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ENVISAT MIPAS MONTHLY REPORT: FEBRUARY 2004

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1 INTRODUCTION

The MIPAS Monthly Report (MR) documents the current status and recent changes to the MIPAS instrument, its data processing chain, and its data products.

The MR is composed of analysis results obtained by the Product Control Facility (PCF), combined with inputs received from the different groups working on MIPAS operation, calibration, product validation and data quality. The following groups participate in the MIPAS Quality Working Group (QWG):

- ESRIN-PCF
- ESOC
- ESTEC
- ABB BOMEM
- Oxford University
- IFAC-CNR
- EADS-Astrium GmbH
- Leicester University
- LPM
- IMK
- University of Bologna,
- ISAC,
- IAA
- DLR
- ECMWF

In addition, the group interfaces with the Atmospheric Chemistry Validation Team (ACVT).

1.1 Scope

The main objective of the MR is to give, on a regular basis, the status of MIPAS instrument performance, data acquisition, results of anomaly investigations, calibration activities and validation campaigns. The MR is composed of the following six sections:

- Summary;
- Unavailability;
- Instrument Configuration and Performance;
- Level 1 Product Quality Monitoring;
- Level 2 Product Quality Monitoring;
- Validation Activities and Results.

1.2 Acronyms and Abbreviations

ACVT	Atmospheric Chemistry Validation Team
ADF	Auxiliary Data File
ADS	Annotated Data Set
AIRS	Atmospheric Infrared Sounder
ANX	Ascending Node Crossing
APID	Application Process Identifier
APS	Absolute Position Sensor
AR	Anomaly Report
ASP	Analogue Signal Processor
ASU	Azimuth Scan Unit
CBB PRT	Calibration Blackbody Platinum Resistance Thermometer
CCU	Central Communication Unit
CFS	CCU Flight Software
CTI	Configuration Table Interface
DLR	Deutsches Zentrum für Luft und Raumfahrt
DSD	Data Set Description
ECMWF	European Centre for Medium-Range Weather Forecasts
ESL	Expert Support Laboratory
ESU	Elevation Scan Unit
FCA	FPS (Focal Plane Subsystem) Cooler Assembly
FPS	Focal Plane Subsystem
IAA	Astrophysics Institute of Andalusia
ICE	Instrument Control Electronics
IDE	IDU Electronics
IDSE	Interferometer Differential Speed Error
IDU	Interferometer Drive Unit
IF	In-Flight
IFAC-CNR	Istituto di Fisica Applicata Nello Carrara – Consiglio Nazionale delle Ricerche
IG	Initial Guess
ILS	Instrument Line Shape
IMK	Institute für Meteorologie und Klimaforschung
INT	Interferometer
IPF	Instrument Processing Facility
ISP	Instrument Source Packet
LOS	Line of Sight
MIO	MIPAS Optical Module
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding
MPH	Main Product Header
MR	Monthly Report
MW	Micro-Window
NESR	Noise Equivalent Spectral Radiance
NL	Non Linear
NOM	Nominal

OCM	Orbit Control Manoeuvre
ODS	Optical Path Difference Measurement Sensor
OPD	Optical Path Difference
PAW	Pre-Amplifier Warm
PCD	Product Confidence Data
PCF	Product Control Facility
QWG	Quality Working Group
REC	Residual and Error Correlation
RGC	Radiometric Gain Calibration
SCF	Spectral Correction Factor
SEM	Special Event Measurement
SPH	Specific Product header
VCS	Vibration Cancellation System
VMR	Volume Mixing Ratio
WCC	Wear Control Cycle

2 THE MONTHLY REPORT

2.1 Summary

- Four IDU velocity error occurred during February.
- Spikes reappeared in the Compressor vibration level and the threshold value has been exceeded during two days.
- Historical LOS pointing ADFs for MIPAS data reprocessing have been disseminated.
- REC Analysis: The derivative signatures all show an increase in magnitude compared to the previous month. Also, while the behaviour of the Southern Polar latitudes is less anomalous than the previous month, large residual signatures have appeared in the pT, CH4, H2O and O3 microwindows.
- Occupation Matrix Statistics indicate more successful retrievals per day of operation than January, a larger fraction of 'nominal' retrievals (i.e. using the nominal OMs) and a larger percentage of pT retrievals for which constituent profiles were also retrieved. Fewer cases of cloud-contaminated spectra were also detected.
- Since MIPAS operations resumed on 8th February, retrievals of many species (particularly H2O) in the upper stratosphere appear to be anomalously high. There was also a temporary increase in pointing altitudes for sweeps higher than 30 km, which is reflected in the drop in tangent point pressures but is not obviously related to the problem with the constituent retrievals.

2.2 UNAVAILABILITY

2.2.1 Instrument Unavailability

Planned decontamination:
Start Time: 2 Feb 2004 20:30:00 (orbit 10074)
Stop Time: 8 Feb 2004 12:36:00 (orbit 10155)

MIPAS switched to Heater/Refuse mode due to an IDU velocity error:
Start Time: 18 Feb 2004 08:10:57 (orbit 10295)
Stop Time: 18 Feb 2004 12:25:00 (orbit 10298)

Start Time: 21 Feb 2004 18:51:33 (orbit 10345)
Stop Time: 21 Feb 2004 22:21:00 (orbit 10347)

Start Time: 24 Feb 2004 12:21:02 (orbit 10384)
Stop Time: 24 Feb 2004 15:52:00 (orbit 10386)

Start Time: 27 Feb 2004 01:38:00 (orbit 10420)
Stop Time: 27 Feb 2004 11:04:00 (orbit 10426)

2.2.2 Data Generation Gaps

2.2.2.1 MIP_NL__0P

Table 1 lists the MIP_NL__0P missing intervals.

Tab. 1 List of missing intervals: MIP_NL__0P.

Start Time	Stop Time	Duration [s]	Start Orbit	Stop Orbit
02-Feb-04 20:29:22	02-Feb-04 20:30:00	38	10074	10074
09-Feb-04 18:32:05	09-Feb-04 18:33:19	74	10173	10173
09-Feb-04 18:33:19	09-Feb-04 18:42:04	525	10173	10173
09-Feb-04 18:34:27	09-Feb-04 18:43:12	525	10173	10173
09-Feb-04 18:43:12	09-Feb-04 18:43:27	15	10173	10173
09-Feb-04 20:12:03	09-Feb-04 20:22:49	646	10174	10174
11-Feb-04 14:18:37	11-Feb-04 14:20:58	141	10199	10199
11-Feb-04 14:20:58	11-Feb-04 14:20:58	0	10199	10199
11-Feb-04 14:20:58	11-Feb-04 14:29:44	526	10199	10199
11-Feb-04 14:29:44	11-Feb-04 14:30:33	49	10199	10199
11-Feb-04 14:30:33	11-Feb-04 14:39:18	525	10199	10199
11-Feb-04 14:39:18	11-Feb-04 14:39:18	0	10199	10199
11-Feb-04 14:39:18	11-Feb-04 14:48:04	526	10199	10199
11-Feb-04 14:48:04	11-Feb-04 14:48:53	49	10199	10199
11-Feb-04 14:48:53	11-Feb-04 14:57:38	525	10199	10199
11-Feb-04 14:57:38	11-Feb-04 15:06:24	526	10199	10199
11-Feb-04 14:57:38	11-Feb-04 14:57:38	0	10199	10199
11-Feb-04 15:06:24	11-Feb-04 15:07:13	49	10199	10199
11-Feb-04 15:07:13	11-Feb-04 15:15:58	525	10199	10199
11-Feb-04 15:15:58	11-Feb-04 15:15:58	0	10199	10199
11-Feb-04 15:15:58	11-Feb-04 15:24:44	526	10199	10199
11-Feb-04 15:24:44	11-Feb-04 15:34:39	595	10199	10200
11-Feb-04 15:34:39	11-Feb-04 15:43:24	525	10200	10200
11-Feb-04 15:43:24	11-Feb-04 15:43:24	0	10200	10200
11-Feb-04 15:43:24	11-Feb-04 15:52:10	526	10200	10200
11-Feb-04 15:52:10	11-Feb-04 15:52:49	39	10200	10200
11-Feb-04 15:52:49	11-Feb-04 16:01:34	525	10200	10200
11-Feb-04 16:01:34	11-Feb-04 16:01:34	0	10200	10200
11-Feb-04 16:01:34	11-Feb-04 16:10:20	526	10200	10200
11-Feb-04 16:10:20	11-Feb-04 16:11:09	49	10200	10200
11-Feb-04 16:11:09	11-Feb-04 16:19:54	525	10200	10200
11-Feb-04 16:19:54	11-Feb-04 16:19:54	0	10200	10200
11-Feb-04 16:19:54	11-Feb-04 16:28:40	526	10200	10200
11-Feb-04 16:28:40	11-Feb-04 16:41:09	749	10200	10200
11-Feb-04 16:41:09	11-Feb-04 16:41:35	26	10200	10200

11-Feb-04 16:41:35	11-Feb-04 16:42:49	74	10200	10200
11-Feb-04 16:42:49	11-Feb-04 16:51:34	525	10200	10200
11-Feb-04 16:51:34	11-Feb-04 16:51:34	0	10200	10200
11-Feb-04 16:51:34	11-Feb-04 17:00:20	526	10200	10200
11-Feb-04 17:00:20	11-Feb-04 17:06:09	349	10200	10200
11-Feb-04 17:06:09	11-Feb-04 17:14:54	525	10200	10200
11-Feb-04 17:14:54	11-Feb-04 17:23:40	526	10200	10201
11-Feb-04 17:23:40	11-Feb-04 17:33:49	609	10201	10201
13-Feb-04 18:07:04	13-Feb-04 18:08:17	73	10230	10230
13-Feb-04 18:08:17	13-Feb-04 18:17:02	525	10230	10230
13-Feb-04 18:09:25	13-Feb-04 18:18:10	525	10230	10230
13-Feb-04 18:18:10	13-Feb-04 18:18:25	15	10230	10230
13-Feb-04 19:47:49	13-Feb-04 19:58:39	650	10231	10231
14-Feb-04 10:38:24	14-Feb-04 10:38:38	14	10239	10240
14-Feb-04 12:47:11	14-Feb-04 14:07:50	4839	10241	10242
14-Feb-04 14:08:25	14-Feb-04 14:08:54	29	10242	10242
14-Feb-04 14:08:55	14-Feb-04 14:24:18	923	10242	10242
16-Feb-04 11:43:09	16-Feb-04 11:43:40	31	10269	10269
16-Feb-04 13:22:51	16-Feb-04 13:23:00	9	10270	10270
16-Feb-04 15:01:10	16-Feb-04 15:01:40	30	10271	10271
16-Feb-04 16:38:45	16-Feb-04 16:39:09	24	10272	10272
16-Feb-04 18:17:31	16-Feb-04 18:18:25	54	10273	10273
16-Feb-04 19:54:58	16-Feb-04 19:56:25	87	10274	10274
17-Feb-04 06:08:24	17-Feb-04 06:10:37	133	10280	10280
17-Feb-04 07:54:37	17-Feb-04 07:55:49	72	10281	10281
17-Feb-04 09:32:11	17-Feb-04 09:33:49	98	10282	10282
17-Feb-04 11:12:29	17-Feb-04 11:14:25	116	10283	10283
17-Feb-04 12:51:31	17-Feb-04 12:53:27	116	10284	10284
17-Feb-04 14:31:08	17-Feb-04 14:33:19	131	10285	10285
17-Feb-04 16:07:13	17-Feb-04 16:09:15	122	10286	10286
17-Feb-04 17:46:15	17-Feb-04 17:48:39	144	10287	10287
17-Feb-04 19:24:26	17-Feb-04 19:27:31	185	10288	10288
17-Feb-04 21:06:19	17-Feb-04 21:07:53	94	10289	10289
18-Feb-04 12:25:00	18-Feb-04 12:25:14	14	10298	10298
20-Feb-04 16:01:03	20-Feb-04 16:11:10	607	10329	10329
21-Feb-04 07:01:10	21-Feb-04 07:01:12	2	10338	10338
21-Feb-04 10:18:16	21-Feb-04 10:18:30	14	10339	10340
21-Feb-04 18:50:50	21-Feb-04 18:51:33	43	10345	10345
21-Feb-04 22:21:00	21-Feb-04 22:21:14	14	10347	10347
24-Feb-04 12:21:00	24-Feb-04 12:21:02	2	10384	10384
24-Feb-04 15:52:00	24-Feb-04 15:52:14	14	10386	10386

2.2.2.2 MIP_LS__0P

Table 2 lists the MIP_LS__0P missing intervals.

Tab. 2 List of missing intervals: MIP_LS__0P.

Start Time	Stop Time	Duration [s]	Start Orbit	Stop Orbit
21-Feb-04 07:02:12	21-Feb-04 07:02:20	8	10338	10338

2.2.2.3 MIP_RW__0P

Table 3 lists the MIP_RW__0P missing intervals.

Tab. 3 List of missing intervals: MIP_RW__0P.

Start Time	Stop Time	Duration [s]	Start Orbit	Stop Orbit
09-Feb-04 18:32:19	09-Feb-04 18:43:19	660	10173	10173
09-Feb-04 20:12:15	09-Feb-04 20:22:43	628	10174	10174
13-Feb-04 18:07:17	13-Feb-04 18:18:17	660	10230	10230
13-Feb-04 19:48:03	13-Feb-04 19:58:31	628	10231	10231

2.2.2.4 MIP_NL__1P

Percentage of missing products: 2.8 %.

2.3 INSTRUMENT CONFIGURATION AND PERFORMANCE

2.3.1 MIPAS Operations

Here a summary of the MIPAS operations planning for the February month is presented together with the analysis of the special measurements (special in-flight calibration and/or special observation modes) execution.

Operations planning:

- Special Event Measurement (SEM) activity every orbit at the same ANX time (=527.1 sec); background SEM compensation time set to low resolution (=10.2 sec).
- Nominal (NOM) background mission; NOM scan starts every orbit at ANX =574.3 sec.
- Line Of Sight (LOS) activity with a prime sequence in the first two orbits visible from Kiruna station on Saturday and a backup sequence on the first two orbits visible from Kiruna station on Sunday.
- Starting from orbit #10300 (18 February) the periodic RGC is performed every 28 orbits, starting at ANX = 5500 sec.

- Periodic Wear Control Cycle (WCC) performed every 5 orbits, starting at ANX =4000 sec.
- Special IF6, IF10, IF11 and IF9 calibrations have been also planned in orbits #10067 to #10073 (2 February).
- The special sequence Passive Decontamination - IF16 - IF4 - IF16 has been planned in orbits #10074 (2 February) to #10231 (13 February).
- The special S1 observation mode has been planned in orbits #10263-10277 (16 February); during those orbits the NOM and orbital SEM measurements are interrupted and resumed just after.

CTI needed for planning:

The SEMs are needed to re-start the NOM measurements in each orbit always at the same latitude. Each SEM is composed by a single scan of two sweeps. In order to execute that special measurement it is needed to define a Configuration Table Interface (CTI) per orbit (CTI_SEM_MP) containing information about: orbit number, SEM start and stop ANX time, number of sweeps (presently 2), resolution (presently high) and DS flag before the SEM. Two further CTI are needed to define respectively the elevation increment and the azimuth increment for the SEM sweep: CTI_S22_MP and CTI_S23_MP.

<u>IF6 (CBB and DS SNR characterization) in orbit #10067:</u>
(TCP for DS and BB already in low resolution)

CTI_DSN_MPVRGT20040109_123409_00000000_00000096_20040202_090801_20781231_235959.N1
Group_13871 RGTv_111 400 sweeps in low resolution
CTI_BBN_MPVRGT20040109_124022_00000000_00000062_20040202_090901_20781231_235959.N1
Group_13872 RGTv_76 400 sweeps in low resolution
MPL_ORS_MPVRGT20040109_124903_00000000_00000033_20040202_091621_20040202_092828.N1
Group_13873 RGTv_48 DS and BB cal segments
CTI_DSN_MPVRGT20040109_125341_00000000_00000097_20040202_093441_20781231_235959.N1
Group_13874 RGTv_112 reset default DS in low resolution
CTI_BBN_MPVRGT20040109_125750_00000000_00000063_20040202_093541_20781231_235959.N1
Group_13875 RGTv_77 reset default BB in low resolution

<u>IF10 (NESR0 verification) in orbit #10068:</u>

CTI_TCP_MPVRGT20040109_135119_00000000_00001722_20040202_104017_20040202_104022.N1
Group_13887 RGTv_1751 set TCP for DS to high resolution
CTI_DSN_MPVRGT20040109_131428_00000000_00000098_20040202_105657_20781231_235959.N1
Group_13877 RGTv_113 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_131750_00000000_00000099_20040202_105837_20781231_235959.N1
Group_13878 RGTv_114 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_132149_00000000_00000100_20040202_110017_20781231_235959.N1
Group_13879 RGTv_115 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_132445_00000000_00000101_20040202_110157_20781231_235959.N1
Group_13880 RGTv_116 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_132812_00000000_00000102_20040202_110337_20781231_235959.N1
Group_13881 RGTv_117 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_133056_00000000_00000103_20040202_110517_20781231_235959.N1
Group_13882 RGTv_118 10 sweeps in high resolution

CTI_DSN_MPVRGT20040109_133423_00000000_00000104_20040202_110657_20781231_235959.N1
Group_13883 RGTv_119 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_133908_00000000_00000105_20040202_110837_20781231_235959.N1
Group_13884 RGTv_120 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_134215_00000000_00000106_20040202_111017_20781231_235959.N1
Group_13885 RGTv_121 10 sweeps in high resolution
CTI_DSN_MPVRGT20040109_134542_00000000_00000107_20040202_111517_20781231_235959.N1
Group_13886 RGTv_122 reset default DS table
CTI_TCP_MPVRGT20040109_135644_00000000_00001723_20040202_111657_20040202_111702.N1
Group_13888 RGTv_1752 reset TCP for DS to low resolution
MPL_ORS_MPVRGT20040109_155357_00000000_00000034_20040202_105659_20040202_111122.N1
Group_13889 RGTv_49 DS cal segments

IF11 (Absence of high resolution features verification) in orbit #10069:
CTI_TCP_MPVRGT20040109_161523_00000000_00001724_20040202_122913_20040202_122918.N1
Group_13890 RGTv_1753 set TCP for DS and BB to high resolution
CTI_DSN_MPVRGT20040109_162737_00000000_00000108_20040202_123013_20781231_235959.N1
Group_13892 RGTv_123 200 sweeps in high resolution
CTI_BBN_MPVRGT20040109_163019_00000000_00000064_20040202_123113_20781231_235959.N1
Group_13893 RGTv_78 200 sweeps in high resolution
CTI_DSN_MPVRGT20040109_163251_00000000_00000109_20040202_131913_20781231_235959.N1
Group_13894 RGTv_124 reset default DS in low resolution
CTI_BBN_MPVRGT20040109_163624_00000000_00000065_20040202_132013_20781231_235959.N1
Group_13895 RGTv_79 reset default BB in low resolution
CTI_TCP_MPVRGT20040109_161814_00000000_00001725_20040202_132113_20040202_132118.N1
Group_13891 RGTv_1754 reset TCP for DS and BB to low resolution
MPL_ORS_MPVRGT20040109_164504_00000000_00000035_20040202_123733_20040202_130751.N1
Group_13896 RGTv_50 DS and BB cal segments

IF9 (Offset tangent height altitude determination) in orbits #10070-10073 (start ANX = 574.3 sec):
CTI_E02_MPVRGT20040112_110359_00000000_00000047_20040202_134516_20781231_235959.N1
Group_13898 start special IF9 calibration mode
CTI_E01_MPVRGT20040112_110359_00000000_00000047_20040202_134519_20781231_235959.N1
CTI_AST_MPVRGT20040112_110359_00000000_00000047_20040202_134522_20781231_235959.N1
CTI_N02_MPVRGT20040112_110359_00000000_00000023_20040202_134525_20781231_235959.N1
CTI_S04_MPVRGT20040112_110358_00000000_00000012_20040202_134528_20781231_235959.N1
CTI_NOC_MPVRGT20040112_110359_00000000_00000047_20040202_134531_20781231_235959.N1
reset background NOM mode in orbit #10074 (start ANX = 574.3 sec):
CTI_E02_MPVRGT20040112_112547_00000000_00000048_20040202_202740_20781231_235959.N1
Group_13899 restart nominal background mode
CTI_E01_MPVRGT20040112_112547_00000000_00000048_20040202_202743_20781231_235959.N1
CTI_AST_MPVRGT20040112_112547_00000000_00000048_20040202_202746_20781231_235959.N1
CTI_N01_MPVRGT20040112_112547_00000000_00000025_20040202_202749_20781231_235959.N1
CTI_S06_MPVRGT20040112_112547_00000000_00000012_20040202_202752_20781231_235959.N1
CTI_NOC_MPVRGT20040112_112547_00000000_00000048_20040202_202755_20781231_235959.N1

F16 (Several limb scanning sequences in RAW data mode) in orbits #10173-10174:
(TCP for DS and BB already in low resolution)
CTI_DSN_MPVRGT20040113_114054_00000000_00000110_20040209_182810_20781231_235959.N1
Group_13965 RGTv_125 set DS table: 60 sweeps in low resolution

CTI_BBN_MPVRGT20040113_115427_00000000_00000066_20040209_182910_20781231_235959.N1
Group_13967 RGTv_80 set BB table: 60 sweeps in low resolution
MPL_ORS_MPVRGT20040113_121019_00000000_00000037_20040209_183210_20040209_202234.N1
Group_13969 RGTv_52 RAW mode, DS and BB segments
CTI_DSN_MPVRGT20040113_114916_00000000_00000111_20040209_200846_20781231_235959.N1
Group_13966 RGTv_126 reset default DS table
CTI_BBN_MPVRGT20040113_115724_00000000_00000067_20040209_200946_20781231_235959.N1
Group_13968 RGTv_81 reset default BB table

IF4 (Non-linearity characterization) in orbits#10175-10211:
(TCP for DS and BB already in low resolution; DS and BB tables already set to required values)
orbit #10175 ---> command to Heater Level 0 (operation manually commanded by ESOC)
orbits #10176-10183 --->
MPL_ORS_MPVRGT20040113_130259_00000000_00000038_20040209_234457_20040210_123641.N1
Group_13973 RGTv_54 2 RGC segments per orbit
orbit #10195 ---> command to Heater Level 9 (operation manually commanded by ESOC)
orbits #10196-10200 --->
MPL_ORS_MPVRGT20040113_132709_00000000_00000039_20040211_085206_20040211_170012.N1
Group_13975 RGTv_56 5 RGC segments per orbit
orbit **(*)** ---> command to Heater Level 4 (operation manually commanded by ESOC)
orbits #10202-10211 --->
MPL_ORS_MPVRGT20040113_134126_00000000_00000040_20040211_192032_20040212_113327.N1
Group_13977 RGTv_58 2 RGC segments per orbit

(*) The Heater Level 4 has to be manually commanded by ESOC as soon as the CBB temperature reaches HL = 9 (~248 K). This has been estimated by ESRIN to happen around orbit #10201 but it is strongly needed the monitoring of the CBB PRT temperatures, starting from orbit #10195. In any case even if the temperature won't reach the higher level it shall be switched down to HL = 4 at last Kiruna pass of the day in order to safeguard the instrument.

F16 (Several limb scanning sequences in RAW data mode) in orbits #10230-10231:
(TCP for DS and BB already in low resolution)
CTI_DSN_MPVRGT20040113_145218_00000000_00000112_20040213_180218_20781231_235959.N1
Group_13978 RGTv_127 set DS table: 60 sweeps in low resolution
CTI_BBN_MPVRGT20040113_145927_00000000_00000068_20040213_180318_20781231_235959.N1
Group_13980 RGTv_82 set BB table: 60 sweeps in low resolution
MPL_ORS_MPVRGT20040113_152512_00000000_00000041_20040213_180708_20040213_195822.N1
Group_13982 RGTv_59 RAW mode, DS and BB segments
CTI_DSN_MPVRGT20040113_145601_00000000_00000113_20040213_194254_20781231_235959.N1
Group_13979 RGTv_128 reset default DS table
CTI_BBN_MPVRGT20040113_150408_00000000_00000069_20040213_194354_20781231_235959.N1
Group_13981 RGTv_83 reset default BB table

Starting S1 (Polar Chemistry and Dynamics) in orbit #10263 (ANX = 574.3 sec, without orbital SEMs):
CTI_E02_MPVRGT20040119_120719_00000000_00000049_20040216_012050_20781231_235959.N1
Group_14045
CTI_E01_MPVRGT20040119_120719_00000000_00000049_20040216_012053_20781231_235959.N1
CTI_AST_MPVRGT20040119_120719_00000000_00000049_20040216_012056_20781231_235959.N1

CTI_N02_MPVRGT20040119_120718_00000000_00000024_20040216_012059_20781231_235959.N1
CTI_S08_MPVRGT20040119_120718_00000000_00000012_20040216_012102_20781231_235959.N1
CTI_NOC_MPVRGT20040119_120718_00000000_00000049_20040216_012105_20781231_235959.N1

Reset background NOM mode in orbit #10277 (ANX = 2032.4 sec):
CTI_E02_MPVRGT20040119_122211_00000000_00000050_20040217_011331_20781231_235959.N1
Group_14046
CTI_E01_MPVRGT20040119_122211_00000000_00000050_20040217_011334_20781231_235959.N1
CTI_AST_MPVRGT20040119_122211_00000000_00000050_20040217_011337_20781231_235959.N1
CTI_N01_MPVRGT20040119_122211_00000000_00000026_20040217_011340_20781231_235959.N1
CTI_S02_MPVRGT20040119_122211_00000000_00000014_20040217_011343_20781231_235959.N1
CTI_NOC_MPVRGT20040119_122211_00000000_00000050_20040217_011346_20781231_235959.N1

Execution analysis:

Table 4 summarizes the status of the special measurements done in January.

Tab. 4 Status of the MIPAS special measurements done in January.

Special Measurement	Date	Orbit	Execution
IF_6	2 February	10067	Successful
IF_10	2 February	10068	Successful
IF_11	2 February	10069	Successful
IF_9	2 February	10070-10073	Successful
IF16	9 February	10173-10174	Missing Intervals: Orbit 10173 18:32:05 - 18:43:27 Orbit 10174 20:12:03 - 20:22:49
IF_4	10 February	10176-10183	Successful
IF_4	11 February	10196-10200	Missing Orbits: 10199 - 10200
IF_4	11 February	10202-10205	Successful
IF_4	12 February	10206-10211	Successful
IF_16	13 February	10230-10231	Missing Intervals: Orbit 10230 18:07:04 - 18:18:25 Orbit 10231 19:47:49 - 19:58:39
S1	16 February	10263-10276	Successful

2.3.2 Thermal Performance

The monthly thermal trend (Fig. 1) is characterized by the sequence Decontamination - IF16 - IF4 - IF16. During decontamination, in fact, no measurements are done and this is evidenced by the data gap shown in the plot. The instrument cooling before restart measurement mode characterizes a lower temperature level at the switch-on. The temperature decrease followed by a temperature increase is coherent with the sequence of commands: Temperature to Level 0, Temperature to Level 9, Temperature to Level 4. The Long-term thermal trend (Fig. 2) evidences a decrease of temperature with respect to previous month where the interferometer has been heated caused by the decontamination sequence.

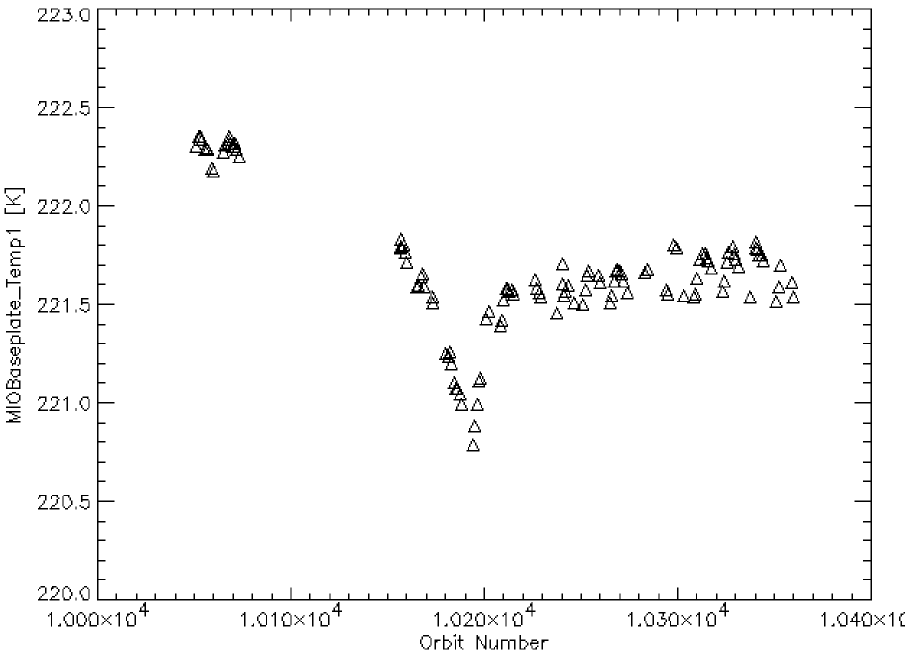

Fig. 1 Short-term trend of instrument temperature (each point represents the orbit mean value): February 2004.

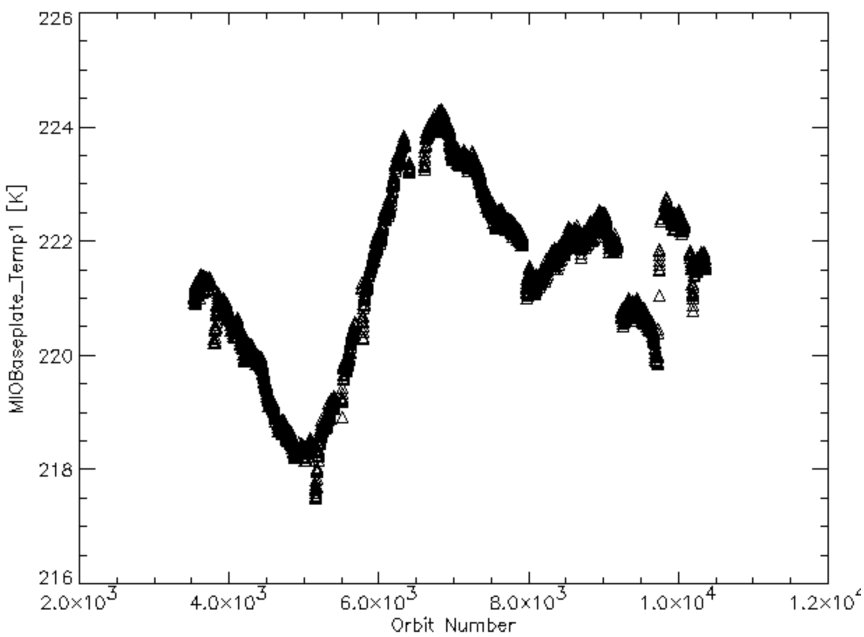

Fig. 2 Long-term trend of instrument temperature (each point represents the orbit mean value): November 2002-February 2004.

The temperature increase of the Interferometer after the INT heater switch-on (9 January 2004) is given in the following picture:

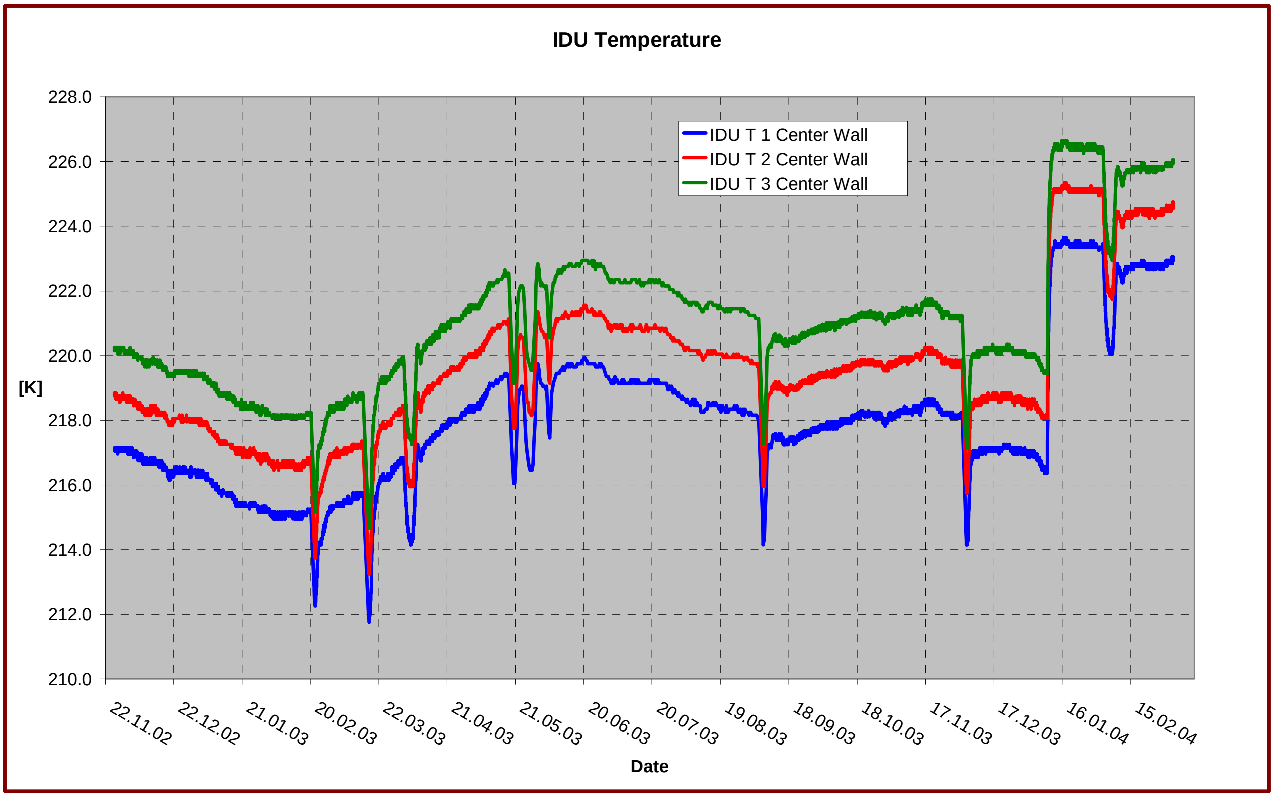

Fig. 3 Interferometer temperatures since November 2002; the increase after INT heater switch-on is about 7K..

2.3.3 Mechanical Performance

2.3.3.1 Cooler Performance

The Compressor and Displacer vibration level, together with the Radiator temperatures, are monitored on a daily basis (an example is shown if Fig. 4). The monitoring foresees a warning message whenever the Compressor vibration level exceeds a threshold value (8 mg) well below the tolerance error that activates the MIPAS standby/refuse mode. During February, the spikes characterizing the threshold exceeding reappeared around 10-12 February 2004 and the warning threshold (8 mg) has been exceeded on 10 February and 12 February.

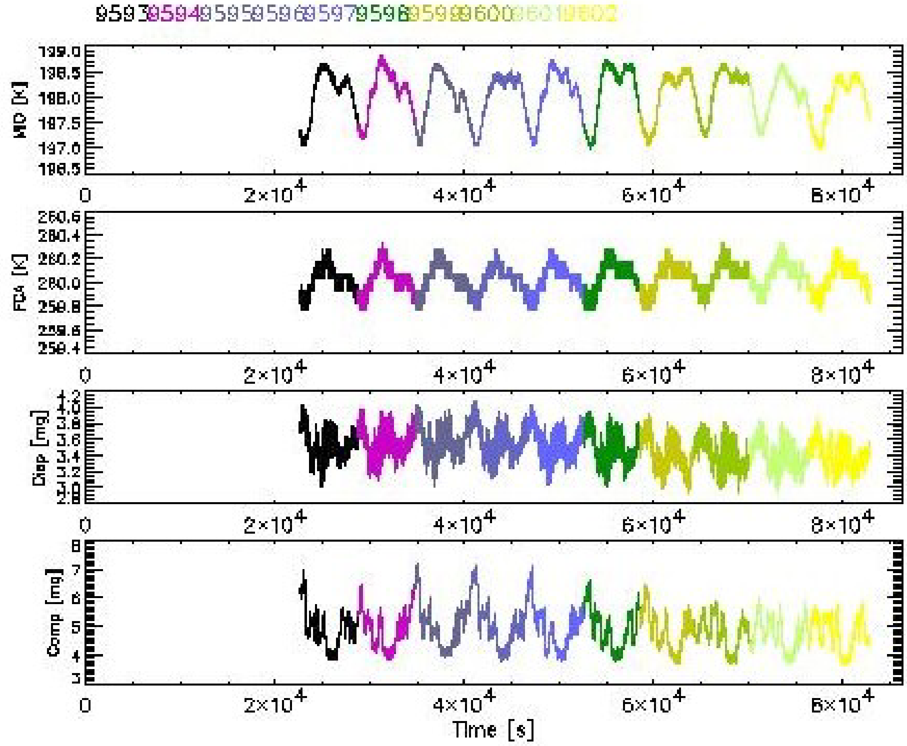

Fig. 4 Daily Compressor and Displacer vibration level, together with the Radiator temperatures as a function of time (each colour refers to a single orbit).

2.3.3.2 Interferometer Performance

Although the Interferometer is running with a very stable scan gate, there are still two anomalies, which are of importance:

- The Interferometer velocity error leading to a Heater/Refuse mode and consequently a MIPAS outage. After the experiences from 2003, it was decided to switch on the Interferometer heaters to reduce the problem. However, the velocity error is still observed, which was unexpected. Detailed investigations are running since then.
- The Interferometer differential speed errors (IDSE) of +4% and -4%; the -4% error has a significantly increased statistics.

Interferometer velocity error:

As already seen for January, in February MIPAS suffered from an increased occurrence of the IDU velocity error. In total four events occurred which are listed below:

- 18 Feb 2004 08:10:57
- 21 Feb 2004 18:51:33
- 24 Feb 2004 12:21:02
- 27 Feb 2004 01:38:00

In order to cope with this anomaly, the INT heaters were switched on 9 January. However, the observation was that directly after the heater switching there were additional velocity errors, which was attributed to thermal gradients within the Interferometers. Therefore it was decided to let the temperature stabilise and to leave MIPAS in Heater Mode (unavailability between 12 January and 15 January). After the stabilisation period, MIPAS was put back into measurement, but even at the higher operational temperature the anomaly was still present, which was in contradiction to on-ground testing experiences and the related earlier anomaly investigations. As a result of this unexpected behaviour, a detailed investigation started to collect all the Interferometer related anomalies observed so far and to match them with error hypotheses. The investigation on this subject is ongoing.

Interferometer differential speed error:

Figure 5 shows the number of +4% anomalies (positive differential speed errors) per day as a function of time starting from October 2003, Figure 6 shows the increase of the -4% error (negative differential speed errors) since August 2003. From both plots it can be seen that the number of differential speed errors were reduced after the INT heater switch-on, but reached the previous levels after about 3 weeks. This points to a temperature dependent phenomenon.

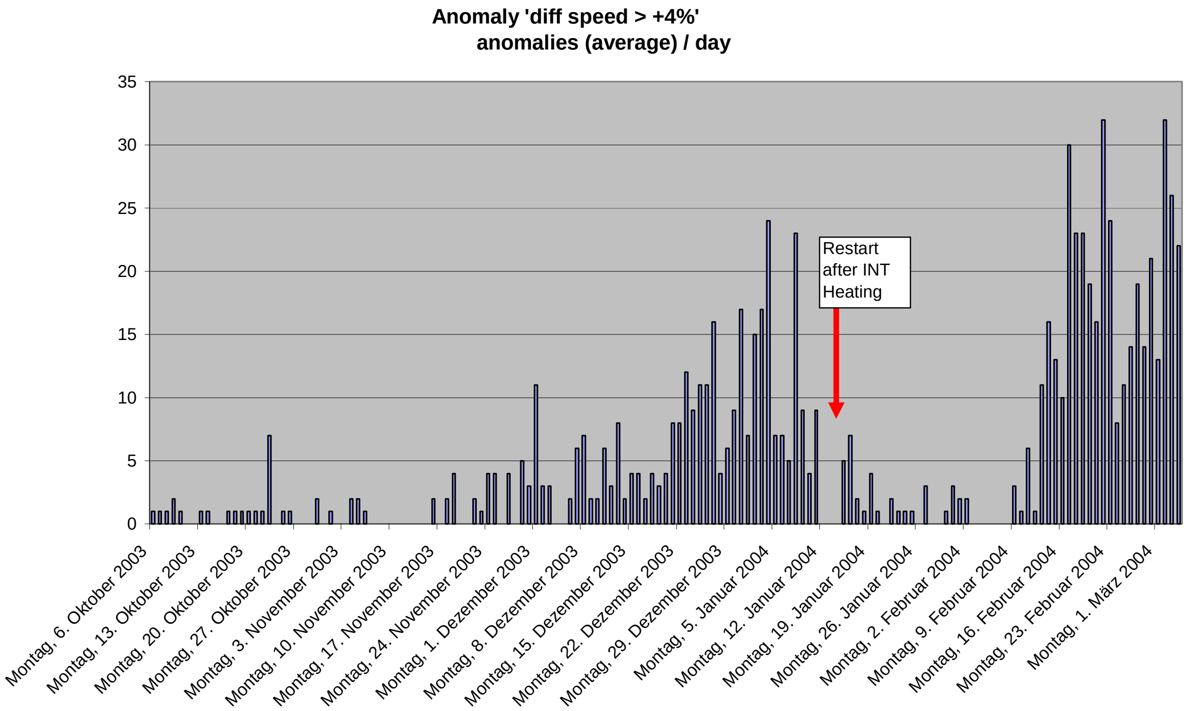

Fig. 5 Number of +4% IDSE per day as a function of time (starting from October 2003).

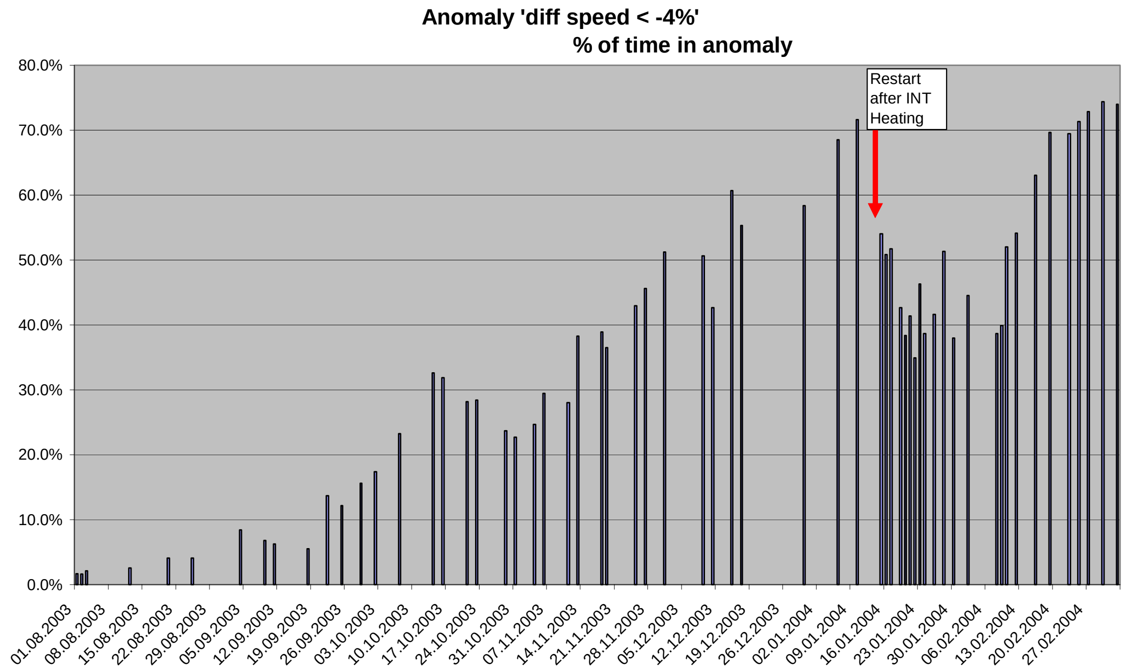

Fig. 6 Number of -4% IDSE per day as a function of time (since August 2003).

<u>Further Interferometer Data Analysis:</u>

In order to trace the interferometer problem, the scan gate length and the Absolute Position Sensor (APS) data were compared to the beginning of the mission (for high-resolution sweeps). While the length of the scan gate is not affected during the lifetime, Fig 7a-c show that the difference between the subtended stroke lengths the rails show an increasing variation. In other words, the scan gate length (or the OPD) is maintained by one slide compensating the variations of the other slide.

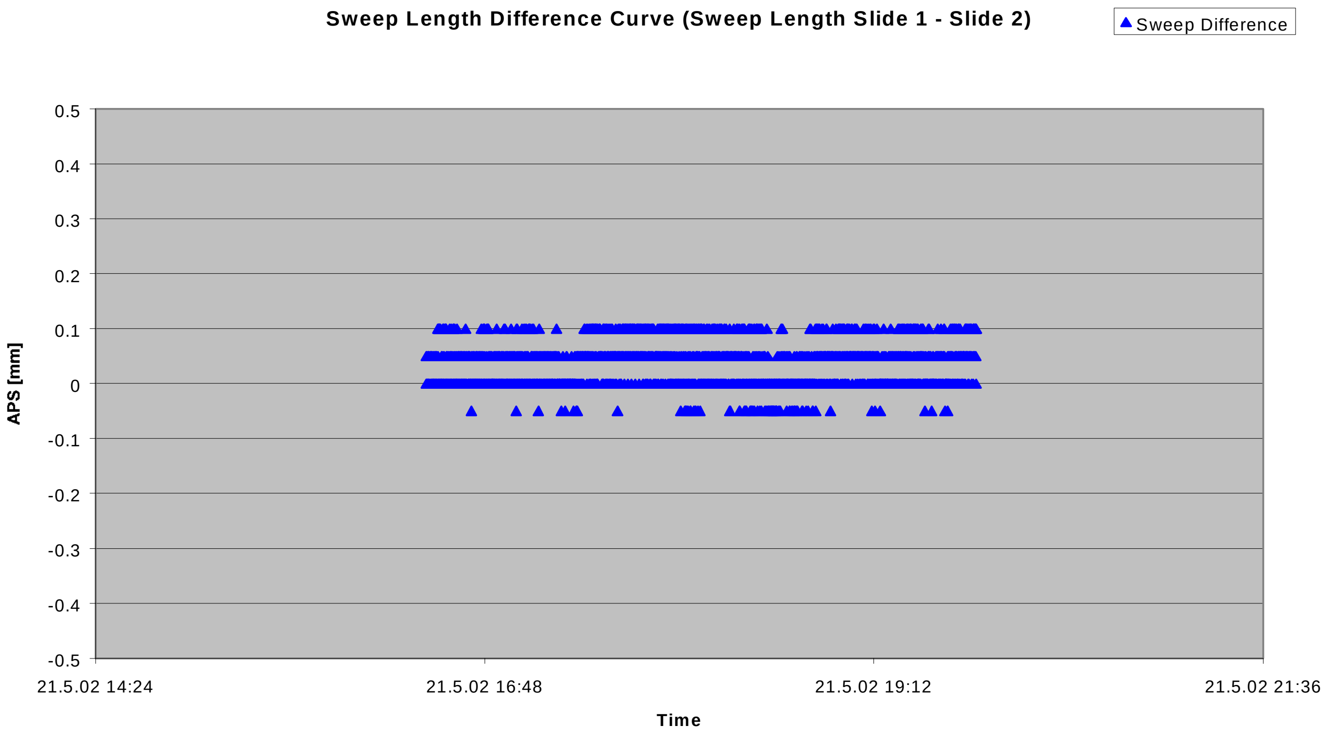

Fig. 7a APS difference between both slides at begin of mission.

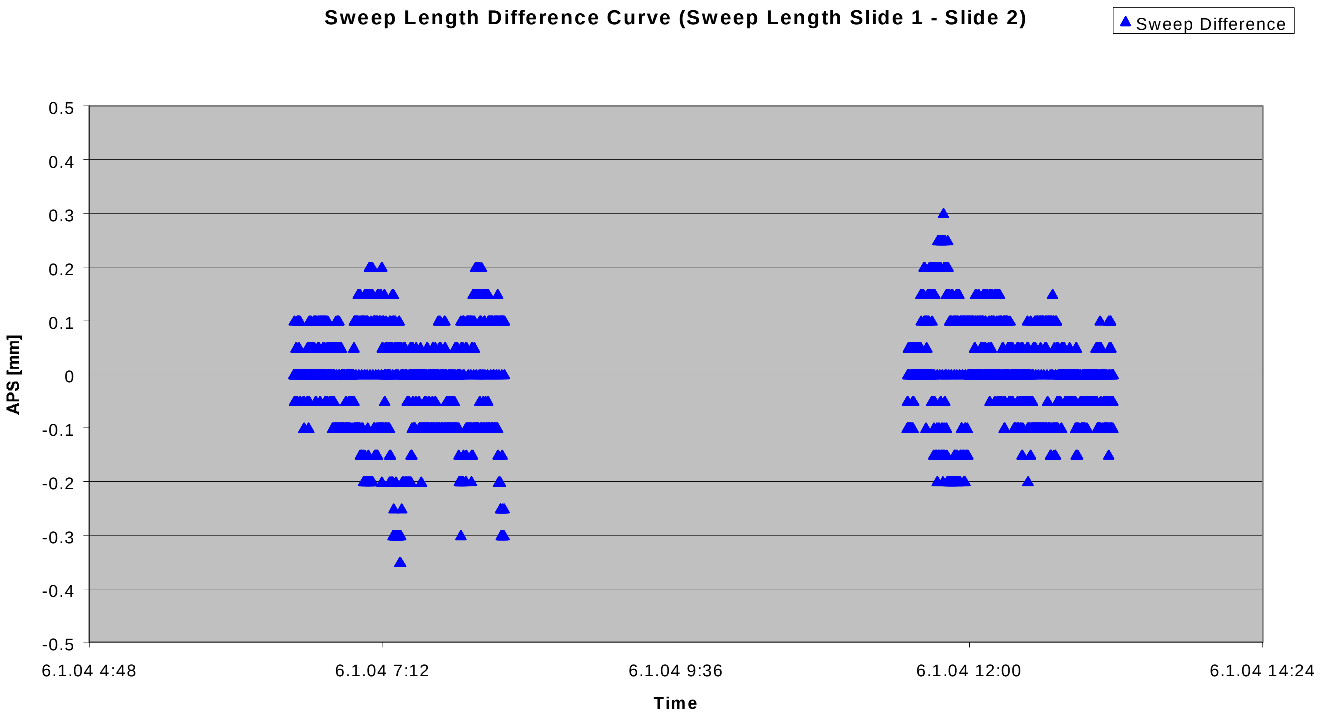

Fig. 7b APS difference in Jan 2004 before INT heater switch-on

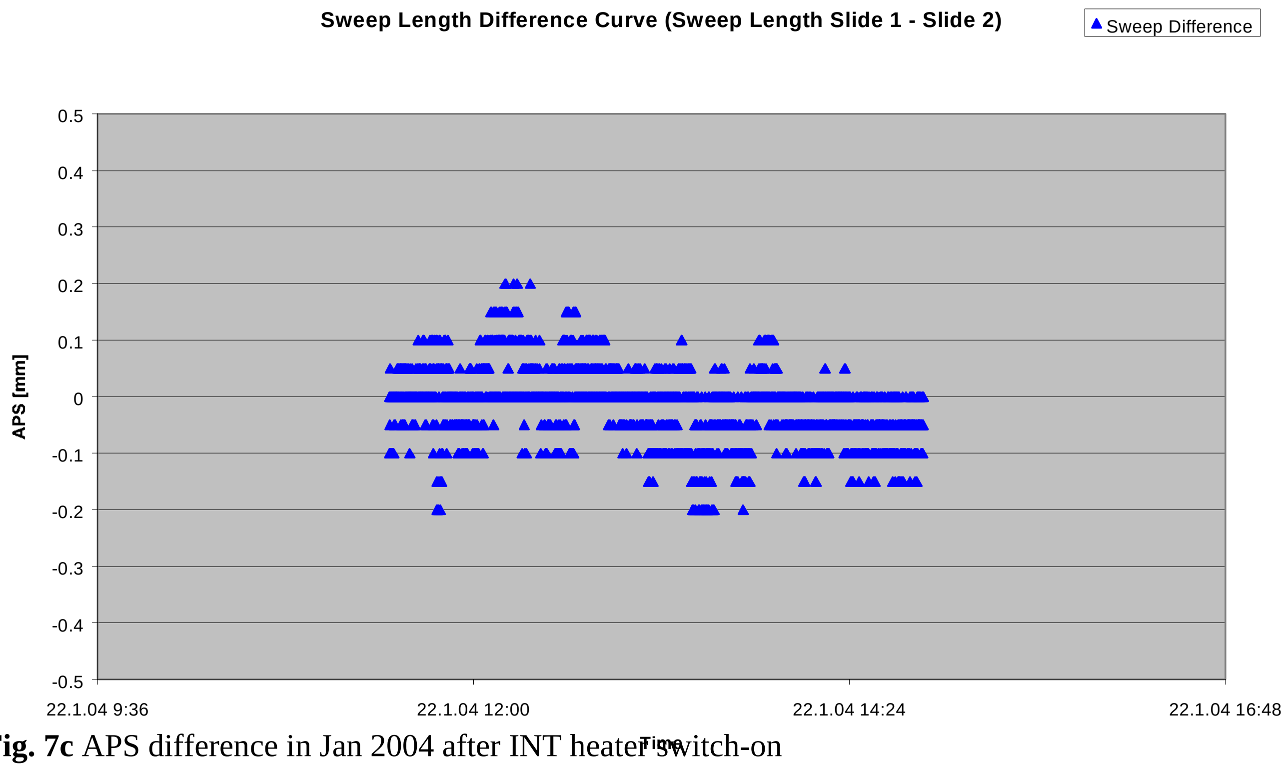

Fig. 7c APS difference in Jan 2004 after INT heater switch-on

The findings from the data evaluation can be summarised as follows:

- The scan gate length is still constant with high accuracy
- During the sweep the differential slide speed varies up to about +/- 5-6%.
- The velocity of an individual slide varies more even extreme up to 10-20%.
- There is a relation between the +/-4% differential speed error occurrence rate and the sweep imbalance between both slides.

Investigations and preparations for countermeasures are ongoing.

2.3.3.3 ASU/ESU Performance

ASU/ESU are performing nominal.

2.3.4 Other Instrument Parameters

N/A.

2.4 LEVEL 1 PRODUCT QUALITY MONITORING

2.4.1 Processor Configuration

2.4.1.1 Version

Table 5 lists the historical updates of the MIPAS processor. Version V4.57 has introduced upgrade only on Level 1 processor, introducing the following modifications:

- Modification of FCE algorithm
- Elimination of strong anomalous oscillations in the spectra
- Modification of NESR reporting
- ADC saturation flagging
- Addition of aliasing spike suppression algorithm

Version V4.59 has introduced only upgrade on Level 2 processor.

Tab. 5 Historical updates of MIPAS processor at near real time (NRT) processing sites (PDHS-K and PDHS-E) and off-line processing sites (LRAC for Level 1 and D-PAC for Level 2).

Centre	Facility Software	Date
LRAC	V4.59	20-08-2003
D-PAC	V4.59	06-08-2003
PDHS-K	V4.59	23-07-2003
PDHS-E	V4.59	23-07-2003
PDHS-K	V4.57	22-07-2003
LRAC	V4.57	22-07-2003
PDHS-K	V4.59	21-07-2003
LRAC	V4.59	21-07-2003
LRAC	V4.57	19-03-2003
PDHS-K	V4.57	18-03-2003
D-PAC	V4.57	05-03-2003
PDHS-E	V4.57	04-03-2003

2.4.1.2 Auxiliary Data Files

Table 6 lists the ADFs valid in February. The new ADFs this month have been: Gain (MIP_CG1_AX), Offset (MIP_CO1_AX) and Spectral (MIP_CS1_AX) calibration files, which are updated weekly in order to prevent degradation of data quality due to gradual accumulation of contamination; LOS (MIP_CL1_AX) calibration file, which is updated less frequently.

Tab. 6 Level 1 ADFs valid in February.

Auxiliary Data File	Start Validity	Stop Validity	Updated in February
MIP_CA1_AXVIEC20031021_143953_20020706_060000_20080706_060000	06-JUL-02	06-JUL-08	No
MIP_CL1_AXVIEC20040220_144507_20040117_000000_20050117_000000	17-JAN-04	17-JAN-05	Yes
MIP_CS1_AXVIEC20040129_140908_20040129_101721_20090129_101721	29-JAN-04	29-JAN-09	No
MIP_CS1_AXVIEC20040206_145238_20040205_123738_20090205_123738	05-FEB-04	05-FEB-09	Yes
MIP_MW1_AXVIEC20031021_144135_20020706_060000_20080706_060000	06-JUL-02	06-JUL-08	No
MIP_PS1_AXVIEC20031021_144418_20020706_060000_20080706_060000	06-JUL-02	06-JUL-08	No
MIP_CO1_AXVIEC20040129_140727_20040129_121741_20090129_121741	29-JAN-04	29-JAN-09	No
MIP_CG1_AXVIEC20040129_140559_20040129_120348_20090129_120348	29-JAN-04	29-JAN-09	No
MIP_CO1_AXVIEC20040206_145134_20040205_135757_20090205_135757	05-FEB-04	05-FEB-09	Yes
MIP_CG1_AXVIEC20040206_145030_20040205_134726_20090205_134726	05-FEB-04	05-FEB-09	Yes

The strategy for the ADFs update is the following one:

- The MIP_CO1_AX, MIP_CG1_AX and MIP_CS1_AX will be updated every week and the MIP_CO1_AX and MIP_CG1_AX are evaluated with previous generation of MIP_CS1_AX.
- The MIP_CL1_AX will be analysed every two weeks and updated if needed.

For MIPAS data reprocessing, the generation of the historical ADFs series is ongoing:

- Weekly generation of MIP_CG1_AX and MIP_CO1_AX with previous evaluation of MIP_CS1_AX
- Monthly generation of MIP_CL1_AX
- Weekly generation of MIP_CS1_AX

During February the historical ADFs for pointing calibration have been disseminated (see ADFs listed in Tab. 7).

Tab. 7 LOS ADFs disseminated in February covering the reprocessing time interval.

Auxiliary Data File	Start Validity	Stop Validity
MIP_CL1_AXVIEC20040220_134214_20020706_000000_20021007_000000	06-JUL-2002	07-OCT-2002
MIP_CL1_AXVIEC20040220_140343_20020907_000000_20021112_000000	07-SEP-2002	12-NOV-2002
MIP_CL1_AXVIEC20040220_140612_20021012_000000_20021209_000000	12-OCT-2002	09-DEC-2002
MIP_CL1_AXVIEC20040220_140808_20021109_000000_20021230_000000	09-NOV-2002	30-DEC-2002
MIP_CL1_AXVIEC20040220_141011_20021130_000000_20030204_000000	30-NOV-2002	04-FEB-2003
MIP_CL1_AXVIEC20040220_141211_20030104_000000_20030301_000000	04-JAN-2003	01-MAR-2003
MIP_CL1_AXVIEC20040220_141405_20030201_000000_20030408_000000	01-FEB-2003	08-APR-2003
MIP_CL1_AXVIEC20040220_141603_20030308_000000_20030512_000000	08-MAR-2003	12-MAY-2003
MIP_CL1_AXVIEC20040220_141751_20030412_000000_20030610_000000	12-APR-2003	10-JUN-2003
MIP_CL1_AXVIEC20040220_141928_20030510_000000_20030707_000000	10-MAY-2003	07-JUL-2003
MIP_CL1_AXVIEC20040220_142118_20030607_000000_20030805_000000	07-JUN-2003	05-AUG-2003
MIP_CL1_AXVIEC20040220_142305_20030705_000000_20030902_000000	05-JUL-2003	02-SEP-2003
MIP_CL1_AXVIEC20040223_101232_20030802_000000_20030923_000000	02-AUG-2003	23-SEP-2003
MIP_CL1_AXVIEC20040220_142647_20030823_000000_20031020_000000	23-AUG-2003	20-OCT-2003
MIP_CL1_AXVIEC20040220_142840_20030920_000000_20031118_000000	20-SEP-2003	18-NOV-2003
MIP_CL1_AXVIEC20040220_143211_20031018_000000_20031215_000000	18-OCT-2003	15-DEC-2003
MIP_CL1_AXVIEC20040220_143405_20031115_000000_20040113_000000	15-NOV-2003	13-JAN-2004
MIP_CL1_AXVIEC20040220_143546_20031210_180000_20040217_000000	10-DEC-2003	17-FEB-2004
MIP_CL1_AXVIEC20040220_144507_20040117_000000_20050117_000000	17-JAN-2004	17-JAN-2005

2.4.2 Spectral Performance

Regeneration of MIPAS ADF calibration files (MIP_CG1_AX, MIP_CO1_AX and MIP_CS1_AX) was done for the period starting from August 2002 to November 2003. Among them, the spectral calibration file MIP_CS1_AX contains the spectral correction factor (SCF), which compensate for instrument metrology variation e.g., aging of laser. The Fig. 8 below gives the variation trend over the period. We observed that the laser frequency had a drift of less than 6 ppm over a period of one year, which is very stable. Note that short-term variations are not necessary due a laser variation itself, the SCF depends on radiance noise because it is computed from atmospheric lines in the spectrum. The SCF variation over an orbit is typically less than +/- 0.4 ppm.

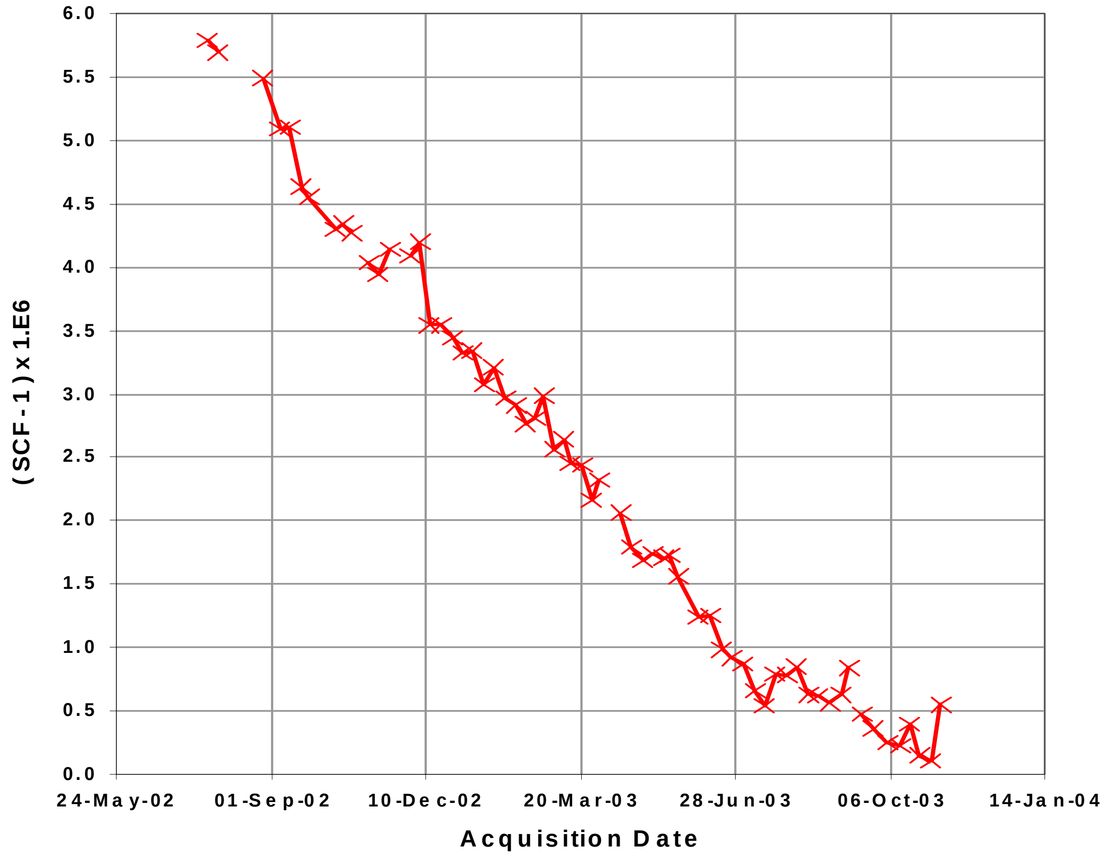

Fig. 8 MIPAS Spectral Calibration Factor (SCF) variation over August 2002 to November 2003.

2.4.3 Radiometric Performance

Only one RGC ADF dissemination has been done during February because of unavailability of data:

6 February 2004 (orbit 10067, 2 February 2004)

Starting from orbit #10300 (18 February) the periodic RGC is performed every 28 orbits.

2.4.4 Pointing Performance

The LOS calibration measurements are performed every week. This configuration allows the analysis of the pointing stability and guarantees the availability of the data in case of missing products. LOS calibration analysis is ongoing. Initial results have evidenced a marked annual cycle (as shown in Fig. 9) covering the period September 2002 – December 2003. The figure shows the relative and the absolute (evaluated taking into account the commanded elevation angle for the LOS calibration) pointing error. That annual trend is not due to the MIPAS instrument itself, but to a mispointing of the entire ENVISAT satellite resulting from software response to orbit control information. In fact, the update in the platform pointing software implemented on 12 December 2003 (orbit 9321) has evidently reduced the pointing deviation trends (see last points in Fig. 9).

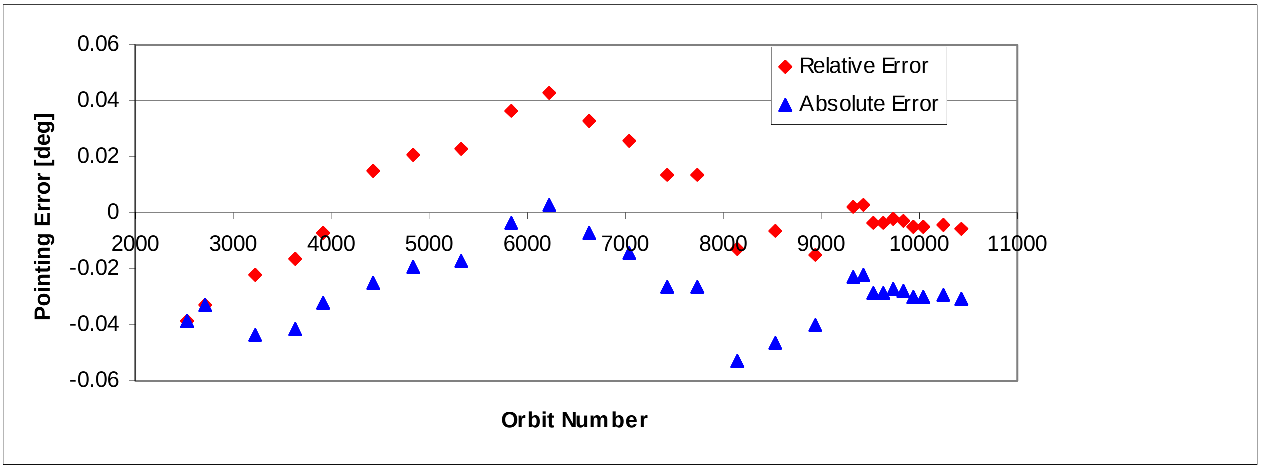

Fig. 9 MIPAS pointing error as a function of the orbit number: September 2002- February 2004.

Three LOS calibration measurements have been performed in January:
14 February 2004, orbit 10238-10239
21 February 2004, orbit 10338-10339
28 February 2004, orbit 10438-10439

2.4.5 Other Results

INCREASED NOISE LEVEL
During January (9 January 2004) the MIPAS interferometer has been heated in order to prevent the frequent IDU velocity error. A new MIP_PS1_AX has been generated and will be disseminated during March in order to adjust the threshold to the modified noise level. Nevertheless, there are no evidences of an increase in the MIPAS noise level as shown in Fig. 10-12 where the $NESR_T$ for orbit 503 is compared with the $NESR_T$ for orbit 9266 (2 January 2004; before heating) and 9816 (15 January 2004; after heating): No significant $NESR_T$ increase is observed.

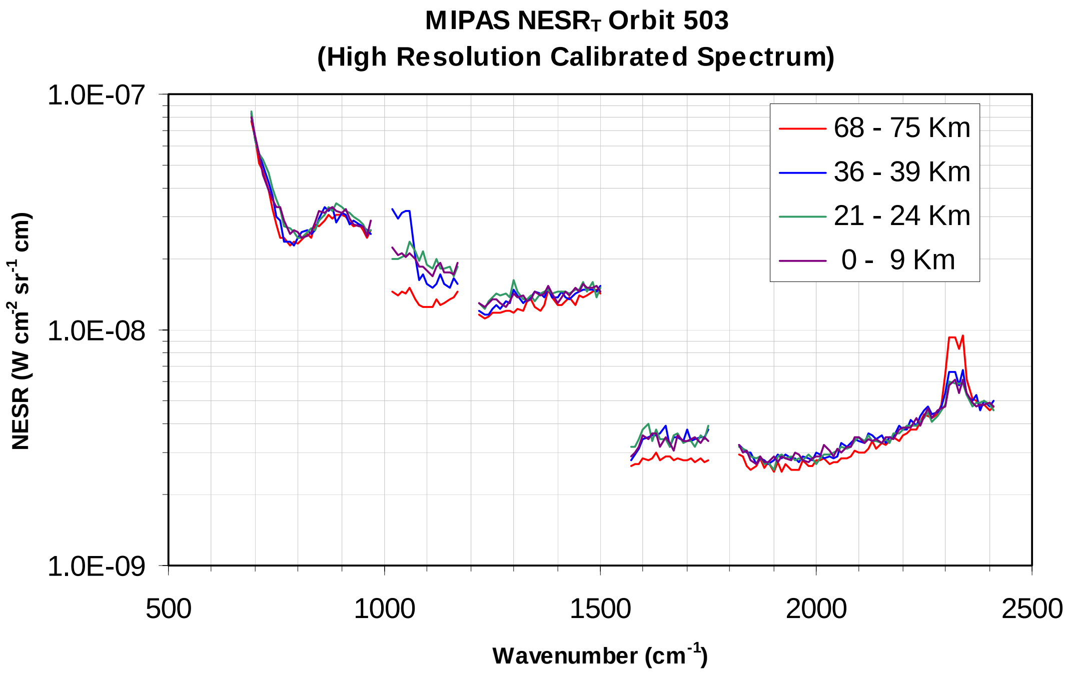

Fig. 10 NESR$_T$ as a function of wavenumber: orbit 503.

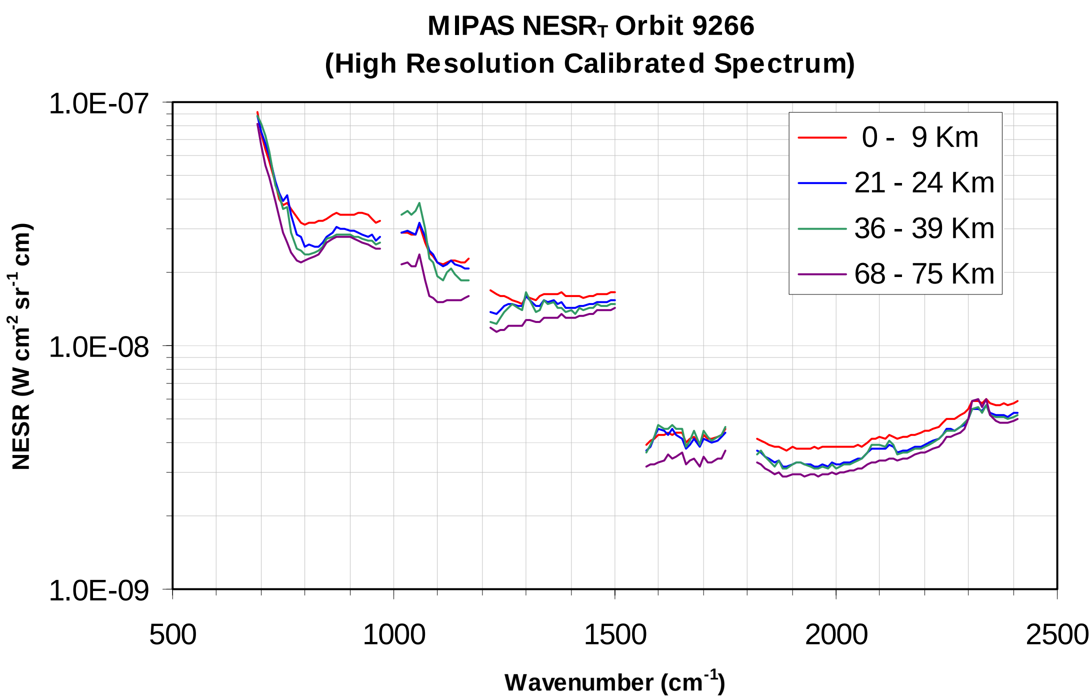

Fig. 11 NESR$_T$ as a function of wavenumber: orbit 9266.

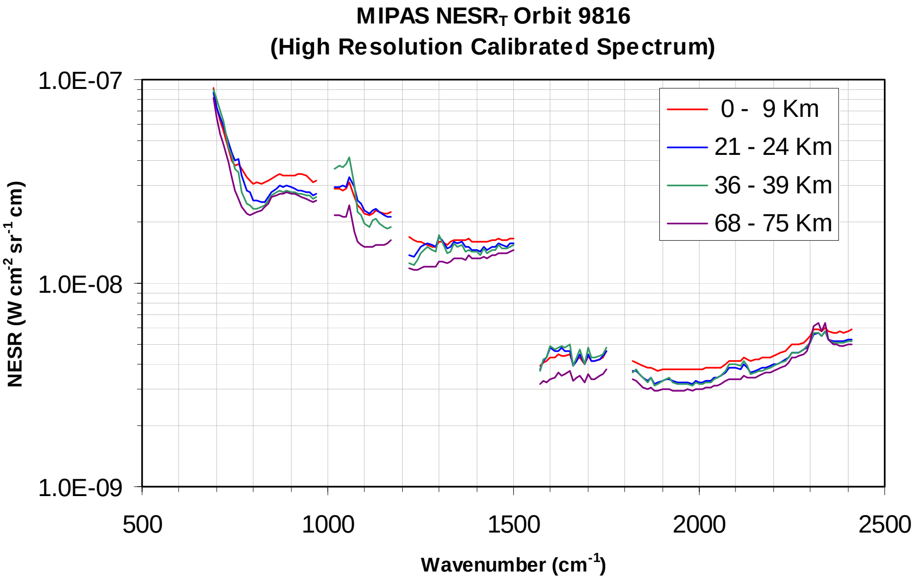

Fig. 12 NESR$_T$ as a function of wavenumber: orbit 9816.

CLOUD-DETECTION ANOMALY

The cloud-detection performed by the MIPAS processor IPF 4.59 is different with respect to the detection done with the prototype. The problem will be fixed with the new IPF 4.61, which will be operational in March.

BUG IN ILS RETRIEVAL

The ILS retrieval performed by the MIPAS processor IPF 4.59 is different with respect to the retrieval done with the prototype. The problem will be fixed with the new IPF 4.61, which will be operational in March. Fortunately, the ILS used for Level 2 product processing is provided via an ADF and is not affected by the wrong retrieval.

OSCILLATING SPECTRA

Starting from middle November, spectra characterized by strong oscillations have been observed. That anomaly has corrupted a big amount of MIPAS Level 1 and Level 2. The anomaly is related to a bug in the MIPAS operating processor (IPF 4.59) and partly has been resolved changing the MIP_CO1_AX, partly will be resolved with a new version of the MIPAS processor (4.61).

FCE ANALYSIS

An assessment of FCE trend was done on orbits 2081 (24 July 2002), 6687 (11 June 2003) and 9266 (8 December 2003). During orbit 2018, 4 FCEs occurred with a total variation of 1. For orbit 6687, around 9 FCEs occurred with a total variation of 3. Finally for orbit 9266, around 7 FCEs occurred with a total variation of 2. So, the increased number of IDU velocity error is not associated to a trend in the FCE.

2.5 LEVEL 2 PRODUCT QUALITY MONITORING

2.5.1 Processor Configuration

2.5.1.1 Version

As already explained in Section 2.4.1.1, Tab. 5 lists the historical updates of the MIPAS processor. The current version V4.59, operational since 23 July 2003, has introduced only Level 2 processing variations. The main improvements introduced via both the processor V4.59 and the installation of a new set of ADFs, have been: the cloud filtering (that is, every time a cloud is detected at a given altitude, the retrieval is performed only above that altitude); the removal of the gaps between the altitude validity ranges (allowing retrievals in the Antarctic region not feasible with the old MIP_MW2_AX); altitudes margins fixed to +/- 4 km. The other updates are listed below:

- MIPAS-SPR-MAINT-0011 Wrong DSD name in L2 product in case of not requested VMR
- MIPAS-SPR-MAINT-0012 Filling of SPH field 22 of MIPAS Level 2 Products
- MIPAS-SPR-MAINT-0013 Filling of the MIPAS MPH and MIPAS Level 2 SPH fields
- MIPAS-SPR-MAINT-0014 Wrong writing of PCD String to the PCD Information ADS
- MIPAS-SPR-MAINT-0015 Too strong test and skipping retrieval
- MIPAS-SPR-MAINT-0016 Not initialised nucl1 and nucl2 in R 8.5.6.3-7A
- ENVI-GSOP-EOAD-NC-03-0539 MIPAS L2 processing aborted

2.5.1.2 Auxiliary Data Files

Table 8 lists the ADFs valid in February and Tab. 9 summarizes the historical (from January 2003) update of Level 2 ADFs.

Tab. 8 Level 2 ADFs valid in February.

Auxiliary Data File	Start Validity	Stop Validity	Updated in January
MIP_IG2_AXVIEC20031118_151533_20031201_000000_20081201_000000	01-DEC-03	01-DEC-08	No
NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 Off-line MIP_MW2_AXVIEC20031027_100858_20020706_060000_20080706_060000	06-JUL-03	06-JUL-03	No
NRT MIP_OM2_AXVIEC20031021_145630_20020706_060000_20080706_060000 Off-line MIP_OM2_AXVIEC20031027_101029_20020706_060000_20080706_060000	06-JUL-03	06-JUL-03	No
NRT MIP_PS2_AXVIEC20031021_145858_20020706_060000_20080706_060000 Off-line MIP_PS2_AXVIEC20031027_101319_20020706_060000_20080706_060000	06-JUL-03	06-JUL-03	No
NRT MIP_PI2_AXVIEC20031021_145745_20020706_060000_20080706_060000 Off-line MIP_PI2_AXVIEC20031027_101146_20020706_060000_20080706_060000	06-JUL-03	06-JUL-03	No
NRT MIP_CS2_AXVIEC20031021_145337_20020706_060000_20080706_060000 Off-line MIP_CS2_AXVIEC20031027_100559_20020706_060000_20080706_060000	06-JUL-03	06-JUL-03	No

NRT MIP_SP2_AXVIEC20031021_150016_20020706_060000_20080706_060000 Off-line MIP_SP2_AXVIEC20031027_101441_20020706_060000_20080706_060000	06-JUL-03	06-JUL-03	No

Tab. 9 Historical update of Level 2 ADFs.

Auxiliary Data File	Start Validity	Description
ADFs V3.1: MIP_MW2_AXVIEC20030722_134301_20030723_000000_20080722_000000 MIP_OM2_AXVIEC20030722_134602_20030723_000000_20080722_000000 MIP_PS2_AXVIEC20030722_102142_20030723_000000_20080722_000000 MIP_PI2_AXVIEC20030722_134848_20030723_000000_20080722_000000 MIP_CS2_AXVIEC20030722_133331_20030723_000000_20080722_000000 MIP_SP2_AXVIEC20030722_093046_20030723_000000_20080722_000000	23-JUL-03	Cloud detection enabled and improved validity mask range in Microwindows files. Improved Occupation Matrices (no gaps between altitude validity ranges).
MIP_IG2_AXVIEC20030214_130918_20030301_000000_20080301_000000	01-MAR-03	Seasonal update of climatological initial guess: This auxiliary file turned out to be corrupt, and a corrected version has been disseminated on 10 March 2003.
MIP_IG2_AXVIEC20030307_142141_20030310_000000_20080301_000000	10-MAR-03	Seasonal update of climatological initial guess: This dissemination substitute the corrupt file disseminated previously.
MIP_IG2_AXVIEC20030522_104714_20030601_000000_20080601_000000	01-JUN-03	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20030731_134035_20030901_000000_20080901_000000	01-SEP-03	Seasonal update of climatological initial guess.
ADFs V3.6: NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20031021_145630_20020706_060000_20080706_060000 MIP_PS2_AXVIEC20031021_145858_20020706_060000_20080706_060000 MIP_PI2_AXVIEC20031021_145745_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031021_145337_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031021_150016_20020706_060000_20080706_060000	06-JUL-03	See description below.

Off-line MIP_MW2_AXVIEC20031027_100858_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20031027_101029_20020706_060000_20080706_060000 MIP_PS2_AXVIEC20031027_101319_20020706_060000_20080706_060000 MIP_PI2_AXVIEC20031027_101146_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031027_100559_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031027_101441_20020706_060000_20080706_060000		

2.5.2 REC Analysis

Residual spectra are the difference between spectra measured by the instrument and spectra generated by the retrieval forward model at the final iteration. Ideally, these should contain only random measurement noise but in practice a number of features are present indicating systematic errors either in the forward model or the instrument characterisation.

Residual and Error Correlation (REC) analysis is a statistical technique for analysing such data. The principle is to identify correlations between persistent features in the residual spectra and the signatures expected from different atmospheric species, other potential sources of forward model error and calibration errors represented by various derivatives of the spectrum with respect to wavenumber. This is now performed routinely as part of the monitoring of MIPAS data quality.

The following analysis refers only to NRT products.

Results:

1. **Pressure**
   Pressure and Temperature microwindow residuals indicate an underestimate of 5-10% between 30-39 km, which was not evident in the previous month. Other microwindow residuals indicate a similar bias at these altitudes, but larger overestimates (approaching 30%) at higher and lower altitudes. These residuals have increased significantly since the previous month.
2. **CH4**
   CH4 microwindow residuals continue to indicate a small overestimate of up to 0.1 ppmv. Other microwindow residuals now indicate a clear underestimate of 0.2 ppmv at 20 km, not evident in the previous month, but continue to have variable sign about 30 km.
3. **H2O**
   H2O microwindow residuals indicate an underestimate of up to 3 ppmv at 30 km, dropping to zero at 42 km, then rising again to 3 ppmv at 60 km, representing an enhancement of the structure of the previous month. Other microwindow residuals indicate the same underestimate below 30 km but continue to increase to 6 ppmv at 42 km and above, a signature only evident in the Southern mid and high latitudes in the previous month.
4. **HNO3**
   HNO3 microwindow residuals indicate a slight underestimate of up to 0.5 ppbv at 27 km. Other microwindow residuals indicate a much larger overestimate varying from 2 ppbv at 12 km up to 8 ppbv at 33 km. The Equatorial latitudes are an exception, indicating an underestimate of 4 ppbv at 12 and 15 km. No significant change from previous month, except for the reduction in the size of the South Polar residuals.

5. **N2O**
   N2O microwindow residuals indicate an underestimate of up to 30 ppbv at 30 km, smaller in the Northern Hemisphere. Other microwindow residuals indicate an underestimate of up to 20 ppbv at 21 km and overestimate of 40 ppbv at 47 km. No significant change from previous month except for a slight increase in amplitudes.
6. **NO2**
   NO2 microwindows show residuals equivalent to an overestimate of up to 1 ppbv from 33-36 km. Other microwindow residuals indicate overestimates of up to 1 ppbv below 30 km and overestimates of up to 2 ppbv at 36 km. The main change from the previous month is the reduction in the signature from the South Polar Region in the non-target microwindows, which is now similar to other latitude bands.
7. **O3**
   O3 microwindow residuals indicate an overestimate reaching 0.8 ppmv at 30 km, with a slight underestimate of 0.2 ppmv at 52 km. Other microwindow residuals indicate an underestimate of up to 0.5 ppmv at 27 km for Equatorial and Southern mid-latitudes, but no clear signal for other latitude bands. Compared to the previous month, the main change is the large overestimate now indicated in the stratosphere from the residuals in the target microwindows.
8. **0th Derivative**
   Apart from the A band, most microwindows show residual signatures of the original spectrum greater than 2% of the original magnitude, very approximately related to the 2% radiometric gain error budget. The A band residuals are generally smaller, except for the PT__0001 microwindow which has a negative signature. Compared to the previous month, the size of most residuals has increased significantly.
9. **1st Derivative**
   Most microwindows show residual 1st derivative signatures corresponding to spectral shifts within the 0.001 cm-1 spectral calibration error budget. The main departures are a for high altitude pT microwindows at long wavelengths and for high altitude NO2 microwindows, both of which show a negative shift. There is a general trend for a positive shift from high altitude to low altitude for any one microwindow somewhat larger than the expected 0.0002 cm-1 that would be expected from the relative Doppler shift caused by a 60 km difference in tangent point altitude. The main change from the previous month is the increase in magnitude of the NO2 microwindow signatures and the negative shift in the pT microwindows.
10. **2nd Derivative**
    The assumed error budget for uncertainty in the width of the apodised instrument lineshape is 2%. There is a general curvature in the plotted points indicating an underestimate in width of 5-10% at the outer edges of the A and C bands with a similar sized overestimate in the AB and B bands. The NO2 microwindows are particularly anomalous, indicating a wide range of large residual signatures. The main change from the previous month is the general increase in size of the residuals.

Explanation of Plots:

Target Species (Fig. 13-19):
Spectral signatures of a large number of error sources are fitted simultaneously for each altitude and latitude band, but only those associated with pressure and the 6 retrieved species are plotted. Different colours/symbols indicate different latitude ranges. X-axis is an approximate conversion of residual signature to VMR or % pressure error based on a mid-latitude daytime profile. Black dashed line indicates +/- climatological 1sigma variability, dotted lines represent +/-10% and 100% of the profile value. Positive values indicate larger signature in atmospheric spectrum than forward model, indicating an underestimate of the `true' profile. Solid symbols represent the residuals fitted using only the target microwindows for each species (e.g., fitting H2O signature in H2O microwindows only) and open symbols represent the residuals fitted for all the other microwindows (e.g., fitting H2O signature in all the non-H2O microwindows).

Spectral Derivatives (Fig. 20-22):
0th, 1st and 2nd derivative signatures are fitted to each microwindow/altitude independently. Colours indicate microwindow target species and symbols indicate altitude range. Microwindow labels are listed in order of increasing wavenumber along the top but the set of small arrows indicates actual position along the x-axis. The y-axis represents a scaling of the signature in terms of some instrumental error. Following this analogy, positive y values indicate an underestimate of either the gain (0th derivative), the wavenumber of atmospheric lines (1st derivative), or the AILS width (2nd derivative), in the sense of regarding the atmospheric spectra as `true' values compared to the forward model. Only points representing large numbers of residuals are plotted.

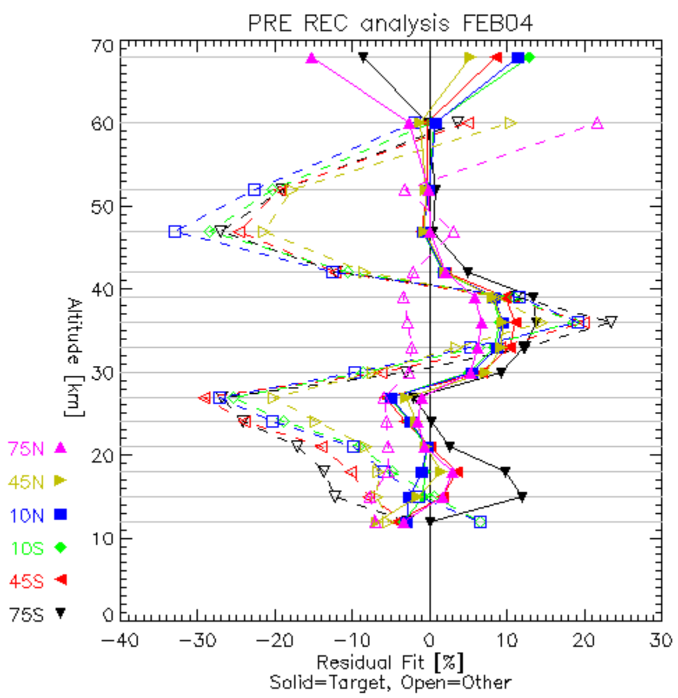

Fig. 13 Pressure REC analysis: February 2004.

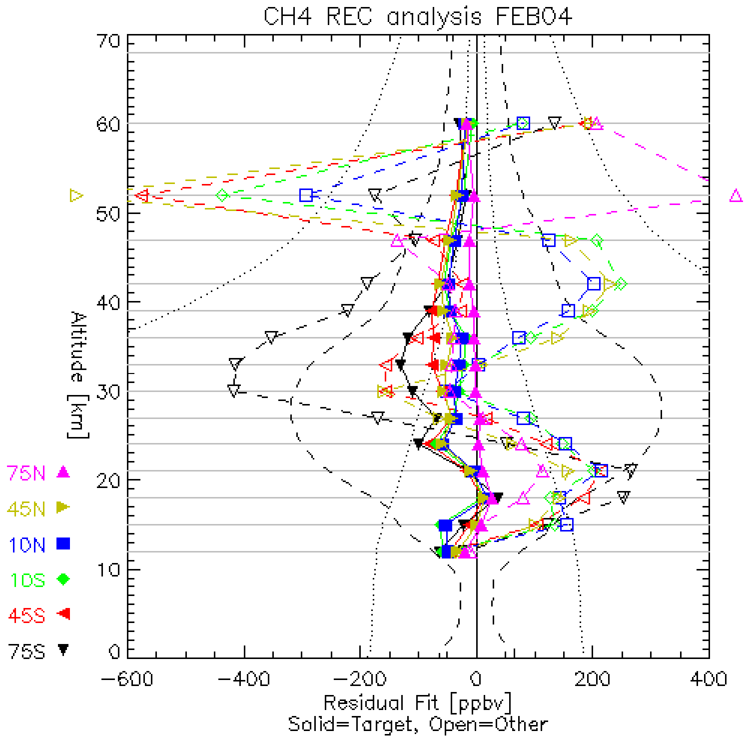

Fig. 14 CH4 REC analysis: February 2004.

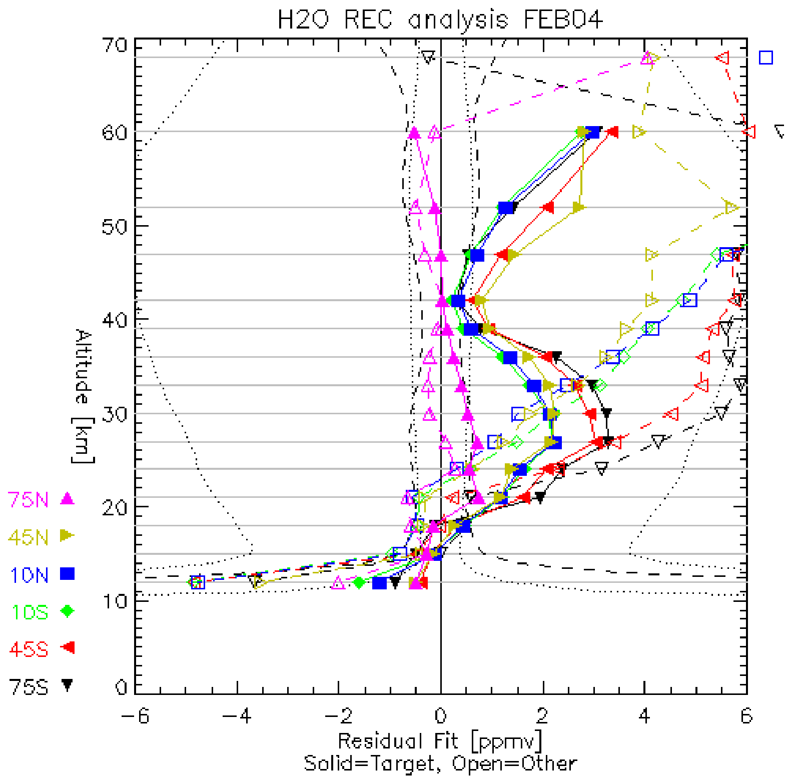

Fig. 15 H2O REC analysis: February 2004.

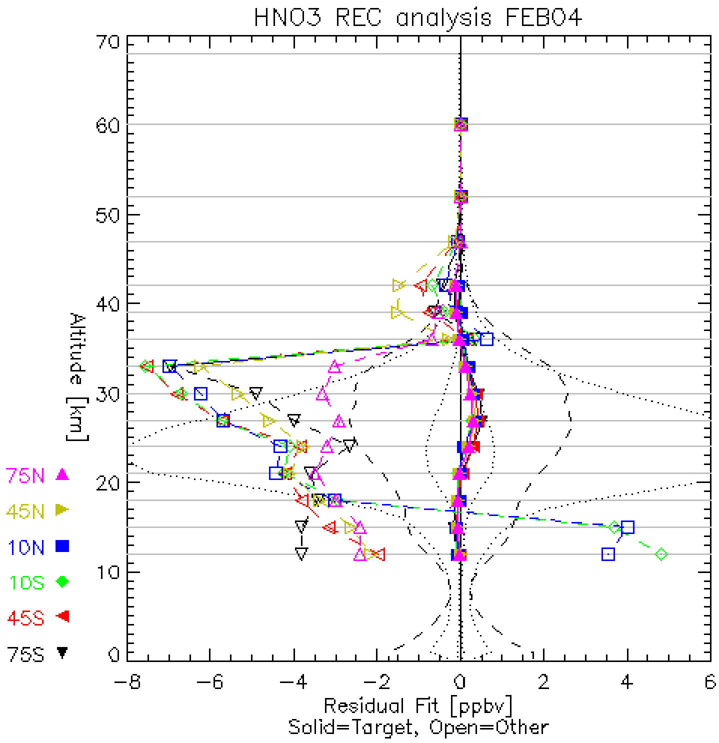

Fig. 16 HNO3 REC analysis: February 2004.

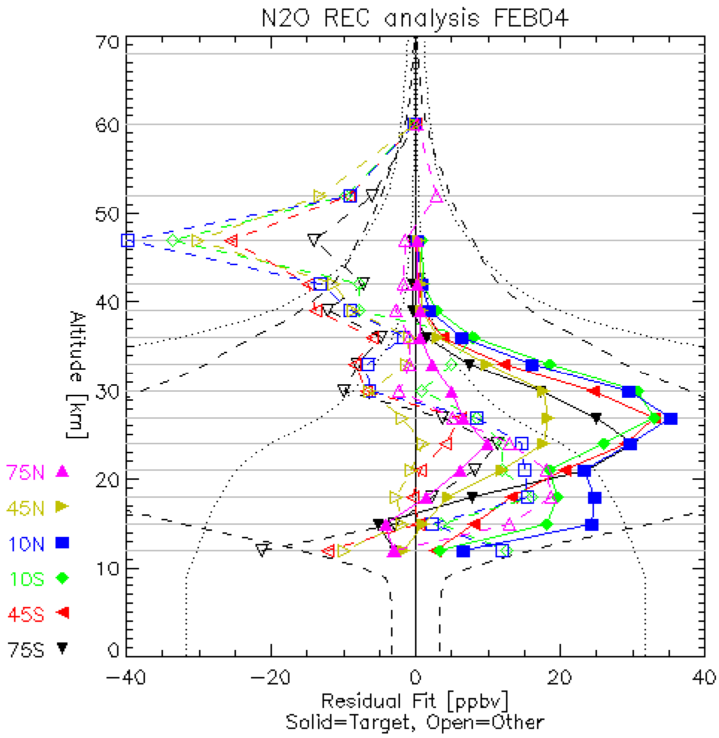

Fig. 17 N2O REC analysis: February 2004.

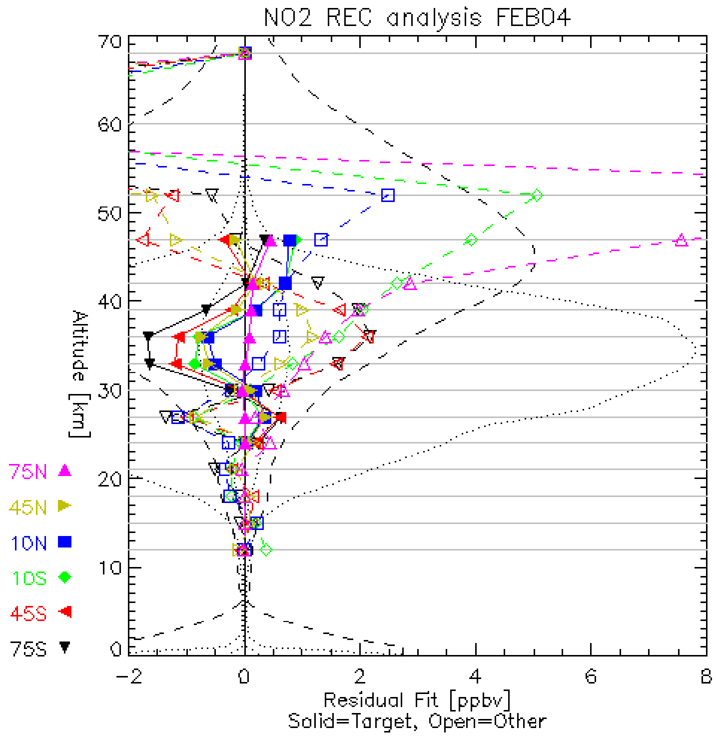

Fig. 18 NO2 REC analysis: February 2004.

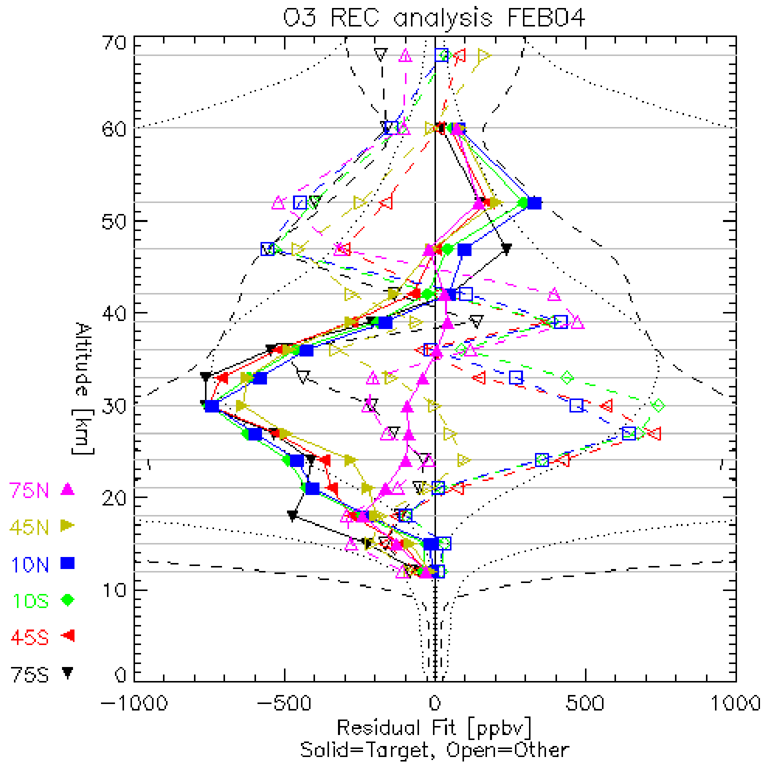

Fig. 19 O3 REC analysis: February 2004.

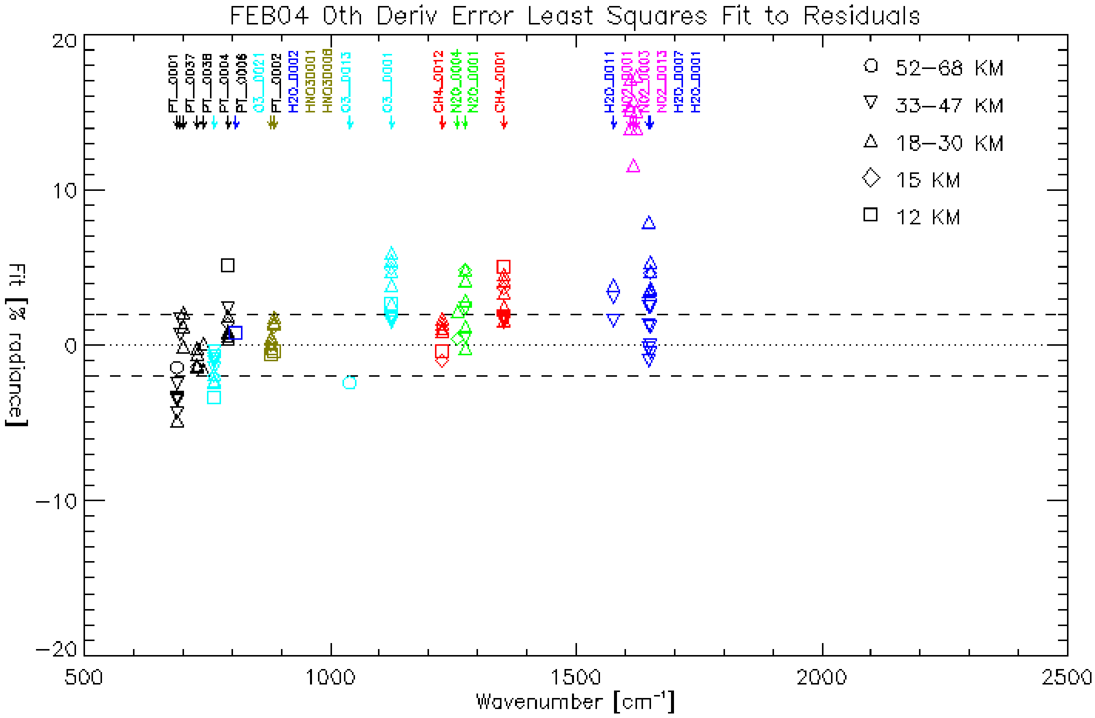

Fig. 20 0[th] order derivative error: February 2004.

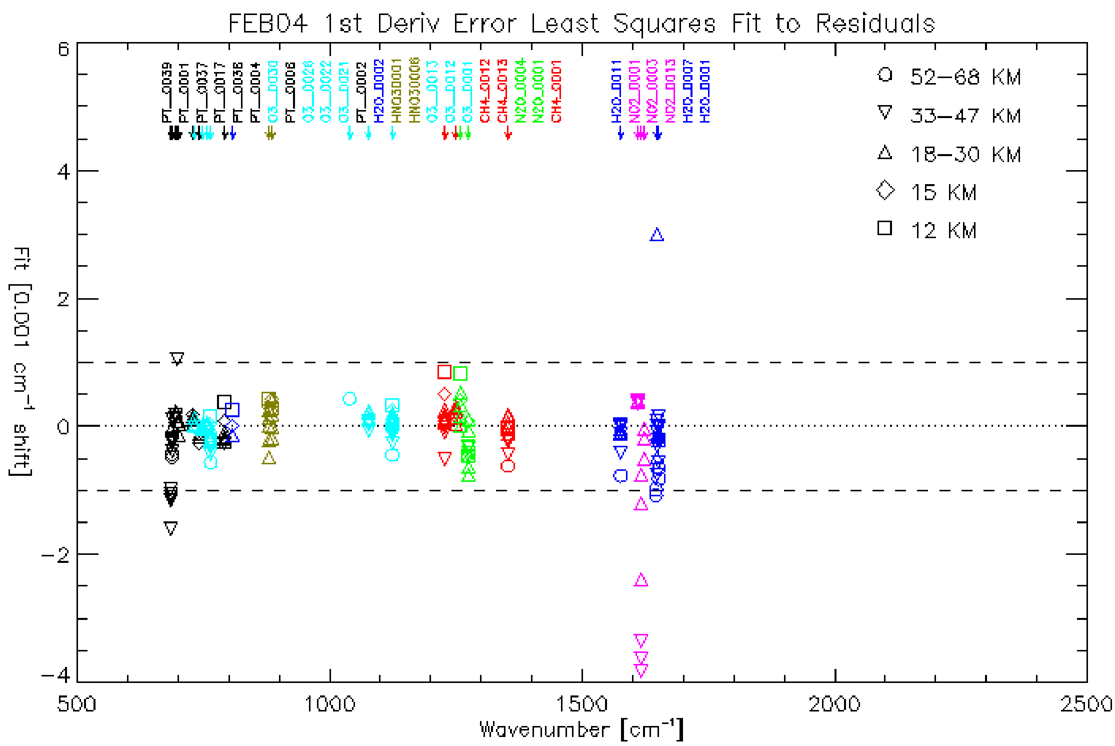

Fig. 21 1[st] order derivative error: February 2004.

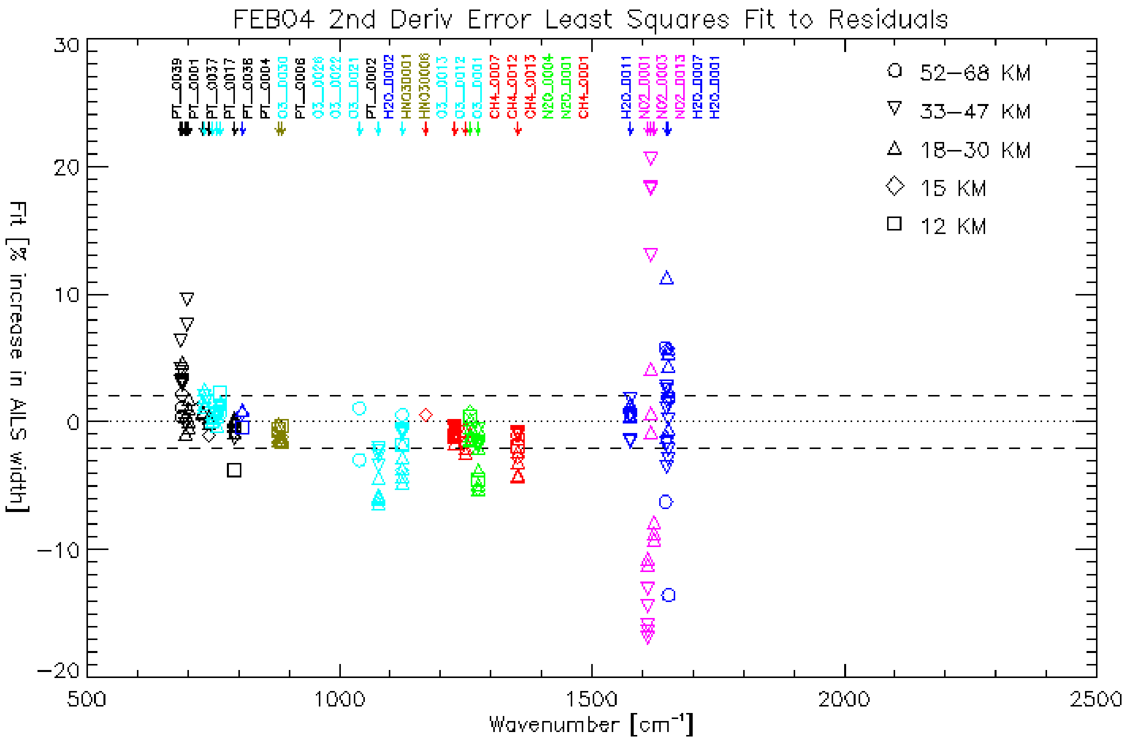

Fig. 22 2nd order derivative error: February 2004.

2.5.3 Occupation Matrix Statistics

An occupation matrix selects the set of microwindows and tangent altitudes used for each retrieval. When all L1B spectra are available for the retrieval, only the 'nominal' OMs #001-006 would be used, the different numbers just indicating different latitude bands. Given the width of these latitude bands and the MIPAS orbital coverage, the expected proportion of profiles within each latitude band are given in the Tab. 10.

Tab. 10 Expected proportion of profiles within each latitude band.

Occupation Matrix	**Latitude Range**	**No. Profiles/orbit**	**Fraction of Profiles**
006	65N-90N	10	14%
005	20N-65N	18	25%
004	EQU-20N	8	11%
003	20S-EQU	8	11%
002	65S-20S	18	25%
001	90S-65S	10	14%

Alternative OMs are also available to cope with situations where one or more spectra are unavailable, e.g. corrupt data or if cloud-contamination is detected in the field of view. These each have a 3-digit code, which can be used to identify the situation encountered, the second and third digits being one of the sweep altitudes. OMs with codes beginning with 6 use the same microwindows as the nominal OMs but with all sweeps up to and including a particular altitude excluded, e.g. 615 means that all spectra up to 15 km are excluded from the retrieval. These were specifically generated to cope with cloudy scenes. If the first digit is 1...5 then only one band at one altitude are excluded, (1=A band, 2=AB band, etc). For example code 421 is an occupation matrix, which excludes the C band at 21 km. If the first digit is 0 then all bands at the particular altitude are excluded. These OMs were generated to cope with corrupt data and, unlike the 600 OMs, often use different microwindows to the nominal OM.

The actual OM selected for retrieval is determined according to a priority list, the nominal OMs being always the first in the list. A check is made to see which bands are available and the priority list is searched sequentially until an OM is found which only requires the available bands. For example, if band A at 15 km is corrupt, OMs 015, 115, 615, 618, 621 ... etc could all be used but the one which is selected will be the highest in the priority list which, in theory, should be the one which allows most information to be retrieved from the remaining spectra.

The following analysis refers only to NRT products.

Results:
1. Valid retrievals only received from 8th February onwards during month, approximately 670 valid pT profiles per day (comparable with December 2003, although lower than previous months which were ~850).
2. VMR retrieved successfully from >98% pT profiles for all species, improvement of a few percent compared to previous month.
3. 22% (OM002) and 23% (OM005) of retrievals are obtained using the nominal mid latitude OMs (expected 25% in the absence of clouds) - increase of 3% in South Hemisphere (OM002) 1% in North Hemisphere (OM005).
4. 13% (OM001) and 14% (OM006) of retrievals are obtained using each of the nominal high latitude OMs (expected 14% in the absence of clouds) – an increase of 3% in the South Hemisphere (OM001) but no significant change in North Hemisphere.
5. 10% (OM003) and 8% (OM004) of retrievals are obtained using the nominal low latitude OMs (expected 11% in the absence of clouds) - increase of 2% in both hemispheres compared to previous month.
6. 5.7% retrievals correspond to OMs with 12 km sweep removed (medium level clouds detected): 612 for pT, O_3, N_2O; 015 for H_2O; 115 for HNO_3; 312 for CH_4 - down by 1.8% compared to previous month.
7. 2.7% retrievals correspond to OMs with both 12 and 15 km sweeps removed (high cloud): 615 for pT, 015 for H_2O (again), O_3; 615 for HNO_3, CH_4, N_2O - down by 0.5% compared to previous month.
8. 2.3% retrievals correspond to OMs with 12-18 km sweeps removed (very high cloud): 618 - down by 1.1% compared to previous month.

9. 1.3% retrievals correspond to OMs with 27 km sweep removed (027), up 0.5% compared to previous month.
10. NO2, only retrieved from 24-47 km, uses no corrupt/missing OMs for more than 0.5% of the time in total - compared to 3% in the previous month.
11. Around 87% of all retrievals (expressed as total pT retrievals), used the nominal occupation matrix, up 9% compared to previous month.

Table 11 summarises the results.

Tab. 11 Occupation matrix statistics.

PT		H2O		O3		HNO3		CH4		N2O		NO2	
No. Profiles		No. constituent profiles as % of No. pT profiles											
14725		98.3		98.3		98.3		98.2		98.1		98.3	
Occupation Matrix labels and frequency as % of pT ('etc.' = those contributing <0.1% each)													
OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	22.7	005	22.7	005	22.7	005	22.8	005	22.7	005	22.8	005	25.3
002	21.9	002	21.8	002	21.9	002	21.9	002	21.9	002	21.9	002	24.0
006	14.2	006	14.1	006	14.1	006	14.1	006	14.1	006	14.1	006	14.8
001	12.5	001	12.5	001	12.6	001	12.6	001	12.5	001	12.6	001	13.5
003	9.7	003	8.9	003	9.0	003	9.0	003	8.9	003	8.9	003	10.4
004	7.5	015	8.2	004	7.1	004	7.1	004	7.1	004	7.1	004	9.7
612	5.7	004	7.1	612	5.6	115	5.6	312	5.7	612	5.6	027	0.2
615	2.7	618	1.6	015	2.7	615	2.7	615	2.7	615	2.7	024	0.2
618	1.3	621	0.5	618	1.3	618	1.6	618	1.3	618	1.3	etc.	0.1
121	0.3	027	0.2	621	0.5	621	0.5	621	0.5	621	0.5	.	.
621	0.3	624	0.2	018	0.3	027	0.2	018	0.3	018	0.3	.	.
021	0.3	etc.	0.4	027	0.2	624	0.2	027	0.2	624	0.2	.	.
030	0.2	.	.	624	0.2	.	.	624	0.2	etc.	0.0	.	.
027	0.2	.	.	etc.	0.1	.	.	etc.	0.1	.	.	.	.
124	0.2	.	.	.	.	.	.	.	.	.	.	.	.
036	0.1	.	.	.	.	.	.	.	.	.	.	.	.
etc.	0.1	.	.	.	.	.	.	.	.	.	.	.	.
OM	%	OM	%	OM	%	OM	%	OM	%	OM	%	OM	%
005	22.7	005	22.7	005	22.7	005	22.8	005	22.7	005	22.8	005	25.3
002	21.9	002	21.8	002	21.9	002	21.9	002	21.9	002	21.9	002	24.0
Profiles retrieved with nominal occupation matrix (OM001 ... OM006) as % of pT													
88.5		87.2		87.4		87.4		87.2		87.4		97.8	

2.5.4 Altitude Retrieval Performance

ANOMALOUS SPECIES RETRIEVAL
Since MIPAS operations resumed on 8th February, retrievals of many species (particularly H2O) in the upper stratosphere appear to be anomalously high. There was also a temporary increase in

pointing altitudes for sweeps higher than 30 km, which is reflected in the drop in tangent point pressures but is not obviously related to the problem with the constituent retrievals. Those anomalies are probably caused by a not updated gain because of the lack of data.

INCONSISTENCY IN COMPUTED RESIDUAL SPECTRA
Number of computed residual spectra with processor IPF 4.59 is not consistent with the number of observation. The problem will be fixed in the IPF 4.61, which will be installed in March.

ANOMALOUS PROCESSING TIME
An excessive processing time for Level 2 off-line processing characterizes some MIPAS products. This has been tracked down to 2 causes:

- A discrepancy between processor and prototype processing time.
- A bug in the processor that is not able to process scans composed by one only altitude level.

In order to quickly remove the second problem, a new MIP_OM2_AX has been generated for both NRT and off-line processing in order to eliminate occupation matrix composed by scans with only one level. The new ADF will be disseminated in March after testing.

INCREASED NOISE LEVEL
For the same reason explained in *Section 2.4.5*, a new MIP_PS2_AX has been generated and will be disseminated in March.

2.5.5 Improvements

2.5.5.1 Improvement done

A modification to the software for MIP_CO1_AX generation has been done to force statistics to one as a workaround for the not correct handling of standard deviation different from one done by the processor.

2.5.5.2 Future improvement

In order to conform the data processing to the new noise level introduced by the interferometer heating new MIP_PS1_AX and MIP_PS2_AX have been generated and will be disseminated in March after testing.

A new MIP_OM2_AX has been generated and will be disseminated in March in order to quickly resolve the problem related to processing of scans composed by one only altitude level.

2.6 VALIDATION ACTIVITIES AND RESULTS

2.6.1 Consistency Verification

The following figures show the comparison of the monthly mean vertical profiles (altitude, pressure, temperature, and species) with the ones obtained the previous month.

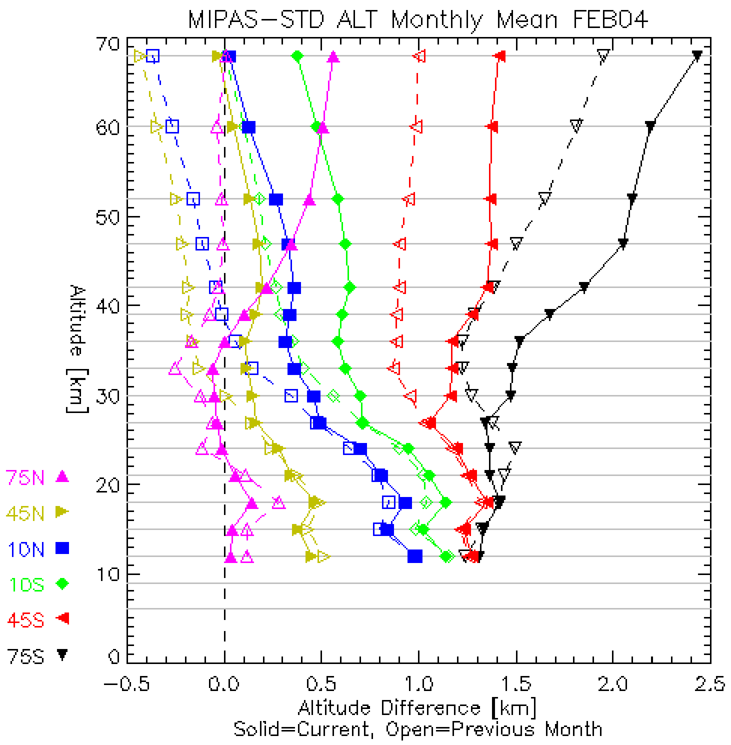

Fig. 23 Profile comparison between January and February: Altitude difference.

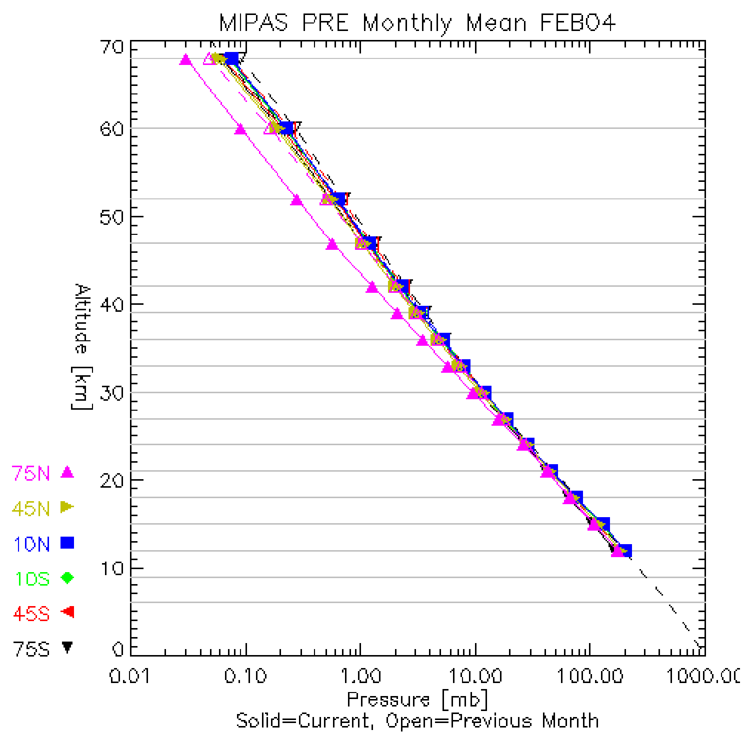

Fig. 24 Profile comparison between January and February: Pressure.

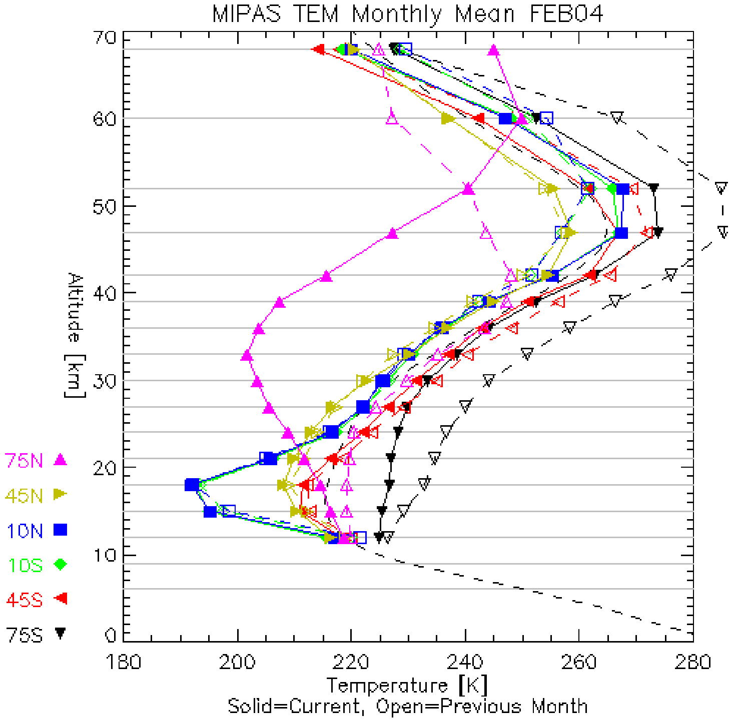

Fig. 25 Profile comparison between January and February: Temperature.

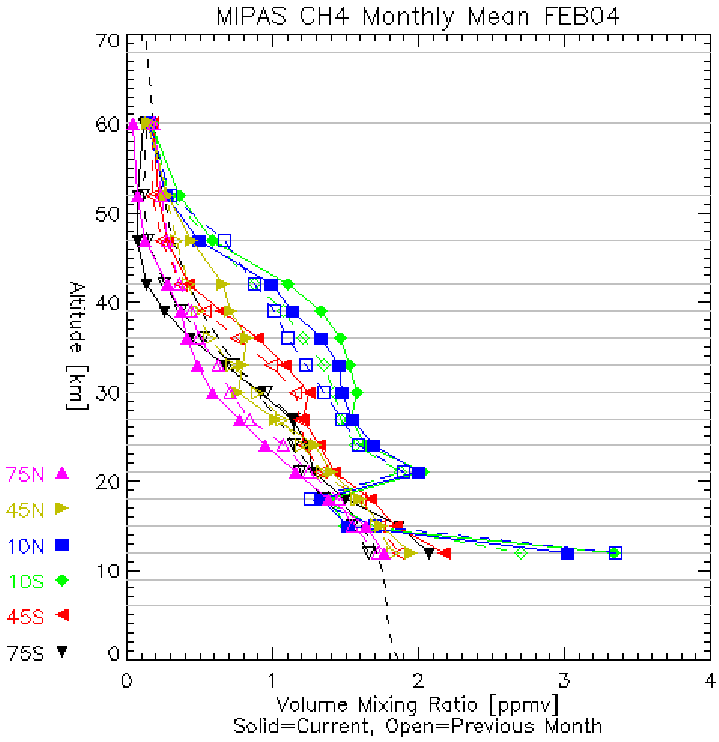

Fig. 26 Profile comparison between January and February: CH4.

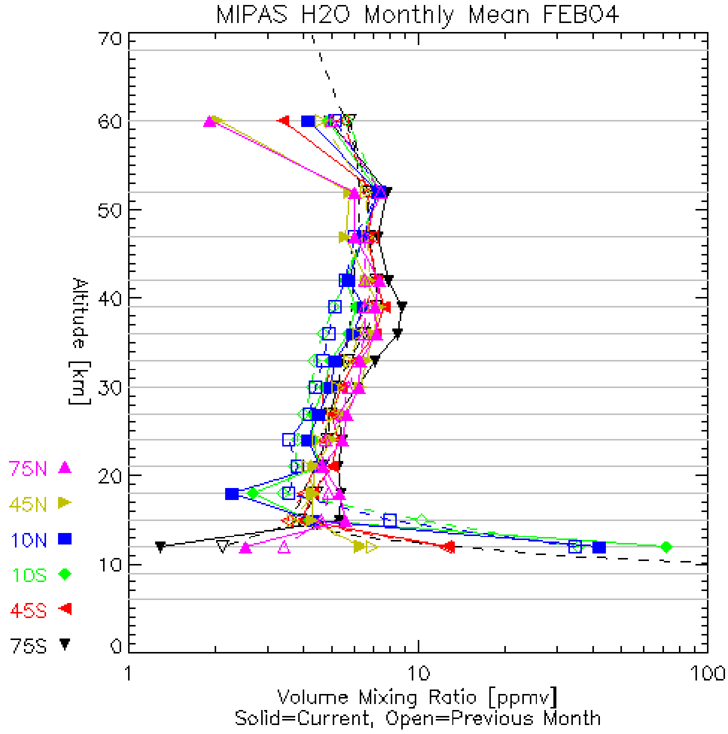

Fig. 27 Profile comparison between January and February: H2O.

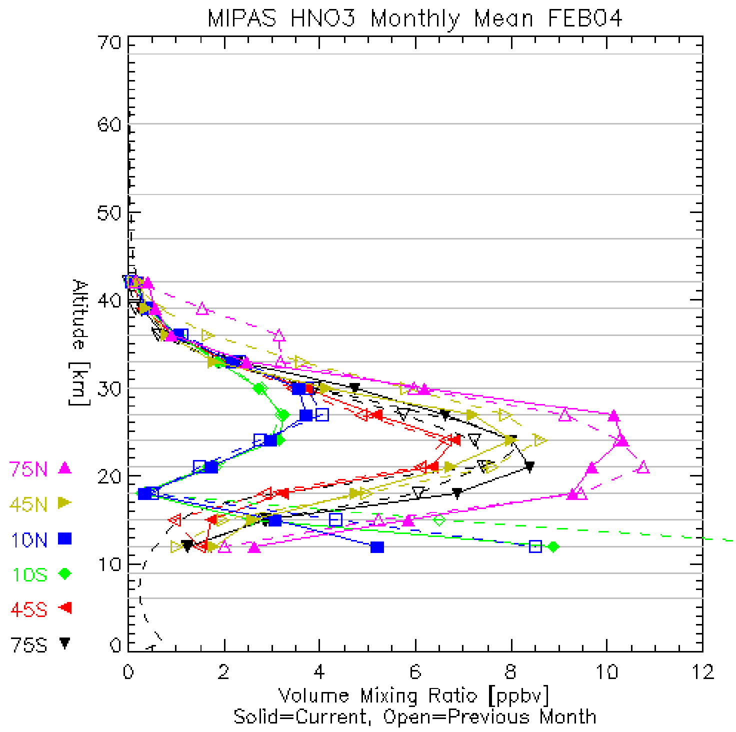

Fig. 28 Profile comparison between January and February: HNO3.

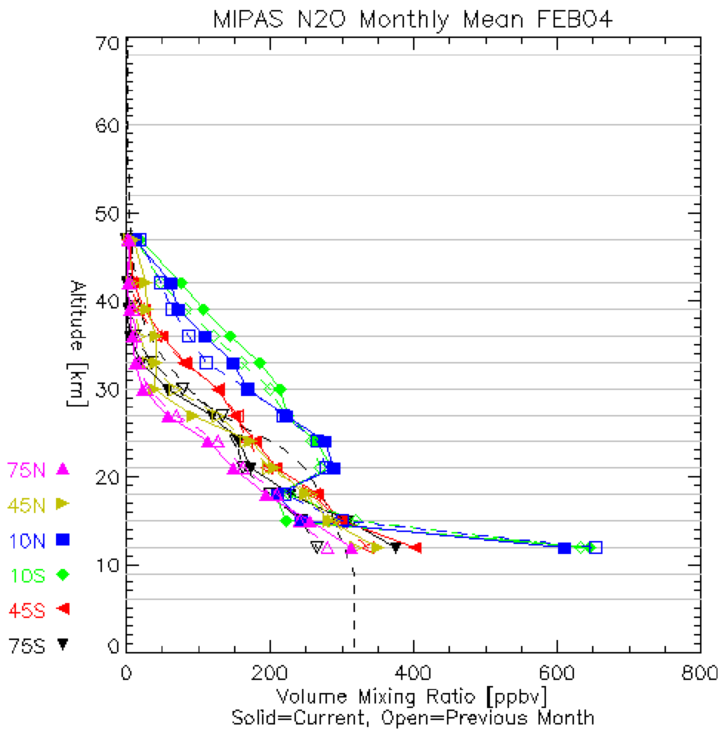

Fig. 29 Profile comparison between January and February: N2O.

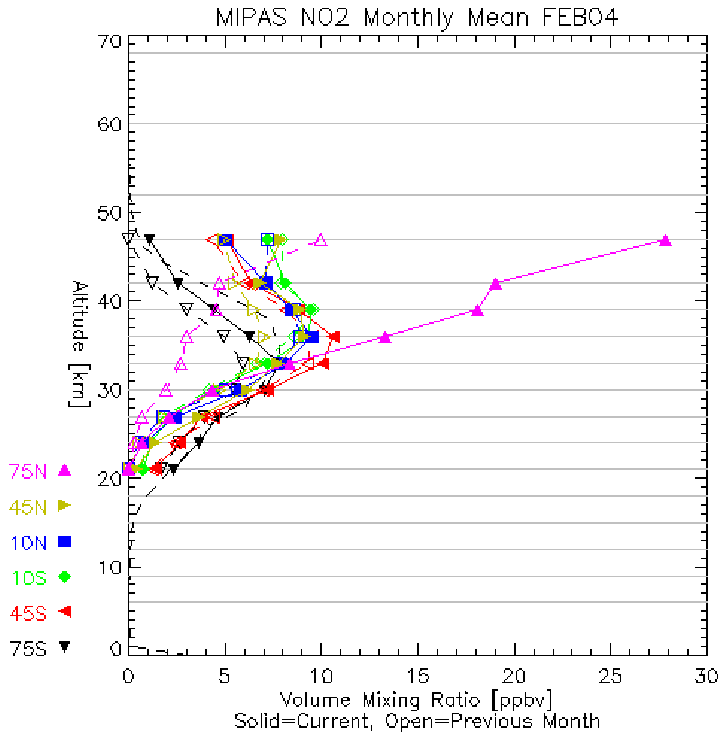

Fig. 30 Profile comparison between January and February: NO2.

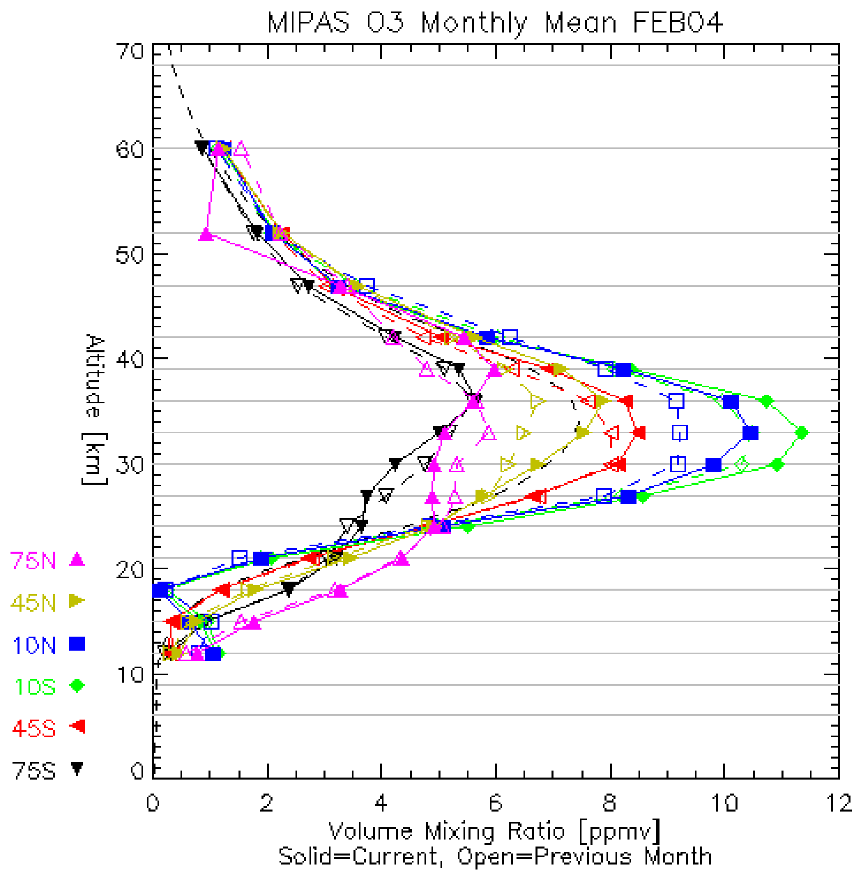

Fig. 31 Profile comparison between January and February: O3.

Comments:

Altitude Difference

Reported altitudes in the Southern Hemisphere, and lower altitudes near the Equator, remain about 1 km higher than the nominal elevation scan altitudes. Since the previous month there has been an increase of approximately 400 m in the mean reported altitudes above 30 km (arising from the period 8-16th February when pointing was 1 km above the usual values).

Temperature

The Northern Polar Region shows a cooling of up to 40 K in the stratosphere and warming of up to 20 K in the mesosphere with respect to the previous month. No significant changes at other latitudes.

Pressure

Above 30 km, tangent pressures are generally of the order of 10% or more lower than the previous month, probably due to the increase in reported tangent altitudes. Pressures at Polar latitudes have decreased by 30-40% but are now more consistent with the Initial Guess climatology.

CH4

CH4 values are up to 0.4 ppmv higher than the IG profile values in the 33-47 km range for equatorial and mid latitudes, an increase of approx 0.2 ppmv compared to the previous month. The standard deviations have also increased for all latitudes.

H2O
H2O values are rather high (around 1 ppmv higher than the IG profile values) in the 33-47 km range, for all latitude bands. The difference is most pronounced for the southern polar profile. The SD for all latitudes is higher than the previous month.
HNO3
The underlying retrieved structure is similar to last month, although the Equatorial values for 12 km are substantially lower and the mid-stratospheric values for the South Polar Region have increased. Above 33 km the enhancement for north Polar Regions has now disappeared.
N2O
At altitudes below 27 km the profiles are almost identical to the previous month except for the increased values in the South Polar Region. At high altitudes in the equatorial region, values have increased compared to the previous month.
NO2
For the North Polar Region above 36 km there are large nighttime values, compared to low values the previous month. The Southern Polar latitude nighttime profile peaks at 33 km while other latitudes peak at 36 or 39 km. Daytime retrievals have not changed significantly.
O3
At Equatorial and mid-latitudes there is a general increase of 10-20% in the peak values. For the North Polar Region there is no clear peak in the nighttime profile. SD values have increased for all latitudes.

2.6.2 Statistics from Intercomparison with External Data

2.6.2.1 Comparison with ECMWF data

TEMPERATURE
MIPAS temperature departures in the stratosphere are smaller than in December, with area mean departures of less than 1%. MIPAS area averaged temperatures are lower than ECMWF temperatures below 10-20 hPa in most latitude bands, whereas they previously used to be larger than ECMWF temperatures there. MIPAS temperatures are lower than ECMWF temperatures above 2 hPa, apart from temperatures in 90-65N, where the ECMWF model has a cold bias at this time of year. Departures increase towards the model top, where area averaged departures reach values up to -8% (+8% in 90-65N). The scatter plots show a cooling at high northern latitudes compared to December in the stratosphere. Over the South Pole temperatures have also cooled in the upper stratosphere.

WATER VAPOUR
MIPAS water vapour values are 10-60% larger than ECMWF water vapour values over much of the stratosphere and departures are larger than in December. The largest departures are seen below 100 hPa in 0-20S.

OZONE
MIPAS ozone profiles are actively assimilated now. This means that comparison with ECMWF ozone values does not give an independent validation any more. The analysis is drawing to the

MIPAS data. Unrealistically large ozone and water vapour values remain in the tropics below 60 hPa, possibly a sign of cloud contamination.