MIPAS Occupation Matrix Statistics Jul02–Feb03
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Introduction

This is a statistical analysis of the occupation matrices which have been used in the ESA processing of MIPAS L2 data from July 2002 to Februrary 2003.

Occupation matrices (OMs) are the set of microwindows/tangent altitude used to retrieve the L2 profiles. As part of the L2 preprocessing, the L1 spectra are checked to see which spectral bands/altitudes are flagged as corrupt or otherwise unusable. The list of occupation matrices is then searched until one is found which only requires microwindows within the remaining valid bands/altitudes. The search order is defined by the 'priority list' (see Appendix), with the nominal occupation matrix always first in the list. The OM also determines the range of altitudes over which the retrieval is performed, truncating the retrieval when little or no information is available for that altitude.

The following codes have been used to label OMs.

001–006 Nominal occupation matrices, defined for the usual situation when all L1 spectra are available. However, since L2 residuals are averaged together for consecutive profiles with the same occupation matrix, the nominal OMs have been assigned 6 different labels according to latitude band in order to force the residuals to be averaged separately for each latitude band.

Expected distribution of nominal occupation matrices for an orbit of 72 profiles

OM	Latitude Band	No. Profiles	% Total
001	90S–65S	10	14
002	65S–20S	18	25
003	20S–Equ	8	11
004	Equ–20N	8	11
005	20N–65N	18	25
006	65N–90N	10	14

015–068 'Missing sweep' occupation matrices. 015 is an occupation matrix selected without any microwindows assigned to the 15km tangent height, 018 for 18km etc. These allow for cases when an entire spectrum (all 5 spectral bands) for a particular tangent height is flagged as unusable (there is no 012 case since this is logically equivalent to the 612 cloud contamination case below).

112–568 'Missing band' occupation matrices. 112 is an occupation matrix selected without any A-band microwindows for 12km tangent height, 212 is without AB-band, 312 with C-band etc. These allow for cases where just one spectral band at one tangent height is flagged as unusable.

612–660 'Cloud contamination' occupation matrices (although cloud detection is not yet implemented in the operational processor). 612 allows for the case when the complete 12km tangent height spectrum is flagged as unusable, 615 when both 12 and 15km are unusable, 618 when 12, 15 and 18km are unusable etc. These are the same microwindows as the nominal OMs but with reduced tangent altitude ranges.

Discussion

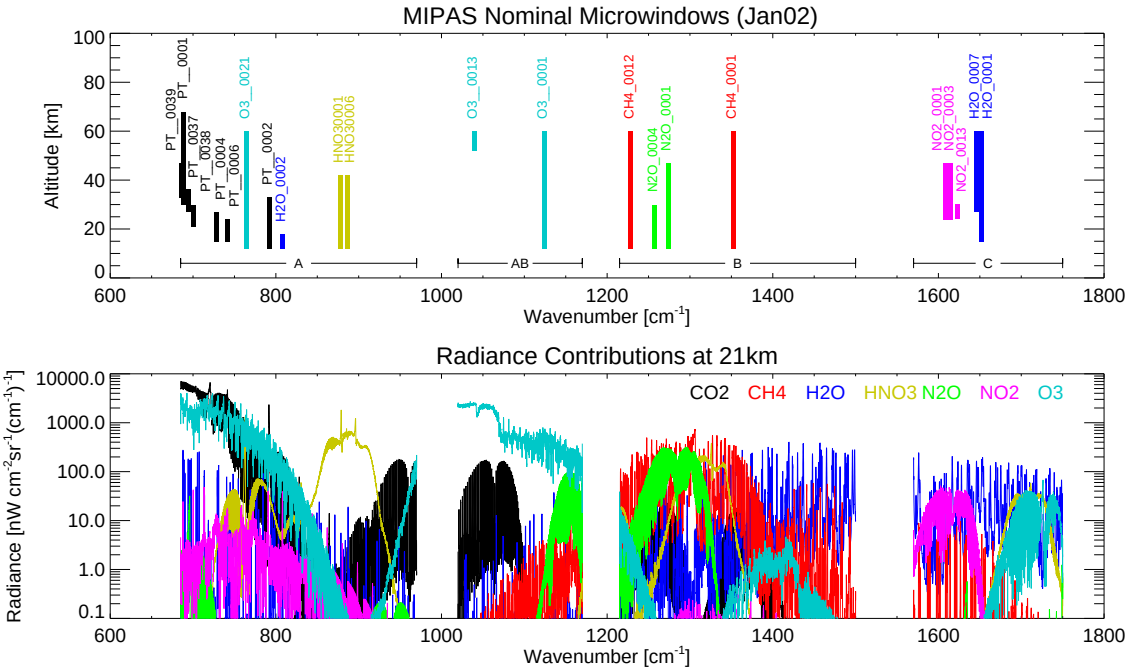
Monthly analyses are presented in the following pages with an Appendix listing the OM priority lists for each species. The following general points emerge.

(a) There is often a discrepancy between the number of species profiles and the number of pT profiles (particularly NO_2), the number of species profiles apparently exceeding the number of pT profiles. This cannot be the case since a constituent retrieval is not attempted unless the pT retrieval has been successful. The number of profiles counted here is obtained from the residuals information in the L2 data and this is sometimes incorrect. This appears to be a bug in the L2 data since the discrepancy is observed using both local software and Enviview.

(b) There is no explicit occupation matrix label in the L2 data (which would have been helpful), however the occupation matrix itself is written out. Local software is used to match this information with the list of delivered OMs and so establish the 3-digit OM label. However, in a number of cases for H_2O and O_3 the OM data written in the file does not match any of the delivered OMs (whenever this occurs an extra row is written in the monthly analysis tables). This could either be a bug in the L2 software or some corruption of the delivered OMs.

(c) There is a high frequency of corrupt L1 data for 24 and 27 km which begins in August but begins to affect ~5% of retrieved profiles from October onwards. This is almost certainly related to the tendency for nominal OM retrievals to be lost in particular latitude bands: equator to 20N in October, 90S–65S from Nov–Jan, then 20S–20N in February. The L1 problem is thought to relate to a fringe-count error which should be corrected with the March software upgrade.

(d) There are fewer CH_4 retrievals than other species, and also the 12 km C-band (OM 312) spectrum appears to be flagged as corrupt more often than other bands. It may be that the CH_4 retrieval works better without the 12 km spectrum (cloud contamination?) since there are more retrievals for this OM than for N_2O which is presumably attempted with the 312 OM just as often as CH_4. However, the CH_4 312 OM also includes additional microwindows from the AB and C bands which may simply improve the retrieval.



July 2002

PT		H2O		O3		HNO3		CH4		N2O		NO2	
No.Profiles		No. constituent profiles as % of No. *pT* profiles											
9799		87.1		98.6		100.2		80.7		81.9		106.8	
Occupation Matrix labels and frequency as % of *pT* ('etc.' = those contributing <0.1% each)													
OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	32.7	005	27.4	005	29.2	005	32.8	005	21.1	005	26.0	005	37.2
002	21.7	002	19.3	002	21.6	002	21.7	002	17.7	002	18.7	002	23.2
006	19.1	006	18.1	006	18.5	006	19.1	006	15.5	003	9.5	006	18.8
003	10.8	003	7.3	003	10.1	003	10.7	312	7.0	006	8.2	003	12.3
004	7.8	004	5.8	004	6.1	004	7.8	003	6.0	004	6.6	004	9.7
001	5.6	001	5.6	001	5.6	001	5.6	001	5.5	001	5.6	001	5.6
015	2.0	618	2.6	618	1.4	618	2.6	004	3.6	618	3.1	etc.	0.1
115	0.3	115	0.7	612	0.2	etc.	0.0	618	2.6	312	2.5		
etc.	0.1	etc.	0.1	015	0.1			015	0.6	015	1.0		
				etc.	0.1			336	0.6	318	0.2		
								615	0.3	621	0.2		
								etc.	0.2	etc.	0.1		
Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of *pT*													
97.7		83.4		91.1		97.6		69.4		74.7		106.7	
No. profiles with unidentified occupation matrix													
0		37		551		0		0		0		0	

Comments

1. CH_4 and N_2O have lowest successful retrieval rate
2. Apparently more HNO_3 and NO_2 profiles than *pT* profiles
3. There is a hemispheric asymmetry in distribution of retrieved profiles with most successful retrievals in the northern hemisphere for high-latitudes (006>001) and mid-latitudes (005>002), but the southern hemisphere for low-latitudes (003>004)
4. Retrievals in southern high-latitudes (=polar winter) (001) are significantly below expected numbers (6% instead of 14%)
5. CH_4 (10%) and N_2O (7%) retrievals frequently result from non-nominal OMs, which could indicate problems with the B band
6. Large number of unidentified OMs for O_3 (approx. 5% of all retrievals), and to a lesser extent H_2O
7. CH_4 OM 312 used frequently (7%), although less often for N_2O (2.5%), suggesting that CH_4 retrieval is more robust when 12km altitude is excluded (and that the N_2O retrieval is less robust otherwise % would be the same).

August 2002

PT	H2O	O3	HNO3	CH4	N2O	NO2
No.Profiles	No. constituent profiles as % of No. pT profiles					
5919	96.4	98.5	100.1	87.0	94.9	101.7

Occupation Matrix labels and frequency as % of pT ('etc.' = those contributing <0.1% each)

OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	25.2	005	24.1	005	25.0	005	25.2	005	20.4	005	24.6	005	26.1
002	21.7	002	21.4	002	21.5	002	21.7	002	20.4	002	20.4	002	21.7
004	14.4	006	13.3	006	13.5	004	14.4	006	12.8	004	13.1	004	15.3
006	13.5	004	12.6	004	13.1	006	13.5	001	10.9	006	11.7	006	13.7
003	12.1	003	11.5	003	11.8	003	12.1	003	7.7	003	11.2	003	12.6
001	11.1	001	10.6	001	11.1	001	11.1	004	6.8	001	10.9	001	10.8
015	0.5	618	0.7	627	0.6	618	0.7	312	4.9	312	1.0	027	0.7
127	0.5	627	0.6	618	0.6	627	0.6	618	0.7	627	0.8	630	0.5
630	0.5	115	0.5	630	0.5	630	0.5	627	0.6	618	0.7	633	0.1
115	0.2	630	0.5	612	0.4	633	0.1	630	0.5	624	0.2	024	0.1
033	0.1	633	0.1	633	0.1	624	0.1	336	0.5	621	0.1	etc.	0.2
124	0.1	436	0.1	015	0.1	etc.	0.1	015	0.3	etc.	0.2		
etc.	0.2	624	0.1	624	0.1			615	0.2				
		etc.	0.2	etc.	0.2			633	0.1				
								624	0.1				
								360	0.1				
								etc.	0.2				

Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of pT						
98.0	93.5	95.9	98.0	78.9	92.0	100.1
No. profiles with unidentified occupation matrix						
0	3	4	0	0	0	0

Comments

1. CH_4 continues to have lowest successful retrieval rate (compared to pT) but improved since July
2. Still apparently more HNO_3 and NO_2 profiles than pT profiles
3. Proportion of retrievals in southern high-latitudes (=polar winter) (001) doubled since July but still slightly below expected (11% instead of 14%).
4. Continued (but reduced) asymmetry in distribution of retrieved profiles, more successful retrievals in the northern hemisphere for low, mid and high latitude bands.
5. CH_4 continues to have largest fraction of profiles generated using non-nominal OM, with 312 still the most frequently used non-nominal OM, although less often than previous month.
6. Continued, but fewer, unidentified OMs for O_3 and H_2O

September 2002

PT	H2O	O3	HNO3	CH4	N2O	NO2
No.Profiles	No. constituent profiles as % of No. *pT* profiles					
11230	97.0	99.1	100.6	89.1	98.4	102.7

Occupation Matrix labels and frequency as % of *pT* ('etc.' = those contributing <0.1% each)

OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	25.7	005	24.7	005	25.5	005	25.9	005	21.8	005	25.8	005	26.4
002	20.5	002	20.2	002	20.4	002	20.5	002	19.6	002	20.3	002	20.7
004	14.8	004	13.2	004	13.9	004	14.8	006	12.7	004	13.8	004	15.9
006	12.7	006	12.7	006	12.7	006	12.9	001	10.7	006	12.9	006	13.0
003	12.3	003	11.8	003	12.1	003	12.3	003	8.0	003	12.1	003	13.0
001	10.9	001	10.8	001	10.8	001	10.8	004	7.5	001	10.6	001	11.2
015	0.7	627	0.9	627	0.9	627	0.9	312	4.5	627	1.0	027	0.9
124	0.6	618	0.8	618	0.7	618	0.8	627	0.9	618	0.8	024	0.7
127	0.5	624	0.7	624	0.7	624	0.7	618	0.8	624	0.7	630	0.4
630	0.4	115	0.4	630	0.4	630	0.4	624	0.7	312	0.3	633	0.4
033	0.4	630	0.4	633	0.4	633	0.4	015	0.4	621	0.1	etc.	0.0
627	0.2	633	0.4	612	0.2	etc.	0.1	336	0.4	etc.	0.1		
etc.	0.3	etc.	0.2	015	0.1			630	0.4				
				etc.	0.2			633	0.4				
								360	0.1				
								615	0.1				
								etc.	0.1				

Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of *pT*						
97.0	93.2	95.4	97.4	80.2	95.5	100.2

Comments

1. CH_4 continues to have lowest successful retrieval rate but slightly improved (+2%) since August
2. Still apparently more HNO_3 and NO_2 profiles than *pT* profiles
3. Continued asymmetry in distribution of retrieved profiles with more successful retrievals in the northern hemisphere for low, mid and high latitude bands.
4. CH_4 continues to have largest fraction of profiles generated using non-nominal OM, with 312 still the most frequently used non-nominal OM, although less often than previous month.
5. OM 627, plus other *24 and *27 OMs starting to appear more frequently, indicating problems with 24 and 27 km spectra in 1–2% of retrievals. Note that 627 and 624 are generally below 027 and 024 in the priority lists indicating problems not only at these altitudes but also lower altitudes
6. No unidentified OMs

October 2002

PT		H2O		O3		HNO3		CH4		N2O		NO2	
No.Profiles				No. constituent profiles as % of No. *pT* profiles									
3255		97.6		98.4		100.8		91.6		98.5		101.8	
Occupation Matrix labels and frequency as % of *pT* ('etc.' = those contributing <0.1% each)													
OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	25.7	005	24.1	005	25.7	005	25.7	005	22.7	005	25.6	005	25.7
002	22.6	002	21.8	002	21.8	002	22.6	002	22.1	002	22.3	002	22.3
006	13.0	006	13.0	006	13.0	006	13.0	006	13.0	006	13.0	006	13.0
003	11.4	003	11.0	001	10.7	003	11.4	001	10.1	003	10.5	003	11.7
001	11.0	001	11.0	003	10.3	001	11.0	003	6.5	001	10.2	001	11.2
004	9.4	004	8.7	004	8.5	004	9.4	627	5.2	004	8.5	004	9.9
127	3.6	627	4.7	627	4.5	627	4.5	004	4.7	627	5.3	027	5.3
124	1.7	624	2.3	624	2.3	624	2.3	312	3.4	624	2.3	024	2.3
024	0.4	630	0.3	630	0.3	630	0.3	624	2.3	312	0.5	630	0.3
630	0.3	115	0.2	612	0.3	027	0.2	015	0.5	618	0.2	etc.	0.1
627	0.3	618	0.2	015	0.3	618	0.2	630	0.3	etc.	0.2		
027	0.2	027	0.2	027	0.2	etc.	0.1	615	0.3				
015	0.2	etc.	0.1	618	0.2			618	0.2				
etc.	0.1			etc.	0.1			336	0.2				
								etc.	0.2				
Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of *pT*													
93.2		89.6		90.2		93.2		79.1		90.1		93.9	

Comments

1. This table also includes November data up until 13th when processor changes were made.
2. CH_4 continues to have lowest successful retrieval rate but improving — plus another 2% since September.
3. Still apparently more HNO_3 and NO_2 profiles than *pT* profiles
4. Reduction in retrievals for northern low-latitudes (004) from 14% down to 9% (expected value is 11%)
5. OM 627, plus other *24 and *27 OMs indicating problems with 24 and 27 km now accounting for >5% of retrievals (implication is that these are from northern low-latitudes)
6. CH_4 OM 312 frequency reduced by 1% since September.

November 2002

PT		H2O		O3		HNO3		CH4		N2O		NO2	
No.Profiles		No. constituent profiles as % of No. *pT* profiles											
6577		102.2		109.0		111.1		94.2		105.2		117.1	
Occupation Matrix labels and frequency as % of *pT* ('etc.' = those contributing <0.1% each)													
OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	30.9	005	29.8	005	32.9	005	33.4	005	28.0	005	31.9	005	35.2
002	24.8	002	25.5	002	27.2	002	27.5	002	21.9	002	25.1	002	29.4
006	13.8	006	15.5	006	15.6	006	15.8	006	15.2	006	15.7	003	16.5
003	12.9	003	11.7	003	12.7	003	13.7	003	7.2	003	12.3	006	15.7
004	11.3	004	10.4	004	11.6	004	12.2	004	6.4	004	11.1	004	14.4
001	2.1	001	3.8	001	3.8	001	3.8	312	4.8	618	2.9	001	3.9
015	1.6	618	2.9	618	2.4	618	2.9	001	3.5	001	2.9	027	1.7
127	1.4	627	1.5	627	1.5	627	1.5	618	3.1	627	1.7	024	0.3
115	0.7	115	0.7	624	0.3	624	0.3	627	1.6	312	1.2	etc.	0.0
124	0.2	624	0.3	018	0.3	etc.	0.1	336	1.2	624	0.3		
027	0.1	etc.	0.2	612	0.2			015	0.6	015	0.1		
etc.	0.1			015	0.2			624	0.3	etc.	0.1		
				etc.	0.2			615	0.2				
								360	0.1				
								etc.	0.2				
Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of *pT*													
95.8		96.7		103.9		106.3		82.1		98.9		115.1	

Comments

1. This table only includes November data after 13th when processor changes were made.
2. All species apart from CH_4 appear to have more profiles than *pT* profiles
3. Percentage of CH_4 profiles continues to increase: up 3% since October
4. Northern low-latitude retrievals (004) back up to normal values
5. Large reduction in southern high-latitude retrievals (001) from 11% in previous month down to 2–5%
6. OM 618 is most frequent non-nominal OM (3% of retrievals) with 627 (or 027 for NO_2) accounting for 1.5%. Note that 618 is below 018 in most priority lists indicating that the problem is not only with the 18 km spectra but also lower altitudes.
7. CH_4 OM 312 frequency increased — back up to 5%.

December 2002

PT		H2O		O3		HNO3		CH4		N2O		NO2	
No.Profiles				No. constituent profiles as % of No. *pT* profiles									
15666		79.3		92.0		94.2		75.5		91.7		97.4	
Occupation Matrix labels and frequency as % of *pT* ('etc.' = those contributing <0.1% each)													
OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	31.3	005	26.9	005	30.7	005	31.2	005	24.6	005	30.9	005	32.0
002	23.9	002	17.3	002	23.0	002	23.3	002	15.9	002	22.6	002	24.4
003	14.8	006	12.6	006	12.7	006	12.8	006	12.1	006	12.7	004	13.5
004	13.5	004	9.6	004	11.1	004	12.2	004	6.7	004	11.4	003	12.9
006	12.9	003	8.8	003	10.9	003	11.6	003	6.0	003	10.5	006	12.6
127	1.1	618	1.2	627	1.1	618	1.2	312	4.7	627	1.3	027	1.3
015	0.9	627	1.1	618	1.0	627	1.1	618	1.4	618	1.2	001	0.5
033	0.6	115	1.0	001	0.5	001	0.5	627	1.1	312	0.5	etc.	0.2
001	0.5	001	0.5	612	0.3	etc.	0.1	336	1.1	001	0.4		
115	0.2	etc.	0.3	015	0.2			015	0.7	015	0.1		
etc.	0.3			018	0.1			001	0.5	etc.	0.1		
				etc.	0.2			615	0.3				
								360	0.1				
								etc.	0.3				
Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of *pT*													
96.9		75.7		89.0		91.7		65.8		88.5		96.0	
No. profiles with unidentified occupation matrix													
0		0		1		0		0		0		0	

Comments

1. All constituents this month have fewer profiles than *pT*
2. Percentage of CH_4 and H_2O profiles is reduced significantly — now both <80% of *pT* profiles
3. Continued asymmetry in distribution of retrieved profiles at mid-latitudes with significantly more in northern hemisphere (005) than southern hemisphere (002).
4. Further reduction in southern high-latitude retrievals using nominal (001) OM — now only 0.5% of total
5. OM 618 and 627 each account for 1% of total of constituent retrievals
6. OM 127 and 015/115 appear in *pT* statistics instead of 627 and 618 — these are higher up the OM priority list and exclude the same altitudes (24 and 27 km for 127; 12, 15 and 18 km for 015; 15 and 18 km for 115)
7. CH_4 OM 312 frequency increased — back up to 5%.
8. Single unidentified O_3 OM.

January 2002

PT	H2O	O3	HNO3	CH4	N2O	NO2
No.Profiles	No. constituent profiles as % of No. *pT* profiles					
19797	79.8	90.9	92.5	75.7	90.3	97.3

Occupation Matrix labels and frequency as % of *pT* ('etc.' = those contributing <0.1% each)

OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	30.5	005	25.7	005	29.9	005	30.3	005	23.9	005	29.7	005	31.1
002	20.3	002	15.1	002	18.7	002	19.0	006	13.7	002	17.9	002	20.8
003	15.5	006	13.6	006	13.8	006	14.0	002	12.8	006	13.9	003	13.9
006	14.1	003	9.3	003	11.4	003	12.0	004	6.3	003	11.0	006	13.8
004	13.0	004	9.1	004	10.7	004	11.2	003	5.7	004	10.3	004	12.7
127	3.0	627	3.0	627	3.0	627	3.0	312	4.5	627	4.0	027	4.0
015	1.1	618	1.8	618	1.5	618	1.8	627	3.3	618	1.8	001	0.8
001	0.8	115	0.9	001	0.8	001	0.8	618	2.0	312	0.8	etc.	0.2
033	0.6	001	0.8	027	0.4	027	0.4	336	1.2	001	0.6		
115	0.4	027	0.4	015	0.2	etc.	0.1	015	0.7	etc.	0.2		
027	0.4	etc.	0.3	612	0.2			001	0.6				
etc.	0.1			018	0.2			018	0.3				
				etc.	0.1			615	0.3				
								027	0.2				
								etc.	0.2				

Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of *pT*						
94.2	73.5	85.2	87.3	63.1	83.6	93.1
No. profiles with unidentified occupation matrix						
0	0	13	0	0	0	0

Comments

1. CH_4 and H_2O continue to be retrieved for <80% of *pT* profiles
2. Continued asymmetry in distribution of mid-latitude profiles with significantly more in northern hemisphere (005) than southern hemisphere (002).
3. Continued small fraction (0.8%) of southern polar retrievals using nominal (001) OM
4. OM 618 and 627 (and *pT* equivalents) increasing to account for 5% of retrievals
5. CH_4 OM 312 frequency increased from 2.7 to 4.5%.
6. Some unidentified O_3 OMs

February 2002

PT		H2O		O3		HNO3		CH4		N2O		NO2	
No.Profiles		No. constituent profiles as % of No. pT profiles											
20075		90.0		97.6		98.5		81.5		81.5		110.1	
Occupation Matrix labels and frequency as % of pT ('etc.' = those contributing <0.1% each)													
OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	29.6	005	25.1	005	29.1	005	29.4	005	21.8	005	25.8	005	33.1
002	26.0	002	21.5	002	25.3	002	25.3	002	16.6	002	17.8	002	31.8
001	18.3	001	18.0	001	18.3	001	18.3	006	14.0	006	14.1	001	20.8
006	15.0	006	14.4	006	14.9	006	15.0	001	13.9	001	6.8	006	15.7
127	4.3	627	4.2	627	4.1	627	4.3	627	4.8	627	5.5	027	5.5
015	2.3	618	3.2	618	2.8	618	3.2	312	4.7	618	4.2	003	1.6
003	1.5	003	1.0	003	1.1	003	1.2	618	3.3	312	2.7	004	1.2
004	1.3	004	0.9	004	0.9	004	1.0	004	0.6	015	1.7	024	0.2
115	0.6	115	0.7	027	0.5	027	0.4	003	0.5	003	1.0	etc.	0.1
027	0.5	027	0.4	018	0.3	624	0.2	015	0.3	004	0.8		
033	0.2	624	0.2	624	0.2	etc.	0.1	027	0.2	615	0.3		
124	0.2	etc.	0.3	etc.	0.3			624	0.2	621	0.3		
etc.	0.1							336	0.2	624	0.2		
								615	0.1	318	0.2		
								612	0.1	etc.	0.0		
								360	0.1				
								etc.	0.2				
Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of pT													
91.7		80.9		89.5		90.3		67.3		66.4		104.3	

Comments

1. Recurrence of problem of apparently more NO_2 profiles than pT profiles
2. Number of H_2O retrievals increased by 10% since January but N_2O decreased to around <80%, similar to CH_4.
3. Reduced asymmetry in hemispheric distribution of mid-latitude profiles: 005 > 002 by 3% (except CH_4 and N_2O) instead of 10% in January
4. Southern high-latitude retrievals increased significantly from previous months: 001 now at 18% (expected 14%)
5. Instead, nominal low-latitude nominal retrievals 003 and 004 now each account for only 1% of total (expected 11%).
6. OM 618 and 627 (and pT equivalents) continue to increase, accounting for 7–10% of retrievals
7. OM 312 maintained at 4.7% for CH_4 and 2.7% N_2O at which might explain missing 002 retrievals for these species
8. No unidentified OMs

Appendix: OM Priority Lists

The priority list establishes the search sequence for a valid OM given the set of L1 bands/altitudes available. There are actually 6 lists per species, one for each latitude band, with the nominal OMs 001–006 as the first in each list. However, the subsequent OMs to cope with various missing data combinations are identical in each band and listed below.

Pri.	PT	H2O	O3	HNO3	CH4	N2O	NO2
1.	00n	00n	00n	00n	00n	00n	00n
2.	115	415	115	112	312	312	024
3.	118	115	133	612	360	015	424
4.	015	421	136	615	060	315	624
5.	018	118	139	115	612	612	027
6.	112	436	142	015	336	318	427
7.	121	442	147	118	015	018	030
8.	152	447	160	618	315	024	430
9.	124	452	152	018	615	324	627
10.	133	460	112	121	018	333	047
11.	142	418	127	124	318	033	447
12.	139	424	130	130	352	615	033
13.	160	430	121	127	036	047	433
14.	021	015	124	133	327	347	630
15.	147	112	612	136	024	021	036
16.	033	427	212	139	324	321	436
17.	136	612	215	142	021	336	039
18.	127	021	218	021	321	036	439
19.	612	433	221	621	052	030	633
20.	068	027	224	027	027	330	042
21.	168	033	227	024	333	027	442
22.	618	615	230	042	330	327	636
23.	027	039	233	039	033	339	639
24.	621	439	236	624	047	039	642
25.	130	024	239	030	347	618	
26.	024	030	242	036	339	342	
27.	624	036	247	033	030	042	
28.	615	618	252	627	618	621	
29.	030	018	260	630	342	624	
30.	060	042	015	633	039	627	
31.	036	060	118	636	042	630	
32.	052	047	615	———	621	633	
33.	627	621	018	O3	624	636	
34.	039	624	060	(ctd)	627	639	
35.	047	052	021	———	630	642	
36.	630	627	618	627	633		
37.	042	630	052	042	636		
38.	633	633	024	036	639		
39.	636	636	047	630	642		
40.	639	639	621	633	647		
41.	642	642	030	636	652		
42.	647	647	624	639			
43.	652	652	033	642			
44.	660		027	647			
45.			039	652			