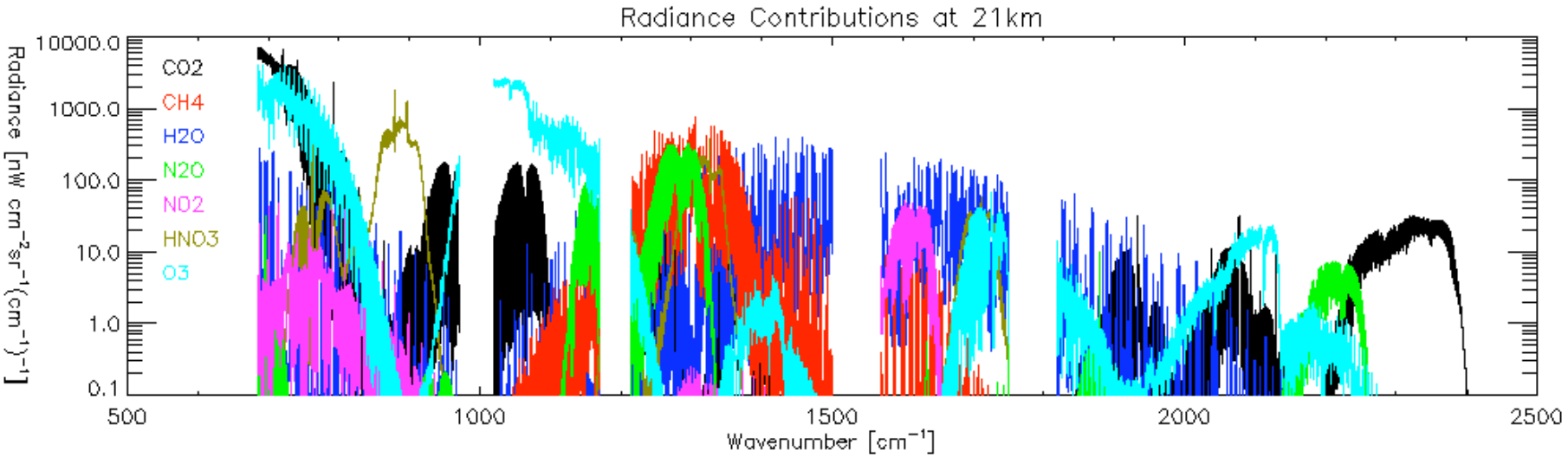
NO_2 and NO_2+pT

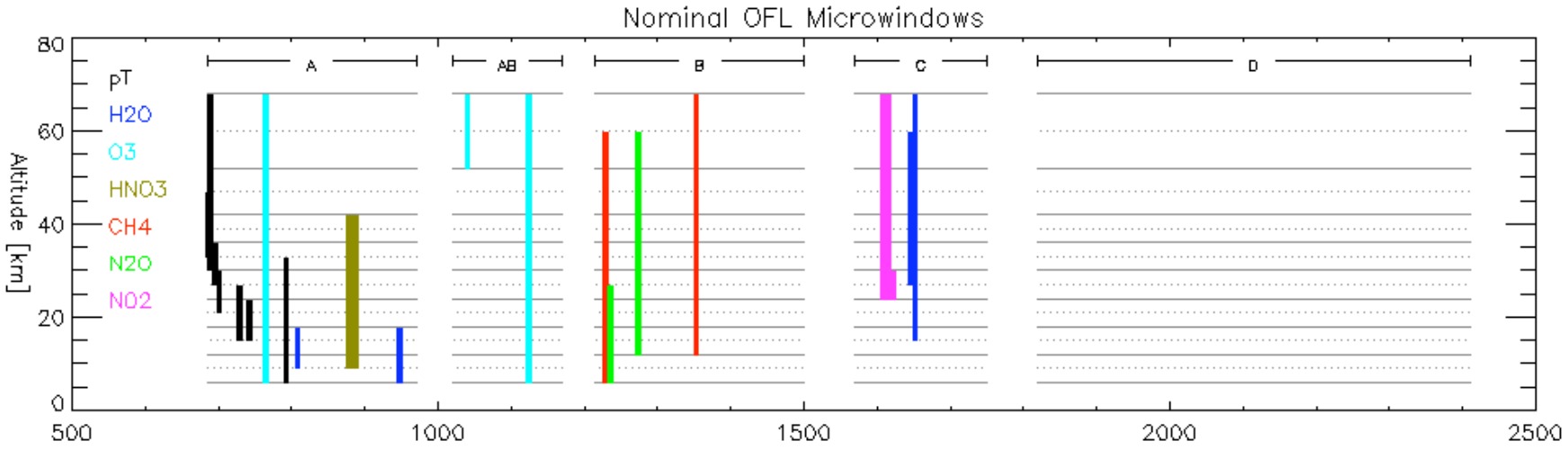




Summary

- The r.m.s spread w.r.t the bias is generally larger than the averaged retrieval error (not including pT error contribution)
- Problem with pT error VCM in OFFLINE data
- Not complete v5.61 set of orbits for every day


Radiance Contributions at 21km
Radiance [nW cm^{-2}sr^{-1}(cm^{-1})$^{-1}$]
10000.0
1000.0
100.0
10.0
1.0
0.1
CO2
CH4
H2O
N2O
NO2
HNO3
O3
500
1000
1500
2000
2500
Wavenumber [cm^{-1}]


Nominal OFL Microwindows
Altitude [km]
80
60
40
20
0
A
AB
B
C
D
pT
H2O
O3
HNO3
CH4
N2O
NO2
500
1000
1500
2000
2500