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**ASDAR MONITORING REPORT**

**JANUARY - MARCH 1996**

S.G. Smith

**Headquarters, Bracknell**

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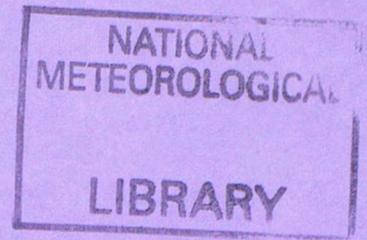
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**THE ASDAR CENTRE**

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## 1) INTRODUCTION

ASDAR reports received into the Met. Office data-banks have been monitored by the ASDAR Centre since the first ASDAR unit began flying on 29/11/90. The aim of the monitoring is to detect and identify any problems with the data or their transmission as soon as possible and to instigate fault correction procedures. These processes are vital to maintaining data quality and credibility.

Monitoring of the observations has covered data availability, receipt delays, reporting frequency and checks on the consistency and quality of the meteorological data. All irregularities have been reported to the ASDAR Technical Centre. This report highlights outstanding problems with data availability, transmission and quality, and with fault correction procedures.

## 2) OPERATIONAL UNITS

Data from seventeen ASDAR units were received at Bracknell during the period, the same as in the previous period.

Table 1 shows the carriers, types of aircraft, identifiers and the dates on which observations were first received for current operational units.

## 3) LIST OF OUTSTANDING PROBLEMS

All faults are reported to the ASDAR Technical Centre, who inform the relevant bodies where appropriate.

Known faults and anomalies present during the latest three month period are listed below. For faults where a specific unit is not mentioned, the fault is present for more than one unit (usually several.)

### i) Long term problems (that were identified more than 3 months ago)

a) Occasional missing positional information eg latitude or missing meteorological information eg temperature.

b) Occasional erroneous data eg impossibly strong wind speeds.

Both (a) and (b) often occur when the aircraft is on the edge of a satellite "footprint". Erroneous wind speeds and directions are often associated with a phase of flight of "LW", which indicates a "maximum speed" report, although such reports have a missing phase of flight if they are routed via Darmstadt. These maximum speed reports are produced in addition to the routine ones generated every seven minutes in level flight. Not all of them give incorrect values.

c) Missing reports - these occur for all units and during all three stages of flight : cruise level, ascent and descent. Lack of descent reports can be attributed to the aircraft

being powered down after landing and before transmission time. On a number of occasions data are received at the satellite but fail to get on to the Global Telecommunications System.

d) A number of units occasionally have a single report containing a spuriously high wind speed near the ground on ascent or descent (eg a report near the ground having a speed of 60 knots with the reports immediately before and after recording less than 20 knots.) The reason for this anomaly is unknown.

e) There are sometimes instances where a batch of consecutive reports from a particular unit give erroneous values for at least one of the meteorological elements, for reasons which are often unknown but could be transmission faults. In the latest quarter none of these occurrences lasted more than one day. Such instances related to BA009BMZ on 5th March, BA026LGZ on 6th March and KL014URZ on 9th March.

f) In last quarter's report it was noted that two of the latest units to produce observations, SA015AUZ and SA016ATZ, gave mean observation minus model background field values for temperatures and for wind speeds which were larger than for the other units. To some extent this was also true for the other new unit SV003IMZ. For the latest three months, there have been few reports from SA016ATZ, but those from the other two units have continued to produce anomalous results. Relative to the numerical weather prediction fields and to the other units, temperatures are about 0.5 - 1.0 deg C warmer for SA015AUZ and SV003IMZ at most levels and wind speeds about 0.5 - 1.5 knots stronger again at most levels.

Although it was thought initially that these findings may be due to a bias caused by the predominant flight tracks of the aircraft flying the new units, in conjunction with model biases, this is not now believed to be the case. Hence, the biases would appear to be the result of biases in the observations. It is also noted that wind direction biases and the standard deviation of the temperature and wind elements differences are also larger relative to those from other units. Reference to these anomalies is also made in section 5.

ii) New problems (that were identified during the latest 3 month period)

a) An antenna fault affected the receipt of data from SA016ATZ in January and February and no reports at all were received after 23rd February. The antenna will be replaced when one becomes available.

#### 4) MONITORING RESULTS

i) Data Availability

ASDAR reports are received via different collecting centres from one of three geostationary satellites depending on the location of the aircraft. Some collecting centres transmit reports in BUFR (a form of binary) code rather than the more traditional character format. The number of reports per day received from any one unit can be as high as 280 but on average the number per unit per day is about 150. On any

one day, not all operational units may be producing data; for example the aircraft on which the unit is flying may be undergoing maintenance.

The average number of reports per day received for the latest quarter was 2083. The highest average number of reports per day from any single unit (omitting days for which no reports were received) was 190 for KL014URZ.

Units not reporting for more than 7 consecutive days during the three month period were :-

**BA010PUZ:** 14th - 21st Jan (reason not known)

**BA025LFZ:** 21st Jan - 20th Mar - aircraft was in hangar for maintenance from 21st January until 29th February. Unfortunately the batteries in the Data Processing Unit discharged during this time, upsetting the ASDAR clock. This was not reset until 21st March.

**BA000NEZ:** 24th Jan - 2nd Feb - aircraft in hangar for maintenance.

**KL013UPZ:** 12th Feb - 21st Feb - aircraft in hangar for maintenance

**BA008DJZ:** 20th Feb - 11th Mar - aircraft in hangar for maintenance

**BA026LGZ:** 21st Feb - 5th Mar - aircraft in hangar for maintenance

Fig 1 shows the number of units that have produced reports received at Bracknell in successive three month periods since October - December 1992.

## ii) Data Coverage

Although some of the aircraft carrying the ASDAR units only fly predominately between Europe and North America or within these regions, others fly also to destinations in Asia, Africa, Australasia and South America. Figure 2 shows the global coverage of the ASDAR reports over one week at the end of the report period.

## iii) Data Timeliness

Speed of data receipt is good. For each unit over the three month period, over 80% of reports were received within one hour of observation time and over 98% within two hours.

## iv) Frequency of Reporting

The expected frequency of ASDAR reports is one every 7 minutes during level flight and one every 10 hPa or 50 hPa during ascent and descent (with the higher frequency applying to the lower part of the atmosphere). Taking daily samples wherever possible, statistics have been compiled of the average time between reports during level flight, and the average pressure difference (in hPa) between the first 10 reports on ascent and the first 10 reports below 3500 feet (approximately 890 hPa) on descent. The pressure

differences for ascent and descent are obtained from height differences using the standard atmosphere relationship that 1 hPa is approximately equivalent to 29 feet in the layer 1000-900 hPa.

All the reporting units are reporting every seven minutes in level flight and the "report every 10 hPa" target is being met in the near-ground phase of ascent. However, the mean frequency for near-ground descent continues to be slightly poorer than the specified criterion for a number of the units. (The maximum mean separation over all units was 10.3 hPa.)

## 5) DATA QUALITY

Differences between observations and model forecast fields from the UK 19-level global forecast model have been used to analyse the quality of ASDAR reports. Vertical profiles of observation minus model background ("O-B") and observation minus model analysis ("O-A") differences for levels between 950 and 150 hPa have been plotted for all operational units for the last month of the three month period.

Figures 3 - 5 show the profiles for one unit from each of the British Airways, KLM and Lufthansa airlines respectively and figures 6 - 7 show the profiles for SA015AUZ and SV003IMZ. Results are given for temperature and for wind (u component, v component, speed, direction and rms vector) separately and show mean and standard deviation of the differences from the model fields at each level. Fig 3 has been annotated to clarify the headings.

Although both "O-B" and "O-A" plots are displayed, comparison with the background field is more meaningful as in data sparse areas the model analysis will tend to fit to an observation, regardless of its quality, provided it passes the quality control.

The profiles shown (together with those not shown) indicate that the observations were generally of good quality. However, it is noted that for SA015AUZ and for SV003IMZ, mean O-B temperatures and wind speeds were larger than for the other units (see also section 3(i)(f)). Wind direction differences were also somewhat anomalous compared to other units as were the standard deviations of these quantities.

## 6) SUMMARY

- i) Overall timeliness and quality of the data from the existing operational units remained high, although there is some concern about the accuracy of the temperatures and winds from SA015AUZ and SV003IMZ, plus SA016ATZ before it ceased transmitting reports in February.
- ii) The number of units reporting in the period, seventeen, was the same as in the previous period. However, one unit, SV003IMZ has not reported since 23rd February due to an antenna fault and aircraft maintenance work meant that a further five units did not report for extended periods during the quarter.
- iii) All units maintained the stipulated reporting frequencies for level flight and for near-ground phase of ascent. Overall, the frequency for near-ground phase of descent fell slightly short of stipulated frequencies.

## 7) AMDAR DATA FROM DUTCH AIRCRAFT

AMDAR coded data from KLM aircraft using software from the Dutch meteorological service, KNMI, are also being monitored. These data first began being transmitted in September 1993. The software has been designed to simulate ASDAR data for onboard aircraft computers. The data are therefore in the same format as the ASDAR data but they are transmitted via ground receiving stations to Schipol (Amsterdam) Airport where they are inserted on to the GTS, rather than by satellite links. Observation coverage is restricted to 80 deg west - 40 deg east and 90 deg south - 35 deg north and ascent/descent reports restricted to the vicinity of Schipol Airport because of the relatively high cost of receiving each report. The monitoring has mainly taken the form of visual inspection of sequences of reports.

In the latest quarter, reports from eight units were received: KL130CA, KL131CB, KL132CC, KL133CD, KL134CE, KL135CF, KL136CG and KL137CH. The visual inspection of the reports suggests there were no obvious problems with the quality of data from any of the units, except that the flight level continued to be sometimes incorrectly reported as zero, or less frequently as an incorrect positive number. This error occurs for about 1-2 reports per day per unit. In such cases, the meteorological information reported looks correct.

Given the different method of transmission of the data, it is not surprising that the speed of receipt is not as good as it is for the ASDAR units - about 55% of reports were received within one hour and 65% within two hours.

## 8) ACKNOWLEDGEMENT

Mr J Leighton (NWP) produced the map of ASDAR coverage forming fig. 2.

Table 1 : Operational ASDAR units

Airline	Aircraft type	Identifier	start date
British Airways	747	BA000NEZ@	12/ 6/92
British Airways	DC 10	BA001LLZ	29/11/90
British Airways	DC 10	BA008DJZ	19/12/91
British Airways	DC 10	BA009BMZ	11/ 2/92
British Airways	747	BA010PUZ	27/ 6/91
British Airways	747	BA025LFZ	15/ 4/94
British Airways	747	BA026LGZ	15/ 4/94
British Airways	747	BA027LJZ	15/ 4/94
British Airways	747	BA028LLZ	15/ 4/94
British Airways	747	BA029LYZ	18/12/94
KLM	747	KL012UMZ=	23/ 4/92
KLM	747	KL013UPZ	11/ 1/95
KLM	747	KL014URZ	23/ 3/95
Lufthansa	747	LH005VNZ	23/ 6/93
South African Airways	747	SA015AUZ	15/12/95
South African Airways	747	SA016ATZ	24/10/95
Saudia	747	SV003IMZ+	27/10/95

@ Unit identifier reported as BA000NDZ before 4/10/92  
= Unit identifier reported as PH012UMZ before 11/5/93  
+ Unit identifier also initially reported as SV003ISZ

# Figure 1

No. of units producing data received at Bracknell  
 Values represent numbers over a 3 month period

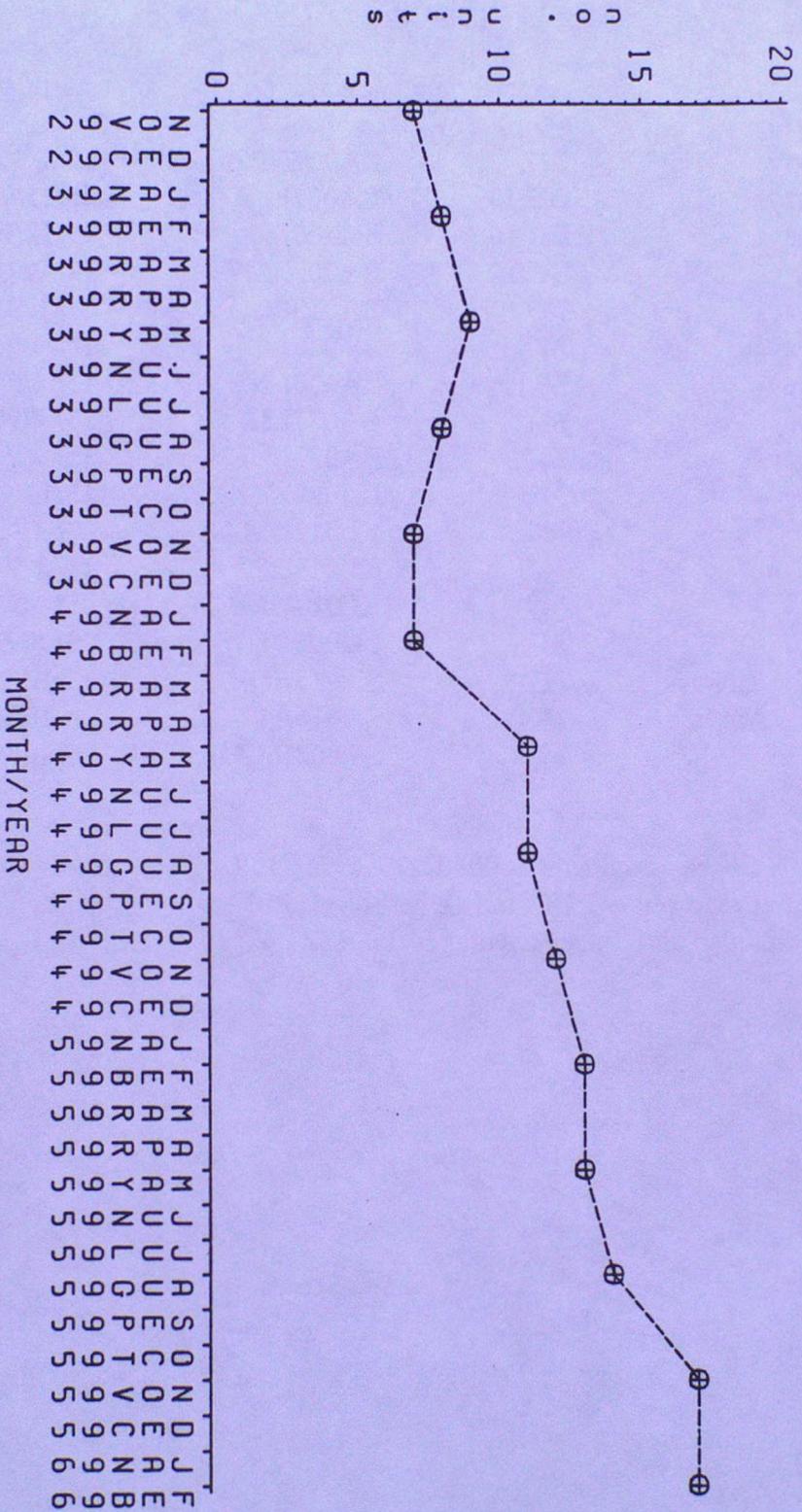


FIGURE 2

ASDAR COVERAGE : 25 - 31 MARCH 1996

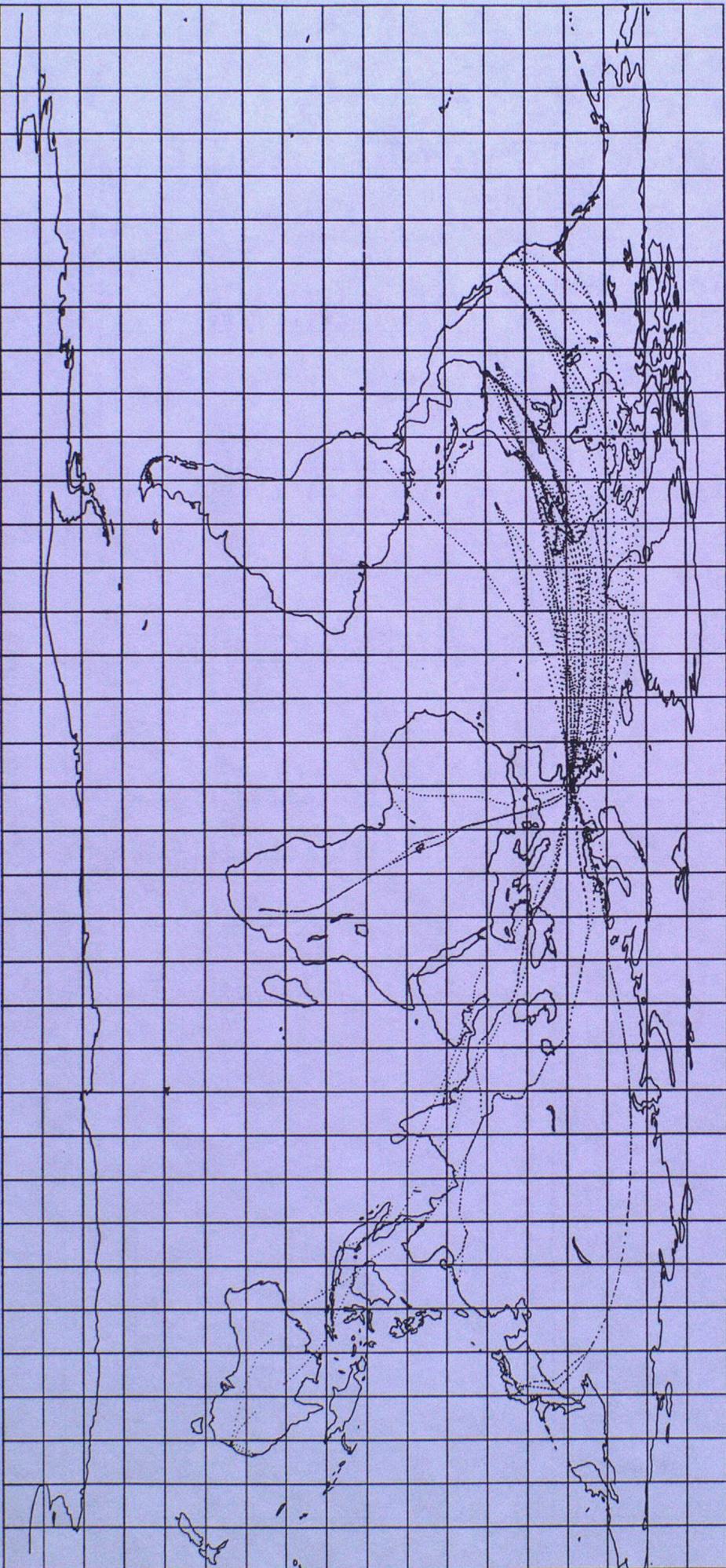


FIGURE 3 : BA0000NEZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

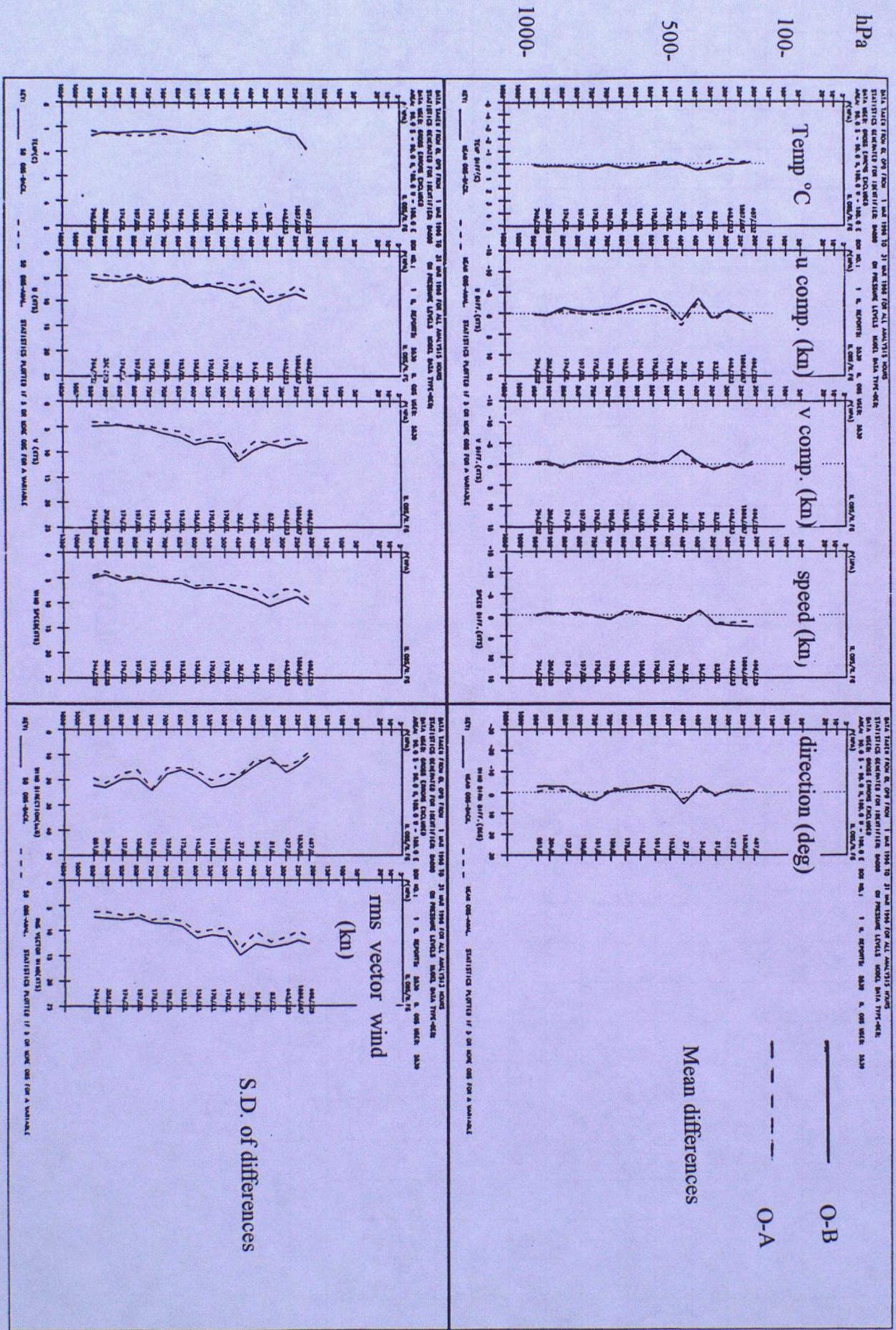


FIGURE 4 : KL012UMZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

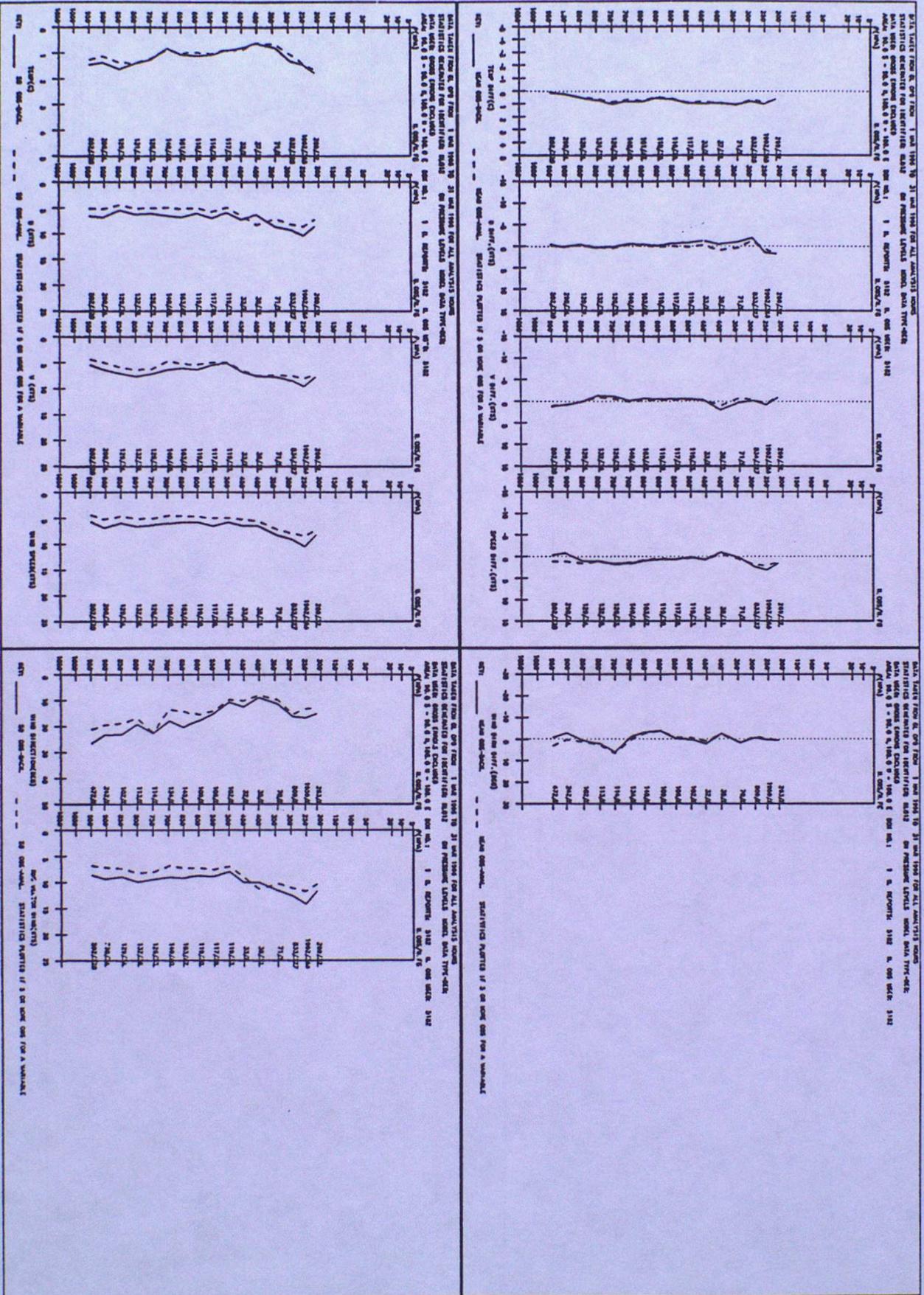




FIGURE 6 : SA015AUZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

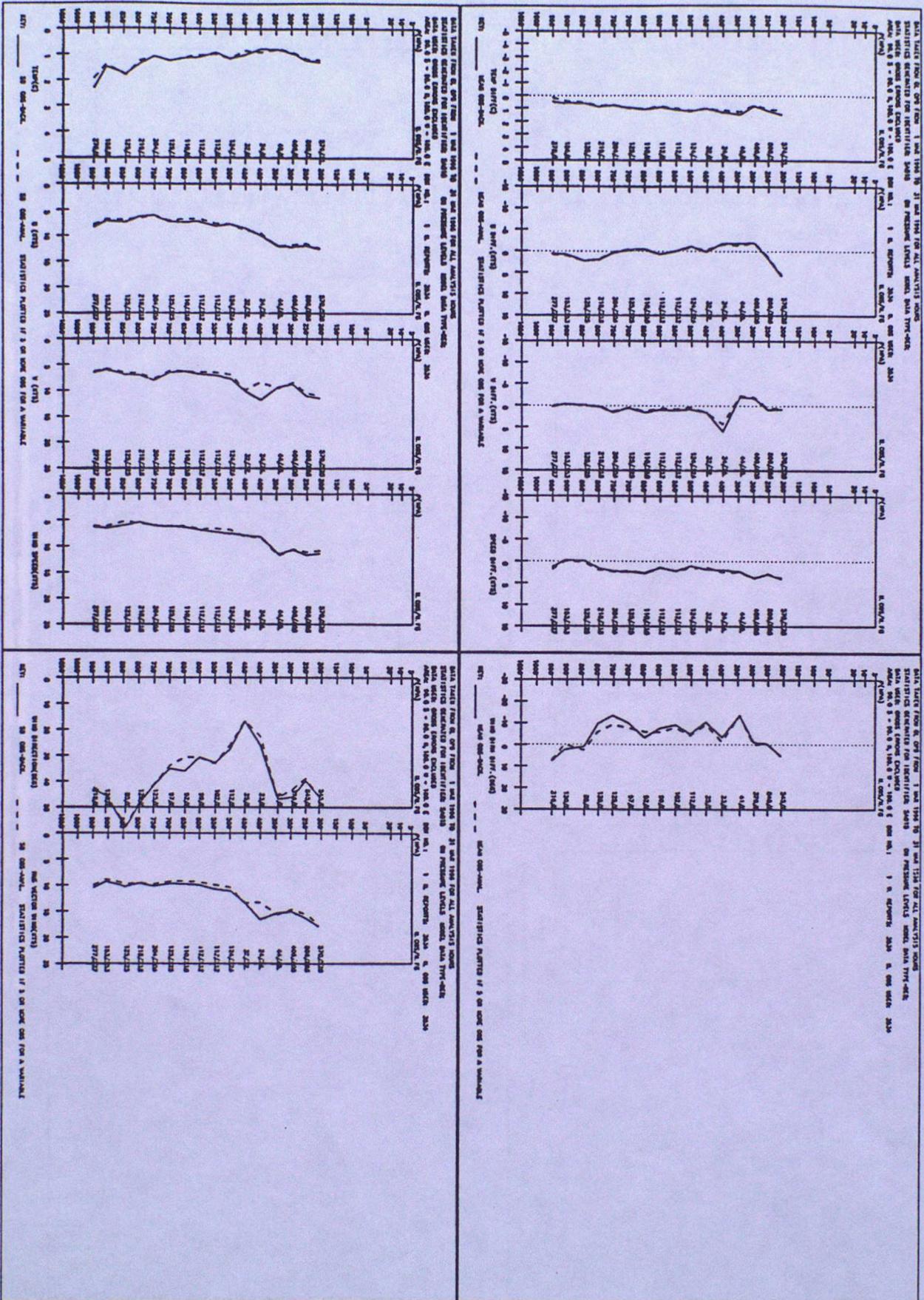


FIGURE 7 : SV003IMZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

