

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

**2001-II**

Report number 7                      01 November 2001

Period: 1 APRIL 2001 – 30 JUNE 2001

KNMI  
Wilhelminalaan 10  
NL-3732 GK De Bilt  
The Netherlands

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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](mailto: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](mailto: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	<a href="mailto:Jochen.Dibbern@dwd.de">Jochen.Dibbern@dwd.de</a>	(+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	<a href="mailto:Grooters@knmi.nl">Grooters@knmi.nl</a>	(+31) (0)30 2206 691	(+31) (0)30 2210 407
Mr T HOVBERG SMHI SE-601 76 Norrköping SWEDEN	SAS	<a href="mailto:tore.hovberg@smhi.se">tore.hovberg@smhi.se</a>	(+46) (0)11 495 8237	(+46) (0)11 495 8001
Jean-Louis GAUMET Meteo-France SETIM BP 202 78195 TRAPPES CEDEX FRANCE	Air France	<a href="mailto:jean-louis.gaumet@meteo.fr">jean-louis.gaumet@meteo.fr</a>	(+33) (0)130 136470	(+33) (0)130 136468
Bruce TRUSCOTT Met Office, Beaufort Park, Easthampstead, Wokingham Berkshire RG40 3DN ENGLAND	BA	<a href="mailto:bruce.truscott@metoffice.com">bruce.truscott@metoffice.com</a>	(+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 406 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* (220 units operational August 2001).

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 March 1<sup>st</sup>, 2001, 00:00 UTC to June 30<sup>st</sup>, 2001, 24:00 UTC (2001Q2).

## 2) Operational AMDAR units

Data from 183 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. During this quarter a **further significant decrease** of the number of such erroneous bulletins was found. A typical code error found to be persistent in a number of bulletins:  $TBB_A=TB'$  and  $i_{\rho}i_{\rho}i_{\rho} = ///$  in section 2 (see example 1). The " $TBB_A=TB'$ " errors will be solved before the beginning of the next quarter after installing a new software release and is not outstanding anymore.

```

AMDAR 1405
LVR EU0003 5810N 00651E 0515 F370 MS560 281/042 TBO S011=
LVR EU0003 5730N 00813E 0522 F370 MS582 284/051 TBO S011=
/// EU0003 5648N 00931E 0529 F368 MS585 289/054 TB/ S111=
LVR EU0003 5600N 01023E 0536 F250 MS355 289/029 TBO S011=
LVR EU0003 5559N 01053E 0543 F221 MS292 293/023 TB S011=
/// EU0003 5554N 01046E 0546 F183 MS207 300/013 TB/ S111=
DES EU0003 5551N 01101E 0547 F160 MS150 277/012 TB/ S011=
DES EU0003 5549N 01116E 0549 F138 MS107 265/014 TB/ S011=
DES EU0003 5547N 01127E 0550 F118 MS065 262/011 TB/ S011=
DES EU0003 5547N 01130E 0550 F114 MS060 260/010 TB/ S011
333 F000 VG000=

```

errors:

[1]  $TB_{B_A}=TB'$ ; accent sign not allowed. Turbulence indicator  $B_A=0, 1, 2$  or  $3$  (code table 0302)

[2]  $i_p i_p i_p = ///$ ; defined values: LVR, LVW, ASC, DES and UNS

date: 14 May 2001

Example 1

- b) In section 2 of FM42-XI Ext. two additional groups are defined, i.e.  $TB_{B_A}$  and  $s_{S_1 S_2 S_3}$ , representing turbulence and system parameters respectively ( $s_{S_1 S_2 S_3}$  stand for type of navigation system, type of system used (ASDAR/ACARS) and temperature precision (2,0 or 1,0 °C)). Although these two groups are not very critical it will be good practice to confirm to the stated code recommendations. In example 2 a bulletin is presented where these two groups are omitted.

```

AMDAR 1405
LVR EU5612 6124N 01822E 0555 F240 MS370 303/021=
LVR EU5612 6120N 01824E 0555 F240 MS370 302/021=
LVR EU5612 6116N 01827E 0556 F240 MS370 301/021=
LVR EU5612 6112N 01829E 0556 F240 MS368 301/024=

```

date: 14 May 2001

[3] No "turbulence" and "system parameters group" ( $TB_{B_A}$  and  $s_{S_1 S_2 S_3}$ ) presented

Example 2

- c) Occasionally typical code errors are found (see example 3). The source of these errors might be a software application or a communication mismatch problem.

```

AMDAR 1305
LVR EU0985 4433N 08541W 0357 F290 MS500 332/044 TBO S011=
LVR EU0985 4519N 08505W 0404 F290 MS500 318/046 TBO S011=
LVR EU0985 4607N 08431W 0411 F290 MS510 307/047 TBO S011=
LVR EU0985 4652N 08343W 0417 F290 MS510 296/040 TBO S011=
LVR EU0985 4733N 08248W 0424 F290 MS515 310/045 TBO S011=
LVR EU0985 4814N 08151W 0431 F290 MS505 301/029 TBO S011=
LVR EU0985 4855N 08055W 0438 F290 MS485 311/036 TBO S011=
LVR EU0985 4937N 07958W 0445 F290 MS475 281/020 TBO S011=
LVR EU0985 5020N 07859W 0452 F290 MS475 262/016 TBO S011=
LVR EU0985 5103N 07758W 0459 F290 MS462 218/022 TBO SOLL=

```

```

AMDAR 1410
ASC EU3908 6536N 01256E 1053 F374 MS456 289/023=
LVR EU3908 6443N 01226E 1100 F390 MS443 289/018=
LVR EU3908 6351N 01157E 1107 F390 MS445 284/019=
LVR EU3908 62100N 01132E 1114 F390 MS455 285/022=

```

date: 14 May 2001

[4] Code error in  $s_{S_1 S_2 S_3}$  and  $L_a L_a L_a L_a A$

Example 3

- d) To avoid date confusion 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, in a large number of the received FM42-IX AMDAR bulletins this code change was found (see example 4).

```

AMDAR 1404
ASC EU6281 6313N 01426E 0404 F033 MS025 328/012=
ASC EU6281 6312N 01426E 0404 F034 MS030 333/014=
ASC EU6281 6312N 01425E 0405 F035 MS033 331/016=
ASC EU6281 6310N 01425E 0405 F045 MS050 321/028=

AMDAR 2423
LVR EU0254 4248N 06500W 242348 F349 MS522 021/031 TB0 S011=
LVR EU0254 4307N 06355W 242355 F349 MS527 008/047 TB0 S011=
LVW EU0254 4324N 06250W 250002 F349 MS527 006/065 TB0 S011=
date: 14 May 2001

[5] Hour+minute group GGgg replaced by Day+Hour+minute YYGGgg for many reports

```

*Example 4*

However, for a number of bulletins the day-number was incorrect for observations from the previous day or for the new day (see example 5). This error was found for bulletins with observations from two days:

```

UDEU02 EGRR 242348
AMDAR 2422
LVR EU0947 5419N 03824E 242240 F299 MS490 312/048 TB0 S011=
LVR EU0947 5402N 03959E 242247 F299 MS487 317/035 TB0 S011=
LVR EU0947 5343N 04131E 242254 F299 MS492 317/027 TB0 S011=
LVR EU0947 5327N 04301E 242301 F299 MS497 338/020 TB0 S011=
LVR EU0947 5312N 04430E 242308 F299 MS495 248/007 TB0 S011=
LVR EU0947 5253N 04554E 242315 F306 MS500 184/023 TB0 S011=
LVR EU0947 5231N 04713E 242322 F332 MS537 196/059 TB0 S011=
LVR EU0947 5208N 04830E 242329 F332 MS530 196/059 TB0 S011=
LVR EU0947 5145N 04945E 242335 F332 MS550 182/062 TB0 S011=
LVR EU0947 5122N 05054E 242342 F332 MS565 175/056 TB0 S011=

UDAS02 EGRR 250105
AMDAR 2523
LVR EU0947 5040N 05323E 252356 F332 MS542 188/047 TB0 S011=
LVR EU0947 5019N 05438E 260003 F332 MS542 198/047 TB0 S011=
LVR EU0947 4957N 05554E 260010 F332 MS532 222/052 TB0 S011=
LVW EU0947 4932N 05712E 260017 F332 MS525 246/063 TB0 S011=
LVR EU0947 4904N 05828E 260024 F332 MS522 249/047 TB0 S011=
LVR EU0947 4817N 05916E 260031 F332 MS522 267/060 TB0 S011=
LVR EU0947 4732N 06007E 260038 F332 MS520 265/044 TB0 S011=
LVR EU0947 4649N 06059E 260045 F332 MS522 267/030 TB0 S011=
LVR EU0947 4606N 06149E 260052 F332 MS522 272/028 TB0 S011=
LVR EU0947 4518N 06228E 260059 F332 MS517 286/027 TB0 S011=

UDAS02 EGRR 250222
AMDAR 2501
LVR EU0947 4334N 06335E 250113 F332 MS500 300/038 TB0 S011=
LVR EU0947 4241N 06407E 250120 F332 MS495 303/040 TB0 S011=
UNS EU0947 4147N 06439E 250127 F332 MS497 321/037 TB/ S111=
LVR EU0947 4058N 06523E 250134 F332 MS487 319/043 TB0 S011=

```

LVR	EU0947	4008N	06605E	250141	F332	MS485	321/049	TB0	S011=
LVR	EU0947	3913N	06635E	250148	F332	MS460	316/047	TB0	S011=
LVR	EU0947	3815N	06656E	250155	F332	MS450	312/050	TB0	S011=
LVR	EU0947	3718N	06717E	250202	F330	MS445	307/052	TB0	S011=
LVR	EU0947	3625N	06754E	250209	F330	MS420	300/058	TB0	S011=
LVR	EU0947	3532N	06831E	250216	F330	MS412	293/058	TB0	S011=

date: 24/25 May 2001

[6] Code error in **YYGGgg** (values in red should be subtracted by 1)

*Example 5*

## 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.

#### *Special issues*

- As part of the E-AMDAR AMDAR Fleet Configuration Plan, aircraft were activated on April 1st and May, 16<sup>th</sup>.
- Due to budgetary constraints aircraft were deactivated on May 21<sup>st</sup>- 23<sup>rd</sup>, 29<sup>th</sup> and 30<sup>th</sup>.

More details on availability issues are presented in table 3.

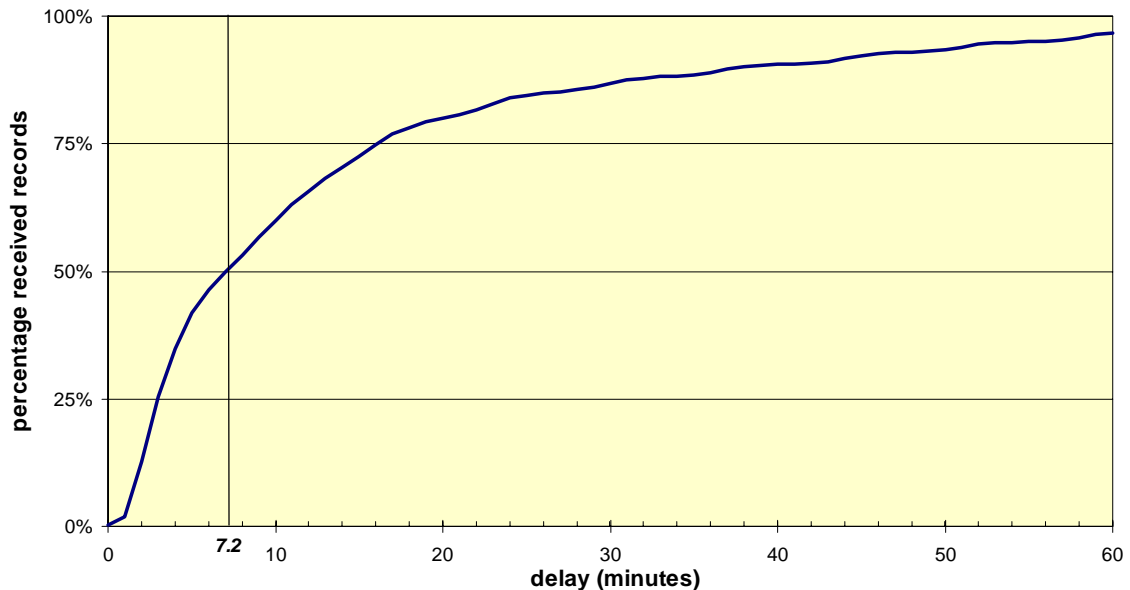
### b) Data coverage

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, 99,0 % of all reports was received within one hour of observation time and 99,8 % within 2 hours from observation. With respect to the previous quarter a significant increase is found. In fact these values are comparable to those of end 2000. Overall the data timeliness is very good. This is demonstrated by figure 1 below, where from the cumulative frequency distribution it follows that 50% of all FM42 recorded observations is received within 7 minutes:

**timeliness (cumulative) FM42  
QEvC2001Q2: - 17-19 May 2001**



*Fig. 1. Cumulative frequency distribution for all FM42 encoded EU-Amdar observations during the period 17-19 May 2001 as a function of the interval between observation and time of reception. (median value: 7,2 minute).*

#### **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.

#### **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-31-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. However, 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:  $|T_A(O)-T_A(B)| \geq 0,5 \text{ }^\circ\text{C (0,5 K)}$
- Wind speed:  $|f(O)-f(B)| \geq 2,0 \text{ m/s (4 Knots)}$
- 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  $-0.6^\circ\text{C}$  and  $+1.4^\circ\text{C}$ . Aircraft with a mean difference, typically significant larger than expected are: EU0167, EU3421, EU4593, EU5435, EU6444, EU6544, EU7629 and EU8520. Only aircraft EU3544 exceeded typically the stated mean wind speed tolerance, but no aircraft exceeded the wind direction differences. 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 ( $^\circ\text{C}$ )
EU3544	2001.04.02	17.39	52.57	13.29	200	242.2	289.6	-47.4
EU3544	2001.03.31	14.51	50.04	8.57	310	242.2	282.8	-40.6
EU5441	2001.04.25	10.28	45.70	9.90	6670	273.2	246.7	26.5
EU0167	2001.05.26	22.50	38.77	-9.08	320	321.2	297.6	23.6
EU0167	2001.05.27	20.57	50.08	8.64	160	315.2	292.1	23.1
EU2189	2001.06.23	09.00	52.47	9.71	470	302.2	281.8	20.4
EU3000	2001.06.03	12.17	48.21	11.47	3390	278.7	259.9	18.8
EU0313	2001.05.03	19.13	49.24	11.01	8220	252.5	234.5	18.0

Aircraft with occasionally extreme temperature differences are: EU0167, EU0985, EU1334, EU2301, EU3000, EU3544, EU5331 and EU6444.

Remarkable wind speed differences were observed for:

AIRCRAFT	Day	Time (UTC)	Latitude	Longitude	Altitude (m)	Wind speed [observed] (m/s)	Wind speed [background] (m/s)	Wind speed difference (m/s)
EU3544	2001.04.01	19.17	50.03	8.53	1110	52.0	1.5	50.5
EU3544	2001.03.31	15.10	50.04	8.57	310	52.0	4.4	47.6
EU3544	2001.04.02	20.12	52.57	13.26	90	52.0	6.0	46.0
EU7654	2001.06.21	10.04	54.40	18.20	570	32.9	2.4	30.5
EU0332	2001.04.02	09.36	50.80	0.10	2980	42.6	13.7	28.9

EU3000	2001.05.18	16.19	49.34	9.22	9440	38.1	13.5	24.6
EU2189	2001.06.23	07.38	52.47	9.71	9740	27.3	6.3	21.0
EU1929	2001.04.05	01.19	40.50	39.30	10630	59.1	38.2	20.9
EU9245	2001.05.19	05.54	62.80	19.90	7620	21.6	3.1	18.5

Aircraft with occasionally extreme wind speed differences are: EU0041, EU3000, EU3544 and EU4532.

Occasionally wind direction difference of 90° or more are observed, even up to 180°, e.g.:

AIRCRAFT	Day	Time (UTC)	Latitude	Longitude	Altitude (m)	Wind direction [observed] (°)	Wind direction [background] (°)	Wind direction difference (°)
EU0002	2001.06.12	09.11	49.00	2.50	480	44.0	224.0	180.0
EU0032	2001.06.10	04.07	52.20	4.60	510	63.0	243.0	180.0
EU0021	2001.04.10	09.23	45.40	8.70	1060	138.0	319.0	179.0
EU0041	2001.06.30	09.59	41.90	2.78	450	238.0	59.0	179.0
EU0047	2001.06.02	09.05	45.22	7.66	1420	161.0	343.0	178.0
EU0022	2001.06.17	10.41	47.40	19.20	600	154.0	337.0	177.0

Aircraft with occasionally extreme wind direction differences are: EU0002, EU0003, EU0021, EU0022 and EU0041. An impression of the distribution of the individual wind direction differences is given in figure 2, where a frequency distribution is presented of  $\langle |\Delta DD| \rangle$  ( $= \text{AVG}(\text{ABS}(\text{DD\_OBS} - \text{DD\_MOD}))$ ):

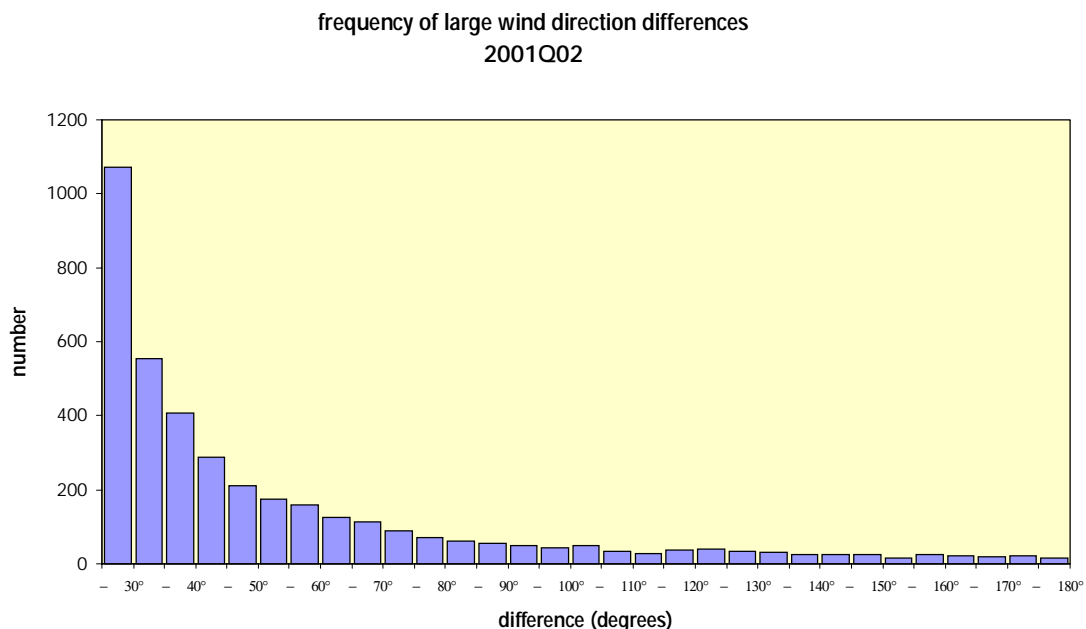


Fig. 2. Frequency distribution for the individual O-B obs wind direction differences,  $\langle |\Delta DD| \rangle$ . Note that for most of the observations it holds that  $\langle |\Delta DD| \rangle < 30^\circ$ , so this figure presents only a small subset of the total amount of received data: i.e. 0,2%.

## 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.

The following errors/problems, as mentioned in paragraph 3 of this report, have been addressed:

- Code error in  $L_a L_a L_a L_a A$  (no. [5] in par. 3) is found to be a software application problem. A fix, to solve this problem, is implemented in the second quarter of 2001.

## 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 (99,3% within 45 min).
2. The number of aircraft reporting (EU-)AMDAR was 183.
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. Overall, anomalies of  $\pm 0.25^\circ\text{C}$ ,  $\pm 0,1$  m/s,  $\pm 7^\circ$  (for LVR/LVW) and  $\pm 15^\circ$  (for ASC/DES) are typical (see Annexes II and III). These value are based on a 50% cumulative level score, .i.e. 50% of all data are within these ranges.

## 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=183). 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 within ranges of approx.  $-0,6$  to  $+1,5^\circ\text{C}$ ,  $-0,2$  to  $+0,4$  m/s and  $\pm 10^\circ$  (for LVR/LVW) to  $\pm 20^\circ$  (for ASC/DES) (to be considered as the *uncertainty* of observation).

### b) Wind direction observations

In Annex III of this report the result of a case study on wind directions observations is presented. For the period 17-19 May 2001, data from all are analysed. In the figures both the measured wind directions and the O-B wind directions differences are presented in scatter plots as a function of altitude. The plots with the O-B wind speed difference give a clear impression of these differences as a function of altitude.

### **c) Trends in the daily amount of observations**

From April, 1<sup>st</sup> to June, 30<sup>th</sup> the amount of observations is registered on a daily base. In Annex IV of this report the trend of this daily amount is presented. Obviously there was a slight increase in the number of received data during this quarter.

### **d) Altitude distribution of LVR and LVW data from the North Atlantic.**

In Annex V of this report the results of a case study on altitude distribution is presented (observation period: 17-19 May 2001). Clearly all observations (only LVR, LVW; no ASC or DES in this area) are at 9500 to 12000 m.

### **e) The daily cycle and observation times.**

In Annex VI of this report four figures are presented, which gives a clear impression of AMDAR data availability during a 24h cycle. In these figures (source: ECMWF) positional information is presented for the four main intervals of a day. Typically, very little data are available around 00:00 UTC.

**Table 1, List of operational AMDAR units**

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

Identifier	Identifier	Identifier	Identifier	Identifier	Identifier
EU0002	EU0249	EU0947	EU2189	EU4444	EU5802
EU0003	EU0254	EU0961	EU2301	EU4519	EU5821
EU0008	EU0263	EU0985	EU2389	EU4527	EU5891 A
EU0021	EU0299	EU1001	EU2547	EU4529	EU6264
EU0022	EU0301	EU1002	EU2559	EU4532	EU6281
EU0032	EU0303	EU1222	EU2590	EU4573	EU6349
EU0034	EU0307	EU1234	EU2618	EU4582	EU6444
EU0041	EU0311	EU1275 D	EU2630	EU4587	EU6524
EU0043	EU0313	EU1282	EU2751	EU4591 A	EU6527
EU0045	EU0316	EU1301	EU2773	EU4593	EU6544 A
EU0047	EU0319	EU1312	EU2845	EU4607	EU6556 A
EU0049	EU0332 D	EU1334	EU2984	EU4699	EU6821
EU0051	EU0359	EU1345 D	EU3000	EU4721	EU6890
EU0054	EU0367	EU1367	EU3181	EU4756 A	EU7218
EU0055	EU0372 D	EU1389 D	EU3257	EU4792	EU7629
EU0060	EU0432	EU1411	EU3268	EU4853	EU7643
EU0072	EU0456	EU1436 D	EU3321	EU4865	EU7654
EU0081	EU0457	EU1456	EU3421	EU4950	EU7724
EU0082	EU0458	EU1495	EU3544 D A	EU5175 D	EU7888
EU0088	EU0476	EU1532	EU3598	EU5218	EU8520
EU0106	EU0482 D	EU1541 D	EU3654	EU5331	EU8969
EU0109	EU0498	EU1547	EU3684	EU5351	EU9145
EU0123	EU0568	EU1567	EU3725	EU5435	EU9158
EU0124	EU0689	EU1593	EU3781	EU5441	EU9234
EU0154	EU0711	EU1692	EU3803 D	EU5478	EU9245
EU0158	EU0802	EU1698	EU3859 D	EU5529	EU9544
EU0167	EU0807	EU1795 D	EU3874	EU5587 A	EU9680
EU0185	EU0826	EU1863	EU3908	EU5591	EU9729
EU0204	EU0875	EU1929	EU4002	EU5612	[183]
EU0209	EU0921	EU2043	EU4333	EU5613 A	
EU0234	EU0934	EU2123 D	EU4426	EU5777	

**Table 2, Quantity and Timeliness of AMDAR Reports**

<b>Summary</b>	
Number of days in this period	91
Number of aircraft reporting AMDAR	183
Number of E-AMDAR activated aircraft	182
Total number of observations evaluated during the period	1907037
Average daily number of aircraft reporting AMDAR	138 (76% of activated aircraft)
Percentage of data available within 60 minutes is	99.3%
Percentage of data available within 120 minutes is	99.8%
Average reports per day, per reporting aircraft is	152

<b>Legend</b>	
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

<b>AIRCRAFT</b>	<b>Total No of Reports</b>	<b>Days of Reports</b>	<b>Actual/possible</b>	<b>Average reports/day</b>	<b>0–45 min</b>	<b>0–60 min</b>	<b>0–120 min</b>
EU0002	11820	81	89%	146	98.9%	99.1%	99.9%
EU0003	9840	69	76%	143	98.7%	99.0%	99.8%
EU0008	9435	70	77%	135	98.8%	99.2%	100.0%
EU0021	9171	83	91%	110	99.2%	99.4%	100.0%
EU0022	11126	77	85%	144	99.4%	99.5%	100.0%
EU0032	3884	77	85%	50	99.8%	99.8%	100.0%
EU0034	3350	73	80%	46	100.0%	100.0%	100.0%
EU0041	22582	89	98%	254	99.0%	99.4%	99.6%
EU0043	22076	88	97%	251	99.2%	99.4%	100.0%
EU0045	11666	74	81%	158	98.5%	98.7%	99.7%
EU0047	24686	89	98%	277	99.6%	99.7%	99.9%
EU0049	10331	81	89%	128	99.7%	99.7%	100.0%
EU0051	4193	51	56%	82	99.4%	99.4%	99.4%
EU0054	6669	74	81%	90	100.0%	100.0%	100.0%
EU0055	12776	85	93%	150	99.7%	99.8%	100.0%
EU0060	5445	65	71%	84	98.4%	98.7%	99.3%

<b>AIRCRAFT</b>	<b>Total No of Reports</b>	<b>Days of Reports</b>	<b>Actual/ possible</b>	<b>Average reports/ day</b>	<b>0–45 min</b>	<b>0–60 min</b>	<b>0–120 min</b>
EU0072	10992	85	93%	129	99.4%	99.7%	100.0%
EU0081	10481	74	81%	142	99.2%	99.4%	99.9%
EU0082	10768	71	78%	152	98.9%	100.0%	100.0%
EU0088	14229	84	92%	169	99.3%	99.5%	99.9%
EU0106	23867	85	93%	281	99.2%	99.3%	99.4%
EU0109	11748	86	95%	137	99.2%	99.5%	99.9%
EU0123	9786	74	81%	132	98.6%	99.0%	99.6%
EU0124	9698	64	70%	152	99.8%	99.8%	100.0%
EU0154	25168	87	96%	289	99.0%	99.2%	99.9%
EU0158	25072	87	96%	288	99.2%	99.4%	99.7%
EU0167	20835	85	93%	245	99.3%	99.4%	99.8%
EU0185	24956	87	96%	287	98.6%	99.0%	99.7%
EU0204	11373	79	87%	144	99.4%	99.4%	100.0%
EU0209	2987	74	81%	40	99.6%	99.6%	100.0%
EU0234	11537	78	86%	148	98.2%	98.8%	100.0%
EU0249	12043	81	89%	149	99.3%	99.5%	99.8%
EU0254	10484	81	89%	129	99.6%	99.7%	100.0%
EU0263	10450	83	91%	126	99.5%	99.5%	100.0%
EU0299	11945	80	88%	149	99.2%	99.8%	100.0%
EU0301	10755	83	91%	130	98.9%	99.0%	100.0%
EU0303	22417	77	85%	291	99.4%	99.5%	99.7%
EU0307	24013	90	99%	267	99.3%	99.5%	100.0%
EU0311	19526	87	96%	224	99.1%	99.1%	100.0%
EU0313	19546	89	98%	220	99.4%	99.7%	99.9%
EU0316	24465	90	99%	272	99.4%	99.6%	99.9%
EU0319	22792	88	97%	259	98.9%	99.2%	99.7%
EU0332	6385	51	56%	125	98.9%	99.1%	99.9%
EU0359	25476	89	98%	286	99.3%	99.4%	99.9%
EU0367	9718	64	70%	152	99.4%	99.4%	100.0%
EU0372	4428	38	42%	117	98.7%	99.1%	99.7%
EU0432	12751	85	93%	150	99.6%	99.8%	100.0%
EU0456	22672	85	93%	267	98.8%	99.0%	99.6%
EU0457	5117	77	85%	66	98.1%	98.3%	99.8%
EU0458	23634	85	93%	278	98.9%	99.1%	99.7%
EU0476	23942	85	93%	282	99.3%	99.4%	99.8%
EU0482	6351	56	62%	113	99.4%	99.6%	100.0%
EU0498	1079	15	16%	72	100.0%	100.0%	100.0%
EU0568	17210	39	43%	441	96.2%	96.2%	99.4%
EU0689	1130	20	22%	57	98.7%	99.3%	100.0%
EU0711	24481	82	90%	299	99.7%	99.7%	99.9%
EU0802	24911	84	92%	297	98.6%	98.8%	99.8%
EU0807	6674	72	79%	93	99.7%	99.9%	100.0%
EU0826	10668	77	85%	139	99.6%	99.8%	100.0%
EU0875	23575	83	91%	284	98.9%	99.1%	99.6%
EU0921	24528	90	99%	273	98.9%	99.1%	99.9%
EU0934	8318	59	65%	141	98.3%	98.7%	99.1%

<b>AIRCRAFT</b>	<b>Total No of Reports</b>	<b>Days of Reports</b>	<b>Actual/ possible</b>	<b>Average reports/ day</b>	<b>0–45 min</b>	<b>0–60 min</b>	<b>0–120 min</b>
EU0947	12055	79	87%	153	98.9%	99.4%	99.8%
EU0961	10827	71	78%	152	97.4%	98.3%	99.5%
EU0985	10422	73	80%	143	97.8%	98.1%	99.4%
EU1001	9673	72	79%	134	99.7%	99.7%	100.0%
EU1002	11689	75	82%	156	98.4%	98.8%	99.6%
EU1222	5113	38	42%	135	97.8%	98.2%	99.8%
EU1234	22712	85	93%	267	99.3%	99.5%	100.0%
EU1275	3549	50	55%	71	99.8%	99.8%	100.0%
EU1282	1879	54	59%	35	98.8%	98.8%	99.6%
EU1301	3817	65	71%	59	99.0%	99.6%	100.0%
EU1312	5646	79	87%	71	99.4%	99.5%	100.0%
EU1334	4827	73	80%	66	98.4%	98.6%	99.6%
EU1345	977	46	51%	21	99.2%	99.2%	100.0%
EU1367	2856	52	57%	55	99.7%	99.7%	100.0%
EU1389	2868	45	49%	64	98.2%	98.6%	99.3%
EU1411	2255	52	57%	43	99.0%	99.4%	100.0%
EU1436	2765	46	51%	60	99.3%	99.3%	99.7%
EU1456	11065	75	82%	148	99.0%	99.0%	99.5%
EU1495	10627	71	78%	150	98.7%	99.2%	99.7%
EU1532	12594	83	91%	152	99.4%	99.7%	99.8%
EU1541	3107	45	49%	69	98.1%	99.1%	99.7%
EU1547	25464	86	95%	296	98.9%	99.3%	99.8%
EU1567	12654	84	92%	151	99.6%	99.8%	100.0%
EU1593	8847	80	88%	111	98.1%	98.8%	99.7%
EU1692	1976	56	62%	35	96.5%	96.5%	99.5%
EU1698	10990	79	87%	139	99.6%	99.7%	100.0%
EU1795	2109	47	52%	45	99.1%	99.5%	100.0%
EU1863	24793	82	90%	302	99.3%	99.6%	100.0%
EU1929	2460	56	62%	44	98.8%	98.8%	99.6%
EU2043	1804	46	51%	39	97.3%	97.3%	100.0%
EU2123	3162	47	52%	67	98.4%	99.1%	99.7%
EU2189	21857	77	85%	284	99.1%	99.5%	99.6%
EU2301	22495	89	98%	253	99.2%	99.6%	100.0%
EU2389	6509	43	47%	151	98.7%	99.1%	99.9%
EU2547	12652	82	90%	154	97.7%	98.6%	99.5%
EU2559	24645	90	99%	274	99.5%	99.7%	99.8%
EU2590	9382	81	89%	116	98.9%	99.9%	100.0%
EU2618	9369	82	90%	114	98.1%	98.4%	99.8%
EU2630	1527	47	52%	32	100.0%	100.0%	100.0%
EU2751	2597	59	65%	44	98.6%	98.6%	99.3%
EU2773	4457	72	79%	62	99.6%	99.6%	100.0%
EU2845	13818	84	92%	165	99.4%	99.6%	100.0%
EU2984	1807	37	41%	49	98.6%	98.6%	98.6%
EU3000	13345	71	78%	188	98.8%	99.1%	99.4%
EU3181	6431	74	81%	87	98.8%	99.2%	99.7%
EU3257	20969	82	90%	256	99.2%	99.3%	99.9%

<b>AIRCRAFT</b>	<b>Total No of Reports</b>	<b>Days of Reports</b>	<b>Actual/ possible</b>	<b>Average reports/ day</b>	<b>0–45 min</b>	<b>0–60 min</b>	<b>0–120 min</b>
EU3268	2505	50	55%	50	98.5%	99.4%	100.0%
EU3321	4617	51	56%	91	97.1%	98.3%	99.2%
EU3421	23501	87	96%	270	99.2%	99.4%	99.8%
EU3544	18457	54	59%	342	99.8%	100.0%	100.0%
EU3598	14604	81	89%	180	98.7%	98.9%	100.0%
EU3654	7198	74	81%	97	98.4%	99.2%	100.0%
EU3684	5224	60	66%	87	98.1%	98.5%	100.0%
EU3725	3171	56	62%	57	98.5%	99.1%	99.1%
EU3781	4149	74	81%	56	97.2%	98.5%	99.0%
EU3803	2480	34	37%	73	99.3%	99.6%	100.0%
EU3859	2412	51	56%	47	98.4%	99.2%	100.0%
EU3874	2344	49	54%	48	98.0%	98.8%	99.6%
EU3908	12058	82	90%	147	98.2%	99.0%	99.6%
EU4002	4370	55	60%	79	98.7%	98.9%	99.9%
EU4333	8328	78	86%	107	98.9%	99.5%	99.8%
EU4426	9767	75	82%	130	99.1%	99.4%	99.9%
EU4444	6436	69	76%	93	99.1%	99.2%	100.0%
EU4519	6648	74	81%	90	98.3%	98.7%	99.7%
EU4527	25028	74	81%	338	99.5%	99.5%	99.8%
EU4529	13889	84	92%	165	99.2%	99.6%	99.9%
EU4532	22867	78	86%	293	99.4%	99.4%	99.9%
EU4573	10840	72	79%	151	98.0%	98.8%	99.7%
EU4582	6623	43	47%	154	98.8%	99.2%	100.0%
EU4587	2962	70	77%	42	99.3%	99.3%	100.0%
EU4591	7376	71	78%	104	99.3%	99.9%	100.0%
EU4593	22732	87	96%	261	99.1%	99.2%	99.6%
EU4607	7749	73	80%	106	98.7%	99.2%	99.8%
EU4699	6831	63	69%	108	98.3%	98.9%	99.6%
EU4721	4538	68	75%	67	98.6%	99.4%	99.9%
EU4756	1247	24	26%	52	100.0%	100.0%	100.0%
EU4792	2435	59	65%	41	99.2%	100.0%	100.0%
EU4853	7417	76	84%	98	97.4%	98.7%	99.5%
EU4865	7817	79	87%	99	97.9%	98.7%	99.3%
EU4950	2641	59	65%	45	98.1%	99.1%	99.9%
EU5175	49	2	2%	25	100.0%	100.0%	100.0%
EU5218	12683	85	93%	149	99.4%	99.6%	100.0%
EU5331	17184	79	87%	218	99.0%	99.6%	99.8%
EU5351	21017	79	87%	266	99.5%	99.7%	99.9%
EU5435	17733	83	91%	214	99.8%	99.9%	100.0%
EU5441	5473	56	62%	98	99.0%	99.2%	99.7%
EU5478	12167	81	89%	150	98.3%	99.0%	99.9%
EU5529	12892	86	95%	150	97.3%	98.8%	99.5%
EU5587	14604	45	49%	325	99.8%	99.9%	100.0%
EU5591	3945	55	60%	72	99.2%	99.2%	100.0%
EU5612	7970	75	82%	106	97.6%	98.3%	99.4%
EU5613	12174	37	41%	329	99.5%	99.7%	100.0%

AIRCRAFT	Total No of Reports	Days of Reports	Actual/ possible	Average reports/ day	0–45 min	0–60 min	0–120 min
EU5777	7856	77	85%	102	98.8%	99.1%	99.6%
EU5802	7590	76	84%	100	97.3%	97.9%	99.2%
EU5821	8151	79	87%	103	97.4%	98.9%	99.9%
EU5891	13089	42	46%	312	99.2%	99.6%	100.0%
EU6264	7593	70	77%	108	99.1%	99.9%	99.9%
EU6281	8354	78	86%	107	98.0%	98.6%	99.4%
EU6349	2614	52	57%	50	98.3%	98.7%	99.1%
EU6444	3045	68	75%	45	96.8%	98.6%	99.8%
EU6524	13496	81	89%	167	99.4%	99.7%	100.0%
EU6527	5045	59	65%	86	98.2%	98.8%	99.4%
EU6544	11614	44	48%	264	99.3%	99.3%	100.0%
EU6556	11557	45	49%	257	98.9%	99.2%	100.0%
EU6821	2212	45	49%	49	100.0%	100.0%	100.0%
EU6890	3227	66	73%	49	98.2%	98.5%	99.9%
EU7218	3590	47	52%	76	99.2%	100.0%	100.0%
EU7629	4009	47	52%	85	98.5%	98.8%	99.9%
EU7643	5292	57	63%	93	99.2%	99.4%	100.0%
EU7654	2197	53	58%	41	99.1%	99.9%	100.0%
EU7724	5296	63	69%	84	98.9%	99.4%	100.0%
EU7888	6419	64	70%	100	98.5%	98.7%	99.9%
EU8520	3497	54	59%	65	97.7%	98.3%	99.8%
EU8969	5095	62	68%	82	96.8%	97.7%	99.2%
EU9145	4109	56	62%	73	99.7%	100.0%	100.0%
EU9158	11787	75	82%	157	99.2%	99.8%	99.8%
EU9234	7192	72	79%	100	99.4%	99.7%	100.0%
EU9245	8697	79	87%	110	98.3%	99.0%	100.0%
EU9544	8379	76	84%	110	98.9%	99.5%	99.7%
EU9680	3233	60	66%	54	99.2%	99.2%	100.0%
EU9729	2177	44	48%	49	99.0%	99.0%	100.0%

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

**Identifier**

EU2984

**Table 3, Description and number of errors**

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**Aircraft with parameter anomalies:**

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*Aircraft deactivated due to temperature anomalies*

- EU3544: Deactivated April 4<sup>th</sup>. Temperature readings suspect due to probable malfunction of ACARS Met Unit.
- EU1795: Deactivated May, 30<sup>th</sup>
- EU2123: Deactivated May, 23<sup>rd</sup>

*Warm temperature biases were noted on the following aircraft*

- EU0032: Occasionally warm temperature bias in April.
- EU0041: Warm temperature bias (1,5 °C) since September, 20<sup>th</sup> 2000. Consistent bias during this quarter.
- EU0158: Warm temperature bias (1 °C) in June 2001.
- EU0316: Warm temperature bias (1 °C) since December 2000. Consistent bias during this quarter.
- EU1334: Occasionally warm temperature bias in April.
- EU1541: Occasionally warm temperature bias in April.
- EU1795: Warm temperature bias (1,5 °C) since December 2000. Consistent bias during April and May. Aircraft deactivated May, 30<sup>th</sup>.
- EU2123: Warm temperature bias (1 °C) since April, 4<sup>th</sup> 2001. Frequent bias in April and May. Aircraft deactivated May, 23<sup>rd</sup>.
- EU3421: Warm temperature bias (1 °C) since June, 26<sup>th</sup> 2000. (Operator informed). Consistent bias during this quarter.
- EU3781: Warm temperature bias (2-3 °C) since May, 6<sup>th</sup>, 2001. Operator to arrange sensor inspection during July.
- EU4582: Warm temperature bias (1 °C) since January 1<sup>st</sup>, 2001. Frequent bias during this quarter.
- EU4593: Warm temperature bias (1,5 °C) since March 14<sup>th</sup>, 2001 Consistent warm bias during this quarter.
- EU5435: Warm temperature bias (1 °C) since March, 13<sup>th</sup> 2001. Frequent bias during this quarter.
- EU6444: Warm temperature bias (2 °C, occasionally 3°C) since November, 26<sup>th</sup> 2000. Consistent bias during this quarter. (information passed to operator).
- EU6544: Warm temperature bias (1.5 °C) since May 16<sup>th</sup>, 2001.

*Consistent warm temperature biases were noted on the following aircraft*

- 1 to 2°C EU0041, EU0158, EU0316, EU1795, EU2123, EU3421, EU4582, EU4593, EU5435, EU6544
- >2°C EU6444, EU3781.

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**No reports received although expected:**

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- EU0003: no reports April 1<sup>st</sup> - 5<sup>th</sup> maintenance (continued from last month). No reports June 1<sup>st</sup> - 5<sup>th</sup> reinitiated by operator.
  - EU0008: no reports April 1<sup>st</sup> - 9<sup>th</sup> major maintenance (continued from last month).
  - EU0022: no reports June 7<sup>th</sup> - 15<sup>th</sup> (maintenance).
  - EU0045: no reports April 2<sup>nd</sup> - 11<sup>th</sup> aircraft (reactivated by operator).
  - EU0051: no reports April 22<sup>nd</sup> - 29<sup>th</sup>, May 19<sup>th</sup> - 27<sup>th</sup>, June 15<sup>th</sup> - 28<sup>th</sup> (maintenance).
  - EU0054: no reports June 1<sup>st</sup> - 9<sup>th</sup> maintenance (continued from last month).
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- EU0060: no reports June 4<sup>th</sup> -20<sup>th</sup> (maintenance).
  - EU0081: no reports June 16<sup>th</sup> - 24<sup>th</sup> (maintenance).
  - EU0082: no reports April 21<sup>st</sup> - 30<sup>th</sup> maintenance.
  - EU0123: no reports May 2<sup>nd</sup> - 8<sup>th</sup> (reactivated by operator).
  - EU0124: no reports May 1<sup>st</sup> - 15<sup>th</sup> (maintenance).
  - EU0167: no reports May 12<sup>th</sup> - 17<sup>th</sup> (maintenance).
  - EU0234: no reports May 7<sup>th</sup> - 13<sup>th</sup> (maintenance).
  - EU0303: no reports June 19<sup>th</sup> - 30<sup>th</sup> (maintenance).
  - EU0367: no reports June 1<sup>st</sup> 13<sup>th</sup> (major maintenance whilst in Portugal)
  - EU0372: no reports April 1<sup>st</sup> - 12<sup>th</sup> (software problems. Reconfigured by operator).
  - EU0498: no reports April 20<sup>th</sup> - 30<sup>th</sup> (maintenance), no reports May 1<sup>st</sup> - June 30<sup>th</sup> (rotation of reporting aircraft - budgetary constraints)
  - EU0568: no reports April 1<sup>st</sup> - 18<sup>th</sup> (DMU problems)
  - EU0568: no reports April 22<sup>nd</sup> - 30<sup>th</sup> (maintenance).
  - EU0568: no reports May 1<sup>st</sup> - 18<sup>th</sup> (DMU problems - unit replaced)
  - EU0689: no reports May 1<sup>st</sup> - June 30<sup>th</sup> (rotation of reporting aircraft - budgetary constraints).
  - EU0807: no reports June 5<sup>th</sup> - 14<sup>th</sup> (clock in error, reset by operator.)
  - EU0934: no reports June 3<sup>rd</sup> - 14<sup>th</sup> (reinitiated by operator); June 25<sup>th</sup> - 30<sup>th</sup>
  - EU0961: no reports May 1<sup>st</sup> - 8<sup>th</sup> (maintenance).
  - EU1001: no reports June 1<sup>st</sup> - 10<sup>th</sup> (maintenance)
  - EU1222: no reports April 14<sup>th</sup> - 26<sup>th</sup> (maintenance), May 11<sup>th</sup> - June 20<sup>th</sup> (major maintenance).
  - EU1282: no reports May 14<sup>th</sup> - June 5<sup>th</sup> (maintenance)
  - EU1367: no reports April 1<sup>st</sup> - 6<sup>th</sup> maintenance (continued from first quarter) and April 20<sup>th</sup> - 30<sup>th</sup> (maintenance)
  - EU1411: no reports May 11<sup>th</sup> - 31<sup>st</sup> (maintenance)
  - EU1456: no reports April 8<sup>th</sup> - 14<sup>th</sup> (maintenance)
  - EU1495: no reports April 13<sup>th</sup> - 27<sup>th</sup> (maintenance).
  - EU1593: no reports May 22<sup>nd</sup> - 27<sup>th</sup> (maintenance).
  - EU1692: no reports June 11<sup>th</sup> - 15<sup>th</sup> (maintenance).
  - EU1863: no reports April 13<sup>th</sup> - 18<sup>th</sup> (maintenance).
  - EU1929: no reports April 6<sup>th</sup> - 24<sup>th</sup> (maintenance).
  - EU2043: no reports May 1<sup>st</sup> - 14<sup>th</sup> (maintenance).
  - EU2389: no reports April 20<sup>th</sup> - May 29<sup>th</sup> (maintenance).
  - EU2547: no reports June 1<sup>st</sup> - 5<sup>th</sup> (reinitiated by operator)
  - EU2630: no reports April 3<sup>rd</sup> - 24<sup>th</sup> (maintenance).
  - EU2751: no reports May 21<sup>st</sup> - 26<sup>th</sup> (maintenance).
  - EU2984: no reports April 24<sup>th</sup> - May 12<sup>th</sup>, May 14<sup>th</sup> - 19<sup>th</sup>, May 23<sup>rd</sup> - 31<sup>st</sup> (maintenance).
  - EU3000: no reports June 6<sup>th</sup> - 10<sup>th</sup> (maintenance).
  - EU3268: no reports June 9<sup>th</sup> - 13<sup>th</sup> (maintenance).
  - EU3321: no reports June 16<sup>th</sup> - 22<sup>nd</sup> (maintenance).
  - EU3544: no reports May 1<sup>st</sup> - 7<sup>th</sup> DMU replaced ( continued from last month).
  - EU3684: no reports April 4<sup>th</sup> - 14<sup>th</sup> (maintenance).
  - EU3725: no reports June 8<sup>th</sup> - 21<sup>st</sup> (maintenance).
  - EU3874: no reports May 7<sup>th</sup> - 17<sup>th</sup> (maintenance).
  - EU4002: no reports May 24<sup>th</sup> - 28<sup>th</sup> (maintenance).
  - EU4426: no reports June 12<sup>th</sup> - 20<sup>th</sup> (maintenance).
  - EU4527: no reports April 1<sup>st</sup> - 16<sup>th</sup> (major maintenance)
  - EU4573: o reports May 21<sup>st</sup> - 31<sup>st</sup> (maintenance).
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- EU4582: no reports April 1<sup>st</sup> - May 20<sup>th</sup> (maintenance).
- EU4587: no reports May 19<sup>th</sup> - 26<sup>th</sup> (maintenance).
- EU4699: no reports June 22<sup>nd</sup> - 30<sup>th</sup> (maintenance).
- EU4792: no reports June 1<sup>st</sup> - 5<sup>th</sup>, June 15<sup>th</sup> - 23<sup>rd</sup> (maintenance).
- EU5351: no reports April 17<sup>th</sup> - 25<sup>th</sup> (maintenance).
- EU5441: no reports June 1<sup>st</sup> - 8<sup>th</sup> (maintenance).
- EU5613: no reports May 19<sup>th</sup> - 25<sup>th</sup> (maintenance).
- EU6349: no reports April 23<sup>rd</sup> - May 7<sup>th</sup> (maintenance)
- EU6444: no reports June 2<sup>nd</sup> - 9<sup>th</sup> (maintenance)
- EU6527: no reports June 10<sup>th</sup> - 18<sup>th</sup> (maintenance).
- EU7218: no reports May 1<sup>st</sup> - 7<sup>th</sup>, June 23<sup>rd</sup> - 30<sup>th</sup> (maintenance).
- EU7643: no reports April 7<sup>th</sup> - 15<sup>th</sup> (maintenance).
- EU7888: no reports June 17<sup>th</sup> - 22<sup>nd</sup> (maintenance).
- EU9145: no reports June 4<sup>th</sup> - 19<sup>th</sup> (maintenance)
- EU9158: no reports April 12<sup>th</sup> - 22<sup>nd</sup> (maintenance).
- EU9729: no reports April 13<sup>th</sup> - 19<sup>th</sup> (maintenance).

#### Specific problems:

- EU0051: May 6th - 7th on board clock in error.

#### Ground stations issues and other problems:

- AF: Software monitoring problems resulting in low data returns May 2nd and no data May 3rd Problem resolved May 4th
- LH: -New software implemented in the ground processing system May 10th - this software will resolve the problem of overlength BUFR messages.  
- strike action by Lufthansa pilots May 10th, May 17th - reduction in totals (80% of European and domestic flights were cancelled on the 10th).
- SAS: - During June, new ACMS software installation being carried out on the B737 fleet, bulletin capacity increased from 1-4 reports to 1-10 reports.  
- During June, new ACMS software installation being carried out on the B767 fleet (software upgrade will remove date timestamp errors).  
- wef 12:00UTC May 21<sup>st</sup> AMDAR data from SAS aircraft are being processed by the E-ADAS at Bracknell.
- Bracknell (E-ADAS) - data processing problems during period June 24/1637 - 25/1034UTC, data from BA and SAS not processed onto the GTS. Problem was resolved by development team. Data totals from BA and SAS were decreased during the period by approx 18%.

#### Activated and deactivated aircraft:

- The following aircraft was activated as part of the E-AMDAR Optimisation Plan on April 1<sup>st</sup>:  
EU4591
- The following aircraft were activated on May 16<sup>th</sup> as part of E-AMDAR Fleet Configuration Plan: EU5587, EU5613, EU5891, EU6544 and EU6556.
- The following aircraft were deactivated due to budgetary constraints:
  - May 21<sup>st</sup>: EU1275
  - May 22<sup>nd</sup>: EU0332, EU0372, EU1345, EU1389, EU1436, EU3803
  - May 23<sup>rd</sup>: EU1541, EU2123
  - May 29<sup>th</sup>: EU3859
  - May 30<sup>th</sup>: EU0482, EU1795

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- EU3544: Deactivated April 4<sup>th</sup>, temperature readings suspect due to probable malfunction of ACARS Met Unit.
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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 ( $i_p i_p i_p = \text{ASC or DES}$ )
- 2) Cruise level, level flight at cruising height ( $i_p i_p i_p = \text{LVR or LVW}$ )

Notes:

- Data with  $i_p i_p i_p = \text{UNS or ///}$  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  $\langle |\Delta DD| \rangle (= \text{AVG}(\text{ABS}(\text{DD\_OBS} - \text{DD\_MOD})))$  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) Table 4, *Temperature (°C)*

AIRCRAFT	Temperature Cruise level in °C					Temperature Ascent & Descent in °C				
	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU0002						10002	-11.0	17.9	-0.2	1.0
EU0003	5624	-46.7	10.6	-0.2	1.5	3061	4.7	14.3	-0.1	1.0
EU0008	5667	-49.3	8.7	-0.1	1.7	2434	-0.5	12.7	-0.1	1.1
EU0021	1198	-44.7	14.1	-0.5	1.2	6004	-3.4	11.4	-0.2	1.1
EU0022	1373	-48.4	14.3	0.1	1.3	7428	2.3	12.1	-0.2	1.2
EU0032	897	-45.7	13.9	0.0	0.9	2262	7.6	8.1	0.3	1.2
EU0034	699	-47.6	12.6	0.0	1.3	2023	7.3	8.0	0.0	1.3
EU0041	2147	-46.4	14.3	1.2	1.4	20435	-5.2	19.5	0.5	1.3
EU0043	1782	-46.7	14.5	0.9	1.3	20294	-7.0	19.9	0.3	1.1
EU0045	7092	-48.3	9.6	-0.3	1.6	3280	3.6	13.6	-0.2	1.0
EU0047	1797	-46.3	13.8	0.7	1.4	22889	-7.4	20.1	0.3	1.1
EU0049						8988	-16.5	19.9	-0.3	1.0
EU0051	805	-51.1	10.1	-0.4	1.3	2687	0.8	12.8	-0.4	1.2
EU0054	1246	-50.0	10.5	-0.3	1.3	4183	1.8	12.8	-0.2	1.3
EU0055						10849	-11.3	18.0	0.1	1.0
EU0060	3547	-46.2	8.9	-0.3	1.4	1414	11.4	9.9	0.0	1.1
EU0072	1012	-46.3	16.4	-0.1	2.6	7555	3.5	11.7	0.0	1.2
EU0081	1474	-49.0	13.4	0.2	2.0	6899	3.0	12.2	0.2	1.2
EU0082						9160	-10.4	17.6	0.2	1.0
EU0088	1531	-46.3	14.0	0.2	1.3	9757	3.2	12.1	0.0	1.2
EU0106	1244	-42.2	15.4	-0.3	1.2	22623	-7.0	19.1	-0.3	1.0
EU0109	1705	-48.5	13.9	0.2	2.1	7577	3.0	11.8	0.0	1.3
EU0123	5846	-49.6	8.5	0.1	1.6	2622	-2.6	12.9	0.0	1.1
EU0124						8255	-10.8	17.7	0.4	1.0
EU0154	1477	-45.1	15.1	-0.2	1.2	23691	-6.8	18.7	-0.5	1.0
EU0158	1567	-43.3	13.6	1.0	1.0	23505	-4.6	18.4	0.6	1.0
EU0167	1167	-41.7	15.3	1.5	4.7	19668	-4.6	18.8	1.0	2.9
EU0185	1242	-40.9	16.6	0.5	1.1	23714	-6.1	18.2	0.2	1.0
EU0204	2363	-50.9	11.2	0.4	1.5	6501	4.0	12.5	0.3	1.3
EU0209	466	-47.5	13.6	0.0	1.4	1915	7.5	7.7	0.0	1.2
EU0234						9847	-12.0	18.2	-0.1	1.0
EU0249	2444	-52.0	11.2	-0.1	1.4	6999	4.3	12.7	0.3	1.4
EU0254	5378	-49.9	7.8	0.5	1.8	4062	6.9	13.3	0.3	1.2
EU0263	5401	-50.1	8.0	0.1	1.6	3993	6.1	13.4	0.1	1.2
EU0299						10224	-14.3	18.8	-0.1	1.0
EU0301	936	-47.7	12.5	0.6	1.2	9819	-6.7	19.7	0.4	1.1
EU0303	1417	-45.8	15.4	-0.4	1.1	21000	-7.7	19.0	-0.4	1.0
EU0307	1564	-46.4	15.3	-0.5	1.3	22449	-6.9	18.9	-0.4	1.0
EU0311	1140	-43.0	13.5	0.4	1.0	18386	-5.8	18.5	0.2	1.0

2001-II 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
EU0313	1210	-43.9	15.0	0.6	1.1	18336	-5.3	18.1	0.4	1.1	
EU0316	1974	-46.2	14.1	1.2	1.4	22491	-6.6	19.8	0.7	1.2	
EU0319	2132	-47.3	14.8	0.1	1.2	20660	-6.2	19.7	0.1	1.1	
EU0332	3258	-52.1	7.5	-0.1	1.8	2517	3.6	12.8	0.0	1.1	
EU0359	1576	-43.1	15.0	0.6	1.0	23900	-5.4	18.1	0.3	1.0	
EU0367						8266	-12.8	17.7	-0.3	1.0	
EU0372	2430	-50.2	8.4	0.6	1.8	1594	3.9	13.2	0.1	1.0	
EU0432						11078	-14.8	19.3	-0.1	1.0	
EU0456	1285	-41.8	16.9	0.2	1.1	21387	-8.0	19.3	0.3	1.0	
EU0457	3812	-48.5	8.1	0.2	1.5	985	17.5	10.9			
EU0458	1382	-44.4	15.1	0.0	1.1	22252	-7.9	19.6	0.2	1.1	
EU0476	1301	-41.7	16.4	-0.1	1.1	22641	-8.3	19.7	0.1	1.1	
EU0482	3309	-51.6	8.0	-0.2	1.6	2415	4.8	12.6	0.0	1.2	
EU0498	283	-47.5	11.9	0.1	1.6	601	5.8	9.1	-0.1	0.9	
EU0568						15316	-12.4	20.8	0.2	1.0	
EU0689	337	-47.0	11.5	0.0	0.9	610	6.1	8.6	-0.1	1.0	
EU0711	1295	-41.0	17.2	-0.1	1.1	23186	-7.5	19.2	0.0	1.0	
EU0802	1408	-43.7	14.3	0.4	1.1	23503	-5.4	18.2	0.2	1.0	
EU0807	1617	-48.3	9.8	-0.3	1.1	3843	2.4	13.5	-0.3	1.4	
EU0826						9133	-11.3	17.6	-0.1	1.0	
EU0875	1316	-43.5	14.1	0.7	1.1	22259	-6.3	18.3	0.4	1.0	
EU0921	1404	-44.2	14.9	0.3	1.2	23124	-6.1	18.9	-0.2	1.1	
EU0934	5289	-49.4	8.8	-0.3	1.5	2118	2.1	13.6	-0.2	1.1	
EU0947	7207	-47.7	10.4	-0.4	1.5	3495	3.4	14.5	-0.2	1.1	
EU0961	6439	-46.6	10.7	0.0	1.5	3112	3.8	14.4	-0.1	1.2	
EU0985	6810	-50.2	7.9	-0.3	1.6	2511	-0.9	12.7	-0.3	1.0	
EU1001						8274	-18.3	19.9	-0.3	1.0	
EU1002	7862	-50.0	6.4	-0.2	1.6	2813	-1.6	12.6	-0.2	1.0	
EU1222	3225	-50.2	8.2	-0.4	1.6	1282	-0.1	13.7	-0.2	1.2	
EU1234	1292	-45.2	14.7	-0.5	1.2	21420	-7.5	19.2	-0.4	1.0	
EU1275	2589	-49.0	8.6	0.5	1.6	701	17.9	11.3			
EU1282	1644	-49.5	7.2	-0.2	1.6	161	10.7	10.2			
EU1301	1809	-43.3	9.4	0.1	1.3	1465	12.5	9.4			
EU1312	3405	-44.1	9.7	0.3	1.2	1649	9.0	10.5	0.1	1.0	
EU1334	3988	-47.5	7.9	0.2	1.6	666	4.6	11.5			
EU1345	968	-52.7	6.6	0.7	1.8						
EU1367	2473	-48.2	7.8	0.4	1.7	287	8.9	10.9			
EU1389	2673	-50.1	7.2	0.1	1.8	115	7.6	8.0			
EU1411	1986	-46.9	7.8	0.1	1.6	164	6.0	7.5			
EU1436	2356	-49.9	8.3	0.4	1.6	275	14.6	10.4			
EU1456						9233	-16.6	19.8	0.5	1.0	

2001-II 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
EU1495	6682	-50.5	9.2	-0.2	1.7	2628	-0.3	12.9	0.0	1.0	
EU1532						10811	-11.8	17.8	-0.2	1.0	
EU1541	2399	-48.2	7.6	0.6	1.5	549	5.7	12.5			
EU1547	1370	-43.4	16.7	-0.1	1.3	24094	-6.9	19.0	-0.3	1.0	
EU1567						10858	-13.6	19.0	-0.2	1.0	
EU1593	5303	-50.1	8.0	-0.3	1.6	2339	-2.7	13.2	-0.1	1.2	
EU1692	481	-46.8	11.0	-0.1	1.2	1142	-3.8	12.9	0.0	1.2	
EU1698						9284	-11.2	17.6	0.1	1.0	
EU1795	1761	-46.4	8.5	0.7	1.5	275	10.5	11.3			
EU1863	1426	-45.5	14.3	-0.4	1.1	23367	-6.6	19.1	-0.4	1.0	
EU1929	2342	-50.5	5.8	0.2	1.8	71	10.7	8.4			
EU2043	1562	-47.2	7.8	0.3	1.5	179	8.7	7.5			
EU2123	2977	-49.9	7.0	0.7	1.7	129	9.4	7.9			
EU2189	1209	-43.5	13.8	0.7	1.2	20648	-6.6	18.6	0.4	1.2	
EU2301	1826	-47.0	13.8	0.7	1.4	20669	-6.7	19.7	0.2	1.1	
EU2389	556	-41.6	15.6	-0.6	1.1	4506	1.9	12.2	-0.3	1.1	
EU2547	7470	-48.1	10.6	0.0	1.6	3674	2.4	14.3	0.0	1.1	
EU2559	2040	-47.7	12.9	1.1	1.4	22605	-7.0	20.2	0.5	1.1	
EU2590	822	-41.1	8.1	0.3	1.2	8559	-7.7	16.6	0.0	1.2	
EU2618	586	-42.6	9.0	0.3	1.2	8783	-8.1	16.2	-0.2	1.1	
EU2630	346	-51.7	6.5	0.5	1.4	1174	-10.5	20.0	-0.2	1.2	
EU2751	2101	-45.3	8.5	0.0	1.5	344	8.5	10.9			
EU2773	3789	-46.9	7.9	0.2	1.6	497	6.6	11.3			
EU2845	2260	-46.7	11.3	-0.1	1.0	8977	3.2	12.3	-0.2	1.2	
EU2984	230	-49.4	7.6	0.8	1.3	1577	-9.0	18.0	-0.3	1.3	
EU3000	838	-43.5	16.0	-0.3	1.7	12507	-6.9	18.8	-0.2	1.8	
EU3181	4313	-44.6	8.9	0.0	1.3	1539	12.1	9.3			
EU3257	1065	-42.4	16.4	-0.3	1.2	19904	-6.4	18.9	-0.5	1.0	
EU3268	300	-48.2	9.5	0.1	1.4	2205	-9.3	18.2	-0.4	1.1	
EU3321	971	-49.9	10.2	0.2	1.3	3646	-7.0	18.8	-0.4	1.2	
EU3421	1773	-47.0	13.2	1.4	1.3	21728	-6.5	19.7	0.7	1.1	
EU3544	500	-29.5	24.6	-0.2	4.2	17957	-7.7	19.3	-0.6	5.5	
EU3598	586	-38.9	18.7	0.0	1.1	14018	-8.7	19.5	0.1	1.0	
EU3654	777	-43.9	8.6	0.2	1.1	6419	-8.5	17.2	-0.3	1.2	
EU3684	1007	-48.8	9.4	1.4	1.6	4217	-6.7	18.9	0.0	1.2	
EU3725	2552	-47.1	7.7	-0.1	1.6	454	8.8	10.4			
EU3781	2436	-46.9	9.3	0.8	1.9	1246	13.4	9.3			
EU3803	1260	-40.8	9.6	0.1	1.1	898	11.9	9.4			
EU3859	1963	-45.7	8.7	0.3	1.5	317	11.2	10.2			
EU3874	1863	-42.9	8.3	0.1	1.3	351	7.3	8.7			
EU3908	1045	-44.8	7.3	0.9	1.6	11013	-9.2	17.0	-0.2	1.1	

2001-II 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	693	-49.8	9.3	0.6	1.3	3677	-7.7	18.7	-0.1	1.1	
EU4333	471	-42.6	7.7	0.5	1.2	7857	-7.5	16.0	0.0	1.1	
EU4426	891	-41.6	15.4	-0.5	1.0	6594	2.1	11.9	-0.3	1.2	
EU4444	686	-45.6	8.3	-0.3	1.2	5749	-9.2	17.3	-0.3	1.2	
EU4519	782	-43.5	9.0	0.3	1.1	5864	-8.7	16.8	-0.1	1.2	
EU4527	668	-29.4	22.8	0.2	1.1	24360	-7.9	19.3	0.2	1.0	
EU4529	2166	-46.5	11.3	-0.3	1.1	9261	3.8	12.2	-0.2	1.2	
EU4532	526	-25.4	23.7	0.3	1.0	22341	-7.9	18.7	0.2	1.0	
EU4573	857	-46.9	5.6	0.7	1.4	9983	-9.1	17.3	-0.1	1.2	
EU4582	649	-42.5	7.1	1.1	1.3	5974	-7.2	17.0	0.4	1.1	
EU4587	672	-45.4	10.7	0.2	1.2	1774	-2.1	12.5	0.2	1.0	
EU4591	912	-46.9	6.9	0.4	1.2	6464	-11.3	17.4	-0.2	1.2	
EU4593	1763	-46.0	13.8	1.6	1.4	20969	-6.5	19.7	0.9	1.0	
EU4607	965	-45.0	8.6	0.6	1.2	6784	-10.2	17.7	0.2	1.3	
EU4699	835	-46.1	7.7	-0.1	1.1	5996	-11.0	17.3	-0.3	1.3	
EU4721	837	-50.5	6.9	0.5	1.4	3701	-10.2	18.5	-0.2	1.1	
EU4756	311	-45.4	10.4	0.1	0.9	641	13.9	8.6	0.3	1.3	
EU4792	622	-52.5	7.6	0.0	1.2	1813	-10.7	19.2	-0.3	1.2	
EU4853	765	-47.5	7.5	0.1	1.2	6651	-8.3	17.0	-0.4	1.3	
EU4865	905	-47.6	7.3	0.3	1.2	6912	-10.3	17.8	-0.1	1.3	
EU4950	665	-49.2	8.0	1.1	1.4	1976	-10.1	19.8	0.0	1.2	
EU5175	2	-53.7	2.0	-0.2	0.1	37	5.2	6.9	0.0	1.2	
EU5218	985	-42.3	14.8	0.1	1.0	8748	1.9	12.0	-0.1	1.2	
EU5331	1521	-45.7	13.8	1.0	1.4	15663	-5.3	19.9	0.6	1.3	
EU5351	1231	-43.1	14.9	0.4	1.1	19786	-4.6	18.1	0.2	1.0	
EU5435	1133	-43.2	13.6	1.2	1.0	16600	-4.4	18.1	0.8	1.1	
EU5441	916	-47.9	8.2	1.3	1.5	4556	-8.0	18.5	-0.1	1.2	
EU5478	960	-47.2	7.1	0.1	1.4	11207	-9.9	16.7	-0.4	1.1	
EU5529	1229	-46.5	7.5	0.7	1.4	11663	-9.9	16.8	-0.2	1.1	
EU5587	669	-39.4	16.3	1.1	1.0	13935	-3.8	17.9	0.5	1.0	
EU5591	491	-42.6	12.3	-0.1	1.1	2575	2.4	13.0	-0.1	1.2	
EU5612	917	-47.3	9.2	-0.3	1.2	7049	-10.7	17.5	-0.3	1.3	
EU5613	629	-40.5	14.7	1.0	1.1	11545	-3.2	18.0	0.7	1.0	
EU5777	1042	-46.1	8.1	0.5	1.2	6814	-10.9	17.4	-0.1	1.3	
EU5802	878	-46.3	8.6	-0.1	1.1	6712	-11.4	17.6	-0.3	1.3	
EU5821	984	-46.4	8.0	0.3	1.2	7167	-10.5	17.6	-0.1	1.3	
EU5891	685	-40.1	15.0	0.6	1.1	12404	-4.0	18.0	0.6	1.0	
EU6264	882	-44.1	9.2	-0.2	1.0	6709	-8.5	16.9	-0.3	1.3	
EU6281	937	-44.7	8.0	0.5	1.1	7414	-8.5	17.1	-0.1	1.3	
EU6349	393	-48.4	8.4	1.2	1.3	2221	-7.7	17.7	0.2	1.1	
EU6444	678	-49.0	6.2	3.5	1.8	2367	-8.8	19.5	1.3	1.5	

2001-II 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
EU6524	2299	-46.5	11.8	0.3	1.3	8750	4.2	12.2	0.4	1.3	
EU6527	970	-50.0	9.7	0.8	1.5	4075	-7.6	19.0	-0.1	1.2	
EU6544	773	-42.6	16.5	1.4	1.2	10841	-5.1	19.8	0.9	1.0	
EU6556	962	-45.4	14.7	0.6	1.4	10595	-4.7	19.8	0.7	1.1	
EU6821	528	-44.0	10.2	0.1	1.3	1189	11.0	10.3	0.3	1.4	
EU6890	813	-51.6	6.5	0.6	1.4	2414	-10.3	19.8	0.0	1.2	
EU7218	741	-49.8	9.6	0.3	1.5	2849	-7.6	18.8	-0.2	1.1	
EU7629	666	-48.8	8.2	1.5	1.3	3343	-6.4	18.5	0.4	1.2	
EU7643	892	-48.7	10.3	-0.1	1.3	4400	-6.4	18.3	-0.6	1.2	
EU7654	522	-51.3	5.8	0.4	1.5	1675	-11.0	19.0	-0.4	1.1	
EU7724	971	-49.8	9.3	0.8	1.4	4325	-7.7	18.4	-0.2	1.2	
EU7888	753	-44.2	8.9	0.2	1.2	5664	-7.4	17.2	-0.1	1.4	
EU8520	697	-48.3	8.6	1.6	1.5	2800	-8.9	19.2	0.2	1.2	
EU8969	955	-50.1	9.8	0.4	1.4	4140	-7.7	18.6	-0.4	1.1	
EU9145	680	-49.4	8.4	1.2	1.3	3429	-9.4	18.9	-0.2	1.2	
EU9158	1023	-45.5	8.0	0.3	1.2	10764	-9.3	17.0	-0.2	1.1	
EU9234	826	-46.7	8.5	-0.2	1.1	6366	-10.4	17.3	-0.2	1.3	
EU9245	1026	-48.0	7.7	0.0	1.1	7671	-10.6	17.6	-0.1	1.3	
EU9544	974	-46.4	8.7	-0.3	1.1	7405	-9.8	17.5	-0.4	1.3	
EU9680	340	-49.4	7.6	-0.3	1.4	2893	-8.4	18.5	-0.4	1.2	
EU9729	273	-50.0	6.2	-0.1	1.0	1904	-8.5	18.6	-0.5	1.1	

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

2001-II 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						10002	13.7	9.5	0.1	2.3
	EU0003	5624	19.5	12.4	0.1	2.4	3061	7.7	5.7	0.0	1.9
	EU0008	5667	22.8	14.1	0.1	2.8	2434	9.5	6.4	-0.1	2.0
	EU0021	1198	23.7	12.3	0.1	2.7	6004	10.8	6.9	0.1	2.1
	EU0022	1373	20.0	12.2	0.1	2.3	7428	8.7	5.6	-0.1	2.0
	EU0032	897	23.4	14.9	0.1	1.8	2262	8.0	5.2	-0.1	1.9
	EU0034	699	23.7	14.6	0.1	2.6	2023	8.1	5.6	-0.1	2.6
	EU0041	2147	20.6	12.1	0.2	2.4	20435	10.6	8.6	-0.2	2.5
	EU0043	1782	21.1	11.9	0.3	2.4	20294	11.1	9.2	0.1	2.2
	EU0045	7092	20.7	12.2	0.0	2.5	3280	8.3	5.7	0.1	1.9
	EU0047	1797	21.7	12.4	0.2	2.4	22889	11.5	9.2	0.0	2.3
	EU0049						8988	15.6	11.3	0.1	2.3
	EU0051	805	24.8	12.3	0.3	2.6	2687	8.0	6.1	0.0	2.1
	EU0054	1246	23.4	12.2	0.2	2.7	4183	8.5	6.3	0.1	2.3
	EU0055						10849	13.7	9.7	-0.1	2.4
	EU0060	3547	18.9	14.9	0.1	2.4	1414	6.8	3.9	0.0	2.0
	EU0072	1012	23.8	13.5	0.1	2.7	7555	8.6	5.8	0.0	2.0
	EU0081	1474	21.7	11.4	0.2	2.4	6899	8.7	5.7	0.0	2.0
	EU0082						9160	13.1	9.2	0.0	2.4
	EU0088	1531	20.8	11.7	0.0	2.6	9757	8.4	5.6	0.0	2.1
	EU0106	1244	20.7	11.6	0.3	3.0	22623	11.3	9.2	0.1	2.4
	EU0109	1705	17.2	9.6	0.2	2.3	7577	8.8	5.6	0.0	2.0
	EU0123	5846	20.7	13.2	0.0	2.5	2622	9.3	6.1	-0.1	1.9
	EU0124						8255	14.3	10.0	0.0	2.6
	EU0154	1477	21.6	12.1	0.3	2.6	23691	11.0	8.8	0.2	2.4
	EU0158	1567	20.5	11.7	0.2	2.5	23505	10.6	8.4	0.1	2.2
	EU0167	1167	20.7	11.3	0.3	2.7	19668	10.8	8.3	0.2	2.2
	EU0185	1242	21.9	13.1	0.3	2.6	23714	11.1	8.7	0.1	2.3
	EU0204	2363	22.0	11.6	0.2	2.6	6501	8.4	6.0	0.1	2.2
	EU0209	466	28.1	14.9	0.0	1.9	1915	7.7	5.1	-0.2	2.1
	EU0234						9847	15.3	10.9	0.0	2.4
	EU0249	2444	22.3	12.1	0.2	2.5	6999	8.5	5.9	0.2	2.2
	EU0254	5378	25.5	14.3	0.1	2.7	4062	8.9	6.1	0.0	2.1
	EU0263	5401	24.6	14.6	0.2	2.8	3993	8.6	5.8	0.0	2.1
	EU0299						10224	15.2	10.4	-0.1	2.5
	EU0301	936	20.7	11.8	0.2	2.4	9819	11.8	9.8	-0.1	2.3
	EU0303	1417	21.3	12.6	0.2	2.8	21000	11.2	8.8	0.2	2.4
	EU0307	1564	20.3	12.0	0.1	2.7	22449	11.1	8.9	0.0	2.4
	EU0311	1140	20.2	12.2	0.2	2.7	18386	10.9	8.5	0.0	2.3

2001-II 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
EU0313	1210	22.4	13.2	0.1	2.6	18336	10.9	8.8	0.0	2.2	
EU0316	1974	19.7	11.4	0.1	2.5	22491	11.3	9.1	0.0	2.4	
EU0319	2132	21.6	12.0	0.1	2.4	20660	11.1	8.7	0.0	2.3	
EU0332	3258	25.4	14.7	0.1	3.0	2517	9.2	6.5	-0.1	2.4	
EU0359	1576	20.3	12.1	0.1	2.5	23900	10.4	7.9	0.0	2.2	
EU0367						8266	15.1	9.9	0.0	2.5	
EU0372	2430	27.0	15.6	0.2	2.8	1594	9.8	6.4	0.0	2.0	
EU0432						11078	15.4	11.0	0.1	2.5	
EU0456	1285	21.3	12.3	0.0	2.6	21387	11.7	8.4	0.4	2.3	
EU0457	3812	21.7	14.6	0.1	2.4	985	6.9	3.9			
EU0458	1382	22.3	12.8	0.1	2.5	22252	11.6	8.9	0.2	2.2	
EU0476	1301	21.0	12.2	-0.1	2.7	22641	11.8	8.6	0.3	2.4	
EU0482	3309	26.7	15.6	0.0	2.9	2415	9.2	6.3	-0.2	2.1	
EU0498	283	22.6	14.1	0.1	1.9	601	7.4	4.0	-0.2	2.1	
EU0568						15316	13.8	10.0	0.2	2.4	
EU0689	337	20.9	13.9	0.1	3.0	610	8.0	4.6	-0.2	2.1	
EU0711	1295	20.2	11.9	0.2	2.7	23186	11.8	8.8	0.2	2.3	
EU0802	1408	22.7	13.4	0.3	2.7	23503	10.2	8.0	0.2	2.1	
EU0807	1617	22.4	12.8	0.3	2.7	3843	8.2	6.5	0.0	2.4	
EU0826						9133	13.4	9.8	0.1	2.3	
EU0875	1316	21.1	12.8	0.0	2.6	22259	11.3	8.8	0.1	2.2	
EU0921	1404	21.6	12.5	0.3	2.6	23124	10.9	8.5	0.1	2.6	
EU0934	5289	21.1	12.6	0.1	2.5	2118	8.7	6.1	0.1	1.9	
EU0947	7207	20.0	12.5	0.2	2.5	3495	7.5	5.4	0.0	2.1	
EU0961	6439	20.0	12.6	0.1	2.4	3112	8.0	5.7	0.0	2.0	
EU0985	6810	22.2	13.4	0.1	2.4	2511	10.4	6.5	0.1	1.8	
EU1001						8274	15.8	11.5	0.1	2.6	
EU1002	7862	19.6	12.7	0.0	2.3	2813	9.2	6.2	0.1	2.0	
EU1222	3225	20.3	12.8	0.0	2.4	1282	10.3	7.5	0.1	2.2	
EU1234	1292	21.1	12.4	0.3	2.5	21420	11.3	9.1	0.1	2.4	
EU1275	2589	25.0	15.6	0.1	2.3	701	7.2	4.3			
EU1282	1644	19.3	12.5	0.2	2.3	161	6.6	3.7			
EU1301	1809	15.9	12.9	0.1	2.4	1465	5.8	3.2			
EU1312	3405	17.3	13.4	0.1	2.1	1649	6.8	4.5	0.1	2.0	
EU1334	3988	18.7	12.1	0.0	2.2	666	7.3	6.5			
EU1345	968	22.5	11.9	0.2	2.3						
EU1367	2473	18.3	11.8	0.2	2.2	287	4.5	3.0			
EU1389	2673	20.9	13.3	0.1	2.3	115	7.0	5.3			
EU1411	1986	23.8	15.7	0.1	2.6	164	7.7	5.3			
EU1436	2356	21.0	11.9	0.1	2.2	275	5.2	2.9			
EU1456						9233	15.1	10.7	0.4	2.7	

2001-II FF AIRCRAFT	Wind Speed Cruise level in m/s					Wind Speed Ascent & Descent in m/s				
	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU1495	6682	21.1	12.7	0.1	2.6	2628	9.2	5.6	0.1	2.0
EU1532						10811	14.3	9.9	0.1	2.3
EU1541	2399	19.2	12.7	0.1	2.3	549	6.9	6.2		
EU1547	1370	21.6	12.0	0.4	2.9	24094	11.1	8.9	0.2	2.5
EU1567						10858	14.5	10.6	0.2	2.5
EU1593	5303	21.1	13.5	0.1	2.6	2339	10.7	6.8	0.0	2.1
EU1692	481	23.4	12.4	0.2	2.7	1142	11.2	7.2	0.2	2.6
EU1698						9284	14.5	10.1	0.0	2.3
EU1795	1761	20.9	13.9	0.1	2.1	275	7.3	6.0		
EU1863	1426	22.1	12.8	0.3	2.7	23367	11.0	8.8	0.2	2.4
EU1929	2342	20.1	12.6	0.1	2.4	71	3.6	1.9		
EU2043	1562	19.1	11.4	0.1	2.3	179	6.3	3.7		
EU2123	2977	21.1	13.2	0.1	2.4	129	6.1	3.3		
EU2189	1209	21.9	11.9	0.3	3.0	20648	11.5	8.7	0.1	2.4
EU2301	1826	20.4	11.7	0.3	2.6	20669	10.9	9.0	0.1	2.3
EU2389	556	25.5	12.1	0.2	3.0	4506	9.4	6.0	0.0	2.1
EU2547	7470	20.4	12.1	0.1	2.5	3674	8.4	5.7	-0.1	2.0
EU2559	2040	19.1	10.9	0.2	2.4	22605	10.9	8.6	0.0	2.3
EU2590	822	15.7	9.1	0.4	2.9	8559	9.1	7.2	0.2	2.6
EU2618	586	17.4	11.1	0.1	2.5	8783	9.6	8.1	0.0	2.5
EU2630	346	18.1	10.4	0.1	2.3	1174	12.1	9.3	0.0	2.3
EU2751	2101	17.8	12.7	0.1	2.4	344	5.9	3.8		
EU2773	3789	19.2	12.9	0.0	2.2	497	8.1	6.0		
EU2845	2260	21.4	12.2	0.1	2.7	8977	8.2	5.9	-0.1	2.2
EU2984	230	20.1	11.2	-0.2	2.7	1577	10.8	8.3	0.0	2.3
EU3000	838	20.5	12.3	0.6	4.4	12507	9.9	7.7	0.2	3.0
EU3181	4313	18.7	13.9	0.1	2.3	1539	6.1	3.9		
EU3257	1065	22.2	12.4	0.3	2.9	19904	11.0	8.8	0.1	2.5
EU3268	300	21.2	10.5	0.0	2.5	2205	10.6	8.1	0.1	2.4
EU3321	971	19.1	9.9	0.1	2.5	3646	10.3	7.9	0.1	2.5
EU3421	1773	21.8	12.0	0.2	2.5	21728	11.2	9.2	0.0	2.3
EU3544	500	18.2	13.1	1.3	6.9	17957	13.7	11.7	1.7	8.1
EU3598	586	21.2	11.8	0.2	2.7	14018	12.2	9.1	0.3	2.2
EU3654	777	19.1	10.5	0.4	2.2	6419	10.6	8.1	0.4	2.4
EU3684	1007	17.2	8.8	0.2	2.3	4217	10.2	7.3	0.0	2.5
EU3725	2552	19.9	13.8	0.1	2.2	454	8.6	8.0		
EU3781	2436	20.4	14.4	0.2	2.6	1246	5.7	3.5		
EU3803	1260	16.4	14.5	0.0	1.8	898	5.3	3.0		
EU3859	1963	19.5	13.1	0.0	2.6	317	6.0	5.1		
EU3874	1863	16.2	13.3	0.0	2.5	351	6.5	4.0		
EU3908	1045	17.1	10.1	0.0	2.6	11013	9.9	8.0	0.1	2.5

2001-II 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
EU4002	693	15.0	7.9	0.1	2.2	3677	8.6	6.5	0.1	2.4	
EU4333	471	17.0	10.4	0.2	2.6	7857	9.6	7.7	0.1	2.6	
EU4426	891	21.9	12.5	0.2	2.6	6594	8.7	5.8	0.0	2.1	
EU4444	686	18.0	9.9	-0.2	2.9	5749	10.1	7.3	0.2	2.3	
EU4519	782	20.1	11.7	0.1	2.1	5864	10.5	7.9	0.2	2.3	
EU4527	668	18.5	12.3	0.0	2.5	24360	11.5	8.7	0.3	2.3	
EU4529	2166	23.7	13.3	0.2	2.8	9261	8.5	6.1	-0.2	2.2	
EU4532	526	16.1	11.2	0.1	2.4	22341	11.9	8.9	0.3	2.4	
EU4573	857	14.5	9.3	0.0	2.1	9983	9.3	7.4	0.1	2.4	
EU4582	649	13.6	8.8	0.1	2.1	5974	9.0	7.6	0.0	2.3	
EU4587	672	21.0	11.5	0.2	2.9	1774	8.7	6.1	-0.1	2.3	
EU4591	912	21.0	12.3	0.1	2.6	6464	11.0	8.5	0.2	2.4	
EU4593	1763	21.1	11.8	0.2	2.5	20969	11.5	9.3	0.0	2.3	
EU4607	965	18.9	11.4	0.1	2.5	6784	10.7	8.1	0.2	2.4	
EU4699	835	19.7	12.1	0.3	2.8	5996	11.2	8.8	0.2	2.4	
EU4721	837	16.8	9.6	0.1	2.2	3701	10.9	8.3	0.2	2.6	
EU4756	311	16.2	12.8	0.1	2.4	641	6.4	4.4	-0.5	2.1	
EU4792	622	16.9	8.5	0.0	2.0	1813	11.3	7.6	0.2	2.2	
EU4853	765	16.9	10.0	0.2	2.4	6651	10.6	7.4	0.2	2.4	
EU4865	905	16.8	10.4	0.2	2.1	6912	10.7	8.3	0.1	2.2	
EU4950	665	16.6	10.6	0.0	2.0	1976	10.3	8.7	0.1	2.3	
EU5175	2	28.5	1.8	1.1	0.3	37	5.6	4.2	-0.3	2.2	
EU5218	985	21.5	13.0	0.3	3.0	8748	8.6	6.0	0.0	2.2	
EU5331	1521	21.7	12.3	0.0	2.5	15663	11.1	8.9	0.1	2.2	
EU5351	1231	21.5	12.2	0.1	2.6	19786	10.7	8.4	0.1	2.2	
EU5435	1133	22.5	12.4	0.2	2.4	16600	11.1	8.2	0.1	2.2	
EU5441	916	18.3	10.6	0.1	2.3	4556	10.6	8.5	0.0	2.5	
EU5478	960	15.7	9.6	0.1	2.3	11207	9.5	7.9	0.1	2.4	
EU5529	1229	15.9	9.6	0.2	2.2	11663	9.4	7.9	0.0	2.4	
EU5587	669	19.1	11.6	0.2	2.5	13935	11.2	8.8	0.0	2.2	
EU5591	491	23.2	12.7	0.6	3.2	2575	9.8	6.9	0.2	2.3	
EU5612	917	19.4	11.7	0.2	2.2	7049	11.4	8.8	0.1	2.3	
EU5613	629	24.5	13.9	0.2	2.5	11545	11.6	9.2	0.0	2.2	
EU5777	1042	18.8	11.1	0.3	2.3	6814	10.8	8.2	0.1	2.3	
EU5802	878	17.9	11.2	0.0	2.3	6712	10.9	8.4	0.1	2.4	
EU5821	984	19.0	11.2	0.0	2.4	7167	10.8	8.2	0.2	2.3	
EU5891	685	22.2	11.6	0.0	2.4	12404	11.0	8.5	-0.1	2.2	
EU6264	882	20.3	12.0	0.5	2.8	6709	10.4	7.6	0.2	2.6	
EU6281	937	17.2	11.0	0.5	2.5	7414	9.8	7.8	0.3	2.4	
EU6349	393	17.6	12.2	-0.2	2.1	2221	10.0	8.2	0.1	2.2	
EU6444	678	17.9	10.7	-0.1	2.2	2367	9.7	7.9	0.0	2.4	

2001-II 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
EU6524	2299	24.4	13.7	0.2	2.8	8750	8.6	6.0	0.0	2.2	
EU6527	970	19.2	10.2	0.1	2.5	4075	10.6	7.8	0.1	2.4	
EU6544	773	20.2	11.9	-0.1	2.4	10841	11.7	9.3	0.1	2.2	
EU6556	962	19.9	11.3	0.2	2.3	10595	10.7	8.8	0.0	2.1	
EU6821	528	16.0	12.1	-0.1	2.8	1189	7.5	4.6	-0.4	2.4	
EU6890	813	17.4	9.2	0.0	2.2	2414	10.0	8.0	-0.1	2.5	
EU7218	741	19.9	11.1	0.1	2.2	2849	9.7	7.6	0.0	2.3	
EU7629	666	18.0	9.6	-0.2	2.1	3343	9.7	7.8	0.1	2.2	
EU7643	892	16.3	8.9	0.0	2.3	4400	9.8	7.5	0.1	2.6	
EU7654	522	17.7	10.8	0.1	2.2	1675	10.9	7.9	0.2	3.1	
EU7724	971	15.8	9.3	-0.1	2.2	4325	10.2	8.2	0.2	2.3	
EU7888	753	17.9	11.2	0.4	2.4	5664	10.7	7.7	0.2	2.5	
EU8520	697	17.1	9.2	0.1	2.6	2800	10.9	8.5	0.0	2.6	
EU8969	955	17.9	10.5	0.2	2.4	4140	10.0	7.9	0.0	2.4	
EU9145	680	16.4	9.9	0.0	2.2	3429	10.0	6.9	0.1	2.4	
EU9158	1023	16.3	10.3	0.2	2.3	10764	9.8	8.0	0.0	2.4	
EU9234	826	18.5	10.9	-0.1	2.5	6366	10.6	7.9	0.0	2.3	
EU9245	1026	18.7	12.1	0.2	2.4	7671	10.2	7.8	0.1	2.3	
EU9544	974	17.7	10.5	0.2	2.5	7405	10.1	7.5	0.1	2.3	
EU9680	340	18.8	10.0	0.1	2.3	2893	9.3	7.7	0.0	2.2	
EU9729	273	18.1	9.9	0.0	2.1	1904	9.6	8.0	0.1	2.2	

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

AIRCRAFT	Wind Direction Cruise level in degrees					Wind Direction Ascent & Descent in degrees				
	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU0002						10002			13	21
EU0003	5624			5	12	3061			8	24
EU0008	5667			7	14	2434			8	19
EU0021	1198			7	12	6004			14	22
EU0022	1373			8	13	7428			16	23
EU0032	897			1	8	2262			7	22
EU0034	699			1	10	2023			7	21
EU0041	2147			8	14	20435			19	31
EU0043	1782			8	14	20294			16	22
EU0045	7092			4	12	3280			7	19
EU0047	1797			7	13	22889			15	23
EU0049						8988			13	21
EU0051	805			6	10	2687			18	25
EU0054	1246			8	15	4183			19	28
EU0055						10849			13	21
EU0060	3547			3	9	1414			2	24
EU0072	1012			7	12	7555			16	25
EU0081	1474			7	11	6899			14	20
EU0082						9160			13	20
EU0088	1531			8	15	9757			17	25
EU0106	1244			8	13	22623			17	23
EU0109	1705			9	14	7577			14	20
EU0123	5846			7	12	2622			10	22
EU0124						8255			13	21
EU0154	1477			8	13	23691			17	24
EU0158	1567			7	12	23505			16	23
EU0167	1167			9	14	19668			15	23
EU0185	1242			8	12	23714			14	21
EU0204	2363			7	11	6501			19	28
EU0209	466			2	12	1915			10	20
EU0234						9847			12	20
EU0249	2444			7	11	6999			18	27
EU0254	5378			5	12	4062			7	16
EU0263	5401			6	12	3993			8	21
EU0299						10224			13	20
EU0301	936			7	13	9819			16	23
EU0303	1417			8	14	21000			17	24
EU0307	1564			8	13	22449			16	24
EU0311	1140			8	14	18386			15	22
EU0313	1210			7	13	18336			16	23

2001-II 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
EU0316	1974			8	13	22491			16	23	
EU0319	2132			7	11	20660			16	24	
EU0332	3258			5	12	2517			7	18	
EU0359	1576			8	14	23900			15	22	
EU0367						8266			11	19	
EU0372	2430			6	14	1594			8	19	
EU0432						11078			12	20	
EU0456	1285			8	14	21387			14	21	
EU0457	3812			5	15	985					
EU0458	1382			7	13	22252			14	19	
EU0476	1301			8	13	22641			14	20	
EU0482	3309			6	13	2415			8	19	
EU0498	283			1	11	601			6	22	
EU0568						15316			13	22	
EU0689	337			1	7	610			6	20	
EU0711	1295			8	14	23186			15	22	
EU0802	1408			8	15	23503			16	23	
EU0807	1617			8	11	3843			20	29	
EU0826						9133			13	21	
EU0875	1316			8	13	22259			15	23	
EU0921	1404			10	17	23124			17	24	
EU0934	5289			4	13	2118			7	20	
EU0947	7207			4	12	3495			8	22	
EU0961	6439			4	11	3112			7	20	
EU0985	6810			6	13	2511			8	20	
EU1001						8274			13	22	
EU1002	7862			6	12	2813			7	23	
EU1222	3225			6	12	1282			9	26	
EU1234	1292			8	14	21420			17	25	
EU1275	2589			4	11	701					
EU1282	1644			5	15	161					
EU1301	1809			1	8	1465					
EU1312	3405			3	11	1649			1	15	
EU1334	3988			3	9	666					
EU1345	968			6	11						
EU1367	2473			5	13	287					
EU1389	2673			4	8	115					
EU1411	1986			4	11	164					
EU1436	2356			3	10	275					
EU1456						9233			13	21	
EU1495	6682			6	13	2628			9	22	
EU1532						10811			12	20	

2001-II 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
EU1541	2399			3	9	549					
EU1547	1370			9	14	24094			17	25	
EU1567						10858			13	20	
EU1593	5303			7	12	2339			9	20	
EU1692	481			7	13	1142			15	24	
EU1698						9284			11	19	
EU1795	1761			3	9	275					
EU1863	1426			9	15	23367			18	24	
EU1929	2342			5	11	71					
EU2043	1562			4	12	179					
EU2123	2977			4	9	129					
EU2189	1209			8	11	20648			15	22	
EU2301	1826			7	11	20669			16	24	
EU2389	556			7	11	4506			16	23	
EU2547	7470			5	13	3674			8	22	
EU2559	2040			8	14	22605			16	23	
EU2590	822			13	23	8559			19	31	
EU2618	586			10	17	8783			18	28	
EU2630	346			8	11	1174			13	20	
EU2751	2101			3	9	344					
EU2773	3789			3	11	497					
EU2845	2260			8	12	8977			20	29	
EU2984	230			7	8	1577			15	22	
EU3000	838			10	17	12507			19	26	
EU3181	4313			2	7	1539					
EU3257	1065			8	13	19904			19	25	
EU3268	300			6	8	2205			16	24	
EU3321	971			7	10	3646			17	25	
EU3421	1773			8	12	21728			16	24	
EU3544	500			12	25	17957			16	25	
EU3598	586			8	13	14018			14	20	
EU3654	777			7	10	6419			19	26	
EU3684	1007			7	9	4217			18	28	
EU3725	2552			3	10	454					
EU3781	2436			3	10	1246					
EU3803	1260			1	8	898					
EU3859	1963			3	10	317					
EU3874	1863			3	10	351					
EU3908	1045			9	14	11013			16	27	
EU4002	693			9	15	3677			18	26	
EU4333	471			9	13	7857			20	32	
EU4426	891			8	14	6594			16	25	

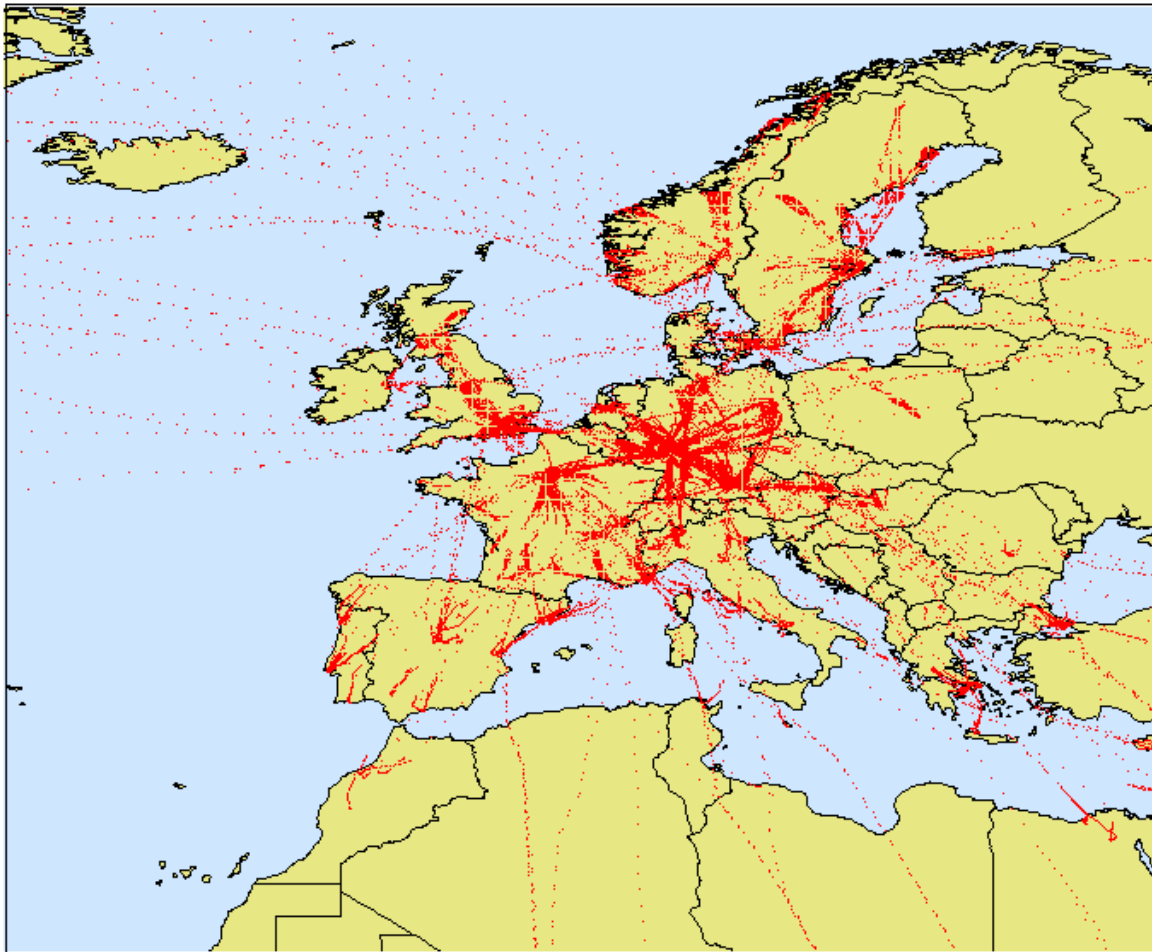
2001-II DD	Wind Direction Cruise level in degrees					Wind Direction Ascent & Descent in degrees					
	AIRCRAFT	Number of Reports	Observed		Obs-backgrnd		Number of Reports	Observed		Obs-backgrnd	
			Mean	SD	Mean	SD		Mean	SD	Mean	SD
EU4444	686			8	13	5749			17	23	
EU4519	782			9	19	5864			17	24	
EU4527	668			9	15	24360			14	20	
EU4529	2166			7	11	9261			18	27	
EU4532	526			10	17	22341			13	19	
EU4573	857			11	16	9983			16	27	
EU4582	649			11	16	5974			16	27	
EU4587	672			9	14	1774			16	23	
EU4591	912			8	10	6464			15	22	
EU4593	1763			7	13	20969			15	23	
EU4607	965			8	12	6784			16	24	
EU4699	835			7	11	5996			15	22	
EU4721	837			8	11	3701			16	23	
EU4756	311			2	18	641			15	34	
EU4792	622			8	11	1813			14	24	
EU4853	765			9	12	6651			16	23	
EU4865	905			8	12	6912			15	23	
EU4950	665			7	9	1976			17	26	
EU5175	2			3	0	37			18	23	
EU5218	985			10	16	8748			18	27	
EU5331	1521			8	16	15663			15	23	
EU5351	1231			8	12	19786			15	22	
EU5435	1133			7	14	16600			15	21	
EU5441	916			7	11	4556			18	26	
EU5478	960			9	16	11207			16	25	
EU5529	1229			9	14	11663			16	27	
EU5587	669			9	17	13935			14	21	
EU5591	491			8	11	2575			18	24	
EU5612	917			9	14	7049			16	25	
EU5613	629			7	13	11545			15	22	
EU5777	1042			7	12	6814			16	23	
EU5802	878			9	13	6712			16	23	
EU5821	984			8	14	7167			15	21	
EU5891	685			6	10	12404			15	22	
EU6264	882			10	17	6709			19	27	
EU6281	937			9	12	7414			19	26	
EU6349	393			9	15	2221			15	24	
EU6444	678			8	13	2367			18	28	
EU6524	2299			7	12	8750			19	28	
EU6527	970			7	10	4075			17	25	
EU6544	773			7	10	10841			14	21	
EU6556	962			7	11	10595			16	25	

2001-II 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
	EU6821	528			3	20	1189			13	26
	EU6890	813			7	8	2414			19	29
	EU7218	741			8	14	2849			19	29
	EU7629	666			7	11	3343			20	29
	EU7643	892			8	11	4400			20	28
	EU7654	522			9	15	1675			14	20
	EU7724	971			9	13	4325			18	27
	EU7888	753			9	14	5664			14	20
	EU8520	697			8	10	2800			17	26
	EU8969	955			8	11	4140			17	25
	EU9145	680			10	15	3429			16	24
	EU9158	1023			10	16	10764			17	29
	EU9234	826			9	16	6366			15	21
	EU9245	1026			9	14	7671			16	24
	EU9544	974			8	13	7405			16	24
	EU9680	340			7	9	2893			17	25
	EU9729	273			8	10	1904			18	24

## Annex I. EU Amdar Observations from 17 – 19 May, 2001.

In order to have a brief impression of the distribution of the locations of observations, two maps are presented. In fig. 3 Europe is presented with all EU Amdar observations for the period 17 – 19 May 2001. Note that most data is acquired during ascending or descending (ASC: 54%, DES: 28%, LVR: 17%, LVW: 0%). In figure 4 (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. 4.

### AMDAR Coverage May 17 - 19, 2001



*Fig. 3 All EU AMDAR observation locations, for the period 17 – 19 May 2001 and zoomed in over Europe.*

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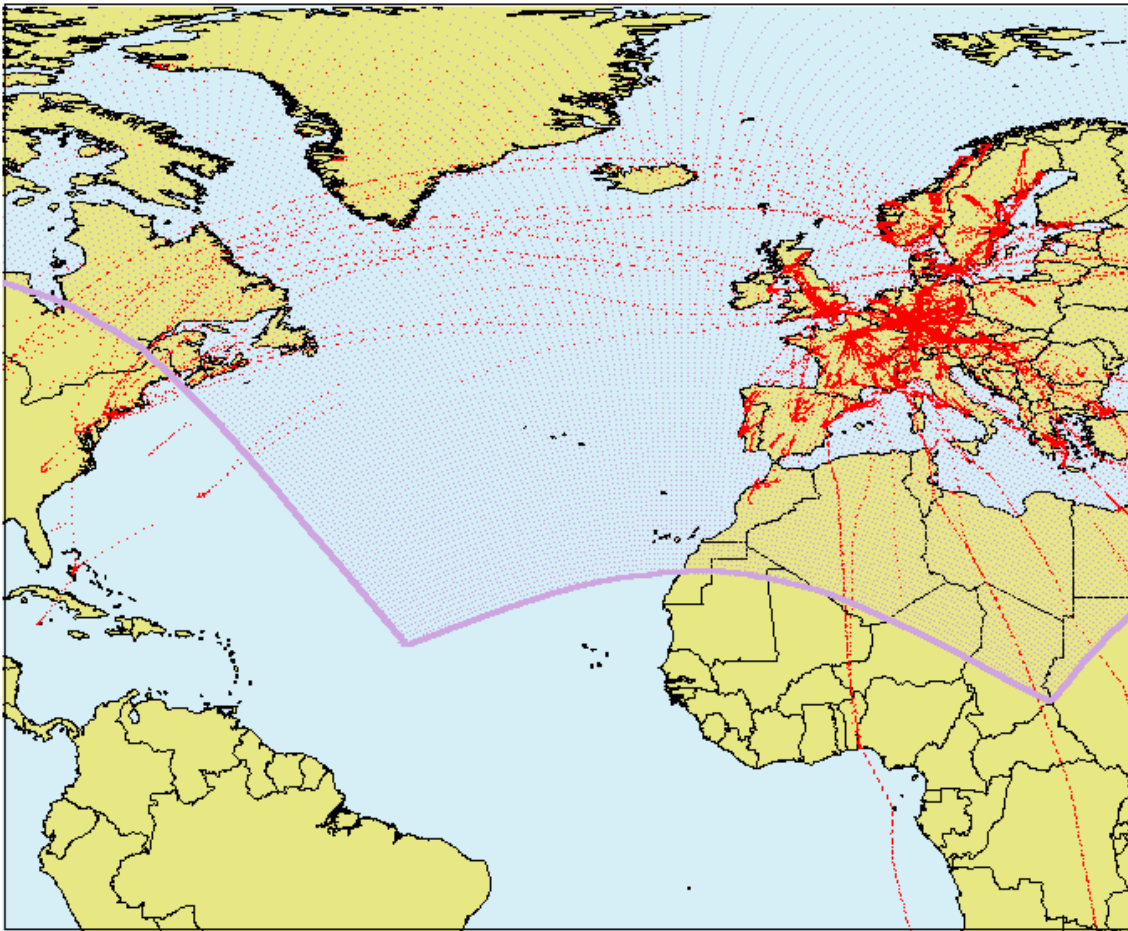


Fig. 4 All EU-AMDAR observations locations for 17 – 19 May 2001. In this figure the HIRLAM area used for the evaluation purposes is indicated ( )

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

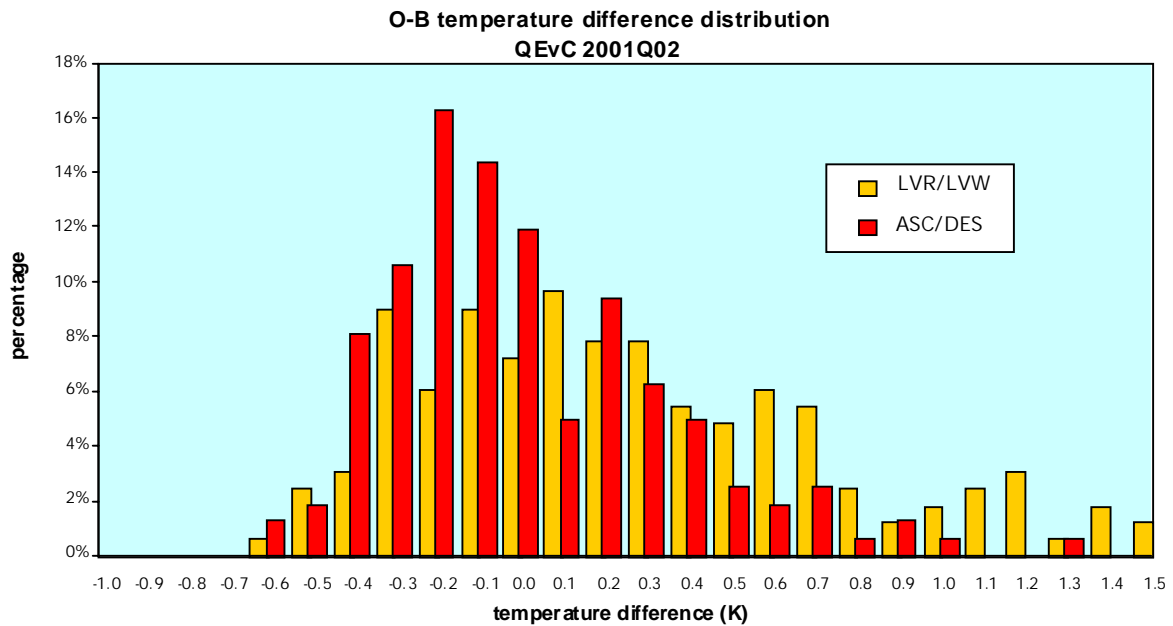


Fig. 5 Frequency distribution of the mean temperature difference (OBS–Background) for the number of aircraft reporting AMDAR reports (N=183). Distinction is made between the Flight Level (LVR/LVW) and the Ascending or Descending phase (ASC/DES). Clearly, there is no significant difference between the distributions of both phases.

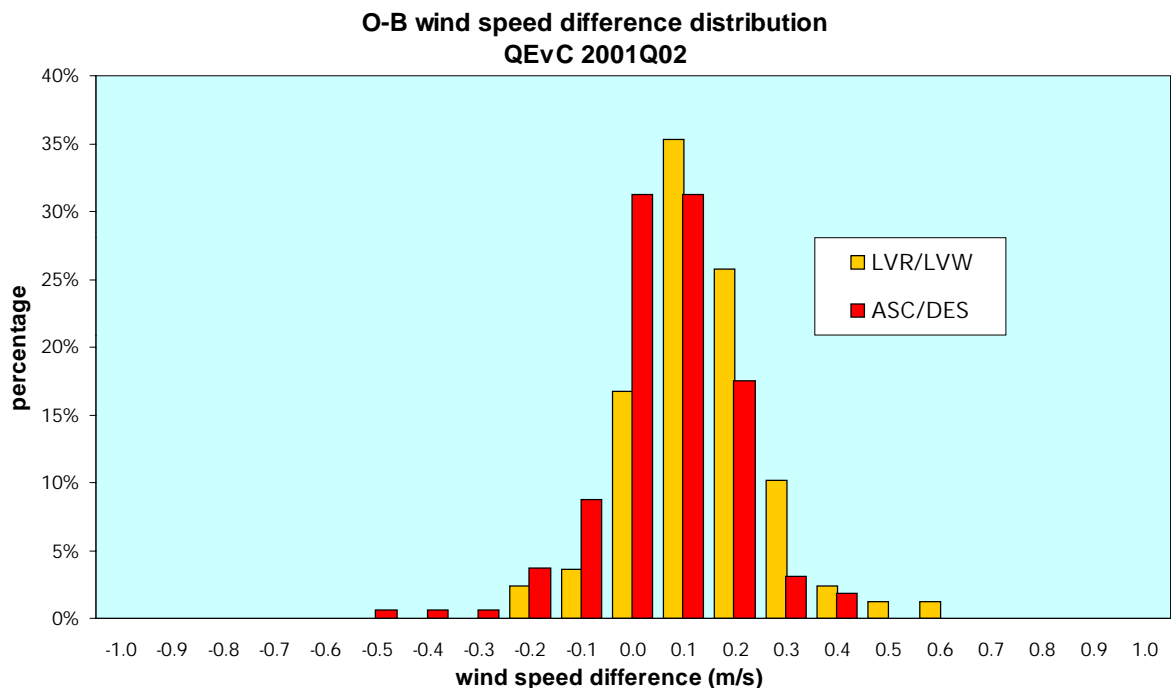


Fig. 6. Frequency distribution of the mean wind speed difference (OBS–Background) for the number of aircraft reporting AMDAR reports (N=183). Distinction is made between the Flight Level (LVR/LVW) and the Ascending or Descending phase (ASC/DES). Clearly, there is no significant difference between the distributions of both phases

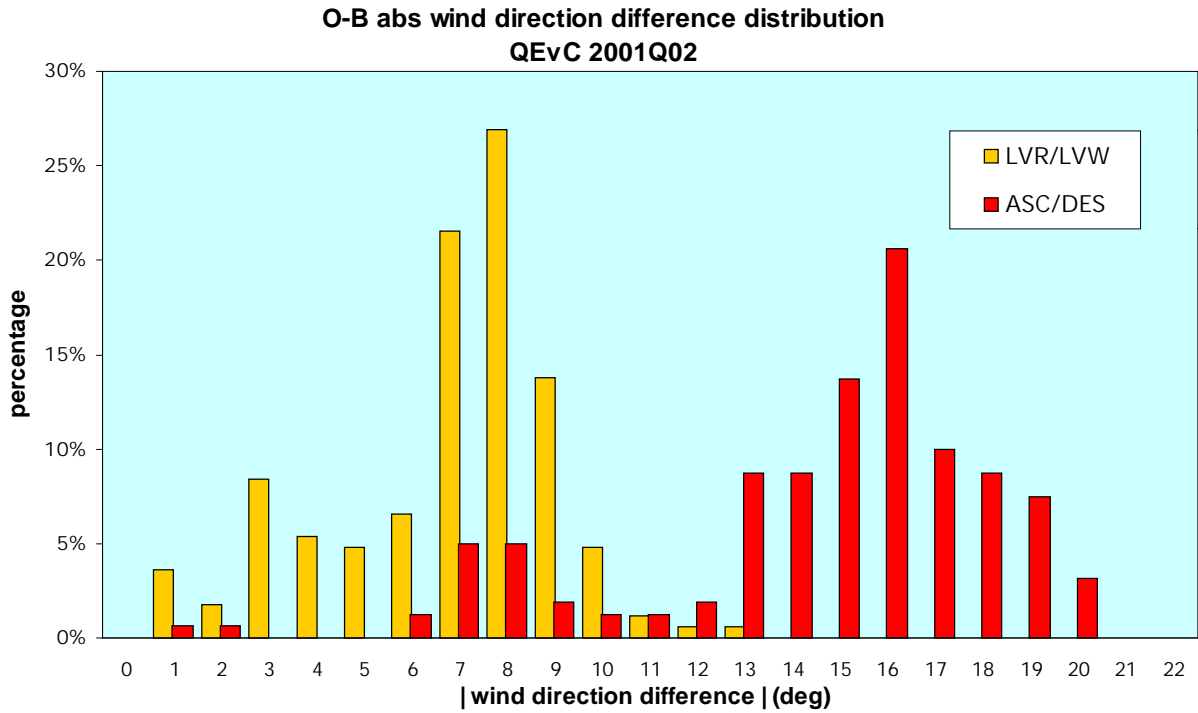


Fig. 7. Frequency distribution of the mean of the absolute wind direction difference ( $|OBS-Background|$ ) for the number of aircraft reporting AMDAR reports ( $N=183$ ). Distinction is made between the Flight Level (LVR/LVW) and the Ascending or Descending phase (ASC/DES). Clearly, in this case there is a significant difference between the distributions of both phases.

### Annex III. Wind direction observations: An analyses.

For all aircraft during the period 17-19 May 2001, wind direction data are analysed. In figure 8 the observed wind direction is presented as function of altitude. Note that these observations are made at different locations and time and therefore not correlated but give a brief impression of the wind direction as a function of altitude (note that most of the observations are from the Europe region with mostly winds coming from the SW).

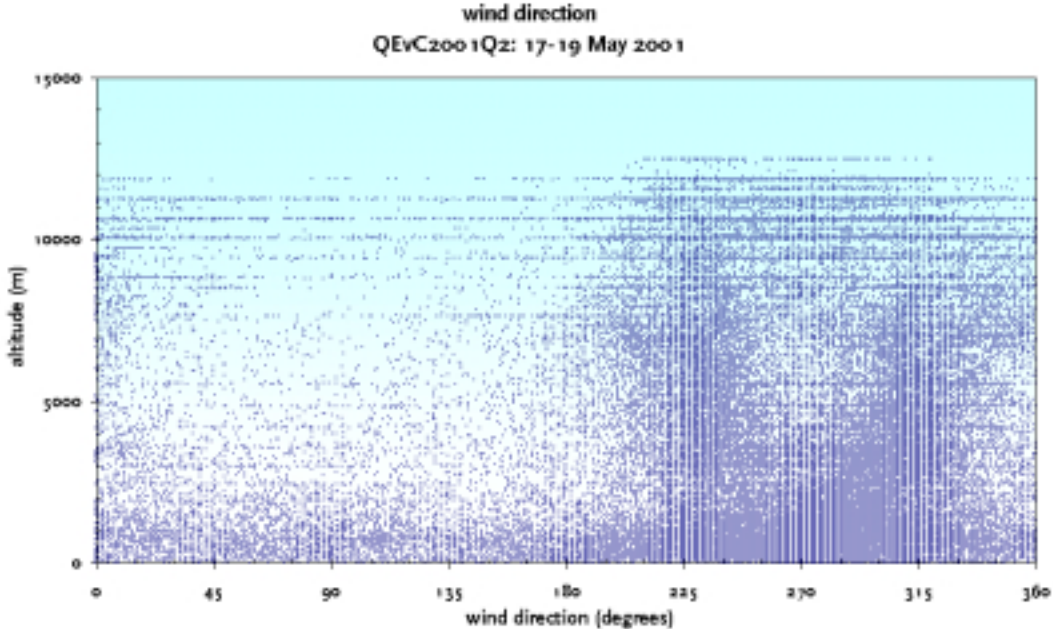


Fig. 8. Wind directions, measured during the period 17 - 19 May 2001 for all aircraft.

The OBS-MOD wind direction differences are presented in figure 9. Clearly no significant particular difference in behaviour of any aircraft can be recognised. In particular the OBS-MOD wind direction differences might demonstrate significant differences. In figure 10, the OBS-MOD wind direction differences are shown as a function of altitude.

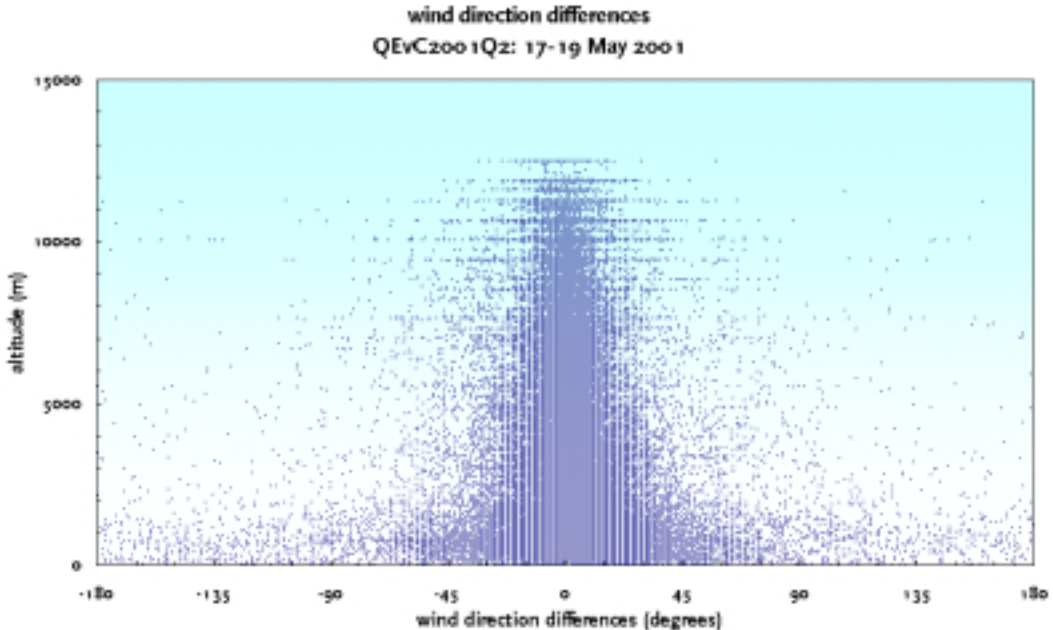


Fig. 9. OBS-MOD Wind direction differences as a function of altitude, measured during the period 17-19 May 2001 for all aircraft.

### Annex IV. Trend in the daily amount of observations.

The number of observations, received every day can be presented as a function of time (see fig. 10). Such a figure will demonstrate the trend in this daily amount. The figure shows clearly an increase during the whole quarter. Due to an software update of the GTS Message Switch at the QEvC centre a bug in that software resulted in the rejection of FM42 encoded bulletins and only BUFR encoded bulletins were evaluated from May, 30<sup>th</sup> to June 5<sup>th</sup> (see the red box indicated in fig. 10).

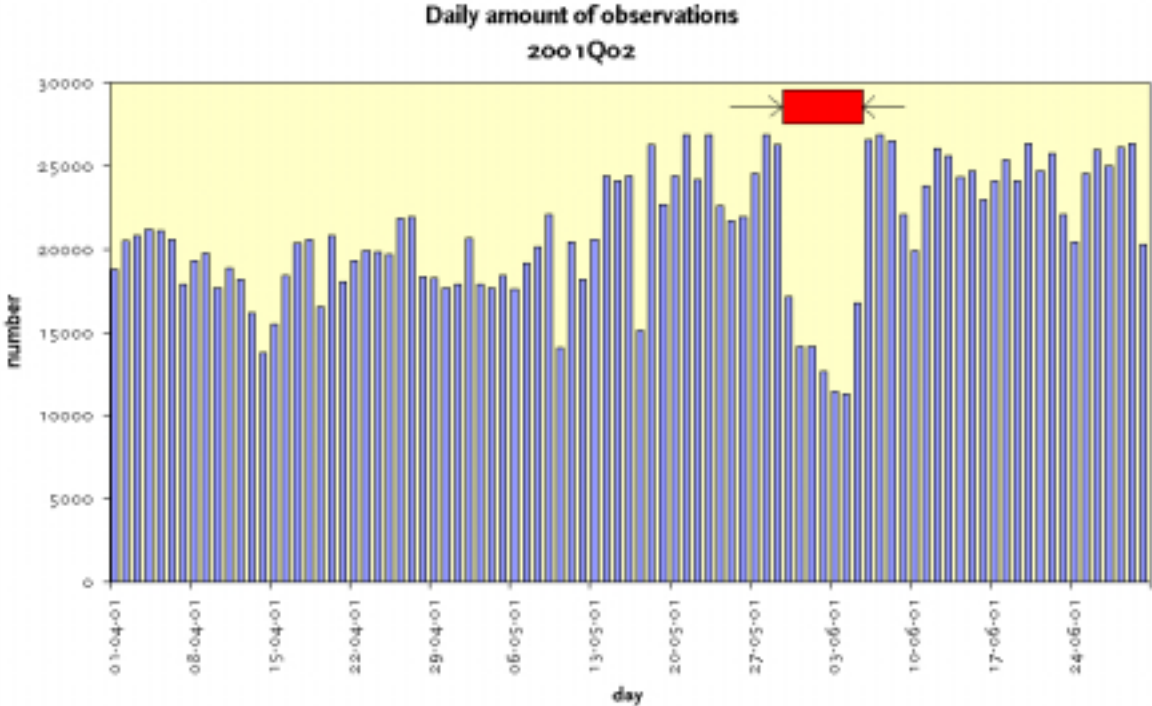


Fig. 10. The daily amount of EU-Amdar observation, received at De Bilt. Notice the variability. The red box indicates a period, where due to a software bug at the QEvC only BUFR encoded bulletins were analysed.

## Annex V. Altitude distribution of observations from the North Atlantic.

For the period 17-19 May 2001 all observations from the North Atlantic region are investigated to obtain an impression of the altitude distribution (see Annex I, fig. 4). Of course all data are LVR or LVW only for  $[-50^\circ < \text{longitude} < -10^\circ]$ . In figure 11 the position of the aircraft is given as a function of longitude (most aircraft fly west to east or east to west only).

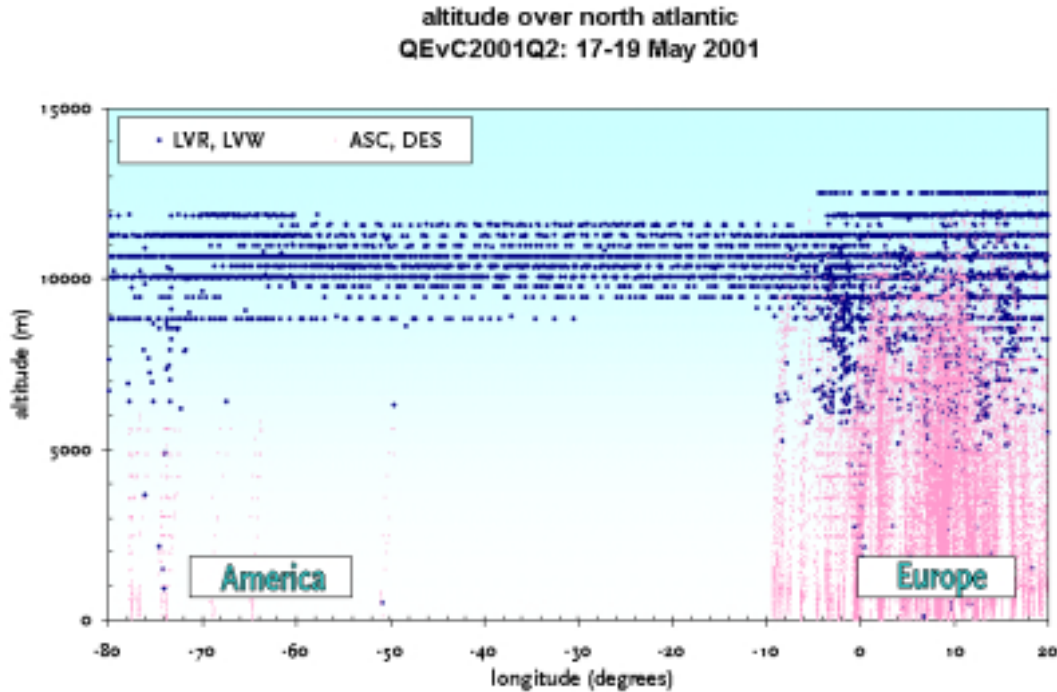


Fig. 11. Position information of the observations for aircraft crossing the North Atlantic region (longitude:  $-50^\circ$  to  $-10^\circ$ ).

In figure 12 a distribution as a function of altitude is presented. Almost all observations are around 11 km.

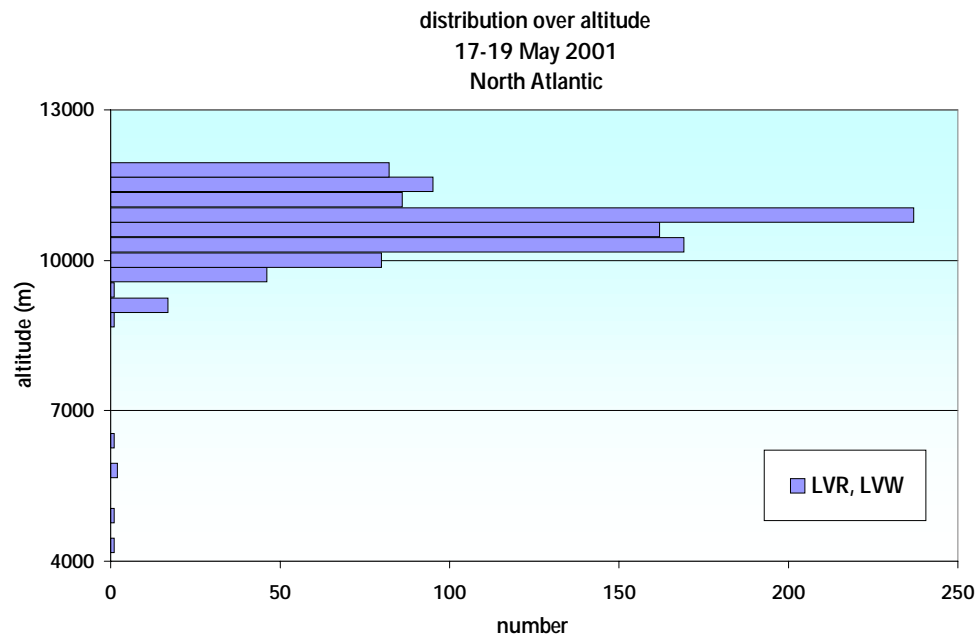


Fig. 12 Distribution of the observations over altitude for observations during LVR or LVW crossing the North Atlantic. Clearly all observations are in the altitude interval 9000 to 12000 m.

## Annex VI. The daily cycle and observation times.

In the figures 13a-d the 'aircraft data coverage' is presented for the period 18 June 2001 18:00 - 19 June 2001 12:00 UTC (for observations from aircraft: AIREP [●], AMDAR [◆] and ACARS [■]). The figures give an impression of the availability of aircraft observations for use in the ECMWF models runs at 00, 06, 12 and 18 UTC.

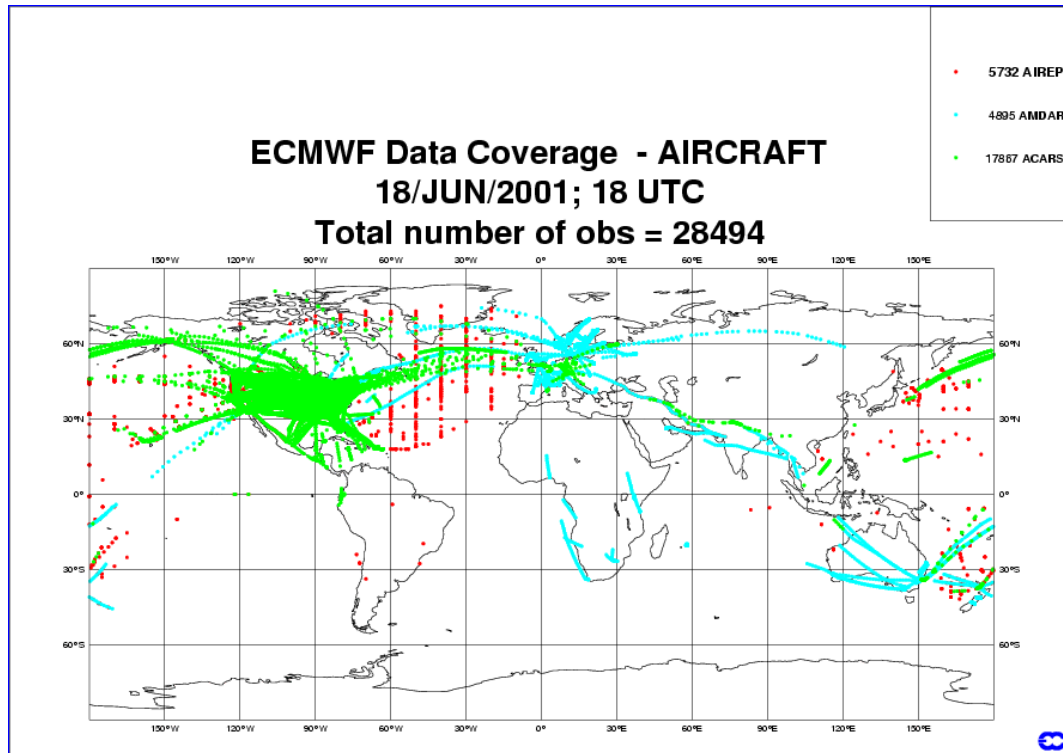


Fig. 13a

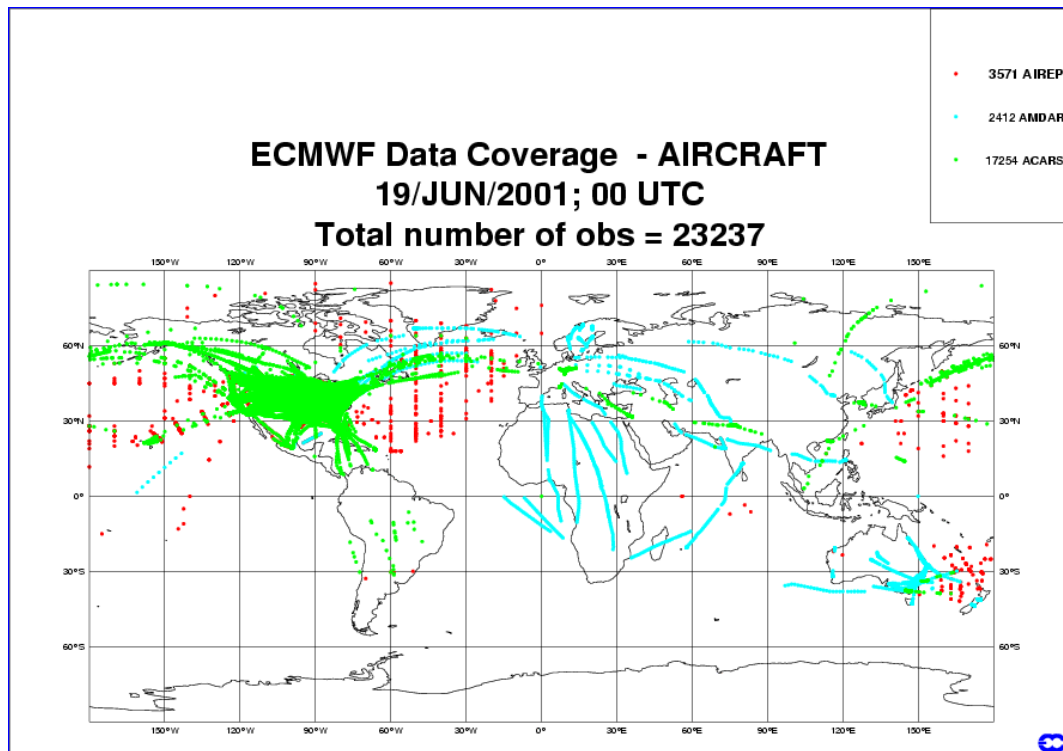


Fig. 13b

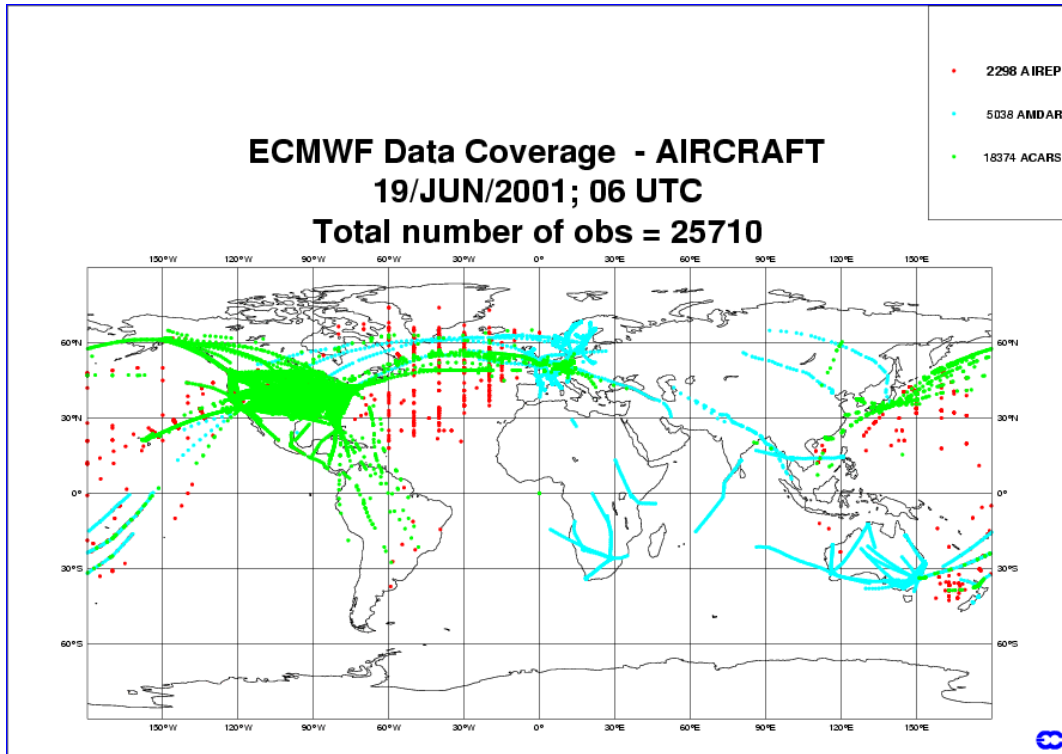


Fig. 13c

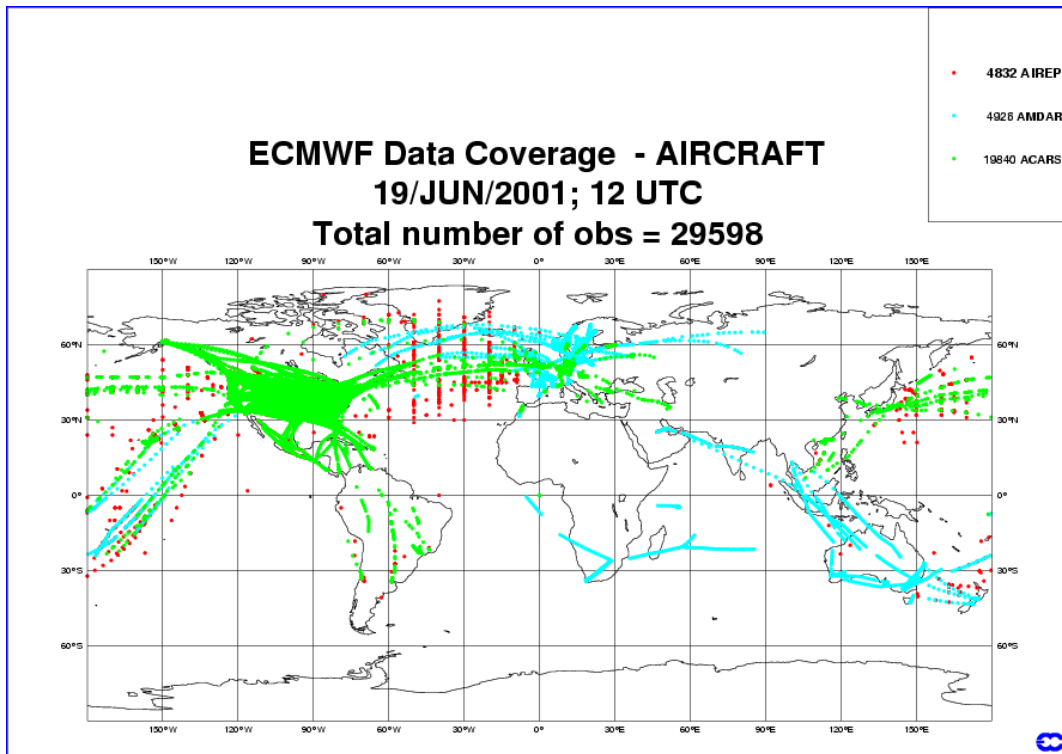


Fig. 13d

Obviously the AMDAR data coverage for the Europe region is very well for 06, 12 and 18 UTC, but very limited for the 00 UTC run (especially ASC and DES data, providing profiles; LVR and LVW data from aircraft during intercontinental flights outside Europe are well covered).