Technical Note on

MIPAS-B2 Flight 7 data analysis with the Oxford MWs selected for satellite measurements

Draft

Delivery of the second part of WP 7240 of the CCN#5 of the study:
"Development of an Optimised Algorithm for Routine p, T and VMR Retrieval from MIPAS Limb Emission Spectra"
Contract no. 11717/95/NL/CN

Prepared by:

Name	Institute
B.M. Dinelli	ISM-CNR

Approved by:

Name	Institute

Reference documents

1. F. Friedl-Vallon et al. '*MIPAS-B-Flight report: Flight #7 of 26/27.1.1999 Esrange/Sweden*'
2. B.M. Dinelli, *'MIPAS-B2 Flight 7 data analysis with Oxford MWs data base developed for balloon measurements'* - TN-ISM-0004
3. B.M. Dinelli, *'MIPAS-B2 Flight 6 data analysis with Oxford MWs data base selected for satellite measurements and delivered on February 2001'* - TN-ISM-0005

1- Introduction

This technical note reports the results of the data analysis operated on MIPAS-B2 data collected during the flight (identified as flight 7) from Kiruna in January 1999. The process leading to the calibrated spectra used in the retrievals described in this document is reported in reference document 1. The retrievals were carried out with the version of ORM specifically developed at ISM for the balloon-borne MIPAS instrument used in reference document 2. The present document uses as a starting point the reference document 2 that refers to the analysis of flight 7 using the set of MWs selected by University of Oxford for balloon measurements and delivered in September 2000. From now on this set of MWs will be referred to as Sep0100 MWs.
In February, University of Oxford has delivered a set of MWs selected for the MIPAS-ENVISAT instrument (Feb0101 MWs). In reference document 3 the analysis of Flight 6 using the Feb0101 MWs was reported. The complete list of the selected MWs is reported in the same document in table 1 to 6. As already stated in reference 3, all p,T MWs but one are outside the frequency range of flight 7, making the p,T retrieval impossible to be performed. For ozone there is no MWs to be used in flight 7 analysis. Moreover, for each species, the majority of the selected MWs were in a single measurement band. This could cause a problem if, during MIPAS measurements, that band could not be used in the retrievals.
In April, University of Oxford has delivered a new set of MWs for MIPAS-ENVISAT measurements (Apr0101). For the p,T retrieval the new MWs were selected using a different criterion, so that the set was almost completely new. For all the other molecules the new database contained all the MWs selected in February complemented with MWs in other bands to be used when the principal measurement bands are not available because of measurement problems (corrupted bands). Unfortunately, also in this more extended database, few MWs could be used for the p,T retrieval.
Here we report the analysis of Flight 7 made merging all the MWs databases selected by University of Oxford.

2 – p,T retrieval

We started to examine the list of Apr0101 MWs for p,T. Out of ?? MWs only 2 of them could be used for the analysis of Flight 7. This number was not enough to enable a satisfactory retrieval of tangent pressure and temperature. We decided then to attempt a p,T retrieval adding to the two MWs the Sep0100 MWs plus the MW of the Feb0101 dataset that was in flight 7 frequency range. The list of the selected MWs appears in Table 1. Since there were two MWs with the same label, one of them has been renamed and the new label appears in Table 1.
The first attempt of the p,T retrieval produced a final temperature profile very similar to the initial guess one and very high tangent altitude corrections. In order to see if this was an artefact due to a

too strong regularization, the Marquardt dumping factor value was decreased of a factor of 10 in order to weaken the regularization of the retrieval.

Table 1 – List of selected p,T MWs

MW	*Original label*	*frequency range (cm^{-1})*	*Database*	*New Label*
1	PT___0002	791.375 - 792.875	Feb0101	
2	PT___0035	944.200 - 946.200	Apr0101	
3	PT___0012	953.925 - 954.525	Sep0100	
4	PT___0003	1895.750 - 1898.025	Sep0100	
5	PT___0002	1909.425 - 1912.425	Sep0100	PT___0001
6	PT___0011	1931.750 - 1934.725	Sep0100	
7	PT___0021	1932.850 - 1934.350	Apr0101 (Corr. Bands)	
8	PT___0008	1936.375 - 1937.875	Sep0100	
9	PT___0005	2062.850 - 2065.850	Sep0100	
10	PT___0013	2073.850 - 2076.850	Sep0100	
11	PT___0023	2075.200 - 2077.500	Apr0101 (Corr. Bands)	
12	PT___0015	2076.875 - 2077.600	Sep0100	
13	PT___0014	2092.975 - 2094.675	Sep0100	
14	PT___0010	2262.875 - 2263.075	Sep0100	

Figures 1 and 2 show the final result of this analysis. In Figure 1 the final temperature profile is shown and in Figure 2 the altitude corrections are reported.

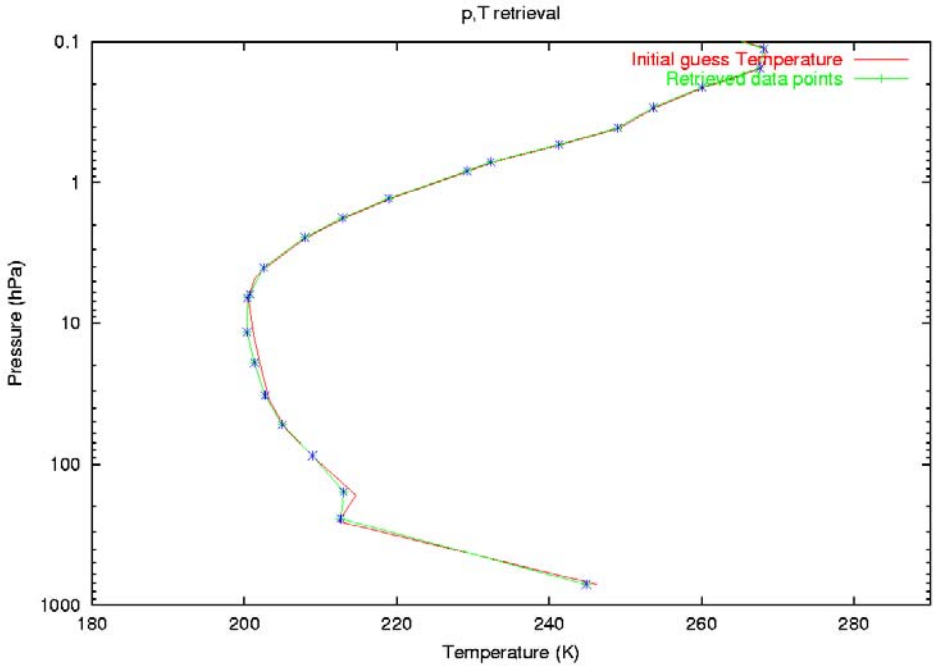

Figure 1 Final temperature profile of the first attempt

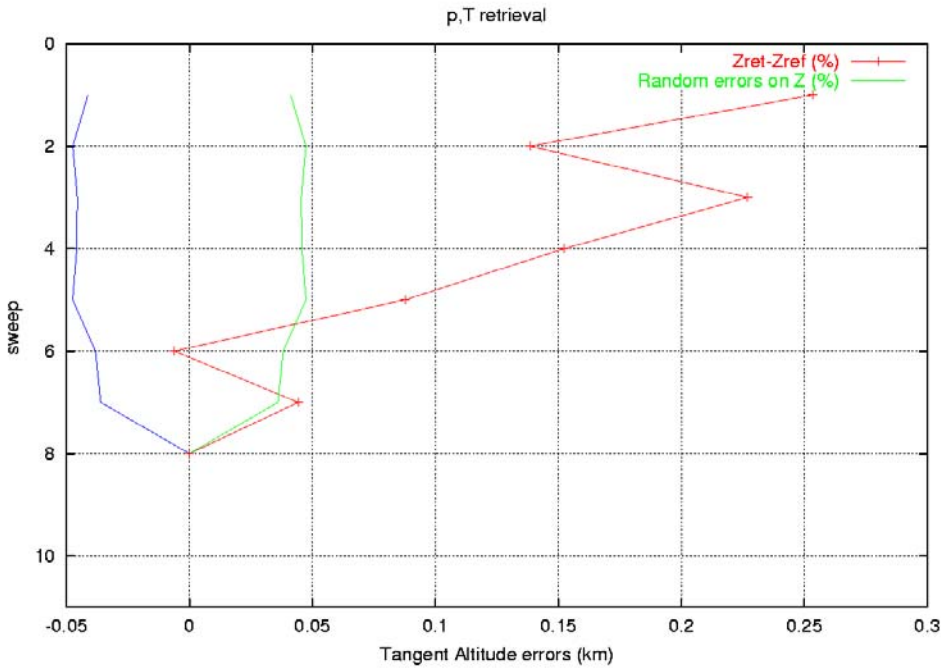

Figure 2 final altitude corrections of the first attempt

As can be seen in fig.2 the altitude corrections are quite high.
Since the height corrections obtained with the previous set of MWs were quite large, and the temperature profile appeared to be too similar to the initial guess one, we decided to investigate if removing some of the MWs (that have been selected using different criteria) was improving the performances of the p,T retrieval. We have found that removing just one MW the p,T results were more stable. The table below shows MWs used during the p,T retrieval in this case. The MW that has been removed from the previous set is the PT_002 (February database), that includes a CO_2 Q-branch.

During this analysis the Marquardt dumping factor was set to 0.1.

H_2O

MW	*Label*	*frequency range (cm-1)*	*Database*
1	H2O___0002	807.850 - 808.450	Feb0101
2	H2O___0022	946.650 - 947.700	Apr0101 (Corr. Bands)
3	H2O___0028	959.400 - 959.900	Apr0101 (Corr. Bands)
4	H2O___0011	1574.800 - 1577.800	Feb0101
5	H2O___0008	1608.875 - 1609.000	Feb0101
6	H2O___0010	1616.400 - 1616.800	Feb0101
7	H2O___0009	1637.550 - 1637.625	Feb0101
8	H2O___0007	1645.525 - 1646.200	Feb0101
9	H2O___0001	1650.025 - 1653.025	Feb0101

O_3

MW	*Label*	*frequency range (cm-1)*	*Database*

1	O3___0021	763.375 – 766.375	Apr0101 (Corr. Bands)
2	O3___0029	791.425 – 792.075	Apr0101 (Corr. Bands)

HNO_3

MW	*Label*	*frequency range (cm-1)*	*Database*
1	HNO3_0004	774.900 - 775.050	Feb0101
2	HNO3_0001	876.375 - 879.375	Feb0101
3	HNO3_0006	885.100 - 888.100	Feb0101
4	HNO3_0012	895.675 - 898.675	Feb0101
5	HNO3_0025	1306.975 - 1307.525	Apr0101 (Corr. Bands)
6	HNO3_0029	1308.850 - 1309.025	Apr0101 (Corr. Bands)
7	HNO3_0023	1311.425 - 1312.350	Apr0101 (Corr. Bands)
8	HNO3_0028	1312.750 - 1313.125	Apr0101 (Corr. Bands)
9	HNO3_0022	1313.750 - 1314.025	Apr0101 (Corr. Bands)
10	HNO3_0026	1314.925 - 1316.125	Apr0101 (Corr. Bands)
11	HNO3_0027	1316.925 - 1317.575	Apr0101 (Corr. Bands)
12	HNO3_0024	1317.825 - 1318.925	Apr0101 (Corr. Bands)
13	HNO3_0021	1319.050 - 1322.050	Apr0101 (Corr. Bands)
14	HNO3_0003	1324.175 - 1327.175	Feb0101

CH_4

MW	*Label*	*frequency range (cm-1)*	*Database*
1	CH4__0023	1138.875 - 1140.075	Apr0101 (Corr. Bands)
2	CH4__0003	1155.250 - 1156.800	Feb0101
3	CH4__0024	1160.550 - 1160.950	Apr0101 (Corr. Bands)
4	CH4__0007	1169.300 - 1169.800	Feb0101
5	CH4__0017	1215.800 - 1216.575	Feb0101
6	CH4__0012	1227.175 - 1230.175	Feb0101
7	CH4__0015	1236.550 - 1237.525	Feb0101
8	CH4__0013	1247.775 - 1248.650	Feb0101
9	CH4__0004	1255.450 - 1256.150	Feb0101
10	CH4__0005	1256.675 - 1257.650	Feb0101
11	CH4__0025	1589.400 - 1589.950	Apr0101 (Corr. Bands)
12	CH4__0022	1607.750 - 1610.750	Apr0101 (Corr. Bands)
13	CH4__0021	1626.500 - 1626.775	Apr0101 (Corr. Bands)

N_2O

MW	*Label*	*frequency range(cm-1)*	*Database*
1	N2O__0023	1145.775 - 1146.250	Apr0101 (Corr. Bands)
2	N2O__0028	1147.575 - 1148.100	Apr0101 (Corr. Bands)
3	N2O__0026	1148.675 - 1149.650	Apr0101 (Corr. Bands)
4	N2O__0024	1152.700 - 1155.275	Apr0101 (Corr. Bands)
5	N2O__0027	1158.200 - 1158.400	Apr0101 (Corr. Bands)
6	N2O__0022	1159.200 - 1159.975	Apr0101 (Corr. Bands)
7	N2O__0025	1160.000 - 1161.600	Apr0101 (Corr. Bands)
8	N2O__0021	1161.625 - 1164.625	Apr0101 (Corr. Bands)
9	N2O__0019	1164.775 - 1165.075	Feb0101
10	N2O__0012	1233.275 - 1236.275	Feb0101
11	N2O__0015	1256.075 - 1256.275	Feb0101

12	N2O__0004	1256.675 - 1257.975	Feb0101
13	N2O__0005	1262.350 - 1263.125	Feb0101
14	N2O__0007	1263.350 - 1263.900	Feb0101
15	N2O__0008	1265.750 - 1266.800	Feb0101
16	N2O__0006	1266.825 - 1267.750	Feb0101
17	N2O__0001	1272.050 - 1275.050	Feb0101
18	N2O__0016	1284.925 - 1285.975	Feb0101

NO_2

MW	*Label*	*frequency range (cm-1)*	*Database*
1	NO2__0030	767.325 - 767.500	Apr0101 (Corr. Bands)
2	NO2__0028	789.950 - 790.525	Apr0101 (Corr. Bands)
3	NO2__0021	790.550 - 791.425	Apr0101 (Corr. Bands)
4	NO2__0024	807.825 - 808.475	Apr0101 (Corr. Bands)
5	NO2__0022	824.600 - 827.600	Apr0101 (Corr. Bands)
6	NO2__0023	842.125 - 845.125	Apr0101 (Corr. Bands)
7	NO2__0029	861.650 - 862.025	Apr0101 (Corr. Bands)
8	NO2__0002	1606.700 - 1607.200	Feb0101
9	NO2__0001	1607.275 - 1610.275	Feb0101
10	NO2__0008	1612.800 - 1613.700	Feb0101
11	NO2__0003	1613.725 - 1616.600	Feb0101
12	NO2__0010	1619.125 - 1622.125	Feb0101
13	NO2__0013	1622.550 - 1623.475	Feb0101
14	NO2__0006	1624.225 - 1627.800	Feb0101
15	NO2__0004	1634.225 - 1634.925	Feb0101

Retrieval	*1st case*	*2nd case*	*Technical Note*
P,T	24.1	1.013	1.02
H_2O	21.4	17.3	18.7
O_3	29.2	26.7	3.5
HNO_3	66.3	65.8	33.0
CH_4	7.91	5.68	2.4
N_2O	7.04	6.22	1.8
NO_2	1.34	1.35	----

3 - Retrievals