OBSERVATION PROVISION BRANCH

REPORT ON ASDAR MONITORING RESULTS

JANUARY - MARCH 1995

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THE ASDAR CENTRE

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1) INTRODUCTION

ASDAR reports received into the Met. Office Synoptic Data Bank (SDB) 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 thirteen ASDAR units were received in the SDB during the period, one more than in the previous period. A further unit, that on BA027LJZ, is still nominally operational, but did not produce any reports during the quarter (see section 4).

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 relevent 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 reports are produced in addition to the routine ones produced every seven minutes in level flight. Not all the maximum speed reports give incorrect values.

c) Missing reports - these occur for all units and during all three stages of flight : cruise level, ascent and descent. Exceptionally whole flights are missing. 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 being received at the satellite but fail to get on to the Global Telecomunications System. The reasons for this are being investigated.

d) Temperature biases - there are positive temperature differences for KL012UMZ (and for KL013UPZ and KL014URZ since they began operation) relative to numerical forecast model fields of about 2.0 deg C at cruise levels. Temperature differences taken over all the other units are about +0.4 deg C for all levels, which might be due to a model bias. For KL012UMZ there used to be a negative temperature bias at lower levels, but this since to have largely disappeared in recent quarters. A new temperature probe was fitted to this unit on 21st March but this does not seem to have altered the bias.

e) Varying cruise flight levels - cruise flight levels reported from KL012UMZ (and for KL013UPZ and for KL014URZ since they began operation) fluctuate more frequently than those from other ASDAR aircraft and regularly vary by 100 or 200 feet between observations. Although this feature is anomalous, it does not affect the validity of the ASDAR meteorological data.

f) Receipt of reports from LV005VNZ has been somewhat patchy, due to suspected problems with the co-axial feeder. Receipt of reports from BA029LYZ has also been relatively poor.

g) No reports were received during the quarter from Tokyo, or at least none with call sign RJTD (Tokyo). The reason for this is being investigated.

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

a) Reports from BA009BMZ were often corrupt between 26th January - 14th February eg wind speed and direction out of range and constant flight level. The problem was caused by a fault in the Flight Data Acquisition Unit, which was eventually replaced. Subsequently there were problems with the reporting of turbulence and this resolved by changing the accelerometer in early March.

b) No reports were received from BA010PUZ after 13th February and none at all from BA027LJZ (see next section)

4) MONITORING RESULTS

i) Data Availability

ASDAR reports are received via Darmstadt (EESA), Washington (KWBC) and Tokyo (RJTD), depending on the location of the aircraft. Table 2 shows for each unit the number of reports received in the SDB, the number of days when no reports were received and the average number of reports received per day.

The number of reports received is adjusted to remove duplicates (identical versions of the same report) but, due to inconsistencies in the reports received via Washington and Darmstadt, the totals are likely to include some duplicates.

Periods of more than 7 days when a particular unit did not report were :-

BA008DJZ : Jan 23rd - Mar 4th (aircraft out of service for maintenance)

BA010PUZ : No reports after Feb 13th (initial checks suggest a fault with the Signal Transmission Unit)

BA027LJZ : No reports this quarter (suspected antenna fault being investigated by manufacturer).

LH005VNZ :- Feb 4th - Feb 19th (aircraft out of service for maintenance)

Over the 3 month period as a whole an average of 1283 reports per day were received from all units combined, compared with 1035 in the previous three-month period. Fig 1 displays the average daily number of ASDAR reports received since the end of 1992. It is important to note that earlier versions of the ASDAR software gave rise to significantly more reports in level flight for some units than the standard once every seven minutes. Hence the numbers of reports obtained between the beginning and end of the period shown in fig 1 are not strictly comparable.

Fig 2 shows the number of units that have produced reports received at Bracknell in successive three month periods.

ii) Data Coverage

The majority of the aircraft carrying ASDAR units during the period flew predominately between Europe and North America or within these regions. However the aircraft carrying units BA025LFZ, BA026LGZ, BA028LLZ, BA029LYZ, KL013UPZ and LH005VNZ also flew to Asia, Africa, Australasia and South America.

iii) Data Timeliness

Table 3 gives the frequencies of report receipt delays. Receipt delay is taken to be "time of receipt in SDB - time of report" and reports where the time is missing are ignored.

Speed of data receipt was good with 77.5% of reports being received within one hour of observation time and 98.8% 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, 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 are shown in Table 3. Maximum and minimum values are also given. The pressure differences 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.

From Table 4 it can be seen that all the reporting units achieved the "report every 7 minutes" target in level flight. All units also achieved the "report every 10 hPa" target in the near-ground phase of ascent. However, the mean frequency for near-ground descent was slightly poorer than the specified criterion for most of the units.

5) DATA QUALITY

Figures 3 to 15 show for individual units and the complete three month period the results of "O-B" (observation minus background i.e. a 6-hour forecast) and "O-A" (observation minus analysis) comparisons for all levels between 950 and 150 hPa. The UK 19-level global forecast model is the model used for the comparison. 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 shown, 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 indicate general high quality of the reports. There are a few wild outliers which are due to problems with the data-base and not the ASDAR data. The positive bias at cruise level for the three “KL” units is evident.

6) SUMMARY

i) Overall timeliness and quality of the data from the existing operational units remain high. The number of reports received increased over the previous period and thirteen units contributing to the total, one more than the previous quarter.

ii) All units maintained the stipulated reporting frequencies for level flight and for near-ground phase of ascent. The frequency for near-ground phase of descent fell slightly short of stipulated frequencies for most of the units.

iii) Temperatures from KL012UMZ compared to model background temperatures continued to be about 2 deg C higher at cruise levels compared to other units. KL013UPZ and KL014URZ, which came into operation this quarter, also showed the same feature.

7) AMDAR DATA FROM DUTCH AIRCRAFT

AMDAR coded data from Dutch aircraft are also being monitored. In the latest quarter six units reported, havingthe following identifiers : KL130CA, KL131CB, KL132CC, KL133CD, KL134CE, KL135CF. 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 because of the cost of receiving each report, there are frequent gaps in the sequences of reports. This makes it difficult to monitor their quality or to produce meaningful statistics. Visual checks of the reports suggest that the quality of the meteorological data is satisfactory. However, one recurring error that has been noted, is that the flight level is sometimes incorrectly reported as zero, or less often as an incorrect positive number. This error is not confined to any one aircraft. In such cases, the meteorological information reported looks correct.

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

@ Unit identifier reported as BA000NDZ before 4/10/92
^ Unit did not report this quarter
= Unit identifier reported as PH012UMZ before 11/5/93

Table 2 : Summary of data received

UNIT	No. reports	Percentage via KWBC	EESA	RJTD	NR	AV
BA000NEZ	11145	35	65	0	11	143
BA001LLZ	12367	44	56	0	4	145
BA008DJZ	6721	52	48	0	43	146
BA009BMZ	13322	44	56	0	9	167
BA010PUZ	6269	36	64	0	46	146
BA025LFZ	8840	21	79	0	7	108
BA026LGZ	9354	23	77	0	2	108
BA028LLZ	8964	21	79	0	4	105
BA029LYZ	6073	18	82	0	9	76
KL012UMZ	13132	33	67	0	2	151
KL013UPZ	10441	18	82	0	15	141
KL014URZ	1246	3	97	0	80	138
LH005VNZ	6338	14	86	0	18	89
TOTAL	114212					

KEY :

NR : Number of days with no reports
AV : Average number of reports per day (excluding days with no reports)

Table 3 : Summary of delay frequencies

Unit	<PERCENTAGE FREQUENCIES OF DELAY>							max delay	mean delay
	0-30	31-60	61-120	121-180	181-360	361-720	> 720		
	<----------minutes---------->								
BA000NEZ	28.8	43.4	27.1	0.2	0.4	0.0	0.1	1273	49
BA001LLZ	24.3	42.4	32.3	0.4	0.4	0	0.3	1310	54
BA008DJZ	23.9	47.5	27.4	0.7	0.6	0.0	0	362	49
BA009BMZ	28.0	46.3	23.2	1.0	1.3	0.1	0.1	1055	49
BA010PUZ	32.8	49.3	17.0	0.5	0.3	0.0	0	364	42
BA025LFZ	34.4	42.4	21.3	1.3	0.7	0	0.0	1149	46
BA026LGZ	34.0	42.3	23.0	0.6	0.1	0.0	0	437	45
BA028LLZ	35.1	44.6	19.6	0.7	0.0	0	0.0	1337	43
BA029LYZ	36.0	46.1	16.9	0.2	0.5	0	0.2	1216	44
KL012UMZ	30.3	52.8	15.9	0.6	0.4	0	0.0	1014	43
KL013UPZ	35.1	48.3	14.5	1.3	0.7	0	0	357	43
KL014URZ	43.8	46.2	10.0	0	0	0	0	82	36
LH005VNZ	36.2	48.5	14.9	0.1	0.3	0	0	314	40
OVERALL	31.4	46.1	21.3	0.7	0.5	0.0	0.1	1337	46

Table 4 : Summary of reporting frequencies

Unit	<-LEVEL FLIGHT-><--- ASCENT ---->				<--- DESCENT ----->							
	No.	Mean	Min	Max	No.	Mean	Min	Max	No.	Mean	Min	Max
BA000NEZ	63	7.0	6.5	7.0	51	9.4	7.7	10.7	60	10.2	8.4	11.9
BA001LLZ	75	7.0	6.5	7.0	54	9.3	8.0	10.0	38	10.0	8.8	11.9
BA008DJZ	33	7.0	6.5	7.0	26	9.6	8.8	12.3	35	10.1	8.8	11.9
BA009BMZ	70	6.2	4.2	7.0	46	9.9	9.6	10.0	42	10.1	6.5	11.9
BA010PUZ	29	7.0	6.5	7.0	28	9.3	8.4	10.0	31	10.3	7.7	11.9
BA025LFZ	72	7.0	6.5	7.0	44	9.4	8.4	10.3	42	10.2	8.8	11.9
BA026LGZ	70	7.0	6.5	7.0	45	9.2	8.0	10.7	49	9.9	8.0	11.9
BA028LLZ	57	7.0	5.2	7.0	43	9.4	8.0	10.7	52	10.2	8.4	11.9
BA029LYZ	63	7.0	6.5	7.0	23	9.3	8.8	10.0	11	10.5	8.8	13.0
KL012UMZ	2	-	-	-	66	9.3	7.7	11.1	40	10.2	7.7	13.0
KL013UPZ	5	-	-	-	48	9.5	6.9	12.6	38	9.8	7.7	10.7
KL014URZ	1	-	-	-	8	8.9	8.0	10.0	5	-	-	-
LH005VNZ	48	6.9	6.5	7.0	22	9.3	8.4	11.1	27	9.9	8.8	11.9

Note :

1) "KL" units - levels fluctuate frequently in level flight (see text)

Figure 1

Average daily number of ASDAR reports

Values represent centred 3 month means

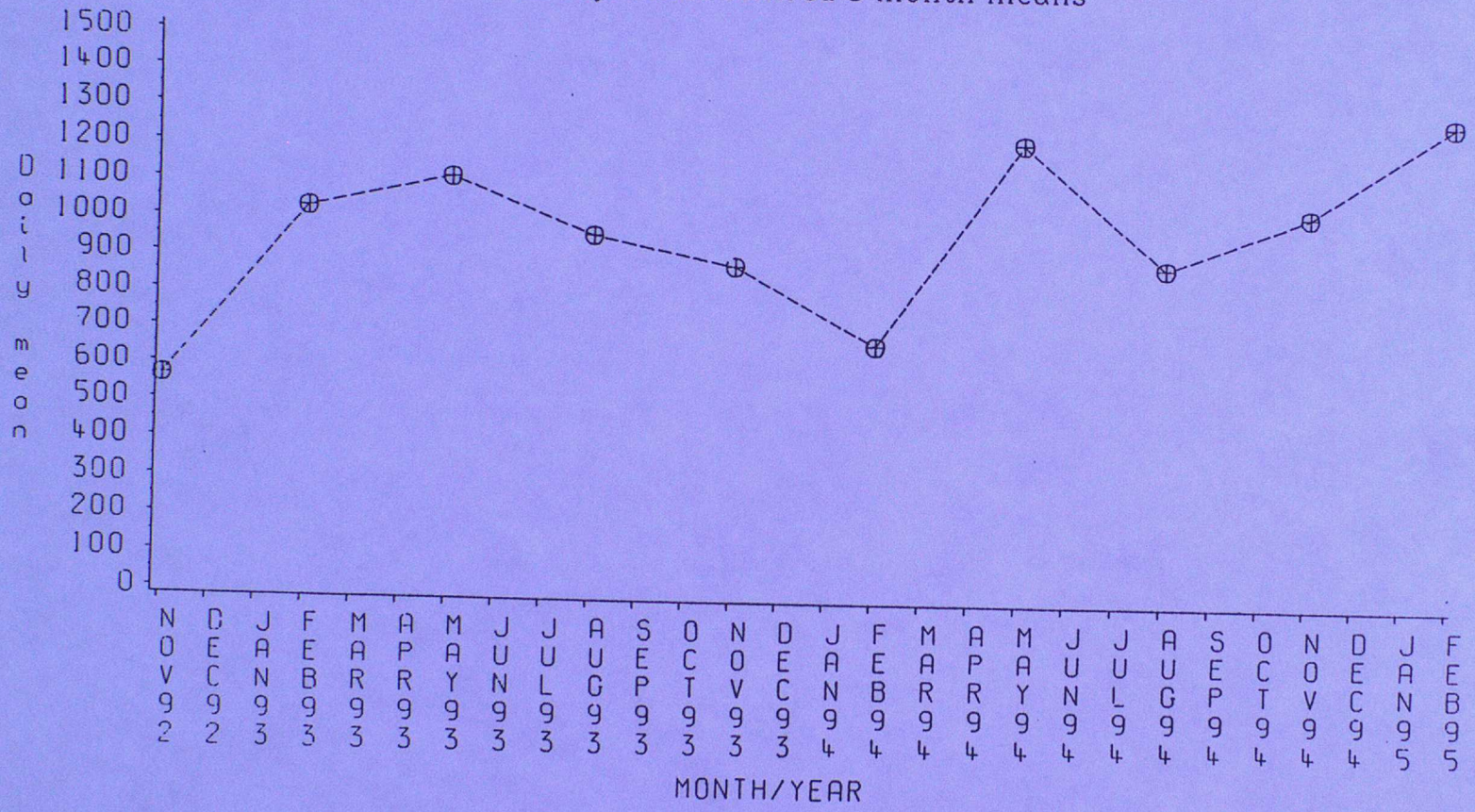

Figure 2

No. of units producing data received at Bracknell

Values represent numbers over a 3 month period

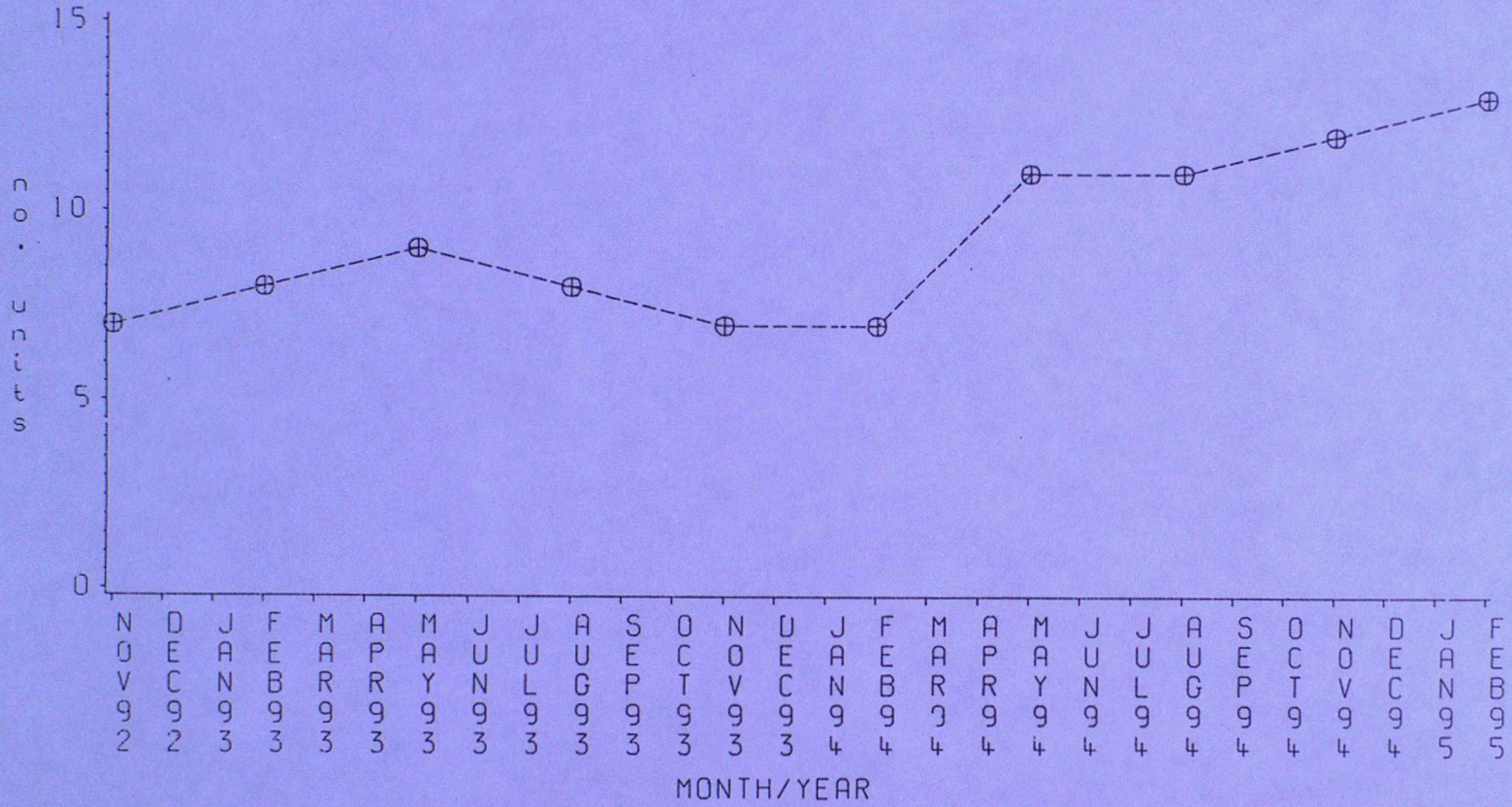

FIGURE 3 : BA000NEZ - MODEL COMPARISON RESULTS (950-150 hPa)

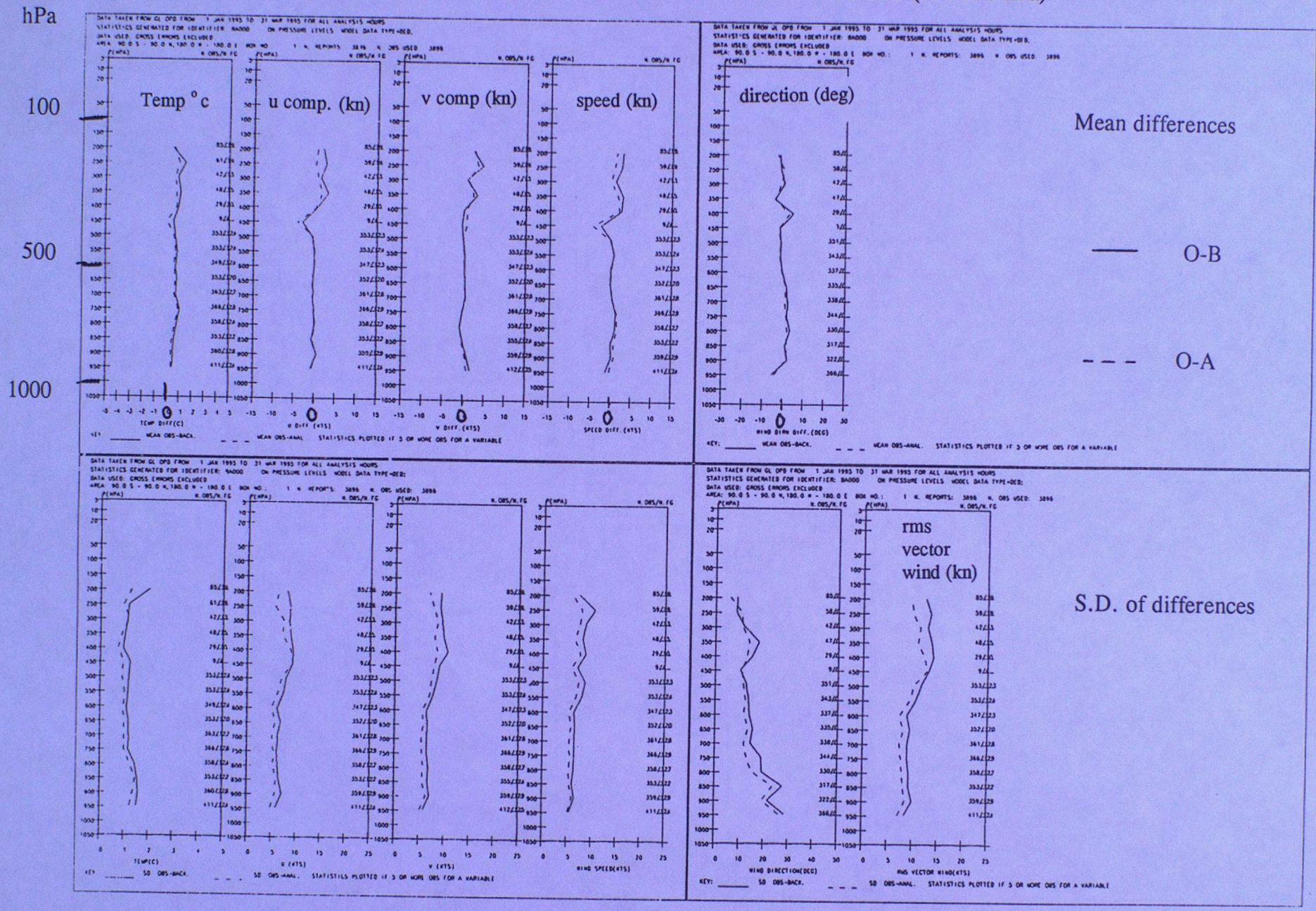

FIGURE 4 : BA001LLZ - MODEL COMPARISON RESULTS (950-150 hPa)

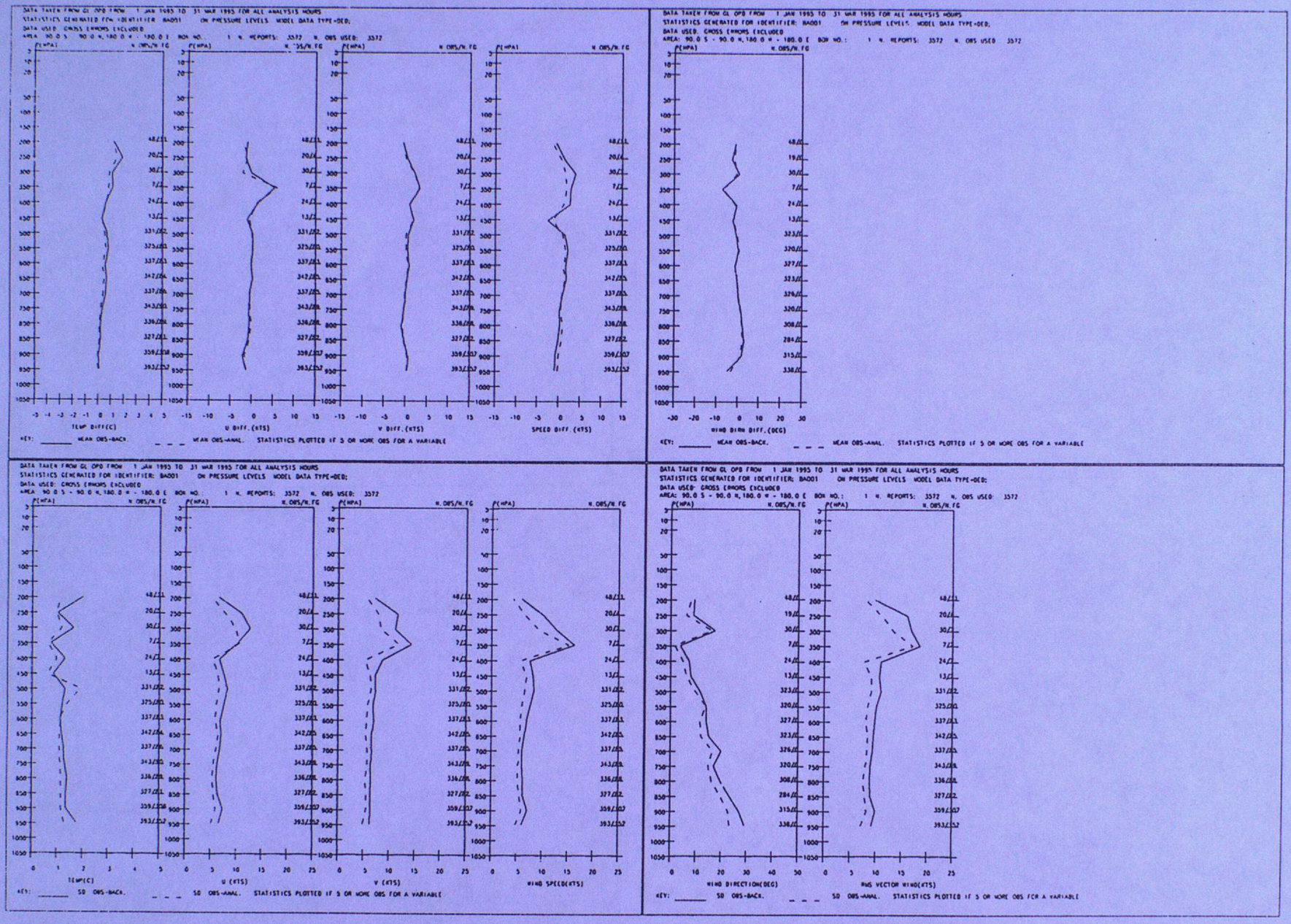

FIGURE 5 : BA008DJZ - MODEL COMPARISON RESULTS (950-150 hPa)

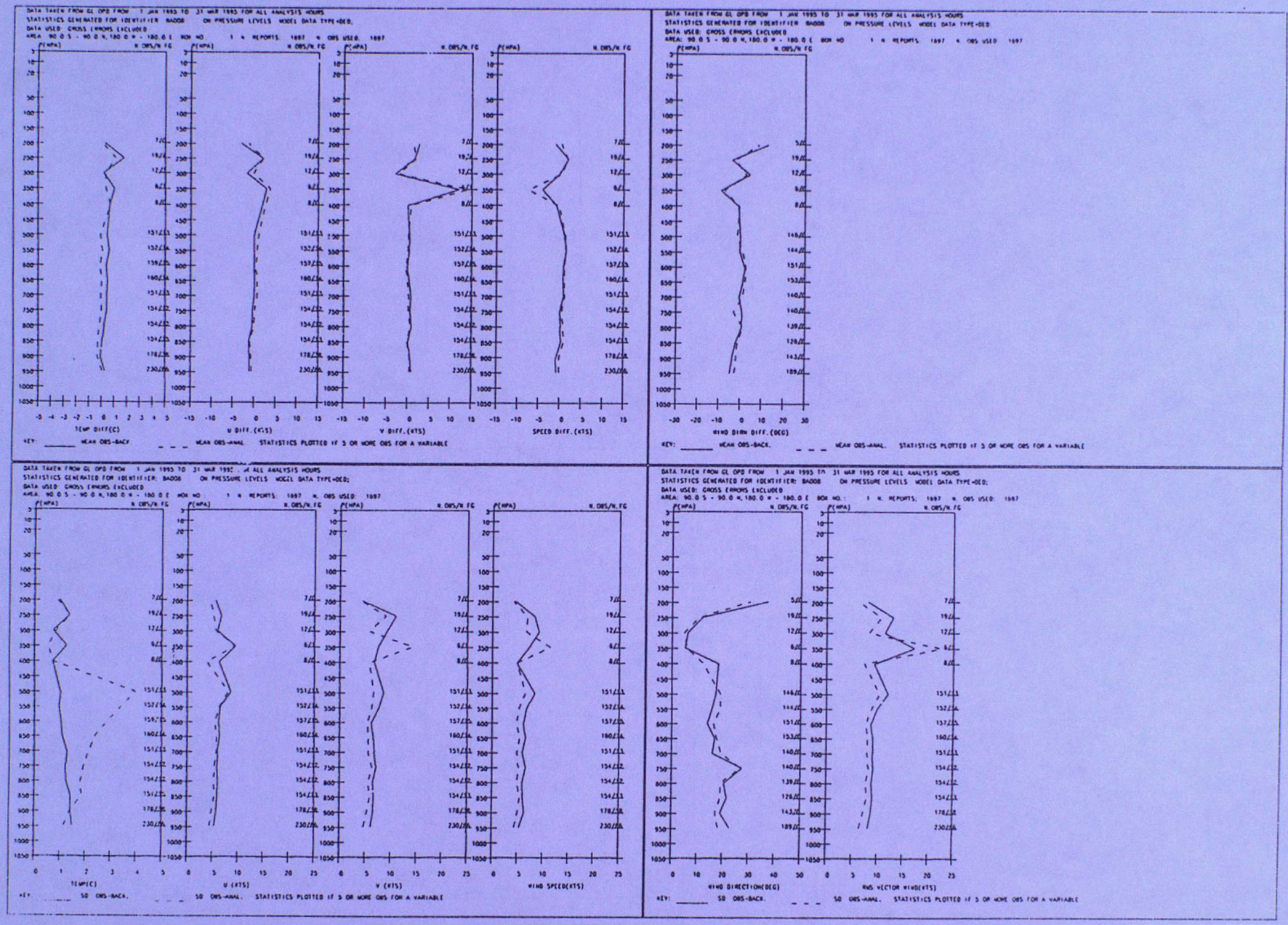

FIGURE 6 : BA009BMZ - MODEL COMPARISON RESULTS (950-150 hPa)

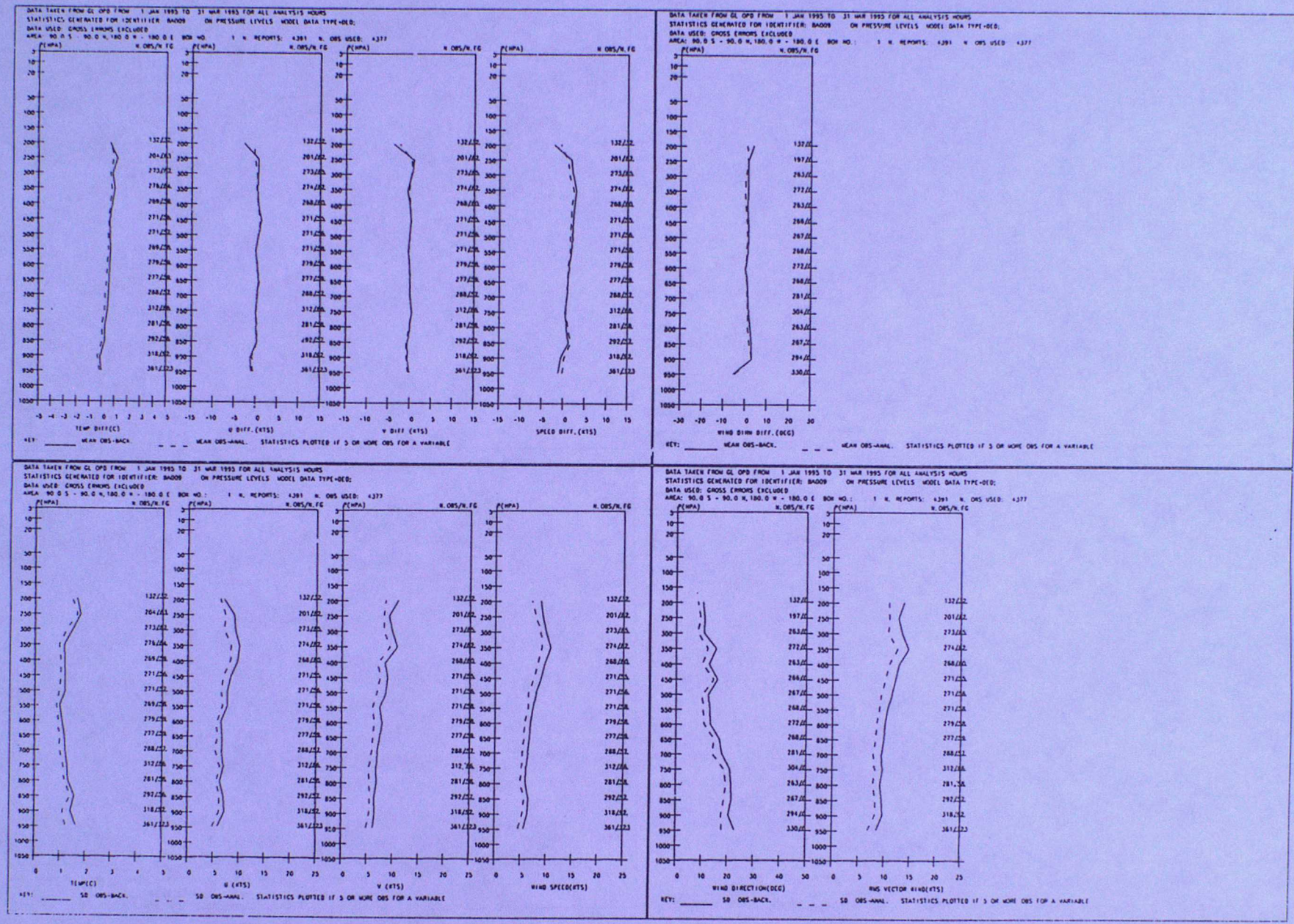

FIGURE 7 : BA010PUZ - MODEL COMPARISON RESULTS (950-150 hPa)

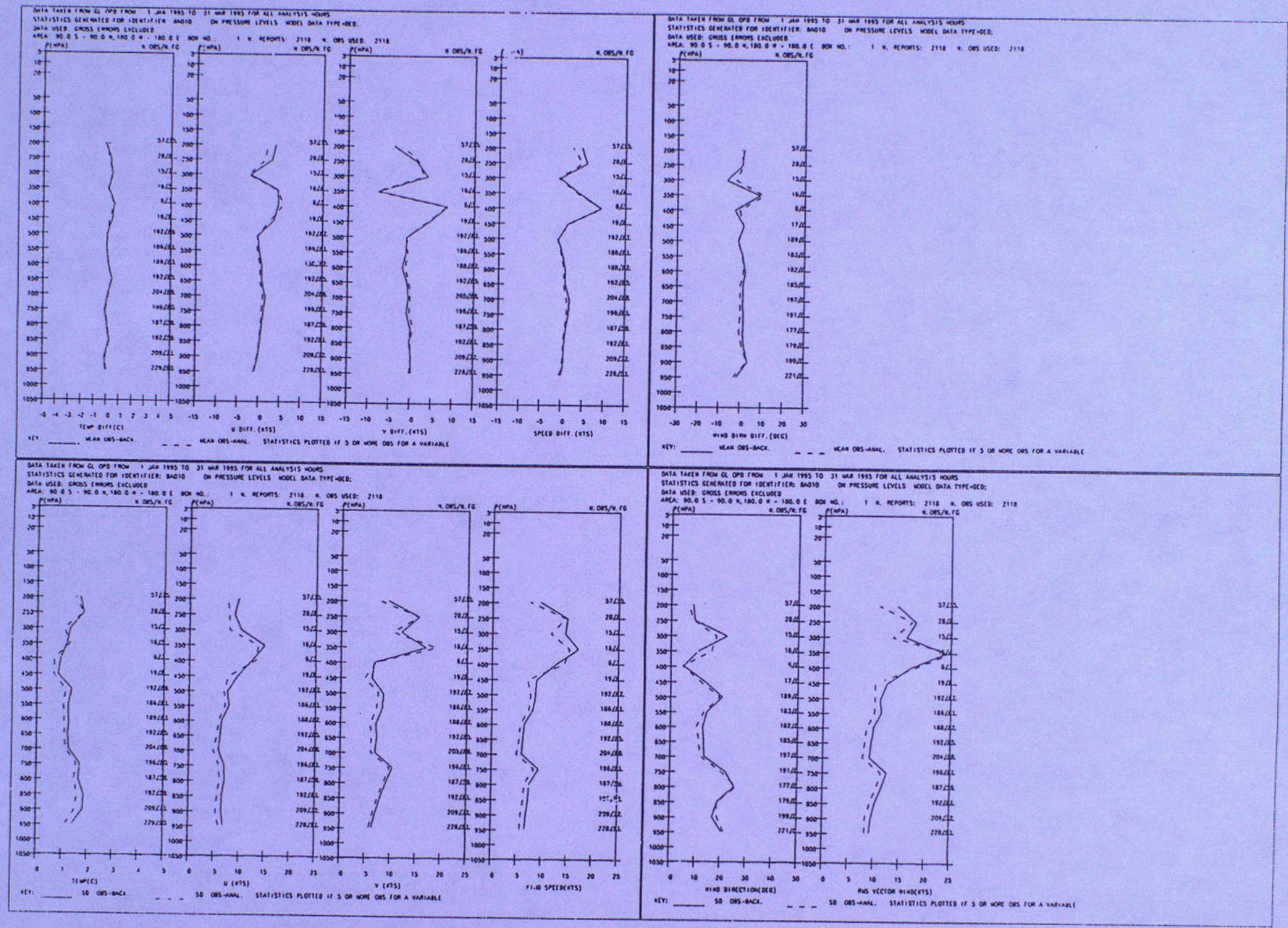

FIGURE 8 : BA025LFZ - MODEL COMPARISON RESULTS (950-150 hPa)

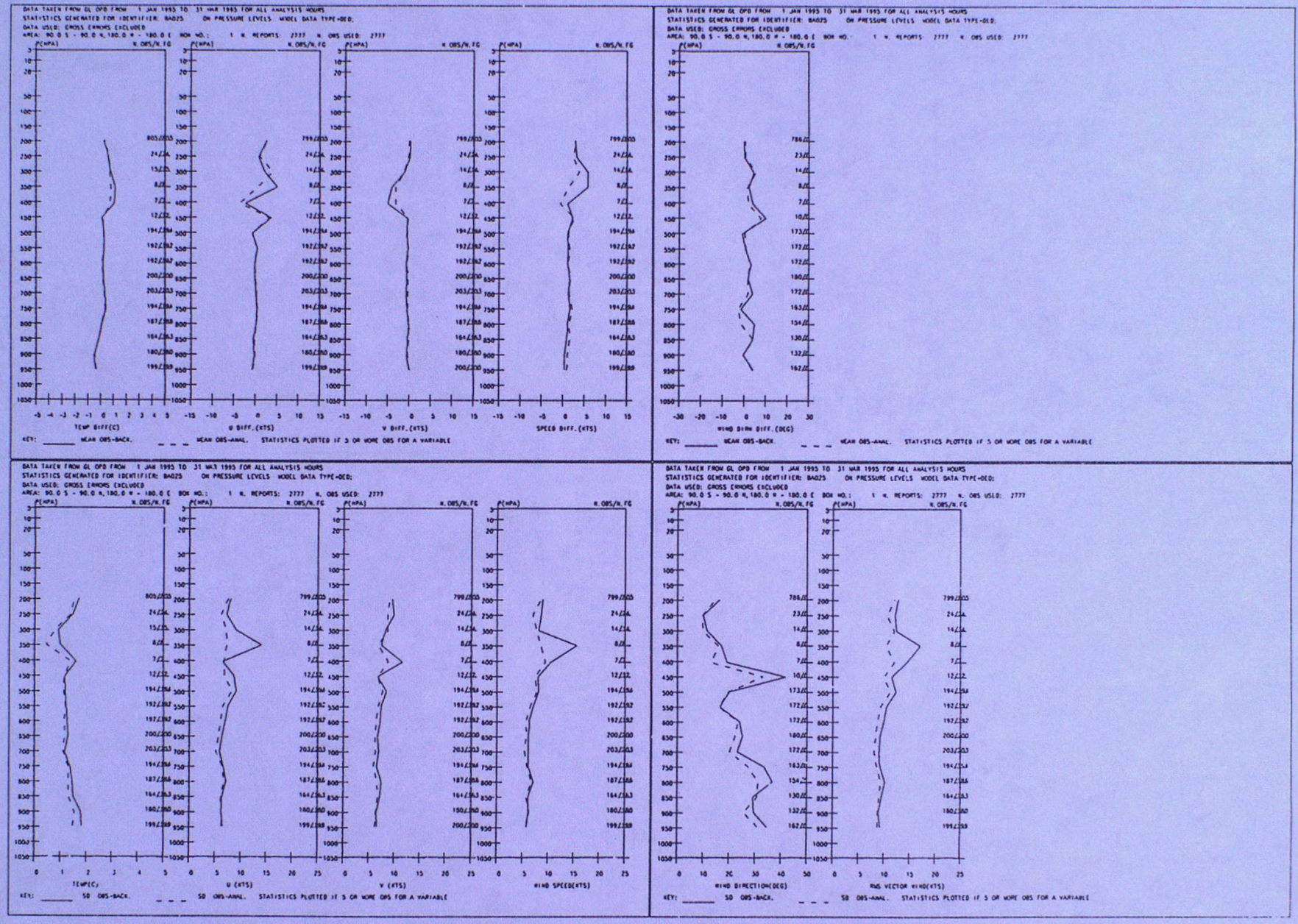

FIGURE 9 : BA026LGZ - MODEL COMPARISON RESULTS (950-150 hPa)

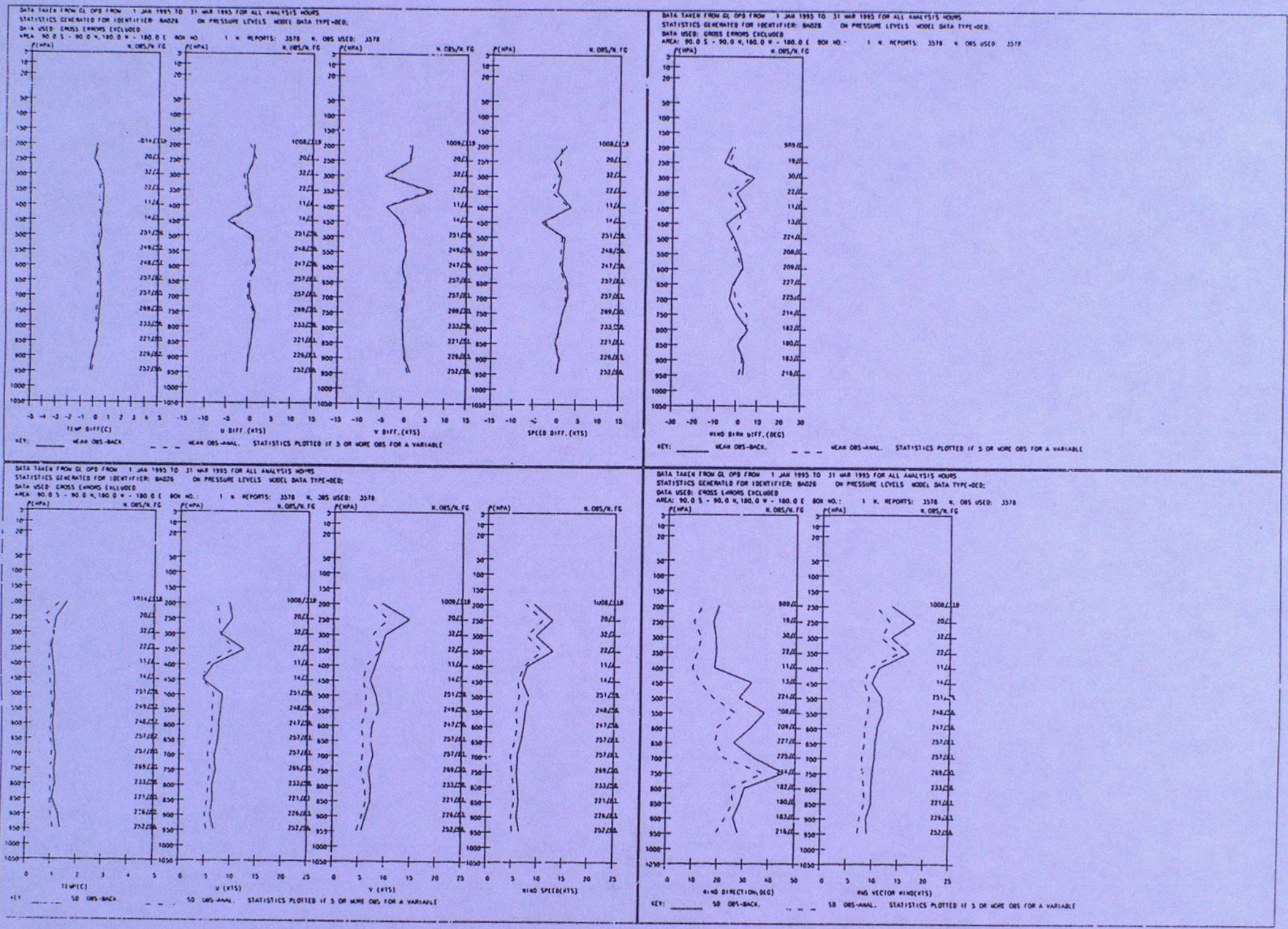

FIGURE 10 : BA028LLZ - MODEL COMPARISON RESULTS (950-150 hPa)

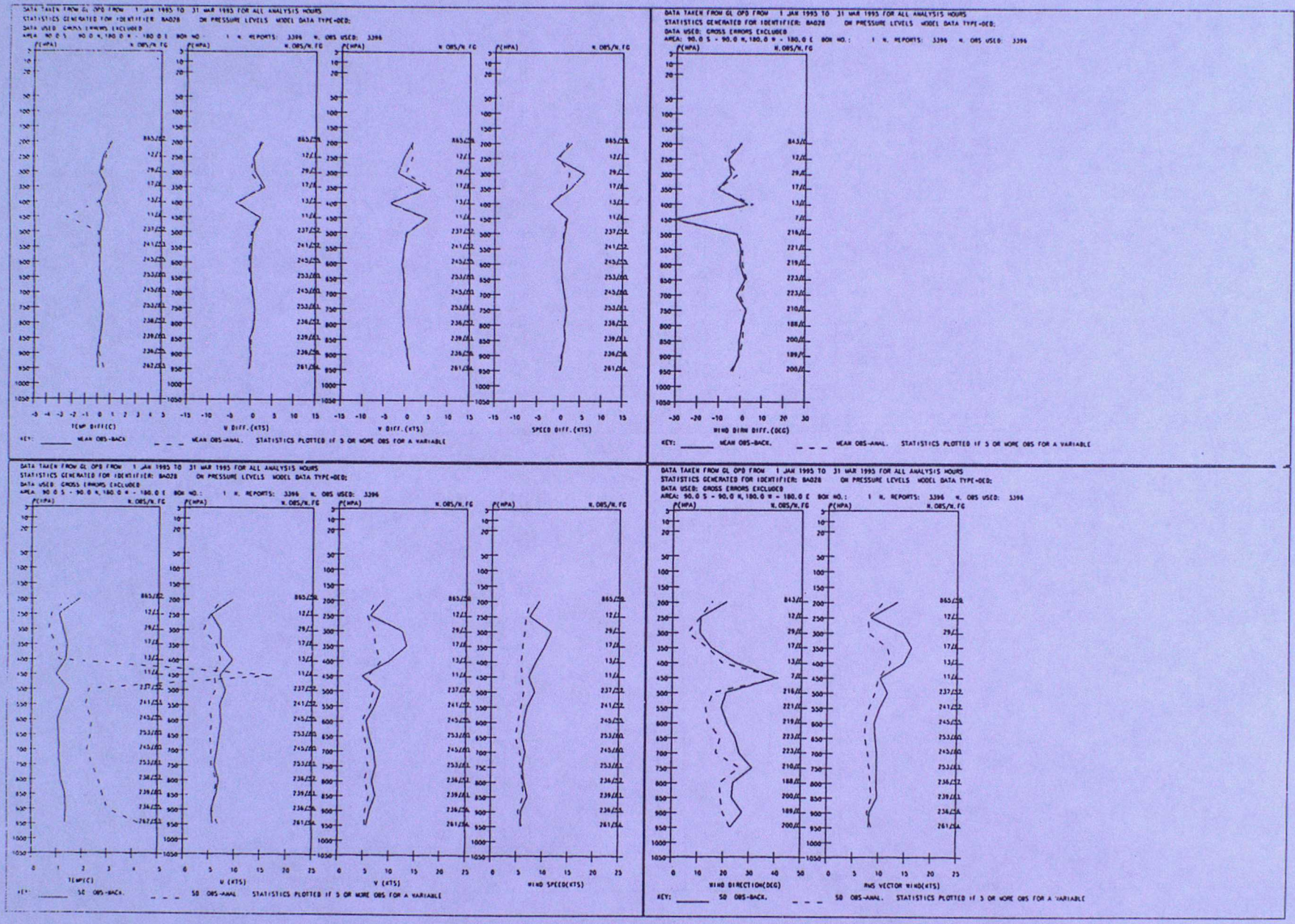

FIGURE 11 : BA029LYZ - MODEL COMPARISON RESULTS (950-150 hPa)

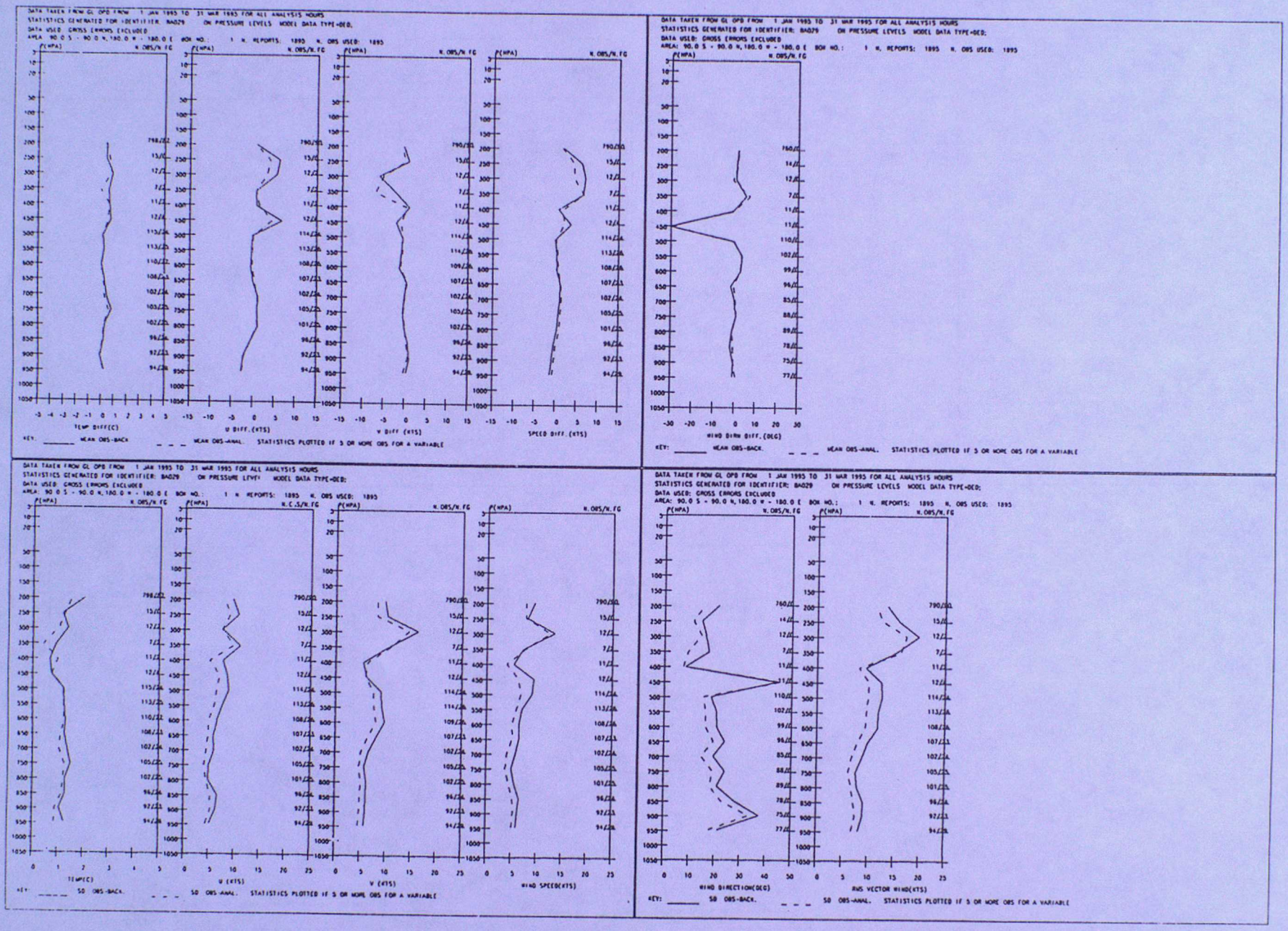

FIGURE 12 : KL012UMZ - MODEL COMPARISON RESULTS (950-150 hPa)

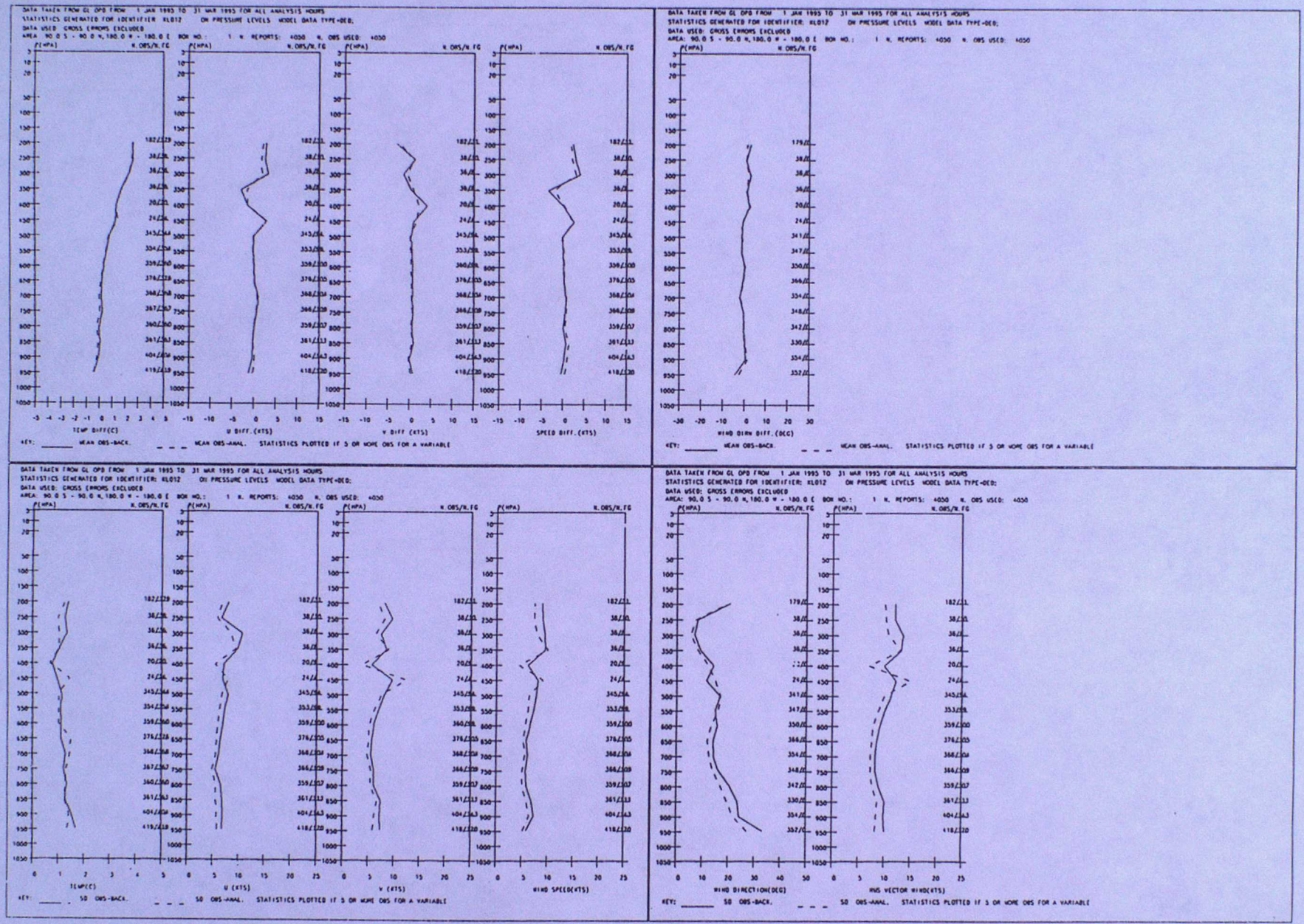

FIGURE 13: KL013UPZ - MODEL COMPARISON RESULTS (950-150 hPa)

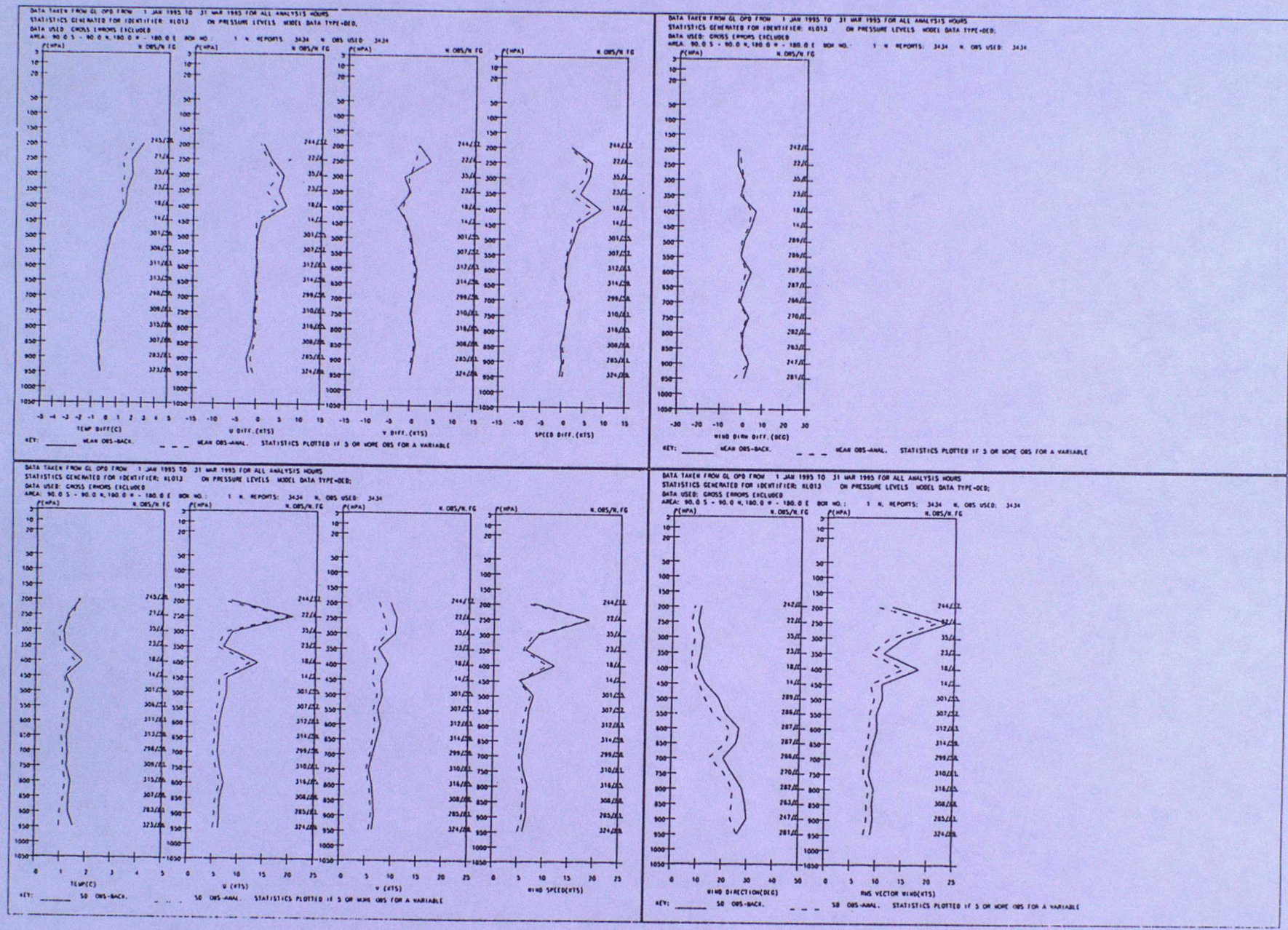

FIGURE 14 : KL014URZ - MODEL COMPARISON RESULTS (950-150 hPa)

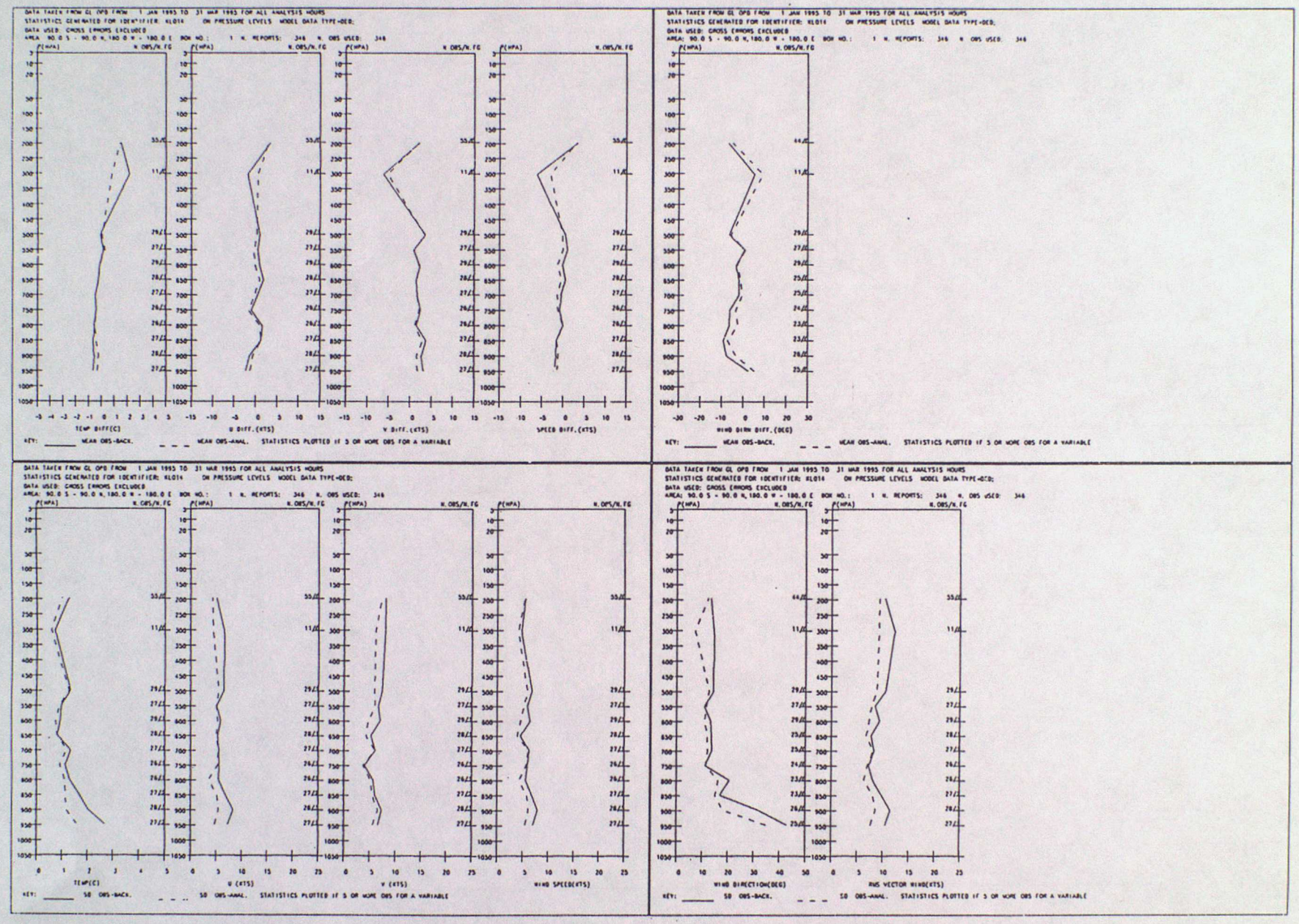

FIGURE 15 : LH005VNZ - MODEL COMPARISON RESULTS (950-150 hPa)