WORLD METEOROLOGICAL ORGANISATION

==========

COMPOSITE OBSERVING SYSTEM FOR THE NORTH ATLANTIC (COSNA)

Consolidated Monitoring Report

on COSNA - Components

2001

SUBMITTED TO

CGC XII, HAMBURG, 29 – 31 AUGUST 2001

Table of Contents

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 is very much appreciated and allows by automatic data processing to detect long-term-trends of data availability, timeliness and quality without considering the differences between different Monitoring Centres. These differences sometimes exceed the variability of the system under investigation and it is not the intention of this report to focus on internal and temporary problems of data processing. Although data are available starting from 1996, the graphical presentation starts later for the sake of a better readability.

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 and 1.b 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.

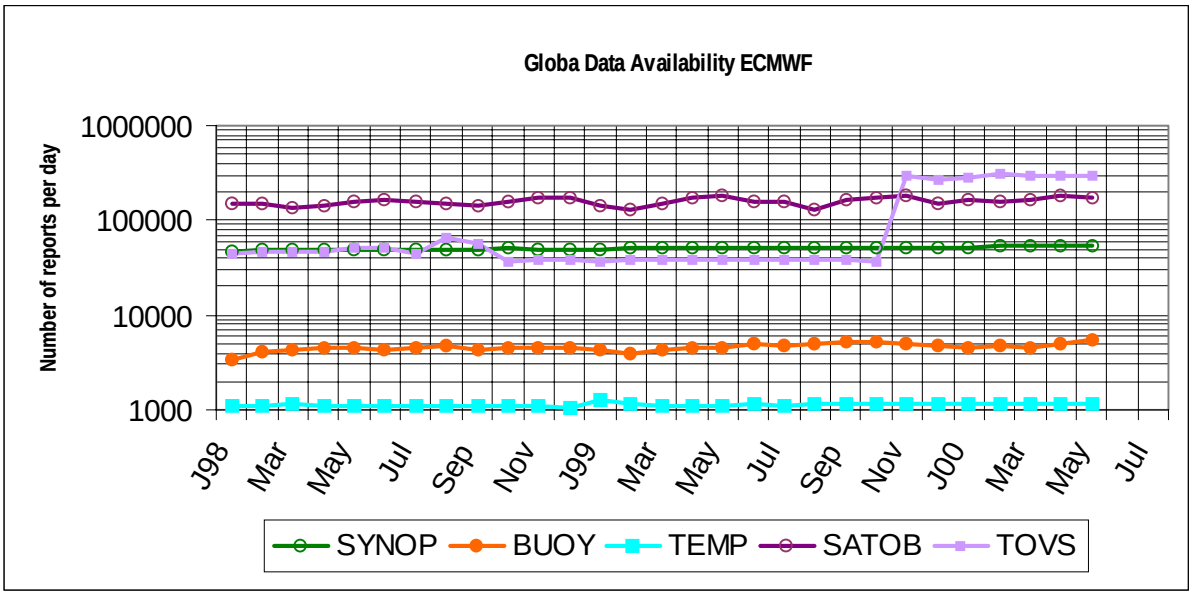


Figure 1.a Time series of data availability in the North Atlantic in terms of number of reports of SYNOP, SHIP, DRIFTR and TEMP available at ECMWF (ECMWF Monthly Monitoring report).

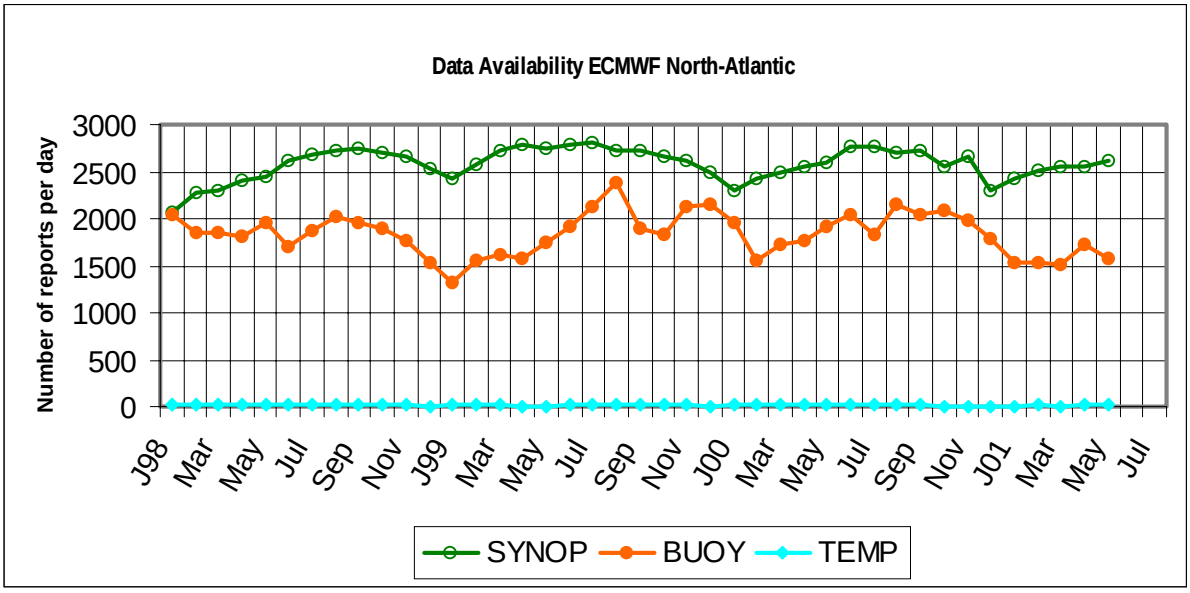


Figure 1.b Time series of data availability in the North Atlantic in terms of number of SYNOP, SHIP BUOY DRIFTR and TEMP reports available at ECMWF (ECMWF Monthly Monitoring report).

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.

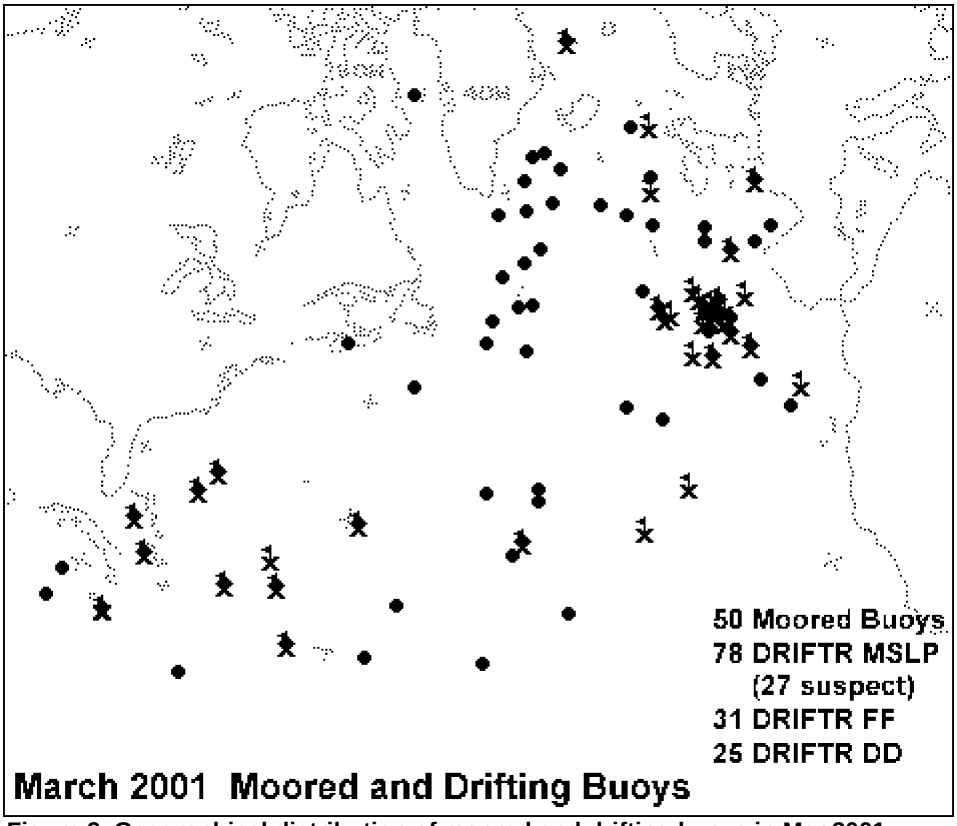


Figure 2. Geographical distribution of moored and drifting buoys in Mar 2001 (ECMR and WMO-OPNL). Black circles for drifting buoys reporting MSLP, flags for drifting buoys reporting wind, X for suspect drifting buoys and anchors for moored buoys.

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-Guayana and along 10°W at and 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:

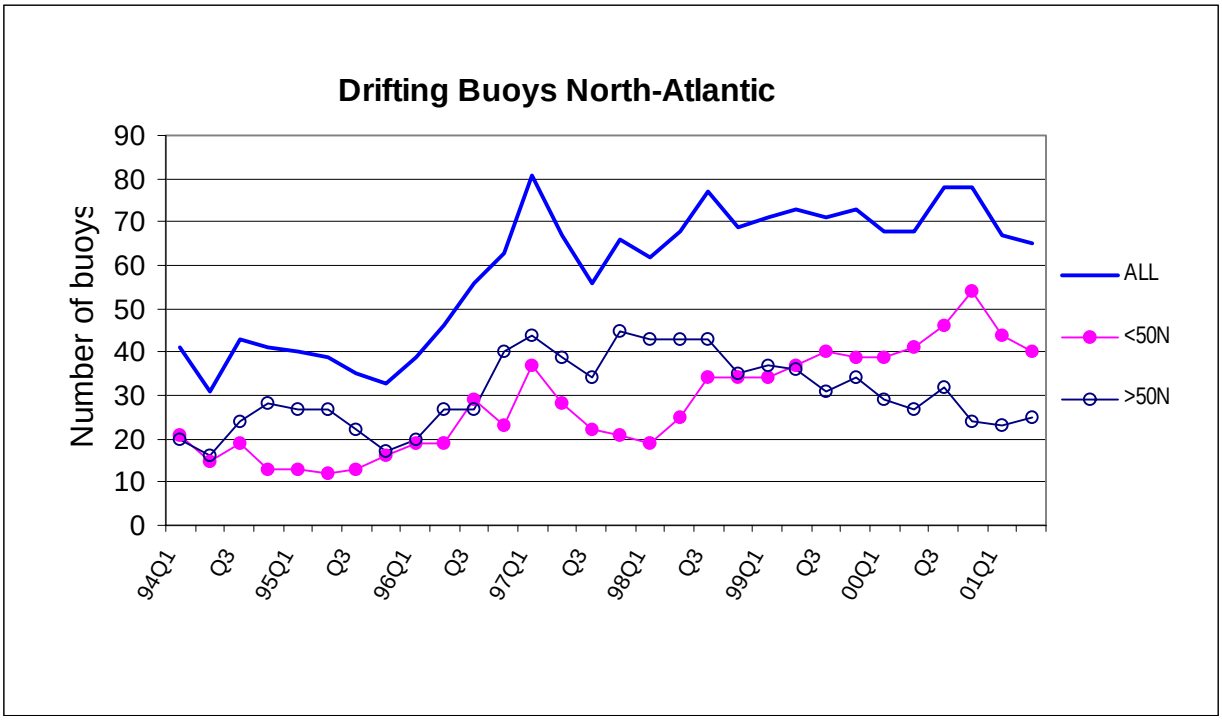
Moored buoys in the COSNA area and adjacent seas

Canada	9	South of New-Foundland
USA	15	East Coast of USA
France	2	Caribbean / French-Guayana
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	13	Areas around UK and Ireland
UK AWS light vessels	4	Channel
Total	52	

Moored buoys in April 2001, from WMO-OPNL

EGOS, the United States and Canada operate most of the drifting buoys. 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. There was a strong increase in numbers in 1996 up to a maximum of more than 80 drifting buoys during FASTEX in spring 1997. During 1998 a significant increase of drifting buoys in the North Atlantic south of 50°N can be observed and ever since 1999 the number of drifting buoys in the southern part of the North-Atlantic exceeds that of the northern part.



.

Figure 3 Number of buoys in the North-Atlantic north and south of 50°N reporting at least MSL pressure. (UKQR-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

2000/01	Jul	Aug	Sep	Oct	Nov	Dec	J01	Feb	Mar	Apr	May	Jun
MSLP	80	90	85	91	92	82	70	74	78	84	74	80
W-SPD	23	30	31	22	23	19	20	34	31	30	30	27
W-DRN	20	29	29	20	19	13	13	33	25	26	27	25

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 double the number of buoys reporting wind-speed or wind-direction, respectively. This ratio has hardly changed through the years.

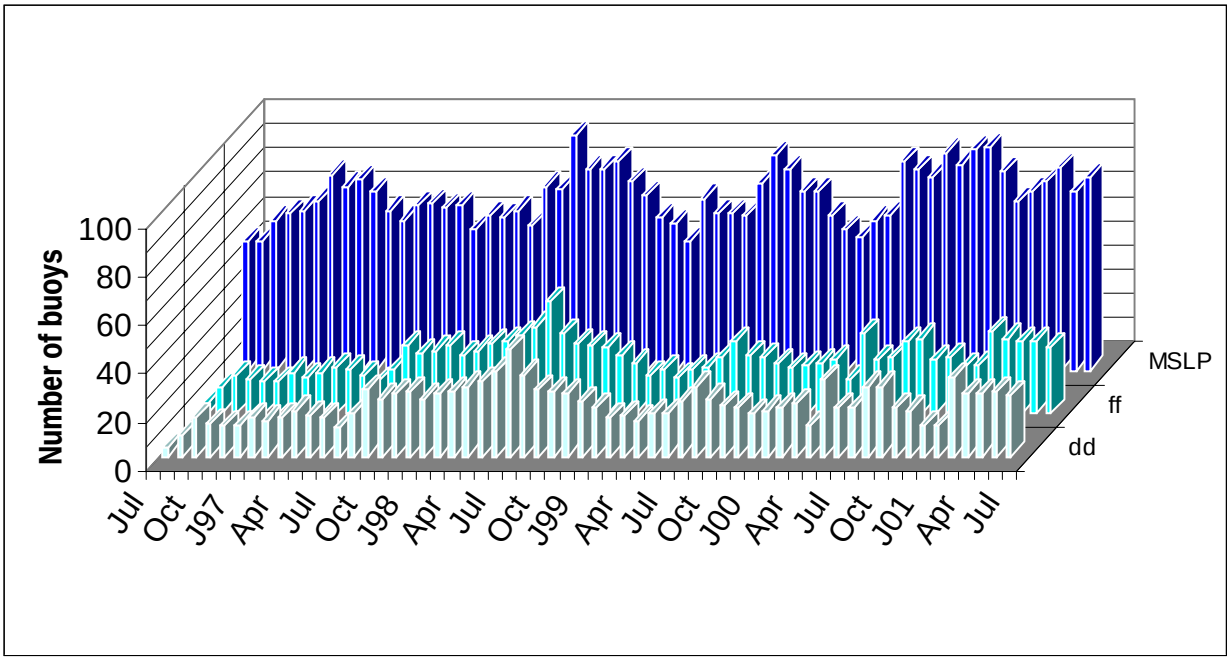


Figure 4. Number of drifting buoys in COSNA-Area reporting MSL pressure, wind-speed and wind-direction July 1996 through June 2001 (ECMWF-MMR)

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, is 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 reports per day from all buoys vary between 1500 and 2000 with about 500 reports per day more available at the UK Met.Office.

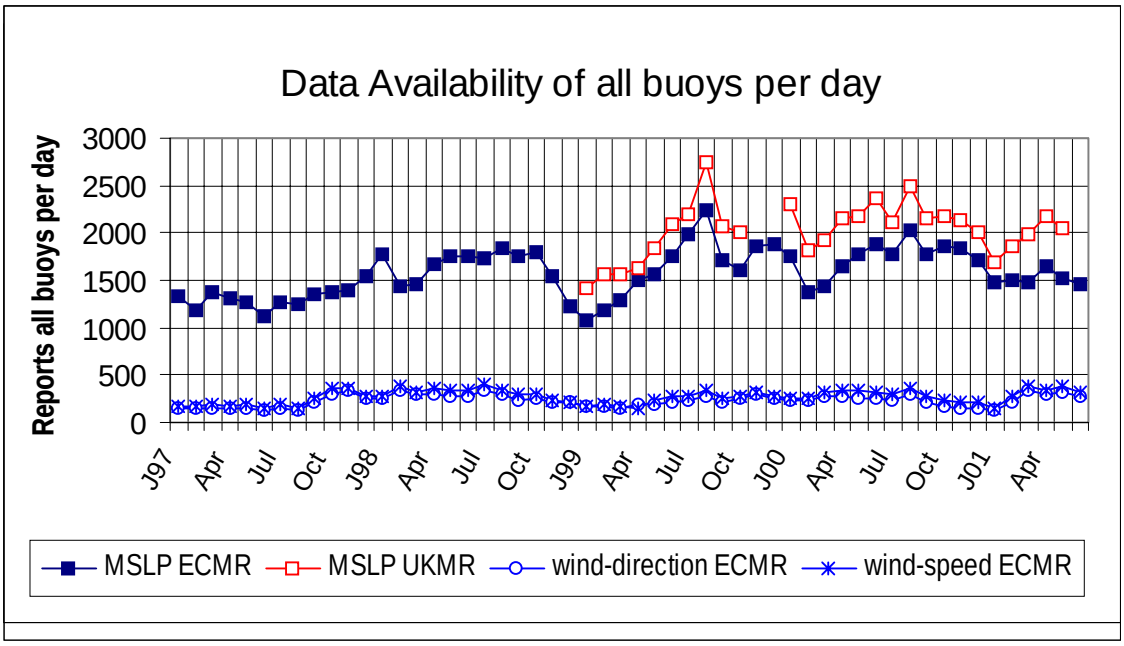


Figure 5. Number of reports of MSL pressure, wind-speed and wind-direction per day from all drifting buoys in the COSNA area.

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

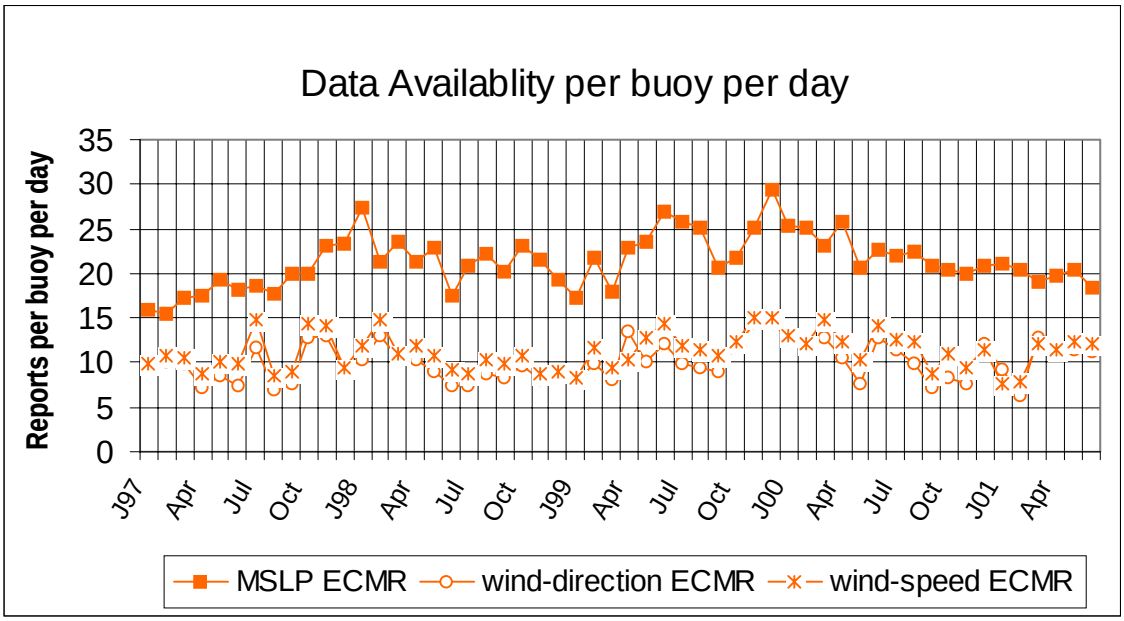


Figure 6. Same as Figure 5., but number of reports from each single buoy

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

	98Q1	98Q3	99Q1	99Q3	00Q1	00Q2	00Q3	00Q4	01Q1	01Q2
N of 50°N	43	43	37	31	29	27	32	24	23	25
S of 50°N	19	34	34	40	39	41	46	54	44	40
Total	62	77	71	71	68	68	78	78	67	65

Data from UKQR Buoys 01Q1 denotes the 1.Quarter of 2001.

Figures 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 1999Q1 through 2001Q2 (UKMO Quarterly Reports on Drifting Buoys) north and south of 50N, respectively.

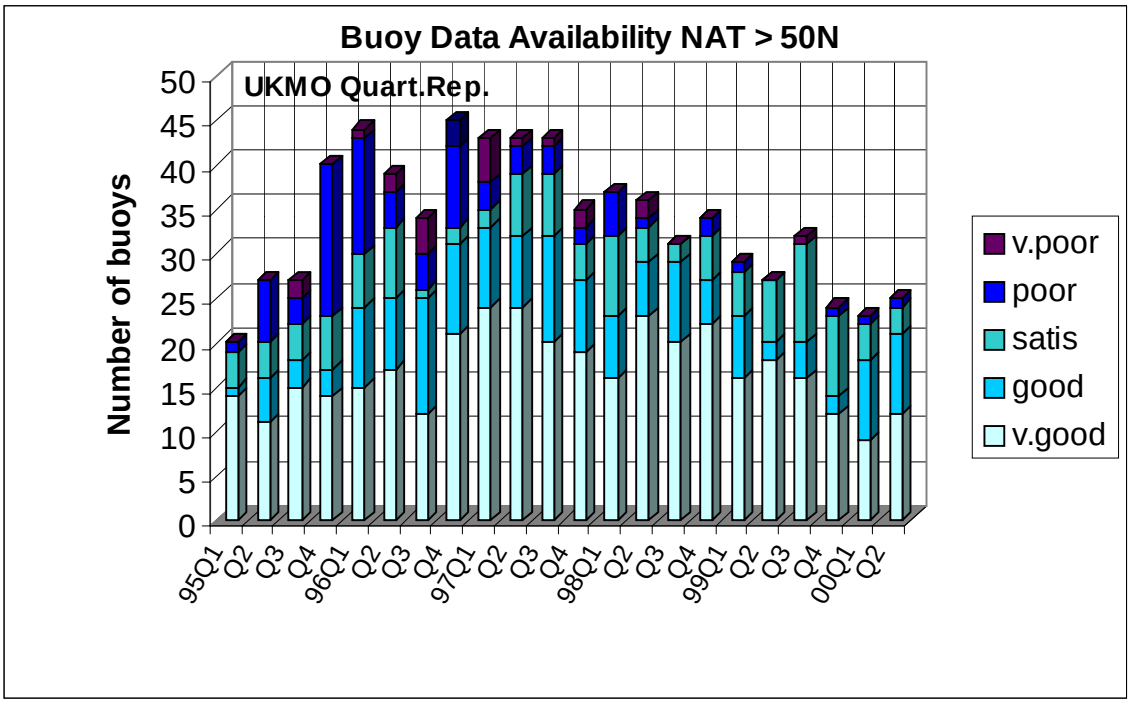


Figure 7. Relative Data Availability of drifting buoys in the North-Atlantic north of 50°N. Different categories refer to the number of observations per buoy per day (UKQR-Buoys)

Buoy Data Availability North Atlantic, North of 50° N

Obs/day	98Q1	98Q3	99Q1	99Q3	00Q1	00Q2	00Q3	00Q4	01Q1	01Q2	Categ.
> 35	56 %	47 %	46 %	65 %	55 %	67 %	50 %	50 %	39 %	48 %	**v.good**
26 – 35	21 %	28 %	19 %	29 %	24%	7 %	13 %	13 %	39 %	36 %	**Good**
16 – 25	5 %	16 %	24 %	6 %	17 %	26 %	34 %	34 %	18 %	12 %	**Medium**
6 – 15	7 %	7 %	14 %	0 %	4 %	0 %	0 %	0 %	4 %	4 %	**Poor**
< 5	12 %	2 %	0 %	0 %	0 %	0 %	3 %	3 %	0 %	0 %	**v.poor**

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

The relative availability in the table above shows an improvement in early 2001. While there were typically 30 % or more of the buoys performing as 'medium or worse', there are now only around 20 % of buoys with such a performance with 80 % of the buoys performing as ‘good’ or ‘very good’.

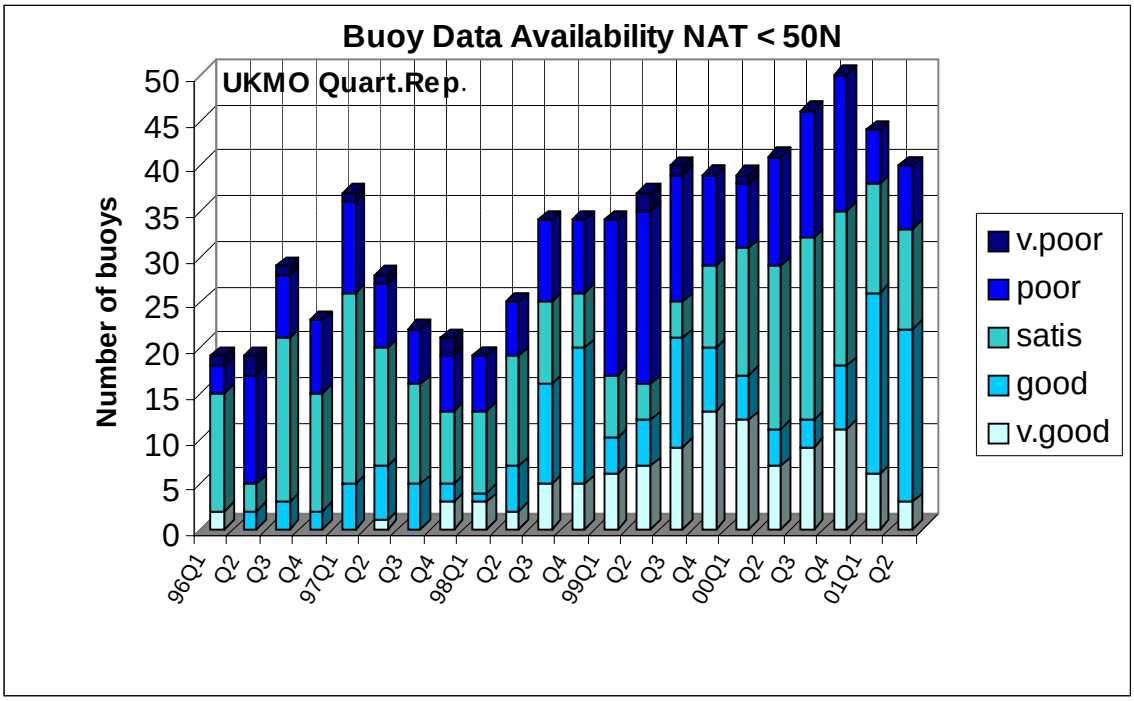


Figure 8. Relative Data Availability of drifting buoys in the North-Atlantic south of 50°N. Different categories refer to the number of observations per buoy per day (UKQR Buoys)

Buoy Data Availability North Atlantic, South of 50° N

Obs/day	98Q1	98Q3	99Q1	99Q3	00Q1	00Q2	00Q3	00Q4	01Q1	01Q2	Categ.
> 35	16 %	15 %	18 %	23 %	31 %	17 %	20 %	20 %	14 %	3 %	**v.good**
26 - 35	5 %	32 %	12 %	30 %	13 %	10 %	7 %	13 %	46 %	48 %	**Good**
16 - 25	47 %	26 %	21 %	10 %	36 %	44 %	43 %	32 %	27 %	28 %	**Med.**
6 - 15	32 %	26 %	49 %	35 %	18 %	29 %	30 %	35 %	13 %	14 %	**Poor**
< 5	0 %	0 %	0 %	2 %	2 %	0 %	0 %	0 %	0 %	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 30 % or more of the buoys performing as ‘poor’ or ‘very poor’ until 2000 and only about 15 % performing as ‘poor’ in 2001.

Buoy Data Timeliness

Received	99Q1	99Q2	99Q3	99Q4	00Q1	00Q2	00Q3	00Q4	01Q1	01Q2	Category
< 1 hr	69 %	62 %	54%	62%	56%	54%	48%	39%	33 %	36 %	**v.good**
.. 2 hrs	7 %	19 %	24%	21%	31%	34%	42%	46%	43 %	52 %	**good**
.. 3 hrs	4 %	11 %	13%	11%	9%	6%	4%	11%	15 %	6 %	**medium**
.. 4 hrs	14 %	0 %	4%	0%	3%	0%	0%	0%	2 %	2 %	**poor**
> 4 hrs	6 %	8 %	5%	6%	1%	6%	6%	4%	7 %	4 %	**v.poor**

Percentage of reports received within time given left

The number of buoys increased, but the relative percentage of all categories of timeliness changed only very little with still 80 % of all buoys performing as 'good' or better. This performance with respect to timeliness has reached a level, which is restricted by specific system features or by user requirements with respect to delayed 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 also reasons other than only data quality which determine whether observations are rejected, 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:

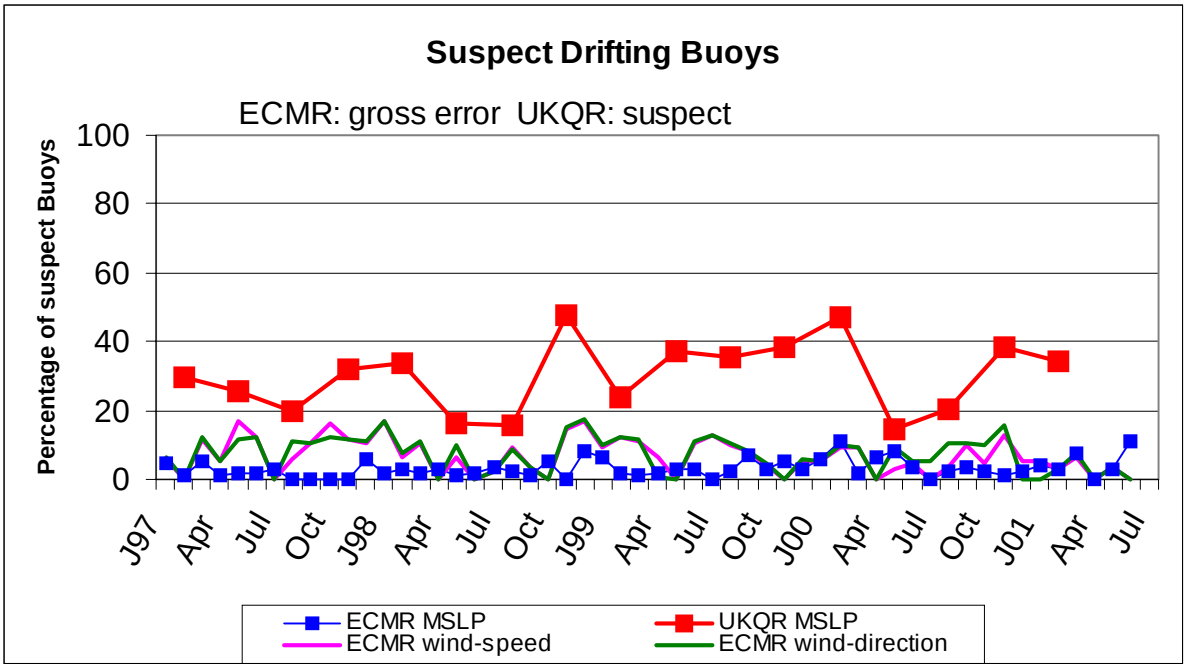


Figure 9. Percentage of buoys reporting suspect observations (for data from UKQR-Buoys according to their definition, for data from ECMR if the gross error rate exceeds 10 percent)

The upper solid red line with filled squares in Figure 9. shows the percentage of drifting buoys, which are classified as 'MSLP suspect' in the UKQR-Buoys. The lower lines refer to buoys with a gross error rates of more than 10% in the ECMR with respect to MSLP, wind-speed and wind-direction. The rates of the suspect buoys of the UKQR-Buoys are higher due to 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 1200 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 1200 SYNOP-SHIP reports per day.

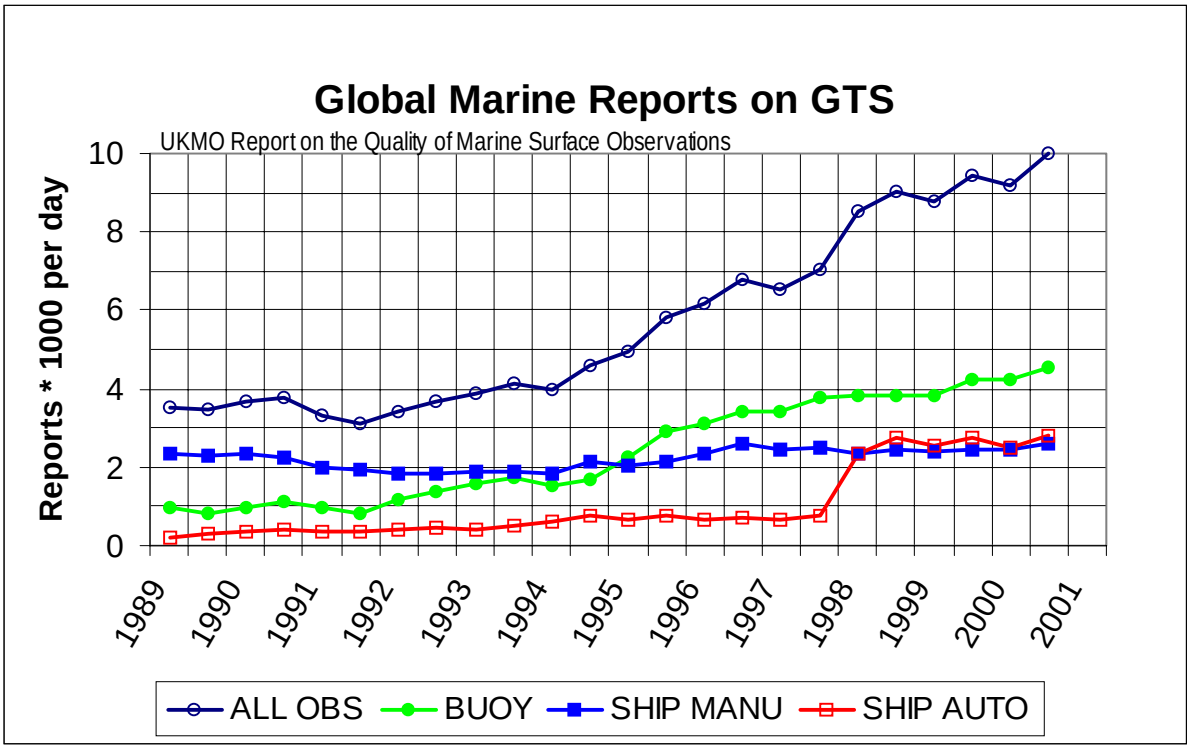


Figure 10. Number of global marine observations from MANUAL SYNOP-SHIP, AUTOMATIC SYNOP-SHIP and AUTOMATIC DRIFTR-BUOY from 1989 until 1999. Global number of observations per day from all units (UKMO Report on the Quality of Marine Surface Observations)

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

93-01	Jul 93	Jul 94	Feb95	Jul 96	Jul 97	Jul 98	May99	May00	May01
ALL	40825	40519	43009	44136	46196	48599	48642	51322	53049
NAT	2069	2133	2120	2300	2310	2691	2749	2586	2623

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

96/01	J96	Jul	J97	Jul	J98	Jul	J99	Jul	J00	Jul	J01	Jun
MSLP	5	8	7	6	6	7	8	10	9	12	17	13
W-SPD	10	15	5	6	5	5	12	5	8	7	9	6
W-DRN	4	10	1	1	1	2	2	3	8	7	5	4

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 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. All British Airways units have been withdrawn from use from April to June 2000. The following table gives the remaining units in the second quarter of the year 2001

Operational ASDAR-Units in 2001Q2

Aerolineas Argentinas	AR006LOZ	AR007EPZ	
KLM	KL012UMZ	KL013UPZ	KL014URZ
Lufthansa	LH005VNZ		
South African	SA015AUZ	SA016ATZ	
Saudi Arabian	SV003IMZ	SV023IKZ	
Air Mauritius	MK021AKZ	MK022ALZ	

ASDAR units in 2001Q2 from UKMO ASDAR Quarterly Report

5.2 ASDAR Data Coverage

About 50 percent of the aircraft carrying ASDAR units fly predominantly between Europe and North America or within these continents. The remainder operates 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 mid 1999, the number decreased continuously since then mainly due to the reduced number of units.

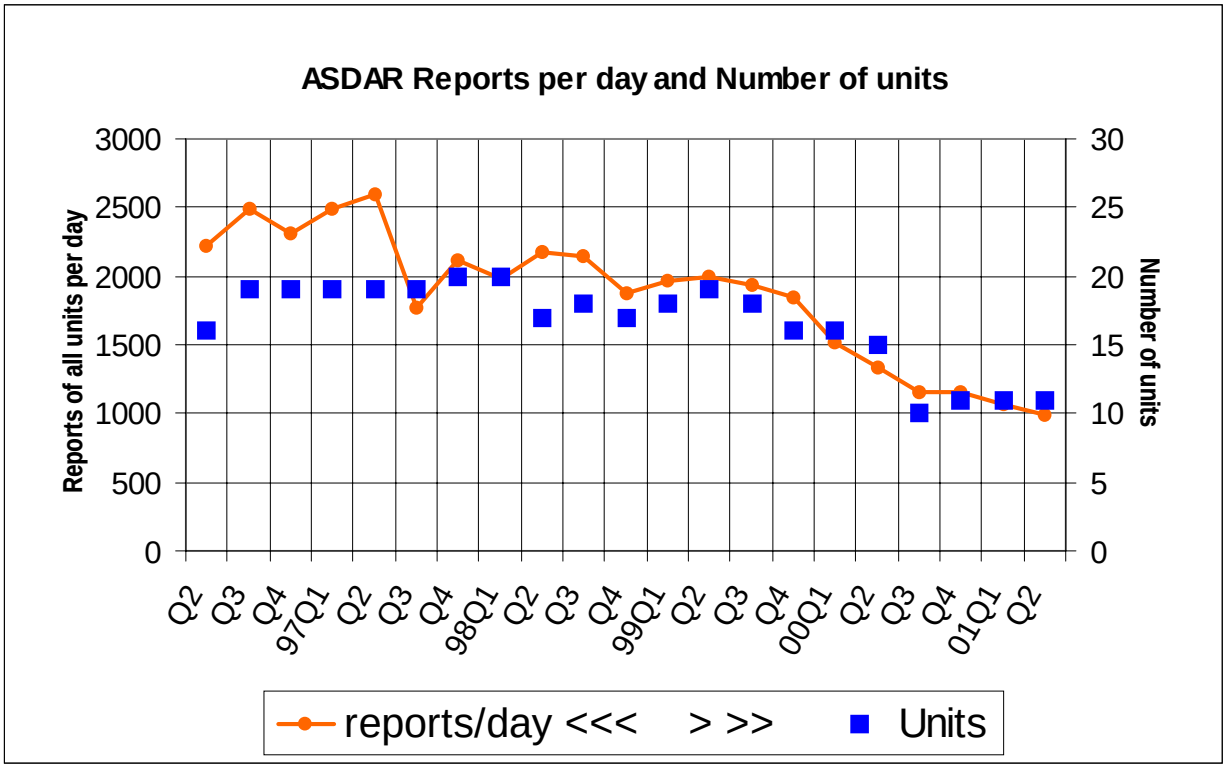


Figure 11. Number of ASDAR-units (filled squares, right Y-axis) and number of reports of all these units (filled circles, left Y-axis. (UKQR-ASDAR)

The filled squares in Figure 11. show the decline of the number of ASDAR- units in 1999 and 2000 mainly due to the withdrawal of the British Airways units. The number of available reports decreased accordingly to only half of the amount before.

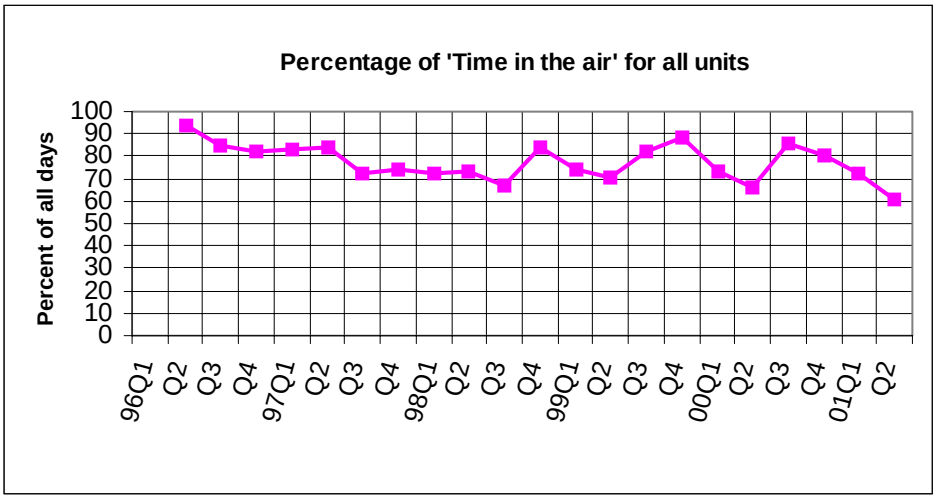


Figure 12. Percentage of days with reports from all ASDAR units: 100 % for 'every aircraft in the air every day, all reporting', 0 % for 'all aircraft on ground every day, no reports'.

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 factor affecting the total number of reports. There started stronger variations between 70 % and 90 % in late 1998 with a new minimum of as low as 60 % in the second quarter 2001.

.

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

ASDAR	99Q1	99Q2	99Q3	99Q4	00Q1	00Q2	00Q3	00Q4	01Q1	01Q2
# units	18	19	18	14	16	15	10	11	11	11
# units/day	13.6	14.7	14.7	14.0	11.7	9.9	8.6	8.9	8.0	6.7
% Efficiency	76 %	77 %	82 %	100 %	73 %	66 %	86 %	81 %	73 %	79 %

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:

2000Q4	SA015	reports intermittently
2001Q1/Q2	SV015	reports intermittently
2001Q1/Q2	AR007	high Temp. / high Wind Std. Dev.
2001Q1/Q2	SV003	high Temp. Std. Dev.

5.5 AMDAR, E-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 is shown in Figure 13.

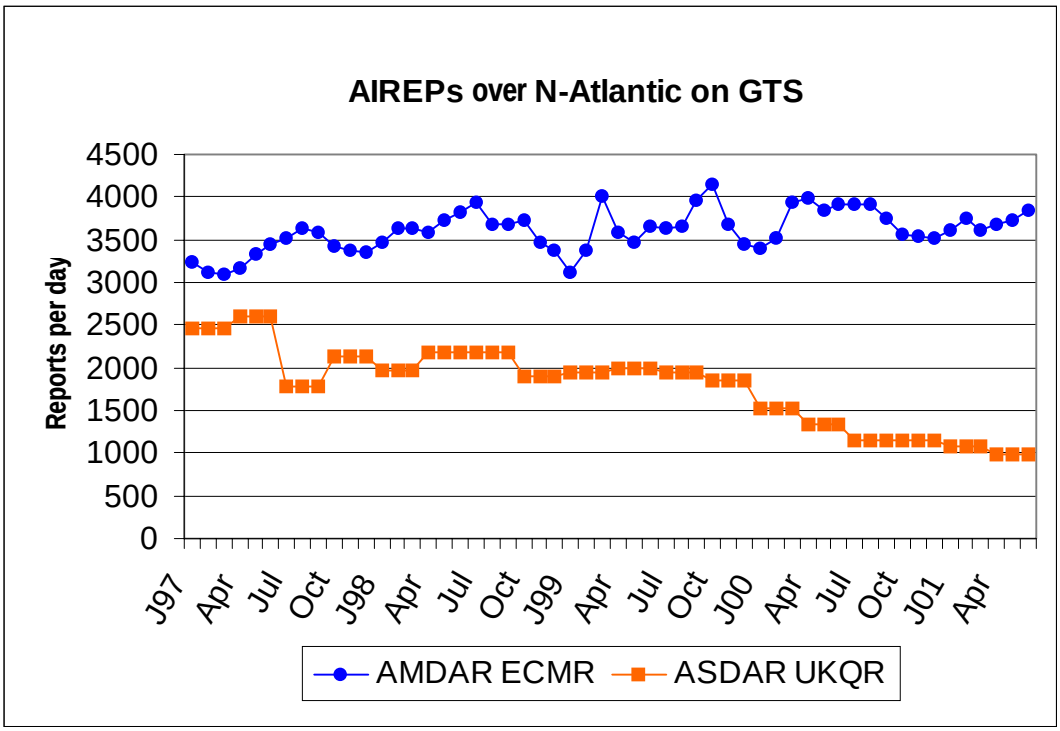


Figure 13. Number of AIREP reports per day over the North-Atlantic (ECMR) and number of ASDAR reports per day (UKQR-ASDAR)

Special efforts have been undertaken by the E-AMDAR project, which was launched in 1999 by 14 participants and became operational in the year 2000. Reports of 203 E-AMDAR equipped aircraft (British Airways, Air France, KLM, Lufthansa and SAS with also short- and medium-range type aircraft so that the reporting areas are as over Europe as along the Intercontinental routes of these airlines) were received in January 2001 at De Bilt. They contribute to a total of around 25,000 reports per day. 70 % of the reports are provided by the two airlines Lufthansa and Scandinavian. A system for the selectable activation of the aircraft in order to optimise the network efficiency has been developed with Lufthansa.

The number of airports covered with vertical profiles has now reached 123 varying between 3 airports with hourly profiles and 58 airports with at least one profile per day. The number of profile reports has reached 729 per day in January 2001. It is intended to overcome the problem of lack of data during night hours by using cargo aircraft, which normally operate at these times (TNT, DHL).

The data quality and timeliness is comparable to 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 few single units, no significant temperature, wind speed or wind direction anomalies were found.

6 Radio-soundings (TEMP, ASAP)

6.1 System Availability

The TEMP-Stations covering the COSNA-Area are the land-based stations of Iceland and of the adjacent continental areas and the mobile ASAP-units aboard ships. The land-based stations are performing very well and hardly appear in the suspect lists of the monitoring centres; therefore the following investigation refers to the mobile ASAP TEMP units only:

Operational ASAP-Ships in COSNA Area

Denmark	QXYH2*	OXTS2*	OVYA2	
France	FNOR	FNOU	FNPH	FNRS
Germany	DBBH	ELML7		
Sweden/Iceland	S6LA			
EUMETNET	SWJS			
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						

Both tables from ACC Annual Report 2000

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:

Arina Arctica OVYA2; Irena Arctica OXTS2; Nuka Arctica OXYH2

North Atlantic along the 60°N parallel between Scandinavia and Greenland and northbound along the West Coast of Greenland

Hornbay ELML7

North Atlantic between German, Dutch and French harbours Venezuela

Meteor DBBH

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

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

North Atlantic between Le Havre and the West Indies.

Selfoss S6LA

Operation area North Atlantic between Reykjavik, Iceland and Norfolk, Virginia, USA. Operation ceased in September 2000.

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 will be launched at 0600z and 1800z, otherwise soundings are made at 0000z and 1200z.

CanMar Pride ZCBP6

Operation area North Atlantic

The coverage of the mobile ASAP-units as described above covers 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)	**1998**	**1999**	**2000**
Denmark	414 (1 unit)	701 (2 units)	752 (2 units)	768 (2 units)
France		1364 (4 units)	1421 (4 units)	1360 (4 units)
German Research		321 (1 unit)	377 (1 unit)	459 (1 unit)
German Merchant	631 (3 units)	648 (1 unit)	515 (1 unit)	497 (1 unit)
Sweden Iceland	331 (1 unit)	265 (1 unit)	174 (1 unit)	117 (1 unit)
UK				220 (1 unit)
Spain	78 (1 unit)			3 (1 unit)
EUMETNET				27 (1 unit)
Total	3791 (12 units)	3299 (9 units)	3239 (9 units)	3451 (11 units)
Change		- 13 %	- 2 %	+ 7 %

Number of soundings of mobile ASAP-units in COSNA-area by

The British ASAP-unit aboard **ZCBP6** CanMar Pride entered service in January 2000. Another new unit is the EUMETNET ASAP-unit aboard **SWJS** Peljasper which is the only ship operating mainly in the Mediterranean Sea. The launching schedule will be co-ordinated with the proximity of the ship to land-based TEMP stations.

The German research vessel DBBH increased its number of soundings in 2000, but was mainly outside the COSNA area in the South-Atlantic Ocean. The German merchant vessel ELML7 had 18 reports (- 4%) less than in 1999. The Danish units increased their number of soundings by 16 (2 %), whereas the French ships had 61 soundings (4 %) less than 1999, nevertheless still being the most important contributor. The Swedish ship S6LA was in operation only until September resulting in 57 (33 %) less soundings than in 1999. There were only 3 soundings available from the Spanish EHOA.

The radio-soundings aboard ASAP-Ships are mainly performed by crewmembers and then fed into the GTS via Telecom-facilities. The results on 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 are expected anywhere else.

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).

The number of TEMP reports on GTS for each individual ship as given by the ASAP-operators and as available at ECMWF are given in the table below. Mostly the numbers by ASAP-operators are higher than the numbers of TEMP reports available at ECMWF.

ASAP-TEMPs Data Availability on GTS in 2000

	TEMPs launched	TEMPs transm	TEMPs available	TEMPs available	TEMPSs on GTS	TEMPSs on GTS	Difference OPS-GTS
SHIP	byOperator	ByOperator	at ECMWF	at ECMWF . / %	By Operator Number	By Operator . %	Number / %
OXYH2	>312	312	305	97.8 %	306	98.1 %	7 / 0.3 %
OVYA2	>337	337	335	99.4 %	337	100.0 %	2 / 0.6 %
OXTS2	>119	119	118	99.2 %	119	100.0 %	1 / 0.8 %
FNOR	306	295	272	78.9 %	287	97.2 %	23 / 8.3 %
FNOU	350	335	315	94.0 %	334	99.7 %	20 / 5.7 %
FNPH	357	324	286	88.3 %	321	99.1 %	36 / 10.8 %
FNRS	347	317	294	92.7 %	313	98.8 %	23 / 6.1 %
DBBH	459	459	241	52.5 %	330	71.9 %	218 /19.6 %
ELML7	497	497	406	81.7 %	276	55.6 %	-89 /-26.1%
S6LA	117	92	73	79.3 %	72	78.6.%	1 / 1.4 %
ZCBP6	220	159	156	98.1 %	155	97.5 %	1 / 0.6 %
SWJS	27	22	9	40.9 %	22	100.0 %	13 / 59.1%
LDWR			(680)°				
DBLK			(54)°				
Total	3448	3268	2810	86.0 %	2872	87.9 %	38 / 2.2 %

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 and the number of TEMP reports, which are expected to be available on GTS by the ASAP operators. Significant differences show ELML7, DBBH and SWJS.

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 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 %.

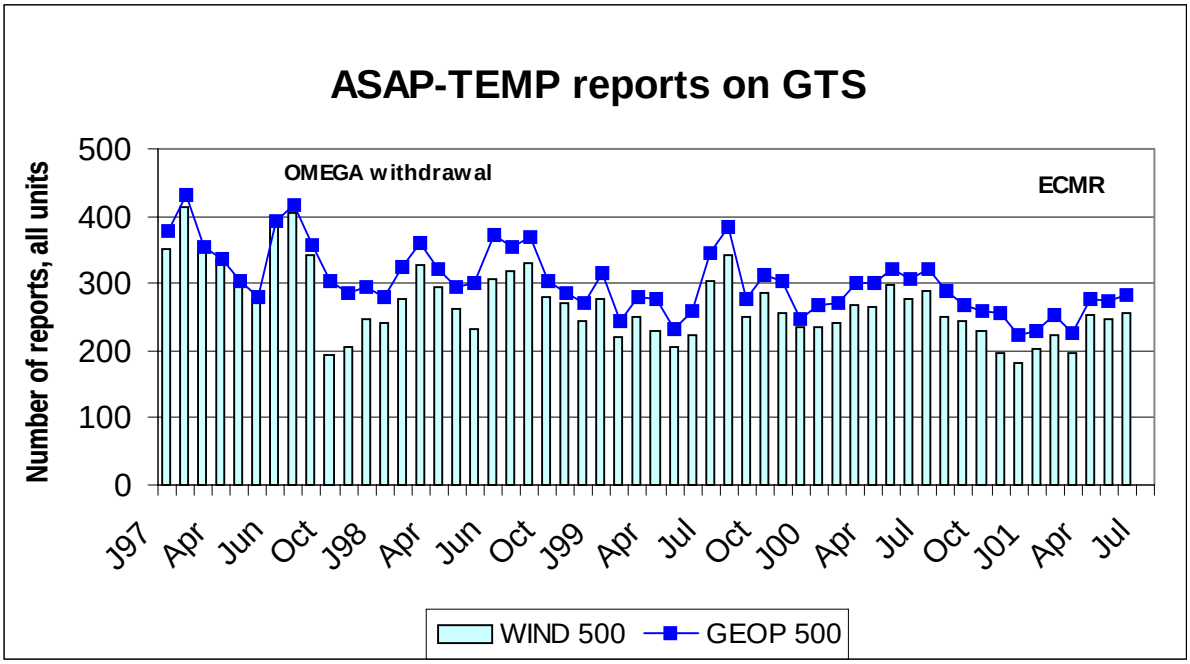


Figure 15 ASAP TEMP reports of all ASAP ship in the COSNA area, all observation times. Omega–withdrawal in October 1997 resulting in a deficit of wind reports since then. (ECMR).

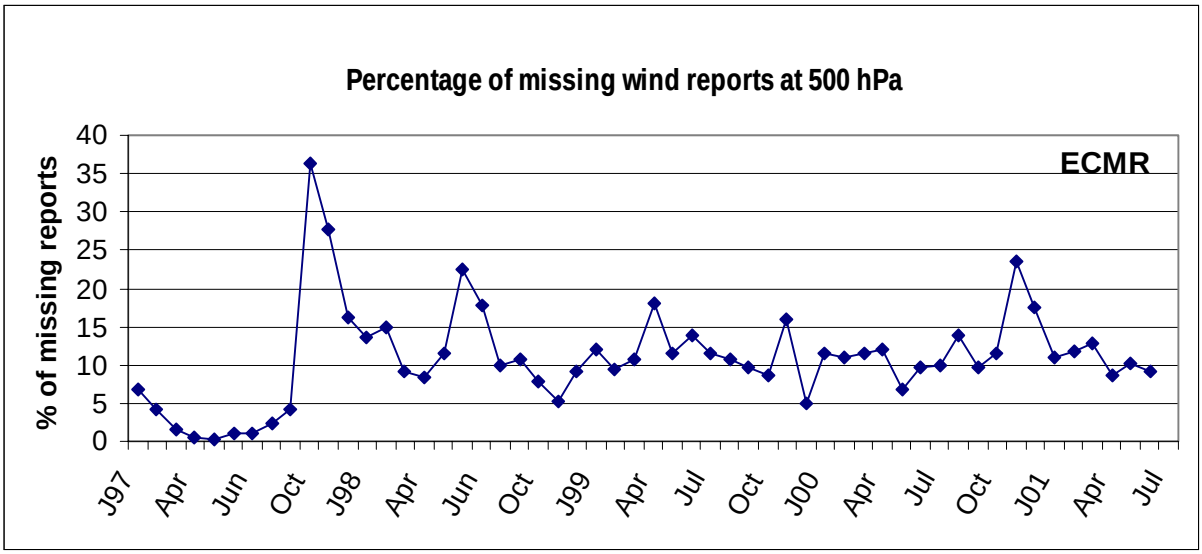


Figure 16. Deficit of wind reports of all ASAP ships in the COSNA area for level 500 hPa. (ECMR)

Figure 16 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 and also in the year 2001 it is not significant lower than 10 %.

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 2000 by ship

SHIP Callsign	Wind by	Z500	V500	Missing Wind / %
(LDWR)	LORAN-C	(676)	(677)	(-0.1 %)
DBLK	GPS	51	50	2.0 %
FNOR	GPS	243	222	8.6 %
DBBH	GPS	241	216	10.4 %
FNOU	GPS	279	248	11.1 %
ELML7	GPS	303	269	11.2 %
OVYA2	LORAN-C/GPS	287	233	18.8 %
FNPH	GPS	252	196	21.2 %
S6LA	LORAN-C	64	50	21.9 %
OXYH2	LORAN-C/GPS	277	208	24.9 %
FNRS	GPS	256	182	28.9 %
OXTS2	LORAN-C/GPS	104	64	38.5 %
ALL SHIPS		3033	2615	13.8 %
ALL ex LDWR		2357	1938	17.8 %

Number of TEMP reports available at ECMWF for Geopotential 500 hPa and Wind 500 hPa from ASAP-Ships in 2000.

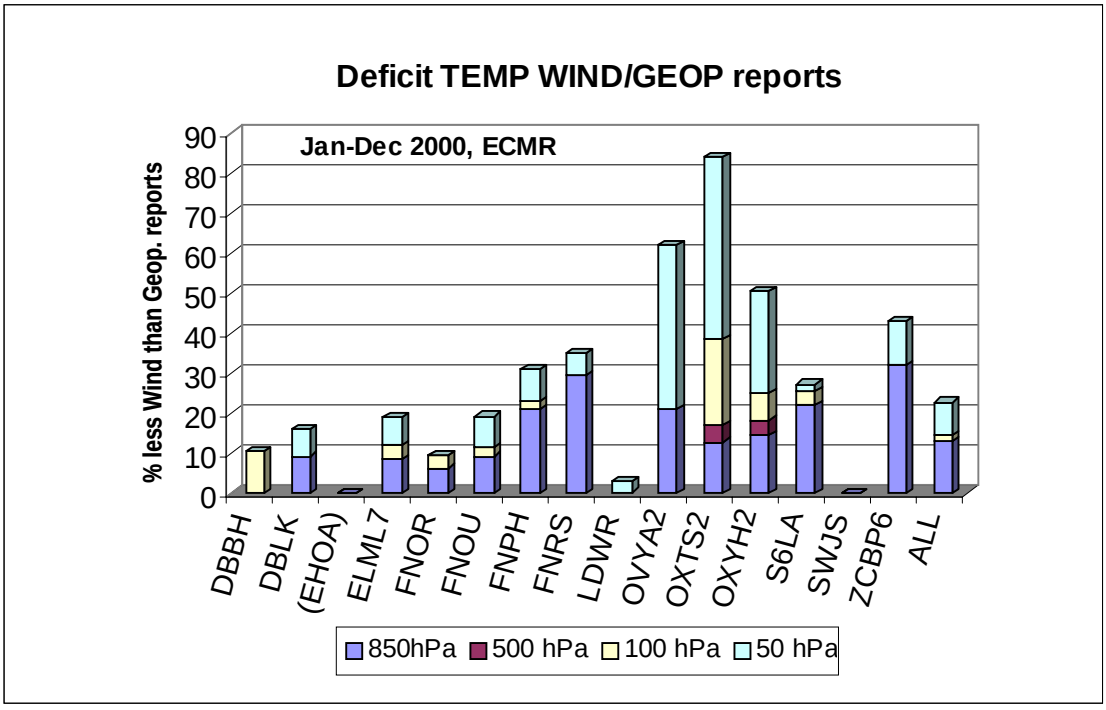


Figure 17. Deficit of TEMP wind reports, relative in % at different mandatory levels (850, 500, 100 and 50 hPa) for each individual ASAP ship. The higher the columns, the higher the deficit.

The mandatory levels for which TEMP reports of geopotential and wind are available varies with the terminal sounding height of the soundings. The percentage for all soundings

reaching the levels of 500, 100 and 50 hPa for each ship, if there were reports at 850 hPa, is shown in Figure 18 (geopotential) and in Figure 19 (wind).

The 100 hPa level is reached by 90 % of all soundings for all ships except ELML7 and EHOA. A significant deficit of reports for 50 hPa has the ships OXTS2, EHOA, OVYA2 and ELML7. Slightly worse than the average for all are also FNPH, OXYH2 and FNRS.

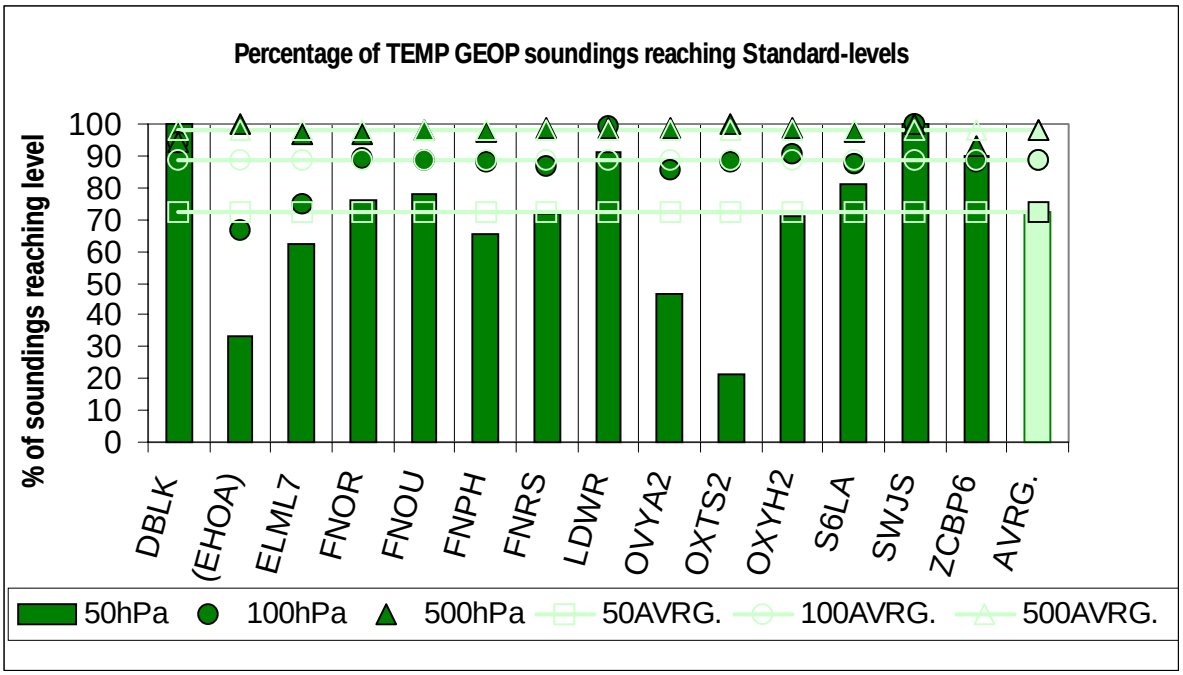


Figure 18. Percentage of ASAP TEMP ships reporting geopotential at 850 hPa, also reporting at mandatory levels 500 hPa, 100 hPa and 50 hPa. EHOA data are from 3 soundings only.

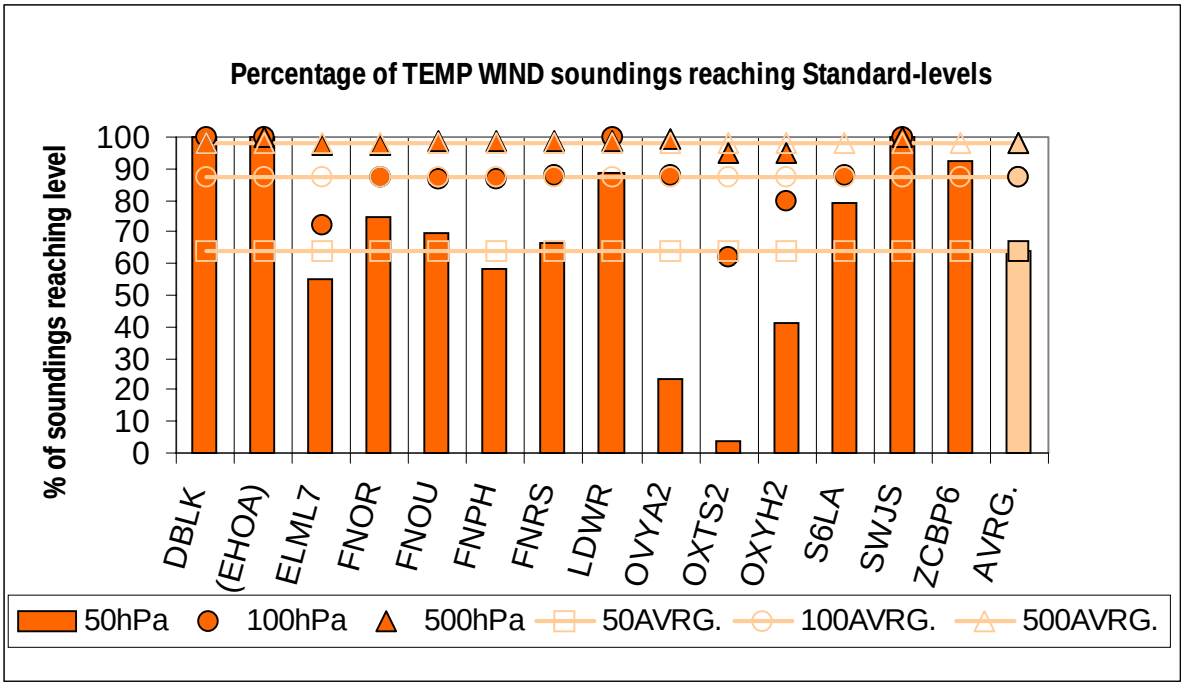


Figure 19. same as Figure18, but for wind reports

Figure 19 shows the decreasing number of wind reports at standard levels 500, 100 and 50 hPa. If there were wind reports available at 850 hPa, then there were about 90 % of the wind reports at 500 hPa. There is a higher than average loss of wind reports between 500 and 100 hPa and between 100 and 50 hPa for the ships OXTS2, ELML7 and OXYH2.

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 2000 Geopotential 500 hPa / Wind 500 hPa

SHIP	Total	J00	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
OXYH2													
OVYA2	8/1	1/-	2/-	1/1		1/-				2/-			1/-
OXTS2	2/-		1/-	1/-									
FNOR													
FNOU	1/-					1/-							
FNPH	1/1					1/1							
FNRS	1/-										1/-		
DBBH													
ELML7	1/12			1/1		-/11							
SWJS	1/-												1/-
ZCBP6								1/-					
LDWR	4/2	1/-		1/1		1/1							1/-
total	**19/16**	2/-	3/-	4/3		4/13		1/-		2/-	1/-		3/-

ASAP radiosondes, number of suspect reports of Geopotential 500 hPa / Wind 500 hPa,
from ECMWF 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 potential problem of these two ships.

6.5 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.

- **DRIFTING BUOYS** The number of drifting buoys could maintain the high number of around 70 buoys which was reached in 1998. The number of buoys south of 50°N exceeded the number of buoys north of 50°N for the first time in 1999. Since then there are about ten buoys more south of this parallel than north of it.

- **DRIFTING BUOYS** The data availability of drifting buoys remains high and even shows a slight improvement in 2001. However, the data quality was not as good with 30 to 40 percent of buoys providing suspect observations. There was only a temporary improvement to less than 20 % in mid 2000.

- **ASDAR** Another five units (British Airways) have been withdrawn from use in 2000 reducing the number of operational ASDAR units to 11. These units, however, cover areas where data availability would otherwise be very low.

- **ASDAR** The performance (in terms of days with reports from each unit) has reached a level of 70 %, which means, that reports from an equivalent of only 12 to 14 units, compared to an optimum of 17 units, are actually received.

- **AMDAR** The number of AMDAR reports has already reached a high level with a still slightly rising trend.

- **E-AMDAR** The E-AMDAR project, which started in 1999, became operational in 2000. Apart from providing a high number of reports of high quality, it shows a new flexibility allowing for selective data availability and providing vertical profiles of wind and temperature in the vicinity of major airports.

- **ASAP** Two new ASAP units came new into operation in 2000: the ASAP unit of the United Kingdom on M/V CanMar Pride ZCBP6 in January 2000, the EUMETNET ASAP unit on M/V Peljasper SWJS in December 2000.

- **ASAP** The EUMETNET unit on M/V Peljasper SWJS is the first ASAP unit operating in the Mediterranean Sea and the first unit with a launch schedule taking into account the proximity of the ship to land-based TEMP stations: if the ship is closer than 75 nm to a land station, launches will be performed at 0600z / 1800z, otherwise at 0000z / 1200z.

- **ASAP** In general, the numbers of soundings available on the GTS given by ASAP operators fit much better than in previous years to the numbers of soundings available at ECMWF. There are, however, significant differences with respect to German ships (20 % less at ECMWF than given by the Operator)

- **ASAP** The deficit of TEMP wind reports compared to TEMP reports of geopotential has not improved compared to 1999 and remains at around 14 %. There is a higher than average deficit of TEMP wind reports (reference level 500 hPa) for OXTS2, FNRS, OXYH2, S6LA, FNPH and OVYA2.

- **ASAP** The data quality remains high and only single ASAP TEMP reports are mentioned in the suspect lists of the Monitoring Centres.

- **ASAP** There are some ships with less than average reports at middle and higher standard levels. This holds for geopotential at 100 hPa from ELML7, for geopotential at 50 hPa from ELML7, OVYA2 and OXTS2 (see Fig.14), for wind at 100 hPa from ELML7, OXTS2 and for wind at 50 hPa for OVYA2, OXTS2 and OXYH2 (see Fig.15).

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 contributed very much to the final version of this report and is therefore highly appreciated.

Annex

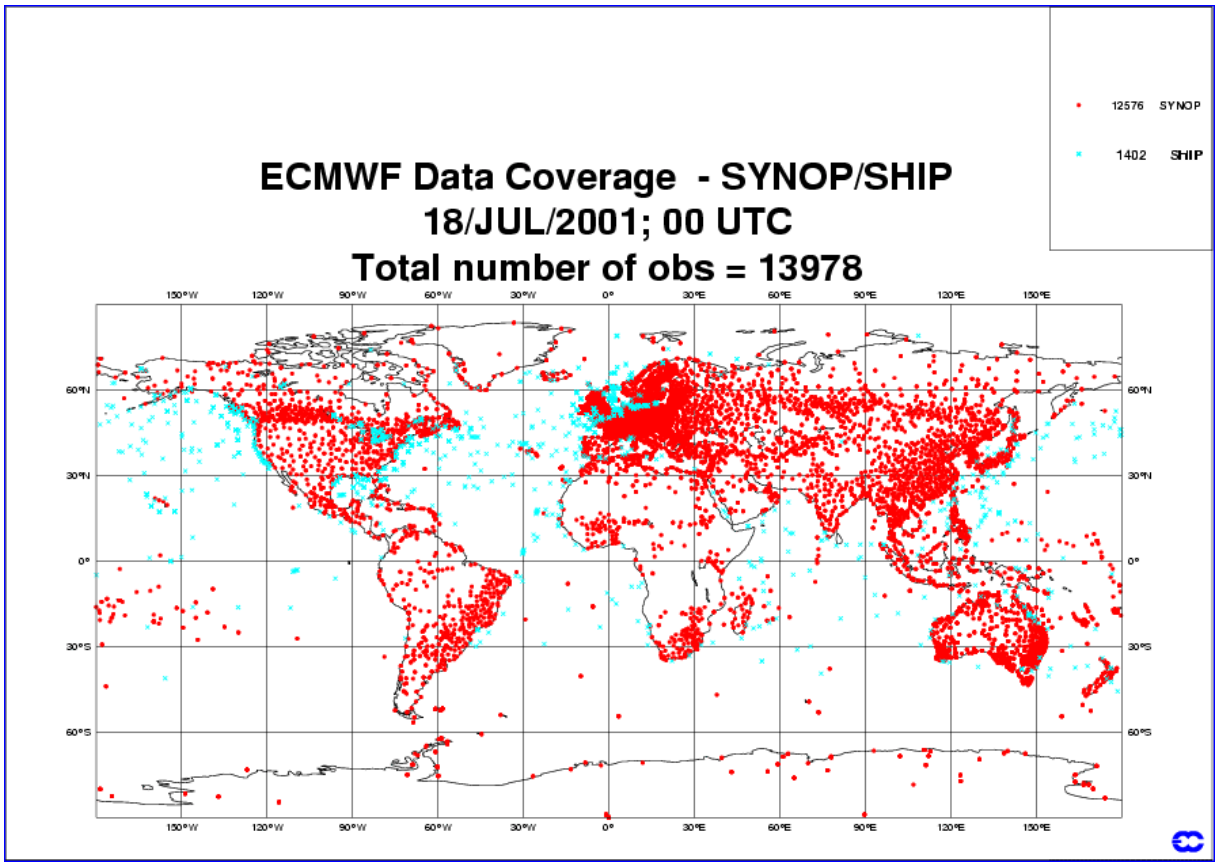


Figure Annex 1. Global Data Coverage SYNOP / SHIP (ECMWF)

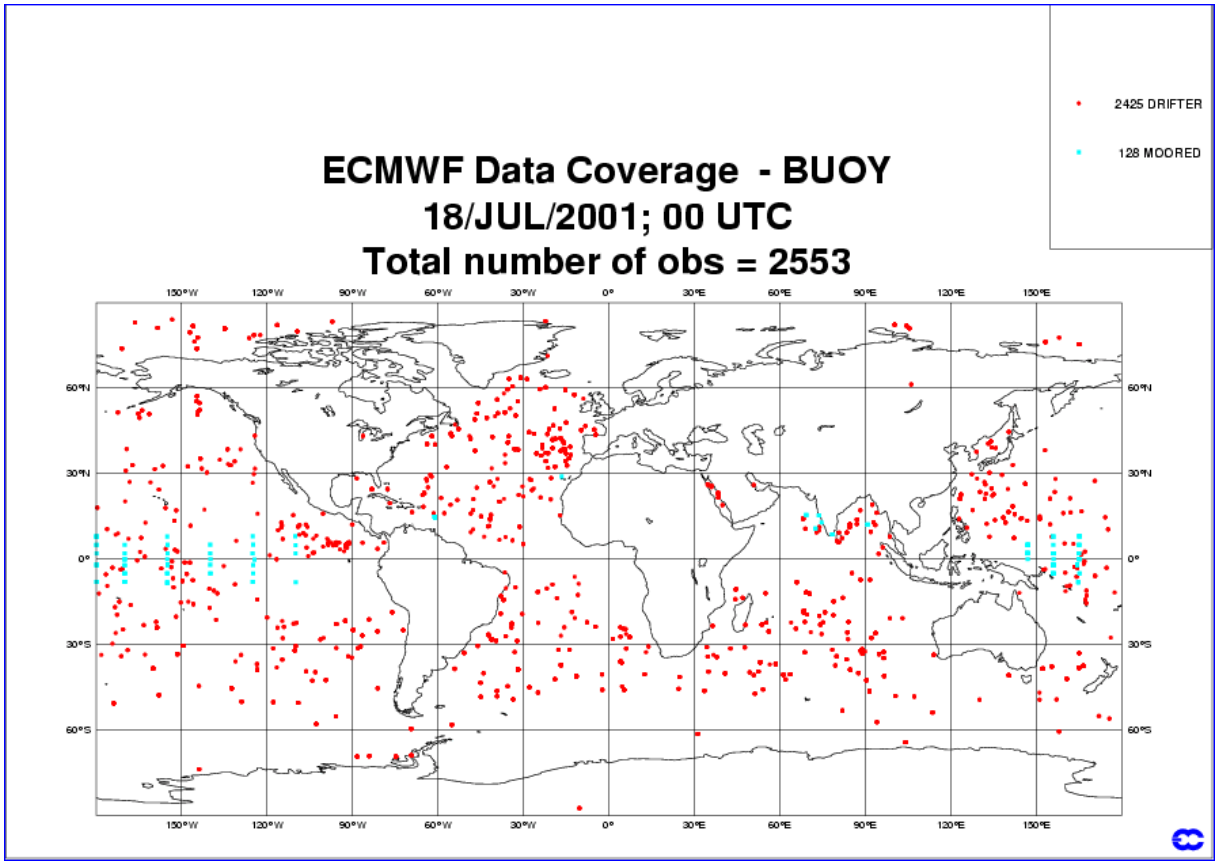


Figure Annex 2. Global Data Coverage Buoys (ECMWF)

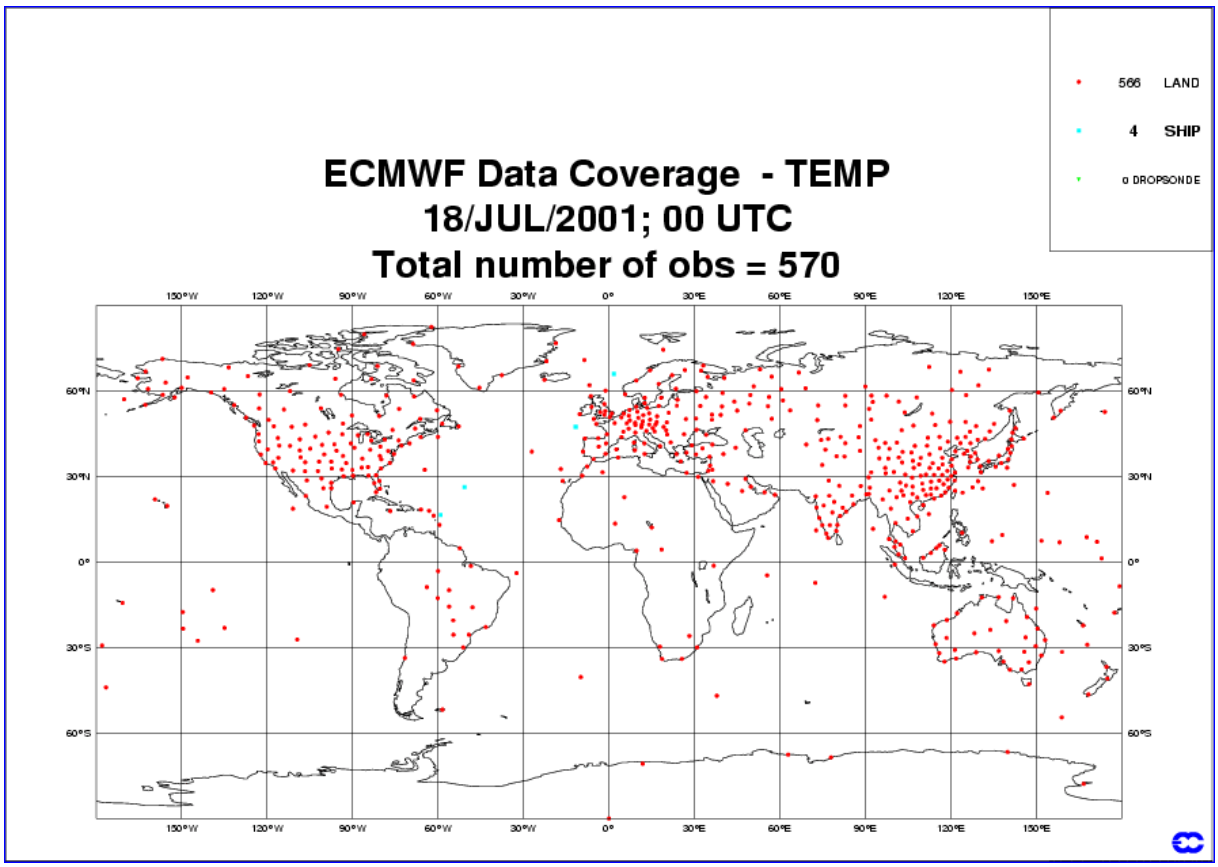


Figure Annex 3. Global Data Coverage TEMP (ECMWF)

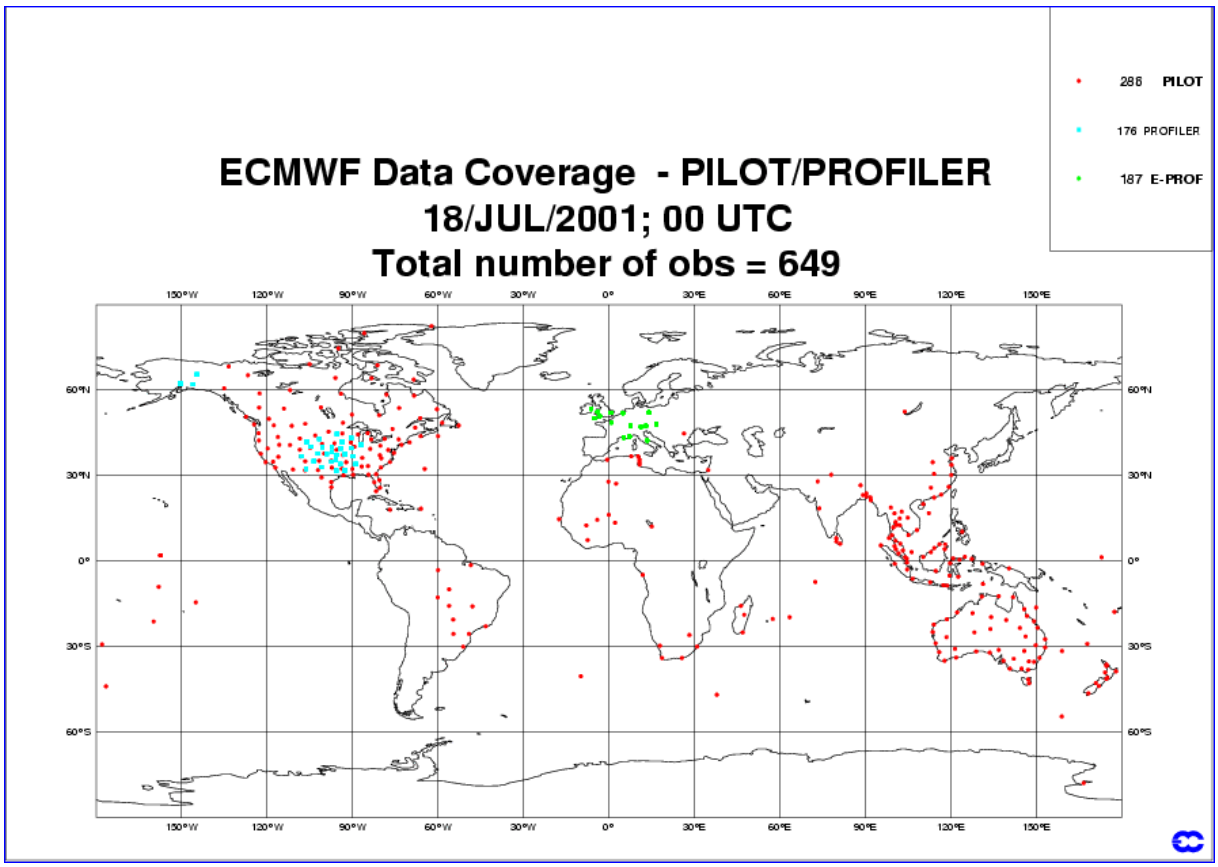


Figure Annex 4. Global Data Coverage Pilot/Profiler (ECMWF)

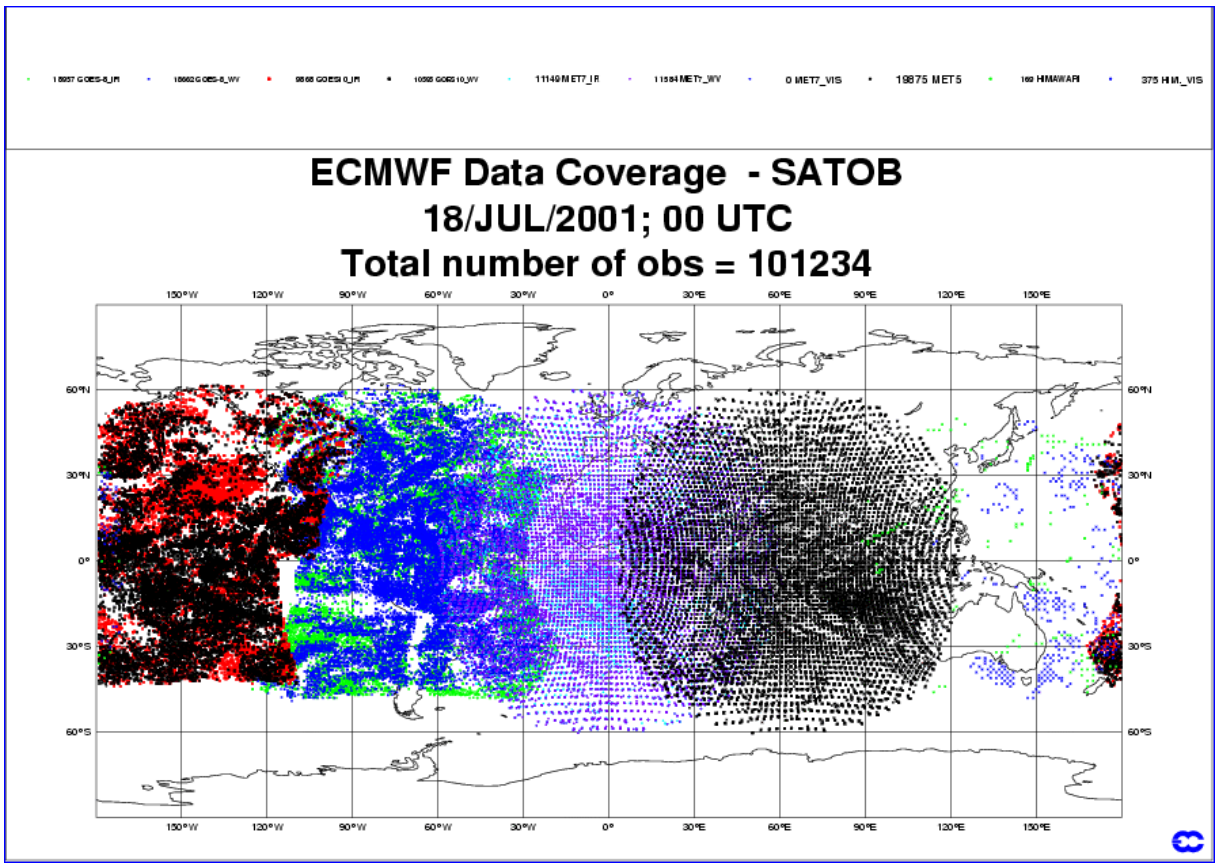


Figure Annex 5. Global Data Coverage SATOB (ECMWF)

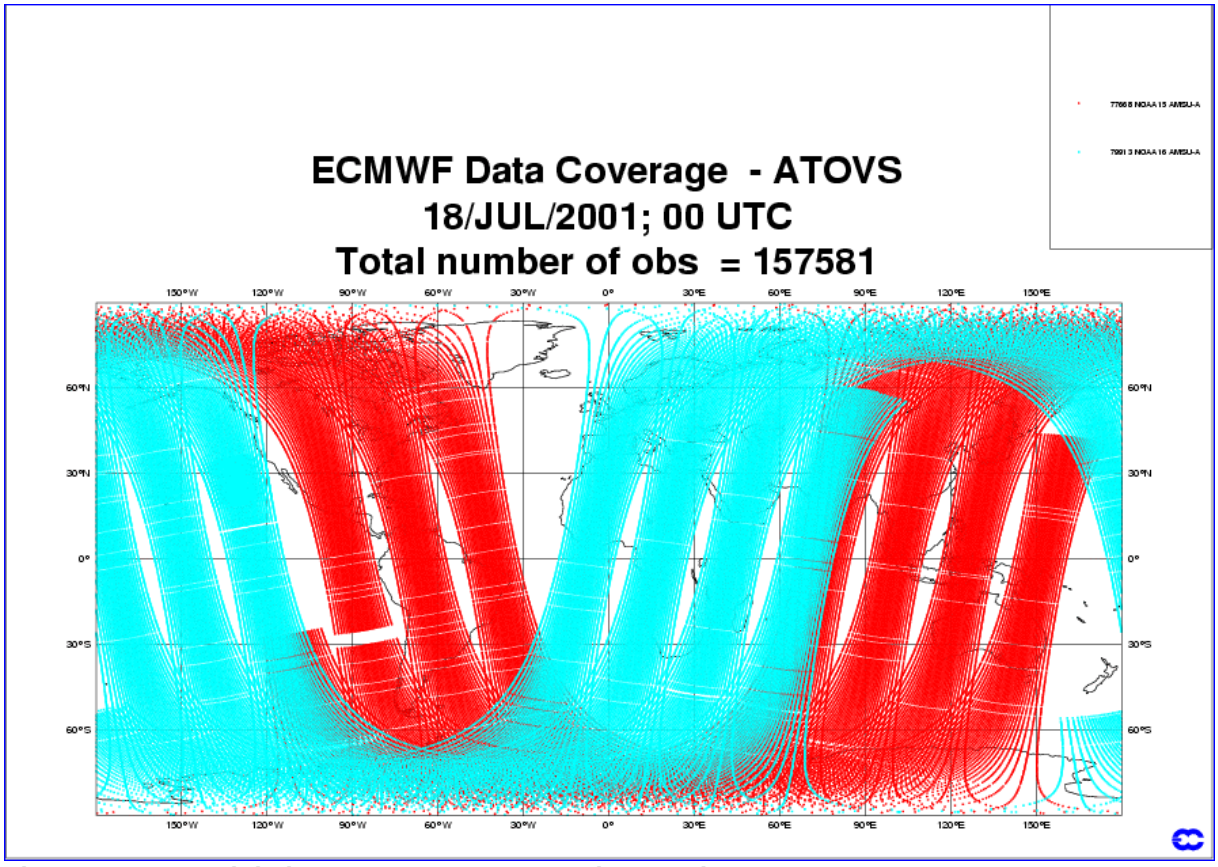


Figure Annex 6. Global Data Coverage ATOVS (ECMWF)

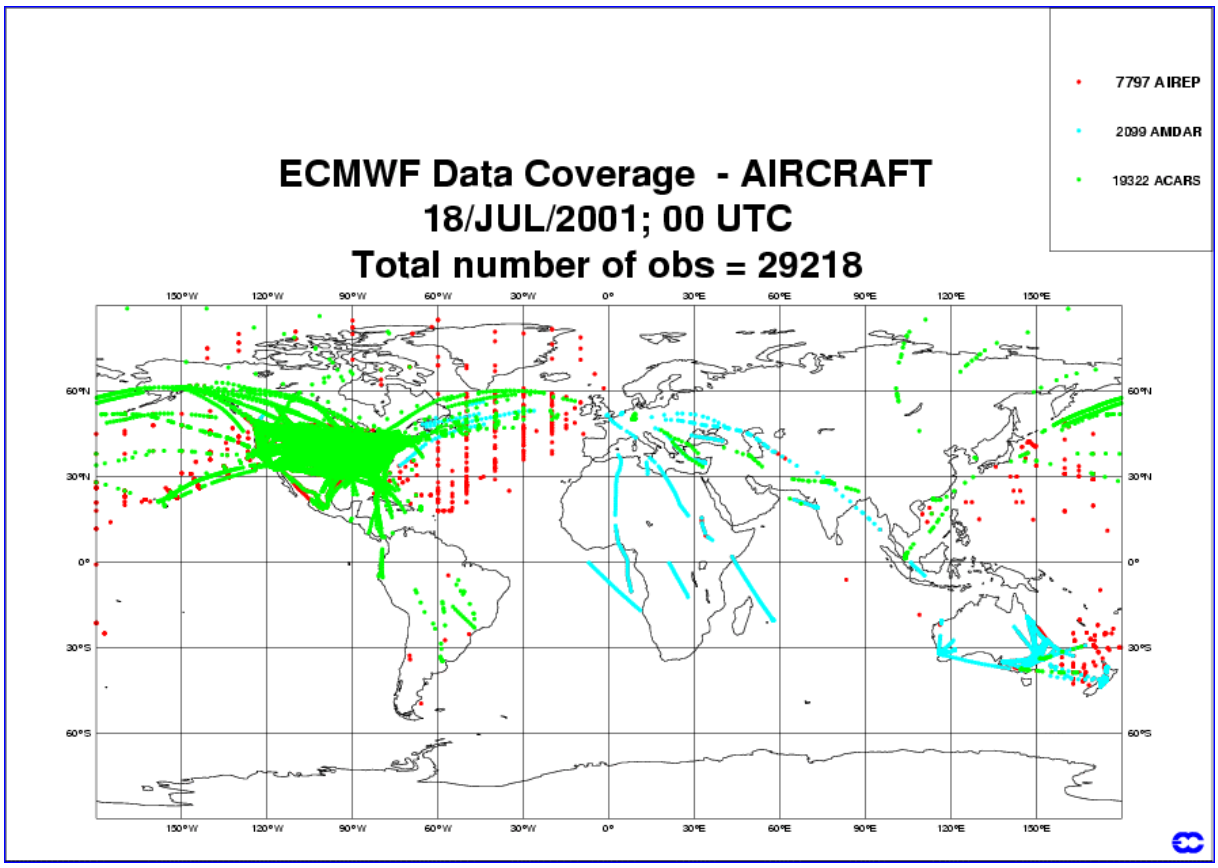


Figure Annex 7. Global Data Coverage AIREP (ECMWF)

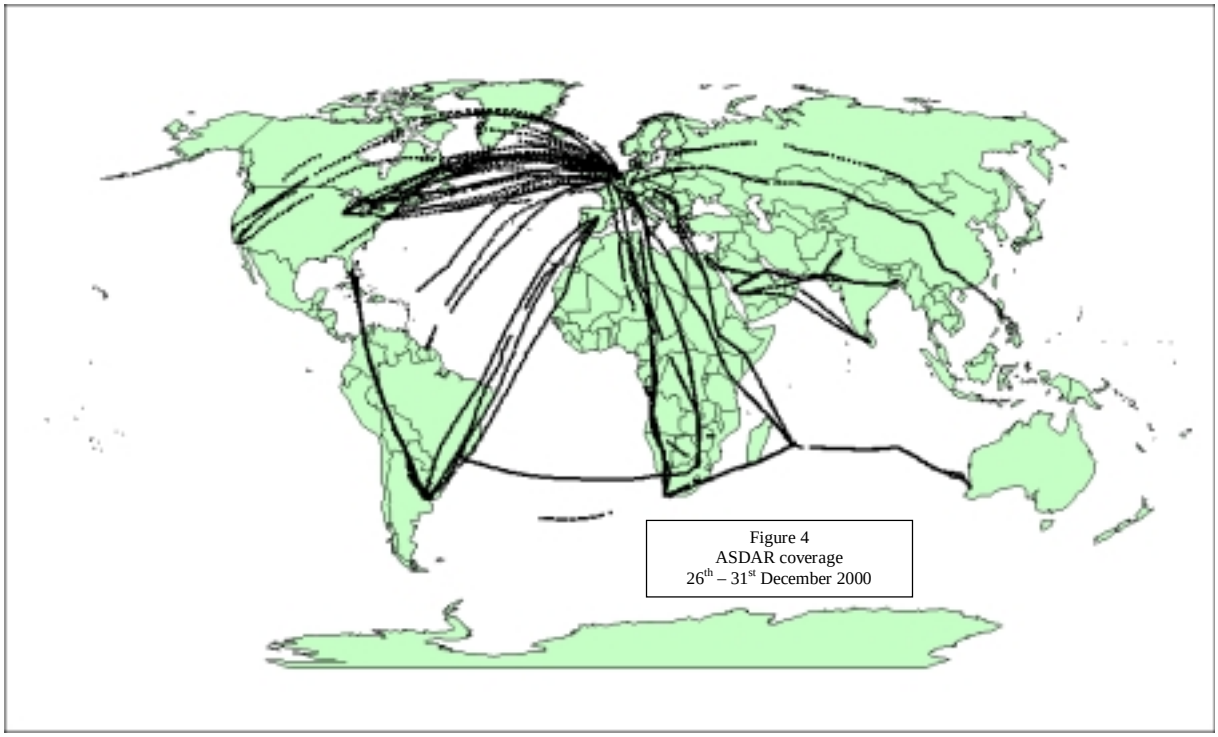


Figure Annex 8. Data Coverage of ASDAR units 21.-31.12.2000 (UKQR-ASDAR)