WORLD METEOROLOGICAL ORGANISATION

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COMPOSITE OBSERVING SYSTEM FOR THE NORTH ATLANTIC (COSNA)

Consolidated Monitoring Report

on COSNA - Components

2002

SUBMITTED TO

CGC XIII, REYKJAVIK, 28. – 30. AUGUST 2002

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1. Introduction

The COSNA Consolidated Monitoring Report follows a proposal of the Coordinating Group for the COSNA (CGC). The goal of this report is to provide a consolidated monitoring overview of all the systems contributing to COSNA. This is done by extracting information from the existing monitoring reports of the Monitoring Centres and compiling this information in a way that specific deficiencies of the COSNA can be detected, long-term trends be monitored and appropriate action be taken.

The availability of the data of the ECMWF Monthly Monitoring Reports (ECMWF MMR) in ASCII-format allows the automatic data processing to detect long-term-trends of availability, timeliness and quality of data without considering the differences between different Monitoring Centres. These differences or discontinuities sometimes exceed the variability of the system under investigation and it is not the intention of this report to focus on the procedures of of data processing.

Another source of continuous comparable information for long-term trends of data from drifting buoys and the ASDAR-Units are the Quarterly Reports of the UK Met.Office covering these components; their data have been used whenever possible.

The ASAP-components are monitored very effectively using information directly from the ASAP operators. They submit completed forms with data (e.g. number of successful soundings, number of reports transmitted and percentage on GTS) to the ASAP Panel (ASAPP). The comparison of the numbers given by the ASAPP and the numbers given in the ECMWF Monthly Monitoring Reports shows some differences, which will be discussed in more detail in this report.

Considering that the monitoring centres use different monitoring procedures and different sources of information, this report has the goal to consider, merge and visualise the data in such a way that COSNA-specific information can be extracted and an assessment of the status of the system be made.

The COSNA-Area covers the coastal areas and islands within the North Atlantic and Caribbean Sea. Unfortunately, areas within different limits are used in the monitoring procedures (e.g. ECMWF: TEMP 0N-90N,100W-40E; BUOYS: 10N-80N,85W-0W; AIREP: 40N-70N,60W-0W; METEO FRANCE: 0N-90N,80W-30E), but whenever possible the results are being adjusted to make them comparable.

The Monitoring Reports listed below have been used and will be referred to throughout the text by the following abbreviations:

ECMR	ECMWF Monthly Global Data Monitoring Report
UKMR	UKMO Monthly Global Data Monitoring Report
MFMR	Meteo-France Monthly Global Data Monitoring Report
ASAPP	Annual Report of the ASAP Panel
UKQR-ASDAR	Quarterly Report on Quality Evaluation of ASDAR data
E-AMDAR	E-AMDAR Annual Report 2000
UKQR-Buoys	Quarterly Report on Drifting Buoys in the North-Atlantic
UKMR-SHIP	UKMO 6-monthly Report on the Quality of Marine SFC-Observations
WMO-OPNL	WMO 2-monthly Operational Newsletter

2. Global Observations - Data Coverage and Data Availability

The charts in the Annex of this report show the global data coverage and data availability of all observing systems. These charts of ECMWF give the numbers and spatial distribution of SYNOP/SHIP, BUOY, TEMP, AIREP, SATOB and ATOVS reports for the 18.07.2001 0000z.

Figures 1.a (logarithmic Y-axis) and 1.b (linear Y-axis) show the long-term trend of the availability of these data since January 1999 globally and for the North Atlantic on basis of the global distribution 10°-square plots of the ECMWF Monthly Monitoring Report. The number of about 50,000 SYNOP reports globally available per day consists of about 10 % of SYNOP SHIP reports.

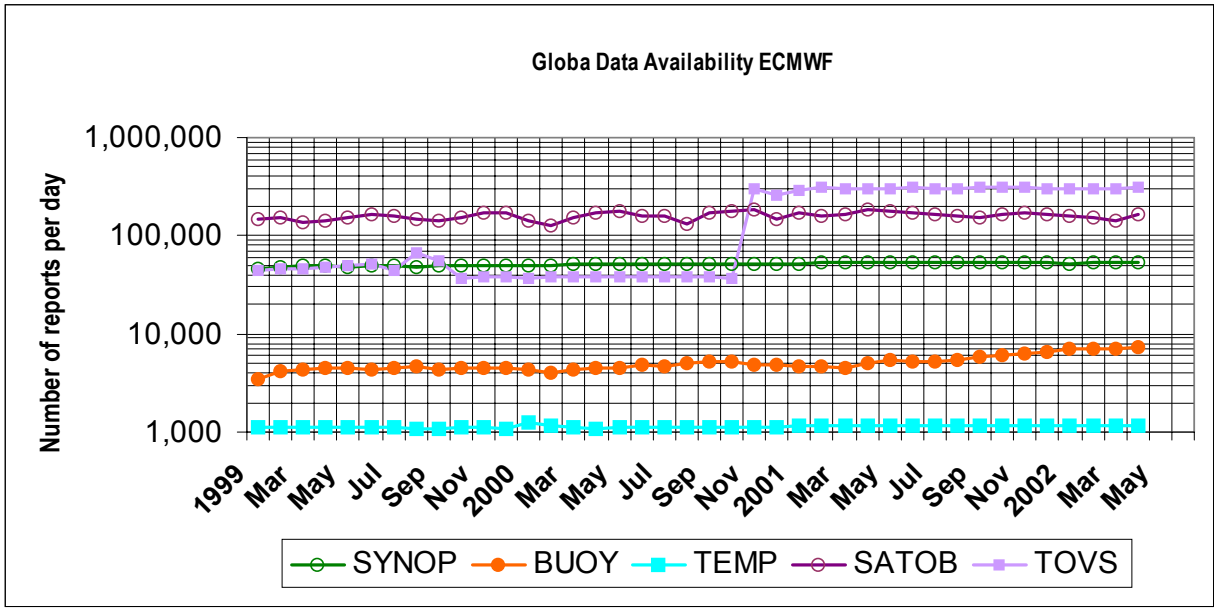

Figure 1.a Time series of data availability in the North Atlantic in terms of number of reports of SYNOP, SHIP, DRIFTR and TEMP available at ECMWF (ECMWF Monthly Monitoring report).

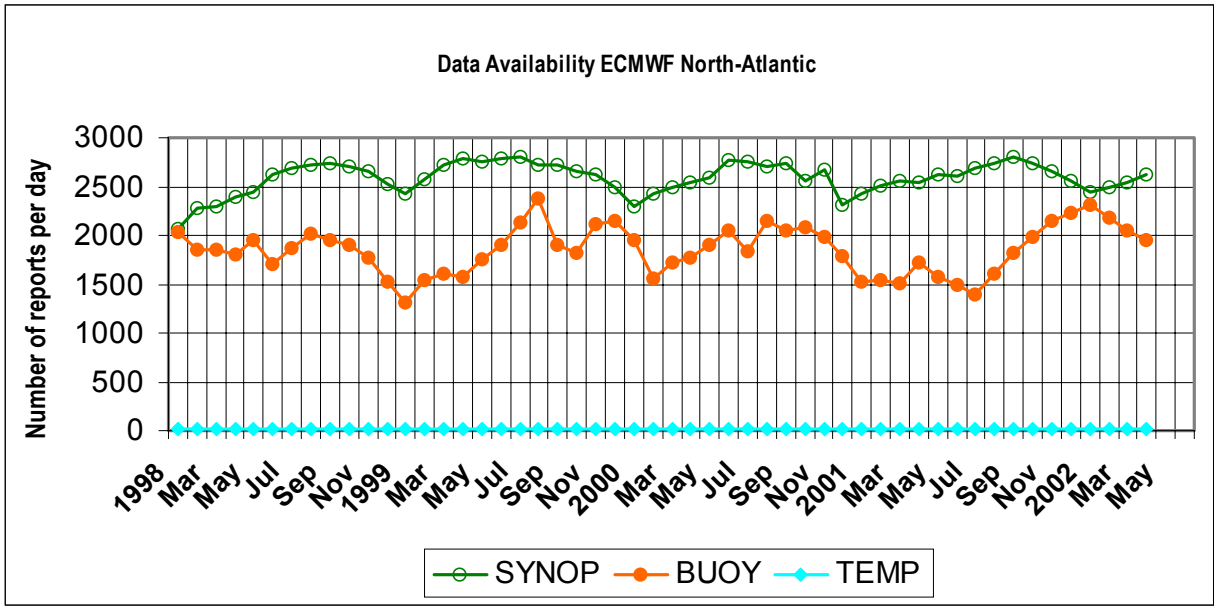

Figure 1.b Time series of data availability in the North Atlantic in terms of number of SYNOP, SHIP BUOY DRIFTR and TEMP reports available at ECMWF (ECMWF Monthly Monitoring report).

3. BUOY Observations

3.1. Data Coverage

The average total number of buoys in the North Atlantic reporting at least MSL pressure is approximately 120 with 50 moored buoys and 70 drifting buoys. The typical data coverage of all these buoys in the COSNA area for March 2001 is shown on the map of Figure 2.

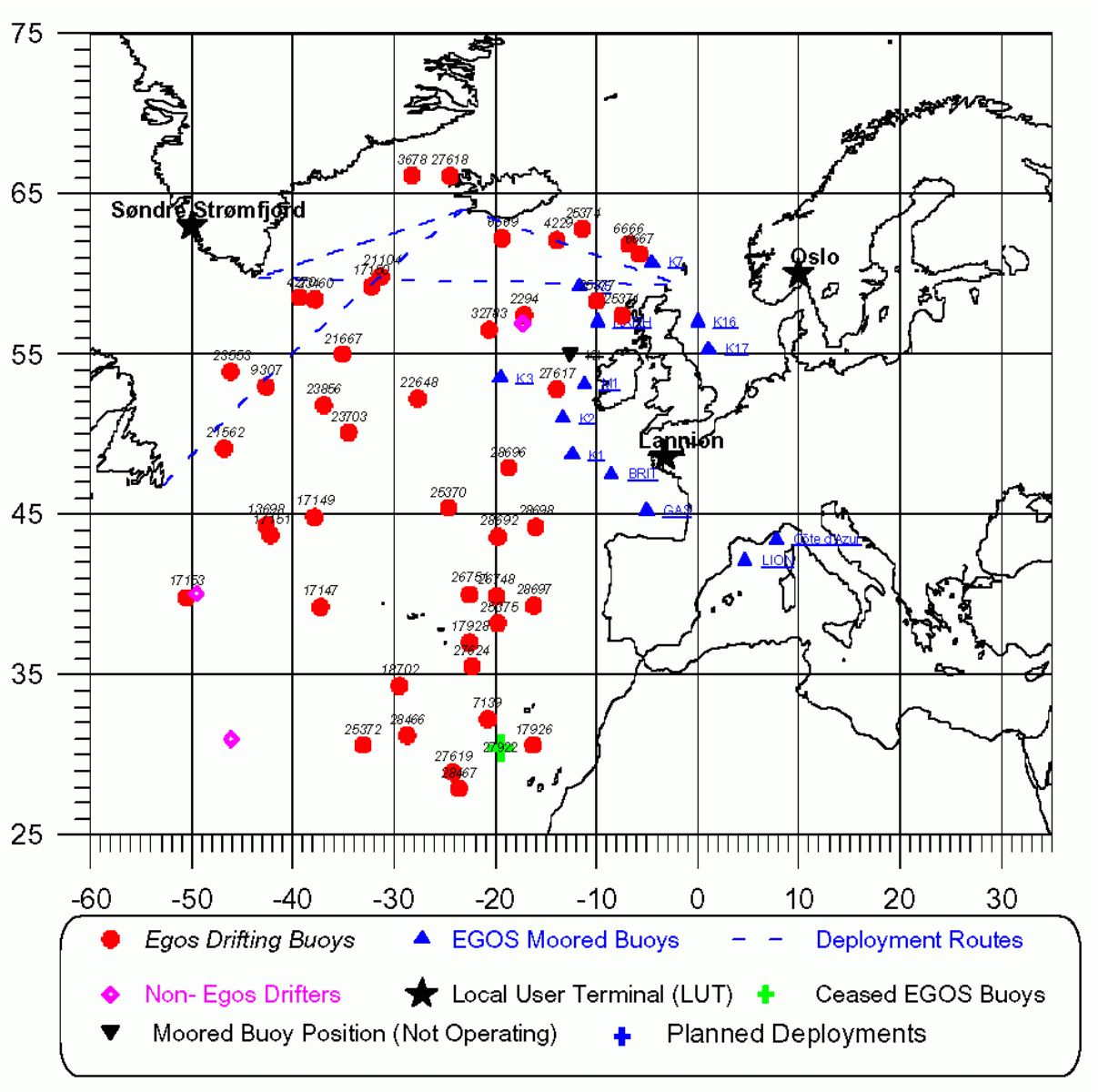

Figure 2. Geographical distribution of moored and drifting buoys reporting MSL Pressure in June 2002 (Source: EGOS Monthly Report, June 2002)

3.2 System Availability

The moored buoys are mostly operating along the national coastline of their operating countries. This holds for the moored buoys of Canada, USA, United Kingdom and France, with France also operating moored buoys off the coast of French-Guyana and along 10°W at or south of the equator. Two buoys are operated in co-operation between UK and France (62001 “Gascogne” at N4514 W00500 and 62163 “Brittany” at N4733 W00828). One buoy of

UK (62090 “Eirann/M1 at N5308 W01112) was built by the UK Met.Office, but is owned by Met Eirann. Apart from ownership it is, however, identical to the other moored buoys. Other stations reporting automatically in FM13 SYNOP SHIP code are the UK operated light vessels. The number of buoys of each country is given in the table below:

Moored buoys in the COSNA area and adjacent seas

Canada	9	South of New-Foundland
USA	15	East Coast of USA
France	2	Caribbean / French-Guyana
France	3	Along 10°W, N/S of the equator ‘Pirata’ project
France	4	Bay of Biscay, English Channel
France/UK	2	Bay of Biscay
UK	9	Areas around UK and Ireland
UK AWS light vessels	4	Channel
Total	48	

Moored buoys in June 2002, from WMO Operational Newsletter

Most of the drifting buoys are operated by EGOS, the United States and Canada. The UK Met. Office, other NMC's and the EGOS group itself monitor their performance,. The results shown here are based mainly on the ECMWF Monthly Monitoring reports and on the UKMO Quarterly Reports on Drifting Buoys in the North Atlantic

The long-term numbers of drifting buoys in the North Atlantic are given in Figure 3. After the strong increase in 1996 up to a maximum of 80 buoys during FASTEX in spring 1997, numbers established around 70 buoys. After having more buoys south of 50N.during 2000/2001, the number of buoys south of 50N decreased significantly in 2001.

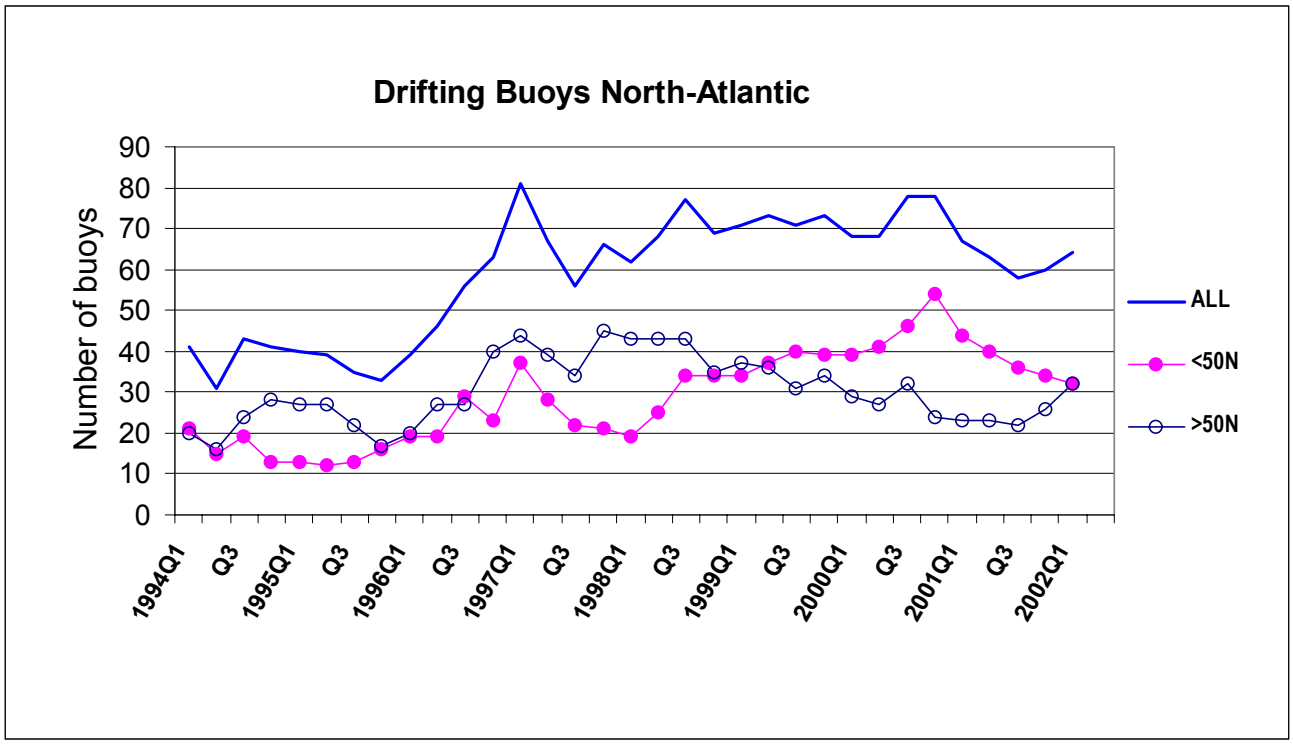

Figure 3. Number of buoys in the North-Atlantic north and south of 50°N reporting at least MSLP pressure. (UKMO Quarterly Report on Drifting Buoys)

The number of drifting buoys reporting at least MSL pressure is typically higher than the number of those reporting also wind-speed and wind-direction. The number of buoys reporting the different parameters is given in the table below:

Number of Drifting Buoys in COSNA-Area

2001/02	Jul	Aug	Sep	Oct	Nov	Dec	J02	Feb	Mar	Apr	May	Jun
MSLP	78	75	69	65	74	73	76	72	72	73	86	81
W-SPD	22	31	31	26	26	21	18	17	17	26	25	18
W-DRN	20	30	30	24	26	20	18	17	17	25	24	18

Numbers from ECMWF Monthly Monitoring Report

The long-term variation of the number of buoys reporting different parameters is given in Figure 4. The number of buoys reporting MSL pressure is typically twice to three times the number of buoys reporting wind-speed or wind-direction. This ratio has hardly changed through the years.

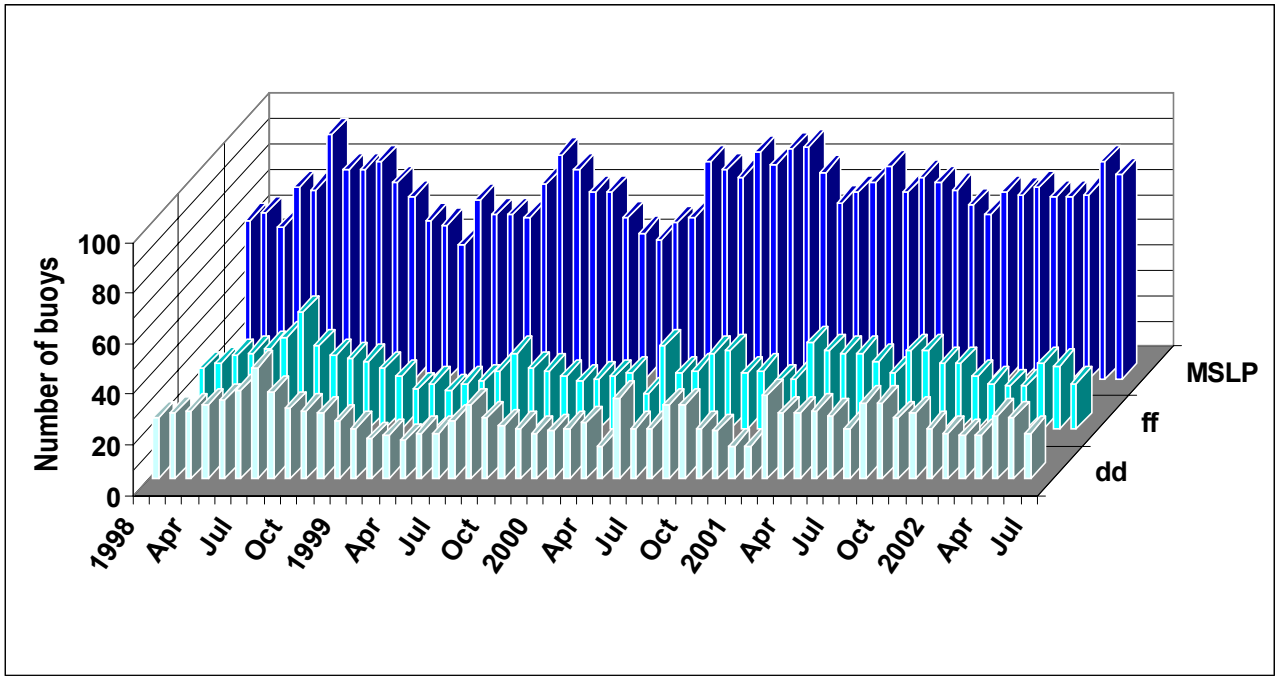

Figure 4. Number of drifting buoys in COSNA-Area reporting MSL pressure, wind speed and wind direction January 1998 through June 2002 (ECMWF-Monthly Monitoring Report)

3.3. Data Availability

The drifting buoys are interrogated mainly by the ARGOS System, so that the maximum number of possible reports varies with latitude and is given in the table below:

Buoy Data-Availability versus Latitude

Latitude	0 ..	.. 30	.. 45	.. 60	.. 90
Max.reports per day	6 ..	.. 8	.. 12	.. 17	.. 25

Max.number of reports from drifting buoys per day due to satellite's orbit

The timeliness is sometimes restricted by the geometry of the polar orbit: If the buoys and the receiving ground station are not in the same satellite view, a delayed transmission of reports is inevitable. The timeliness is, however, mainly dependent on the user's requirements and financial considerations.

The number of reports from all buoys per day in the COSNA area available at ECMWF is given in Figure 5. Apart from the typical maximum of reports during the summer period, the numbers of reports per day from all buoys vary between 1500 and 2000 with about 500 reports more per day available at the UK Met.Office.

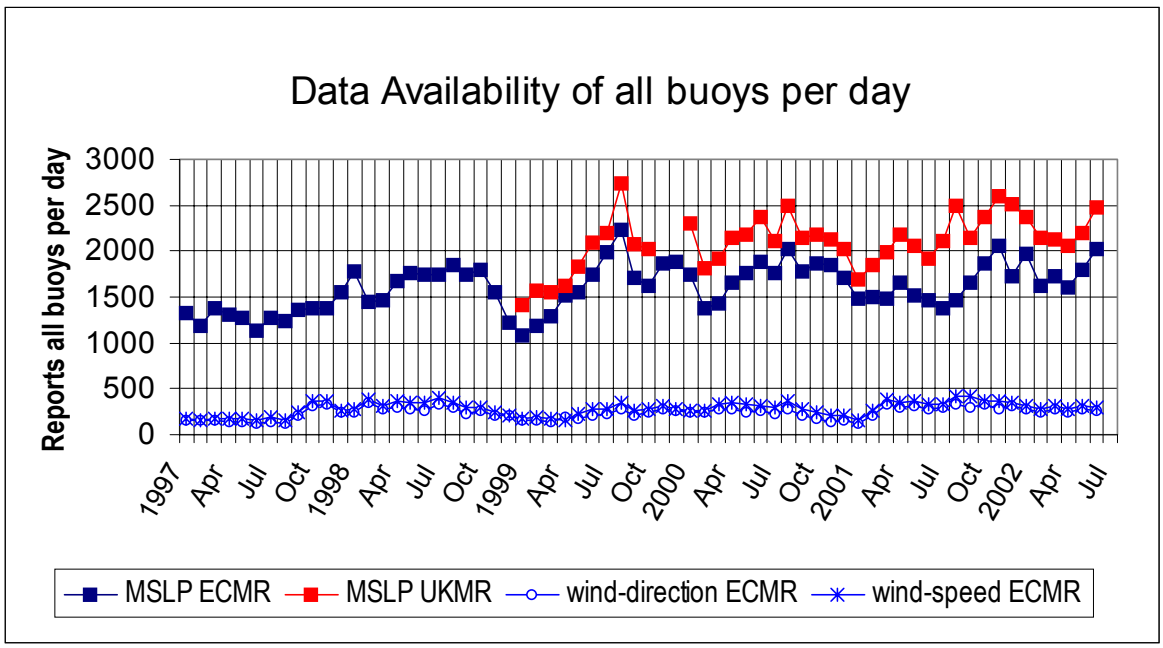

Figure 5. Number of reports of MSL pressure, wind-speed and wind-direction per day from all drifting buoys in the COSNA area.

Figure 6 shows the efficiency of each single buoy in terms of reports per single buoy per day. After stronger variations until early 2000 it has now stabilised at about 20 reports/day.

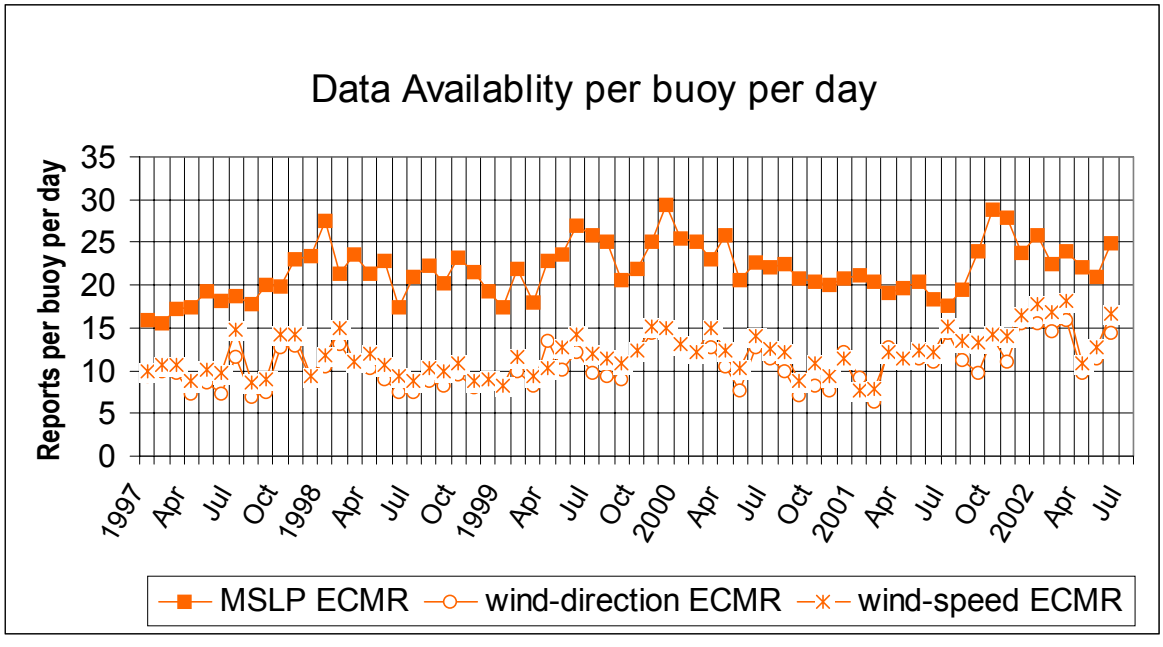

Figure 6. Same as Figure 5., but number of reports from each single buoy

Number of drifting buoys in the N-Atlantic with reporting at least MSLP

	98Q1	99Q1	00Q1	01Q1	01Q2	01Q3	01Q4	02Q1	02Q2
N of 50°N	43	37	29	23	23	22	26	32	
S of 50°N	19	34	39	44	40	36	34	32	
Total	62	71	68	67	63	58	60	64	

Data from UKMO Quarterly Report on Drifting Buoys; 02Q1 denotes the 1.Quarter of 2002.

Figure 7 and Figure 8 show the data availability and timeliness of buoys in terms of number of reports available on the GTS within certain time limits for the period 1995, 1.Quarter through 2002, 1.Quarter (UKMO Quarterly Reports on Drifting Buoys) north and south of 50N, respectively.

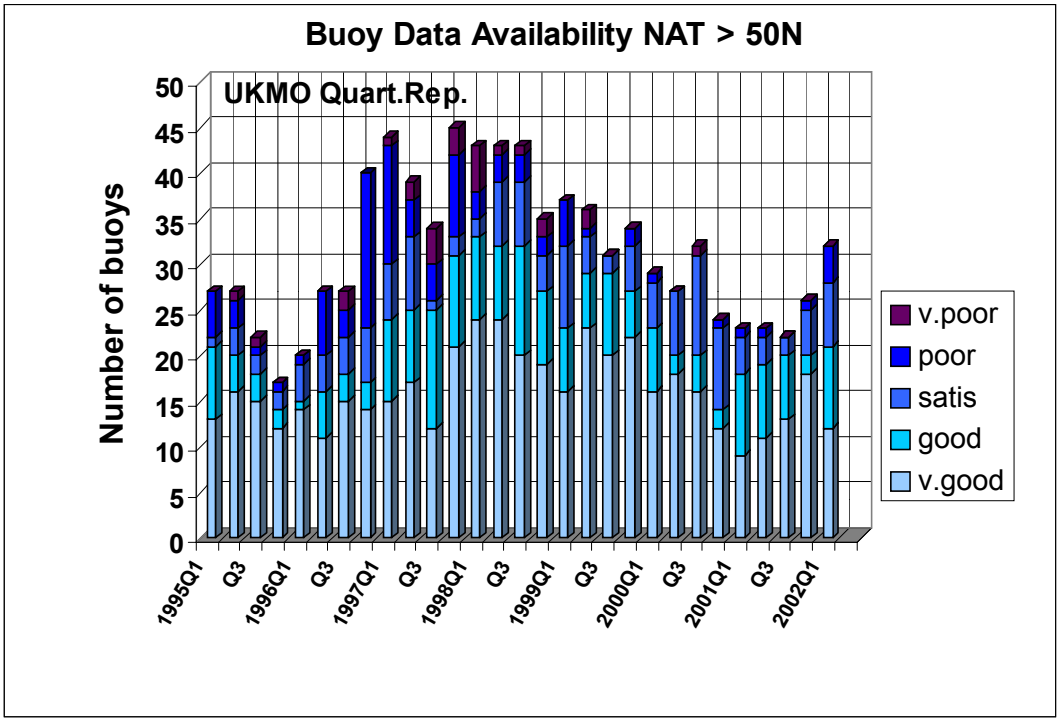

Figure 7. Relative Data Availability of drifting buoys in the North Atlantic north of 50°N. The categories refer to the number of observations per buoy per day (UKQR-Buoys)

Buoy Data Availability North Atlantic, North of 50° N

Obs/day	98Q1	99Q1	00Q1	01Q1	01Q2	01Q3	01Q4	02Q1	02Q2	Categ.
> 35	56 %	46 %	55 %	39 %	48 %	59 %	69 %	38 %		**v.good**
26 – 35	21 %	19 %	24%	39 %	35 %	32 %	8 %	28 %		**Good**
16 – 25	5 %	24 %	17 %	18 %	12 %	9 %	19 %	22 %		**Satisf.**
6 – 15	7 %	14 %	4 %	4 %	4 %	0 %	4 %	12 %		**Poor**
< 5	12 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %		**v.poor**

Percentage of drifting buoys with number of reports per day as given left

The numbers of relative data availability in the table above do not change significantly over the years: while between 60 % and 90 % of all buoys perform as "good" or better, typically 10 % or less perform as "poor" or worse.

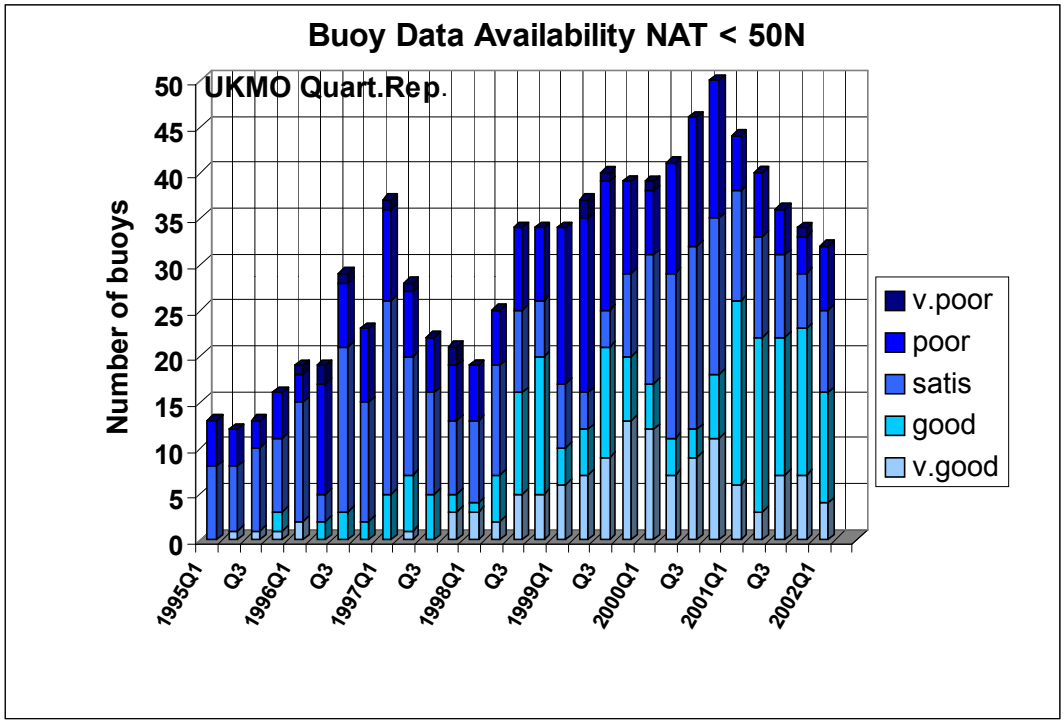

Figure 8. Relative Data Availability of drifting buoys in the North-Atlantic south of 50°N. Different categories refer to the number of observations per buoy per day (UKQR Buoys)

Buoy Data Availability North Atlantic, South of 50° N

Obs/day	98Q1	99Q1	00Q1	01Q1	01Q2	01Q3	01Q4	02Q1	02Q2	Categ.
> 35	16 %	18 %	31 %	14 %	8 %	19 %	21 %	13 %		v.good
26 - 35	5 %	12 %	13 %	46 %	48 %	42 %	47 %	38 %		Good
16 - 25	47 %	21 %	36 %	27 %	27 %	25 %	18 %	28 %		Satisf.
6 - 15	32 %	49 %	18 %	13 %	17 %	14 %	12 %	21 %		Poor
< 5	0 %	0 %	2 %	0 %	0 %	0 %	2 %	0 %		v.poor

Percentage of drifting buoys with number of reports/day as given left

Although the data availability in the Southern North Atlantic is limited by the satellite's orbit It has also improved with typically more than 50 % of the buoys performing as "good" or better and only 20 % or less performing as ‘poor’ ever since then.

Buoy Data Timeliness

Received	98Q1	99Q1	00Q1	01Q1	01Q2	01Q3	01Q4	02Q1	02Q2	Category
< 1 hr	73 %	69 %	56%	33 %	38 %	26 %	32 %	34 %		v.good
.. 2 hrs	13 %	7 %	31%	43 %	54 %	59 %	58 %	63 %		Good
.. 3 hrs	8 %	4 %	9%	15 %	2 %	10 %	7 %	3 %		Satisf.
.. 4 hrs	5 %	14 %	3%	2 %	2 %	2 %	0 %	0 %		Poor
> 4 hrs	2 %	6 %	1%	7 %	4 %	3 %	3 %	0 %		v.poor

Percentage of reports received within time given left

The data timeliness of reports of drifting buoys has established on a high performance level with about 90 % of all buoys performing as 'good' or better. This level of performance with respect to timeliness has now reached a level, which is mainly given by specific system features or by user requirements (intended delay of data transmission).

3.4 Data Quality

The categorisation of data quality based on the term 'rejected' by the model has been abandoned, as there are reasons other than data quality alone which determine whether observations are rejected or not, e.g. the 'thinning out' of data within the initialisation process of the model.

The data quality of drifting buoys is now based on the percentage of gross errors and on the classification by the UK Quarterly Report on Drifting Buoys. Based on the ECMWF-MMR, buoys were classified as 'suspect', if the gross error rate exceeded 10 %.

The data quality of drifting buoys on basis of the UKQR-Buoys with respect to MSL Pressure is given in the table below:

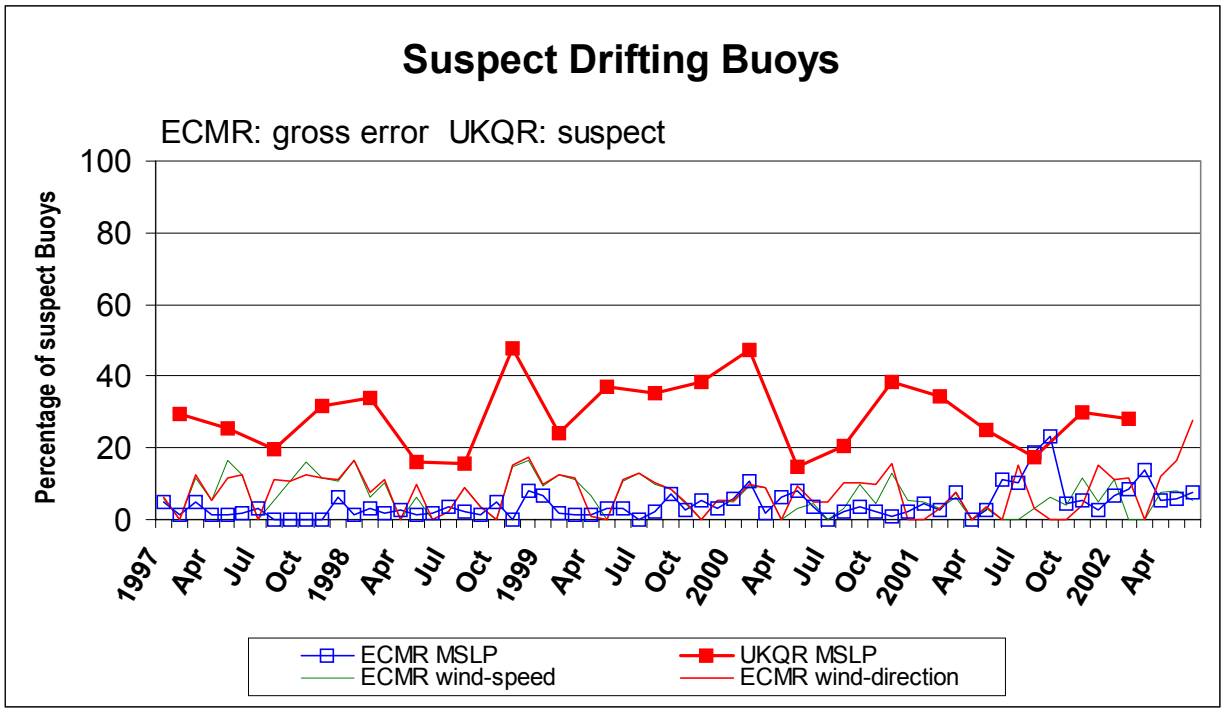

Figure 9. Percentage of buoys reporting suspect observations (for data from UKQR-Buoys according to their definition, for data from ECMR if the gross error rate exceeds 10 percent)

The rates of the suspect buoys in Figure 9 (above) as classified in the Quarterly report on drifting buoys are higher due to the use of different criteria. The trends of both data sets are, however, similar with quite significant suspect rates for MSLP and temporarily higher gross error reports for wind than for MSL pressure in the ECMWF reports.

4 Voluntary Observing Ships

4.1 Operational Units

The global long-term evolution in the availability of SYNOP-SHIP reports (manual or automatic) in the past decade is shown on Figure 10, which is based on data given by the semi-annual 'Report on the Quality of Marine Observations' from the UK Met.Office. The numbers represent reports per day. The number of reports of GLOBAL MANUAL SYNOP-SHIP observations was around 2500 per day at the beginning of the last decade and, although they decreased somewhat in the mid 1990's, they are now stable again at around 2500 SYNOP-SHIP reports per day.

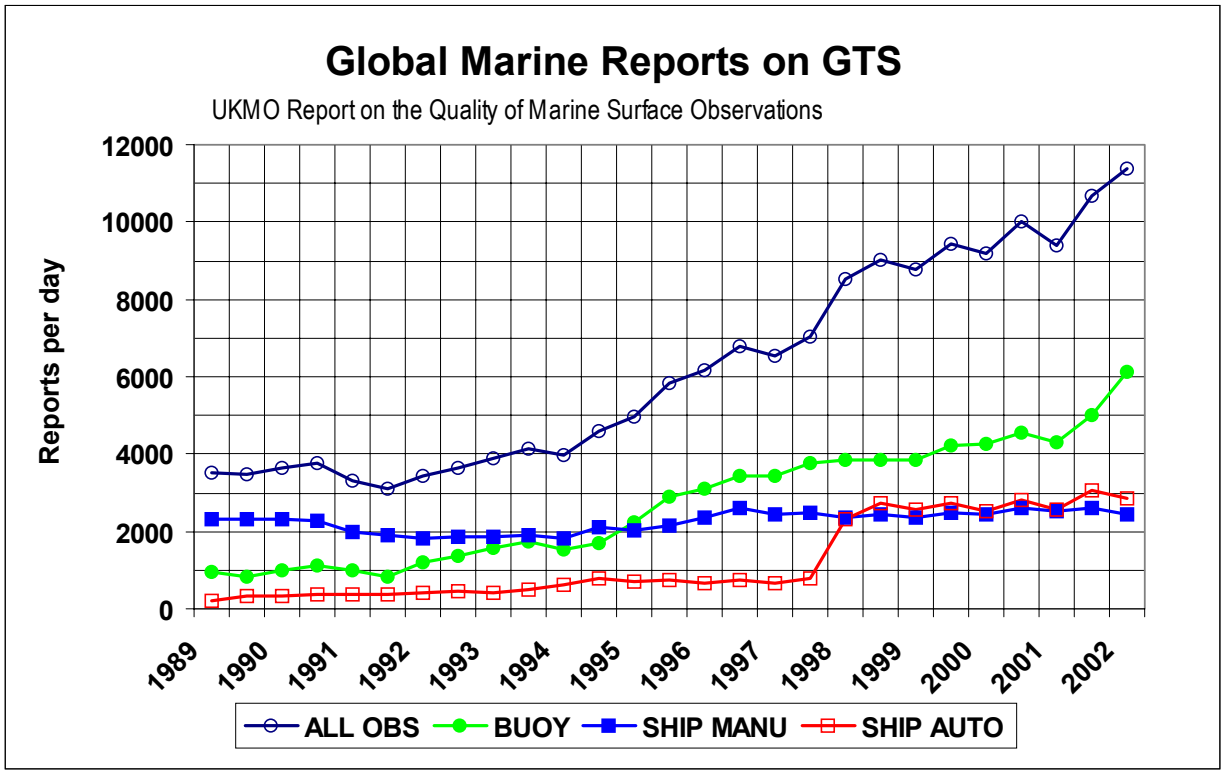

Figure 10. Number of global marine observations from MANUAL SYNOP-SHIP, AUTOMATIC SYNOP-SHIP and AUTOMATIC DRIFTR-BUOY from 1989 through 2002. Global number of observations per day from all units (UKMO Report on the Quality of Marine Surface Observations)

During the first five years of the past decade there were around 200 GLOBAL AUTOMATIC SYNOP-SHIP reports per day available. This number increased to 400 in late 1994 and remained constant until 1997. In 1998 there was a significant increase of AUTOMATIC SYNOP-SHIP to more than 2500 reports per day. This high number remained stable until today. The number of reports from global drifting buoys increased from around 1000 per day to more than 4000 today.

4.2 Data Coverage

Figure 1 of the Annex shows the global coverage of SHIP observations for a single observation time on all synoptic observations (FM12 LAND and FM13 SHIP). Most automatic marine stations, i.e. moored buoys and platforms do also report in FM13–Code; their observations are also shown on this chart. SHIP observations are concentrated over the open North Atlantic along the main ship routes between Europe and the Americas.

4.3 Data Availability

The following table gives the number of SYNOP reports according to the 5°-square plots of ECMWF:

Number of SYNOP reports Global and North-Atlantic Region per day

94...02	Jul 94	Feb95	Jul 96	Jul 97	Jul 98	May99	May00	May01	Apr 02
ALL	40519	43009	44136	46196	48599	48642	51322	53049	53765
NAT	2133	2120	2300	2310	2691	2749	2586	2623	2619

Data from ECMWF Monthly Monitoring Reports

4.4 Data Quality

The suspect list of ECMWF gives only ship's call sign, but no position indicating the area of operation. However, according to the Meteo-France reports the problem of suspect data seems to be restricted to very few ships only rather than being a general deficiency of the system. The estimated numbers of ships with suspect observations in the COSNA - Area are given in the table below:

Estimated number of ships in the North-Atlantic reporting suspect SYNOP reports

97…02	J97	Jul	J98	Jul	J99	Jul	J00	Jul	J01	Jul	J02	Jun
MSLP	7	6	6	7	8	10	9	12	17	13	18	20
W-SPD	5	6	5	5	12	5	8	7	9	6	6	12
W-DRN	1	1	1	2	2	3	8	7	5	4	13	8

Data from ECMWF Monthly Monitoring Report

The numbers of suspect SYNOP reports from ships show an increase in 2001. Nevertheless, assuming 50 reports per ship per month, the percentage of suspect observations is still less than 1 %.

5. Aircraft Data (ASDAR / AMDAR)

Aircraft Upper Air Observations are fed into GTS in different ways and in different codes. Most of the aircraft data on GTS are AMDAR coded. The other aircraft data acquisition systems are ASDAR and ACARS. ASDAR units are supplied by MET services to selected aircraft. ACARS, providing data from the aircraft integrated data collection and addressing system, is coming more and more into service. ASDAR and ACARS data include temperature, wind speed and -direction and information on turbulence during climb / descent and en route.

5.1 ASDAR - Units

16 ASDAR - Units were reporting in the beginning of the year 2000. After all British Airways units have been withdrawn from use from April to June 2000 and two KLM units in 2001, the remaining operational units in the second quarter of the year 2002 are shown in the table below.

Operational ASDAR-Units in 2002Q2

Aerolineas Argentinas	AR006LOZ	AR007EPZ	
KLM	KL012UMZ		
Lufthansa	LH005VNZ		
South African	SA015AUZ	SA016ATZ	
Saudi Arabian	SV003IMZ	SV023IKZ	
Air Mauritius	MK021AKZ	MK022ALZ	

ASDAR units in 2002Q2 from UKMO ASDAR Quarterly Report

5.2 ASDAR Data Coverage

About 50 percent of the aircraft carrying ASDAR units fly predominantly between or within Europe and North America. The remainder operate typically from their hubs, i.e. Buenos Aires, Johannesburg, Mauritius, Jeddah, to destinations in the Middle East, Far East, South America, North America and Europe.

5.3 ASDAR Data Availability

The ASDAR units are aboard the above listed aircraft and transmit their reports according to the operational status of the unit, the airline operations and schedule. Figure 11 shows the average number of all reports of all units per day and the number of units. After a phase of stable numbers of reports (around 2000 from all units per day) until late 1999, the number of reports has decreased almost continuously since then due to the withdrawal of units from operational use.

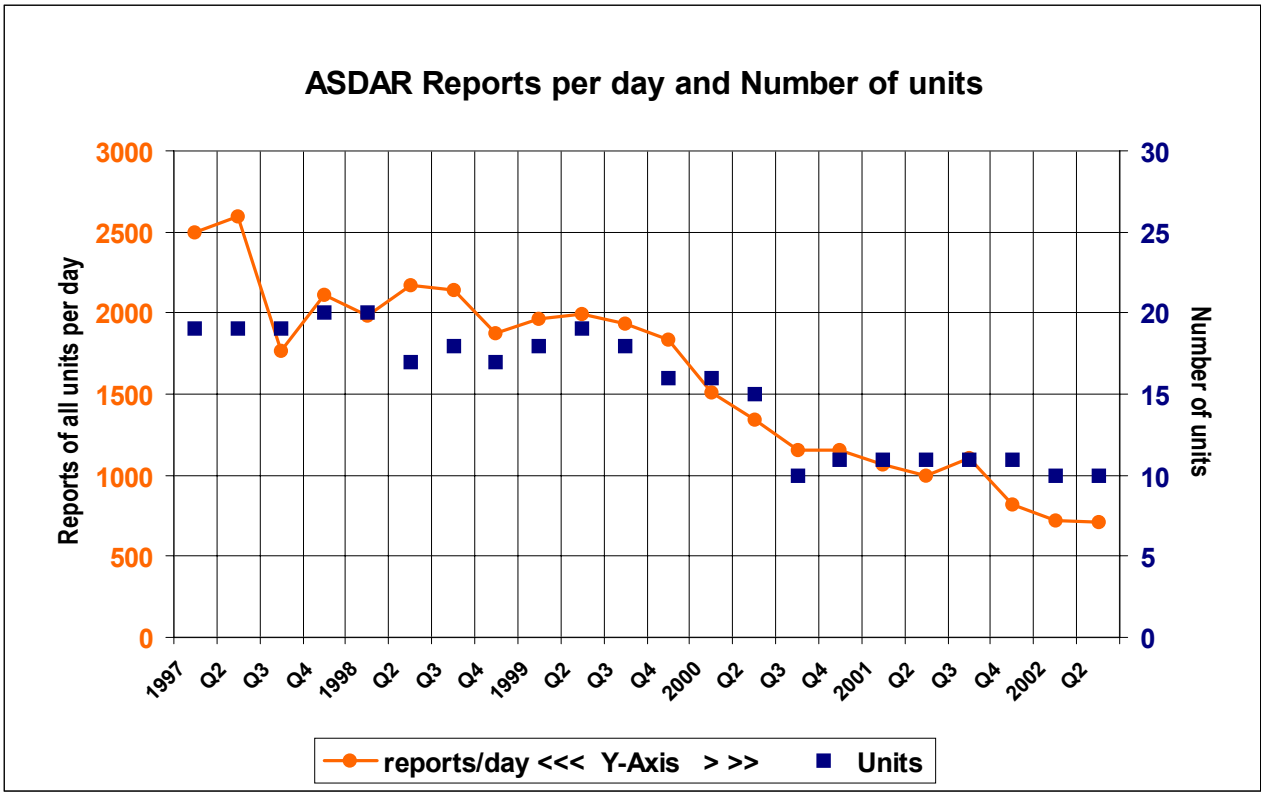

Figure 11. Number of ASDAR-units (filled squares, right Y-axis) and number of reports of all these units (filled circles, left Y-axis. (UKQR-ASDAR)

Figure 11 shows the development of the ASDAR-system in terms of units (blue squares) and number of reports (orange dots). After the withdrawal of all British Airways units in 2000, another two units have been withdrawn from operation in 2001 (KLM013, KLM014).

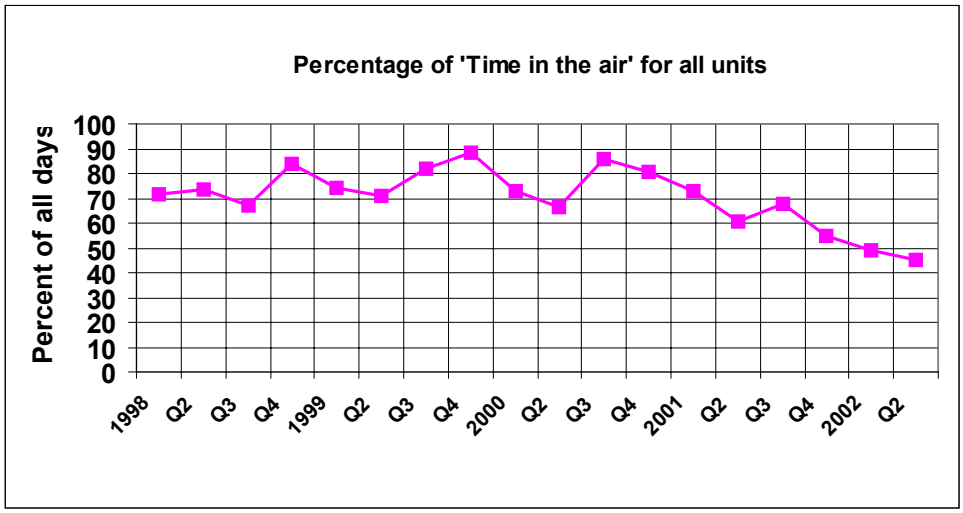

Figure 12. Percentage of days with reports from all ASDAR units: 100 % for 'each aircraft in the air every day, all reporting', 0 % for 'all aircraft on ground every day, no reports'.

Figure 12. shows the system efficiency as percentage of days all units are in the air and reporting relative to the number of potential reporting days. The percentage of days with no reports of each aircraft (aircraft on ground) is the most important indicator for the performance of the system; after a period with values between 70% and 90%, it has decreased almost continuously since 2000 and is now below 50%.

Due to temporary maintenance requirements, the number of actually operating ASDAR units is typically less than the total number of units available. The table below gives both numbers:

ASDAR	99Q1	00Q1	01Q1	01Q2	01Q3	01Q4	02Q1	02Q1
# units	18	16	11	11	11	11	10	10
# units / day	13.6	11.7	8.0	6.7	7.5	6.0	4.9	4.5
% Efficiency	76 %	73 %	73 %	79 %	83 %	75 %	82 %	65 %

Number of ASDAR units and average number of units per day, also as efficiency[%]. UKQR-ASDAR.

The timeliness of the ASDAR data remains high with 93.3 % of the reports received at Bracknell within one hour and 99.5 % within 115 minutes.

All units maintain the expected reporting rate of one report per seven minutes in level flight and one every 10 hPa during near-ground phase of climb or descent and one every 50 hPa at higher levels during climb or descent.

5.4 ASDAR Data Quality

The ASDAR-data are monitored by the UKMO on basis of the forecast fields of their 30-level global forecast model. The differences between observations and background field at 950 and 400 hPa during climb/descent and between 300 and 150 hPa en route are used to analyse the quality of ASDAR reports on a monthly basis.

Apart from a general high quality of the observations, the following problems occurred with single units:

SA015AUZ exhibits large temperature error of +2.1 K
SV016ATZ exhibits large temperature error of +1.6 K, intermittent fault
LH005SVNZ has not resumed operation after maintenance in February 2002

5.5 AMDAR

Aircraft crews transmit AIREPs en route at mandatory positions over the North Atlantic in oral form to ATC. More and more reports are now sent via the aircraft's own avionics system using communication providers (SITA, ARINC) and then encoded into AMDAR code. The frequency of reports during climb and descent makes it possible to provide vertical soundings (parameters: temperature wind-speed and wind-direction) comparable to radio-soundings. The numbers of AMDAR AIREPs in the North-Atlantic-Area given by ECMWF are shown in Figure 13.

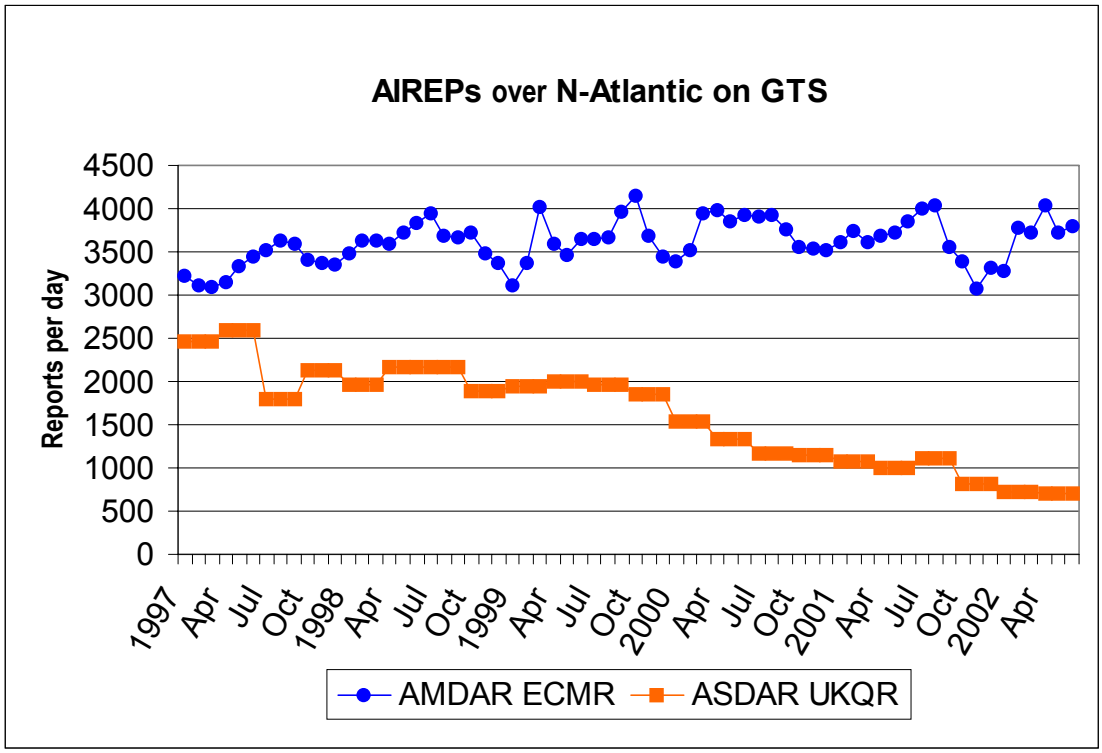

Figure 13. Number of AIREP reports per day over the North-Atlantic (ECMR) and number of ASDAR reports per day (UKQR-ASDAR)

5.6 E-AMDAR

Special efforts have been undertaken by Eumetnet in the E-AMDAR project, which was launched in 1999 by 14 participants and became operational in the year 2000. In April 2002 the E-AMDAR fleet numbers more than 500 aircraft of British Airways, Air France, KLM, Lufthansa and SAS, 80% of which are flying on European routes and 20% are operating long haul routes. On 1.April 2002 268 aircraft out of the assigned 528 were fully operational.

During the first three months of 2002 a total of more than 2 million AMDAR-reports were received from more than 250 aircraft averaging more than 8000 reports by each aircraft; the aircraft with the highest numbers sent more than 18.000 reports. The data coverage follows the main routes and is shown for 2001 and 2002 in Figures 9 through 11 for Europe and outside Europe.

E-AMDAR reports are received via dedicated collecting centres and then fed into GTS. Reports of long-range aircraft are also sent via Satcom. The target to have the reports available as soon as possible is met with 96 % of all reports received within one hour and 98 % within two hours. 50 % of all reports are even received within 15 minutes and 90 % within 30 minutes after observation.

The average reporting frequency during cruise is expected to be one report per 10 minutes. During climb and descent the reporting frequency should increase to provide one report every 50 hPa at higher levels and up to one report every 10 hPa in the lower atmosphere. This causes a huge increase of reports during these phases of flight and more reports from short-haul aircraft than from long-range aircraft.

The received reports are subject to a continuous quality control by comparing them to background field of the HIRLAM-31-level model every three hours (update-cycle of the model). The data quality control reveals no significant anomalies of temperature, wind speed or wind direction. More than 50 % of the data are within +/-0.3 K for temperature, +/-0.15 mps for wind speed and +/-6° or +/-12° for wind direction during level flight and during climb and descent, respectively.

About 13 reporting aircraft out of 269 were reporting extreme temperature differences, 17 reporting extreme differences in wind speed and 16 reporting extreme differences in wind direction.

A system for the selective activation of the aircraft for network efficiency optimisation has been developed in cooperation with Lufthansa.

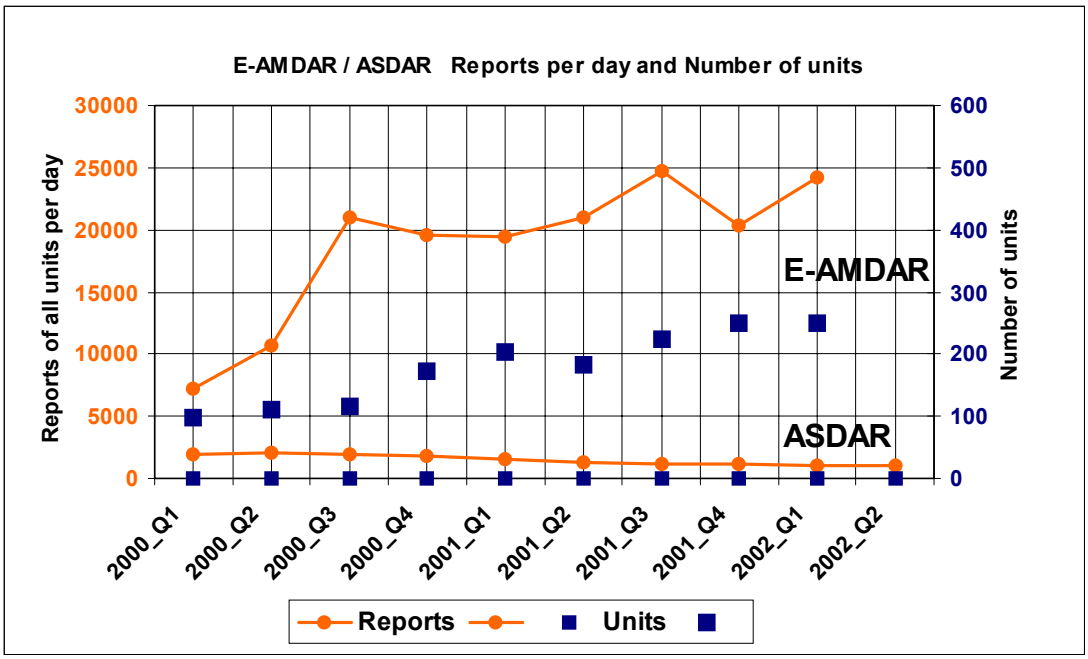

Figure 14. Number of aircraft and number of reports per day available from ASDAR and E-AMDAR From Quarterly Reports of ASDAR (UKMO) and E-AMDAR (KNMI)

In the vicinity of more than 100 airports vertical profiles during climb and descent are available. The frequency is between one profile per hour at the Hubs (AMS, FRA, LON) and at least one profile per day at smaller airports.

The data quality and timeliness is as good as or better than ASDAR or better with 98.8% of all reports received within 45 minutes in the first quarter of 2001. Due to the automatic generation of the AMDAR code, this is in general error free. Apart from a few individual units, no significant temperature, wind speed or wind direction anomalies were found.

6 Radio-soundings (TEMP, ASAP)

6.1 System Availability

The TEMP-Stations in the COSNA-Area are the land-based stations of Iceland and the adjacent continental areas and the mobile ASAP-units aboard ships. The land-based stations are monitored in the special COSNA section of the ECMWF Monthly Monitoring Report; these results will be discussed in section 6.5.

Operational ASAP-Ships in the COSNA Area

Denmark	QXYH2*	OXTS2*	OVYA2	
France	FNOR	FNOU	FNPH	FNRS
Germany	DBBH	DBLK	ELML7	
Sweden/Iceland	V2XO			
EUMETNET	SWJS	WPKD		
United Kingdom	ZCBP6			

***** shared operation of one ASAP-unit

Operational ASAP-Ships outside the COSNA-Area

Japan	JGQH	JDWX	JIVB	JBOA	JNSR	JCCX	JFDG
Russ.Fed.	UWEC						
UK	ZDLP	ZCBP6					
USA	WTEC						
WRAP	GWAN						

Both tables from ACC Annual Report 2001

6.2 Data Coverage

The data coverage is given by the typical operation area or routes of the ships and can roughly be described as follows:

DENMARK: Arina Arctica OVYA2; Irena Arctica OXTS2; Nuka Arctica OXYH2

North Atlantic along the parallel of 60°N between Scandinavia and Greenland and northbound along the West Coast of Greenland. Shared operation of ASAP unit #2 by the ships OXYH2 and OXTS2

GERMANY: Hornbay ELML7

North Atlantic between German, Dutch and French harbours and Venezuela

GERMANY: Meteor DBBH

Research vessel, area depending on experiments, operating mostly outside the COSNA-Area in the South Atlantic.

GERMANY: Polarstern DBLK

Polar Research vessel, operating during the respective hemispheric summers in the Arctic and Antarctic areas of the Atlantic. Operated by German AWI Polar Research Institute, no genuine ASAP-unit, reporting on informal basis.

FRANCE: Fort Royal FNOR; Fort Fleur d'Epée FNOU;
Fort Desaix FNPH; Douce France FNRS

Operation area North Atlantic between Le Havre and the West Indies.

ICELAND/SWEDEN: Lagerfoss V2XO

Operation area North Atlantic between Reykjavik, Iceland and Norfolk, Virginia. Begin of observations in July 2001.

EUMETNET: Peljasper SWJS

Started operation in December 2000. Operating mainly between Greece and the western Mediterranean, but sometimes also in the eastern Mediterranean. If the ship is closer than 75 nm from a land-based TEMP-station, radiosondes are launched at 0600z and 1800z, otherwise soundings are made at 0000z and 1200z.

EUMETNET: Sea-Land Achiever WPKD

Operation between the English Channel and Charleston, South Carolina, and further on between the Keys and Houston, Texas.

UNITED KINGDOM: CanMar Pride ZCBP6

Operation area North Atlantic

The mobile ASAP-units on ships as described above cover the main ship routes over the North Atlantic between Denmark and Greenland, Iceland and Northern USA and between the English Channel and South-/North-America.

The ASAP units operated outside the COSNA area cover mainly the South-Atlantic, Western Pacific and the Antarctic seas (research vessels ZDLP and DBLK, the latter not being an actual ASAP-unit, but a research vessel using Vaisala GPS radiosondes).

6.3 Data Availability

Number of TEMP Soundings in COSNA-Area by country (w/o. MIKE, Ekofisk)

	1383 (4 units)	**1999**	**2000**	**2001**
Denmark	414 (1 unit)	752 (2 units)	768 (2 units)	648 (2 units)
France		1421 (4 units)	1360 (4 units)	1385 (4 units)
German Research		377 (1 unit)	459 (1 unit)	380 (DBBH) (391)(DBLK)
German M/V	631 (3 units)	515 (1 unit)	497 (1 unit)	538 (ELML7)
SWE / ICE	331 (1 unit)	174 (1 unit)	117 (1 unit)	129 (V2XO)
UK			220 (1 unit)	256 (ZCBP6)
Spain	78 (1 unit)		3 (1 unit)	107 (EHOA)
EUMETNET			27 (1 unit)	464 (2 units)
Total	3791 (12 units)	3239 (9 units)	3451 (12 units)	3880 (13 units)
Change		- 2 %	+ 7 %	+ 2 %

Number of soundings of mobile ASAP-units in COSNA-area from ASAP Annual Report 2001

The British ASAP-unit aboard **ZCBP6** CanMar Pride entered service in January 2000. There are now two Eumetnet E-ASAP ships operating: **SWJS** Peljasper which is the only ship operating mainly in the Mediterranean Sea and **WPKD** Sea-Land Achiever. The latter has been supported by NOAA/Office of Global Programs to launch soundings in the Gulf of Mexico.

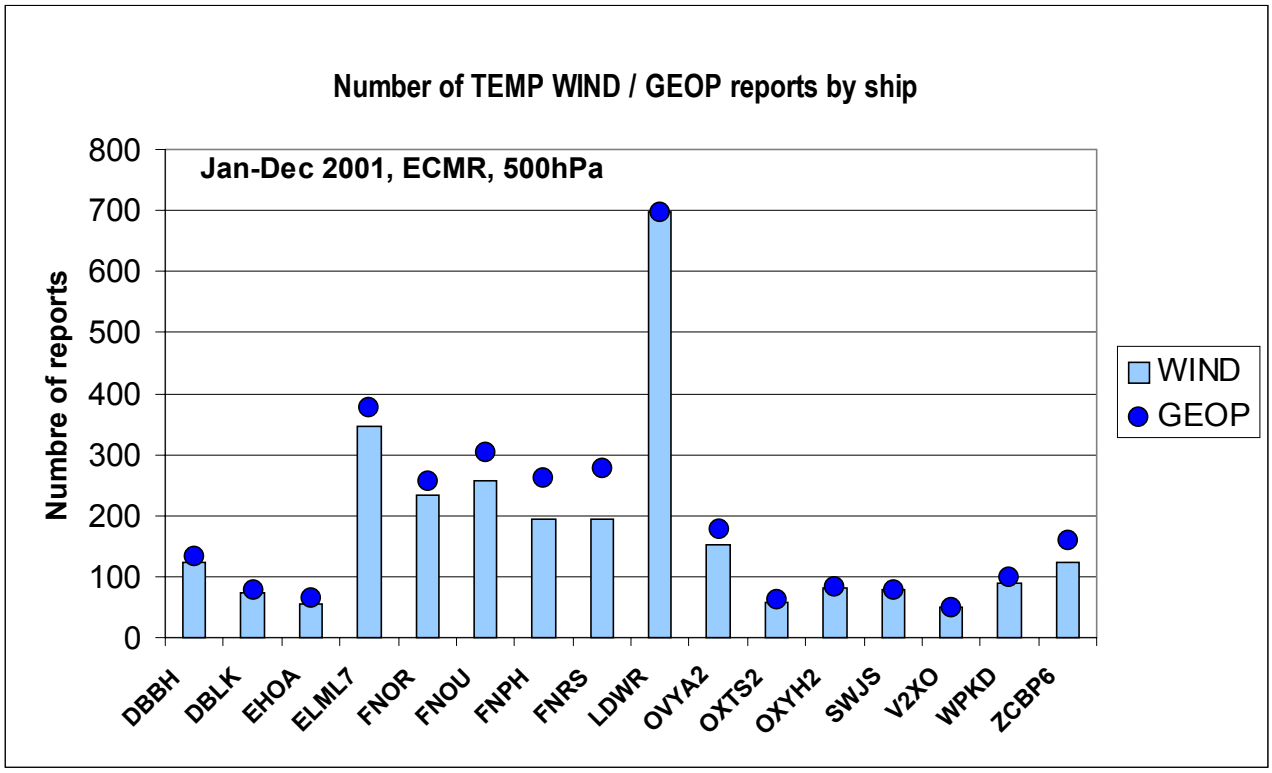

Figure 15: Number of TEMP reports for Geopotential and Wind for each ASAP unit.

The number of soundings of the German research vessel DBBH decreased from 459 in 2000 to 380 in 2001 (-18 %) with the On-GTS-rate decreasing even more due to an unstable Satellite link for ship positions east of the Greenwich meridian. On the other hand, the German merchant vessel ELML7 increased the number of soundings by 18 % from 459 in 2000 to 536 in 2001. The number of soundings from the Danish ships decreased from 768 in 2000 to 648 in 2001 (-16 %). The four French ships slightly increased their number of soundings from 1360 in 2000 to 1385 in 2001 (+2 %) and still remain the largest contributor to the Programme.

The Swedish-Icelandic ship V2XO started operation on the Reykjavik-Norfolk-route due to the delayed installation of the unit on 28.6.2001. Although special soundings were carried out during the SOP period September through October, various technical problems reduced the number of soundings in 2001. There were 103 soundings available from the Spanish hospital ship "Esperanza del Mar" EHOA, which was withdrawn from use in September 2001 and replaced by a ship of the same name, but with the new call sign EBUQ.

The radio-soundings aboard ASAP-Ships are mainly performed by crewmembers and then fed into the GTS via Telecom-facilities. The results of an End-to-end Monitoring done by Meteo-France are published in a separate report. They found that ships inserting their data into the GTS via one RTH only achieve the best scores. As duplication by itself is no reason for corrupt data, but may be considered as a backup, the real reasons for data corruption ar to be found elsewhere.

The ASAP-components are very effectively monitored using data direct from the ASAP operating countries. Completed forms with data such as number of radio-sondes launched, number of messages transmitted and percentage on GTS are then submitted by the ASAP-Operators to the ASAP Panel (ASAPP).

ASAP-TEMPs Data Availability on GTS in 2001

	TEMPs launched	TEMPs transm	TEMPs available	TEMPs available	TEMPSs on GTS	TEMPSs on GTS	Difference OPS-GTS
SHIP	byOperator	ByOperator	at ECMWF Number	at ECMWF . / %	By Operator Number	By Operator . %	Number / %
DBBH	380	375	220	59 %	203	54 %	17 / 5 %
EHOA	107	68	66	97 %	67	98 %	1 / 1 %
ELML7	538	500	400	80 %	440	88 %	40 / 8 %
FNOR	316	302	263	87 %	286	95 %	23 / 8 %
FNOU	358	339	313	92 %	336	99 %	23 / 7 %
FNPH	344	318	268	84 %	285	90 %	17 / 6 %
FNRS	367	325	292	90 %	323	99 %	31 / 9 %
OXYH2	232	196	194	99 %	196	100 %	2 / 1 %
OVYA2	311	275	273	99 %	275	100 %	2 / 1 %
OXTS2	105	94	92	98 %	91	97 %	1 / 1 %
SWJS	262	240	196	82 %	208	87 %	8 / 5 %
V2XO	129	103	74	72 %	80	78 %	6 / 6 %
WPKD	202	170	174	102 %	165	98 %	9 / 3 %
ZCBP6	256	174	174	100 %	174	100 %	0/ 0 %
LDWR			(698)°				
DBLK	391	391	81	21 %	180	46 %	99 / 25 %
Total			3080		3309	74 %	229 / 7 %

Number of TEMP's launched by ASAP-Ships in 2000 from ASAP-Operators and ECMR °No ASAP-unit

The table above shows number of TEMP reports available at ECMWF (500 hPa) and the number of TEMP reports, which are transmitted on GTS by the ASAP operators. The number are good in line. Using collected reports as reference instead of reports of 500 hPa geopotential would bring all numbers to 100 % or more, i.e. more TEMP reports had been collected at ECMWF than were reported by the operators as " transmitted".

The total numbers of TEMP reports of all ASAP ships for geopotential and wind at 500 hPa according to ECMWF are given by Figure 12. The number of geopotential observations at 500 hPa shows annual variations with a maximum in summer and a minimum in winter. The deficit of wind observations against geopotential observations, which started after the withdrawal of the Omega system on 30.Sep.1997, has not yet been made up. We still have a deficit of 20 and 30 TEMP wind reports per month or around 10 %.

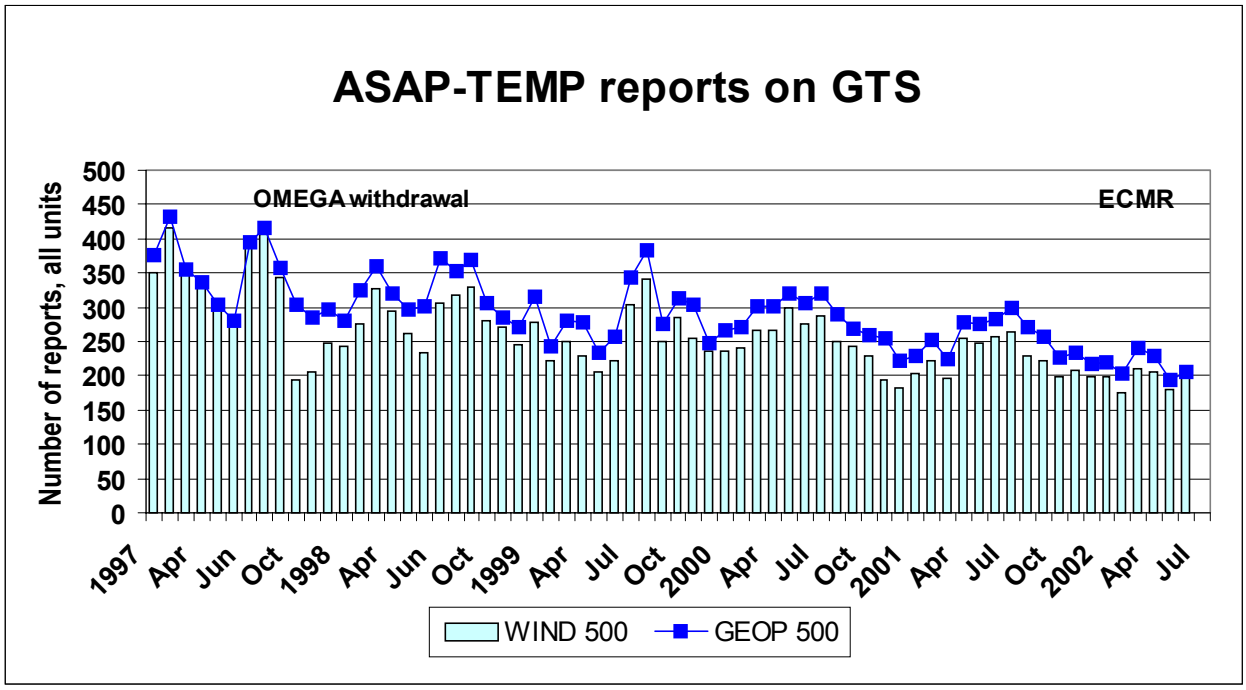

Figure 16 ASAP TEMP reports of all ASAP ship in the COSNA area, all observation times. Omega–withdrawal in October 1997 resulting in a deficit of wind reports since then. (ECMR).

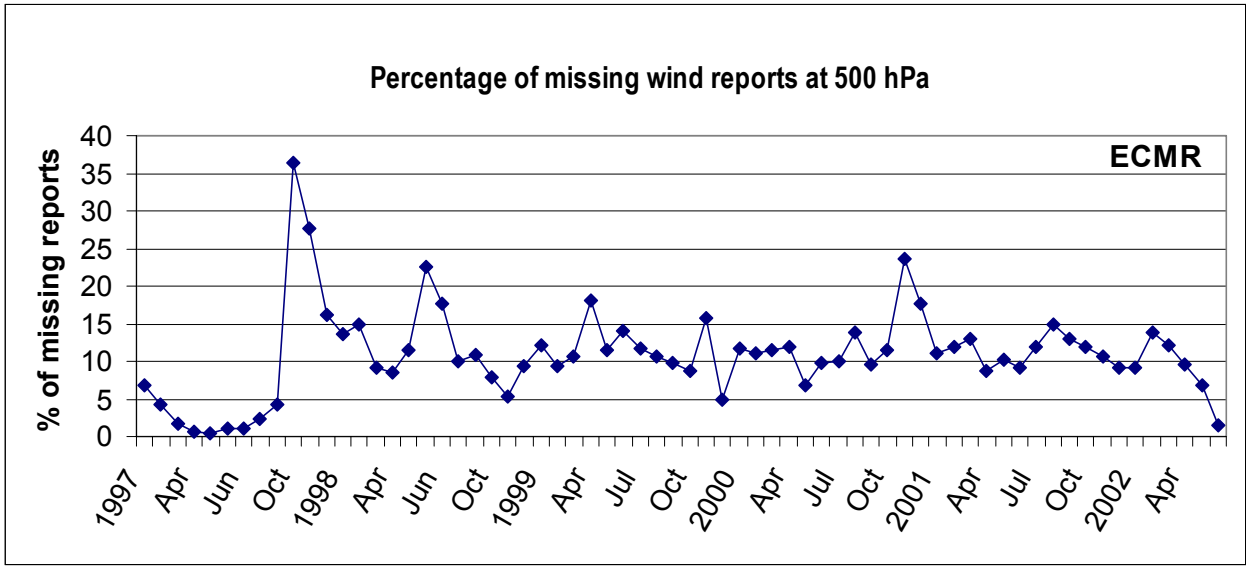

Figure 17. Deficit of wind reports of all ASAP ships in the COSNA area for level 500 hPa. (ECMR)

Figure 17 shows the time series of missing wind reports of ASAP-units. The high deficit of wind reports, which started after withdrawal of the Omega system in October 1997, still remains at between 10 % and 15 %.

The deficit of wind reports at 500 hPa and the wind-finding system for each individual ASAP ship is given in the table below. As there are also well performing ships using GPS, the problem of missing wind reports seems to be a problem of changing from one system to another rather than a particular GPS problem.

ASAP-TEMPs Wind Data Availability 2001 by ship

SHIP Callsign	Wind by	Z500	V500	Missing Wind / %
(LDWR)	LORAN-C	(698)	(698)	(0 %)
SWJS		80	79	1 %
V2XO	LORAN	51	49	4 %
OXYH2	LORAN-C/GPS	85	81	5 %
DBLK	GPS	78	73	6 %
DBBH	GPS	133	123	7 %
OXTS2	LORAN-C/GPS	63	58	8 %
FNOR	LORAN-C	256	234	8 %
ELML7	LORAN-C/GPS	378	345	9 %
WPKD	LORAN-C/GPS	99	89	10 %
OVYA2	LORAN-C/GPS	178	152	15 %
FNOU	GPS	304	258	15 %
EHOA	GPS	66	55	17 %
ZCBP6	GPS	161	123	24 %
FNPH	GPS	263	195	26 %
FNRS	GPS	279	195	30 %
ALL		3172	2807	12 %
ALL ex LDWR		2474	2109	15 %

Number of TEMP reports available at ECMWF for Geopotential 500 hPa and Wind 500 hPa from ASAP-Ships in 2001.

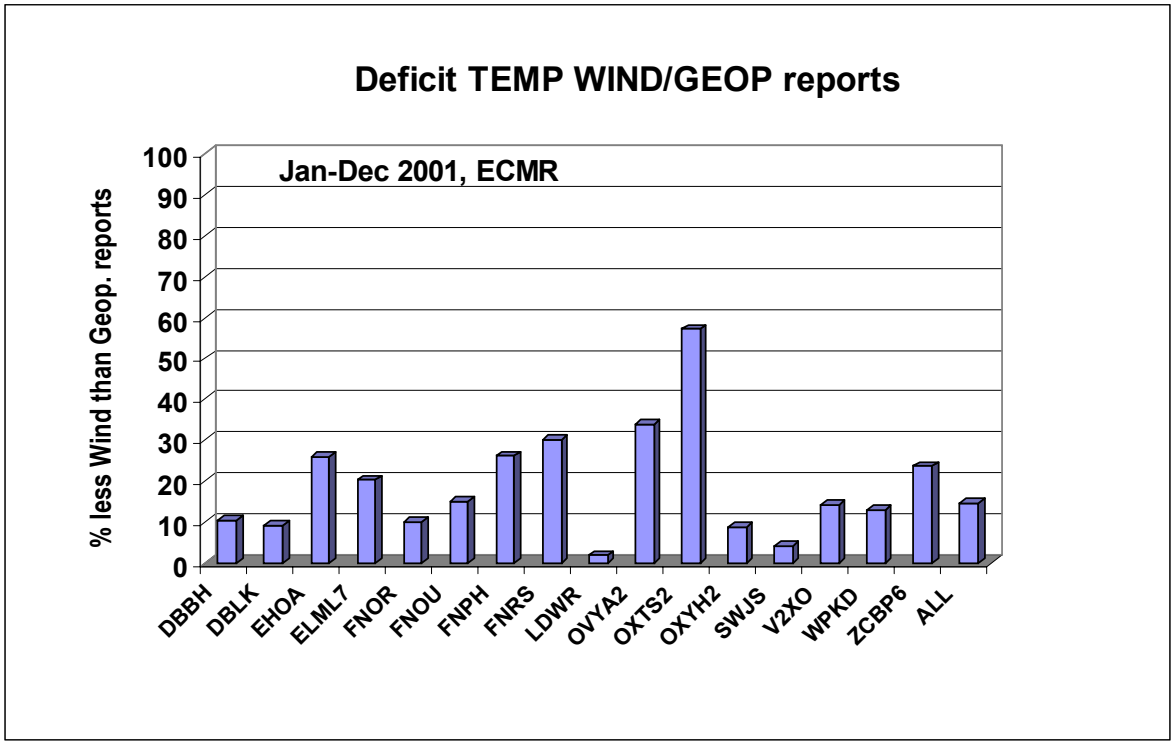

Figure 18. Deficit of TEMP wind reports for each individual ASAP ship (50 hPa).

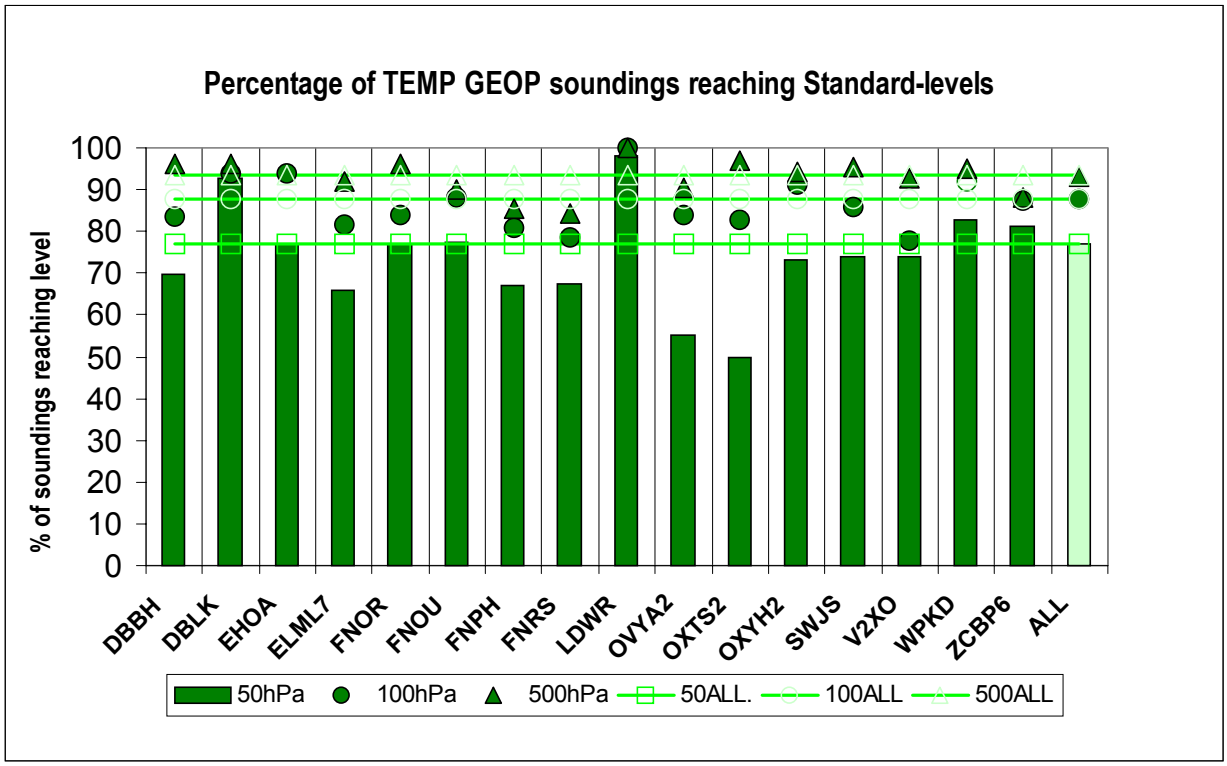

Figure 19. Percentage of all soundings of ASAP ships reaching standard levels 500 hPa, 100 hPa and 50 hPa.

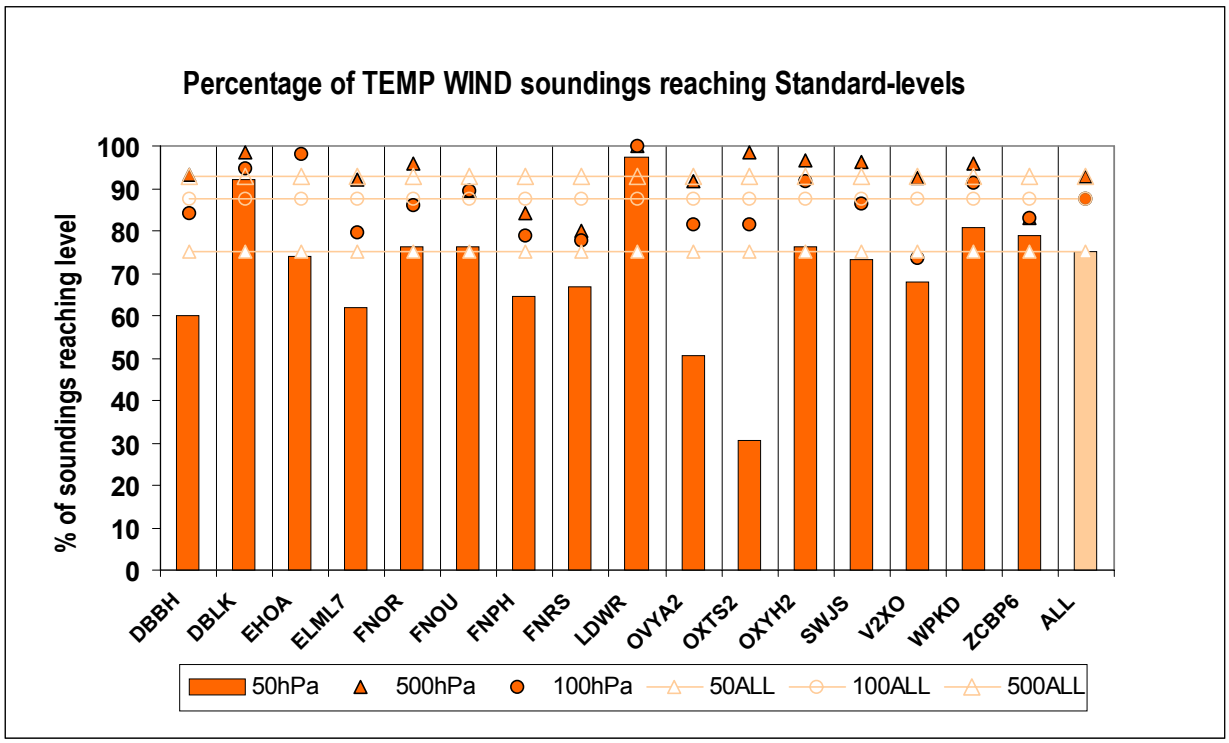

Figure 20. same as Figure19, but for wind reports

Figure 19. (geopotential) and Figure 20 (wind) show for each ship the percentage of radio-soundings reaching the standard levels 50 hPa (triangle), 100 hPa (circle) and 500 hPa (column) level, if the report of 850 hPa is available (i.e. number of reports at 850 hPa equals 100%). The farthest right column and symbols indicate the average for all ships.

Excellent performance shows OWS MIKE (LDWR) with 698 soundings made of which 685 reported geopotential at 50 hPa. The top level heights reached for geopotential are lower than average for DBBH, ELML7, FNPH and FNRS. The radiosondes of OXTS2 and OVYA2 reach 50 hPa in only 50% or 55%, of all launches.

The top heights for wind reports show similar results: Excellent performance of OWS MIKE (LDWR) with 680 out of 698 radiosondes reporting wind at 50 hPa. Poorer performing than average are the same ships as above; only 30% of all soundings of OXTS2 reached the standard level 50 hPa.

6.4 Data Quality

The table below with the suspect reports of all ASAP units with respect to geopotential and wind at 500 hPa shows, that the radio-soundings are in general of high quality, although they operate under severe environmental conditions aboard ships. There are no specific problems reported.

ASAP Suspect TEMP - Reports in 2001 Geopotential 500 hPa / Wind 500 hPa

SHIP	Total	J01	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
OXYH2	25/1		1/-									8/1	16/-
OVYA2	4/1	2/-				1/1	1/-						
OXTS2													
FNOR	2/1	-/1								2/-			
FNOU	2/2				1/-			1/1		-/1			
FNPH	1/2				1/-				-/1	-/1			
FNRS	1/-												1/-
DBBH													
ELML7	1/1			-/1						1/-			
SWJS	4/2			1/1	3/-				-/1				
WPKD	11/1								4/	5/-		1/-	1/1
ZCBP6													
LDWR	4/3	1/1										3/2	
Total	**45/14**	3/2	1/-	1/2	5/-	1/1	1/-	1/1	4/2	8/2	/ / /	12/3	18/1

ASAP radiosondes, number of suspect reports of Geopotential 500 hPa / Wind 500 hPa,
from Meteo France Monthly Monitoring Report

The total number of radio-soundings for all ASAP ships per year is about 3000, so the typical rate of suspect reports according to the table above is about 1 %.

The number of suspect reports of both ELML7 (geopotential and wind) and OXYH2 (wind only) may be an indication of a particular problem of these two ships.

6.5 TEMP Land stations in the COSNA Area

The land stations along the COSNA-Area with regular radiosondings are the following:

01001 Jan Mayen	01028 Bjornoya	03953 Valentia	04220 Egedisminde
04270 Narsarsuaq	04320 Danmarkshavn	04339 Scoresbysund	04360 Angsmagssalik
06011 Thorshavn	08001 La Coruna	08508 Lajes/Acores	08522 Funchal/Madeira
08594 Sal/Cape Verdes			

These stations are monitored by ECMWF with respect to data availability and data quality.

The monitoring results are presented in Figure 21 through 23. Of special interest is the top level height reached by the stations and the number of wind reports compared to the number of geopotential reports.

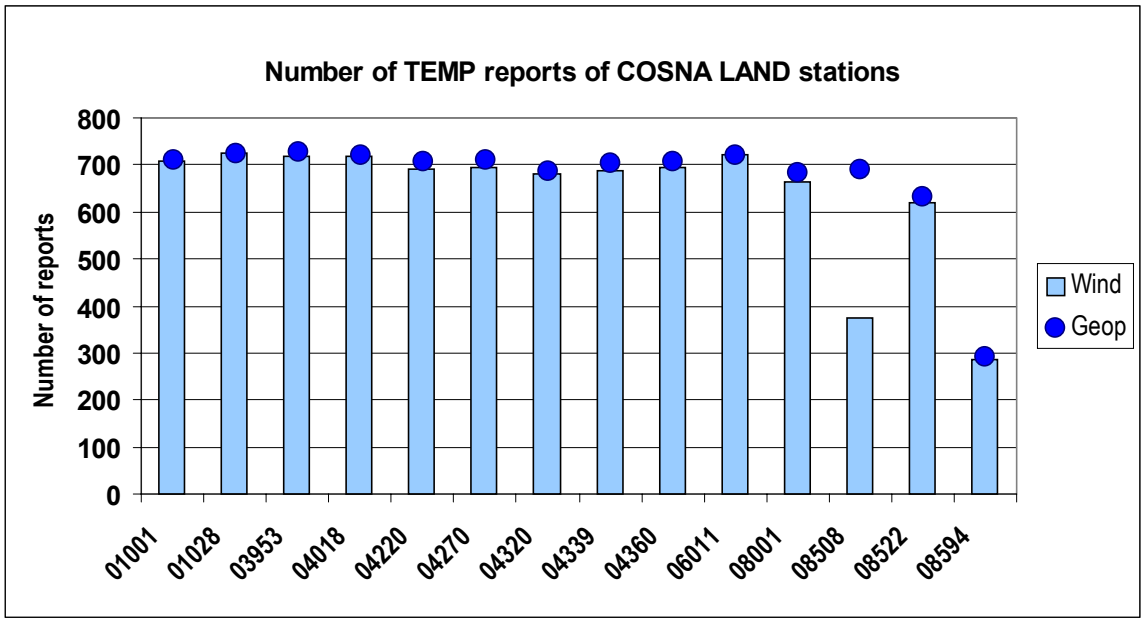

Figure 21. Number of TEMP reports for Geopotential and Wind for each TEMP LAND station in the COSNA Area

Figure 21. shows, that most of the stations have close to 700 launches per year, i.e. almost two soundings every day. The exceptions are 08594 with scheduled 12Z soundings only and 08522 with 620 launches. A problem with the wind sounding data availability is apparent for 08508 with only 373 out of 692 launches having also wind data.

Figures 22 and 23 show the percentage of launches reaching the standard levels of 500hPa, 100 hPa and 50 hPa for geopotential and wind, respectively. While the 50 hPa-level is reached by more than 90 % of all soundings (bright green column, farthest right in Figure 22), it is only reached in around 70 % by 08594 and 03953. The 100 hPa is reached by almost all soundings of 03953, whereas it is only reached in 85 % of all soundings of 08594. 08001 also shows a slightly worse than average performance.

Figure 23. shows the performance of the radiosondes with respect to the wind data availability at the standard top levels. Up to 100 hPa the availability of wind data is close to 100 % (except 08594) and there is no significant deficit of wind data as there is with the ASAP soundings. The average wind data availability at 50 hPa is 88% with the following stations performing worse: 08001 (63 %), 03953 (67 %), 08594 (72 %).

These results show, that there is a problem at 08594 with the wind-finding system, whereas 03953 has a problem with the balloon, which seems to bursts in about 30% of all soundings between 100 hPa and 50 hPa. In a significant number of soundings (20%), the wind sounding system of 08001 ceases operation between 100 hPa and 50 hPa.

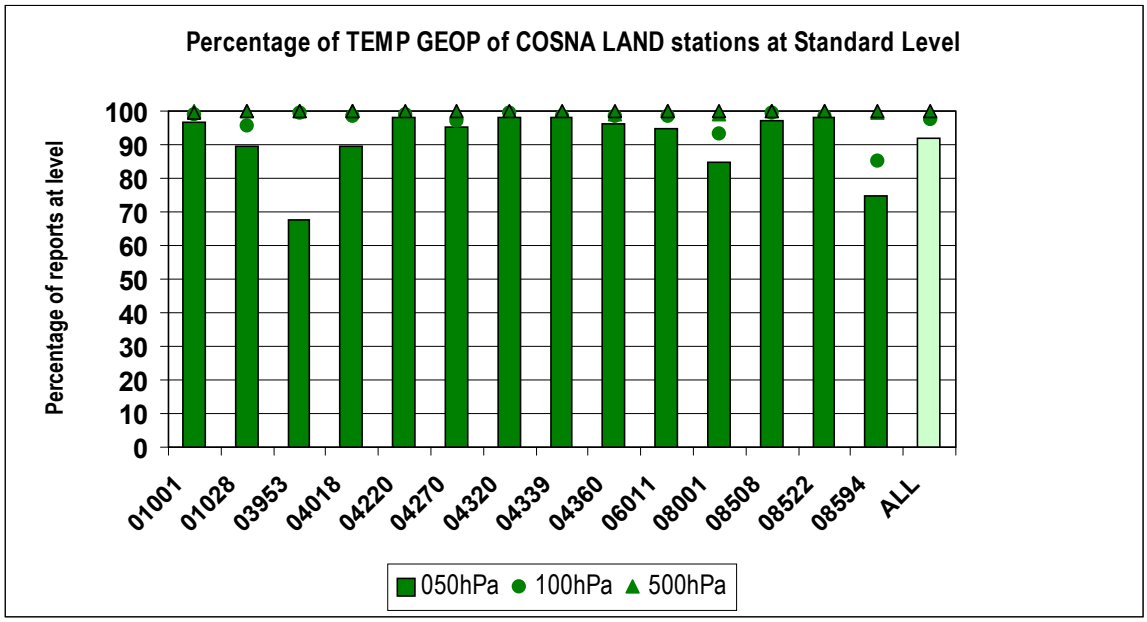

Figure 22. Percentage of all soundings of TEMP land stations in the COSNA Area reaching standard levels 500 hPa, 100 hPa and 50 hPa.

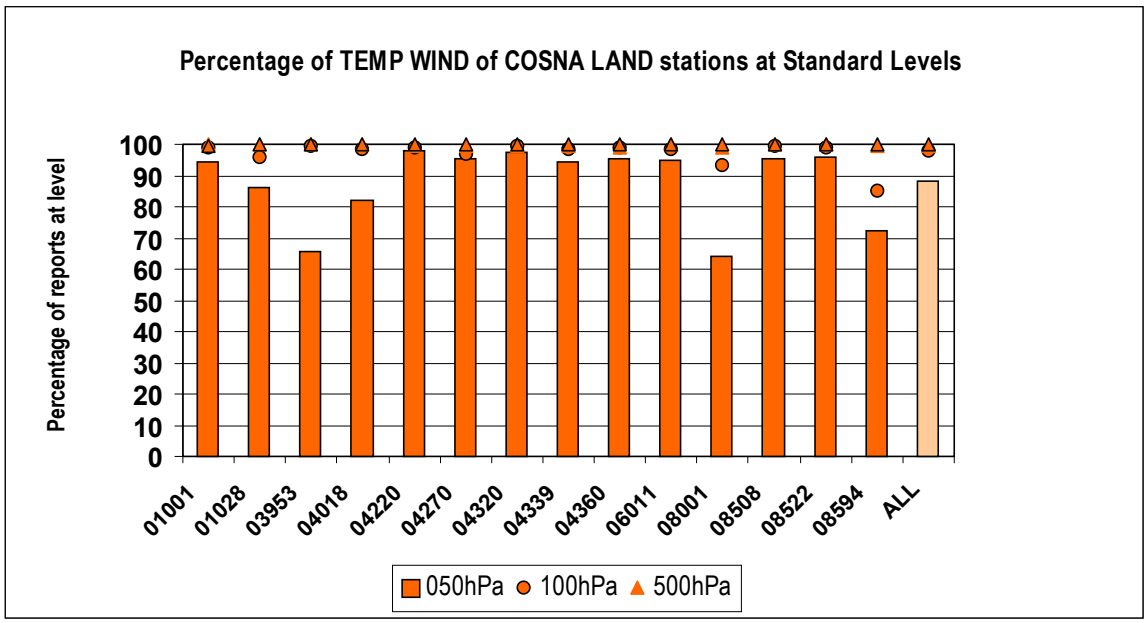

Figure 23. same as Figure 22, but for wind reports

The wind soundings of some stations sometimes start above 850 hPa; e.g., in 18% of all soundings wind data of 04339 (elevation 70m MSL) are available at 500 hPa and above, but not at 850 hPa. Data of geopotential at 850 hPa are, however, reported from all stations in all soundings. The data quality of all stations is very good and they hardly ever appear in the list of suspect stations.

6.6 Other Units

The only remaining Ocean Weather Ship is the Norwegian ship MIKE (LDWR). Another ASAP-unit is being operated in the North Sea on Platform Ekofisk (WMO-ID 01400, ICAO-ID ENEK). Both units continue to perform with excellent performance regarding number of reports, data quality and top level reached,

7. Satellite

The typical data coverage of SATOB and ATOVS as monitored by the ECMWF is shown in the Annex of this report, Figure 5 and Figure 6, the global data availability is shown in Figure 1.a of this report.

8. Conclusions

As a result of the investigation of all available systems providing observation reports in the COSNA-area on basis of the existing monitoring reports, the following conclusions may be drawn:

- **GENERAL** The observational data in the COSNA-Area continue to be of high quality with respect to availability, quality and timeliness.

- **SYNOP SHIP VOS** The number of suspect SYNOP reports from ships show a slight increase in 2001. Nevertheless, assuming 50 reports per ship per month, the percentage of suspect observations is still less than 1 %.

- **DRIFTING BUOYS** The number of drifting buoys decreased during 2001 from almost 80 to below 60, but there are again as many buoys north of 50 N as south of this parallel.

- **DRIFTING BUOYS** The data availability of drifting buoys in terms of MSL pressure reports per buoy per day shows an increase in 2001, but has come back again to values slightly higher than before. The data timeliness even improved with more than 90 % of all buoys are reporting as "good" or better.

- **ASDAR** Another two units (KLM) have been withdrawn from use so that there remain 10 operational units. The data quality is good, but the number of available reports decreases continuously following the number of operational units.

- **AMDAR** The number of AMDAR reports had a significant drop of 1000 reports per day following the events of Sep.11, but has come back to the same number of reports as before with a slight trend of increase.

- **E-AMDAR** The fleet of E-AMDAR equipped aircraft increased from 100 in the first quarter of 2000, 200 in 2001Q1 and has reached 250 units in 2002Q1. The data availability also covers vertical profile data during climb and descent in the vicinity of more than 100 airports.

- **E-AMDAR** The data quality of E-AMDAR reports is very good and there are no significant anomalies observed.

- **ASAP TEMP** Another Eumetnet ASAP-unit (Sea-Land Achiever WPKD) started operation in 2001 sailing between the English Channel and the Gulf of Mexico.

- **ASAP TEMP** There are still differences in the number of TEMP reports as given by the operators as available on GTS and those actually received at ECMWF (771 reports or 23 % less available at ECMWF than given by the operators.).
  - Performing worse than average are OXYH2 (54%), SWJS (52%), WPKD (39%) and OVYA2 (29%),
  - Performing better than average EHOA, ZCBP6, FNPH, FNOR,FNOU, ELML7.

- **ASAP TEMP** A problem remains the difference in the number of wind reports compared to the number of geopotential reports.
  - Poorer than average OXTS2, OVYA2 and FNRS;
  - Better than average SWJS, OXYH2 and DBLK.

- **ASAP TEMP** The required top pressure level of 50 hPa has not been reached by 50% or more of all soundings of the ships OXTS2 and OVYA2. It appears that the balloons of these units burst between 100 hPa and 50 hPa in 50 % or 30 %, respectively, of all soundings.

- **TEMP LAND** The land stations around the COSNA area performing radio-soundings are operating at a high level with respect to data availability and data quality. There is, however, a problem with a few stations:
  - 50 % of the soundings of 08508 do not have any wind report.
  - 30 % of the soundings of 03953 report both geopotential and wind at 100 hPa, but report neither at 50 hPa
  - 20 % of all soundings of 08001 report both geopotential and wind at 100 hPa, but report geopotential only at 50 hPa

9. Acknowledgements

This report has been compiled at the WMO Headquarters in Geneva. The help of Antonio Garcia-Mendez in providing the ECMWF Monthly Monitoring Reports in ASCII-files and the cooperation of M.Holmes and S.Holton, UKMO, is gratefully acknowledged. The helpful advice of Hamish McCombie in preparing the final version of this report is highly appreciated.

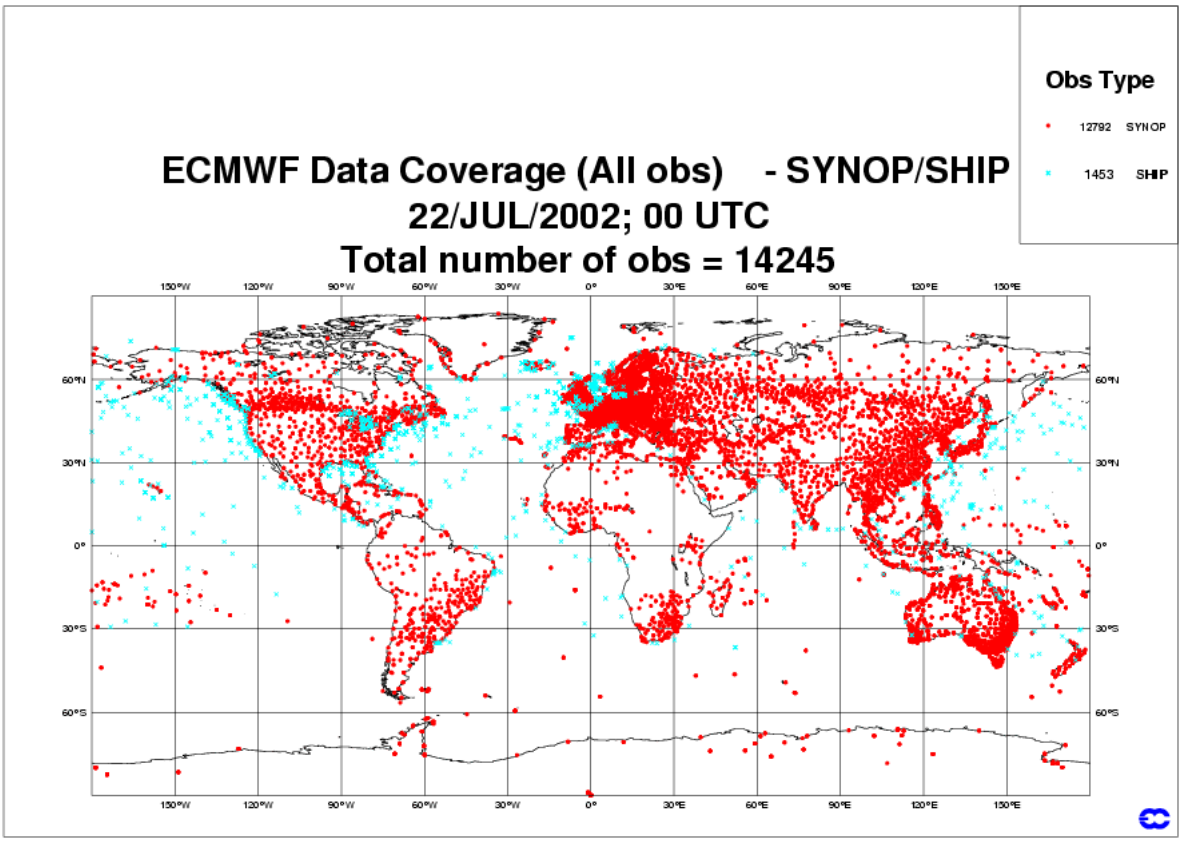

Figure Annex 1. Global Data Coverage SYNOP / SHIP (ECMWF)

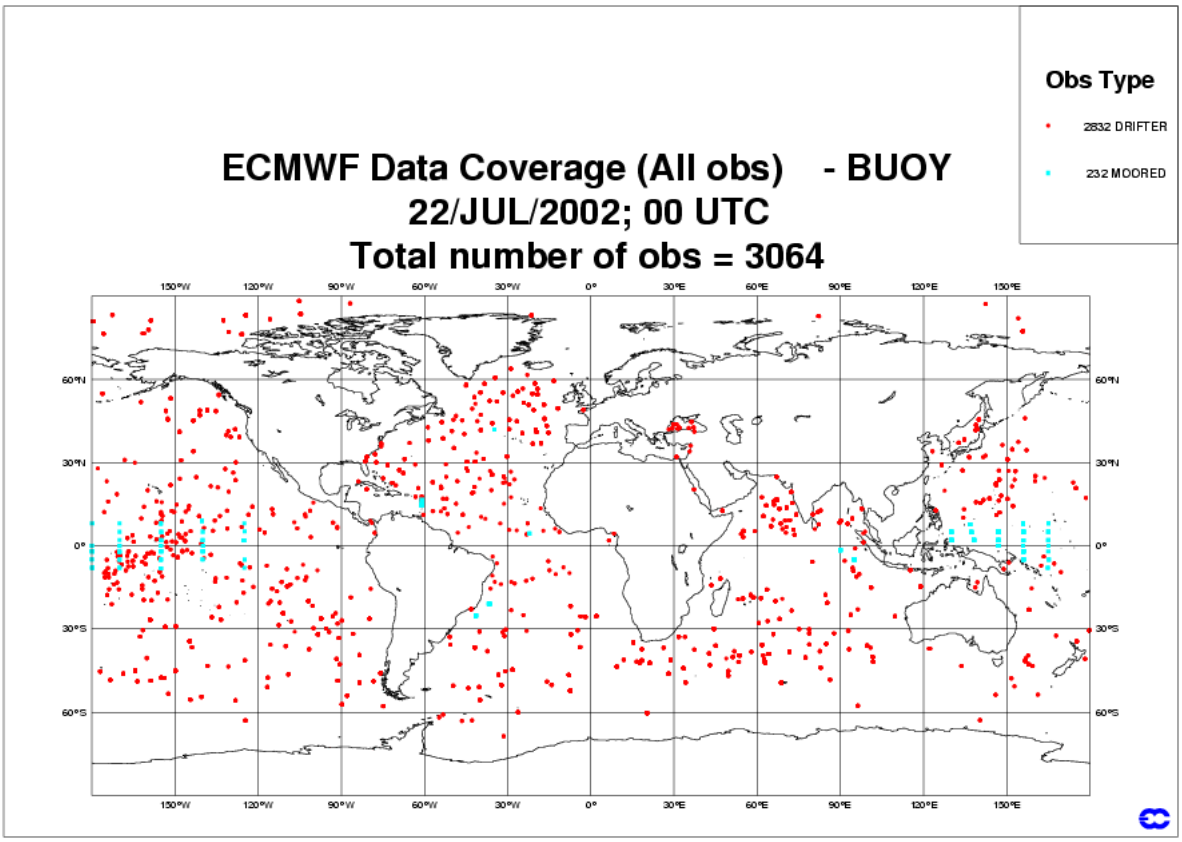

Figure Annex 2. Global Data Coverage Buoys (ECMWF)

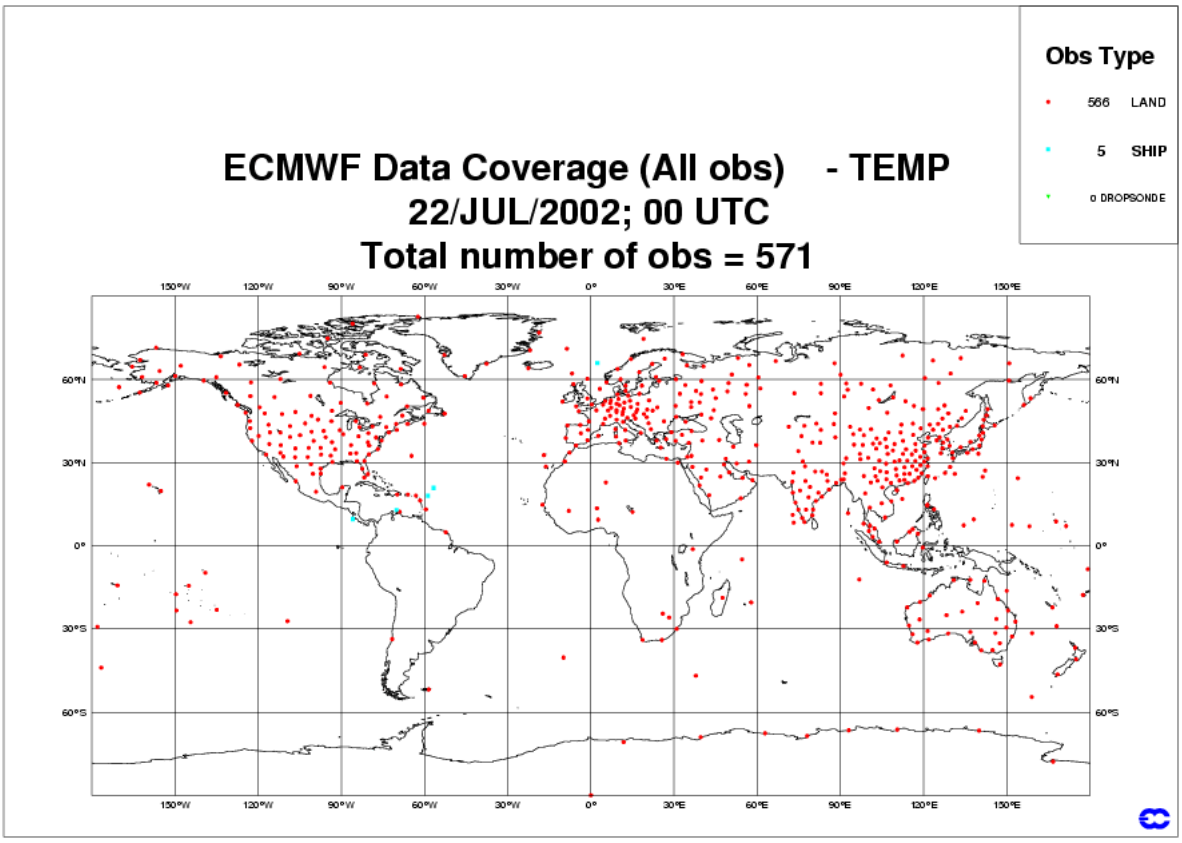

Figure Annex 3. Global Data Coverage TEMP (ECMWF)

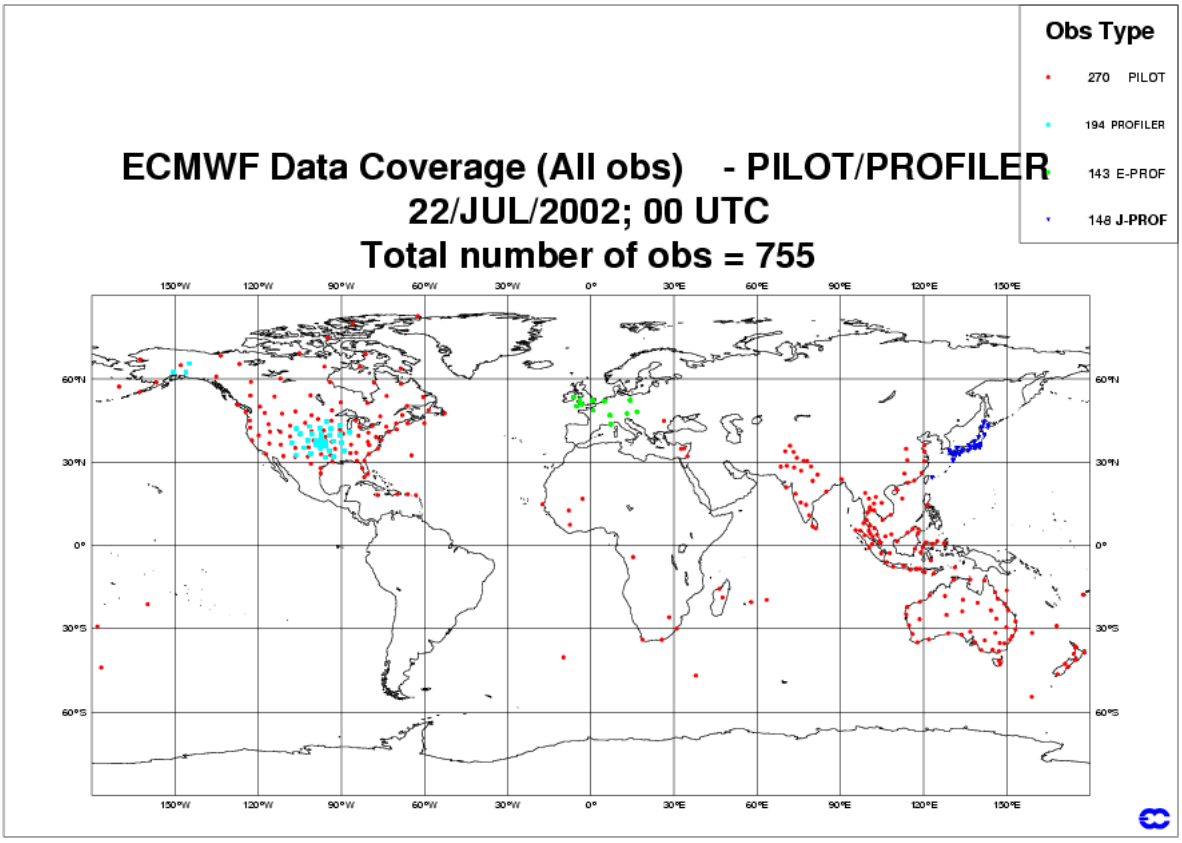

Figure Annex 4. Global Data Coverage Pilot/Profiler (ECMWF)

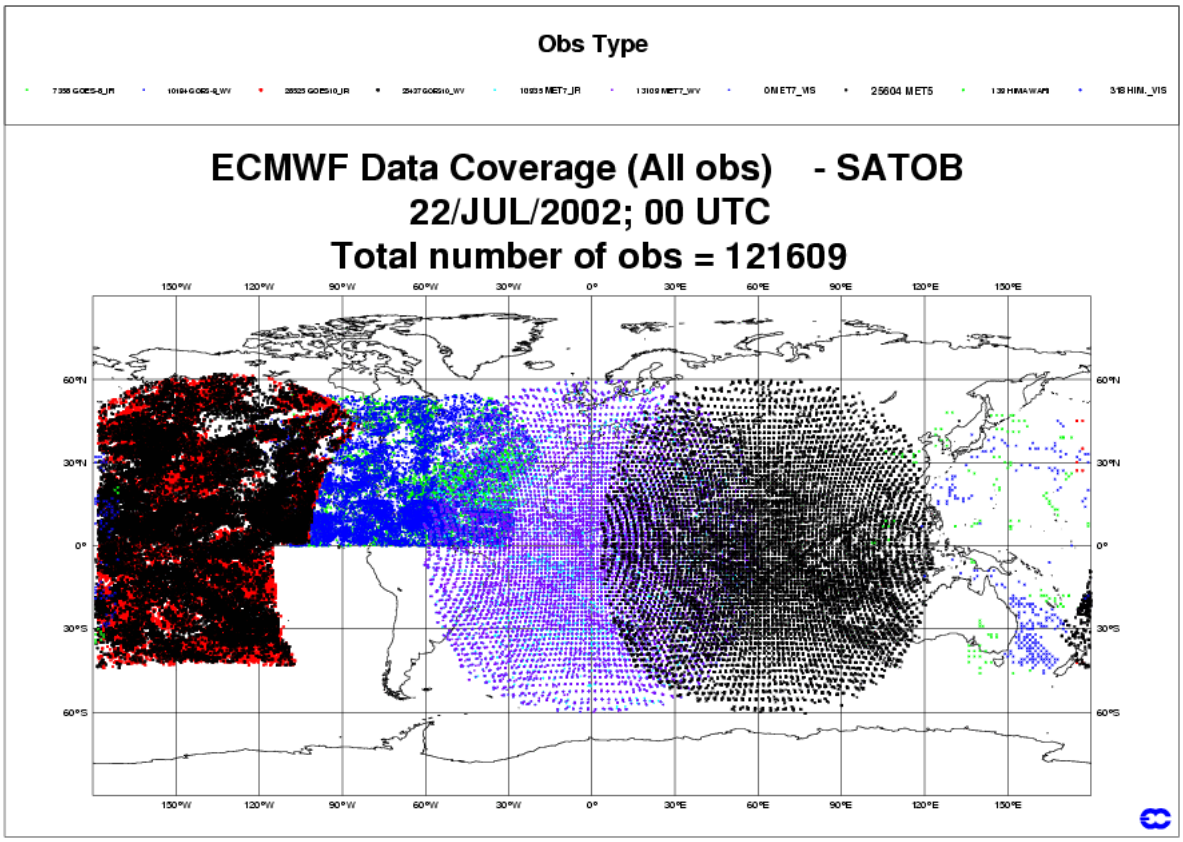

Figure Annex 5. Global Data Coverage SATOB (ECMWF)

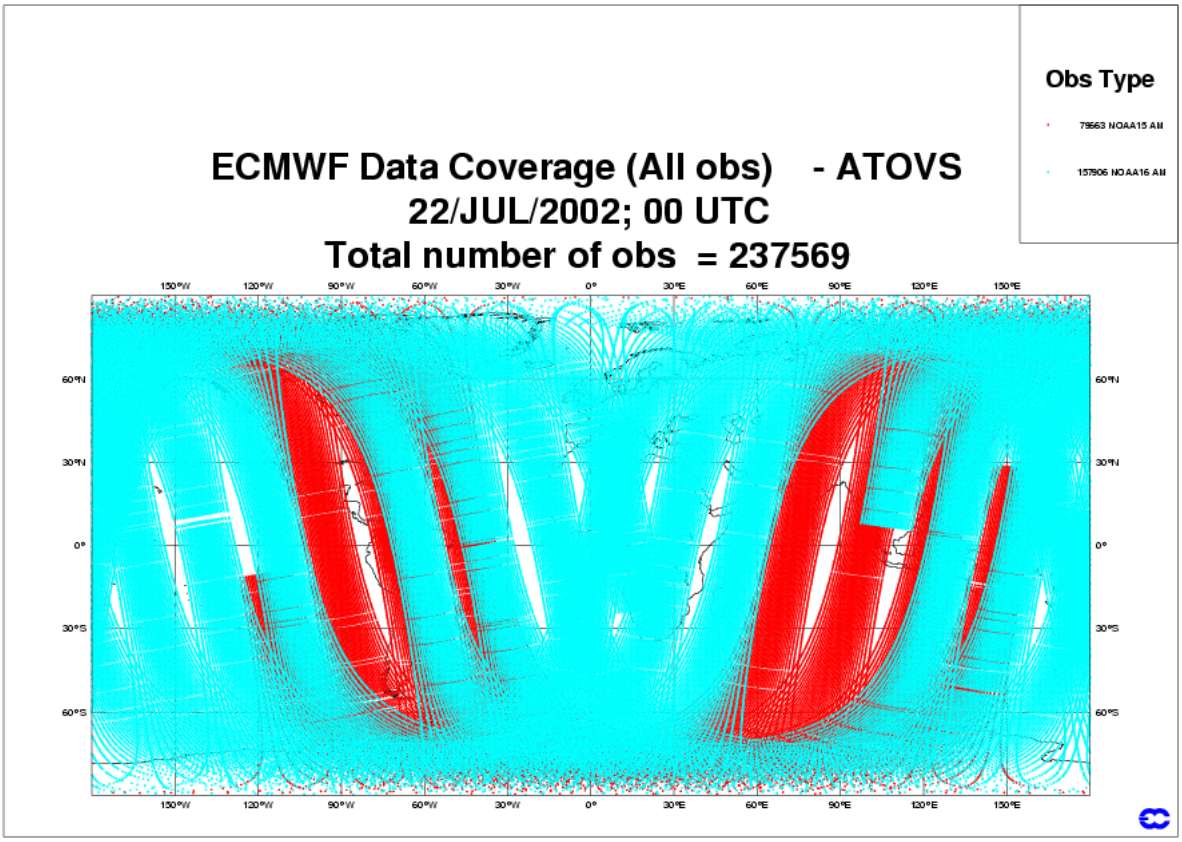

Figure Annex 6. Global Data Coverage ATOVS (ECMWF)

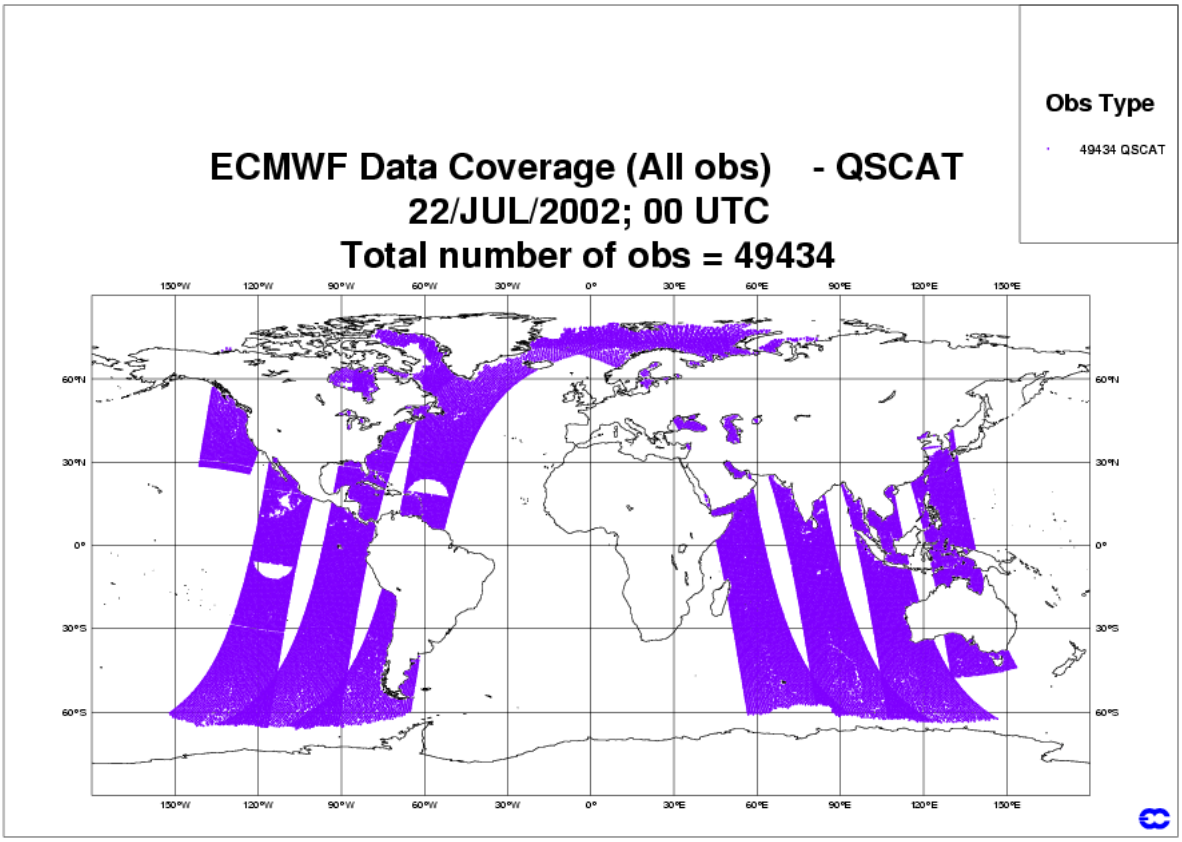

Figure Annex 7. D Global Data Coverage QSCAT (ECMWF)

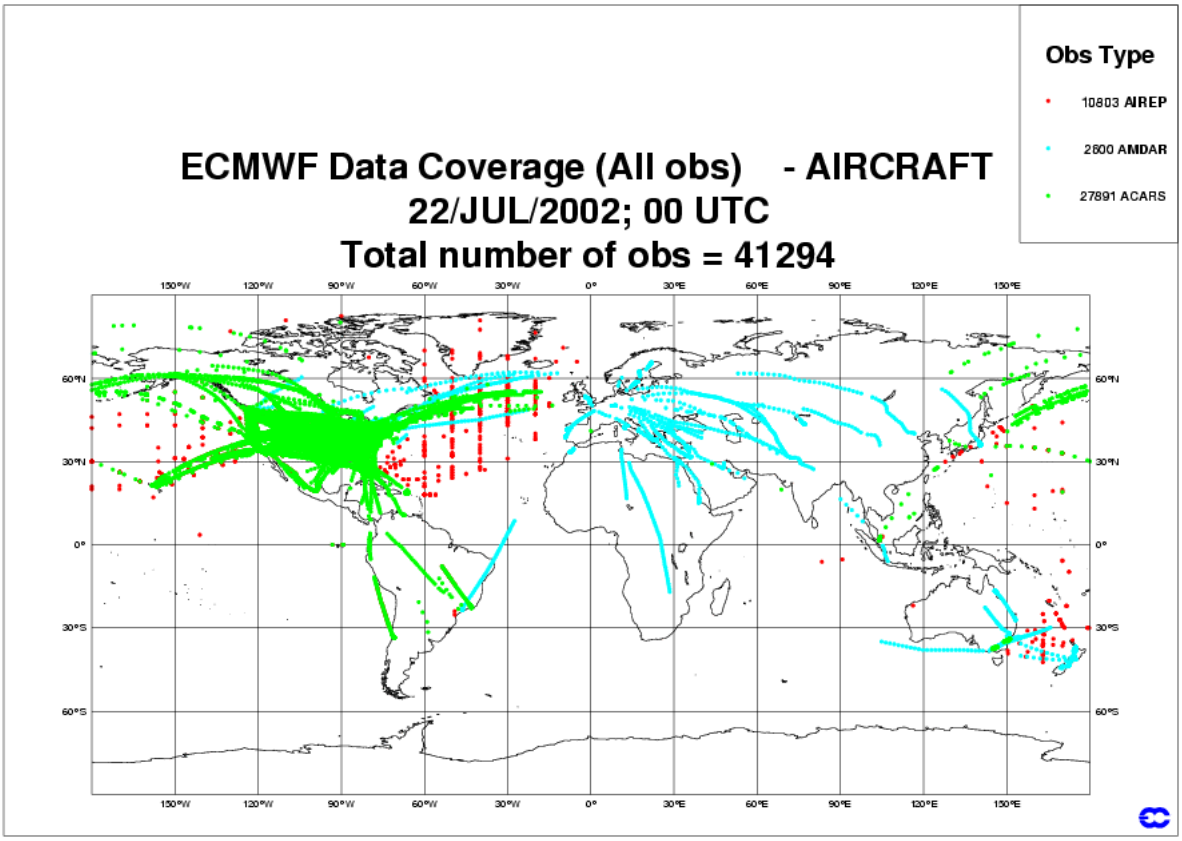

Figure Annex 8. Global Data Coverage AIREP (ECMWF)

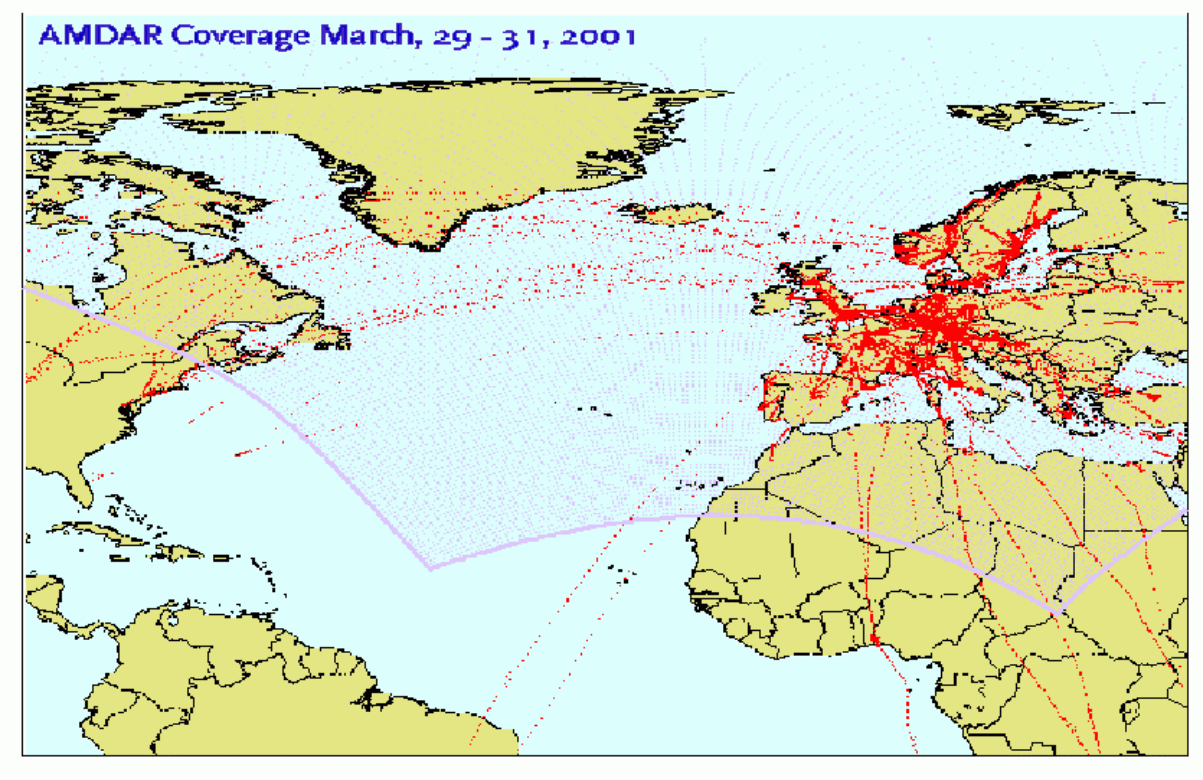

Figure Annex 9. Data Coverage of AMDAR units 29-31 Dec 2001 (KNMI AMDAR-Report)

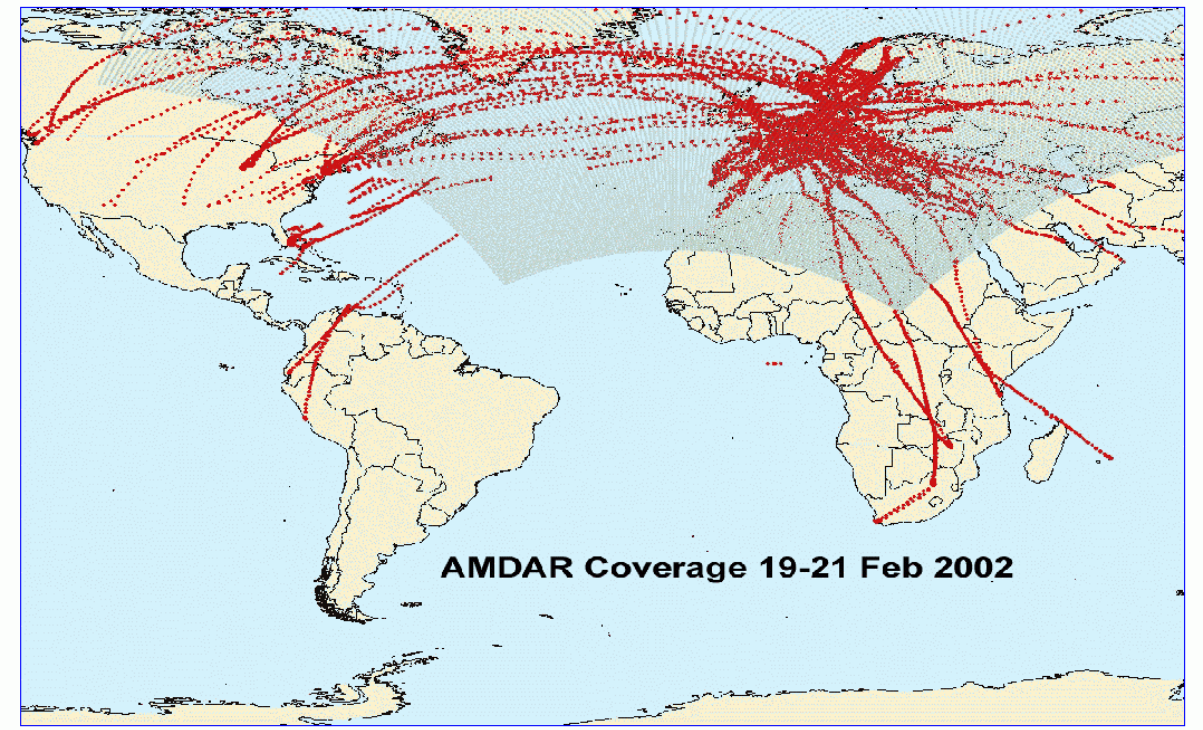

Figure Annex 10. Data Coverage of AMDAR units 19-21 Feb 2002 (KNMI AMDAR-Report)

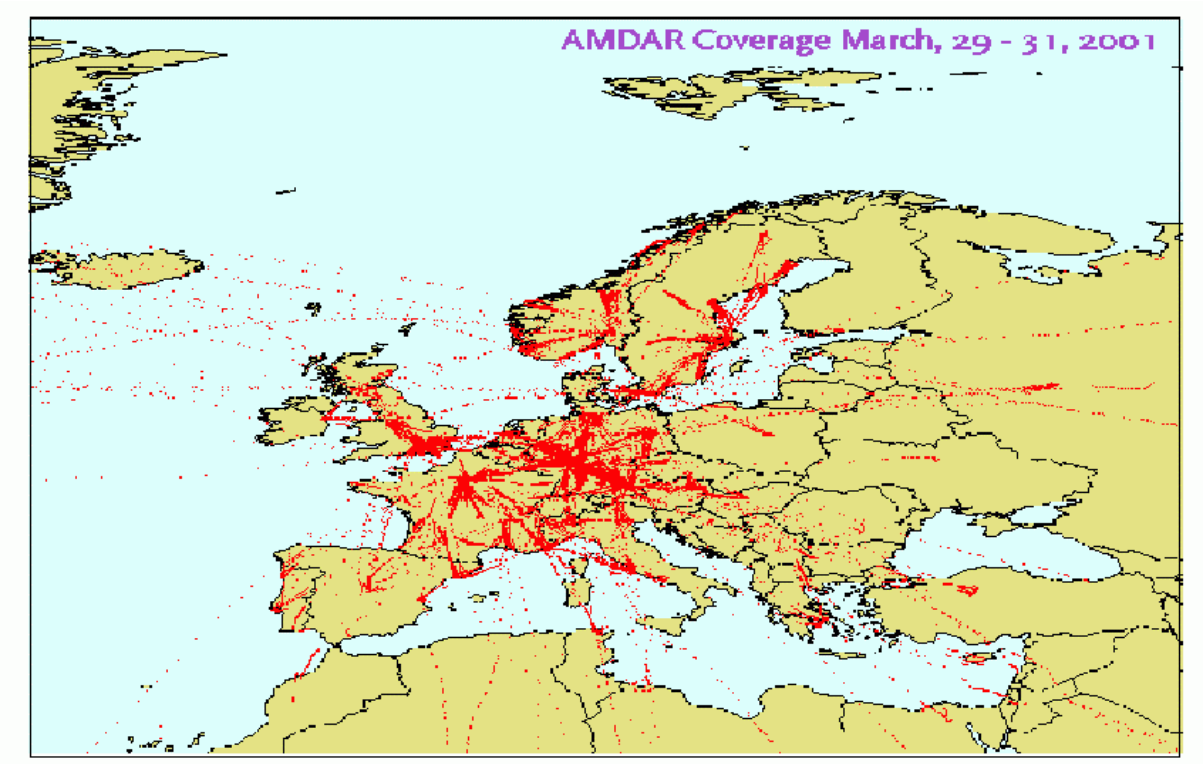

Figure Annex 11. Data Coverage of AMDAR units 29-31 Mar 2001 (KNMI AMDAR-Report)

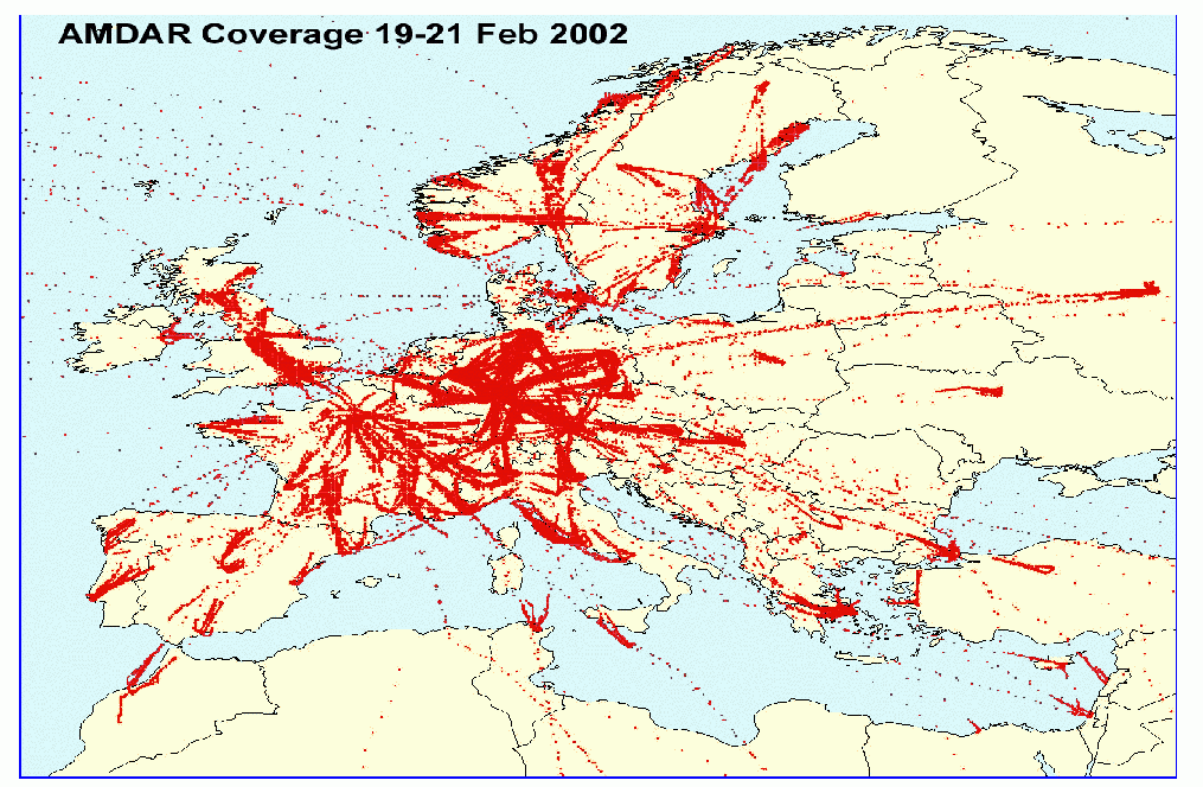

Figure Annex 12. Data Coverage of AMDAR units 19-21 Feb 2002 (KNMI AMDAR-Report)

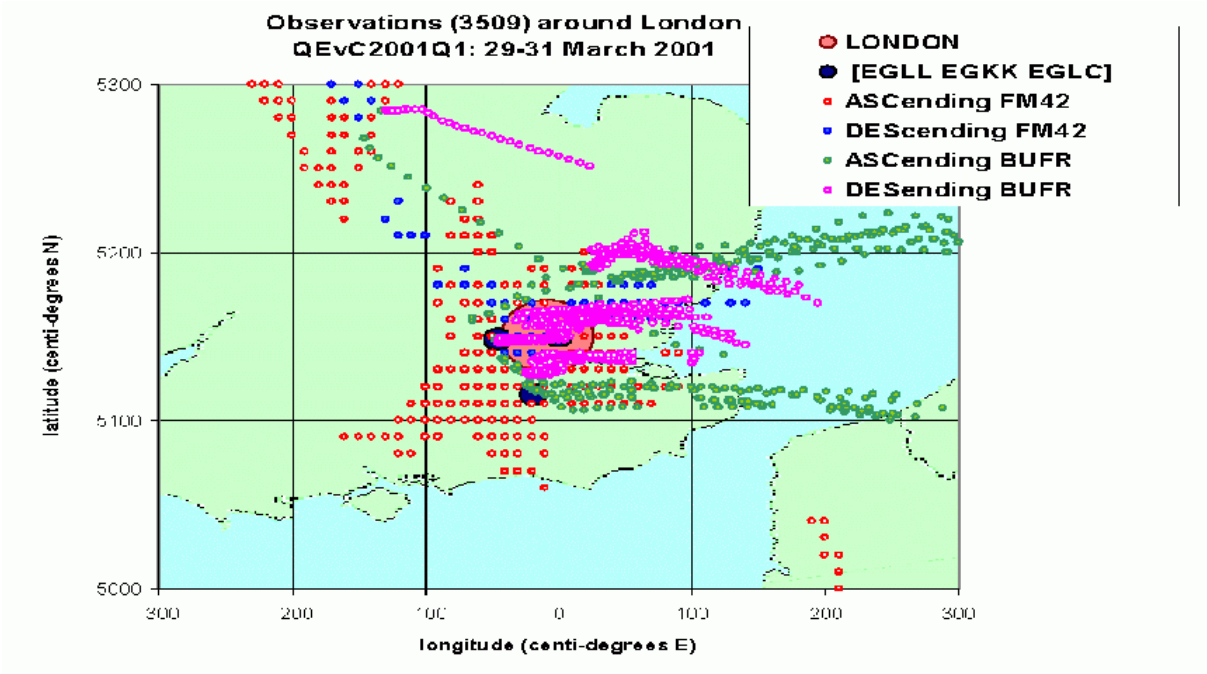

Figure Annex 13. AMDAR reports in the vicinity of London Heathrow

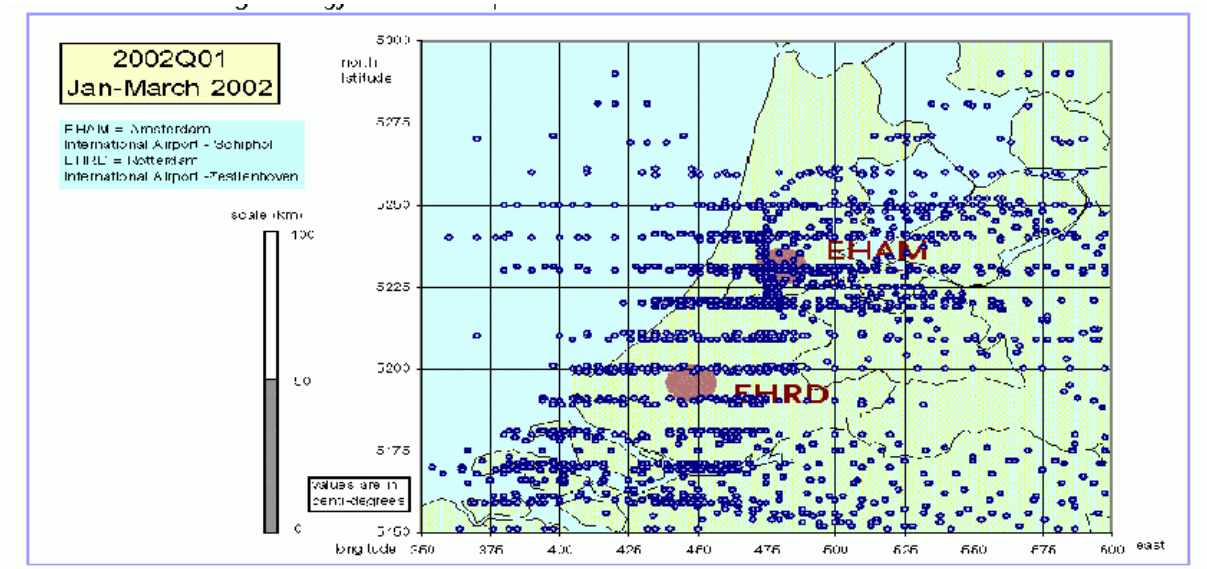

Figure Annex 13. AMDAR reports in the vicinity of Amsterdam Schipol