

Quarterly reports of the E-AMDAR Quality Evaluation Centre on AMDAR data

2000-IV

Report number 5 28 March 2001

Period: 1 OCTOBER 2000 – 31 DECEMBER 2000

KNMI
Wilhelminalaan 10
NL-3732 GK De Bilt
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Identified manager for the production of this report:

Dr Jitze P. van der Meulen, KNMI
 Tel.: +31 30 2206432
 E-mail: meulenvd@knmi.nl

The appointed Technical Co-ordinator E-AMDAR Programme:

Stewart W Taylor
 Met Office
 +44 (0) 1344 855533
 E-mail: stewart.taylor@metoffice.com

Recipients of the report are the Participating National Meteorological Centres:

LIST OF E-AMDAR OPERATORS – Contact Details.

NAME/ADDRESS	AIRLINE	E-MAIL	TELEPHONE	FAX
Dr Jochen DIBBERN Deutscher Wetterdienst Referat TI 22 Frankfurter Str. 135 63067 OFFENBACH AM MAIN GERMANY	Lufthansa	jdibbern@dwd.d400.de	(+49) (0)69 8062 2841	(+49) (0)69 8004201
Mr F GROOTERS KNMI Observations & Modelling Department P.O.Box 201 NL-3730 AE DE BILT NETHERLANDS	KLM	Grooters@knmi.nl	(+31) (0)30 2206 691	(+31) (0)30 2210 407
Mr T HOVBERG SMHI SE-601 76 Norrköping SWEDEN	SAS	ture.hovberg@smhi.se	(+46) (0)11 495 8237	(+46) (0)11 495 8001
Jean-Louis GAUMET Meteo-France SETIM BP 202 78195 TRAPPES CEDEX FRANCE	Air France	jean-louis.gaumet@meteo.fr	(+33) (0)130 136470	(+33) (0)130 136468
Bruce TRUSCOTT Met Office, Beaufort Park, Easthampstead, Wokingham Berkshire RG40 3DN ENGLAND	BA	bruce.truscott@metoffice.com	(+44) (0)1344 855881	(+44) (0)1344 855897

1) Introduction

AMDAR offers the potential for a large increase in upper air wind and temperature data, observed for use as input for models. To improve the usefulness of these data, quality evaluation is essential in combination with appropriate impact studies. Today the E-AMDAR fleet will number approximately 353 assigned aircraft, 80% of which will fly predominantly European routes and the remainder long haul. All E-AMDAR data for evaluation will be made available on the GTS with in near real time performances. ***It should be noted that not all identified aircraft are fully operational at present*** (operational on January, 1st, 2001: 166).

The purpose of this report is to provide statistical information on the quality, quantity and availability of aircraft reports made available from all Participating Members. The information will be used for further impact studies and feed back to the E-AMDAR operators to improve the quality of the E-AMDAR observing system.

The Quality Evaluation Centre has monitored AMDAR reports received at KNMI since September 17th 1999. The aim of the monitoring process is to detect and identify any incorrectness or anomalies of the data or transmission within 24 hours and to instigate fault correction procedures. Such a process is vital for maintaining data quality and credibility at the required level. The monitoring of the observations covers data availability, receipt delays, reporting frequency and checks on the consistency and quality of the meteorological data.

The EUMETNET Council agreed in September 1998 that the Met Office would be the Responsible Member for the E-AMDAR Programme. The Programme Manager is Mr Bruce Truscott. The appointed Technical Co-ordinator, Mr Stewart Taylor, will ensure that any faults identified are investigated and rectified in a timely manner. All irregularities on E-AMDAR data will be reported to the Programme Manager.

Observations period: The coverage of the data used for the statistical analysis for AMDAR reporting aircraft is the period October 1st, 2000, 00:00 UTC to December 31st, 2000, 24:00 UTC (2000Q4).

2) Operational AMDAR units

Data from 169 activated E-AMDAR units producing **FM 42-IX** or **BUFR AMDAR** code were received and analysed at KNMI HQ in De Bilt during the stated period. From one activated aircraft no data was received. Notice that a number of aircraft only report during the ascending phase. For a list of reporting aircraft and their identifiers, see [table 1](#). In this table aircraft are indicated, which were activated or deactivated during this period.

3) List of outstanding issues

- a) In previous quarterly reports a number of issues concerning errors in the FM 42-IX AMDAR code bulletins were presented. These errors were seen during this quarter as well. In the examples below a short summary is presented of these errors. See for more details the previous quarterly reports.

AMDAR 0100
LVR EU1002 5401N 11556W 2308 F350 MS527 208/021 TBO S011=
LVR EU1002 5316N 11640W 2315 F350 MS537 191/025 TBO S011=
LVR EU1002 5230N 11722W 2322 F350 MS525 171/027 TBO S011=
LVR EU1002 5145N 11805W 2329 F313 MS477 184/044 TBO S011=
LVR EU1002 5101N 11850W 2336 F310 MS467 221/021 TB S011=
LVR EU1002 5015N 11936W 2343 F310 MS447 286/030 TBO S011=

```
LVR EU1002 4928N 12021W 2350 F310 MS475 291/054 TBO S011=
LVW EU1002 4841N 12103W 2357 F299 MS490 307/076 TBO S011=
DES EU1002 4814N 12127W 0002 F183 MS240 297/053 TB/ S011=
DES EU1002 4809N 12130W 0002 F159 MS190 297/050 TB/ S011
333 F000 VG000= A
```

AMDAR 0100

```
LVR EU1002 5401N 11556W 2308 F350 MS527 208/021 TBO S011=
LVR EU1002 5316N 11640W 2315 F350 MS537 191/025 TBO S011=
LVR EU1002 5230N 11722W 2322 F350 MS525 171/027 TBO S011=
LVR EU1002 5145N 11805W 2329 F313 MS477 184/044 TBO S011=
LVR EU1002 5101N 11850W 2336 F310 MS467 221/021 TB' S011=
LVR EU1002 5015N 11936W 2343 F310 MS447 286/030 TBO S011=
LVR EU1002 4928N 12021W 2350 F310 MS475 291/054 TBO S011=
LVW EU1002 4841N 12103W 2357 F299 MS490 307/076 TBO S011=
DES EU1002 4814N 12127W 0002 F183 MS240 297/053 TB/ S011=
DES EU1002 4809N 12130W 0002 F159 MS190 297/050 TB/ S011
333 F000 VG000= A=
```

errors:

- [1] Date confusion 2308 to 2357 refer to previous day.
- [2] $TB_{B_A} = TB'$; accent sign not allowed. Turbulence indicator $B_A = 0, 1, 2$ or 3 (code table 0302)
- [3] Obscure end-of-bulletin characters, A or A=
- [4] Identical bulletins are transmitted twice, both with different end-of-bulletin characters

date: 1 November 2000

Example 1

AMDAR 0100

```
/// EU0482 2621N 04949E 0033 F029 PS257 284/015 TBO S111=
/// EU0482 2621N 04949E 0033 F032 PS252 295/016 TBO S111=
/// EU0482 2619N 04946E 0034 F048 PS217 360/012 TBO S111=
/// EU0482 2621N 04944E 0034 F064 PS172 360/008 TBO S111=
/// EU0482 2624N 04945E 0035 F081 PS122 308/008 TBO S111=
ASC EU0482 2626N 04948E 0036 F098 PS072 291/008 TBO S011=
ASC EU0482 2631N 04955E 0037 F117 PS017 300/010 TBO S011=
ASC EU0482 2635N 05001E 0038 F138 MS015 288/018 TBO S011=
ASC EU0482 2636N 05003E 0039 F142 MS025 288/022 TBO S011=
ASC EU0482 2640N 05008E 0039 F159 MS045 269/018 TBO S011
333 F))) VG))) =
```

errors:

- [5] $i_p i_p i_p = ///$; defined values: LVR, LVW, ASC, DES and UNS
- [6] $Fh_d h_d h_d = F))) VG)))$. Pressure altitude and maximum derived equivalent vertical gust should be presented in numbers only.

date: 1 November 2000

Example 2

- b) To prevent the storage of identical reports (like with example 1), each report is checked with reports which are already stored in the database. Moreover, for a number of flights, observations were continued after landing and a dense set of *identical surface measurements* was disseminated. To be able to discard these data all data having identical positions (latitude/longitude and altitude, using the maximum of available precision) are indicated as "double" and only one observation of this set is evaluated.
- c) To avoid date confusion (see example 1) an FM42-IX AMDAR code change is implemented officially by WMO on 3 May 2000 by extending the GGgg group with the day number to become YYGGgg. The addition of the day number will help to prevent the rejection of reports. Without the YY (day) the GGgg (hour/minute) will be interpreted as belonging to the day, indicated section 1 of the bulletin (AMDAR YYGG). Reports, within

the bulletin, referring to hours from the previous day will be indicated as "to early" and disregarded. During this quarter, however, in none of the received FM42-IX AMDAR bulletins this code change was found. Nevertheless a software upgrade is foreseen in the near future.

- d) Occasionally, the altitude information in the reports from the BUFR encoded bulletins is incorrect. In stead of values just below MSL, these reports present values of about 22 km or more. The explanation is that under certain circumstances negative values of the altitude are calculated near the ground by using the Standard-Atmosphere with MSL = 1013.2 hPa, which can not be presented in the code format used on board appropriately. The onboard software adds to the negative value of the altitude the fixed positive value of 73000 feet and transmits the result to the ground system. As a consequence the observed variables differs significantly from the background value representative for this high altitude affecting the statistical analyses as a result. These differences are most significant for temperature. A set of typical examples is given in the table below (the variable *Temperature [background]* is based on the model value for the given altitude):

AIRCRAFT	Day	Time (UTC)	Altitude (m)	Temperature [observed] (°C)	Temperature [background] (°C)	Temperature difference (°C)
EU0043	2000.10.22	14.53	22170	294.9	212.4	82.5
EU0047	2000.10.22	09.25	22230	294.9	211.6	83.3
EU0050	2000.10.28	09.45	22160	292.4	212.7	79.7
EU0052	2000.10.20	16.09	22170	292.2	212.0	80.2
EU0059	2000.10.06	09.08	22220	291.2	212.5	78.7
EU0061	2000.10.31	13.01	22180	289.9	213.6	76.3
EU0106	2000.11.04	17.22	22160	288.7	216.3	72.4
EU0154	2000.10.04	16.01	22230	295.4	211.3	84.1
EU0158	2000.10.04	15.42	22210	295.2	212.7	82.5
EU0167	2000.11.11	13.15	22200	296.2	212.4	83.8
EU0185	2000.10.16	14.01	22190	293.4	213.0	80.4
EU0301	2000.10.02	03.34	22240	294.9	214.7	80.2
EU0311	2000.10.04	05.42	22190	288.7	212.2	76.5
EU0313	2000.11.11	10.44	22190	294.9	212.4	82.5
EU0316	2000.10.28	11.58	22190	295.9	212.6	83.3
EU0319	2000.09.30	11.08	22220	291.2	214.2	77.0
EU0359	2000.10.31	10.53	22200	293.7	212.7	81.0
EU0456	2000.10.07	01.24	22230	291.2	214.1	77.1
EU0458	2000.10.03	07.13	22240	288.9	212.6	76.3
EU0711	2000.11.08	08.35	22240	281.7	208.9	72.8
EU0802	2000.10.15	12.02	22220	297.4	213.1	84.3
EU0875	2000.09.30	22.46	22210	290.9	216.8	74.1
EU0921	2000.10.23	09.45	22230	285.4	212.0	73.4
EU1547	2000.11.12	15.05	22140	286.7	212.8	73.9
EU2189	2000.10.28	13.35	22210	294.4	214.7	79.7
EU2301	2000.10.16	23.11	22220	295.2	212.7	82.5
EU2559	2000.10.30	11.18	22180	294.9	215.4	79.5
EU3257	2000.10.01	09.41	22170	293.9	215.1	78.8
EU3421	2000.10.04	16.50	22220	296.2	212.4	83.8

This issue was solved around December 1st, which can be seen in figure 1 below, where the daily number of these incorrect encoded records is shown.

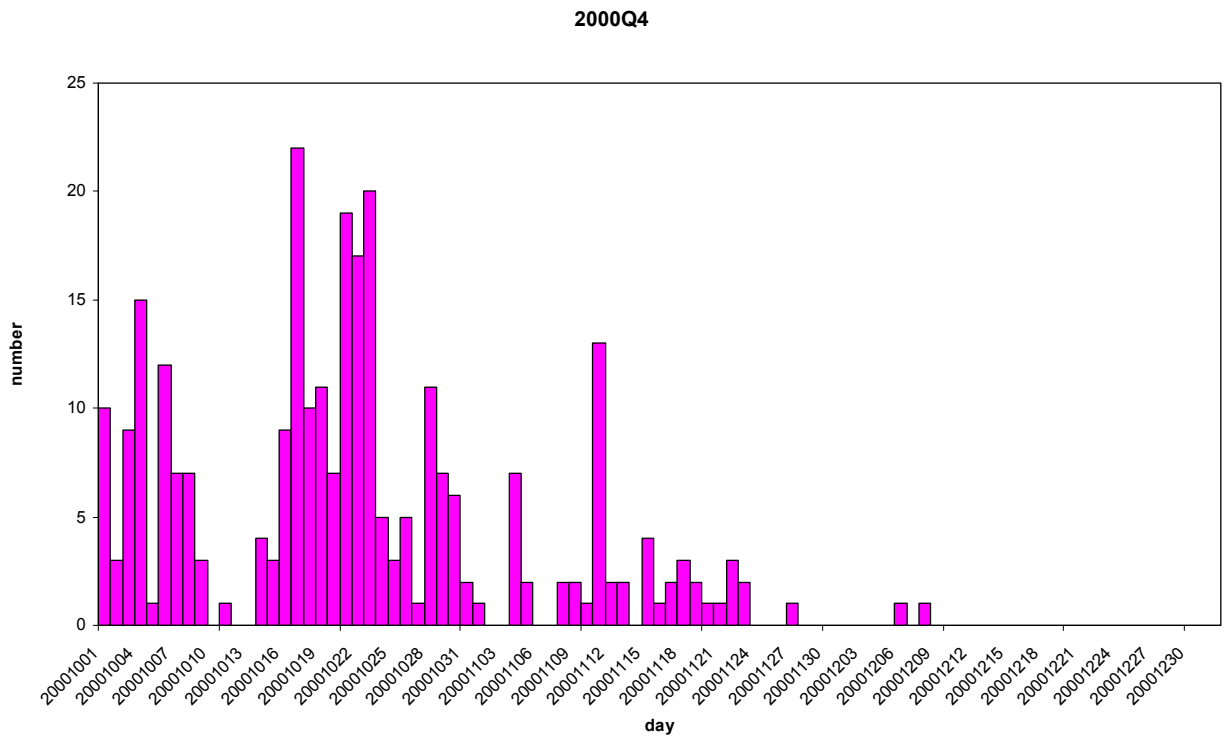


Fig. 1 Daily number of BUFR encoded AMDAR bulletins with erroneous altimeter information.

- e) BUFR encoded AMDAR bulletins present during the ascent phase sometimes one single descent status.
- f) Although activated on November, 2nd, no reports were received from Aircraft EU2773.
- g) From three previously deactivated aircraft (EU4956, EU5191 and EU4589), data was received.
- h) EU4582 reported as "EU4482" on December, 21st - 26th.

4) Monitoring results

a) Data Availability

AMDAR reports are received via the different collecting centres with ground based receiving stations and consequently through GTS. Some aircraft fly "long haul" routes and where no ground station coverage available, send AMDAR data via satellite communications systems. An overview for all aircraft involved is presented in table 2. At the end of this table also a list of aircraft is presented for which more than one percent of the observations took more than two hours to arrive at the QEvC.

Two officially activated aircraft reported during one or two days only: EU3544 and EU9622. EU3544 was activated and deactivated for one day only for testing software. Since no data was received after the first three days of activation on October, EU9622 was deactivated in December. Although activated no data was received from EU2773. Two other aircraft (EU0005 and EU0175) were sold and therefore deactivated by the operator. After deactivation EU0005 transmitted data during the delivery flight, the only data received during this quarter. See table 3 for more details.

b) Data coverage

Aircraft carrying the AMDAR units fly prominently within Europe. To get a brief impression of the EU AMDAR coverage of Europe and the Atlantic two figures are presented in Annex I.

c) Data Timeliness

The delay between observation and reception at the GTS nodes should be small. During the period, 96,7 % of all reports was received within one hour of observation time and 99,1 % within 2 hours from observation. With respect to the previous quarter a significant decrease is found. The reason for this deterioration is being caused by a small set of aircraft and will be investigated by the E-AMDAR Technical Co-ordinator. Overall the data timeliness is very good (see special case study, par. 8.c and Annex IV)

d) Frequency of reporting AMDAR observations

During level flight at cruising height the reporting frequency of AMDAR reports is expected to be one report per 7 minutes or 10 minutes depending on the Aircraft software. During the ascent or descent phase reports should be generated more frequently (*i.e.* every 50 hPa) with the higher frequency applying to the lower part of the atmosphere (*i.e.* every 10 hPa). It was found that the BUFR encoded AMDAR bulletins contain observations repeatedly done within one minute when in ascending or descending phase. As a consequence the reporting frequency of BUFR AMDARS is extremely high during that phase. Most of the aircraft operate within Europe and within relatively short travel distance. As a consequence data obtained from E-AMDAR reports at cruising heights is significant less than e.g. for data from ASDAR units during Atlantic flights. It is recommended to investigate in more detail this issue as an impact study.

e) Data quality evaluation

Every day quality control procedures are performed. By comparing the meteorological and positional information supplied by the AMDAR units with a reference background, suspect reports are selected and presented. FM42-IX and BUFR encoded AMDAR bulletins passing through the KNMI MSS are analysed for statistical evaluation purposes. Incorrectly encoded reports are stored apart and kept outside further evaluation.

The differences between observations and model-forecast fields from the HIRLAM-3 1-level-global-forecast-model are used for analysing the quality of AMDAR reports. These differences between the values from the observation and the model background (indicated by "O-B") are calculated for the levels from 950 to 400 hPa (ascent/descent levels) and for 350 to 150 hPa (cruise levels). Average values and standard deviations of the calculated differences for temperature, wind speed and wind direction are derived for all reports from any AMDAR unit separately and by taking into account time and place/position. For the evaluation process the most actual output from the HIRLAM model is used as reference. Note that this model has a 3 hours update interval. Consequently quality evaluation is performed every 3 hours. From this evaluation process AMDAR units are selected as an entry for identifying as a suspect report in case of overriding the stated criteria. As a result from this evaluation process a daily report is generated for direct transmission by e-mail to the E-AMDAR technical co-ordinator and all E-AMDAR operators. With the exception of rejected reports and of observations outside the HIRLAM area, **all** data is evaluated. For practical reasons, the daily reports present **only** those aircraft with identifiers starting with 'EU' (E-AMDAR) or ending on 'Z' (ASDAR).

Criteria

The critical (absolute) margins used for selecting entries are:

- Air Temperature: $|T_A(O)-T_A(B)| \geq 0,5 \text{ }^\circ\text{C} (0,5 \text{ K})$
- Wind speed: $|f(O)-f(B)| \geq 2,0 \text{ m/s} (4 \text{ Knots})$
- Wind direction: $|d(O)-d(B)| \geq 20 \text{ }^\circ (\text{Degrees})$

No criterion is stated concerning standard deviations.

The Obs-Background mean temperature differences vary between -0.6°C and $+1.2^\circ\text{C}$. Aircraft with a mean difference, typically larger than expected are: EU0158, EU0249, EU0316, EU0324, EU0592, EU4582, EU4950, EU6349, EU6444, EU7888, EU8520, EU9145 and EU9622. No aircraft exceeded the stated mean wind speed and wind direction differences except for the officially deactivated EU4589 (wind direction ASC/DEC). EU3544, activated for testing on October, 9th for one day only demonstrated extreme differences, presumably based on non-representative observations (see also the table below). In Annex II, three figures are shown, presenting the frequency distribution of the mean O-B temperature differences, wind speed differences and wind direction differences as found for the set of aircraft. For a number of observations extreme temperature differences were observed:

AIRCRAFT	Day	Time (UTC)	Latitude	Longitude	Altitude (m)	Temperature [observed] ($^\circ\text{C}$)	Temperature [background] ($^\circ\text{C}$)	Temperature difference ($^\circ\text{C}$)
EU0072	2000.10.27	13.08	52.09	2.91	2220	224.7	277.0	-52.3
EU0088	2000.10.06	08.48	54.49	-3.36	2220	224.7	269.8	-45.1
EU0088	2000.10.20	08.03	50.89	5.25	2860	214.7	271.7	-57.0
EU0109	2000.11.16	11.23	44.41	27.95	3440	209.7	271.0	-61.3
EU0175	2000.10.03	15.26	47.09	5.30	11790	254.0	217.1	36.9
EU0175	2000.10.03	15.54	49.81	2.05	10660	251.2	222.1	29.1
EU0249	2000.10.18	16.15	51.41	-0.35	180	315.7	288.2	27.5
EU0456	2000.10.04	23.52	53.64	9.94	20	332.7	287.5	45.2
EU0807	2000.12.25	19.36	42.70	11.93	10050	245.5	212.4	33.1
EU3544	2000.10.09	09.03	51.97	9.55	10670	286.2	219.9	66.3
EU3544	2000.10.09	09.03	52.85	10.43	10670	286.2	217.3	68.9

On October, 3rd aircraft EU0175 and on October 18th, aircraft EU0249 demonstrated significant temperature differences..

f) Results (tables)

In the tables 4 to 6 attached to this report all (EU-)AMDAR units are presented together with the observed total of average differences and standard deviations. All these tables are divided in two lists, one for the DES/ASC phase and the other for the cruise level phase. No statistics are presented for the UNS phase (unstable) or with $i_p i_p = '///'$.

5) Outstanding identified anomalies.

The identified anomalies are to be considered by the Responsible Members. Reports from published detailed investigations on these issues will be summarised in the following quarterly report. Typical problems/faults (apart from routine maintenance) are presented in table 3 (information provided by the appointed Technical Co-ordinator of the E-AMDAR Programme).

6) Solutions and actions taken from the previous period.

Any outstanding issue from previous reports are listed in paragraph 3.

7) Summary

1. Timeliness and data quality: Timeliness is comparable to ASDAR data or better. The number of anomalies is very low with respect to the total number of reports (95.5% within 45 min).
2. The number of aircraft reporting (EU-)AMDAR was 172.
3. Since reports are generated automatically, in general data is error free at the reception site.
4. Significant temperature, wind speed or wind direction anomalies were not found, except for the issues stated under par. 4.e. Anomalies of $\pm 0.3^{\circ}\text{C}$, $+0.2\text{ m/s}$, 7° (for LVR/LVW) and 13° (for ASC/DES) are typical (see Annex II).

8) Special case studies

a) Frequency distribution of the mean O-B differences

In Annex II of this report three figures are presented to indicate the frequency distribution of the mean O-B differences for temperature, wind speed and wind direction for the set of observing aircraft ($N=172$). In these figures distinction is made between observations in flight level (LVR/LVW) and observations during ascent or descent (ASC/DES). Note that only the absolute values of wind direction are analysed. Obviously differences (averaged over this quarter) vary with approx. 1°C , 0.7 m/s and 10° (for LVR/LVW) to 17° (for ASC/DES)

b) Temperature observations

In Annex III of this report the result of a case study on temperature observations is presented. For the period 15-17 November 2000, data from four aircraft producing the largest number of observations, the temperature data are analysed. In the figures both the measured temperature and the O-B temperature differences are presented in scatter plots as a function of altitude and with respect to each aircraft and with respect to each of the phases of flight (ASC, DEC, LVR). The plots with the O-B temperature difference demonstrate clearly that there is no significant difference between the observations of the aircraft or between the phases of flight.

c) Timeliness: An analyses for FM42 encoded EU-AMDAR

In Annex IV of this report the results of a case study on timeliness are presented. For the period 15-17 November 2000 the delays are analysed between observation time (presented in each record) and the storage time (the moment of storage of the observation in the real-time observation database at the QEvC site, less than a second after passing the MSS). Since the frequency of observations presented in BUFR encoded AMDAR differs significantly from FM42 AMDAR encoded observations we have made a restriction to the FM42 AMDAR encoded reports. The figures in this Annex demonstrate clearly that most of the reports are received within 15 minutes (50% within 7,1 minute). Especially ASC and DES data are received within a very short interval, *Flight Level* data (LVR and LVR) lasts much more time.

d) Time and altitude distribution of ASC and DES data.

In Annex V of this report the results of a case study on the observing time and altitude distribution are presented. For the period 15-17 November 2000 all FM42 encoded observations during ascend and descend around Paris (within $47^{\circ}\text{-}50^{\circ}\text{ N}$ and $1^{\circ}\text{-}4^{\circ}\text{ E}$) are investigated and the altitude of the observation are presented as a function of time of observation. Clearly all data are observed between 7:30 and 21:00 UTC. Moreover the distribution of the altitude levels of descending data differs significantly from ascending data.

Table 1, List of operational AMDAR units

(A: activated, D: deactivated, A D: both activated and deactivated during this quarter)

Identifier	Identifier	Identifier	Identifier	Identifier
EU0002	EU0204	EU0921	EU2751 A	EU5441 A
EU0003	EU0209	EU0934	EU2773 A	EU5478 A
EU0005 D	EU0234	EU0947	EU2845	EU5529 A
EU0008	EU0249	EU0961	EU2984 A	EU5591
EU0021	EU0254	EU0985	EU3000	EU5612 A
EU0022	EU0263	EU1001	EU3257	EU5777 A
EU0032	EU0299	EU1002	EU3268 A	EU5802 A
EU0034	EU0301	EU1222	EU3321 A	EU5821 A
EU0041	EU0303	EU1234	EU3421	EU6264 A
EU0043	EU0307	EU1275 A	EU3544 AD	EU6281 A
EU0045	EU0311	EU1301 A	EU3654 A	EU6349 A
EU0047	EU0313	EU1312 A	EU3684 A	EU6444 A
EU0049	EU0316	EU1456	EU3725 A	EU6524
EU0050	EU0319	EU1495	EU3781 A	EU6527 A
EU0051	EU0324	EU1532	EU3803 A	EU6723
EU0052	EU0332	EU1541 A	EU3874 A	EU6821
EU0054	EU0359	EU1547	EU3908 A	EU6890 A
EU0055	EU0367	EU1567	EU4002 A	EU7218 A
EU0059	EU0372	EU1593	EU4333	EU7629 A
EU0060 A	EU0432	EU1688	EU4426	EU7643 A
EU0061	EU0456	EU1692	EU4444	EU7654 A
EU0072	EU0458	EU1698	EU4519	EU7724 A
EU0081	EU0475	EU1795 A	EU4529	EU7866
EU0082	EU0476	EU1863	EU4573 A	EU7888 A
EU0088	EU0482	EU1929	EU4582 A	EU8520 A
EU0106	EU0498	EU2043	EU4587	EU8969 A
EU0109	EU0568	EU2189	EU4607 A	EU9145 A
EU0123	EU0592	EU2301	EU4699 A	EU9158 A
EU0124	EU0689	EU2389	EU4721 A	EU9234 A
EU0154	EU0711	EU2547	EU4792 A	EU9245 A
EU0158	EU0802	EU2559	EU4853 A	EU9544 A
EU0167	EU0807	EU2590	EU4865 A	EU9622 AD
EU0175..D	EU0826	EU2618	EU4950 A	
EU0185	EU0875	EU2630 A	EU5218	

Table 2, *Quantity and Timeliness of AMDAR Reports*

Summary	
Number of days in this period	92
Number of aircraft reporting AMDAR	172
Number of E-AMDAR activated aircraft	170
Total number of observations evaluated during the period	1798923
Average daily number of aircraft reporting AMDAR	113 (67% of activated aircraft)
Percentage of data available within 60 minutes is	96.7%
Percentage of data available within 120 minutes is	99.1%
Average reports per day, per reporting aircraft is	172

Legend	
AIRCRAFT	Aircraft identifier
Total No of Reports	Number of reports received by E-AMDAR Quality Centre, exclusive of erroneous data.
Days of Reports	Number of days reports were received from aircraft by QEvC
Actual/possible	Ratio of Number of days aircraft reported/ maximum possible days in %
Average reports/day	Average number of reports per day of report from each aircraft
0 – 45	percentage of total reports received within 45 minutes of observation time
0 – 60	percentage of total reports received within 60 minutes of observation time
0 – 120	percentage of total reports received within 120 minutes of observation time

AIRCRAFT	Total No of Reports	Days of Reports	Actual/possible	Average reports/day	0–45 min	0–60 min	0–120 min
EU0002	10614	75	82%	142	98.1%	98.1%	99.0%
EU0003	9476	73	79%	130	83.1%	87.6%	96.3%
EU0005	22	1	1%	22	100.0%	100.0%	100.0%
EU0008	9650	83	90%	116	82.1%	87.2%	96.1%
EU0021	12003	85	92%	141	98.4%	98.6%	99.3%
EU0022	16270	87	95%	187	98.4%	98.6%	99.4%
EU0032	3880	80	87%	49	99.2%	99.2%	100.0%
EU0034	1687	36	39%	47	100.0%	100.0%	100.0%
EU0041	25632	80	87%	320	99.0%	99.2%	99.9%
EU0043	25923	81	88%	320	97.7%	98.0%	99.7%
EU0045	8840	69	75%	128	78.0%	84.4%	95.5%
EU0047	27995	87	95%	322	98.9%	99.2%	99.7%
EU0049	7512	58	63%	130	99.1%	99.3%	99.7%
EU0050	29455	88	96%	335	98.4%	98.5%	99.3%
EU0051	9460	84	91%	113	98.9%	99.1%	99.7%
EU0052	23500	84	91%	280	98.1%	98.2%	99.7%

AIRCRAFT	Total No of Reports	Days of Reports	Actual/ possible	Average reports/ day	0–45 min	0–60 min	0–120 min
EU0054	8499	77	84%	110	98.7%	98.7%	99.3%
EU0055	8874	61	66%	145	99.6%	99.6%	99.6%
EU0059	29443	84	91%	351	98.5%	98.7%	99.3%
EU0060	1954	18	20%	109	100.0%	100.0%	100.0%
EU0061	27941	84	91%	333	97.8%	98.2%	99.3%
EU0072	9510	81	88%	117	98.5%	98.8%	99.8%
EU0081	15903	89	97%	179	98.2%	98.6%	99.5%
EU0082	11385	82	89%	139	98.6%	98.8%	99.3%
EU0088	16244	87	95%	187	98.5%	98.8%	99.5%
EU0106	30863	87	95%	355	99.0%	99.3%	99.8%
EU0109	15652	88	96%	178	99.2%	99.3%	99.7%
EU0123	9079	83	90%	109	82.2%	87.6%	96.0%
EU0124	11663	82	89%	142	98.4%	98.6%	99.3%
EU0154	28711	84	91%	342	98.4%	98.8%	99.2%
EU0158	27948	83	90%	337	98.4%	98.5%	99.1%
EU0167	24636	87	95%	283	98.9%	99.0%	99.8%
EU0175	5294	31	34%	171	99.3%	99.6%	100.0%
EU0185	28920	84	91%	344	98.6%	98.9%	99.6%
EU0204	12156	73	79%	167	97.9%	98.4%	99.3%
EU0209	1815	48	52%	38	100.0%	100.0%	100.0%
EU0234	11796	84	91%	140	99.1%	99.5%	99.7%
EU0249	12033	76	83%	158	98.6%	99.0%	99.2%
EU0254	10309	88	96%	117	99.0%	99.2%	99.6%
EU0263	9588	83	90%	116	98.9%	99.3%	99.6%
EU0299	12535	83	90%	151	98.6%	98.8%	99.5%
EU0301	15223	77	84%	198	98.9%	99.3%	99.9%
EU0303	29903	86	93%	348	98.5%	99.0%	99.6%
EU0307	19879	82	89%	242	98.6%	98.8%	99.6%
EU0311	22278	83	90%	268	98.5%	98.8%	99.3%
EU0313	19811	82	89%	242	97.6%	98.3%	99.3%
EU0316	20355	75	82%	271	97.5%	97.9%	99.6%
EU0319	19734	72	78%	274	98.8%	99.0%	99.7%
EU0324	8908	84	91%	106	98.5%	98.7%	99.1%
EU0332	9027	78	85%	116	98.3%	99.0%	99.8%
EU0359	23369	75	82%	312	97.8%	98.4%	99.5%
EU0367	10279	76	83%	135	99.2%	99.2%	100.0%
EU0372	10275	86	93%	119	98.3%	98.4%	99.4%
EU0432	8667	61	66%	142	98.0%	98.0%	99.1%
EU0456	27671	69	75%	401	99.3%	99.4%	99.8%
EU0457	2635	50	54%	53	97.6%	97.6%	98.7%
EU0458	28336	79	86%	359	98.4%	98.8%	99.6%
EU0475	9290	80	87%	116	98.6%	98.6%	99.6%
EU0476	24764	67	73%	370	98.0%	98.3%	99.7%
EU0482	9693	81	88%	120	99.0%	99.1%	99.7%
EU0498	3253	74	80%	44	100.0%	100.0%	100.0%
EU0568	11376	79	86%	144	98.2%	98.7%	99.2%

AIRCRAFT	Total No of Reports	Days of Reports	Actual/ possible	Average reports/ day	0–45 min	0–60 min	0–120 min
EU0592	14515	86	93%	169	98.4%	98.6%	99.5%
EU0689	3483	77	84%	45	99.8%	99.8%	99.8%
EU0711	34182	86	93%	397	98.3%	98.3%	99.5%
EU0802	19313	76	83%	254	98.7%	98.8%	99.3%
EU0807	10822	87	95%	124	98.3%	98.3%	98.9%
EU0826	12588	84	91%	150	98.9%	98.9%	99.5%
EU0875	16367	57	62%	287	97.9%	98.3%	99.5%
EU0921	19731	70	76%	282	97.8%	98.5%	99.4%
EU0934	7770	67	73%	116	82.4%	86.4%	95.8%
EU0947	9107	67	73%	136	84.0%	90.7%	98.1%
EU0961	9587	73	79%	131	86.6%	90.4%	97.4%
EU0985	3494	32	35%	109	76.5%	83.5%	93.6%
EU1001	8158	58	63%	141	98.6%	98.6%	99.2%
EU1002	5408	45	49%	120	87.8%	91.7%	98.4%
EU1222	8229	76	83%	108	85.2%	89.7%	97.0%
EU1234	28766	87	95%	331	98.8%	99.1%	99.5%
EU1275	2775	51	55%	54	99.6%	99.9%	100.0%
EU1301	1948	46	50%	42	98.0%	98.4%	98.4%
EU1312	3702	55	60%	67	97.4%	97.9%	98.7%
EU1456	1246	11	12%	113	97.9%	97.9%	100.0%
EU1495	6721	72	78%	93	83.1%	86.8%	94.3%
EU1532	13027	83	90%	157	98.9%	98.9%	99.7%
EU1541	4436	51	55%	87	97.8%	98.0%	99.7%
EU1547	17899	58	63%	309	98.7%	99.3%	99.6%
EU1567	12408	85	92%	146	98.1%	98.5%	99.1%
EU1593	9366	72	78%	130	79.8%	85.8%	95.0%
EU1688	952	6	7%	159	100.0%	100.0%	100.0%
EU1692	10652	86	93%	124	98.1%	98.4%	99.3%
EU1698	12619	85	92%	148	98.8%	99.2%	99.8%
EU1795	4341	50	54%	87	99.1%	99.3%	99.5%
EU1863	27545	86	93%	320	98.3%	98.4%	99.5%
EU1929	3420	77	84%	44	99.2%	99.2%	100.0%
EU2043	2417	77	84%	31	99.1%	99.5%	99.8%
EU2189	29398	86	93%	342	97.8%	98.4%	99.5%
EU2301	41674	83	90%	502	93.3%	93.9%	96.6%
EU2389	16260	86	93%	189	98.8%	99.1%	99.7%
EU2547	10868	80	87%	136	81.4%	86.8%	96.4%
EU2559	23404	77	84%	304	98.4%	98.8%	99.8%
EU2590	5321	47	51%	113	87.3%	90.9%	98.9%
EU2618	4659	45	49%	104	85.7%	90.8%	98.2%
EU2630	1404	24	26%	59	85.7%	92.1%	96.6%
EU2751	3487	42	46%	83	98.4%	98.7%	99.2%
EU2845	11130	88	96%	126	98.4%	98.8%	99.1%
EU2984	649	12	13%	54	98.8%	99.4%	100.0%
EU3000	27397	85	92%	322	97.5%	97.9%	99.4%
EU3181	4210	48	52%	88	97.7%	97.7%	98.6%

AIRCRAFT	Total No of Reports	Days of Reports	Actual/ possible	Average reports/ day	0–45 min	0–60 min	0–120 min
EU3257	21189	79	86%	268	98.3%	98.9%	99.8%
EU3268	360	9	10%	40	90.2%	90.2%	90.2%
EU3321	1001	17	18%	59	100.0%	100.0%	100.0%
EU3421	27272	84	91%	325	98.3%	98.7%	99.7%
EU3544	29	1	1%	29	100.0%	100.0%	100.0%
EU3654	4508	44	48%	102	92.7%	95.7%	99.3%
EU3684	1150	21	23%	55	99.9%	100.0%	100.0%
EU3725	4676	52	57%	90	98.6%	98.6%	99.6%
EU3781	2861	54	59%	53	99.0%	99.0%	99.5%
EU3803	1495	42	46%	36	99.7%	99.7%	100.0%
EU3874	4617	56	61%	82	99.4%	99.4%	99.8%
EU3908	6263	54	59%	116	81.1%	87.0%	97.5%
EU4002	1293	20	22%	65	94.7%	94.7%	94.7%
EU4333	15129	57	62%	265	67.1%	78.2%	95.9%
EU4426	15357	85	92%	181	98.7%	98.8%	99.6%
EU4444	4923	48	52%	103	86.1%	92.0%	99.4%
EU4519	6568	56	61%	117	76.8%	84.7%	98.5%
EU4529	8523	69	75%	124	98.4%	98.4%	99.1%
EU4573	9483	55	60%	172	76.2%	82.7%	96.4%
EU4582	443	7	7%	63	100.0%	100.0%	100.0%
EU4587	10219	86	93%	119	99.3%	99.5%	99.9%
EU4589	38	2	2%	19	100.0%	100.0%	100.0%
EU4607	6097	54	59%	113	82.0%	89.1%	98.3%
EU4699	5537	55	60%	101	79.0%	85.4%	97.4%
EU4721	1304	23	25%	57	92.9%	95.5%	95.8%
EU4792	1314	20	22%	66	96.1%	98.9%	99.4%
EU4853	5962	53	58%	112	81.8%	89.9%	97.0%
EU4865	6033	59	64%	102	80.0%	88.3%	99.1%
EU4950	1285	22	24%	58	99.8%	99.8%	99.8%
EU4956	277	6	7%	46	100.0%	100.0%	100.0%
EU5191	2468	62	67%	40	100.0%	100.0%	100.0%
EU5218	11101	76	83%	146	98.4%	98.6%	99.2%
EU5441	2222	28	30%	79	87.5%	92.8%	98.2%
EU5478	5967	47	51%	127	85.0%	91.4%	98.8%
EU5529	6855	57	62%	120	80.7%	84.5%	96.2%
EU5591	15513	85	92%	183	98.1%	98.4%	99.1%
EU5612	6835	62	67%	110	80.5%	88.9%	99.6%
EU5777	6955	61	66%	114	81.0%	87.2%	98.8%
EU5802	4849	47	51%	103	85.6%	89.4%	98.5%
EU5821	6103	55	60%	111	76.3%	81.2%	97.9%
EU6264	5743	52	57%	110	76.7%	84.4%	98.0%
EU6281	4766	46	50%	104	86.4%	90.3%	98.2%
EU6349	1462	22	24%	66	85.3%	91.2%	97.5%
EU6444	1141	19	21%	60	100.0%	100.0%	100.0%
EU6524	1960	50	54%	39	96.8%	97.7%	98.5%
EU6527	1856	24	26%	77	88.9%	90.5%	99.9%

AIRCRAFT	Total No of Reports	Days of Reports	Actual/ possible	Average reports/ day	0–45 min	0–60 min	0–120 min
EU6723	14005	80	87%	175	98.9%	99.1%	99.7%
EU6821	2982	61	66%	49	99.8%	99.8%	100.0%
EU6890	1706	23	25%	74	99.3%	99.3%	99.9%
EU7218	2096	27	29%	78	92.4%	96.2%	97.0%
EU7629	1446	26	28%	56	96.7%	97.7%	98.3%
EU7643	2499	30	33%	83	93.5%	94.9%	100.0%
EU7654	2082	27	29%	77	99.1%	99.2%	99.3%
EU7724	1958	31	34%	63	95.0%	95.7%	100.0%
EU7866	8324	67	73%	124	98.4%	98.6%	99.2%
EU7888	5357	52	57%	103	78.7%	85.6%	96.4%
EU8520	1463	19	21%	77	98.6%	99.6%	100.0%
EU8969	2184	32	35%	68	96.7%	99.7%	100.0%
EU9145	2235	31	34%	72	97.8%	98.3%	98.5%
EU9158	6138	47	51%	131	89.9%	94.3%	98.8%
EU9234	5043	44	48%	115	76.7%	83.3%	97.9%
EU9245	5860	56	61%	105	75.7%	86.1%	98.0%
EU9544	5968	55	60%	109	84.2%	89.8%	99.1%
EU9622	324	3	3%	108	0.0%	4.2%	86.2%

- *Timeliness: From 51 aircraft more than one percent of the received data had a delay after observation for more than two hours:*

Identifier	Identifier	Identifier	Identifier
EU0002	EU1301	EU4333	EU6264
EU0003	EU1312	EU4519	EU6281
EU0008	EU1495	EU4573	EU6349
EU0045	EU1593	EU4607	EU6524
EU0123	EU2301	EU4699	EU7218
EU0457	EU2547	EU4721	EU7629
EU0807	EU2590	EU4853	EU7888
EU0934	EU2618	EU5441	EU9145
EU0947	EU2630	EU5478	EU9158
EU0961	EU3181	EU5529	EU9234
EU0985	EU3268	EU5777	EU9245
EU1002	EU3908	EU5802	EU9622
EU1222	EU4002	EU5821	

- *No data was received from the following aircraft:*

Identifier
EU2773

Table 3, *Description and number of errors*

Aircrafts with temperature anomalies:	
• EU3421:	Warm temperature bias (1 °C) since June 26 th (Operator informed).
• EU0875:	Warm temperature bias (1 °C) since September 1 st . Bias still present after aircraft maintenance (September, 12 th to November 7 th).
• EU0041:	Warm temperature bias (1 °C) since September 20 th . Bias still present after aircraft maintenance (October, 29 th to November 8 th)
• EU0324:	Warm temperature bias (1 °C) since October 1 st .
• EU0249:	Warm temperature bias (>3 °C) since October 17 th . Fault rectified on October 23 rd by maintenance of the temperature sensor (fault cleared)
• EU6441:	Warm temperature bias (2 °C) since November, 26 th (Bias still present after aircraft maintenance (November 30 th to December 5 th).
• EU1795:	Warm temperature bias (1,5 °C) since December
• EU3181:	Warm temperature bias (1 to 2 °C) since December
• EU0316:	Warm temperature bias (1 °C) since December
No reports received although expected:	
• EU0002:	no reports December, 15 th – 25 th (maintenance).
• EU0005:	no reports since October, 1 st (Aircraft no longer operating - sold by operator); reports received on October, 20 th - delivery flight.
• EU0008:	no reports October, 1 st - 4 th (damage to aircraft whilst in the United States)
• EU0032:	no reports October 1 st - 4 th (major maintenance).
• EU0034:	no reports November, 11 th – 30 th ; no reports December, 1 st - 20 th and 24 th - 31 st (major maintenance).
• EU0041:	no reports November, 1 st - 7 th (major maintenance)
• EU0045:	no reports December, 12 th – 26 th (major maintenance).
• EU0049:	no reports December, 2 nd – 31 st (major maintenance).
• EU0051:	no reports October, 2 nd – 5 th (ACARS failure – fixed on October, 4 th)
• EU0055:	no reports November, 24 th – 30 th , December, 1 st - 21 st (major maintenance).
• EU0060:	no reports November, 6 th – 30 th ; no reports December, 23 rd - 31 st (maintenance).
• EU0072:	no reports December, 23 rd – 28 th (maintenance).
• EU0175:	no reports since November, 1 st (Aircraft no longer operating – sold by operator on 31st October 2000)
• EU0204:	no reports October, 1 st - 6 th (DMU failure – fixed on October, 5 th)
• EU0209:	no reports November, 3 rd – 30 th ; no reports December, 18 th - 26 th (maintenance).
• EU0316:	no reports October 2 nd - 9 th (major maintenance)
• EU0319:	no reports December, 5 th – 12 th (maintenance)
• EU0367:	no reports November, 19 th – 26 th (major maintenance)
• EU0432:	no reports October, 1 st – 25 th (major maintenance)
• EU0456:	no reports December, 7 th – 14 th (maintenance).
• EU0482:	no reports November, 7 th – 12 th (on board clock in error).
• EU0498:	no reports October 4 th – 12 th (major maintenance)
• EU0568:	no reports October 2 nd - 7 th (major maintenance).
• EU0802:	no reports November, 20 th - 25 th (major maintenance)
• EU0875:	no reports October 12 th – 8 th (major maintenance).
• EU0456:	no reports December, 7 th - 14 th (maintenance).

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- EU0934: no reports October, 1st – 9th (reactivated by operator); no reports November, 1st - 5th (major maintenance).
 - EU0947: no reports November, 1st - 5th and November, 24th - 29th (reactivated by operator).
 - EU0985: no reports November, 1st - December, 19th (major maintenance).
 - EU1001: no reports December, 1st - 8th and 12th - 31st (major maintenance).
 - EU1002: no reports October, 1st – 26th, November, 10th - 14th, December, 15th - 20th (all maintenance).
 - EU1222: no reports December, 22nd - 26th (maintenance).
 - EU1456: no reports October, 10th – 25th (major maintenance); no reports November, 1st - December, 31st (software problems within DMU).
 - EU1495: no reports November, 3rd - 8th (major maintenance).
 - EU1547: no reports November, 15th – December, 14th (major maintenance).
 - EU1593: no reports December, 24th - 31st (maintenance).
 - EU1688: no reports October, 1st – November, 7th (ACMS software problems - fixed November, 8th) and no reports November, 14th - December, 31st (ACMS software problems and major maintenance).
 - EU2301: aircraft deactivated by operator November, 29th (data link malfunction onboard); no reports December, 1st - 6th (maintenance).
 - EU2547: no reports November, 24th - 29th (major maintenance).
 - EU2590: no reports October, 1st – 17th (Software problems at SAS fixed – aircraft reactivated); no reports November, 1st - 7th, 9th – 19th
 - EU2618: no reports October, 1st – 15th (Software problems at SAS fixed – aircraft reactivated); no reports November, 1st - 9th
 - EU2630: no reports November, 1st – 21st
 - EU2773: no reports November, 2nd – December, 31st
 - EU3268: no reports December, 1st - 9th and 12th - 17th.
 - EU3321: no reports November, 1st – 26th.
 - EU3544: no reports December, 1st – 31st (see activated/deactivated aircraft)
 - EU3654: no reports November, 1st - 6th.
 - EU3684: no reports November, 1st – 21st.
 - EU4002: no reports November, 1st – 24th no reports December, 4th - 9th (maintenance).
 - EU4333: no reports December, 1st – 20th (major maintenance).
 - EU4444: no reports October, 1st – 15th (Software problems at SAS fixed – aircraft reactivated); no reports November, 2nd - 7th, 16th – 20th
 - EU4519: no reports October, 1st – 12th (Software problems at SAS fixed – aircraft reactivated)
 - EU4573: no reports November, 1st - 5th, 16th - 21st.
 - EU4582: no reports December, 1st – 20th (please note reporting as EU4482 December, 21st - 26th).
 - EU4607: no reports November, 1st - 6th
 - EU4699: no reports November, 1st - 6th
 - EU4721: no reports November, 1st – 22nd; no reports December, 23rd - 31st.
 - EU4792: no reports November, 1st – 21st
 - EU4950: no reports November, 1st – 21st
 - EU5441: no reports November, 1st – 22nd
 - EU5218: no reports December, 6th – 11th (maintenance)
 - EU5478: no reports November, 1st - 6th; no reports December, 24th - 31st
 - EU5529: no reports November, 1st - 5th
 - EU5821: no reports November, 1st - 5th
 - EU6349: no reports November, 1st – 27th
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- EU6444: no reports November, 1st – 25th
- EU6524: no reports November, 23rd - 28th
- EU6527: no reports November, 1st – 21st
- EU6723: no reports October, 4th - 9th (major maintenance).
- EU6821: no reports November, 1st - 6th.
- EU6890: no reports November, 1st – 21st
- EU7218: no reports November, 1st - 21st.
- EU7629: no reports November, 1st – 14th.
- EU7643: no reports November, 1st – 21st.
- EU7654: no reports November, 1st – 25th.
- EU7724: no reports November, 1st – 23rd.
- EU8520: no reports November, 1st – 20th.
- EU7866: no reports October, 1st – 21st (major maintenance).
- EU8520: no reports December, 4th – 14th (major maintenance).
- EU8969: no reports November, 1st – 25th.
- EU9145: no reports November, 1st – 19th.
- EU9158: no reports November, 2nd – 10th, 12th - 17th.
- EU9234: no reports December, 14th - 31st.
- EU9245: no reports November, 1st - 6th.
- EU9622: no reports November, 1st – December, 31st (deactivated December, 31st).

Specific problems:

- The following aircraft failed to report due to a software problems: EU1456, EU1688.
- EU0003: ACMS problems fixed October, 1st

Ground stations issues and other problems:

- SAS upgrade to ACMS Processing System October, 2nd
- SAS ACMS Processing System failure late on October, 13th - the morning of October, 16th. This resulted in no data from SAS aircraft on October, 14th and 15th
- SAS ACMS Processing System - software problems October, 28th - 30th Reduction in data over the period.
- SAS upgrade to ACMS Processing System November, 2nd. Some data loss on November, 2nd and 3rd with all data lost 4th. Processing System failure November, 4th, data restored during 5th.
- LH loss of data between LH and DWD Computer Centre November, 25th
- LH to DWD data transmission problems November, 28th 0827-1251 UTC
- SAS – maintenance/upgrade to computer systems on the December, 9th. Servers down during this work being carried out – some uplink commands not sent, this resulted in low daily totals. (Service back to normal on the December, 10th)
- Air France - a "technical migration" at Toulouse resulted in the loss of data during the period December, 18th (10:43 UTC) to 21st (20:00 UTC).

Activated and deactivated aircraft:

- Aircraft activated on October, 13th by the operator as part of E-AMDAR Optimisation Plan: Aircraft are reporting data when flying to/from selected airports, EU2630, EU2984, EU3268, EU3321, EU3654, EU3684, EU3908, EU4002, EU4582 (reporting data "all flights"), EU4607, EU4699, EU4721, EU4792, EU4853, EU4865, EU4950, EU5441, EU5478, EU5529, EU5612, EU5777, EU5802, EU5821, EU6264,

EU6281, EU6349, EU6444, EU6527, EU6890, EU7218, EU7629, EU7643, EU7654, EU7724, EU7888, EU8520, EU8969, EU9145, EU9158, EU9234, EU9345, EU9544

- Aircraft activated on October, 30th by the operator as part of E-AMDAR Optimisation Plan: Aircraft are reporting data when flying in selected regions.
EU1275, EU1301, EU1312, EU3781, EU3803, EU3874.
 - Aircraft activated on November, 2nd by the operator as part of E-AMDAR Optimisation Plan: Aircraft are reporting data when flying in selected regions.
EU0457, EU1541, EU2773 (activated but no reports), EU3181
 - Aircraft activated on November, 6th the by operator as part of E-AMDAR Optimisation Plan: Aircraft are reporting data when flying in selected regions.
EU0060, EU1795, EU2751, EU3725.
 - EU3544: activated by operator on October, 9th (activated for testing - one day only).
 - EU0005: deactivated (01/10/2000), aircraft sold
 - EU0175: deactivated (31/10/2000), aircraft sold
 - EU9622: deactivated (31/12/2000), number now reserved.
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(problems/faults reported here are apart from routine maintenance (less than 5 days).
Information provided by the appointed Technical Co-ordinator of the E-AMDAR Programme;
more details to be inserted in the following Quarterly reports)

Tables 4 to 6, *Evaluation results*

Presented values: Observation minus Reference (Model values), O–B.

All statistics are evaluated separately for two datasets:

- 1) Data from Ascent/Decent ($i_p i_p i_p$ =ASC or DES)
- 2) Cruise level, level flight at cruising height ($i_p i_p i_p$ =LVR or LVW)

Notes:

- Data with $i_p i_p i_p$ =UNS or /// is not evaluated.
- AMDAR aircraft produce much more reports during Ascent/Decent than during Cruise level.
- O–B values larger than the stated criterion are presented in **bold**.
- Temperatures are in °C, wind speed in m/s and wind direction in degrees.
- The total number of reported observations in the table 4 to 6 differs from the total number in table 2. The main reason is that within table two data are presented from observations world wide, whereas in the tables 4 to 6 data are presented which were evaluated with using the HIRLAM model as reference. Since this model is a limited area model, only those data were evaluated which were observed within the HIRLAM area (roughly Europe, Northern Africa and the North Atlantic, see Annex 1 - Figure 3) and within the three hours time-window around main and intermediate hours (eight times a day). Other reasons for this difference are incorrect encoding (e.g. $i_p i_p i_p$), cases with identical reports (only one is used) or in case of incomplete bulletins.
- Notice that a number of aircraft only report during the ascending phase.
- For wind direction (tabel 6) the column "Observed" is not filled to avoid confusion. For the column with the mean differences (*i.e.* Obs-backgrnd, Mean), these values are calculated based on $\langle |\Delta DD| \rangle$ (=AVG(ABS(DD_OBS –DD_MOD))) resulting in non-negative values.

Legends	
Number of Reports	Actual number of reports used for calculation of values
Observed Mean	Average value of the parameter for relevant phase in units of °C (for temperature), m/s (wind speed) or degrees (wind direction)
Observed SD	Standard Deviation of observed parameter
Obs–Backgrnd Mean	Average value of calculated differences (observed parameter minus model output value)
Obs–Backgrnd SD	Standard Deviation of calculated differences (observed parameter minus model output value)

a) Tabel 4, *Temperature (°C)*

2000-IV T	Temperature Cruise level in °C					Temperature Ascent & Descent in °C					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
	EU0002						8947	-13.3	16.7	-0.2	1.1
	EU0003	5408	-50.0	10.4	-0.1	1.5	2974	1.6	14.4	0.0	1.1
	EU0005	22	-53.0	5.3	-0.9	1.7					
	EU0008	5865	-52.2	8.1	-0.1	1.7	2505	-6.9	11.2	0.1	1.2
	EU0021	1881	-48.2	12.3	-0.5	1.3	7922	-5.4	10.8	-0.2	1.2
	EU0022	3435	-51.8	13.2	0.1	1.6	10337	-0.2	11.3	-0.2	1.2
	EU0032	846	-47.0	13.1	0.0	1.5	2270	7.6	8.8	0.2	1.3
	EU0034	390	-48.2	12.4	-0.1	1.6	962	8.9	8.3	-0.2	1.3
	EU0041	1362	-48.0	16.0	1.0	1.3	24270	-6.8	16.8	0.7	2.9
	EU0043	1346	-48.0	14.9	0.8	2.5	24577	-6.7	16.7	0.4	2.9
	EU0045	5065	-50.5	10.8	-0.3	1.5	2746	0.9	13.9	0.0	1.2
	EU0047	1487	-47.3	16.3	0.6	1.2	26508	-6.8	16.4	0.3	3.0
	EU0049						6384	-13.2	16.7	-0.2	1.1
	EU0050	1374	-46.5	16.6	-0.3	2.3	28081	-6.5	15.8	-0.3	2.9
	EU0051	1855	-47.8	14.0	-0.4	1.3	6166	-1.9	11.9	-0.4	1.3
	EU0052	1109	-47.3	16.9	-0.4	1.4	22391	-6.6	15.7	-0.4	2.9
	EU0054	2392	-51.5	10.1	-0.4	1.3	4868	-0.3	11.5	-0.3	1.3
	EU0055	1193	-46.3	16.3	0.1	2.4	7629	-15.7	17.7	0.1	1.1
	EU0059						28250	-6.0	15.8	0.0	2.3
	EU0060	1354	-46.3	9.0	-0.1	1.4	452	9.7	11.4	-0.1	1.2
	EU0061	1127	-45.8	16.6	-0.4	1.3	26814	-6.4	15.9	-0.3	2.8
	EU0072	2602	-51.9	9.4	0.0	1.7	5534	-0.6	11.6	0.0	1.5
	EU0081	3670	-52.4	11.0	0.4	1.6	9698	0.4	11.5	0.2	1.3
	EU0082						9665	-13.9	17.1	0.3	1.1
	EU0088	2658	-49.8	13.0	0.0	1.9	10857	0.0	10.9	0.0	1.3
	EU0106	1259	-46.9	14.8	-0.2	1.2	29604	-7.2	16.6	-0.2	2.3
	EU0109	3522	-52.4	11.4	0.0	2.0	9578	0.1	11.1	-0.1	1.2
	EU0123	5418	-51.7	8.2	-0.1	1.8	2374	-7.5	11.4	0.0	1.2
	EU0124						9908	-13.2	16.8	0.4	1.1
	EU0154	1359	-46.1	16.2	-0.2	1.2	27352	-6.9	15.8	-0.3	2.7
	EU0158	1247	-43.7	17.0	0.9	1.2	26701	-5.0	15.3	0.6	2.8
	EU0167	1144	-45.5	16.8	0.4	2.5	23492	-5.9	15.7	0.4	2.4
	EU0175	1207	-50.2	11.3	0.7	2.5	3149	4.3	11.2	0.5	2.1
	EU0185	1153	-43.0	17.6	0.5	2.3	27767	-5.7	15.2	0.3	2.7
	EU0204	3363	-53.9	9.6	0.6	1.4	6634	0.5	11.7	0.3	1.3
	EU0209	274	-48.1	13.2	-0.1	1.3	1148	7.6	7.6	0.0	1.0
	EU0234						10022	-14.2	17.1	-0.1	1.1
	EU0249	2908	-52.6	11.4	0.9	3.6	7008	2.6	11.9	1.0	3.0

2000-IV T	Temperature Cruise level in °C					Temperature Ascent & Descent in °C					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU0254	5410	-50.6	8.1	0.3	1.7	3765	3.3	13.2	0.1	1.0	
EU0263	5092	-50.7	8.1	0.0	1.7	3500	3.9	12.8	-0.1	1.1	
EU0299						10835	-14.8	17.6	0.0	1.1	
EU0301	596	-47.3	13.9	0.7	1.2	14627	-6.6	16.8	0.5	2.7	
EU0303	1557	-47.8	15.5	-0.3	1.4	28346	-7.0	16.2	-0.4	2.8	
EU0307	1122	-49.0	15.4	-0.4	1.2	18757	-6.7	15.9	-0.3	2.4	
EU0311	1113	-43.5	16.7	0.4	1.2	21165	-5.2	15.1	0.3	2.3	
EU0313	790	-42.6	16.5	0.7	2.8	19021	-5.6	15.3	0.4	2.2	
EU0316	1094	-47.8	16.5	1.3	1.5	19261	-6.9	16.4	0.8	2.3	
EU0319	989	-47.7	15.5	0.3	1.3	18745	-6.4	16.2	0.3	3.5	
EU0324	4485	-54.1	6.7	1.5	1.4	3278	0.5	13.0	0.8	1.5	
EU0332	4670	-50.9	8.0	-0.2	1.6	3348	3.6	12.9	-0.1	1.0	
EU0359	1181	-45.4	15.6	0.8	1.3	22188	-5.1	15.4	0.6	3.0	
EU0367						8766	-13.5	16.9	-0.2	1.1	
EU0372	5264	-51.0	8.6	0.3	1.8	3858	3.9	13.3	0.0	1.1	
EU0432						7421	-16.8	17.7	-0.1	1.1	
EU0456	486	-32.2	21.2	0.2	1.3	27185	-6.8	15.5	0.1	1.4	
EU0457	1465	-46.2	9.2	0.2	1.2	915	17.1	11.2			
EU0458	586	-36.3	19.5	0.0	1.2	27750	-7.3	15.9	-0.1	1.4	
EU0475	3581	-54.0	8.1	0.2	1.3	4370	0.7	12.8	0.1	1.5	
EU0476	508	-37.0	19.0	-0.3	1.5	24256	-8.1	16.0	-0.1	1.4	
EU0482	4855	-51.0	8.7	-0.1	1.6	3623	4.6	13.4	-0.1	1.1	
EU0498	644	-47.6	14.5	-0.1	1.1	1976	6.9	8.3	-0.1	1.1	
EU0568						9755	-14.2	17.3	0.3	1.1	
EU0592	3569	-52.7	10.2	1.1	1.4	8485	1.2	11.5	0.5	1.4	
EU0689	674	-47.6	13.8	-0.1	1.5	2139	6.9	8.5	-0.1	1.1	
EU0711	671	-36.9	19.7	-0.2	1.3	33511	-7.9	16.0	-0.3	1.4	
EU0802	860	-43.6	16.1	0.4	2.8	18453	-5.9	15.5	0.2	2.3	
EU0807	3604	-49.8	8.7	0.6	1.4	5556	-1.2	12.8	0.2	1.4	
EU0826						10768	-14.7	17.1	0.0	1.1	
EU0875	649	-43.4	15.8	0.7	1.7	15718	-5.8	15.2	0.7	1.5	
EU0921	847	-46.5	17.0	-0.2	1.3	18884	-5.7	15.5	-0.2	2.9	
EU0934	4803	-53.0	8.6	-0.3	1.5	2124	-2.4	12.8	-0.1	1.1	
EU0947	5273	-51.3	10.2	-0.3	1.5	2835	-0.4	14.4	-0.2	1.2	
EU0961	5503	-50.2	10.7	0.1	1.3	3029	0.5	14.3	0.1	1.2	
EU0985	2116	-51.4	8.8	-0.3	1.7	1001	-3.0	12.4	-0.3	1.0	
EU1001						7069	-14.3	16.9	-0.1	1.0	
EU1002	3457	-53.4	7.1	-0.2	1.5	1456	-4.5	11.0	-0.1	1.1	
EU1222	4868	-51.6	8.6	-0.3	1.6	2215	-6.2	11.6	0.0	1.1	
EU1234	1119	-45.2	16.5	-0.4	1.2	27647	-7.1	16.6	-0.3	2.7	
EU1275	1655	-50.2	9.8	0.2	1.4	832	12.5	15.1	0.1	1.0	

2000-IV T	Temperature Cruise level in °C					Temperature Ascent & Descent in °C					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU1301	823	-44.5	10.1	0.0	0.9	859	12.1	10.6	0.0	0.8	
EU1312	2266	-47.7	8.9	0.2	1.3	1072	12.8	11.0	0.0	1.0	
EU1456						1078	-10.4	15.1	-0.5	1.1	
EU1495	3864	-51.8	8.2	-0.3	1.6	1882	-7.3	11.8	0.0	1.2	
EU1532						10437	-12.2	18.5	-0.3	1.1	
EU1541	2835	-45.6	9.4	0.2	1.4	1196	12.9	10.5			
EU1547	882	-46.7	15.0	0.0	1.3	17017	-6.5	15.7	-0.2	2.8	
EU1567						10485	-13.6	16.7	-0.1	1.1	
EU1593	5817	-52.4	7.3	-0.3	1.5	2573	-3.9	11.9	-0.1	1.1	
EU1688	230	-54.0	8.6	-0.5	1.0	555	-1.6	11.8	-0.2	1.0	
EU1692	3590	-50.6	8.8	0.0	1.2	5327	-2.4	12.7	-0.2	1.4	
EU1698						10828	-14.1	17.1	0.1	1.1	
EU1795	2995	-45.0	8.8	0.4	1.4	975	12.9	10.7			
EU1863	1537	-48.6	16.8	-0.4	1.3	26008	-6.5	15.4	-0.3	2.6	
EU1929	2894	-47.4	8.8	-0.2	1.2	389	9.7	9.1			
EU2043	2071	-48.1	9.0	0.0	1.3	247	9.6	9.3	0.0	0.0	
EU2189	1310	-44.1	16.9	0.7	2.4	28088	-5.6	15.3	0.4	2.4	
EU2301	1335	-47.9	15.8	0.7	2.3	40339	-10.2	16.2	0.3	2.3	
EU2389	2334	-47.1	13.7	-0.4	1.1	10882	-1.3	11.2	-0.3	1.2	
EU2547	6333	-50.6	10.6	-0.1	1.5	3269	0.2	14.2	0.0	1.2	
EU2559	1170	-46.5	17.7	1.0	2.4	22234	-6.1	16.2	0.5	2.1	
EU2590	539	-49.6	9.5	0.3	1.3	4740	-10.8	16.3	0.1	1.2	
EU2618	353	-51.9	6.9	0.3	1.4	4263	-11.6	16.0	-0.1	1.2	
EU2630	317	-54.5	9.2	0.6	1.5	1083	-13.9	17.8	-0.1	1.4	
EU2751	2551	-46.2	8.7	-0.2	1.4	712	11.8	10.2			
EU2845	3397	-50.3	9.3	-0.1	1.2	5858	-2.2	12.8	-0.2	1.3	
EU2984	177	-54.3	10.9	0.4	1.3	472	-14.6	18.7	-0.2	1.5	
EU3000	1300	-47.5	16.2	-0.3	1.3	26097	-6.7	16.0	-0.4	2.3	
EU3181	2694	-45.1	9.5	0.3	1.6	1094	12.9	9.6			
EU3257	1075	-47.5	16.5	-0.3	1.1	20114	-6.9	15.6	-0.3	2.7	
EU3268	62	-58.5	2.9	0.1	1.2	298	-19.6	17.9	-0.4	1.1	
EU3321	227	-56.1	8.3	0.3	1.6	774	-11.8	17.3	-0.3	1.8	
EU3421	1426	-48.8	15.3	1.3	1.3	25846	-6.3	16.2	0.9	3.0	
EU3544	2	13.1	0.0	67.6	1.8	27	13.1	0.0	18.8	0.0	
EU3654	501	-47.5	10.7	0.3	1.2	3939	-11.9	15.5	-0.3	1.5	
EU3684	212	-55.1	10.6	0.9	1.6	938	-11.6	17.9	0.0	1.3	
EU3725	2866	-47.1	9.5	-0.2	1.3	1323	13.0	10.3	0.0	0.3	
EU3781	1508	-48.8	9.6	0.1	1.5	1011	13.6	10.3			
EU3803	832	-46.2	9.0	0.0	1.2	498	11.1	11.0	0.0	0.4	
EU3874	3340	-46.1	9.1	0.0	1.4	933	12.6	10.2	0.0	0.6	
EU3908	442	-53.2	7.5	0.8	1.6	5756	-12.6	16.5	-0.1	1.3	

2000-IV T	Temperature Cruise level in °C					Temperature Ascent & Descent in °C					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU4002	291	-52.2	9.0	0.7	1.5	1000	-14.0	17.9	-0.1	1.4	
EU4333	1038	-40.7	9.8	0.3	1.2	13511	-7.5	14.4	0.0	1.2	
EU4426	2201	-46.4	13.1	-0.4	1.2	9655	-3.0	10.8	-0.3	1.1	
EU4444	377	-52.9	8.0	0.2	1.2	4491	-11.2	15.9	0.1	1.4	
EU4519	506	-50.2	9.6	0.5	1.2	5939	-10.8	15.8	-0.1	1.4	
EU4529	2841	-51.1	9.1	-0.3	1.2	4396	-1.4	12.6	-0.2	1.4	
EU4573	811	-46.9	12.3	0.3	1.3	8457	-9.9	16.1	-0.1	1.2	
EU4582	18	-53.7	2.3	1.0	0.9	425	-16.8	15.1	0.3	1.2	
EU4587	2655	-49.3	9.9	-0.1	1.2	5842	-2.0	12.3	-0.1	1.3	
EU4589	1	4.7	0.0	-0.4	0.0	30	13.6	8.3	0.7	0.8	
EU4607	616	-53.7	7.9	0.4	1.2	5400	-14.2	16.3	0.1	1.5	
EU4699	619	-53.6	9.1	-0.1	1.3	4841	-14.0	16.4	-0.2	1.4	
EU4721	225	-56.7	8.0	0.3	1.4	1079	-12.0	17.8	-0.2	1.2	
EU4792	251	-54.7	11.1	0.2	1.4	1062	-12.2	17.6	-0.4	1.3	
EU4853	551	-49.8	10.8	-0.1	1.2	5351	-12.1	15.9	-0.3	1.4	
EU4865	532	-52.0	8.4	0.2	1.2	5406	-13.3	16.4	-0.1	1.5	
EU4950	195	-54.8	9.4	1.2	1.5	1090	-12.8	17.3	0.3	1.2	
EU4956	77	-44.9	9.3	0.1	0.8	151	11.9	9.2	0.1	1.1	
EU5191	601	-44.9	11.0	0.1	1.4	1366	8.2	8.9	0.4	1.3	
EU5218	1485	-45.6	13.0	0.1	1.2	7529	-0.9	11.1	-0.1	1.2	
EU5441	537	-52.3	9.4	1.2	1.5	1671	-10.3	17.2	-0.1	1.4	
EU5478	464	-53.1	8.0	0.2	1.5	5433	-11.4	16.3	-0.3	1.3	
EU5529	571	-54.1	6.1	0.7	1.5	6215	-12.9	16.1	-0.1	1.3	
EU5591	2342	-47.5	13.0	-0.3	1.2	9712	-3.2	10.7	-0.2	1.1	
EU5612	560	-54.9	7.8	-0.3	1.2	6043	-13.6	16.0	-0.4	1.4	
EU5777	709	-51.6	9.1	0.7	1.2	6128	-13.9	16.4	-0.2	1.5	
EU5802	496	-52.2	8.8	-0.2	1.1	4291	-14.0	16.4	-0.3	1.5	
EU5821	529	-53.9	9.4	0.5	1.1	5479	-13.3	16.1	-0.2	1.5	
EU6264	480	-51.2	9.5	-0.3	1.2	5177	-12.1	16.1	-0.3	1.4	
EU6281	378	-51.2	8.6	0.9	1.4	4328	-12.6	15.7	-0.3	1.4	
EU6349	262	-52.8	9.6	1.2	1.4	1200	-11.3	16.6	0.3	1.3	
EU6444	241	-52.5	7.9	4.3	1.8	900	-10.4	17.7	1.6	1.5	
EU6524	488	-48.2	8.9	0.3	1.3	1126	-5.1	12.2	0.5	1.3	
EU6527	338	-57.8	7.9	0.7	1.5	1510	-13.1	17.6	-0.2	1.4	
EU6723	3182	-49.3	10.7	0.2	1.3	8316	-0.9	11.5	-0.1	1.2	
EU6821	810	-43.0	11.4	0.1	1.4	1598	9.5	9.0	0.2	1.2	
EU6890	348	-57.2	9.1	0.2	1.5	1358	-13.1	18.0	-0.2	1.4	
EU7218	473	-57.1	8.3	0.2	1.5	1616	-10.5	17.9	-0.3	1.4	
EU7629	272	-57.7	7.8	1.5	1.5	1167	-12.7	17.1	0.2	1.3	
EU7643	502	-54.6	10.5	-0.4	1.4	1997	-12.3	17.9	-0.7	1.4	
EU7654	622	-55.8	9.8	0.1	1.4	1460	-12.9	18.2	-0.4	1.4	

2000-IV T	Temperature Cruise level in °C					Temperature Ascent & Descent in °C					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU7724	404	-54.2	9.9	0.5	1.6	1543	-11.2	16.9	-0.2	1.3	
EU7866	2609	-51.0	8.5	0.0	1.2	4379	-3.2	12.8	-0.1	1.3	
EU7888	404	-51.0	10.3	0.9	1.5	4866	-11.0	15.9	0.0	1.3	
EU8520	298	-54.3	7.8	1.5	1.4	1160	-14.4	17.6	0.0	1.3	
EU8969	411	-56.0	8.3	0.6	1.4	1770	-12.0	18.0	-0.4	1.3	
EU9145	475	-55.9	10.7	1.3	1.6	1756	-13.7	17.9	-0.2	1.4	
EU9158	564	-53.3	8.3	0.5	1.4	5536	-12.7	16.4	-0.1	1.3	
EU9234	429	-53.0	8.8	0.0	1.1	4507	-12.1	15.7	-0.2	1.4	
EU9245	595	-52.8	8.8	0.0	1.2	5146	-13.5	16.5	-0.2	1.4	
EU9544	608	-52.9	9.0	-0.3	1.2	5288	-13.7	16.7	-0.3	1.4	
EU9622	19	-54.9	3.2	-1.0	1.7	293	-13.7	14.2	-0.5	1.3	

b) Tabel 5, *Wind Speed (m/s)*

2000-IV FF	Wind Speed Cruise level in m/s					Wind Speed Ascent & Descent in m/s					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU0002						8947	15.9	10.3	-0.2	2.7	
EU0003	5408	23.9	15.4	0.1	2.5	2974	10.0	7.4	-0.1	2.1	
EU0005	22	29.4	14.6	-1.3	2.8						
EU0008	5865	22.7	14.3	0.0	2.5	2505	12.6	7.9	-0.1	2.1	
EU0021	1881	24.7	13.4	0.3	3.2	7922	13.1	7.6	-0.1	2.5	
EU0022	3435	24.2	13.1	0.2	2.7	10337	11.4	6.9	-0.3	2.2	
EU0032	846	24.7	13.8	0.2	2.7	2270	10.4	6.0	0.2	2.4	
EU0034	390	20.6	12.3	0.1	2.1	962	9.8	6.1	0.1	2.2	
EU0041	1362	22.5	12.8	0.2	2.9	24270	13.0	8.8	0.1	2.5	
EU0043	1346	22.8	12.8	0.1	2.7	24577	13.2	8.9	0.2	2.5	
EU0045	5065	24.2	14.9	0.0	2.6	2746	10.2	7.6	-0.1	2.3	
EU0047	1487	23.4	13.3	0.4	3.0	26508	13.6	9.2	0.1	2.7	
EU0049						6384	15.7	10.4	0.0	3.0	
EU0050	1374	24.4	13.6	0.3	3.0	28081	13.5	9.0	0.0	2.8	
EU0051	1855	25.6	13.6	0.1	3.1	6166	11.5	6.9	-0.3	2.3	
EU0052	1109	23.6	12.8	0.3	4.4	22391	13.0	8.9	0.1	3.0	
EU0054	2392	24.7	12.6	0.0	3.0	4868	10.2	7.0	-0.1	2.5	
EU0055						7629	16.0	10.3	-0.1	2.8	
EU0059	1193	23.3	12.7	0.3	3.5	28250	13.8	9.4	0.3	2.9	
EU0060	1354	22.0	15.1	-0.1	2.8	452	9.0	7.2	-0.2	2.7	
EU0061	1127	23.4	13.0	0.4	3.2	26814	13.3	8.9	0.1	2.8	
EU0072	2602	26.4	13.2	0.3	3.1	5534	10.7	7.0	-0.1	2.5	
EU0081	3670	23.2	13.2	0.1	2.9	9698	10.6	7.0	-0.1	2.4	
EU0082						9665	16.2	10.8	-0.4	2.9	
EU0088	2658	23.8	12.4	0.2	2.9	10857	10.9	7.2	-0.2	2.4	
EU0106	1259	21.7	12.6	0.4	3.1	29604	13.2	9.1	0.2	2.9	
EU0109	3522	23.2	12.1	0.1	2.8	9578	11.2	6.9	-0.2	2.3	
EU0123	5418	23.4	15.1	0.0	2.6	2374	12.7	7.5	-0.1	2.1	
EU0124						9908	15.7	10.2	-0.1	2.8	
EU0154	1359	23.1	13.4	0.2	3.1	27352	13.0	8.9	0.0	2.9	
EU0158	1247	22.1	13.1	0.1	4.0	26701	13.4	8.9	0.1	2.7	
EU0167	1144	22.7	13.3	0.4	2.8	23492	13.3	8.8	0.2	2.5	
EU0175	1207	26.1	13.1	0.1	3.1	3149	10.7	7.7	0.1	2.5	
EU0185	1153	22.4	11.9	0.3	2.7	27767	13.5	9.4	0.2	2.6	
EU0204	3363	24.8	12.8	0.1	2.9	6634	10.9	7.2	-0.1	2.3	
EU0209	274	26.5	14.3	0.0	3.6	1148	10.7	6.4	0.0	2.4	
EU0234						10022	16.1	10.5	-0.2	2.7	
EU0249	2908	26.2	13.5	0.3	3.0	7008	11.2	7.3	0.3	2.4	
EU0254	5410	28.9	16.3	0.1	2.9	3765	10.4	7.8	-0.1	2.4	

2000-IV FF	Wind Speed Cruise level in m/s					Wind Speed Ascent & Descent in m/s					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU0263	5092	29.0	16.6	0.1	2.9	3500	10.0	7.9	-0.3	2.6	
EU0299						10835	16.1	10.3	-0.4	2.9	
EU0301	596	24.4	12.0	0.3	3.5	14627	12.3	8.6	0.2	2.5	
EU0303	1557	24.4	13.3	0.5	3.2	28346	12.7	8.5	0.2	2.7	
EU0307	1122	22.4	12.4	0.4	3.2	18757	13.0	8.7	0.0	2.7	
EU0311	1113	24.5	13.4	0.0	3.3	21165	13.2	9.0	0.1	2.6	
EU0313	790	22.2	13.1	0.3	3.8	19021	12.9	8.9	0.0	2.7	
EU0316	1094	23.2	12.8	0.5	3.0	19261	14.1	9.4	0.1	2.8	
EU0319	989	21.9	12.2	0.3	2.8	18745	13.3	9.0	0.0	2.6	
EU0324	4485	24.1	13.1	0.3	2.7	3278	9.9	6.9	0.2	2.3	
EU0332	4670	29.3	16.7	0.0	2.9	3348	10.6	8.0	-0.2	2.5	
EU0359	1181	24.7	13.2	0.1	3.5	22188	13.3	8.9	0.1	2.6	
EU0367						8766	15.7	9.8	0.1	2.6	
EU0372	5264	26.5	15.3	0.1	3.0	3858	10.5	7.5	-0.1	2.5	
EU0432						7421	16.7	10.3	-0.5	2.8	
EU0456	486	22.1	14.2	-0.1	3.1	27185	13.6	8.3	0.2	2.4	
EU0457	1465	21.9	12.4	0.0	1.9	915	5.2	3.1			
EU0458	586	21.4	12.4	-0.3	2.7	27750	14.2	9.0	0.2	2.4	
EU0475	3581	23.3	12.8	0.2	3.0	4370	9.7	7.1	0.3	2.5	
EU0476	508	21.2	11.9	0.1	3.1	24256	14.0	8.4	0.2	2.5	
EU0482	4855	27.9	16.7	0.1	2.8	3623	10.2	7.7	-0.3	2.4	
EU0498	644	22.9	13.1	0.1	2.1	1976	10.0	6.0	-0.1	2.3	
EU0568						9755	16.8	10.8	0.0	2.6	
EU0592	3569	26.4	13.6	0.2	3.0	8485	10.8	6.9	0.0	2.4	
EU0689	674	21.6	14.5	0.3	4.8	2139	9.9	6.1	0.0	2.3	
EU0711	671	23.3	14.0	0.2	3.4	33511	14.8	9.0	0.1	2.7	
EU0802	860	24.0	14.1	0.2	3.8	18453	13.1	8.8	0.2	2.7	
EU0807	3604	26.7	13.9	0.2	3.0	5556	10.7	7.7	0.0	2.5	
EU0826						10768	16.2	10.9	-0.3	2.8	
EU0875	649	24.9	13.3	0.4	3.2	15718	12.2	8.2	0.1	2.5	
EU0921	847	26.4	14.9	0.2	3.3	18884	14.2	9.4	0.1	3.1	
EU0934	4803	24.1	13.9	0.1	2.5	2124	11.3	7.4	-0.1	2.1	
EU0947	5273	23.7	15.8	0.1	2.5	2835	10.0	7.6	-0.1	2.2	
EU0961	5503	22.3	14.1	0.0	2.3	3029	9.5	7.3	-0.2	2.1	
EU0985	2116	25.6	15.7	0.0	2.6	1001	12.8	7.3	0.1	2.2	
EU1001						7069	15.6	10.1	-0.2	2.8	
EU1002	3457	21.0	13.2	0.1	2.5	1456	11.4	7.1	-0.2	2.1	
EU1222	4868	23.8	15.5	0.0	2.8	2215	12.1	7.6	0.0	2.1	
EU1234	1119	23.7	13.4	0.3	3.1	27647	13.8	9.4	0.2	2.9	
EU1275	1655	25.6	12.8	0.1	2.8	832	7.5	6.2	0.0	2.8	
EU1301	823	20.7	13.9	0.0	2.4	859	7.3	4.5	0.0	1.8	

2000-IV FF	Wind Speed Cruise level in m/s					Wind Speed Ascent & Descent in m/s					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU1312	2266	24.8	16.9	0.1	2.2	1072	7.2	4.6	0.0	2.8	
EU1456						1078	15.5	11.3	-0.4	2.4	
EU1495	3864	23.6	15.4	0.1	2.8	1882	12.6	7.6	-0.1	2.2	
EU1532						10437	15.7	11.0	-0.1	2.8	
EU1541	2835	20.7	14.3	0.1	2.4	1196	6.0	3.4			
EU1547	882	23.4	11.7	0.4	2.8	17017	12.9	8.5	0.2	2.6	
EU1567						10485	15.8	10.2	-0.3	2.8	
EU1593	5817	23.8	14.0	0.1	2.6	2573	12.2	7.5	-0.1	2.1	
EU1688	230	26.5	14.4	0.4	2.3	555	11.3	7.4	-0.2	2.3	
EU1692	3590	25.3	13.9	0.3	3.1	5327	11.2	7.5	0.2	2.5	
EU1698						10828	16.1	10.9	-0.2	2.6	
EU1795	2995	21.1	13.7	0.1	2.5	975	6.5	4.9			
EU1863	1537	23.2	13.4	0.3	3.0	26008	12.8	8.8	0.2	2.8	
EU1929	2894	19.3	13.3	0.0	2.2	389	7.2	4.6			
EU2043	2071	19.1	13.0	0.1	2.2	247	7.0	3.8	0.0	0.0	
EU2189	1310	24.4	13.5	0.3	3.2	28088	13.7	9.1	0.2	2.9	
EU2301	1335	23.5	12.0	0.2	2.7	40339	15.7	9.6	2.6	6.2	
EU2389	2334	26.4	13.8	0.3	3.3	10882	11.7	7.3	0.0	2.5	
EU2547	6333	23.6	14.6	0.1	2.4	3269	10.5	7.4	-0.3	2.3	
EU2559	1170	23.7	12.2	0.2	2.7	22234	12.8	8.7	0.1	2.7	
EU2590	539	20.0	10.1	0.0	2.8	4740	12.1	8.1	-0.3	3.0	
EU2618	353	17.5	10.0	0.2	2.7	4263	10.5	7.2	-0.2	2.8	
EU2630	317	21.3	8.5	0.0	2.6	1083	14.1	9.0	-0.1	3.1	
EU2751	2551	20.3	13.8	0.0	2.4	712	6.8	4.2			
EU2845	3397	26.5	13.9	0.2	2.9	5858	11.4	7.9	-0.1	2.7	
EU2984	177	20.0	12.3	0.5	2.9	472	12.0	8.5	0.1	2.8	
EU3000	1300	23.9	13.1	0.2	3.0	26097	12.9	8.5	0.1	2.7	
EU3181	2694	19.5	14.3	0.2	2.5	1094	5.9	3.3			
EU3257	1075	22.8	12.0	0.3	3.0	20114	13.4	8.6	0.1	2.9	
EU3268	62	24.0	6.7	-0.1	2.5	298	12.6	9.0	0.4	2.2	
EU3321	227	24.4	10.7	0.7	2.7	774	11.7	8.3	0.3	2.7	
EU3421	1426	21.8	12.6	0.4	2.8	25846	13.1	8.8	0.1	2.6	
EU3544	2	0.0	0.0	-22.7	5.3	27	0.0	0.0	-6.4	0.1	
EU3654	501	17.9	9.6	-0.5	2.5	3939	10.8	7.0	0.1	2.5	
EU3684	212	23.2	9.5	0.4	2.8	938	14.5	9.7	0.3	3.0	
EU3725	2866	21.4	14.7	0.1	2.4	1323	5.6	3.5	0.0	1.9	
EU3781	1508	23.3	15.1	0.1	2.8	1011	7.1	3.8			
EU3803	832	20.5	12.6	0.1	2.1	498	7.4	4.0	-0.1	2.5	
EU3874	3340	21.4	14.3	0.0	2.2	933	7.2	4.6	0.0	2.6	
EU3908	442	17.2	10.1	0.1	2.6	5756	11.4	7.9	-0.3	3.1	
EU4002	291	19.0	10.9	0.1	2.3	1000	11.0	8.8	-0.4	2.6	

2000-IV FF	Wind Speed Cruise level in m/s					Wind Speed Ascent & Descent in m/s					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU4333	1038	19.6	10.1	0.1	3.0	13511	12.0	7.3	-0.2	2.8	
EU4426	2201	25.5	13.8	0.2	3.0	9655	12.9	7.7	-0.3	2.4	
EU4444	377	19.6	9.9	0.4	2.4	4491	11.5	6.9	0.2	2.5	
EU4519	506	22.3	9.9	0.6	2.6	5939	12.0	6.8	0.1	2.5	
EU4529	2841	26.8	14.4	0.3	3.2	4396	11.4	7.8	0.0	2.6	
EU4573	811	19.7	8.7	0.2	2.5	8457	11.7	7.5	-0.1	2.8	
EU4582	18	18.0	7.0	0.7	1.4	425	9.6	5.8	0.0	2.4	
EU4587	2655	26.1	14.6	0.3	3.1	5842	11.4	7.5	0.0	2.6	
EU4589	1	7.7	0.0	-1.2	0.0	30	5.2	3.0	-1.2	1.5	
EU4607	616	19.8	10.3	-0.1	2.5	5400	11.3	7.6	0.1	2.4	
EU4699	619	18.9	8.6	0.0	2.6	4841	11.0	7.0	0.0	2.3	
EU4721	225	20.8	10.8	0.1	2.6	1079	12.3	8.5	-0.4	2.6	
EU4792	251	19.4	11.5	0.1	2.7	1062	13.7	10.1	0.4	2.7	
EU4853	551	19.0	10.1	-0.3	2.7	5351	11.0	7.2	0.0	2.4	
EU4865	532	20.7	11.3	0.2	2.8	5406	11.5	7.2	0.1	2.4	
EU4950	195	20.2	13.3	0.3	2.8	1090	10.7	8.0	-0.2	2.4	
EU4956	77	10.4	9.3	0.0	2.8	151	6.6	3.2	-0.1	2.2	
EU5191	601	22.2	14.5	0.2	2.9	1366	10.3	6.1	-0.4	2.4	
EU5218	1485	25.6	13.7	0.3	3.2	7529	11.6	7.3	-0.1	2.4	
EU5441	537	19.5	8.5	-0.1	2.6	1671	12.4	7.9	0.1	2.8	
EU5478	464	19.1	11.8	0.3	2.8	5433	12.0	7.8	-0.2	3.0	
EU5529	571	16.7	9.3	0.4	2.5	6215	10.7	7.7	-0.1	2.9	
EU5591	2342	26.1	13.3	0.2	3.1	9712	12.5	7.6	-0.2	2.6	
EU5612	560	19.4	10.1	-0.2	2.9	6043	11.5	7.0	0.0	2.3	
EU5777	709	19.9	9.6	-0.2	2.6	6128	11.6	7.1	0.0	2.3	
EU5802	496	19.0	9.2	0.6	2.2	4291	10.9	6.9	0.0	2.3	
EU5821	529	21.3	10.8	0.3	3.1	5479	11.6	7.1	-0.1	2.4	
EU6264	480	18.3	8.1	0.0	2.5	5177	11.0	6.7	0.2	2.5	
EU6281	378	18.2	9.6	0.0	2.8	4328	10.8	7.4	0.2	2.5	
EU6349	262	19.7	9.5	0.1	2.4	1200	11.1	7.6	-0.3	2.7	
EU6444	241	18.3	8.2	0.1	2.5	900	10.7	7.8	0.1	2.3	
EU6524	488	24.7	14.7	0.2	2.9	1126	9.4	7.0	-0.2	2.2	
EU6527	338	22.7	10.6	0.5	2.3	1510	12.7	8.1	-0.1	2.7	
EU6723	3182	27.5	14.7	0.2	3.2	8316	11.0	7.5	-0.3	2.5	
EU6821	810	20.1	13.5	0.1	2.5	1598	8.8	5.5	-0.4	2.2	
EU6890	348	21.3	7.9	0.2	2.6	1358	11.5	8.4	-0.1	2.7	
EU7218	473	23.3	10.0	0.4	2.6	1616	13.8	9.0	0.1	2.5	
EU7629	272	22.2	10.3	0.1	2.4	1167	12.0	8.7	0.2	2.6	
EU7643	502	21.3	10.8	-0.3	2.8	1997	12.7	9.1	-0.1	2.6	
EU7654	622	24.4	10.6	0.4	2.9	1460	12.8	9.2	0.1	2.9	
EU7724	404	18.9	8.3	0.2	2.8	1543	11.9	7.9	-0.2	2.5	

2000-IV FF	Wind Speed Cruise level in m/s					Wind Speed Ascent & Descent in m/s					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU7866	2609	27.0	14.7	0.2	2.9	4379	11.9	8.0	0.0	2.8	
EU7888	404	18.3	10.3	-0.1	2.7	4866	11.1	7.5	-0.2	2.7	
EU8520	298	19.6	8.4	0.1	2.6	1160	11.4	7.4	-0.1	2.5	
EU8969	411	19.7	8.3	0.1	2.7	1770	12.8	7.9	-0.2	2.6	
EU9145	475	18.5	7.1	0.2	2.4	1756	11.8	7.3	-0.3	2.5	
EU9158	564	17.0	10.2	0.1	2.6	5536	11.0	7.7	-0.3	3.1	
EU9234	429	20.2	9.6	0.1	2.5	4507	11.6	6.6	0.0	2.4	
EU9245	595	19.7	9.4	0.2	2.5	5146	11.8	6.7	0.1	2.4	
EU9544	608	20.1	10.2	0.1	2.3	5288	11.4	7.1	0.0	2.4	
EU9622	19	25.7	7.9	0.4	3.1	293	15.3	6.4	0.1	2.3	

c) Tabel 6, *Wind direction (deg)*

2000-IV DD	Wind Direction Cruise level in degrees					Wind Direction Ascent & Descent in degrees					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
	EU0002						8947			11	19
	EU0003	5408			4	11	2974			6	18
	EU0005	22			6	4					
	EU0008	5865			7	13	2505			6	14
	EU0021	1881			7	11	7922			11	17
	EU0022	3435			6	9	10337			12	19
	EU0032	846			1	8	2270			5	13
	EU0034	390			1	10	962			7	18
	EU0041	1362			7	10	24270			13	19
	EU0043	1346			7	12	24577			13	19
	EU0045	5065			4	10	2746			5	16
	EU0047	1487			7	10	26508			13	19
	EU0049						6384			12	20
	EU0050	1374			7	11	28081			15	22
	EU0051	1855			7	10	6166			13	17
	EU0052	1109			10	15	22391			16	22
	EU0054	2392			7	11	4868			15	24
	EU0055						7629			11	18
	EU0059	1193			9	15	28250			15	22
	EU0060	1354			2	6	452			1	5
	EU0061	1127			7	10	26814			15	22
	EU0072	2602			6	9	5534			14	20
	EU0081	3670			7	11	9698			14	22
	EU0082						9665			11	19
	EU0088	2658			7	10	10857			14	21
	EU0106	1259			7	10	29604			16	24
	EU0109	3522			7	10	9578			13	20
	EU0123	5418			7	12	2374			7	14
	EU0124						9908			11	17
	EU0154	1359			8	12	27352			15	22
	EU0158	1247			8	12	26701			13	20
	EU0167	1144			7	12	23492			13	20
	EU0175	1207			7	12	3149			16	23
	EU0185	1153			7	11	27767			14	22
	EU0204	3363			7	9	6634			14	23
	EU0209	274			2	6	1148			8	14
	EU0234						10022			11	18
	EU0249	2908			7	11	7008			14	21
	EU0254	5410			5	10	3765			6	17

2000-IV DD	Wind Direction Cruise level in degrees					Wind Direction Ascent & Descent in degrees					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU0263	5092			4	8	3500			6	20	
EU0299						10835			12	19	
EU0301	596			6	10	14627			14	20	
EU0303	1557			7	10	28346			14	21	
EU0307	1122			8	14	18757			14	22	
EU0311	1113			7	11	21165			14	22	
EU0313	790			10	19	19021			15	23	
EU0316	1094			7	10	19261			13	21	
EU0319	989			8	12	18745			13	20	
EU0324	4485			7	12	3278			16	24	
EU0332	4670			4	10	3348			6	14	
EU0359	1181			8	13	22188			14	20	
EU0367						8766			11	19	
EU0372	5264			5	10	3858			6	18	
EU0432						7421			10	16	
EU0456	486			9	14	27185			11	16	
EU0457	1465			2	5	915					
EU0458	586			8	13	27750			11	17	
EU0475	3581			7	11	4370			17	27	
EU0476	508			9	15	24256			11	15	
EU0482	4855			4	9	3623			6	17	
EU0498	644			1	6	1976			7	17	
EU0568						9755			10	18	
EU0592	3569			7	11	8485			14	23	
EU0689	674			1	8	2139			7	13	
EU0711	671			8	13	33511			11	15	
EU0802	860			8	15	18453			14	21	
EU0807	3604			7	10	5556			16	25	
EU0826						10768			11	19	
EU0875	649			7	9	15718			14	19	
EU0921	847			8	12	18884			14	18	
EU0934	4803			5	12	2124			6	17	
EU0947	5273			4	10	2835			7	19	
EU0961	5503			4	12	3029			6	17	
EU0985	2116			5	11	1001			6	13	
EU1001						7069			11	18	
EU1002	3457			5	11	1456			4	10	
EU1222	4868			6	12	2215			7	18	
EU1234	1119			8	10	27647			14	20	
EU1275	1655			4	8	832			2	11	
EU1301	823			1	6	859			0	3	
EU1312	2266			2	11	1072			0	5	

2000-IV DD	Wind Direction Cruise level in degrees					Wind Direction Ascent & Descent in degrees					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU1456						1078				12	21
EU1495	3864			7	14	1882				7	14
EU1532						10437				12	21
EU1541	2835			2	9	1196					
EU1547	882			7	12	17017				14	20
EU1567						10485				11	19
EU1593	5817			5	11	2573				6	14
EU1688	230			6	11	555				11	15
EU1692	3590			8	13	5327				16	24
EU1698						10828				11	18
EU1795	2995			2	10	975					
EU1863	1537			8	14	26008				15	22
EU1929	2894			3	13	389					
EU2043	2071			3	13	247				0	0
EU2189	1310			7	10	28088				14	21
EU2301	1335			7	10	40339				20	25
EU2389	2334			7	11	10882				13	20
EU2547	6333			4	10	3269				5	17
EU2559	1170			7	12	22234				14	21
EU2590	539			8	9	4740				14	22
EU2618	353			9	14	4263				15	22
EU2630	317			6	6	1083				12	19
EU2751	2551			2	8	712					
EU2845	3397			6	10	5858				16	26
EU2984	177			11	23	472				14	20
EU3000	1300			7	10	26097				14	20
EU3181	2694			2	10	1094					
EU3257	1075			7	10	20114				14	20
EU3268	62			5	4	298				14	26
EU3321	227			5	5	774				17	25
EU3421	1426			8	12	25846				14	21
EU3544	2			175	6	27				99	2
EU3654	501			11	21	3939				16	23
EU3684	212			6	13	938				12	18
EU3725	2866			2	9	1323				0	4
EU3781	1508			2	13	1011					
EU3803	832			2	18	498				0	3
EU3874	3340			2	7	933				0	4
EU3908	442			11	16	5756				16	27
EU4002	291			7	8	1000				14	21
EU4333	1038			10	13	13511				14	21
EU4426	2201			7	10	9655				12	18

2000-IV DD	Wind Direction Cruise level in degrees					Wind Direction Ascent & Descent in degrees					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU4444	377			7	8	4491			13	19	
EU4519	506			7	6	5939			13	18	
EU4529	2841			7	9	4396			15	23	
EU4573	811			7	10	8457			13	20	
EU4582	18			8	6	425			16	27	
EU4587	2655			7	11	5842			14	22	
EU4589	1			17	0	30			27	21	
EU4607	616			8	10	5400			15	22	
EU4699	619			8	9	4841			13	19	
EU4721	225			7	10	1079			15	24	
EU4792	251			9	14	1062			12	18	
EU4853	551			8	10	5351			16	23	
EU4865	532			9	13	5406			13	19	
EU4950	195			7	7	1090			14	19	
EU4956	77			0	3	151			7	19	
EU5191	601			2	5	1366			8	14	
EU5218	1485			7	10	7529			14	20	
EU5441	537			7	8	1671			14	23	
EU5478	464			11	19	5433			13	20	
EU5529	571			10	16	6215			16	26	
EU5591	2342			7	10	9712			14	20	
EU5612	560			7	8	6043			13	18	
EU5777	709			6	6	6128			14	20	
EU5802	496			7	8	4291			13	17	
EU5821	529			7	8	5479			13	17	
EU6264	480			8	12	5177			17	24	
EU6281	378			9	15	4328			16	22	
EU6349	262			7	10	1200			16	25	
EU6444	241			6	10	900			17	26	
EU6524	488			8	13	1126			16	22	
EU6527	338			7	7	1510			12	18	
EU6723	3182			6	9	8316			16	24	
EU6821	810			1	5	1598			9	20	
EU6890	348			6	9	1358			16	25	
EU7218	473			6	9	1616			14	26	
EU7629	272			7	9	1167			16	25	
EU7643	502			7	10	1997			12	18	
EU7654	622			6	7	1460			13	19	
EU7724	404			7	6	1543			15	23	
EU7866	2609			6	8	4379			15	25	
EU7888	404			8	13	4866			15	23	
EU8520	298			6	5	1160			15	23	

2000-IV DD	Wind Direction Cruise level in degrees					Wind Direction Ascent & Descent in degrees					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
	EU8969	411			7	7	1770			11	14
	EU9145	475			7	6	1756			14	22
	EU9158	564			9	14	5536			16	26
	EU9234	429			6	8	4507			13	18
	EU9245	595			6	6	5146			12	16
	EU9544	608			6	10	5288			13	18
	EU9622	19			5	6	293			8	7

Annex I. EU Amdar Observations from 15 - 17 November 2000.

In order to have a brief impression of the distribution of the locations of observations, two maps are presented. In fig. 2 Europe is presented with all EU Amdar observations for the period 15-17 November 2000. Note that most data is acquired during ascending or descending (see Annex IV). In figure 3 (next page), data from the North Atlantic is displayed. AMDAR data is evaluated using HIRLAM numerical model data as background. This background reference is restricted by a limited area, as shown in fig. 3.

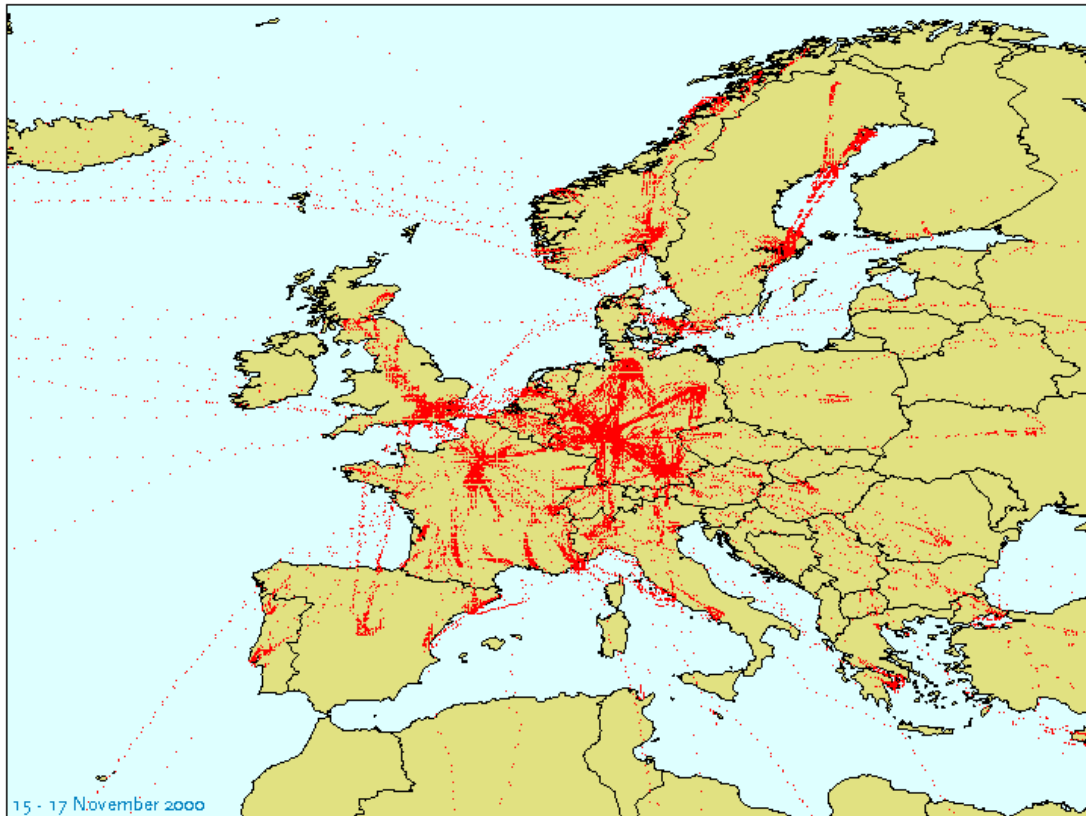


Fig. 2 All EU AMDAR observation locations, for the period 15 -17 November 2000 and zoomed in over Europe.

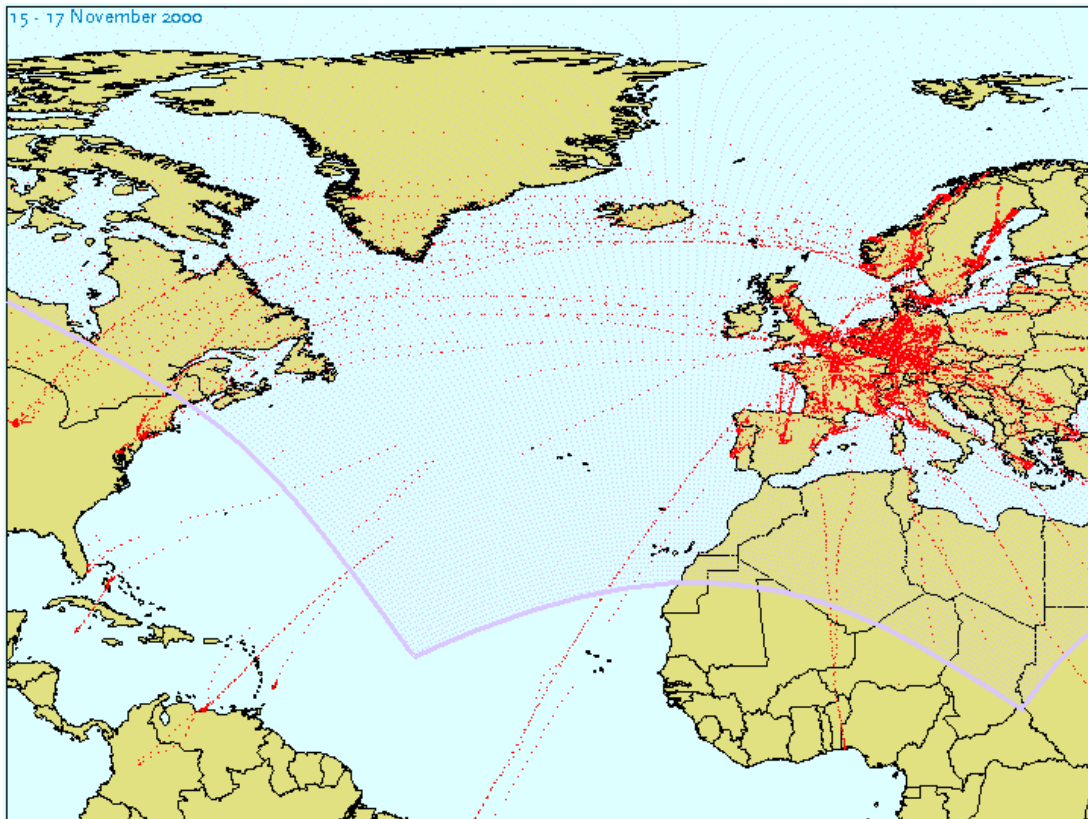


Fig. 3 All EU-AMDAR observations locations for 15-17 November 2000. In this figure the HIRLAM area used for the evaluation purposes is indicated (■)

Annex II. Frequency distribution of mean temperature, mean wind speed and wind direction differences.

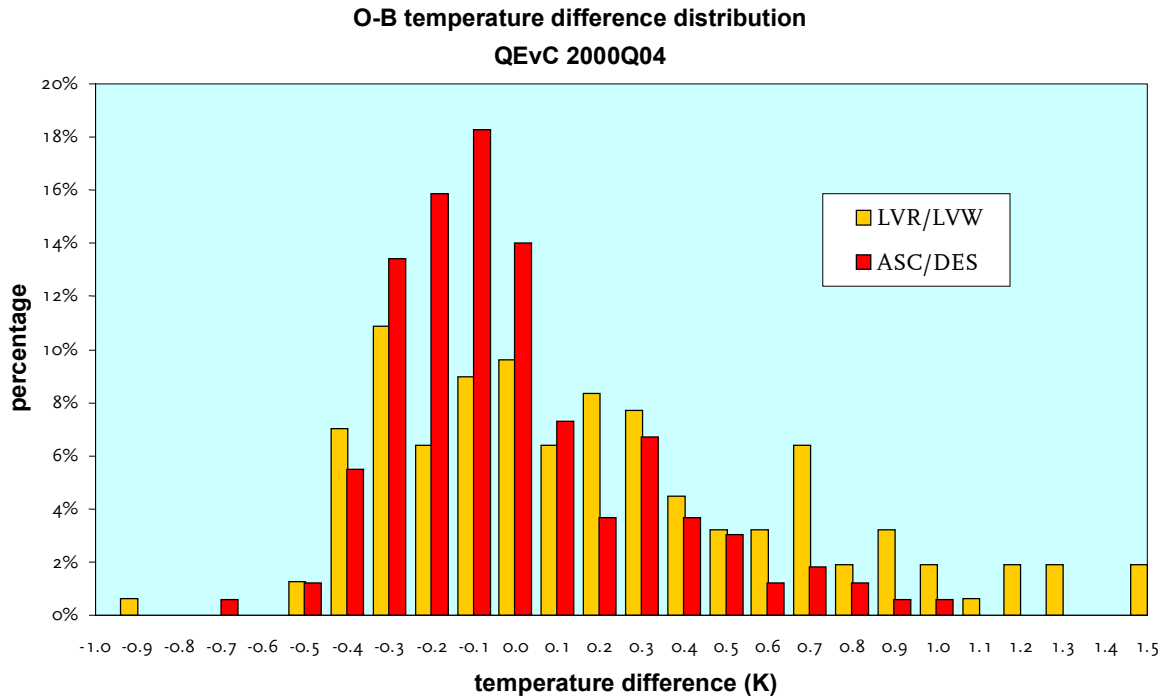


Fig. 4 Frequency distribution of the mean temperature difference (OBS–Background) for the number of aircraft reporting AMDAR reports ($N=172$). Distinction is made between the Flight Level (LVR/LVW) and the Ascending or Descending phase (ASC/DES). Clearly, there is no significant difference between the distributions of both phases.

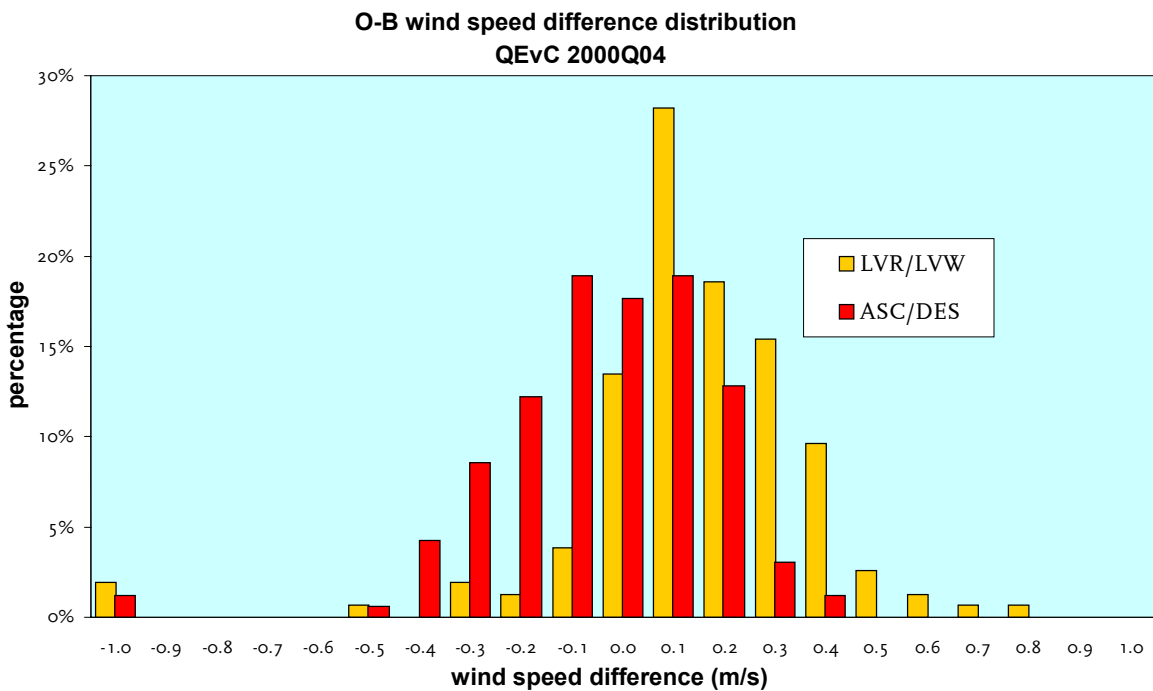


Fig. 5. Frequency distribution of the mean wind speed difference (OBS–Background) for the number of aircraft reporting AMDAR reports ($N=172$). Distinction is made between the Flight Level (LVR/LVW) and the Ascending or Descending phase (ASC/DES). Clearly, there is no significant difference between the distributions of both phases

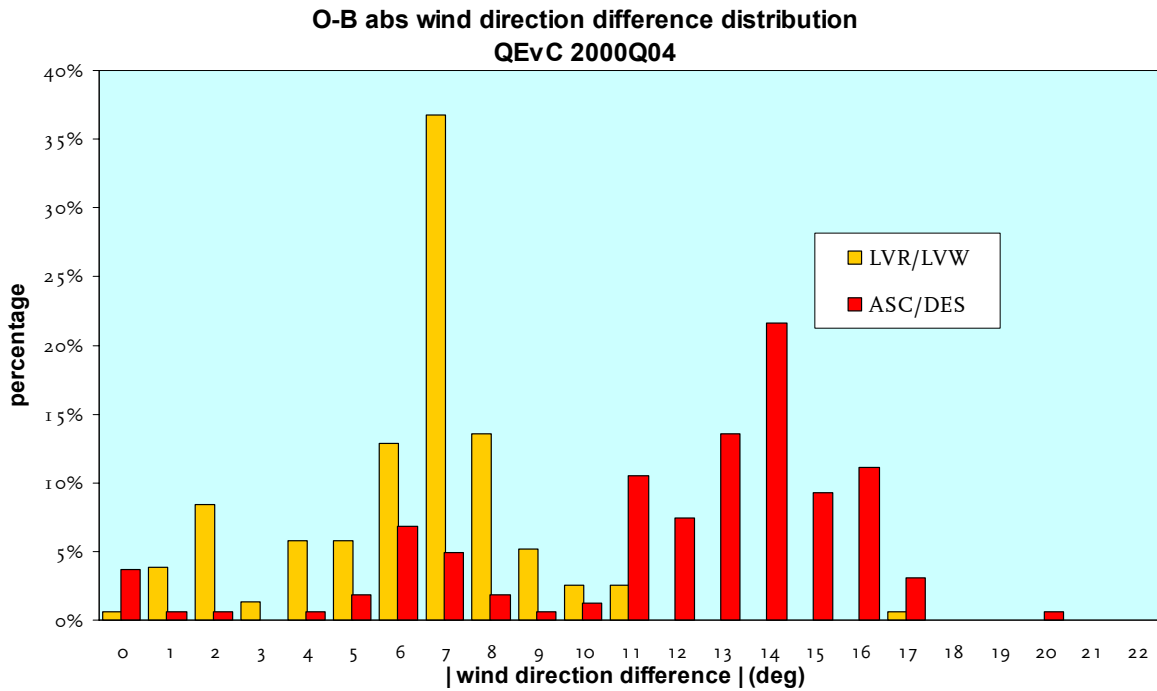


Fig. 6. Frequency distribution of the mean of the absolute wind direction difference ($|OBS-Background|$) for the number of aircraft reporting AMDAR reports ($N=172$). Distinction is made between the Flight Level (LVR/LVW) and the Ascending or Descending phase (ASC/DES). Clearly, in this case there is a significant difference between the distributions of both phases.

Annex III. Temperature observations: An analyses.

For four aircraft producing the largest number of observations during the period 15-17 November 2000, temperature data are analysed. In figure 7 the observed temperature is presented as function of altitude for the four aircraft. Note that these observations are made at different locations and time and therefore not correlated but give a brief impression of the air temperature as a function of altitude. The OBS-MOD temperature differences are presented in figure 8. Clearly no significant particular difference in behaviour of any aircraft can be recognised.

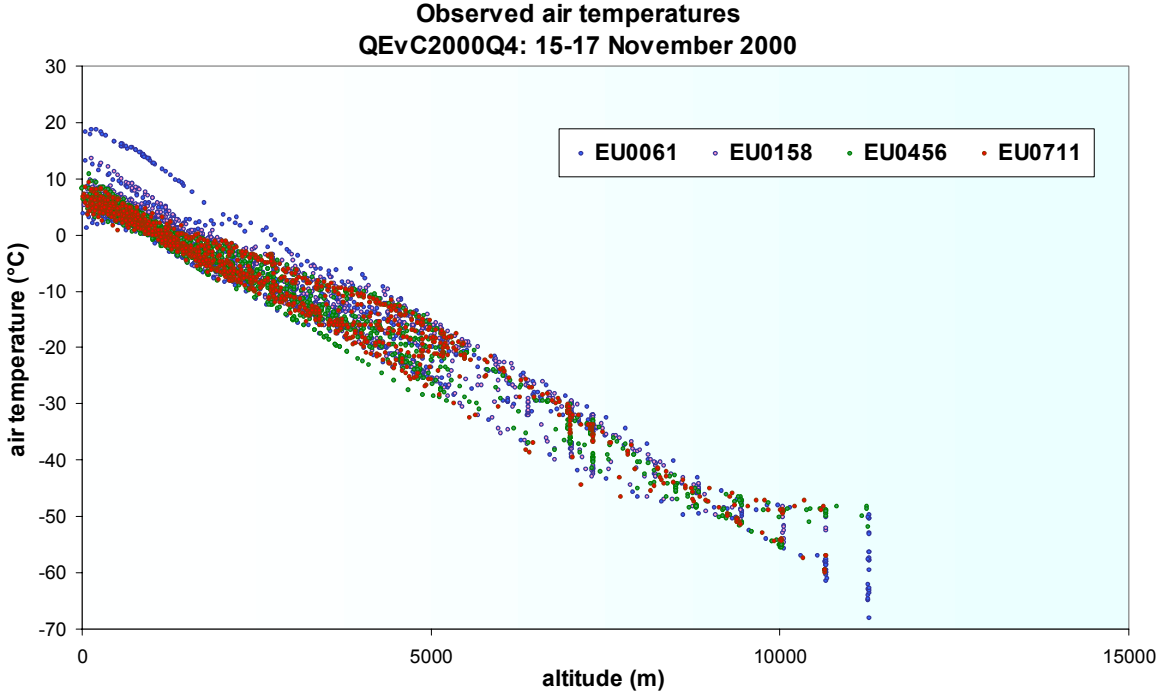


Fig. 7. Temperatures, measured during the period 15-17 November 2000 for the four aircraft EU0061, EU0158, EU0456 and EU0711.

In particular the OBS-MOD temperature differences might demonstrate significant differences, e.g. caused by sensor response delays. In figure 9, the OBS-MOD temperature differences are shown as a function of altitude for the three reported phases of flight, LVR (level flight), ASC (ascending) and DES (descending). Obviously there is no significant difference in the observations for these three types of phases.

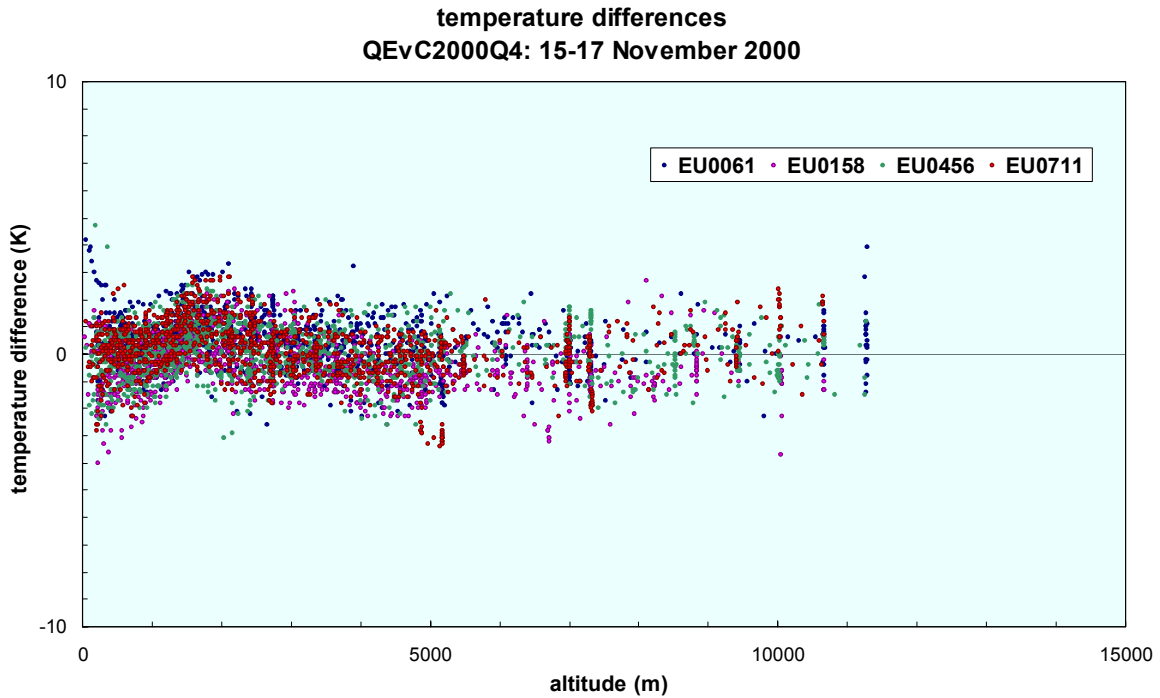


Fig. 8. OBS-MOD Temperature differences as a function of altitude, measured during the period 15-17 November 2000 by the four aircraft EU0061, EU0158, EU0456 and EU0711. No significant mutual difference is found.

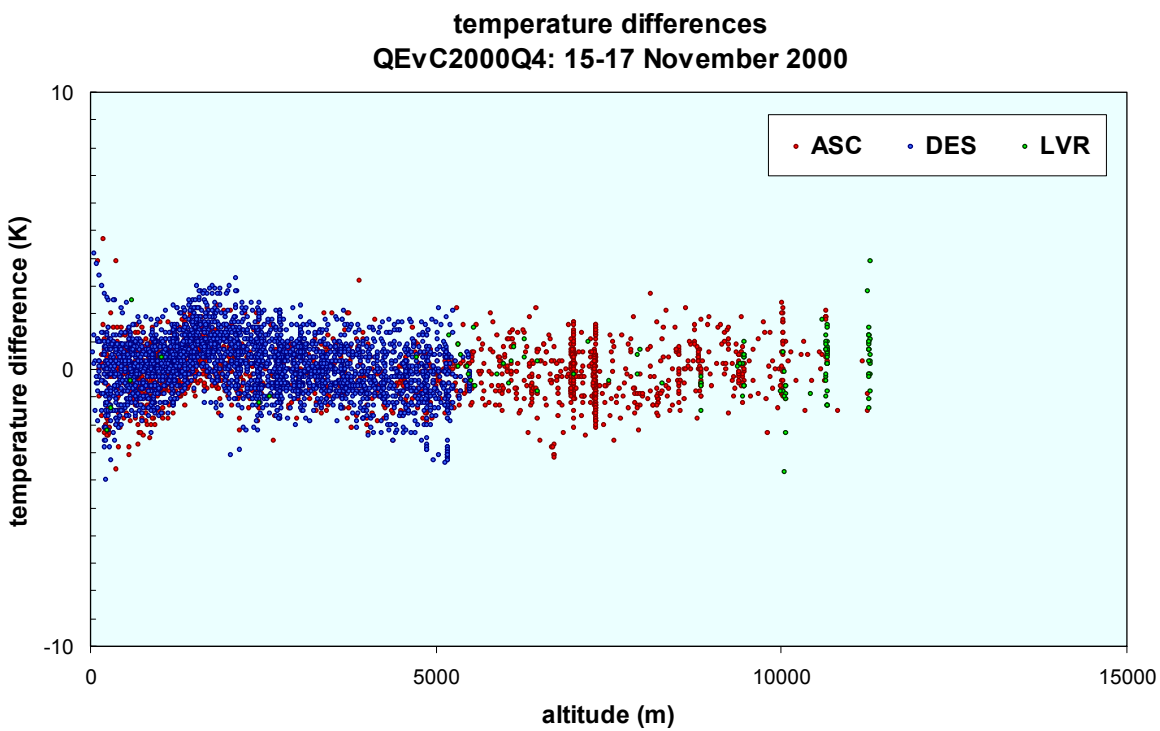


Fig. 9. OBS-MOD Temperature differences as a function of altitude, measured during the period 15-17 November 2000 for the four aircraft together but for each phase of flight apart. No significant difference is found.

Annex IV. Timeliness: An analyses for FM42 encoded EU-AMDAR.

Taking the time of observation indicated in each record and the time of storage into the local QEvC real time observations database, the timeliness of each observation can be investigated. Data from the period 15-17 November 2000 EU-AMDAR is investigated in detail to get a clear impression on the individual timeliness. Since the frequency of observations presented in FM42 encoded bulletins differs from BUFR encoded bulletins, we have investigated FM42 encoded data only for this case study. In the figures 10 and 11 the results of this analyses are presented.

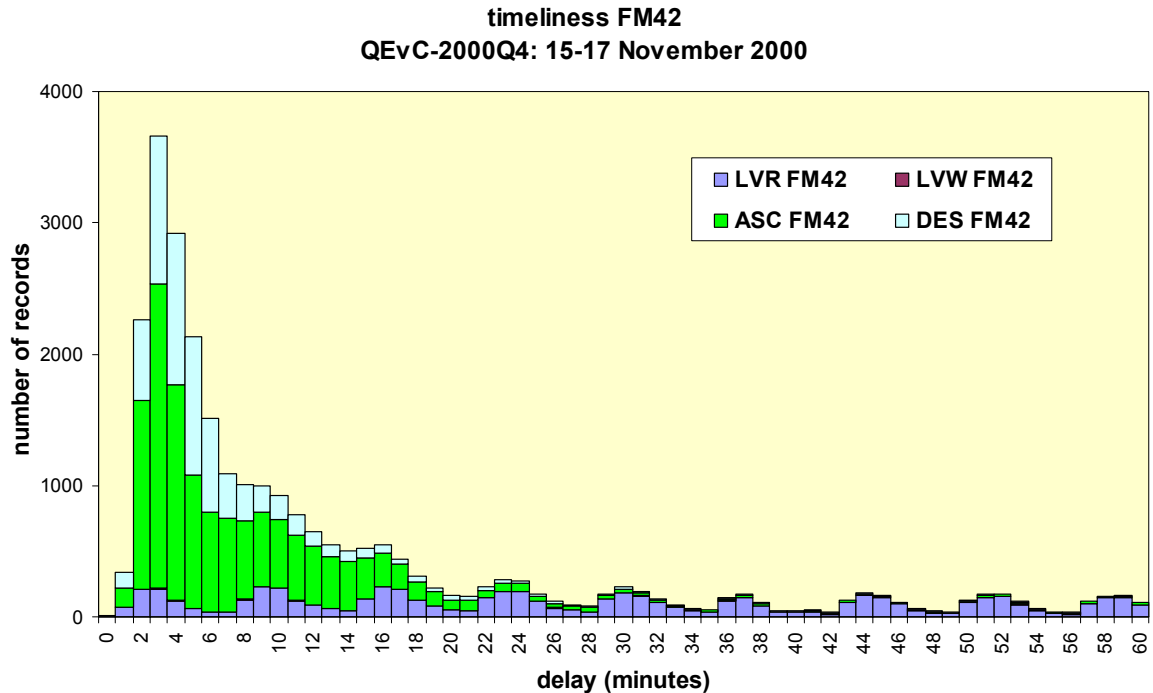


Fig. 10. Frequency distribution for all FM42 encoded EU-AMDAR observations during the period 15-17 November 2000 as a function of delay (interval between time of observation and time of reception/storage). Clearly most of the data is received within 20 minutes. Data from Level Flight however lasts for much longer (LVR, LVW). (number of observations: 64076)

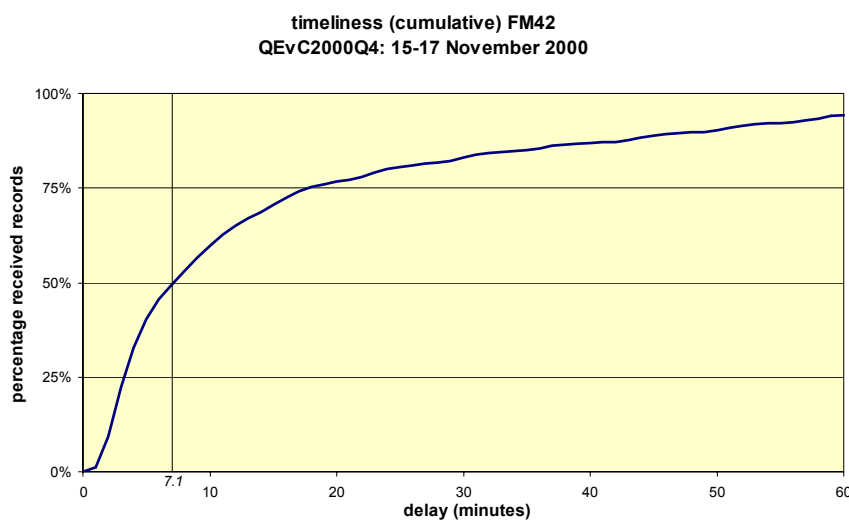


Fig. 11. Cumulative frequency distribution for all EU AMDAR records as a function of timeliness (period 15-17 November 2000; number of observations: 64076). Note that the median value is at 7,1 minute, i.e. 50% of all FM42 encoded data is received within 7,1 minute after observation.

Annex V. Observation time and altitude distribution for ASC/DES data

For the period 15-17 November 2000 all FM42 encoded bulletins with data observed during ascend and descend around Paris (within 47° - 50° N and 1° - 4° E, see fig. 12) are investigated to obtain an impression of the distribution of the observations as a function of place and time. The location of Paris was not chosen for any particular reason, in a future quarterly other locations will be presented as well.

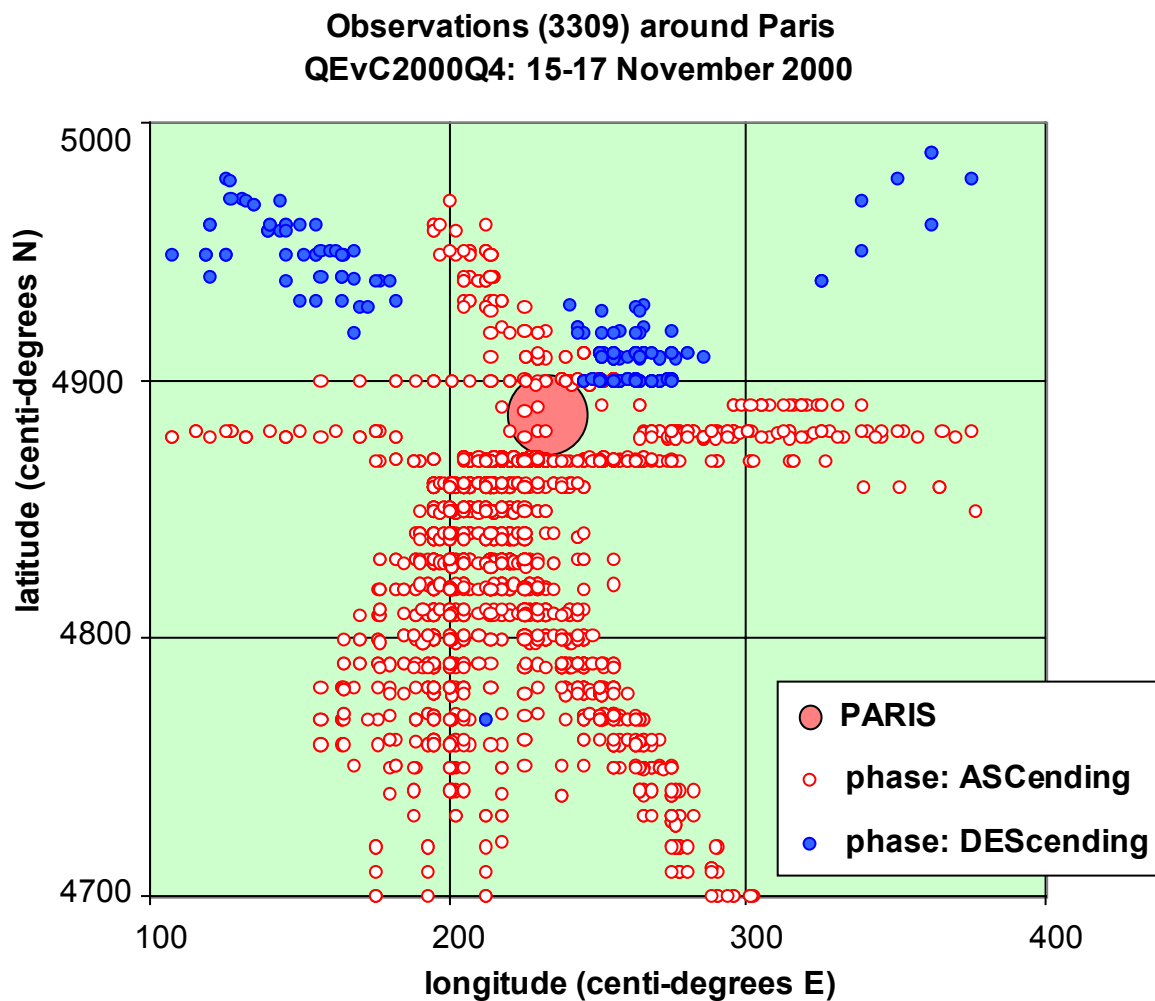


Fig. 12. Spatial distribution of FM42 encoded data for observations during the ascending and the descending phase (period 15-17 November 2000). Latitude and longitude are in centi-degrees, e.g. $4890\text{ N} = 48,90^{\circ}\text{ N} = 48^{\circ}54'\text{ N}$.

In the figures 13 and 14 such a distribution is presented. Clearly at this site all observations are from 7:30 to 21:00 UTC. Moreover the distribution of the altitude levels for descending data differs significantly from ascending data (see fig. 14). Since a large number of aircraft calling at Paris only observe during take-off typically more ASC-data is received than DES-data. For other locations this ratio is more in balance with 50%/50%.

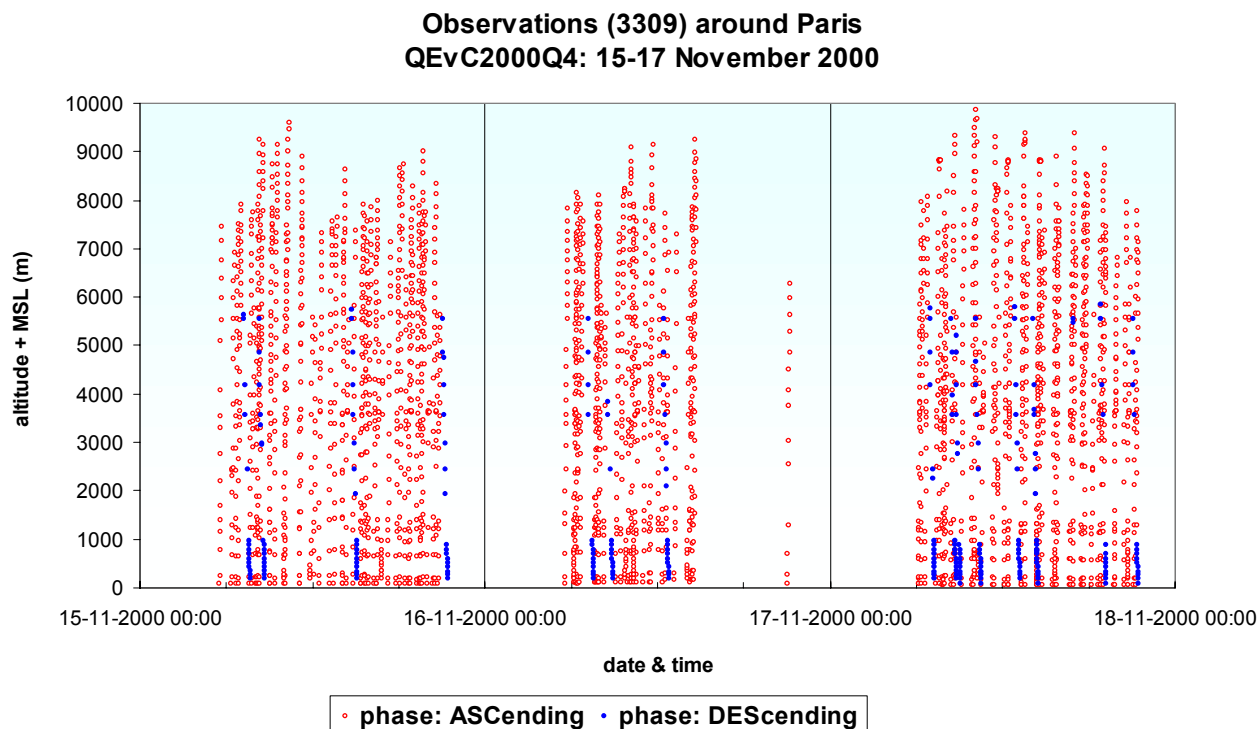


Fig. 13 Distribution of the observations over altitude and time of observation. Note the difference between ASC and DES data. Typically, all daily observations are within 7:30 and 21:00 UTC (the gap at 17-11-2000 18:00 UTC is due to communication problems). Period: 15-17 November 2000, location: Paris, area: 1°-4° E, 47°-50°N (see fig. 12)

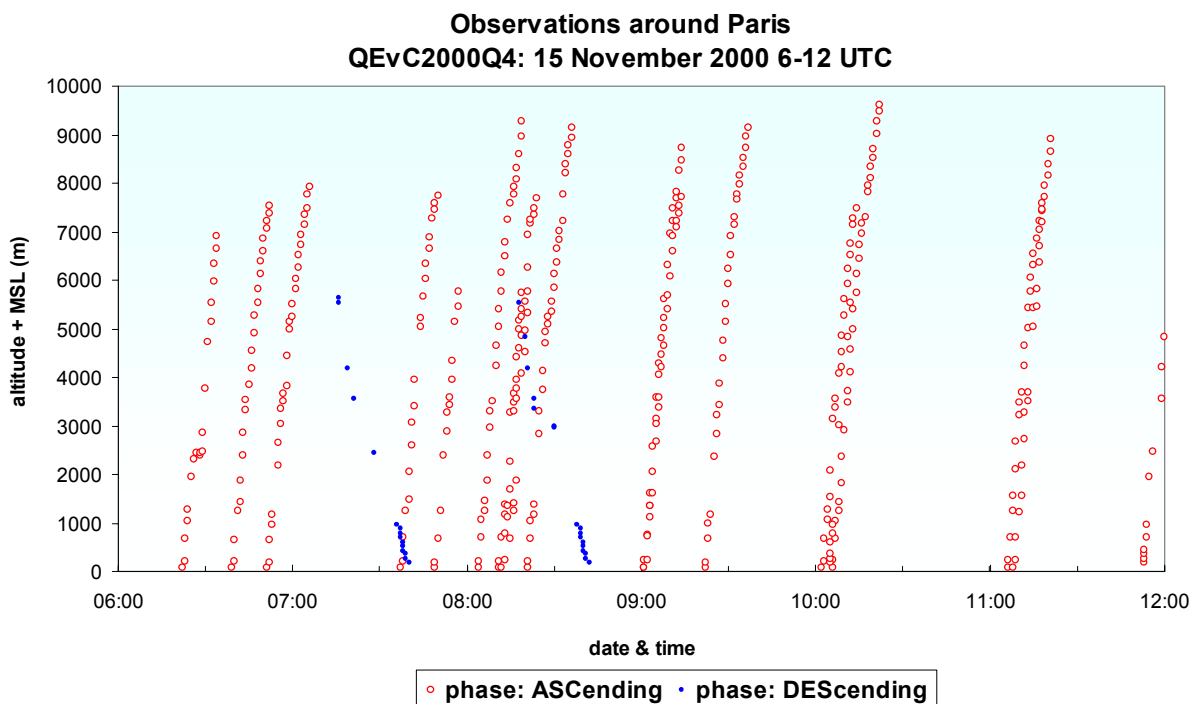


Fig. 14 The same as with fig. 13, but zoomed in on November, 15th, 6-12 UTC.