TASTE - TECHNICAL ASSISTANCE TO ENVISAT VALIDATION BY SOUNDINGS, SPECTROMETERS AND RADIOMETERS

ANNUAL REPORT #1 - 2004

prepared by / *préparé par*	J-C. Lambert, Belgian Institute for Space Aeronomy, Brussels, Belgium
reference / *référence*	BIRA-IASB/ESA/NL/AR-0502
issue / *édition*	1
revision / *révision*	0
date of issue / *date d'édition*	28 February 2005
status / *état*	final
document type / *type de document*	Project Report
distribution / *distribution*	ESA, GOMOS QWG, MIPAS QWG, SCIAMACHY QWG, SCIAVALIG

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CONTENTS

A. INTRODUCTION

The TASTE project provides ESA with Technical ASsistance To Envisat atmospheric chemistry validation throughout the satellite lifetime. The project involves an international consortium gathering complementary expertise in remote sensing and satellite validation, namely, BIRA-IASB (Belgium), CNRS/SA (France), FMI-ARC (Finland), IFE/Bremen (Germany), IMK/FZK (Germany), INTA (Spain), KMI-IRM (Belgium), KNMI (Netherlands), NIWA (New Zealand), and SPbSU (Russia), and their collaborators. Main tasks relate to the collection and delivery of correlative data to the Envisat Cal/Val database operated at NILU on behalf of ESA, the monitoring of those data sets, geophysical validation studies based on comparisons between Envisat (GOMOS, MIPAS and SCIAMACHY) and ground-based data sets, and the valorisation of the validation results.

The present document reports on activities carried out in the first term of ESA TASTE project (Contract No. 3-10885/03/NL/MM). Section B reviews the provision of correlative data records. Section C gives an overview of the validation work performed during the reporting period and to which members of the consortium have contributed. Section D reports on the valorisation of the correlative data and of the validation results. Section E concludes with the perspectives for next term.

B. CORRELATIVE DATABASE

B.1. Overview of activities

The following correlative measurements have been collected for Envisat validation purposes:

- O_3 columns from Dobson and Brewer ultraviolet spectrophotometer and from M-124 ultraviolet filter radiometer;
- O_3 profiles from balloon-borne electrochemical ozonesonde and from millimetre wave radiometer;
- O_3, NO_2, BrO and OClO columns from UV-visible Differential Optical Absorption spectrometer (UVVIS);
- O_3, NO_2, CO, CH_4, HNO_3, and N_2O data from (Fourier Transform) infrared (FT)IR spectrometer.

Correlative measurements have been collected at the geographical locations identified in Figure 1. They cover a variety of major geophysical features in the polar and middle latitudes of both hemispheres and in the tropics. In general, there is at least one representative of every instrument technique by latitude region. The list includes the five primary stations of WMO/GAW Network for the Detection of Stratospheric Change NDSC (Arctic, Alpine, Hawaii, New Zealand and Antarctic) plus a list of complementary NDSC stations. The Russian/NIS ozone-monitoring network enhances considerably the sampling over Eurasia.

Collected data sets have been converted into the agreed HDF 4.1.3 format and uploaded to the Envisat Cal/Val database established at NILU. Upload Status Tables presented in Subsections B.4 to B.7 display, month by month, the number of measurement days uploaded to Cal/Val. Subsection B.6 shows that, at the time of this report, only few data records are still missing for 2004; their upload is progressing. An exception relates to the UVVIS columns of BrO and OClO, for which SCIAMACHY validation procedures are still a matter of research due to issues like the strong diurnal variation of the species or uncertainties on the air mass factor (see dedicated papers (co-) authored by members of the consortium). For this reason, common UVVIS BrO and OClO parameters for SCIAMACHY validation purposes cannot be determined yet, and the upload to Cal/Val varies from one group to another according to his validation method.

Nearly all instruments have worked nominally and for a majority of them correlative data acquired directly by members of the consortium have been uploaded within a few months after data acquisition. A special effort was put in spring 2004 to provide preliminary data much quickly for ACVE-2 purposes. Such an effort is anticipated for ACVE-3, envisaged for late 2005. The larger delay or some minor data gaps experienced at some stations or with some instruments can be justified in most cases by normal field realities: due participation to an inter-calibration campaign mandatory for WMO or NDSC certification; temporary breakdown of the instrument; temporary breakdown of local archiving and processing facilities; temporary lack of manpower caused by effort-demanding field campaigns; change in the station staff in charge of the data acquisition or processing; change in the person in charge of data submission; or change in the analysis software. Group-by-group details are given hereafter in Subsection B.2, as well as previsions for the second term of the project.

Uploads of data acquired partly by third parties, sometimes on a best effort basis (e.g. ozone columns measured at a few stations of the M-124 network and the SAOZ network), are sometimes experiencing larger delays, but it must be pointed out that most of those delayed data sets have still already been available to Envisat validation through other means. In any cases uploads of delayed data sets are progressing. Data have also been uploaded from optional stations.

Finally, although the TASTE project requires formally only data from January 2004 onwards, the consortium has contributed data of 2003 as well to bridge the gap between the preliminary Commissioning Phase validation and the "routine" validation phase addressed by the project. Upload Status Tables presented in Subsections B.4 and B.5 show that uploads of "historical" data sets acquired in 2002 and 2003 are complete for nearly all instruments.

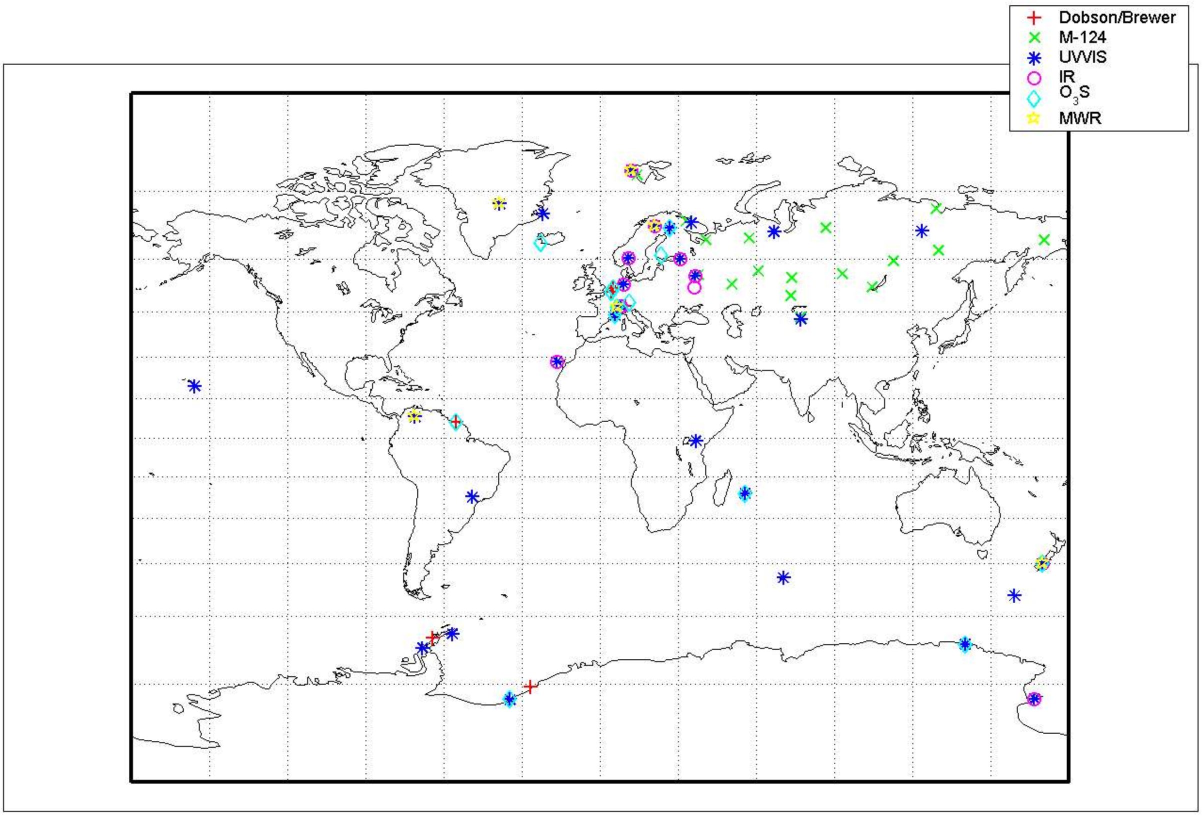

Figure 1. Ground-based instrumentation contributing to the TASTE project: Dobson and Brewer UV spectrophotometers, M-124 UV filter radiometers, UV-visible DOAS spectrometers (UVVIS), IR and FTIR spectrometers (IR), balloon-borne ozonesondes (O_3S), and millimetre wave radiometers (MWR).

To get a consistent overview despite the wide variety of ground-based techniques, numbers reported in the Upload Status Tables of Subsections B.4 to B.7 represent the amount of days for which there is at least one measurement suitable for Envisat validation. It should be noted that the actual amount of individual measurements acquired by an instrument and stored on Cal/Val vary with:

- The type of ground-based instrument: e.g. direct sun observations (Brewer, Dobson, FTIR and M-124) depend on weather conditions while scattered-light UVVIS observations are feasible virtually in all weather;
- The latitude: e.g., most of standard techniques do not provide measurements during polar night;
- The data type and file format adopted by the Data Submitter: some stations store data in monthly files, others in daily files, and others by individual measurement; some Brewer or microwave data files report one measurement every 30 min (reaching sometimes several thousands a month) while others provide only daily averages (thus a maximum of 31 values a month);
- The type of data processing: SAOZ/UVVIS data sets processed at remote stations in real-time by the built-in software and transmitted to CNRS/SA via the ARGOS satellite system, include only one average value for each twilight, while reprocessing at the central laboratory of all the recorded spectra yields one value for every individual measurement.

B.2. Group-by-group status and previsions

BIRA-IASB

All ground-based instruments operated by BIRA-IASB have worked nominally. Data have been analysed and uploaded to the ENVISAT Cal/Val database without delay. The collection and upload of data acquired by NDSC Collaborators have been performed according to the expectations. No problems are foreseen for the second term of this project.

CNRS/SA

The ground-based network of NDSC/SAOZ UV-visible spectrometers operated directly by CNRS/SA and international Collaborators (DMI/Copenhagen, CAO/Moscow, FMI/Sodankylä, U. La Réunion, and UNESP/Bauru) have worked nominally, providing at least 330 days of measurements a year at all stations up to the Polar Circles and about 240-280 days a year at the 70°N site of Scoresbysund (where polar day and polar night prevent taking measurements around both solstices). The SAOZ at Zhigansk experienced problems in March 2004 and after, for which solutions are currently under investigation. Ozonesonde data have also been acquired by CNRS/SA at the NDSC/Antarctic station of Dumont d'Urville. In general, data have been analysed and uploaded to the Envisat Cal/Val database. No problems are foreseen for the second term of this project.

FMI-ARC

All instruments operated by FMI-ARC have worked nominally. Data have been analysed and uploaded to the ENVISAT Cal/Val database without delay. No problems are foreseen for the second term of this project.

IFE/IUP

UV-visible measurements in Ny-Ålesund, Bremen and Nairobi were performed nominally. The instrument in Mérida was set up in March 2004 but suffered two larger data gaps. The first was the result of a hard disk crash in early April 2004, which stopped measurements until begin of May 2004. Due to repeated fluctuations in the voltage of the power mains, the instrument was then severely damaged on July 8th and was repaired on October 25th. The instrument in Summit had a severe detector problem in January 2004 and is operating with a replacement detector of reduced sensitivity since end of February 2004. This should not affect the quality of O_3 and NO_2 columns, but could reduce the S/N ratio for minor absorbers such as BrO and OClO. All measurements have been uploaded to the ENVISAT Cal/Val database with the exception of the Bremen measurements, for which data analysis is still under way.

Instruments of the MW and FTIR group have worked nominally. The RAID-System of this group however broke down in November 2004. Since our system administrator started just a few months ago the backup system was not completely installed. Therefore it was necessary to repair the RAID-system by a commercial company. This is still underway. As soon as the RAID system – where all MW and FTIR spectra are archived – is operating again we will reanalyse all spectra and submit them to the database. This will happen probably in April 2005.

IMK/FZK

Both FTIR measurement sites (Kiruna and Izaña) are active and data acquisition has progressed according to plans. Reanalysis of Kiruna data is complete until the end of October 2004. Due to the setup of a new analysis program, no additional data can be uploaded for Izaña before the end of 2004.

The microwave measurements at Kiruna (cooperation between IRF Kiruna and IMK Karlsruhe) started in late 2002 and continue with some interruptions. Ozone profiles and columns were daily retrieved and the results submitted monthly to the Envisat Cal/Val database. Due to the political circumstances in Venezuela the measurements at Mérida were delayed and instead the IMK-radiometer was installed on the Zugspitze in the Alps between February and July 2003. Since March 2004 the instrument is in operation at Mérida and since May 2004 ozone profiles and columns were regularly retrieved. All data of the IMK-radiometer were submitted monthly to the ENVISAT Cal/Val database.

INTA

All ground-based instruments operated by INTA have worked nominally. Data have been analysed and uploaded to the ENVISAT Cal/Val database without delay. No problem is foreseen for the second term of this project.

KMI-IRM

There was an interruption in the Dobson observations of total ozone column during August 2004 due to a technical problem with the opening of the dome under which the instrument is installed. After repair of the mechanics, the observations were resumed in September 2004. On the longer term it is foreseen to stop the total column observations with Dobson #40 at Uccle in the course of 2005 or 2006. Nevertheless ground-based observations of total ozone columns will remain available at Uccle, as two Brewer spectrophotometers are now operational at the station. Most probably the Dobson instrument will be moved to another location. The choice of the location will be done in consideration with the Dobson community of WMO.

Due to a change in staff at KMI-IRM responsible for the upload of correlative data to the Envisat Cal/Val database, a new account had to be created at NILU in the course of 2004, generating some delay. Since, the regular data upload has resumed.

KNMI

All instruments operated by KNMI have worked nominally. Data have been analysed and uploaded to the ENVISAT Cal/Val database without delay. No problems are foreseen for the second term of this project.

NIWA

All measurements at the various measurement sites have continued nominally. Processing and quality control have in some cases been delayed due to changes in personnel processing the data, but will be brought up to date in due course. The Arrival Heights Dobson instrument was shipped to Melbourne from November 2003 to February 2004 for calibration against a WMO regional standard Dobson, explaining the gap in data for this instrument.

SPbSU

No major problem is to date with the ground-based instruments and data acquisition. M-124 ozone-monitoring network data collected by SPbSU for TASTE are acquired by third parties, sometimes on a best effort basis, therefore delays can not be avoided. Nevertheless uploads of delayed data sets are progressing. Some of the optional data acquired by UV-visible and Infrared spectrometers (columns of NO_2, CO, CH_4, H_2O and N_2O) have been collected and uploaded.

B.3. Climatological verification

A large part of the contributing instruments are part of the NDSC. The NDSC Data Protocol is structured to ensure excellent data quality while providing ready data access. It recognises that, in order to produce a verifiable data product, sufficient time is needed to collect, reduce, calibrate, test, analyse, and inter-compare the streams of preliminary analyses at every NDSC site. Among others, seasonal analyses may be required for observations from both individual and multiple sites and it is expected that such a procedure shall yield the verifiable product referred to as "NDSC data" within a two-year period after acquisition. The faster data availability aimed at by the project implies that limited time only is available to recalibration, state-of-the-art processing or simply quality verification. Therefore we have developed and implemented verification procedures to check first-order quality/consistency of the fresh near-real-time (NRT) data collected in the frame of the project.

The quite large number of contributing instruments and stations implies the use of automated routines flagging non-standard events, which can be looked at more carefully once detected. At ground stations where long enough time-series are available in the NDSC and WOUDC databases, the verification procedure consists in comparing fresh data to climatological means and standard deviations that we calculate on low-pass filtered time-series acquired, if possible, since 1995. A log file is created, which identifies in a first time aberrant data, e.g. impossible Dobson data during polar night or sunrise NO_2 columns exceeding systematically sunset NO_2 columns. Then, column values deviating from the climatological mean by more than 2σ and 3σ are pointed out. Trains of consecutive values falling out of the $\pm 3\sigma$ interval are looked at carefully to determine whether such persistent deviations may be due to data quality issues, to natural atmospheric variability, or to unexpected atmospheric features like the 2002 Antarctic vortex split. Single values falling out of the $\pm 3\sigma$ interval without belonging to a justifiable 2σ train are flagged accordingly but not rejected systematically since they could be associated e.g. to real events of extreme variability or to tropospheric pollution episodes enhanced by multiple scattering within clouds. For newer stations with shorter time-series, consistency checks are based on data already stored at NILU Cal/Val, acquired by other instruments at nearly collocated stations, or even by the same instrument. The climatological verification method is further illustrated in the *TASTE Progress Report January-October 2004* issued in November 2004.

B.4. Monthly Data Distribution for 2002

Brewer	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Sodankylä	67°N		0	0	0	1	0	0	24	30	24	3		82
Jokioinen	61°N	0	0	0	0	0	0	0	18	28	29	15	1	91
De Bilt	52°N	0	0	0	0	1	30	31	31	30	31	30	31	215
Uccle	51°N	0	0	0	0	0	1	29	31	27	31	28	31	178
Arosa	46°N	27	24	24	26	25	27	24	25	22	25	18	20	287
Paramaribo	6°N	2	2	0	0	0	28	31	31	30	22	25	31	202

Dobson	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Uccle	51°N	19	18	17	9	0	0	0	0	0	0	0	0	63
Arosa	46°N	29	21	26	23	22	26	27	26	19	28	14	21	282
Lauder	45°S	21	18	19	15	20	15	18	19	19	27	20	15	226
Vernadsky	65°S	31	28	31	30	*Polar night*			31	30	31	30	31	273
Halley	76°S	31	28	31	15				6	30	31	30	31	233
Arrival Heights	78°S	0	0	0	0				0	0	0	0	0	0

UV-Vis	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N	*Polar night*		0	0	0	0	30	31	29	24	*Polar night*		114
Summit	72°N			0	0	0	0	0	0	0	0			0
Scoresbysund	70°N	14	24	27	22	26	26	18	24	30	29	4		244
Lovozero (optional)	*69°N*	0	0	0	0	0	0	0	0	0	0	0	0	0
Kiruna	68°N	23	28	31	30	31	1	21	31	24	21	28	2	271
Sodankylä	67°N	30	28	30	30	31	30	31	31	30	31	30	31	363
Zhigansk	67°N	30	28	31	30	31	30	31	31	30	31	29	26	358
Harestua	60°N	0	0	0	0	0	26	22	23	30	25	29	29	184
St Petersburg	60°N	0	0	0	0	0	0	30	30	25	28	0	0	113
Zvenigorod (optional)	*55°N*	0	0	0	0	0	0	20	31	30	0	0	0	81
Bremen	53°N	0	0	0	0	0	0	28	31	30	31	30	0	150
Jungfraujoch	47°N	0	0	0	0	31	30	31	31	30	31	30	31	245
O.H.P.	44°N	31	24	29	30	31	30	31	31	21	23	28	31	340
Issyk-Kul (optional)	*43°N*	0	0	0	0	0	0	31	29	22	31	30	29	172
Izaña	28°N	0	0	0	0	0	0	31	28	28	31	20	12	150
Mauna Loa	19°N	31	28	30	30	31	30	31	23	30	31	30	31	356
Nairobi	1°S	0	0	0	0	0	0	0	0	30	31	30	31	122
Saint Denis	21°S	25	21	28	20	0	0	0	0	0	0	13	31	138
Bauru	22°S	29	21	27	27	31	30	22	26	27	31	24	31	326
Lauder	45°S	31	28	31	30	31	30	31	28	29	31	29	31	360
Kerguelen	49°S	20	28	31	30	31	30	31	31	30	31	29	31	353
Macquarie	55°S	31	28	31	30	1	30	31	31	29	31	30	31	334
Marambio	64°S	29	28	31	28	18	0	8	30	30	28	27	31	288
Dumont d'Urville	67°S	31	28	31	30	31	30	31	31	30	31	30	31	365
Rothera	68°S	29	26	29	27	27	20	29	28	29	28	29	29	330
Belgrano	78°S	0	9	23	19	*Polar night*			11	28	29	0	0	119
Arrival Heights	78°S	0	12	31	22				11	30	25	0	0	131

(FT)IR	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N			0	0	0	10	5	6	8	0			29
Kiruna	68°N		0	0	0	0	0	15	13	4	9	5		46
St Petersburg	60°N	0	0	0	0	0	0	7	13	11	0	0	0	31
Obninsk (optional)	*55°N*	0	0	0	0	0	0	6	14	6	2	3	3	34
Zvenigorod (optional)	*55°N*	0	0	0	0	0	0	8	6	9	2	0	6	31
Bremen	53°N	0	0	0	0	0	0	0	1	8	1	1	4	15
Izaña	28°N	0	0	0	0	0	0	8	15	13	9	8	4	57
Lauder	45°S	13	17	21	12	13	11	16	10	15	12	13	11	164
Arrival Heights	78°S	8	5	3	0					9	10	6	8	49

M124	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Barentsburg	78°N			0	0	0	0	30	0	0	0			30
Tiksi	72°N			0	0	0	0	30	0	0	0			30
Murmansk	69°N		0	0	0	0	0	29	29	0	0	0		58
Igarka	67°N		0	0	0	0	0	0	21	0	0	0		21
Markovo	65°N	0	0	0	0	0	0	31	27	29	15	0	0	102
Petchora	65°N	0	0	0	0	0	0	31	30	30	25	0	0	116
Arhangelsk	65°N	0	0	0	0	0	0	29	25	23	21	0	0	98
Yakutsk	62°N	0	0	0	0	0	0	30	17	30	14	0	0	91
St Petersburg	60°N	0	0	0	0	0	0	30	30	25	28	0	0	113
Vitim	59°N	0	0	0	0	0	0	30	30	26	17	0	0	103
Ekaterinburg	57°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Krasnoyarsk	56°N	0	0	0	0	0	0	29	29	28	23	0	0	109
Moscow	56°N	0	0	0	0	0	0	31	31	26	0	0	0	88
Omsk	55°N	0	0	0	0	0	0	31	31	29	29	0	0	120
Samara	53°N	0	0	0	0	0	0	31	30	29	26	0	0	116
Irkutsk	52°N	0	0	0	0	0	0	30	31	28	26	0	0	115
Karaganda	50°N	0	0	0	0	0	0	30	31	30	21	0	0	112
Alma-Ata	43°N	0	0	0	0	0	0	0	0	0	0	0	0	0

Ozonesonde	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Sodankylä	67°N	0	0	1	1	1	0	0	6	5	5	10	13	42
Keflavik	64°N	0	0	0	0	0	0	0	0	0	0	0	8	8
Jokioinen	61°N	0	0	0	0	0	0	0	0	3	5	0	3	11
De Bilt	52°N	0	0	0	0	3	4	4	6	7	6	4	3	37
Uccle	51°N	0	1	0	0	0	0	9	9	13	15	11	11	69
Hohenpeißenberg	48°N	13	11	13	11	9	8	10	8	8	8	12	11	122
Payerne	46°N	0	0	0	0	0	0	14	14	11	13	11	10	73
Paramaribo	6°N	0	0	0	0	0	4	5	4	4	5	3	3	28
Lauder	45°S	0	0	0	0	3	4	5	4	4	10	11	5	46
Marambio	64°S	0	0	0	0	0	0	1	6	6	8	8	7	36
Dumont d'Urville	67°S	0	0	0	0	0	0	4	4	6	6	3	2	25
Belgrano	78°S	0	0	1	1	1	3	3	3	4	5	2	2	25

MicroWave	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Summit	72°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Kiruna	68°N	-	-	-	-	-	-	-	-	-	-	3	30	33
Payerne	46°N	0	0	0	0	0	0	26	27	29	30	23	30	165
Lauder	45°S	0	0	0	0	0	0	31	27	22	16	21	24	141

B.5. Monthly Data Distribution for 2003

Brewer	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Sodankylä	67°N		17	31	30	31	30	28	31	29	25	5		257
Jokioinen	61°N	6	25	28	29	29	25	31	28	30	30	16	3	280
De Bilt	52°N	31	28	31	30	31	30	31	31	30	31	29	31	364
Uccle	51°N	12	28	30	7	31	30	30	31	30	30	30	30	319
Arosa	46°N	21	23	27	25	28	28	27	28	27	22	24	23	303
Paramaribo	6°N	31	28	29	28	31	30	31	31	28	31	30	31	359

Dobson	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Uccle	51°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Arosa	46°N	22	22	28	26	31	30	27	29	23	22	21	22	303
Lauder	45°S	12	12	19	13	16	18	21	16	18	15	17	16	193
Vernadsky	65°S	31	28	31	30				31	30	31	30	31	273
Halley	76°S	31	27	31	16				7	30	31	30	31	234
Arrival Heights	78°S	0	0	0	0				0	0	0	-	-	0

UV-Vis	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Ny-Ålesund	79°N			0	27	31	29	31	30	30	23			201
Summit	72°N			0	0	0	0	0	31	22	31			84
Scoresbysund	70°N	8	26	29	27	27	27	30	27	30	31	21		283
Lovozero (optional)	*69°N*	0	0	0	0	0	0	0	0	0	0	0	0	0
Kiruna	68°N	23	28	31	30	31	1	21	31	30	31	30	3	290
Sodankylä	67°N	31	21	31	30	31	30	31	31	30	31	30	31	358
Zhigansk	67°N	11	25	30	30	31	30	29	30	30	7	26	0	279
Salekhard	67°N	0	0	0	0	0	0	0	0	0	31	30	31	92
Harestua	60°N	31	28	27	27	31	26	31	31	30	31	30	30	353
St Petersburg	60°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Zvenigorod (optional)	*55°N*	0	0	0	19	23	21	27	30	29	30	20	15	214
Bremen	53°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Jungfraujoch	47°N	18	24	31	30	31	28	30	31	30	31	30	31	345
O.H.P.	44°N	31	28	31	30	31	30	31	31	30	24	30	25	352
Issyk-Kul (optional)	*43°N*	0	0	0	0	0	0	0	0	0	0	0	0	0
Izaña	28°N	28	24	7	24	25	14	31	30	21	17	28	17	266
Mauna Loa	19°N	31	24	26	0	0	30	30	31	30	31	30	28	291
Nairobi	1°S	31	28	31	30	31	30	31	31	30	31	30	31	365
Saint Denis	21°S	31	28	31	30	31	30	30	31	27	20	30	31	350
Bauru	22°S	30	23	30	29	31	30	29	28	30	30	26	25	341
Lauder	45°S	29	24	31	30	30	30	31	29	30	31	30	31	356
Kerguelen	49°S	31	28	31	30	31	30	31	31	30	31	30	31	365
Macquarie	55°S	31	27	31	30	31	30	31	31	30	24	28	31	355
Marambio	64°S	31	28	31	24	31	20	24	28	29	31	30	31	338
Dumont d'Urville	67°S	31	28	31	30	31	30	31	30	30	31	30	31	364
Rothera	68°S	30	24	29	27	30	28	29	28	29	30	29	29	342
Belgrano	78°S	0	16	29	10				9	28	28	0	0	120
Arrival Heights	78°S	0	12	31	22				10	30	25	0	0	130

(FT)IR	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N			3	6	1	0	0	0	0	0			10
Kiruna	68°N	5	9	18	9	2	5	14	8	13	8	0		91
St Petersburg	60°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Obninsk (optional)	*55°N*	0	0	0	0	0	0	0	0	0	0	0	0	0
Zvenigorod (optional)	*55°N*	0	0	0	0	0	0	0	0	0	0	0	0	0
Bremen	53°N	1	5	3	3	1	1	0	0	0	0	0	0	14
Izaña	28°N	8	4	9	13	15	12	4	0	0	0	0	0	65
Lauder	45°S	15	18	19	17	13	11	14	14	14	15	16	16	182
Arrival Heights	78°S	10	6	8	2					6	10	14	10	66

M124	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Barentsburg	78°N			0	0	0	0	0	0	0	0			0
Tiksi	72°N			0	0	0	0	0	0	0	0			0
Murmansk	69°N		0	0	0	0	0	0	0	0	0	0		0
Igarka	67°N		0	0	0	0	0	0	0	0	0	0		0
Markovo	65°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Petchora	65°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Arhangelsk	65°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Yakutsk	62°N	0	0	0	0	0	0	0	0	0	0	0	0	0
St Petersburg	60°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Vitim	59°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Ekaterinburg	57°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Krasnoyarsk	56°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Moscow	56°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Omsk	55°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Samara	53°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Irkutsk	52°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Karaganda	50°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Alma-Ata	43°N	0	0	0	0	0	0	0	0	0	0	0	0	0

Ozonesonde	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Sodankylä	67°N	17	6	12	5	4	4	6	4	2	5	4	4	73
Keflavik	64°N	6	6	5	0	0	0	0	0	0	0	0	1	18
Jokioinen	61°N	6	3	7	0	0	0	0	0	0	0	0	0	16
De Bilt	52°N	5	4	4	6	2	4	5	4	4	4	4	5	51
Uccle	51°N	13	14	13	12	11	12	4	11	13	14	10	11	138
Hohenpeißenberg	48°N	11	10	12	11	8	5	9	8	9	9	11	13	116
Payerne	46°N	14	8	12	10	12	12	12	12	12	11	13	13	141
Paramaribo	6°N	6	3	5	4	5	4	5	5	4	4	3	2	50
Lauder	45°S	4	3	9	5	4	4	5	4	4	6	10	6	64
Marambio	64°S	2	2	2	1	2	9	13	13	10	9	7	6	76
Dumont d'Urville	67°S	2	1	1	2	4	8	8	5	0	0	0	0	31
Belgrano	78°S	1	1	3	2	2	4	11	12	9	8	4	1	58

MicroWave	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N	0	9	31	29	0	0	30	20	23	31	30	30	233
Summit	72°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Kiruna	68°N	22	25	23	28	24	21	19	21	25	26	27	28	289
Zugspitze	47°N	-	11	25	13	20	20	16	-	-	-	-	-	105
Payerne	46°N	29	28	27	30	30	30	31	21	27	28	27	31	339
Lauder	45°S	22	24	27	0	0	0	0	0	0	0	0	0	73

B.6. Monthly Data Distribution for 2004

Brewer	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Sodankylä	67°N		18	30	30	31	23	31	31	29	23	2		248
Jokioinen	61°N	3	26	30	30	30	27	30	29	29	31	16	0	281
De Bilt	52°N	30	29	31	30	31	30	31	30	30	31	30	30	363
Uccle	51°N	0	0	16	30	31	30	31	30	30	30	0	0	228
Arosa	46°N	22	26	26	23	26	24	26	25	23	28	23	24	296
Paramaribo	6°N	31	29	24	29	31	30	27	30	30	28	24	27	340

Dobson	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Uccle	51°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Arosa	46°N	21	24	20	25	24	22	28	25	24	29	22	23	287
Lauder	45°S	17	17	17	18	16	17	0	0	0	0	0	0	102
Vernadsky	65°S	31	29	31	30				31	30	31	30	31	274
Halley	76°S	31	26	29	15				4	30	31	30	31	227
Arrival Heights	78°S	-	-	0	0				0	0	0	0	0	0

UV-Vis	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Ny-Ålesund	79°N			31	29	31	30	31	31	30	25			238
Summit	72°N			27	29	15	0	0	8	30	31			140
Scoresbysund	70°N		0	16	30	31	30	25	28	30	27	18		235
Lovozero (optional)	*69°N*	0	0	0	0	0	0	0	0	0	0	0	0	0
Kiruna	68°N	23	16	31	27	31	0	0	23	0	0	0	0	151
Sodankylä	67°N	22	29	25	30	31	29	31	31	30	31	30	0	319
Zhigansk	67°N	3	17	3	0	0	0	0	0	0	0	0	0	23
Salekhard	67°N	29	27	29	30	31	30	30	31	28	30	30	0	325
Harestua	60°N	29	29	31	28	31	30	27	28	30	29	29	29	350
St Petersburg	60°N	27	23	29	29	31	30	29	28	29	30	0	0	285
Zvenigorod (optional)	*55°N*	13	25	0	0	0	0	0	0	0	0	0	0	38
Bremen	53°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Jungfraujoch	47°N	17	29	31	25	27	25	12	10	25	31	22	29	283
O.H.P.	44°N	20	29	31	30	31	28	30	31	30	31	17	0	308
Issyk-Kul (optional)	*43°N*	31	28	30	27	31	30	30	31	26	30	0	0	294
Izaña	28°N	6	27	30	26	31	27	30	28	30	30	29	29	323
Mauna Loa	19°N	30	27	31	30	0	0	0	0	0	0	0	0	118
Mérida	8°N	-	-	-	-	15	28	-	-	-	6	24	4	77
Nairobi	1°S	29	28	30	30	30	28	26	30	21	23	27	0	302
Saint Denis	21°S	22	18	24	26	31	30	30	19	30	10	22	0	262
Bauru	22°S	14	27	28	27	29	27	31	31	28	28	12	0	282
Lauder	45°S	30	29	31	28	29	30	31	31	0	0	0	0	239
Kerguelen	49°S	15	28	31	30	31	30	30	30	30	31	30	0	316
Macquarie	55°S	24	29	30	30	31	30	31	0	0	0	0	0	205
Marambio	64°S	25	28	27	29	29	26	31	30	29	30	29	30	343
Dumont d'Urville	67°S	18	29	31	30	31	30	31	31	30	31	30	0	322
Rothera	68°S	29	28	28	28	29	27	31	31	30	30	30	30	351
Belgrano	78°S	0	15	30	23				0	0	0	0	0	68
Arrival Heights	78°S	0	0	0	0				0	0	0	0	0	0

(FT)IR	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N			0	0	0	0	0	0	0	0			0
Kiruna	68°N	2	10	8	10	14	3	0	0	0	0	0		47
St Petersburg	60°N	2	2	10	24	9	12	5	11	4	6	0	0	85
Obninsk (optional)	*55°N*	0	0	0	0	0	0	0	0	0	0	0	0	0
Zvenigorod (optional)	*55°N*	1	6	11	12	10	8	4	15	4	4	0	0	75
Bremen	53°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Izaña	28°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Lauder	45°S	15	15	8	19	6	10	9	12	9	6	8	9	126
Arrival Heights	78°S	5	3	8	1					7	14	12	10	60

M124	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Barentsburg	78°N			0	0	0	0	0	0	0	0			0
Tiksi	72°N			0	0	0	0	0	0	0	0			0
Murmansk	69°N		19	26	21	0	27	29	30	26	0	0		178
Igarka	67°N		0	0	0	0	0	0	0	0	0	0		0
Markovo	65°N	9	20	0	0	0	0	0	0	0	0	0	0	29
Petchora	65°N	7	17	25	28	29	29	31	28	29	0	0	0	223
Arhangelsk	65°N	6	16	25	27	27	29	31	30	27	0	0	0	218
Yakutsk	62°N	0	0	21	30	29	30	24	30	26	0	0	0	190
St Petersburg	60°N	27	23	29	29	31	30	29	28	29	30	0	0	285
Vitim	59°N	0	0	21	26	29	12	30	30	26	0	0	0	174
Ekaterinburg	57°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Krasnoyarsk	56°N	22	19	22	25	28	29	31	30	27	25	0	0	258
Moscow	56°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Omsk	55°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Samara	53°N	16	20	24	24	30	28	30	31	29	23	0	0	255
Irkutsk	52°N	0	0	0	0	0	15	30	28	30	30	0	0	133
Karaganda	50°N	26	21	0	0	0	0	0	0	0	0	0	0	47
Alma-Ata	43°N	0	0	0	0	0	0	0	0	0	0	0	0	0

Ozonesonde	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Sodankylä	67°N	3	2	5	4	4	5	3	4	5	4	4	6	49
Keflavik	64°N	1	3	3	0	0	0	0	0	0	0	0	0	7
Jokioinen	61°N	0	0	0	0	0	0	0	0	0	0	0	1	1
De Bilt	52°N	4	4	2	4	4	4	5	5	4	4	4	5	49
Uccle	51°N	11	12	14	12	11	12	11	10	13	12	0	0	118
Hohenpeißenberg	48°N	10	12	13	10	8	7	7	9	11	9	11	12	119
Payerne	46°N	13	9	13	13	13	13	12	13	13	11	13	11	147
Paramaribo	6°N	4	4	3	4	4	3	5	3	4	5	3	3	45
Lauder	45°S	4	4	0	0	0	0	0	0	0	0	0	0	8
Marambio	64°S	2	2	2	2	1	2	6	4	4	6	8	6	45
Dumont d'Urville	67°S	0	0	0	0	0	0	0	0	0	0	0	0	0
Belgrano	78°S	2	3	2	2	3	3	3	3	6	4	3	2	36

MicroWave	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Summit	72°N	0	0	0	0	0	0	0	0	0	0	0	0	0
Kiruna	68°N	0	0	0	0	10	27	23	24	23	27	27	13	174
Bremen	53°N	25	28	23	0	10	0	0	0	0	0	0	0	86
Payerne	46°N	27	24	30	30	30	27	27	29	30	23	24	28	329
Mérida	8°N	-	-	-	-	4	18	14	30	30	27	29	24	176
Lauder	45°S	0	0	0	0	0	0	0	0	0	0	0	0	0

B.7. (Provisional) Monthly Data Distribution for 2005

Brewer	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Sodankylä	67°N		13											13
Jokioinen	61°N	5	17											22
De Bilt	52°N	31	23											54
Uccle	51°N													
Arosa	46°N													
Paramaribo	6°N	29	21											50

Dobson	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Uccle	51°N													
Arosa	46°N													
Lauder	45°S													
Vernadsky	65°S													
Halley	76°S													
Arrival Heights	78°S													

UV-Vis	**Lat.**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**#**
Ny-Ålesund	79°N													
Summit	72°N													
Scoresbysund	70°N													
Lovozero (optional)	*69°N*													
Kiruna	68°N													
Sodankylä	67°N													
Zhigansk	67°N													
Salekhard	67°N													
Harestua	60°N	26												26
St Petersburg	60°N													
Zvenigorod (optional)	*55°N*													
Bremen	53°N													
Jungfraujoch	47°N	31												31
O.H.P.	44°N													
Issyk-Kul (optional)	*43°N*													
Izaña	28°N	30												30
Mauna Loa	19°N													
Mérida	8°N													
Nairobi	1°S													
Saint Denis	21°S													
Bauru	22°S													
Lauder	45°S													
Kerguelen	49°S													
Macquarie	55°S													
Marambio	64°S													
Dumont d'Urville	67°S													
Rothera	68°S	28	14											42
Belgrano	78°S													
Arrival Heights	78°S													

(FT)IR	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N													
Kiruna	68°N													
St Petersburg	60°N													
Obninsk (optional)	*55°N*													
Zvenigorod (optional)	*55°N*													
Bremen	53°N													
Izaña	28°N													
Lauder	45°S													
Arrival Heights	78°S													

M124	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Barentsburg	78°N													
Tiksi	72°N													
Murmansk	69°N													
Igarka	67°N													
Markovo	65°N													
Petchora	65°N													
Arhangelsk	65°N													
Yakutsk	62°N													
St Petersburg	60°N													
Vitim	59°N													
Ekaterinburg	57°N													
Krasnoyarsk	56°N													
Moscow	56°N													
Omsk	55°N													
Samara	53°N													
Irkutsk	52°N													
Karaganda	50°N													
Alma-Ata	43°N													

Ozonesonde	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Sodankylä	67°N	6	9											15
Keflavik	64°N													
Jokioinen	61°N	5	7											12
De Bilt	52°N	4	6											10
Uccle	51°N													
Hohenpeißenberg	48°N	11	8											19
Payerne	46°N	11	12											23
Paramaribo	6°N													
Lauder	45°S													
Marambio	64°S	2	2											4
Dumont d'Urville	67°S													
Belgrano	78°S													

MicroWave	Lat.	J	F	M	A	M	J	J	A	S	O	N	D	#
Ny-Ålesund	79°N													
Summit	72°N													
Kiruna	68°N	22												22
Payerne	46°N	29	21											10
Mérida	8°N	12	1											13
Lauder	45°S													

C. VALIDATION ACTIVITIES

During the first term of the project, Envisat level-2 products were generated both by Processing and Archiving Centres (PAC) operated at/on behalf of ESA, and by scientific institutes with their homemade retrieval software tools. In both cases, only sporadic subsets of the entire Envisat data records were made available to the validation teams. Moreover, it was not always straightforward to access the processed data sets since generated and archived at different locations and on different types of media. Despite this sporadic availability, the TASTE Consortium has performed substantial validation work for all available data products under his duty, providing detailed quality assessments as well as valuable input to algorithm and processing teams in view of the improvement of the Envisat ground segment and level-1-to-2 data processors. Validation studies based on scientific processors have also demonstrated the potential of Envisat data for products not generated yet – or not generated with sufficient quality – by the PACs. Validation has been carried out both independently by individual partners using their own methods and jointly by all partners using a common approach. This dual approach has generated constructive discussions yielding consolidated results. Details of the studies fall beyond the scope of this report but they can be found in the reports and publications listed in Section D. This section reports on the main achievements of the reporting period.

C.1. GOMOS

C.1.a GOMOS Prototype Processor 6.0a/b

GOMOS O_3 profile data sets were generated by two versions of the prototype data processor operated at ACRI on behalf of ESA. Version 6.0a produced data sets between May 2002 and the end of the year; for January-April and September-December 2003; and for January-March 2004. Version 6.0b was used to reprocess the entire year 2003 with slightly different settings. Preliminary comparisons with ozonesonde data show no significant changes between 6.0a and 6.0b. GOMOS O_3 profiles are strongly affected by the brightness of the limb through which the star occults. Bright limb situations give poor results. When selecting only dark limb occultations, O_3 profiles agree well with the correlative data. At mid and low latitudes, differences are within 5-10% in the altitude range of 20-50 km. Below and above this range larger differences are reported. For high northern latitudes, the agreement is poorer, but atmospheric variability plays certainly a role. When investigating time structures, a 5-10% agreement was observed, in line with aforementioned height features results. Comparisons show no critical dependence on the occultation angle with ENVISAT orbit plane.

C.1.b GOMOS IPF 4.02

GOMOS ozone profile data are now processed by IPF 4.02. Available data cover the period from May 2004 till January 2005. Preliminary validation shows no significant difference compared to the one generated by the prototype processor. A future upgrade to IPF 5.0 is anticipated for 2005.

C.2. MIPAS

C.2.a MIPAS IPF 4.61

MIPAS ozone profiles retrieved with Off-Line IPF version 4.61 and available to validation teams cover almost the entire nominal-mode operation period of the instrument (from July 2002 to March 2004). Consequently, ground-based comparisons reported at the Envisat symposium held in Salzburg (6-10 September 2004) have been extended to the whole time period. The global mean agreement remains within the 5%-10% level at altitudes down to 18km. No significant seasonal or meridian errors have been detected.

Recently, a new version 4.62 of MIPAS OL processor also generated a few additional sets of MIPAS ozone profiles, spread over the following time periods: Nov-Dec 2002 and Jan-Feb-Dec 2003. Preliminary comparisons with ozonesonde data conclude to a mean agreement similar to that obtained with IPF version 4.61.

Results for other MIPAS IPF 4.61 profile products (N_2O, HNO_3, temperature etc.) are embedded in the IMK/IAA results presented in the following Subsection.

C.2.b MIPAS IMK/IAA Scientific Processor

Ground-based comparisons of MIPAS data generated by the IMK/IAA processor were presented at the IMK/IAA MIPAS Data User Meeting held on 9-10 December 2004 in Karlsruhe (Germany). The main objective of the meeting was to discuss the status of the scientific MIPAS-ENVISAT products. Validation results as well as scientific results were presented. Here, only topics of relevance for the TASTE project are summarised.

At the time of the meeting, MIPAS IMK/IAA data of the Antarctic vortex split in September 2002, the solar storm event in October 2003, Arctic winter 2002/2003, and of orbits close to validation experiments were available on the MIPAS IMK/IAA database. Access to these data is regulated by a formal data protocol. IDL tools are available to search for data. Besides the data itself, a substantial set of diagnostics is available, too. This includes error estimate, a-priori information, altitude resolution, averaging kernel and covariance matrices.

Validation of scientific MIPAS data relies on the use of data from aircraft and balloon campaigns, from other satellite sensors, and from ground-based networks. Results were presented for MIPAS profiles of temperature, O_3, H_2O, N_2O, CH_4, HNO_3, NO, NO_2, N_2O_5, $ClONO_2$, PSC and altitude. Some examples, in particular with respect to ESA or ground-based data, are summarised hereafter on a product-by-product basis:

- O_3 vmr data are typically 0.2 ppmv smaller as compared to ESA IPF 4.61 data. Good agreement with ground-based FTIR at Kiruna and Izaña is found up to about 25 km. Furthermore, for Izaña data a chi-square test was performed which yields a good agreement.
- Stratospheric temperature data show an agreement of better than 0.5K with several different instruments like CHAMP and HALOE satellite, radiosonde, and ground-based lidar data. Compared to ESA IPF 4.61 profiles, there is a low bias of about 0.5K.
- IMK N_2O and CH_4 profiles show less oscillation as compared to ESA profiles. The profiles agree well with ESA profiles above 10hPa, but there is a high bias below 10 hPa.
- For HNO_3 and NO_y there is a low bias to ESA data at around 20 km. Compared with balloon-borne instruments like MIPAS and Mark IV there is a good agreement provided that the coincidence is optimal.
- While there is good agreement of $ClONO_2$ to other instruments, there is some bias to ground-based FTIR, which is under investigation right now.
- PSC types are in agreement with lidar observations; top altitude differs up to 2 km.

The next MIPAS IMK/IAA data user meeting is envisaged for December 2005. Further information is available on the IMK/FZK website (http://www-imk.fzk.de/asf/ame) or by sending an email to thomas.clarmann@imk.fzk.de.

C.3. SCIAMACHY

C.3.a SCIAMACHY IPF 5.01/5.04

At ACVE-2, preliminary validation of the sporadic set of SCIAMACHY validation orbits processed with IPF 5.01 (validation orbits limited to the 2002 period), concluded to O_3 and NO_2 column nadir products reaching a level of quality comparable to that reached by version 2 of the GOME Data Processor (GDP, on which SCIAMACHY IPF version 5 is based). BrO columns were found in reasonable agreement with ground-based and GOME data for large slant columns. Near-infrared products were still under development and not ready yet for validation.

Following the recommendations expressed during and after ACVE-2, IPF 5.01 was upgraded to IPF 5.04 and new SCIAMACHY data sets were processed and delivered to the validation teams in late 2004. Updated results were reported at the SCIAMACHY validation workshop organised by the SCIAMACHY Validation and Interpretation Group (SCIAVALIG) on 6-8 December 2004 in Bremen (Germany), held in conjunction with the final meeting of the German SCIAMACHY Validation Team (GSVT). Results reported at ACVE-2 for some seasons and latitudes were confirmed, demonstrating that the O_3 and NO_2 column data products generated by SCIAMACHY IPF 5.01/5.04 offers the level of quality that can be expected from a processor based on GOME GDP 2. Validations involving larger SCIAMACHY data sets yield less positive conclusions. E.g., from mid-October till maybe the end of the year (to be verified when relevant SCIAMACHY data become available), larger errors than those detectable at the time of ACVE-2 appear both for 2003 and 2004. Those errors correlate with cloud fraction, ghost vertical column and air mass factor values, and they do not show up at several latitudes. This explains apparent differences between individual comparison results and vindicates the maintenance of a network-based effort instead of only a few “representative” stations. In spring 2005, a GDP4-like algorithm will be implemented in the Off-Line SCIAMACHY processor established at DLR and significant improvements are anticipated (see below).

C.3.b SCIAMACHY Scientific Processors

SCIAMACHY O_3 column data sets have also been produced by scientific processors developed at BIRA-IASB, IUP/Bremen and KNMI. Those processors are based on new GOME O_3 column retrieval algorithms (GDOAS, GODFIT, TOGOMI, WFDOAS) which have demonstrated the possibility to cut SZA/season/latitude dependences of the GOME O_3 column product down to the “1% level”, that is, to the level of accuracy reachable with well-maintained and calibrated ground-based sensors when their known dependences on air mass, temperature etc. are corrected for. Those algorithms have also proven to be stable and insensitive to instrumental degradation over the entire GOME lifetime, enabling accurate O_3 trend monitoring. Preliminary validation of their SCIAMACHY O_3 columns shows good agreement with ground-based data in most cases.

Both individual and coordinated validations have also yielded encouraging results for preliminary NO_2 column products generated by BIRA-IASB, IUP/Bremen, IUP/Heidelberg, KNMI, and SAO. Differences between the respective NO_2 products can often be explained by differences in retrieval settings. Validation techniques for tropospheric NO_2 products are under development and some of them will be published in 2005.

Other UV-visible species (BrO, OClO, SO_2, HCHO) are being retrieved by scientific algorithms – sometimes on an operational basis. Validation for those species is not straightforward and appropriate methods are under development. Some of them will be published in 2005.

Comparisons using ground-based, satellite and modelling data, have demonstrated the potential of near-infrared products (columns of CO, CH_4, N_2O, H_2O and CO_2) retrieved from SCIAMACHY measurements by the AMC-DOAS (IUP/ Bremen), IMAP-DOAS (IUP/Heidelberg), IMLM (SRON) and WFM-DOAS (IUP/Bremen) scientific algorithms. Solutions to deal with the build-up of ice on the detectors are progressing. The retrieval residuals have not come down yet to the S/N ratio of the instrument (spectra) and improvements are still feasible. Accurate validation methods are also under refinement, e.g. to deal properly with issues posed by mountainous validation sites and by clouds.

C.3.c SCIAMACHY Limb Products

During the reporting period, the availability of SCIAMACHY limb O_3 profile data generated by the Off-Line processor established at DLR was limited to a few verification orbits not designed for validation, and to a data set produced recently with version 2.5 of the level-1-to-2 processor, both based on the Optimal Estimation retrieval method. A preliminary ground-based check of those OL limb profiles v2.5 show mixed results, with a good agreement in some cases but also large deviations in other cases. DLR is working now on a different retrieval approach and new profile data products should be made available to validation teams in 2005.

A set of SCIAMACHY limb O_3 profiles in 2002 and 2003 has also been generated by version 1.6 of the scientific algorithm developed at IUP/Bremen. Ground-based comparisons of O_3 profiles have highlighted an altitude shift ranging from 1.5 km to 3 km associated with the pointing error in SCIAMACHY level-0 data (thus affecting the OL limb product as well). Altitude shifts between the SCIAMACHY profiles and correlative data were calculated at several ground-based stations all around the world, in order to detect effects of the on-board orbit-model updates performed each time Envisat flies over Caribbean and over Australia. The Caribbean update produces obvious longitudinal structures, with a significant reduction of the altitude shift just after this update, followed by a slow increase. There were not enough coincident profiles to observe the effect of the Australian update. This longitudinal structure leads to large discrepancies between the SCIAMACHY and correlative data. The implementation of a new version of the orbit propagator model on December 9, 2003, and a correction scheme developed at IUP/Bremen is expected to improve considerably the altitude registration of the SCIAMACHY O_3 profiles.

D. VALORISATION

D.1. Presentations at meetings and symposia

Results obtained by members of the consortium independently or in a concerted way were reported and discussed at dedicated Envisat QWG and Science Advisory Group meetings and during several scientific workshops and major symposia, where TASTE members also acted on several occasions as Session Chairs, Session Reporters and/or Scientific Organising Committee Members:

- SCIAMACHY Validation Workshop in De Bilt, Netherlands (5-6 April 2004);
- Annual assembly of the European Geophysical Union in Nice, France (25-30 April 2004);
- Committee on Earth Observation Satellites (CEOS) /Atmospheric Chemistry Sub-Group (ACSG) meeting in Frascati, Italy (3 May 2004);
- Second workshop on the Atmospheric Chemistry Validation of Envisat (ACVE-2) in Frascati, Italy (3-7 May 2004);
- TEMIS Workshop, Milano, Italy (10 May 2004);
- Quadrennial Ozone Symposium in Kos, Greece (1-8 June 2004);
- 35th COSPAR Scientific Assembly in Paris, France (18 - 25 July 2004);
- Envisat and ERS Symposium in Salzburg, Austria (6-10 September 2004);

- NDSC Steering Committee Annual Meeting in Andøya Rocket Range, Norway (14-17 September 2004);
- PROMOTE Meeting, Helsinki, Finland (27-28 September 2004);
- 3rd O_3 Monitoring-Satellite Application Facility Algorithm Forum in Helsinki, Finland (30 September 2004);
- NDSC Infrared Working Group meeting, Queenstown, New Zealand (9-12 November 2004);
- Joint SCIAMACHY Validation Workshop/German SCIAMACHY Validation Team Final Meeting in Bremen, Germany (6-8 December 2004);
- MIPAS IMK/IAA Data User Meeting IMK/Forschungszentrum Karlsruhe, Germany (9-10 December 2004);
- TEMIS Workshop, Frascati, Italy (24-25 January 2005);
- 3rd UFTIR Progress Meeting, Brussels, Belgium (14 February 2005);
- SCIAMACHY Scientific Working Subgroup for Algorithm Development and Data Usage (SADDU), Oberpfaffenhofen, Germany (17 February 2005).

D.2. Publications and reports

Members of the TASTE consortium have contributed to a list of peer-reviewed papers, conference proceedings and reports, outlined hereafter. At the time of this Annual Report, they are working on several contributions to the SCIAMACHY Validation special issue of the Atmospheric Chemistry and Physics discussions (ACPD) and journal (ACP). A web-based article on the ground-based validation of Envisat is also near completion.

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E. PERSPECTIVES FOR NEXT TERM

It is expected that activities related to the collection and submission of correlative data will continue on the same basis. The Consortium will go on with routine validation of current IPF versions for the three instruments. A list of processor upgrades are foreseen for all instruments, which will require appropriate (delta-) validation to verify the correctness of algorithm changes and to assess the quality of the new products. In particular, the new operation mode of MIPAS will require a totally new validation round. Upcoming new SCIAMACHY products will also require proper validation.

Advanced validation methods are under development for MIPAS and SCIAMACHY to get rid of the effect of atmospheric variability on the comparisons and to deal with problems specific to the validated species (diurnal variation effects, vertical smoothing etc.)

Next major events for Envisat validation, in which TASTE partners will play an active role, will be the ACPD special issue on SCIAMACHY Validation in Spring 2005, ACVE-3 in late 2005, the next MIPAS IMK/IAA Data User Meeting in December 2005, and the next SCIAMACHY Validation Workshop (date and place to be determined). Discussion and dissemination of results will be ensured through the participation to other meetings of various communities involved directly in Envisat, in working groups of the NDSC, and in atmospheric research in general.