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ASDAR MONITORING REPORT

OCTOBER - DECEMBER 1995

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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, three more than 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.

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

a) There have been a few instances where successive reports from a particular unit gave erroneous values for at least one of the meteorological elements. The units, elements affected and date(s) were as follows :

**BA008DJZ** - too many incidences of severe turbulence in late October and early November. The Flight Data Acquisition Unit (FDAU) was changed which corrected the problem. There were intermittent batches of erroneous temperature and wind data (plus incorrect flight levels), between 11th - 17th December, again fixed by changing the FDAU. There was a further batch of erroneous wind speeds and directions, on 30th December.

**KL013UPZ** - batch of erroneous wind speeds and directions, on 28th November.

**SV003IMZ** - batch of erroneous temperatures, on 4th November. This was fixed by changing the Programme Management System computer. There were batches of erroneous wind speeds and directions between 22nd - 28th December.

#### 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.



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

**BA009BMZ** : 27th Oct - 19th Nov - aircraft in hangar for "C" check

**BA000NEZ** : 12th - 21st Nov - aircraft in hangar for maintenance

**BA001LLZ** : 20th Nov - 17th Dec - aircraft in hangar for maintenance. Reports from this unit have been sporadic since 17th December due to aircraft engine problems.

In December, the average number of reports received from the ASDAR units (omitting BA001LLZ which only reported sporadically in December) ranged from 121 for SA015AUZ and BA028LLZ, to 214 for KL014URZ. (Days for which no reports were received are omitted from the average.)

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 a seven day period at the end of December.

#### iii) Data Timeliness

Speed of data receipt is good with over 70% of reports being received within one hour of observation time and over 97.5% within two hours, over all reporting units.

#### 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 achieved the "report every 7 minutes" target in level flight and "report every 10 hPa" target 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 10.5 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 - 8 show the profiles for the three units that became operational in the latest period. 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 are generally of good quality. However, it is noted that for SA015AUZ, mean O-B temperatures are larger than for the other units at cruise levels and for all three new units at lower levels. Mean O-B wind speeds are also larger for SA015AUZ and SA016ATZ at cruise levels and for the former at lower levels compared to the values from the other units. For wind directions also, the profile for SA015AUZ is somewhat anomalous. Some differences between profiles will simply be due to sampling fluctuations but the differences highlighted here are all statistically significant, taking the values from all 17 units into account.

It is possible that the anomalies are caused not by any problems with the observations but arise from differences between the predominant flight tracks (over Africa and the Middle East) of the aircraft flying the new units and the flight tracks of the other aircraft, in conjunction with geographical variations in model field characteristics. This possibility will be investigated.



## 6) SUMMARY

- i) Overall timeliness and quality of the data from the existing operational units remain high. However, erroneous data were noted from a few units for short periods (details given in section 3.)
- ii) Three new units become operational during the period, making a total of 17. About 2500 reports per day are now being received.
- 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.
- iv) Some anomalies for temperatures, wind speeds and wind directions compared to model fields for the new units were noted relative to corresponding values from the other units - the reason for these is not yet known.

## 7) AMDAR DATA FROM DUTCH AIRCRAFT

AMDAR coded data from Dutch aircraft are also being monitored. In the latest quarter eight units reported : KL130CA, KL131CB, KL132CC, KL133CD, KL134CE, KL135CF, KL136CG and KL137CH. The data are in the same format as the ASDAR data and provide the same meteorological information but are not transmitted via satellite links. The monitoring has mainly taken the form of visual inspection of sequences of reports.

Due to the fact that observation coverage is restricted to 80 deg west - 40 deg east and 90 deg south - 25 deg north because of the cost of receiving each report, there are frequent gaps in the sequence of reports. However, visual checks of the reports suggest there are no obvious problems with the quality of data from any of the units, except that the flight level is sometimes incorrectly reported as zero, or less frequently as an incorrect positive number. This error is not confined to any one aircraft. In such cases, the meteorological information reported looks correct.

## 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

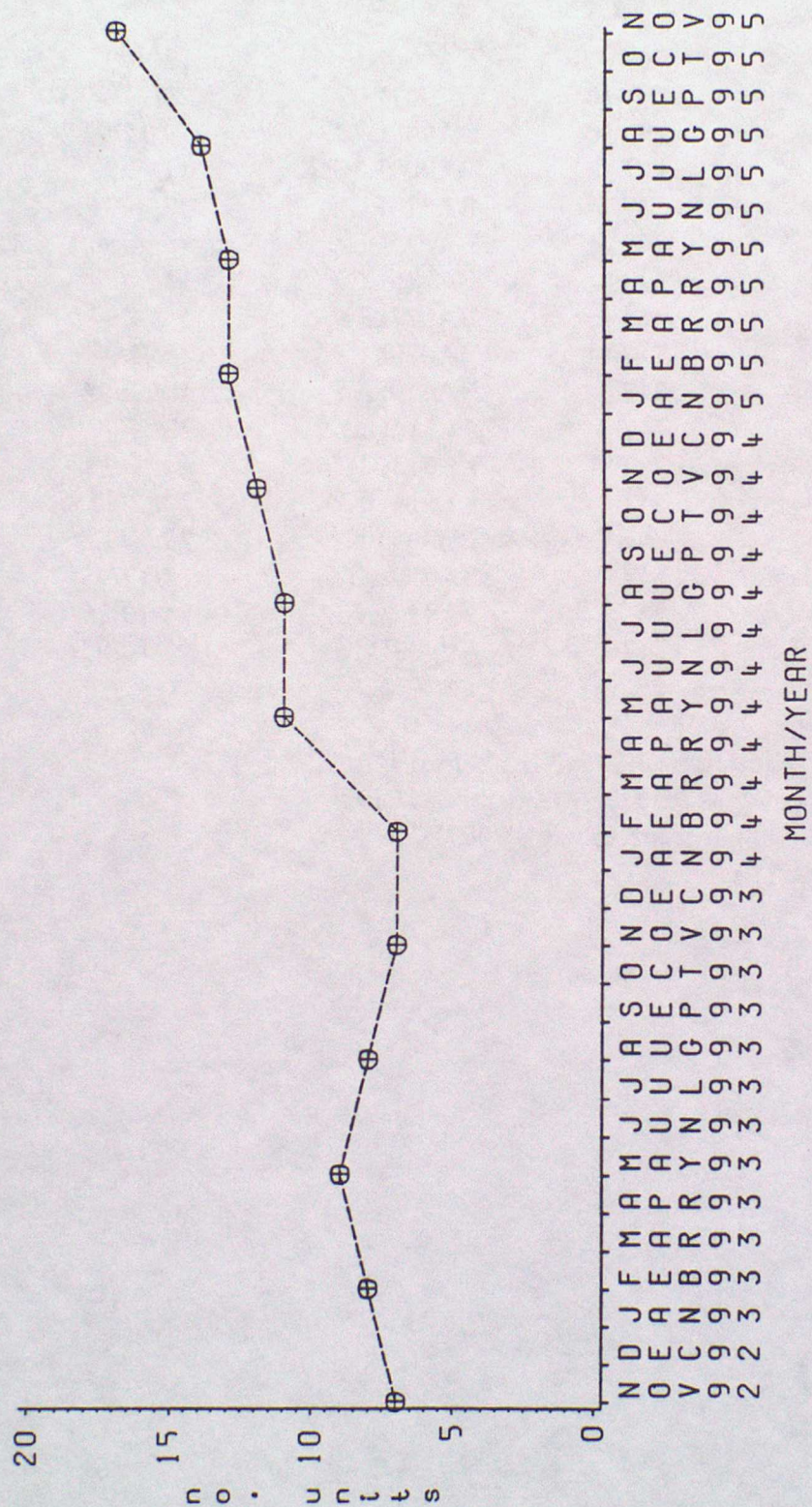
@ Unit identifier reported as BA000NDZ before 4/10/92  
 = Unit identifier reported as PH012UMZ before 11/5/93  
 + Unit identifier also initially reported as SV003ISZ



# Figure 1

No. of units producing data received at Bracknell

Values represent numbers over a 3 month period





**FIGURE 2**

**ASDAR COVERAGE : 25 - 31 DECEMBER 1995**

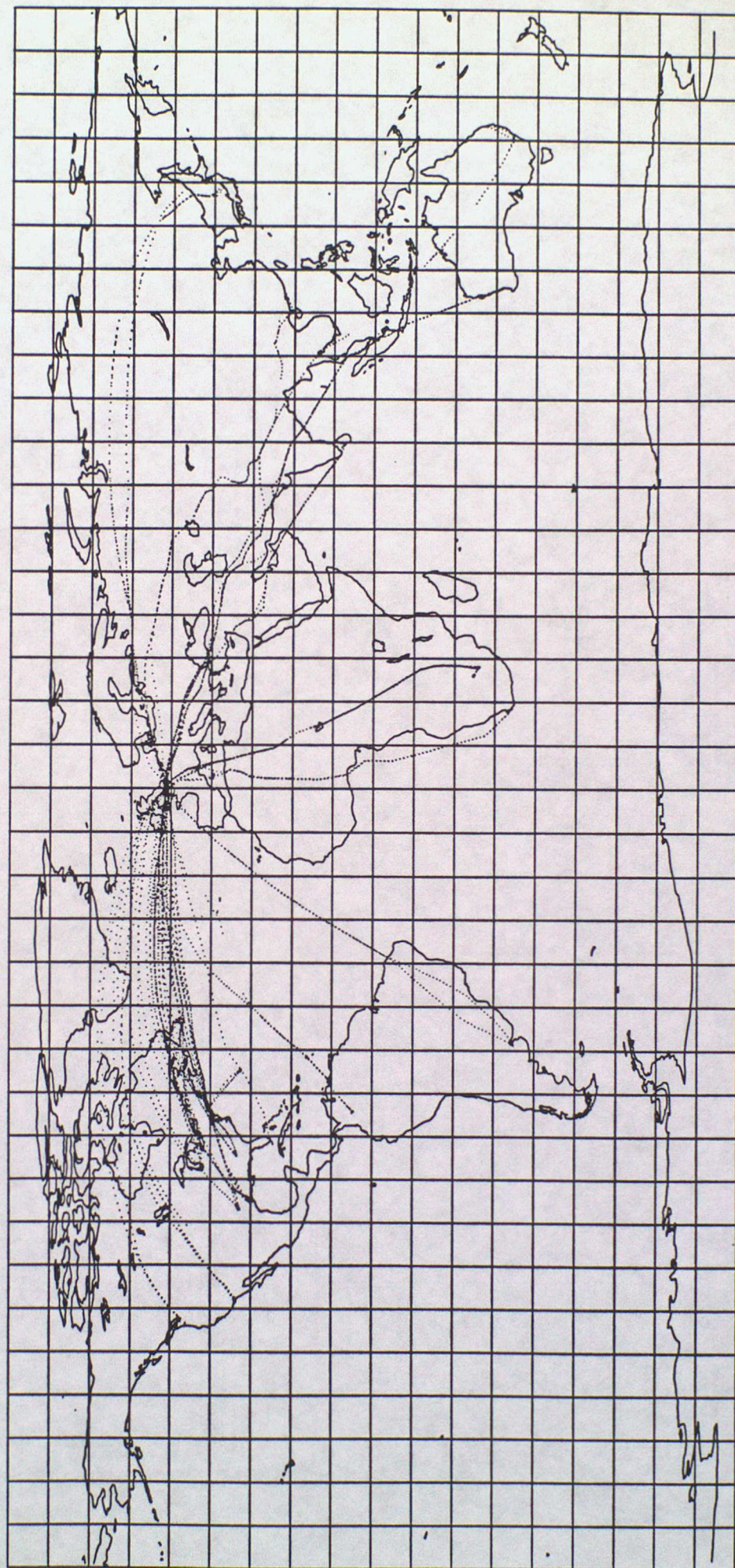




FIGURE 3 : BA00NEZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

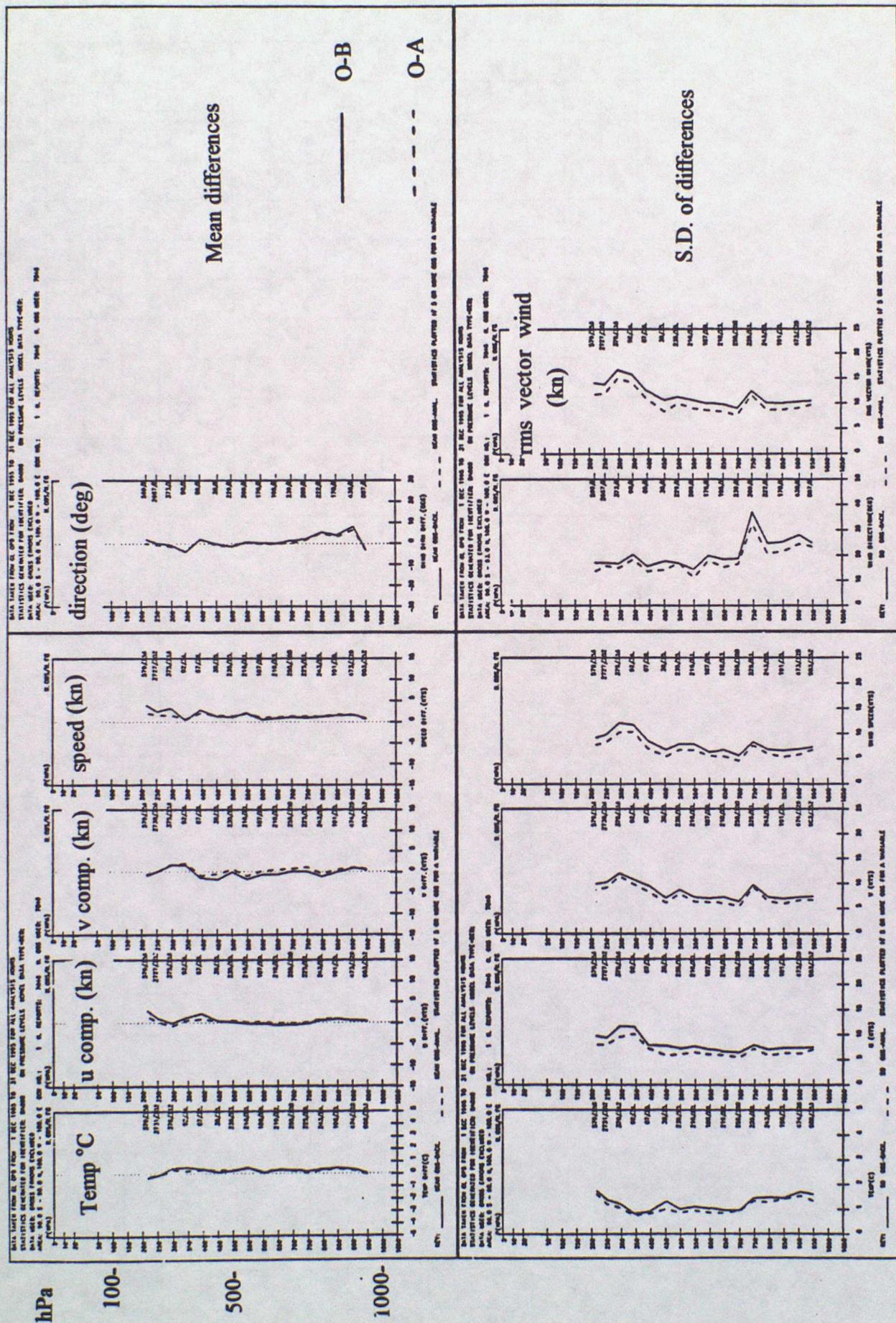




FIGURE 4 : KL012UMZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

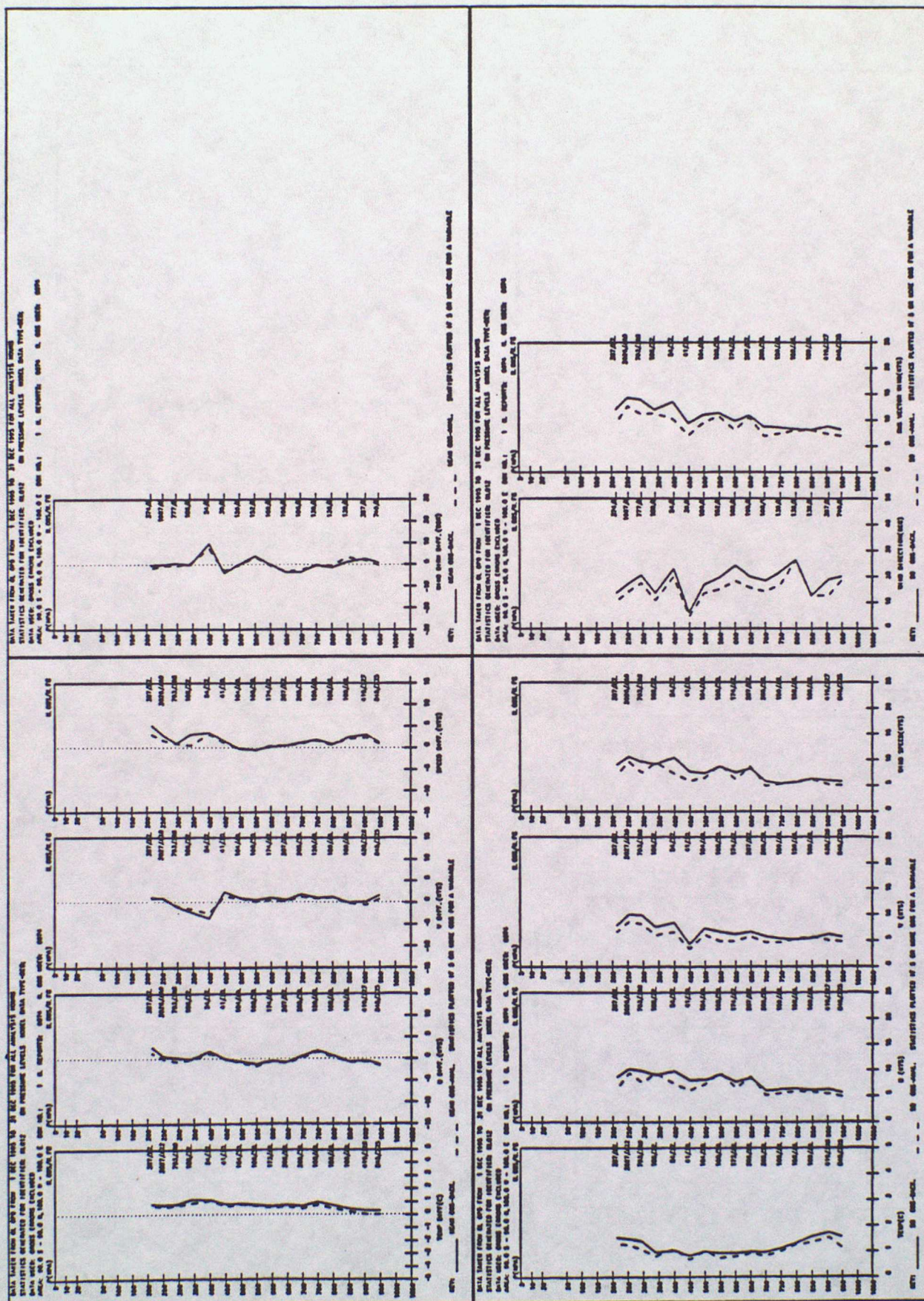




FIGURE 5 : LH005VNZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

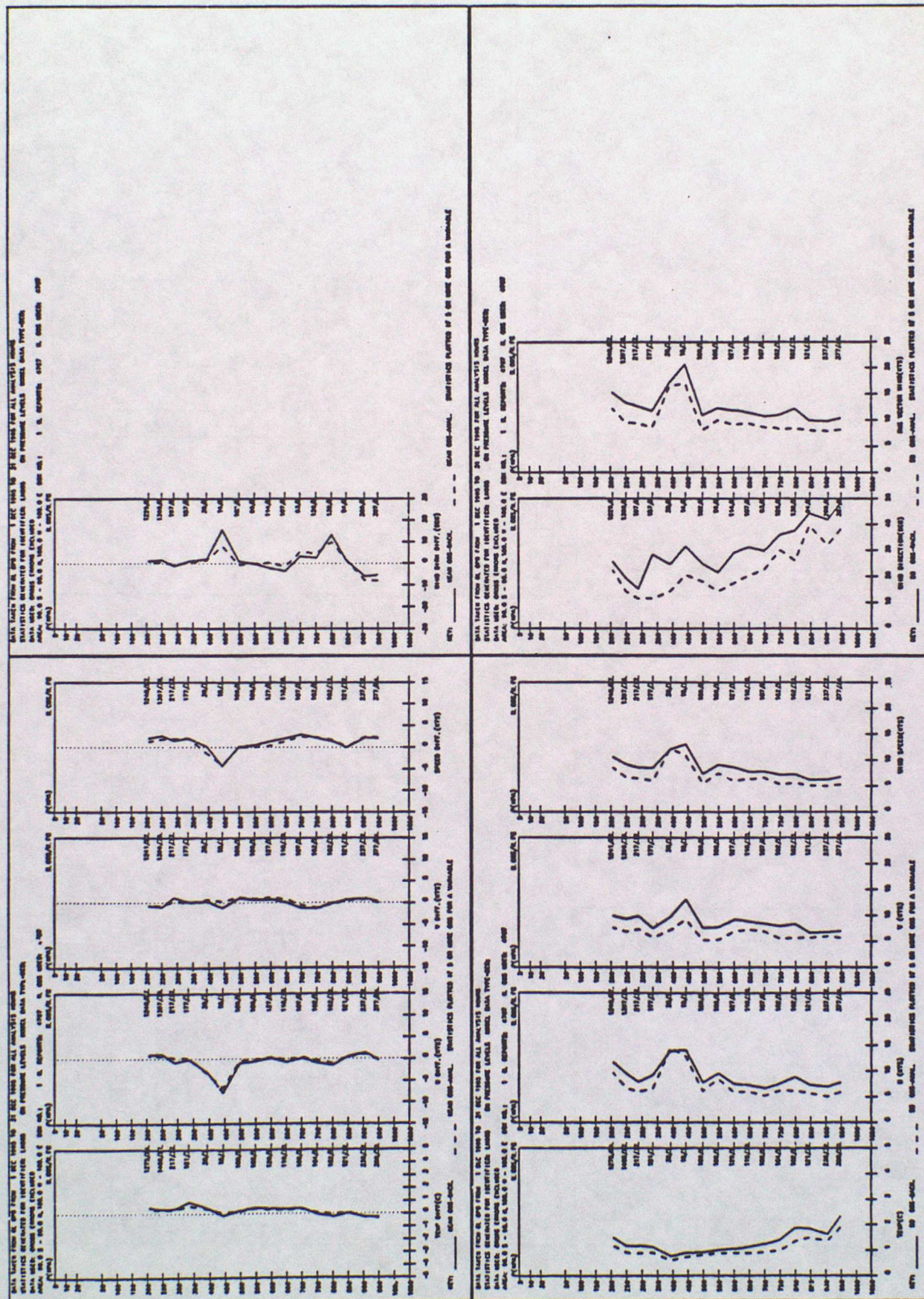




FIGURE 6 : SA015AUZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

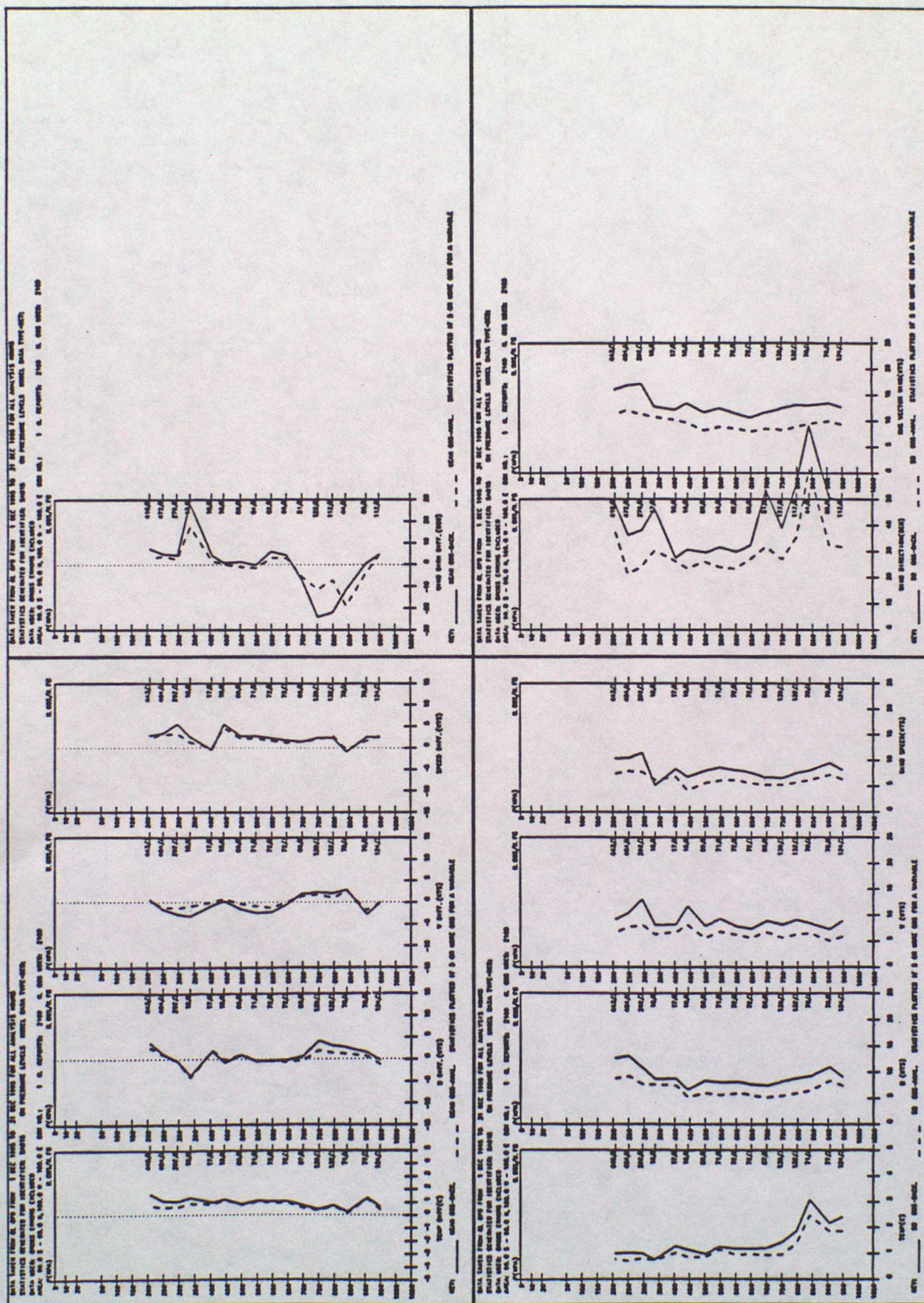




FIGURE 7 : SA016ATZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

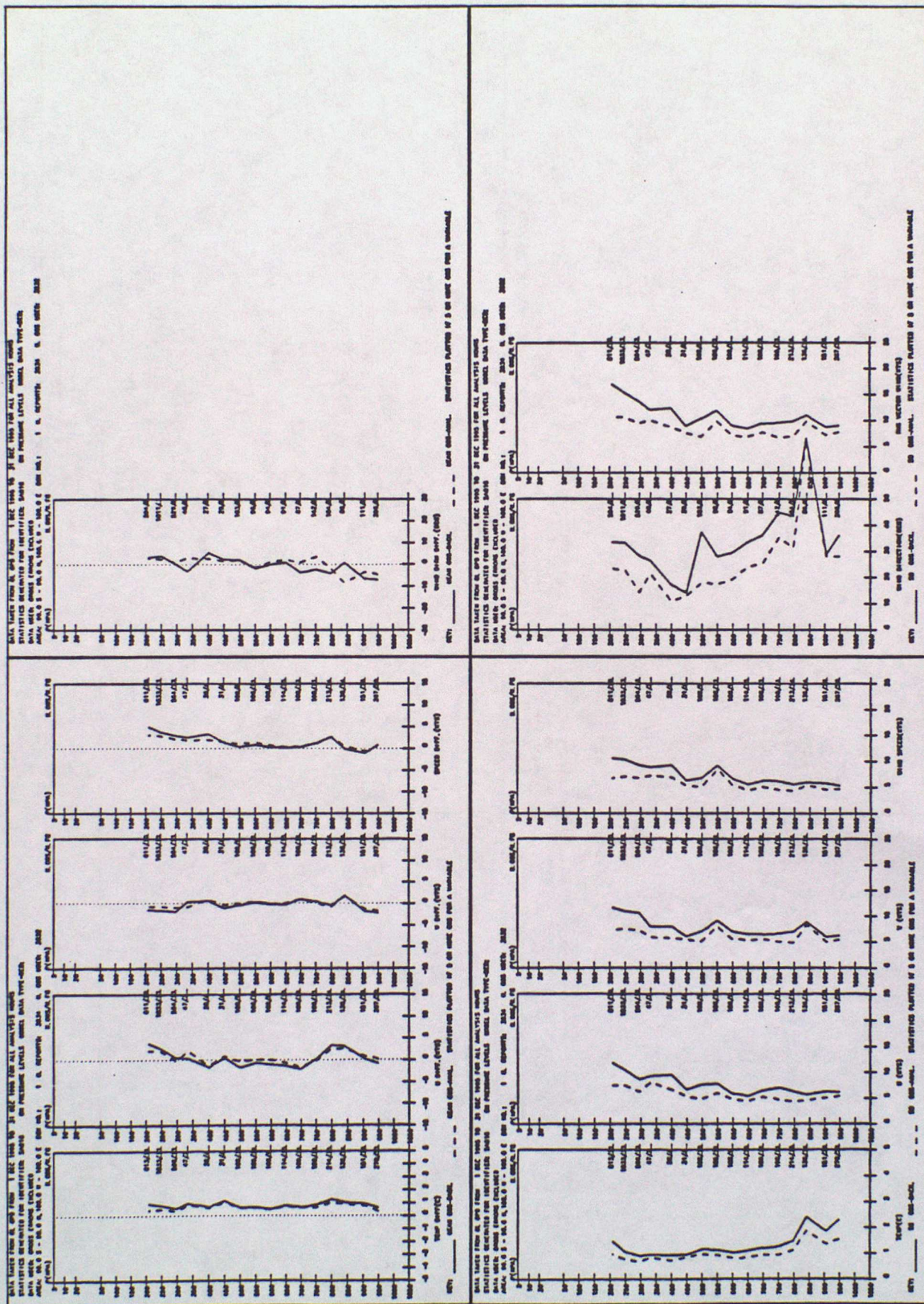




FIGURE 8 : SV003IMZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

