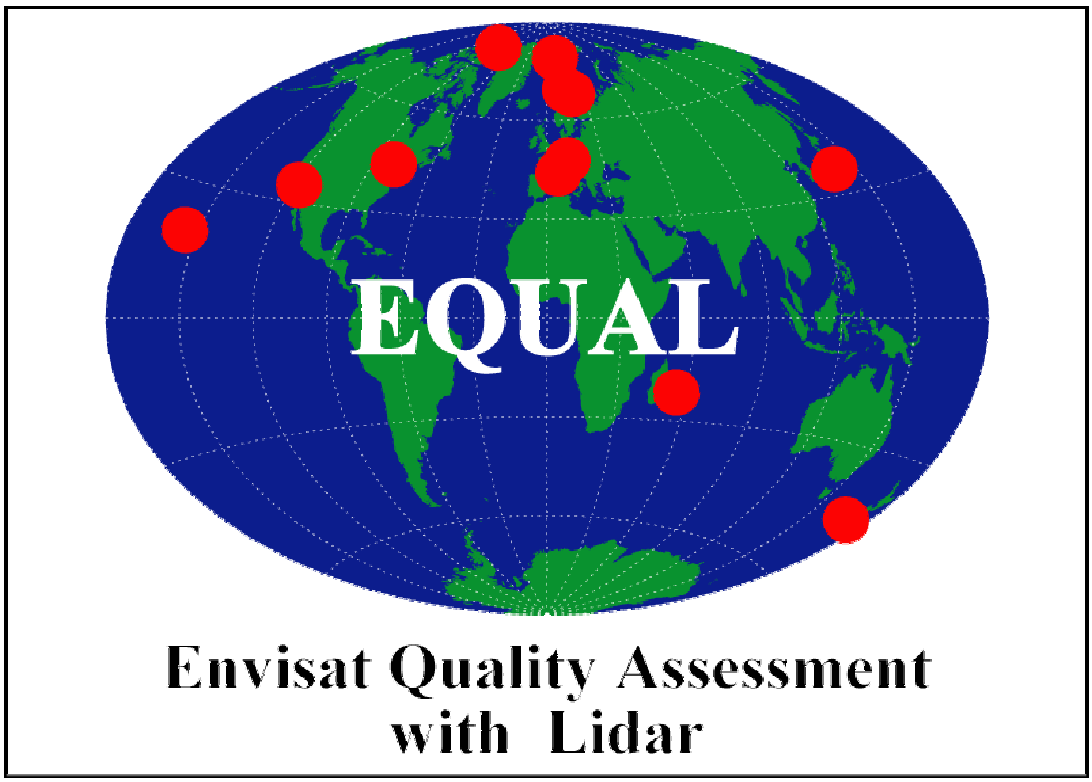
Progress Report

January – March 2005



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1 Introduction

This is the progress report of the EQUAL project led by RIVM. The two Work Packages (WPs) in this project basically involve lidar data submission to the NILU database and validation activities of ENVISAT data with these data. The satellite instruments involved are GOMOS, MIPAS and SCIAMACHY, and in particular we will be investigating their results regarding ozone and temperature profiles. This document describes the work performed for these two WPs and related activities in the indicated period (see cover page).

2 LIDAR Data

2.1 Overview of Data Submission - Figures

The statistics of the lidar data that have been measured, processed, converted (to HDF) and submitted to the NILU database are shown in **Figure 1** for the ozone profiles and in **Figure 2** for the temperature profiles. Each figure presents per month the number of days with lidar measurements. Note that multiple profiles per day are counted as one in this representation. The first set of panels regard the ozone measurements, while the second part concerns the temperature measurements. In each panel title we have indicated with an acronym the station location (see **Table 1**) and the system name which corresponds to the filename in the NILU database (e.g., files with MSC003 in their name contain ozone profile information and MSC004 temperature profile information, and both for Eureka, Canada).

Table 1. Overview of LIDAR systems: acronyms, locations and parameters

Groundstation	**Acro**	**Lat.**	**Long.**	**Parameter**	**System name**
Eureka	EUR	80.05	-86.42	Ozone, temperature	MSC003, MSC004
Ny Ålesund	NYA	78.92	11.93	Ozone	AWI001
Alomar	ALO	69.30	16.00	Ozone	NILU001
Esrange	ESR	67.88	21.10	Temperature	UBONN003
Hohenpeissenberg	HOH	47.80	11.02	Ozone, temperature	DWD001, DWD002*
Obs. Haute Provence	OHP	43.94	5.71	Ozone, temperature	DIAL_CNRS.SA001, RMR_CNRS.SA001*
Toronto	TOR	43.66	-79.40	Ozone	MSC001
Tsukuba	TSU	36.05	140.13	Ozone, temperature	NIES001, NIES002
Table Mountain	TMF	34.40	-117.70	Ozone, temperature	NASA.JPL003 (was CNRS.SA003), NASA.JPL004 (was CNRS.SA002)
Mauna Loa	MLO	19.54	-155.58	Ozone, temperature	NASA.JPL001 (was CNRS.SA004), NASA.JPL002 (was CNRS.SA005)
La Reunion	LAR	-21.80	55.50	Ozone, (temperature)	LAR_LPA001*, x?x[#]
Lauder	LAU	-45.04	169.68	Ozone, (temperature)	RIVM002, RIVM003[#]

* NEW data set in the NILU database which has previously not been submitted.

[#] Data of these systems are currently not available in the NILU database.

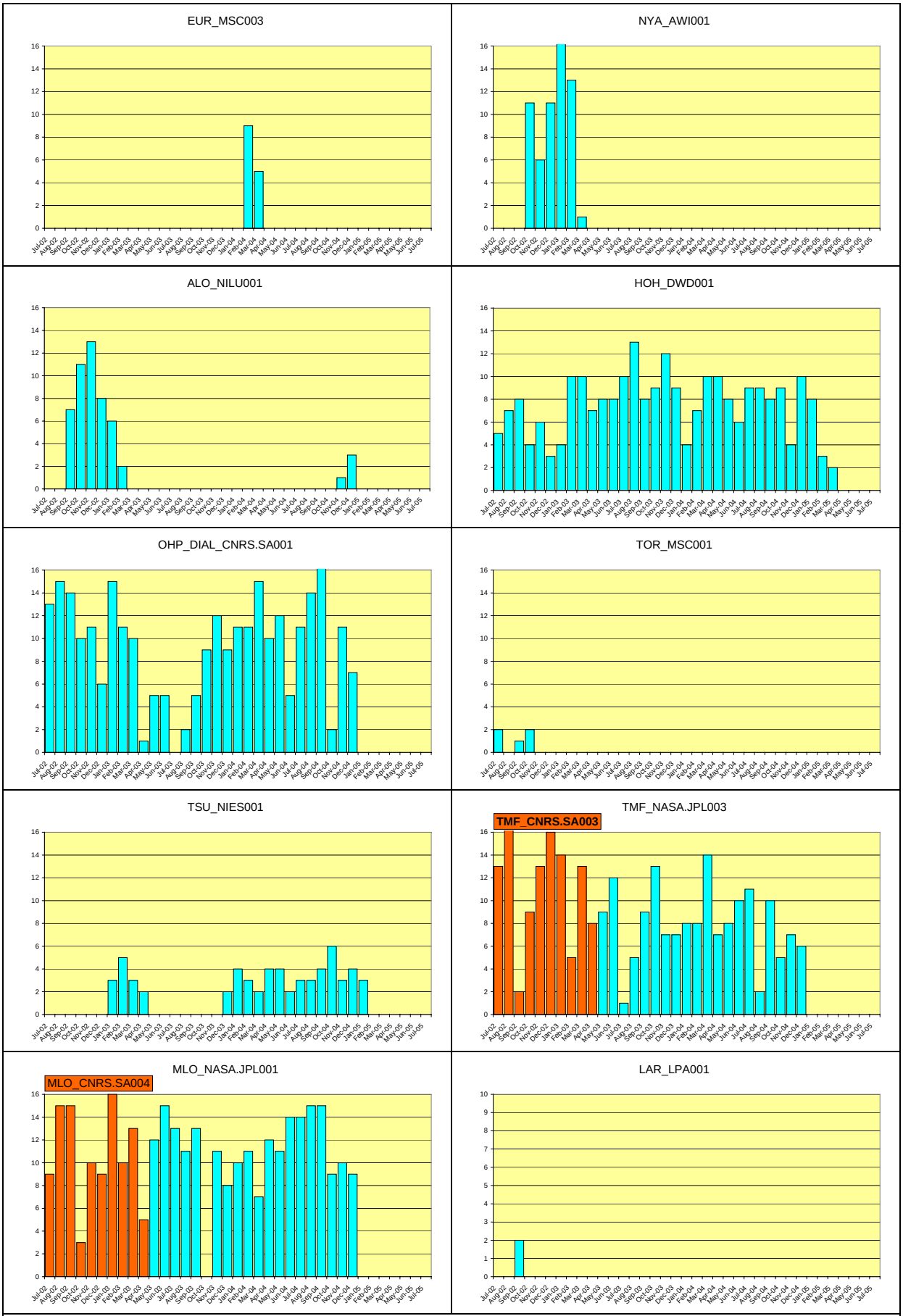

Figure 1. Statistics of available OZONE lidar data in the NILU database. Numbers indicate the number of days per month with lidar measurements.

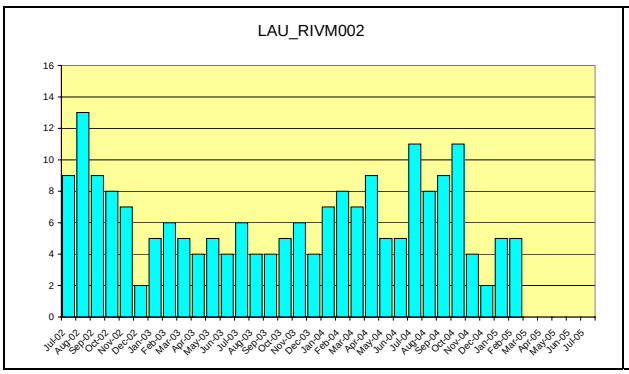

Figure 1. Cont.

Figure 2. Statistics of available TEMPERATURE lidar data in the NILU database. Numbers indicate the number of days per month with lidar measurements.

2.2 Overview of Data Submission – Tables

In this section we give an overview of the lidar data submitted to NILU in Table form. In **Table 2** we present the number of days (**576**) with measurements during the Commissioning Phase of ENVISAT, and most of these data have been submitted prior to the EQUAL project. In **Table 3** we present the statistics for the data measured in 2003. Although the EQUAL project formally started in January 2004, the project partners additionally contributed data of 2003 and hence filled the gap between the end of the Commissioning Phase and the start of the project, which is a bonus for the project and amounts in total an extra **1043** days with measurements. In **Table 4** we present the data measured in 2004, which now come to a total of **1079** days with measurements submitted to the NILU database. In **Table 5** we present the data already measured in 2005, which now come to a total of **34** days with measurements submitted to the NILU database.

Table 2. Data submission statistics, Commissioning Phase (2002)
(in gray temperature lidar systems)

Station	System	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ALO	NILU001	0	0	7	11	13	8	39
ESR	UBONN003	7	13	0	0	0	0	20
HOH	DWD001	5	7	8	4	6	3	33
HOH	DWD002	5	8	8	4	6	3	34
LAR	LPA001	0	0	2	0	0	0	2
LAR	x?x	0	0	0	0	0	0	0
LAU	RIVM002	9	13	9	8	7	2	48
LAU	RIVM003	0	0	0	0	0	0	0
MLO	CNRS.SA004	9	15	15	3	10	9	61
MLO	CNRS.SA005	14	15	15	3	10	9	66
NYA	AWI001	0	0	0	11	6	11	28
OHP	l_CNRS.SA001	13	15	14	10	11	6	69
OHP	r_CNRS.SA001	7	0	3	9	12	9	40
TMF	CNRS.SA003	13	16	2	9	11	10	61
TMF	CNRS.SA002	13	17	2	9	13	16	70
TOR	MSC001	2	0	1	2	0	0	5
TOTAL all systems		97	119	86	83	105	86	576

Table 3. Data submission statistics, 2003 (in gray temperature lidar systems)														
Station	**System**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Total**
ALO	NILU001	6	2	0	0	0	0	0	0	0	0	0	0	8
ESR	UBONN003	9	7	0	0	0	0	0	0	0	0	0	6	22
HOH	DWD001	4	10	10	7	8	8	10	13	8	9	12	9	108
HOH	DWD002	4	10	10	8	8	9	10	13	9	9	12	9	111
LAR	LPA001	0	0	0	0	0	0	0	0	0	0	0	0	0
LAR	x?x	0	0	0	0	0	0	0	0	0	0	0	0	0
LAU	RIVM002	5	6	5	4	5	4	6	4	4	5	6	4	58
LAU	RIVM003	0	0	0	0	0	0	0	0	0	0	0	0	0
MLO	CNRS.SA004	16	10	13	5	End	-	-	-	-	-	-	-	44
MLO	NASA.JPL001	-	-	-	Start	12	15	13	11	13	0	11	8	83
MLO	CNRS.SA005	16	10	14	5	End	-	-	-	-	-	-	-	45
MLO	NASA.JPL002	-	-	Start	1	14	15	13	11	16	8	11	8	97
NYA	AWI001	21	13	1	0	0	0	0	0	0	0	0	0	35
OHP	l_CNRS.SA001	15	11	10	1	5	5	0	2	5	9	12	9	84
OHP	r_CNRS.SA001	16	10	9	3	3	0	14	14	16	9	6	11	111
TMF	CNRS.SA003	10	5	13	7	End	-	-	-	-	-	-	-	35
TMF	NASA.JPL003	-	-	-	Start	9	12	1	5	9	13	7	7	63
TMF	CNRS.SA002	14	5	13	8	End	-	-	-	-	-	-	-	40
TMF	NASA.JPL004	-	-	Start	1	10	13	3	5	9	14	9	8	72
TSU	NIES001	3	5	3	2	0	0	0	0	0	0	0	2	15
TSU	NIES002	3	4	1	2	0	0	0	0	0	0	0	2	12
TOTAL all systems		142	108	102	54	74	81	70	78	89	76	86	83	1043

Table 4. Data submission statistics, 2004 (in gray temperature lidar systems)														
Station	**System**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Total**
ALO	NILU001	0	0	0	0	0	0	0	0	0	0	1	3	4
ESR	UBONN003	2	1	0	0	0	0	4	0	1	1	0	0	9
EUR	MSC003	0	9	5	0	0	0	0	0	0	0	0	0	14
EUR	MSC004	0	9	5	0	0	0	0	0	0	0	0	0	14
HOH	DWD001	4	7	10	10	8	6	9	9	8	9	4	10	94
HOH	DWD002	4	7	10	10	8	6	9	9	8	9	4	10	94
LAR	LPA001	0	0	0	0	0	0	0	0	0	0	0	0	0
LAR	x?x	0	0	0	0	0	0	0	0	0	0	0	0	0
LAU	RIVM002	7	8	7	9	5	5	11	8	9	11	4	2	86
LAU	RIVM003	0	0	0	0	0	0	0	0	0	0	0	0	0
MLO	NASA.JPL001	10	11	7	12	11	14	14	15	15	9	10	9	137
MLO	NASA.JPL002	10	11	7	12	11	14	14	15	15	9	10	9	137
NYA	AWI001	0	0	0	0	0	0	0	0	0	0	0	0	0
OHP	l_CNRS.SA001	11	11	15	10	12	5	11	14	18	2	11	7	127
OHP	r_CNRS.SA001	3	9	17	13	12	15	0	0	0	0	0	0	69
TMF	NASA.JPL003	8	8	14	7	8	10	11	2	10	5	7	6	96
TMF	NASA.JPL004	12	8	14	13	13	17	12	4	11	9	10	10	133
TOR	MSC001	0	0	0	0	0	0	0	0	0	0	0	0	0
TSU	NIES001	4	3	2	4	4	2	3	3	4	6	3	4	42
TSU	NIES002	2	0	1	3	1	2	2	3	3	5	1	0	23
TOTAL all systems		77	102	114	103	93	96	100	82	102	75	65	70	1079

Table 5. Data submission statistics, 2005 (in gray temperature lidar systems)														
Station	**System**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Total**
ALO	NILU001	0	0	0										0
DDU	x?x	0	0	0										0
ESR	UBONN003	0	0	0										0
EUR	MSC003	0	0	0										0
EUR	MSC004	0	0	0										0
HOH	DWD001	8	3	2										13
HOH	DWD002	8	0	0										8
LAR	LPA001	0	0	0										0
LAR	x?x	0	0	0										0
LAU	RIVM002	5	5	0										10
LAU	RIVM003	0	0	0										0
MLO	NASA.JPL001	0	0	0										0
MLO	NASA.JPL002	0	0	0										0
NYA	AWI001	0	0	0										0
OHP	l_CNRS.SA001	0	0	0										0
OHP	r_CNRS.SA001	0	0	0										0
TMF	NASA.JPL003	0	0	0										0
TMF	NASA.JPL004	0	0	0										0
TOR	MSC001	0	0	0										0
TSU	NIES001	3	0	0										3
TSU	NIES002	0	0	0										0
TOTAL all systems		24	8	2	0	0	0	0	0	0	0	0	0	34

3 Validation Activities

This section describes per instrument the validation activities performed during the reporting period using lidar data of one of the EQUAL partners.

3.1 GOMOS Ozone and Temperature Profile Validation

From 26 to 28 January Yasjka Meijer participated in the GOMOS Science and GOMOS Quality Working Group meetings which were held at ACRI, Sophie-Antipolis, France. A presentation was given about the new ESA-funded EQUAL project and what this means for the validation of GOMOS data. Two informal arrangements were made for validation activities. The fist is a contribution to the assessment of proposed processor changes for which RIVM would like to analyze the same data set as for the large validation paper using old and new processor settings. The second is similar but now focussing on the effect of choosing a different ozone absorption cross section database; using the current and using the proposed set by Alain Hauchecorne. So far we have not received any data from ACRI and these action items are on hold.

Another validation effort that we will perform in the near future focuses on the 2003 data set processed with ESA's prototype processor at ACRI. Initially we would like to wait until this data set is extended until the end of 2004 and into 2002, but currently the timeframe for this is not clear and we might just go ahead with the 2003 set only.

3.2 MIPAS Ozone and Temperature Profile Validation

This year we will join an effort initiated by IMK in Karlsruhe to validate MIPAS profiles generated by their institute. There will be a dedicated paper for which we will perform or contribute with the lidar analysis. We are currently waiting for the data to become available. Data processed with the official ESA processor are now being generated more systematically, but it is quite difficult to get a good overview of the available data as data sets seem to be incomplete and additional data are generated for certain periods. Therefore, we are initially preparing the validation software for this product before starting the major download operation of the MIPAS level-2 mission data set.

3.3 SCIAMACHY Ozone and Temperature Profile Validation

In the reporting period we have mostly focused on the validation of SCIAMACHY ozone profiles, and in particular to contribute to an initiative taken by KNMI. They took the lead in the submission of paper **[1]** regarding the validation of these profiles for the special SCIAMACHY Validation issue of the Atmospheric Physics and Chemistry online journal. The analysis using lidar data taken within the EQUAL project forms one of the major pillars of the paper. In the Appendix we have attached the major analysis results of the three different data sets that were investigated, namely from two different ESA offline processor versions (2.4 and 2.5) covering the period November 2004 to January 2005 and data for five months in 2004 (January, March, May, September and November) from IFE (version 1.61) in Bremen, Germany. A surprising result is the clear presence of an altitude shift in the data. Although there has been an improvement of the software controlling the ENVISAT attitude, there is still a problem remaining and data can not be correctly retrieved. A best estimate for the effect on the SCIAMACHY limb profiles is that there is an altitude shift of –1.5 km, which we have 'corrected' for (i.e. applied) before confronting these data with the lidar profiles.

4 References

[1] Geophysical Validation of SCIAMACHY Limb Ozone Profiles, E. J. Brinksma, A. Bracher, D. E. Lolkema, A. J. Segers, I. S. Boyd, K. Bramstedt, H. Claude, S. Godin-Beekmann, G. Hansen, G. Kopp, T. Leblanc, I. S. McDermid, Y. J. Meijer, H. Nakane, A. Parrish, C. von Savigny, D. P. J. Swart, G. Taha, and A. J. M. Piters, submitted to *Atmos. Chem. Phys. (Discuss.)*, April 2005.

Appendix 1.

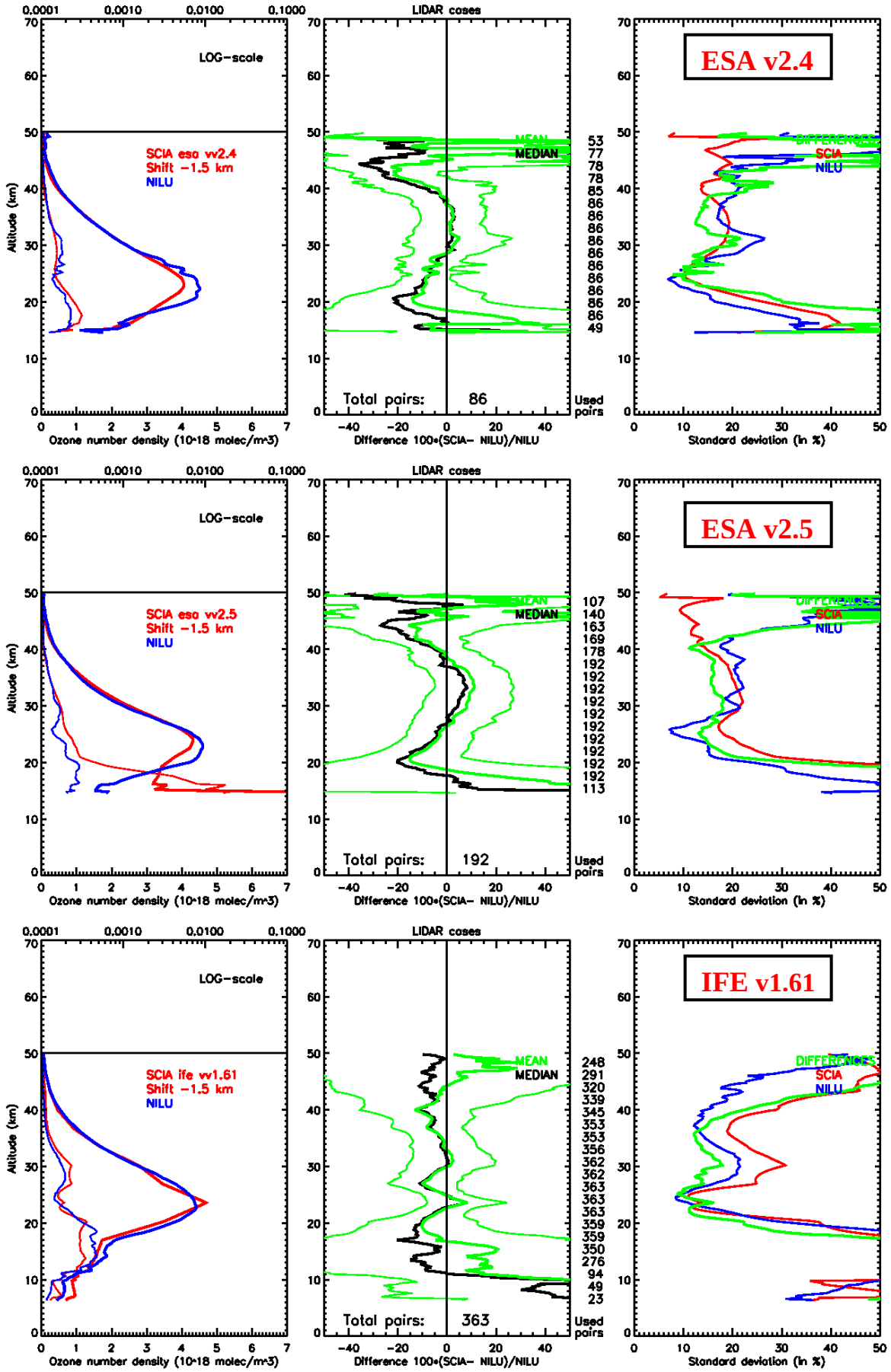

Figure 1. Sciamachy validation results for ESA offline processing versions 2.4 (top) and 2.5 (middle), and scientific product of IFE version 1.61 (bottom). Note applied shift to Sciamachy data of –1.5 km.