OBSERVATIONS, PLANS AND REQUIREMENTS BRANCH

ASDAR MONITORING REPORT

APRIL - JUNE 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, 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 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 generated 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 received at the satellite but fail to get on to the Global Telecomunications System.

d) Temperature biases - there are positive temperature differences for the three "KL"-prefixed units 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. The reason for the anomaly in the "KL" units has recently been found to be due a software error which will now be corrected.

e) Varying cruise flight levels - cruise flight levels reported from the three "KL" prefixed units 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 BA029LYZ has continued to be patchy due to suspected problems with the antenna.

g) No reports are apparently being received via Tokyo (call sign RJTD.)

h) No reports had been received from BA010PUZ from 13th February 1995. It was not until the Signal Transmission Unit (STU) was changed on 2nd June that observations were resumed. The delay had been caused by British Airways mislaying the STU in their stores system.

i) There were still no reports from BA027LJZ this quarter due to an antenna fault.

ii) <u>New problems</u> (that were identified during the latest 3 month period)

a) Matra-Marconi Space requested British Airways to reset the timeclock on BA008DJZ on 3rd April since it was running a few minutes slow. Unfortunately the clock was reset to BST instead of GMT which caused reports around midnight to be assigned to the wrong day in the SDB in addition to other reports being one hour out. The fault was finally corrected on 25th April.

b) Erroneously high temperatures from KL012UMZ on 23rd-24th April were caused by a fault on the Total Air Temperature probe which was replaced.

c) Significant errors in data from BA009BMZ between 10th - 14th June were caused by a fault in the Flight Data Acqisition Unit (FDAU). A change to the unit did not correct a fault in the turbulence reports which were in error until 29th June, when another FDAU was installed.

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 :-

BA000NEZ : Apr 10th - 26th (aircraft maintenance)

BA010PUZ : Feb 14th - June 1st (delay installing new Signal Transmission Unit)

BA025LFZ : May 29th - June 12th

BA027LJZ : No reports this quarter - antenna fault

Over the 3 month period as a whole an average of 1449 reports per day were received from all units combined, compared with 1283 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

About half the aircraft carrying ASDAR units during the period flew predominately between Europe and North America or within these regions. The aircraft carrying units BA025LFZ, BA026LGZ, BA028LLZ, BA029LYZ, KL013UPZ, KL014URZ 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 76.6% 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 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 4. 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 the majority 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. There are occasional anomalies in the O-A plots for a few of the units - these are not due to the observations and can be ignored.

The profiles shown indicate general high quality of the reports.

6) SUMMARY

i) Overall timeliness and quality of the data from the existing operational units remain high. However a fault with the Total Air Temperature probe on one aircraft and the Flight Data Acquisition Unit on another caused erroneous data to be received for short periods from two aircraft.

ii) The total number of reports increased by 13% in the latest quarter compared to the previous three month period; the number of units reporting stayed constant.

iii) Temperatures from the KL-prefixed units continued to be about 2 deg C too high at cruise levels.

iv) 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.

7) AMDAR DATA FROM DUTCH AIRCRAFT

AMDAR coded data from Dutch aircraft are also being monitored. In the latest quarter eight units reported : KL103FD, KL130CA, KL131CB, KL132CC, KL133CD, KL134CE, KL135CF and KL136CG. 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.

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	10416	46	54	0	23	153
BA001LLZ	11312	48	52	0	11	141
BA008DJZ	13184	49	51	0	5	153
BA009BMZ	13117	52	48	0	8	158
BA010PUZ	4213	53	47	0	62	145
BA025LFZ	7119	31	69	0	22	103
BA026LGZ	8748	30	70	0	15	115
BA028LLZ	10069	29	71	0	3	114
BA029LYZ	4329	19	81	0	20	61
KL012UMZ	12773	35	65	0	1	141
KL013UPZ	14770	30	70	0	0	162
KL014URZ	13590	26	74	0	1	151
LH005VNZ	8232	30	70	0	12	104
TOTAL	131872					

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> 0-30	31-60	61-120	121-180	181-360	361-720	> 720	max delay	mean delay
	<----------minutes---------->								
BA000NEZ	23.8	42.3	32.6	0.8	0.4	0.1	0.0	1093	52
BA001LLZ	23.0	42.7	32.8	1.3	0.2	0.1	0	441	52
BA008DJZ *									
BA009BMZ	28.3	47.5	22.0	1.2	0.4	0.4	0.0	1019	48
BA010PUZ	28.7	50.9	20.0	0.4	0	0.0	0	391	44
BA025LFZ	30.8	38.5	29.9	0.6	0.2	0	0	294	49
BA026LGZ	31.7	39.8	26.8	1.2	0.2	0.4	0	433	50
BA028LLZ	31.1	43.2	24.1	0.8	0.5	0.2	0	446	47
BA029LYZ	36.3	46.7	16.0	0.9	0.0	0	0	265	43
KL012UMZ	33.4	50.6	15.2	0.6	0.1	0.1	0.0	530	43
KL013UPZ	36.6	48.1	14.5	0.6	0.2	0	0.0	1060	40
KL014URZ	38.3	47.3	12.8	1.3	0.3	0.0	0.0	891	42
LH005VNZ	31.9	47.4	19.9	0.6	0.2	0	0	280	43
OVERALL	31.2	45.4	22.2	0.7	0.2	0.1	0	1093	46

Note :

* Statistics for BA008DJZ are omitted due to distortion caused by time clock error (see text).

Table 4 : Summary of reporting frequencies

Unit	<-LEVEL FLIGHT->				<--- ASCENT ---->				<--- DESCENT ----->			
	No.	Mean	Min	Max	No.	Mean	Min	Max	No.	Mean	Min	Max
BA000NEZ	53	7.0	6.5	7.0	53	9.5	8.4	11.9	57	10.1	7.7	11.9
BA001LLZ	72	7.0	6.5	7.0	59	9.3	7.7	11.1	60	10.1	8.8	11.9
BA008DJZ	47	7.0	6.4	7.0	63	9.4	8.4	11.1	63	10.1	7.7	13.0
BA009BMZ	73	6.8	3.3	7.0	57	9.5	8.8	10.0	67	10.1	7.7	11.9
BA010PUZ	21	7.0	7.0	7.0	25	9.4	8.4	10.7	21	10.3	8.8	11.9
BA025LFZ	61	7.0	6.5	7.0	41	9.3	8.0	11.1	36	10.4	8.8	11.9
BA026LGZ	68	7.0	5.6	7.0	52	9.0	8.0	11.1	46	10.4	8.8	13.0
BA028LLZ	65	7.0	6.1	7.0	58	9.0	6.9	10.0	51	10.2	8.8	11.9
BA029LLZ	45	7.0	6.1	7.0	26	9.3	8.4	10.0	3	9.5	8.8	10.0
KL012UMZ	1	-	-	-	74	9.3	8.4	10.7	48	9.9	6.5	11.9
KL013UPZ	0	-	-	-	79	9.4	8.0	11.1	56	10.0	7.7	11.9
KL014URZ	1	-	-	-	76	9.1	8.0	10.0	52	9.8	7.7	10.7
LH005VNZ	68	7.0	4.9	7.0	39	9.4	7.7	11.1	32	10.0	8.8	10.7

Notes :

KL012UMZ, KL013UPZ and KL014URZ - levels fluctuate slightly in level flight (see text)

2) Statistics for BA029LYZ are omitted due to lack of data.

Figure 1

Average daily number of ASDAR reports

Values represent centred 3 month means

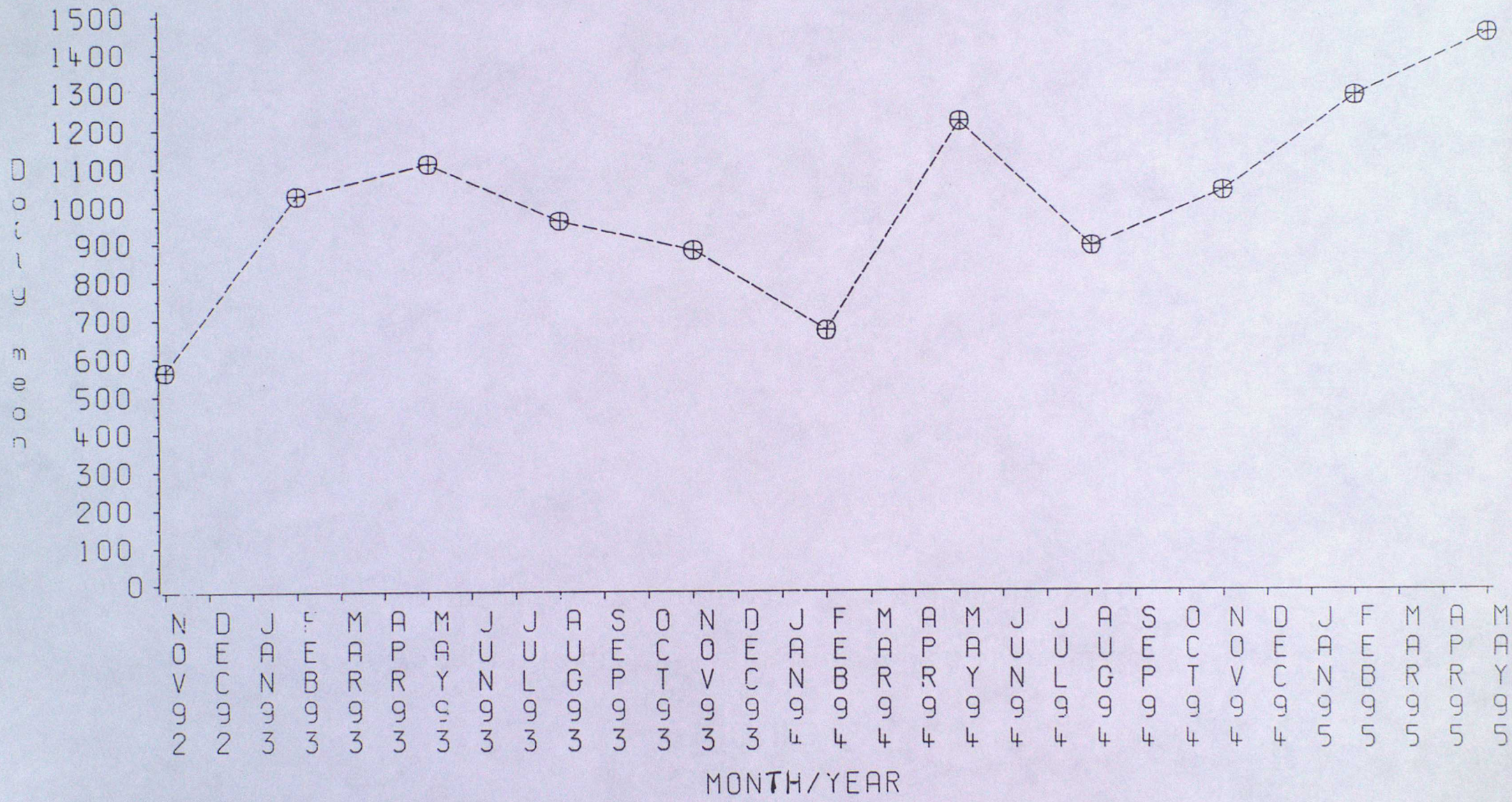

Figure 2

No. of units producing data received at Bracknell

Values represent numbers over a 3 month period

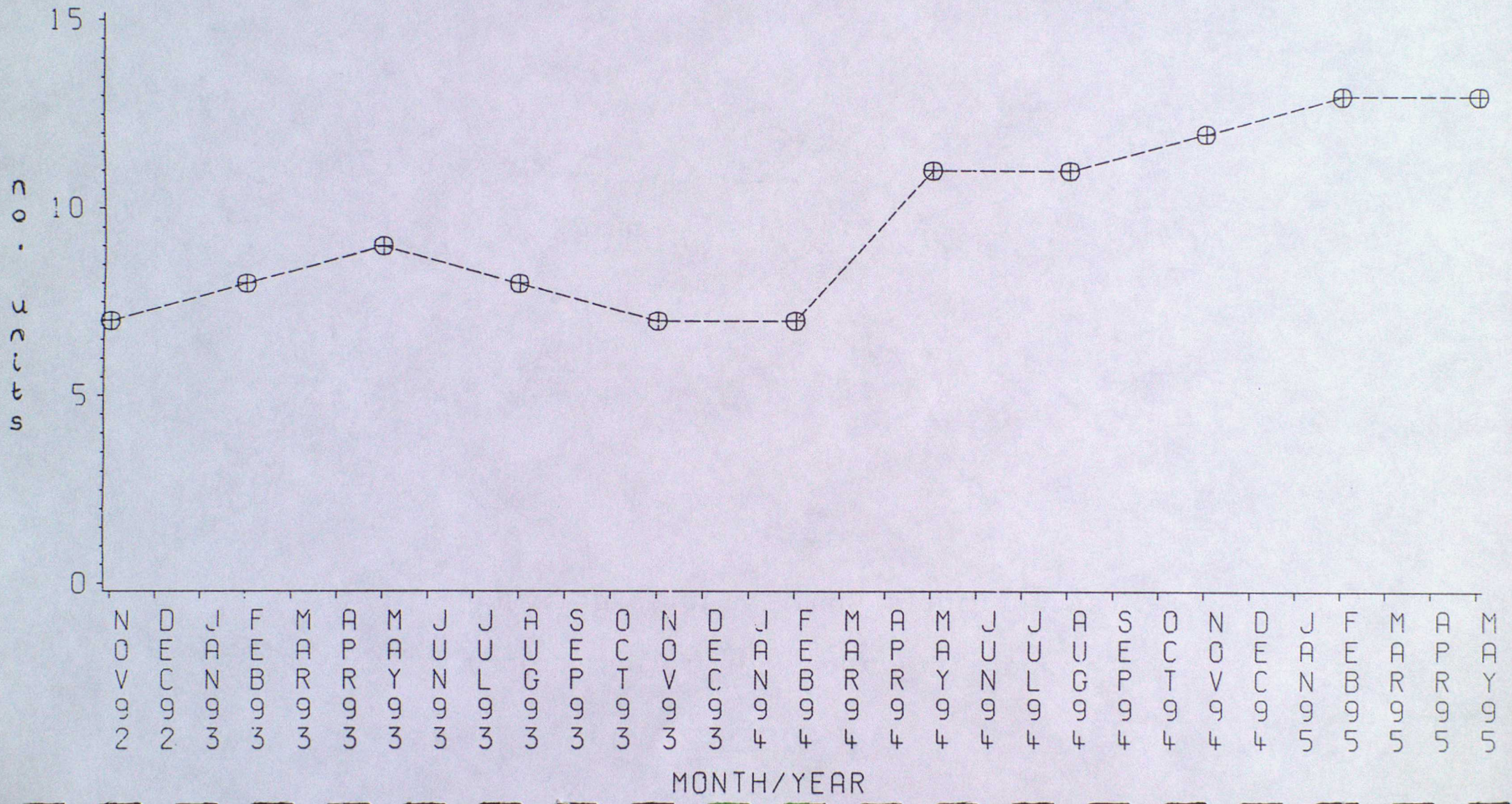

FIGURE 3 : BA000NEZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

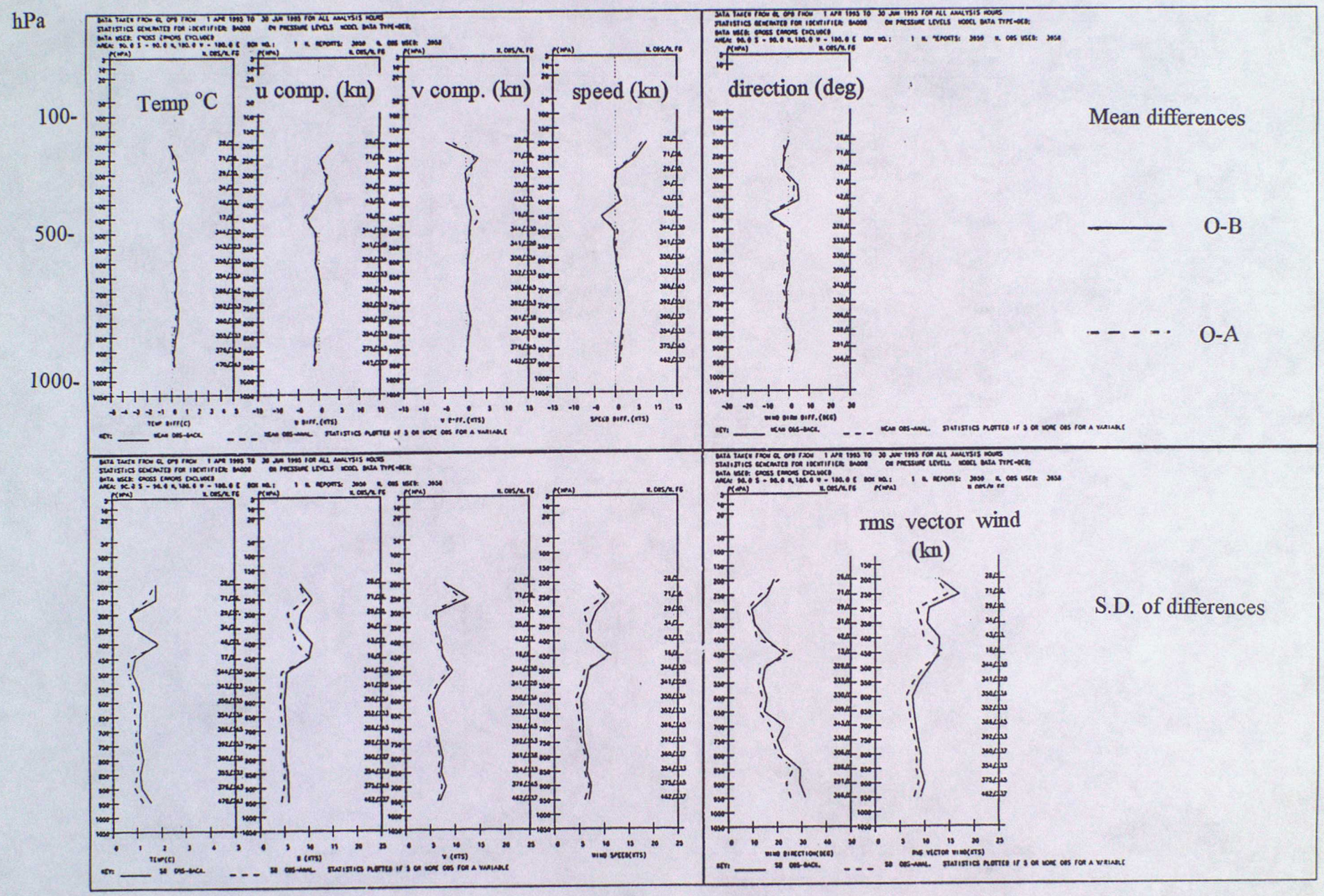

FIGURE 4 : BA001LLZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

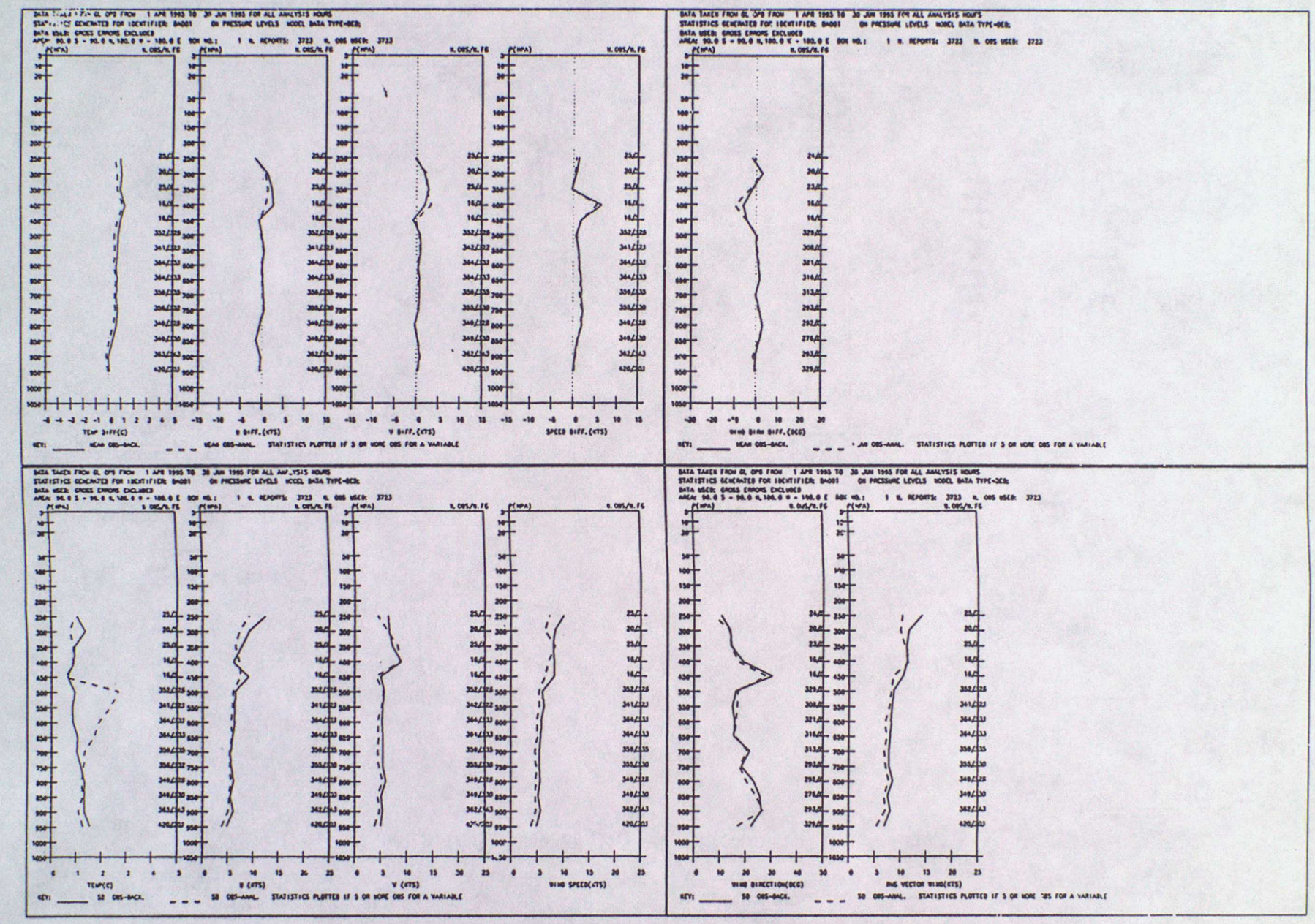

FIGURE 5 : BA008DJZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

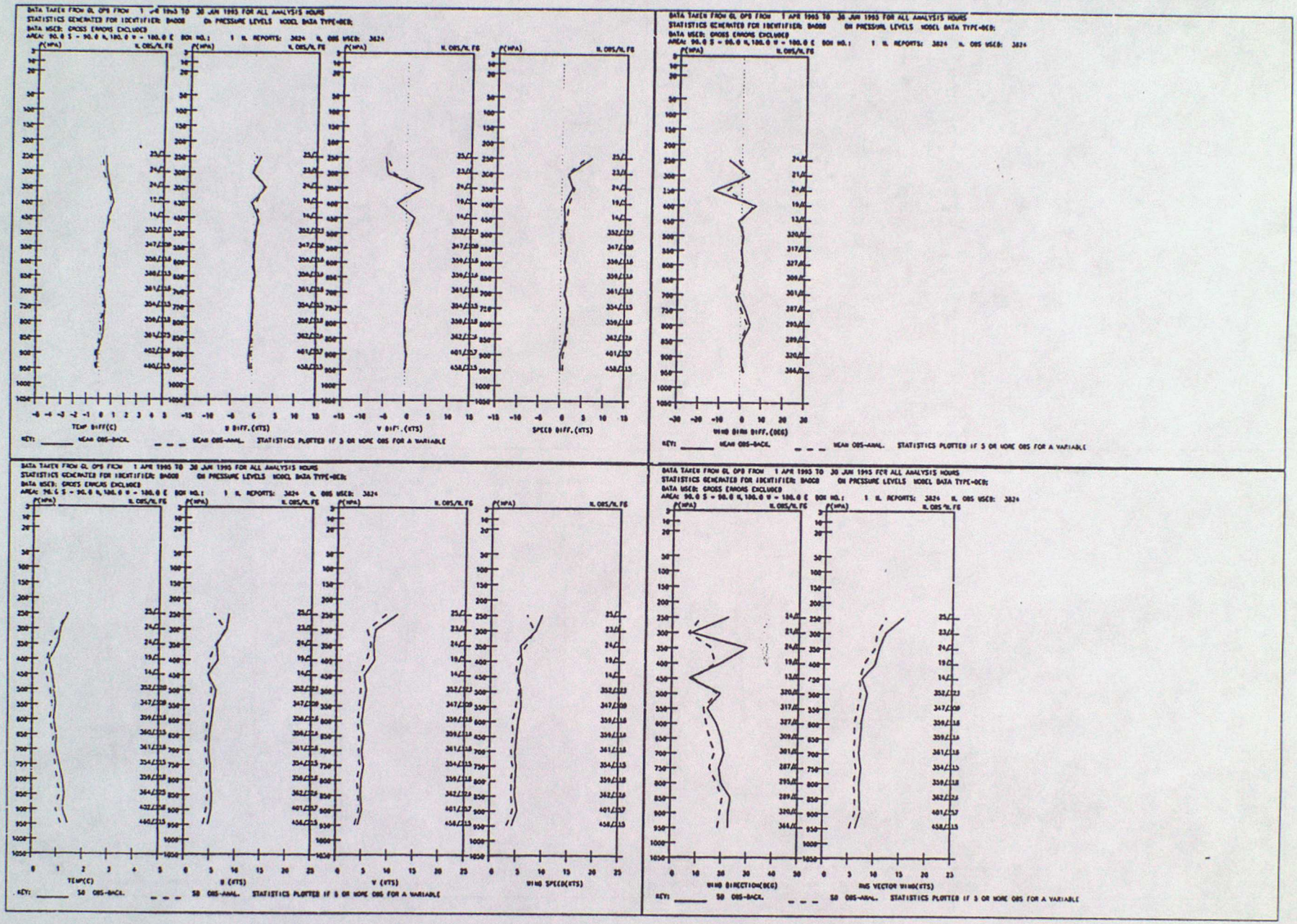

FIGURE 6 : BA009BMZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

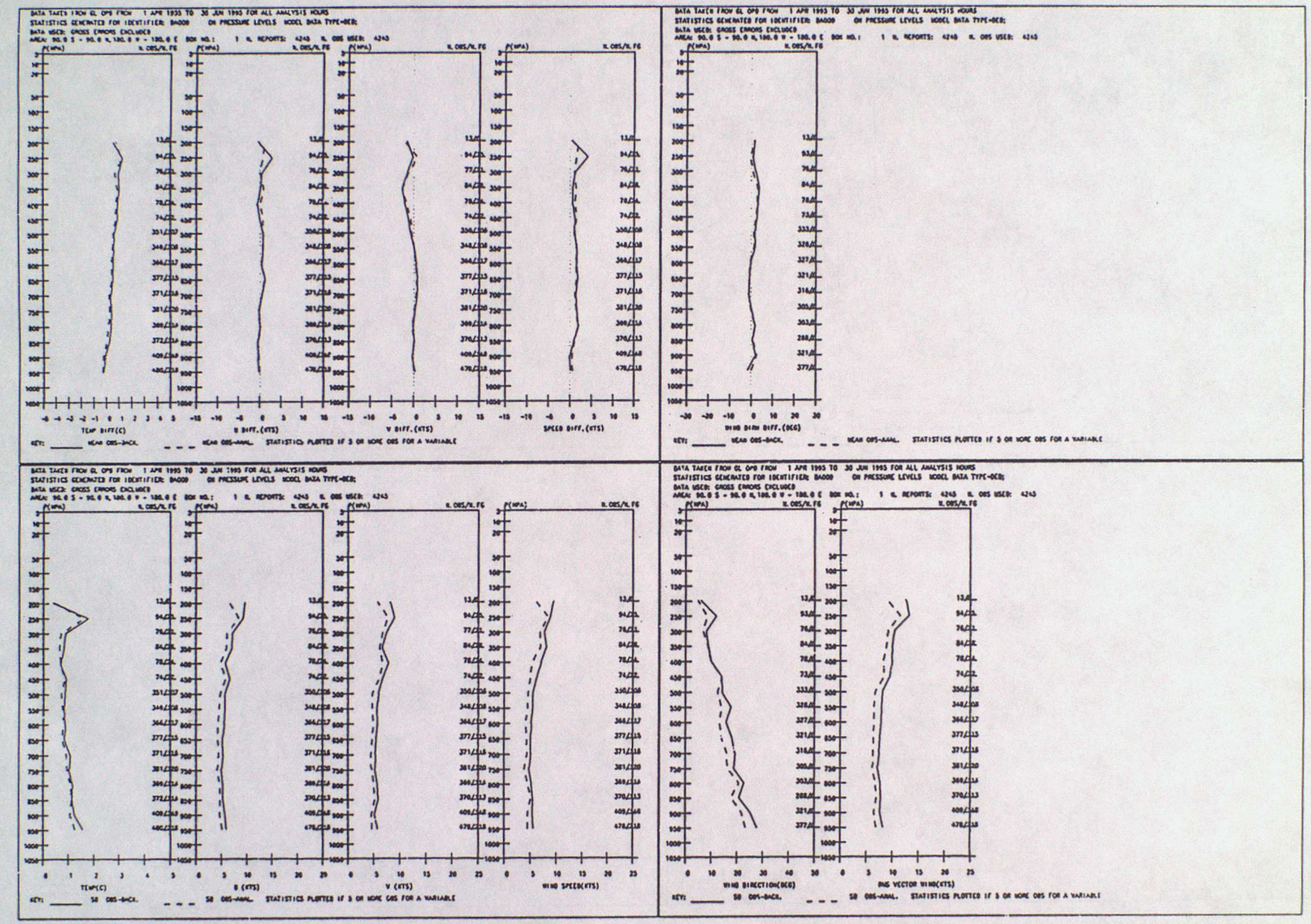

FIGURE 7 : BA010PUZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

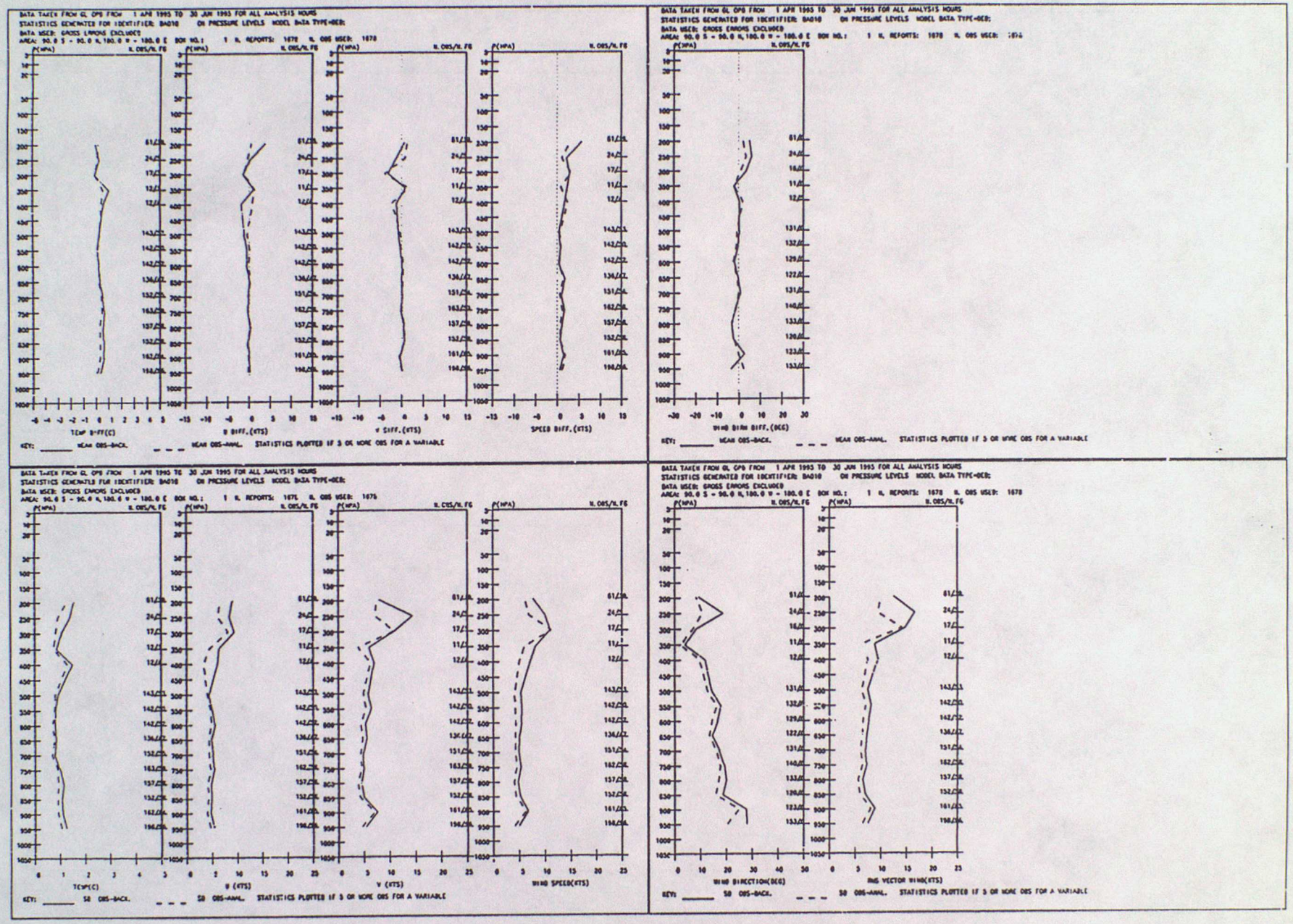

FIGURE 8 : BA025LFZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

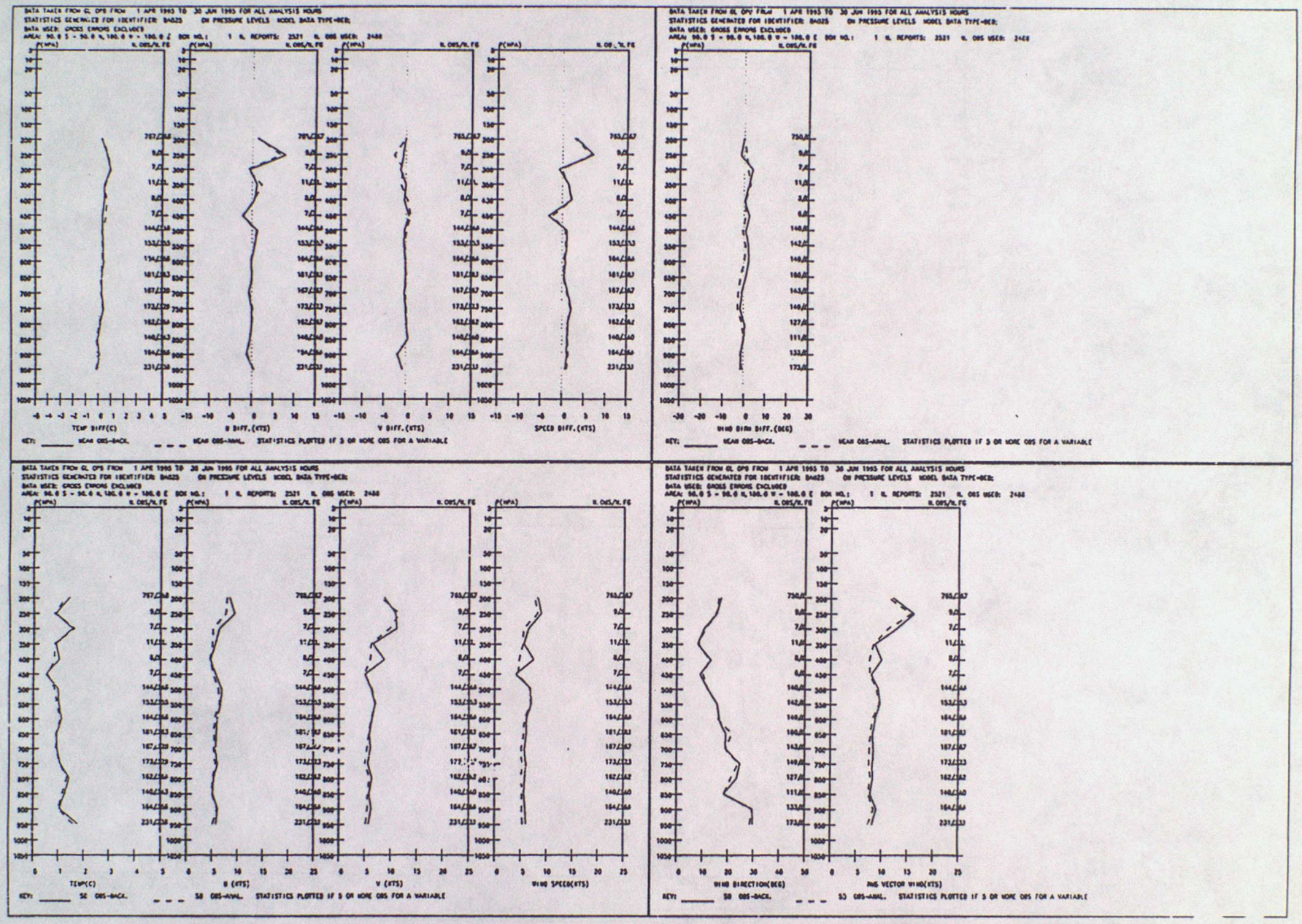

FIGURE 9 : BA026LGZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

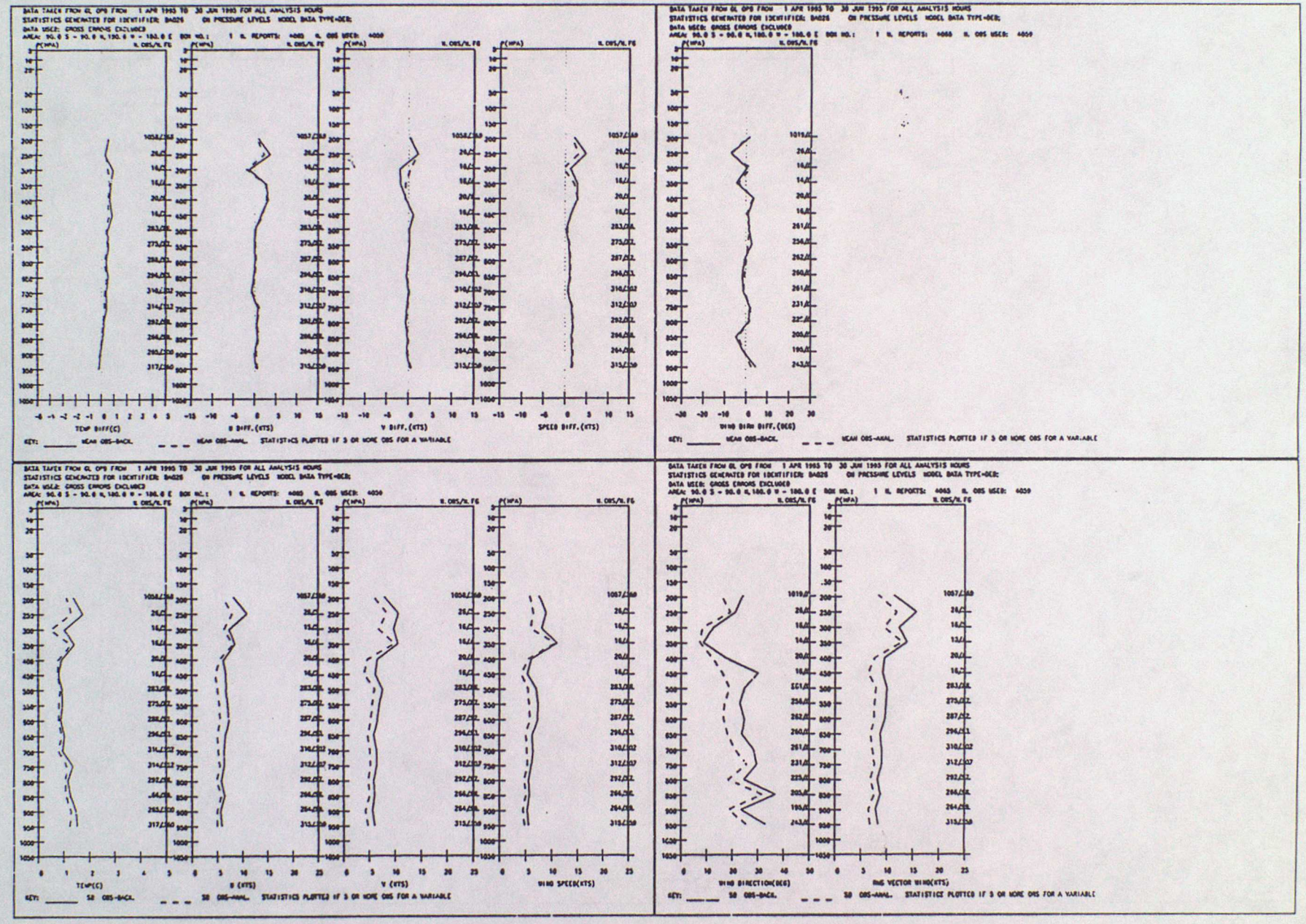

FIGURE 10 : BA028LLZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

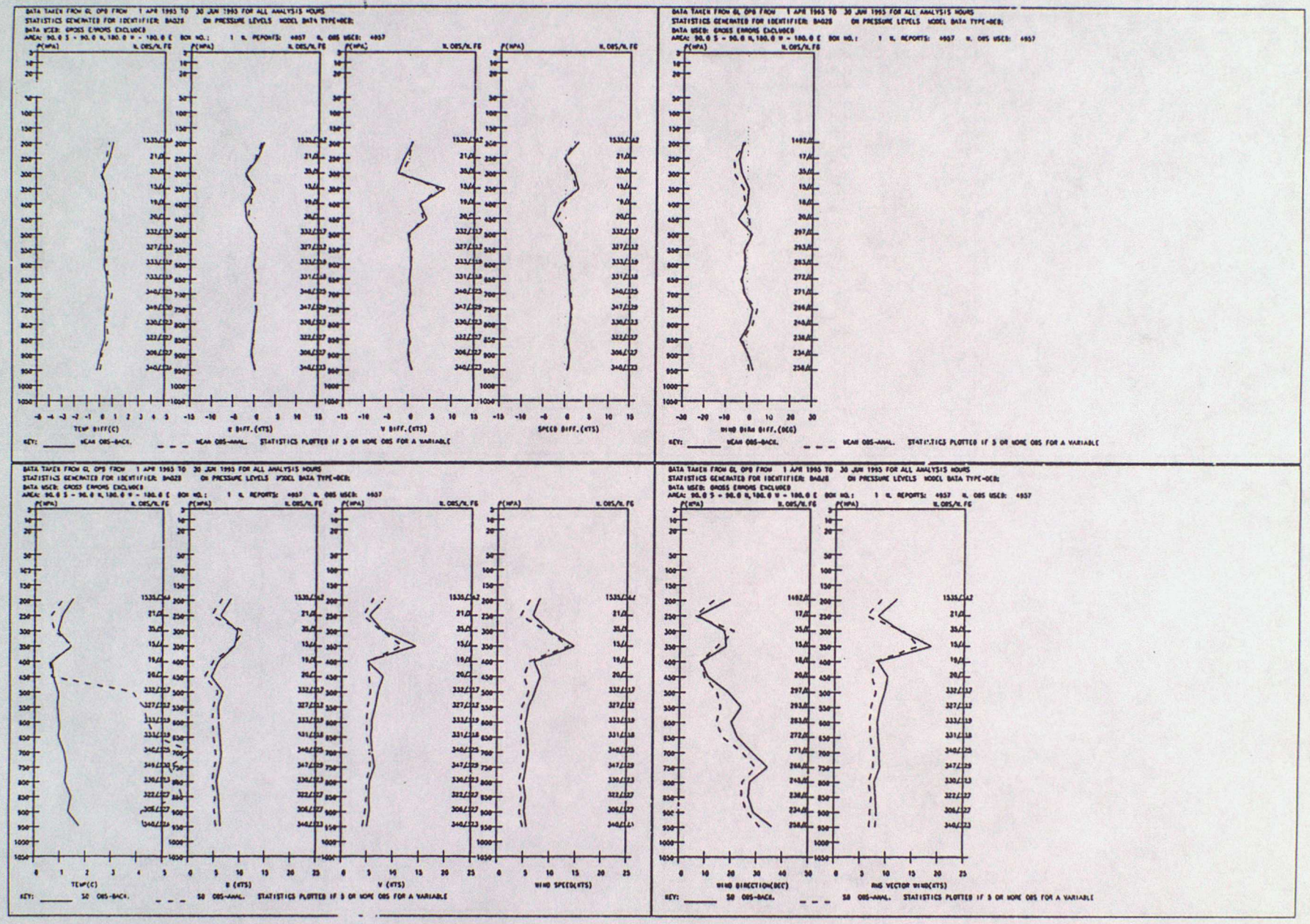

FIGURE 11 : BA029LYZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

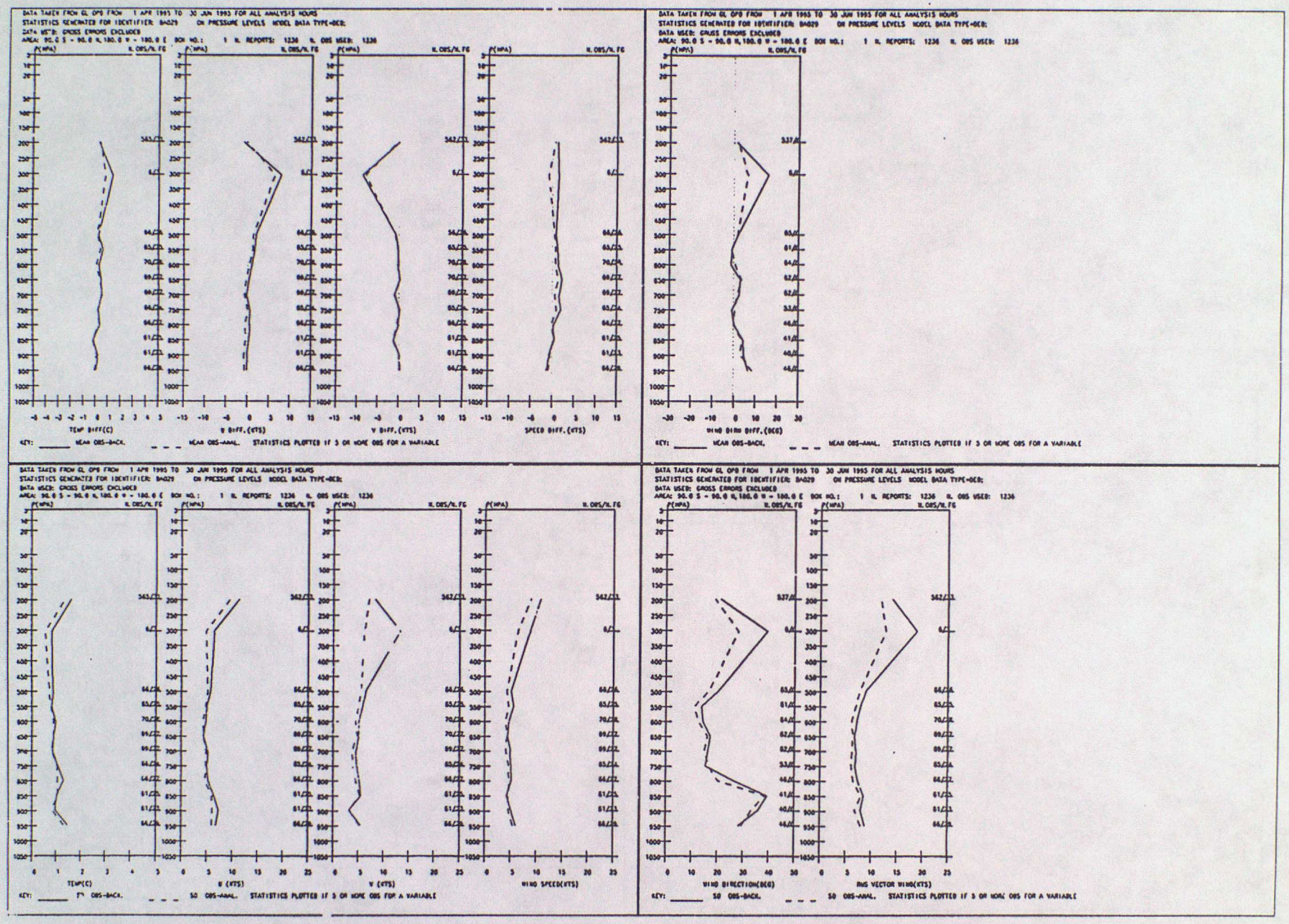

FIGURE 12 : KL012UMZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

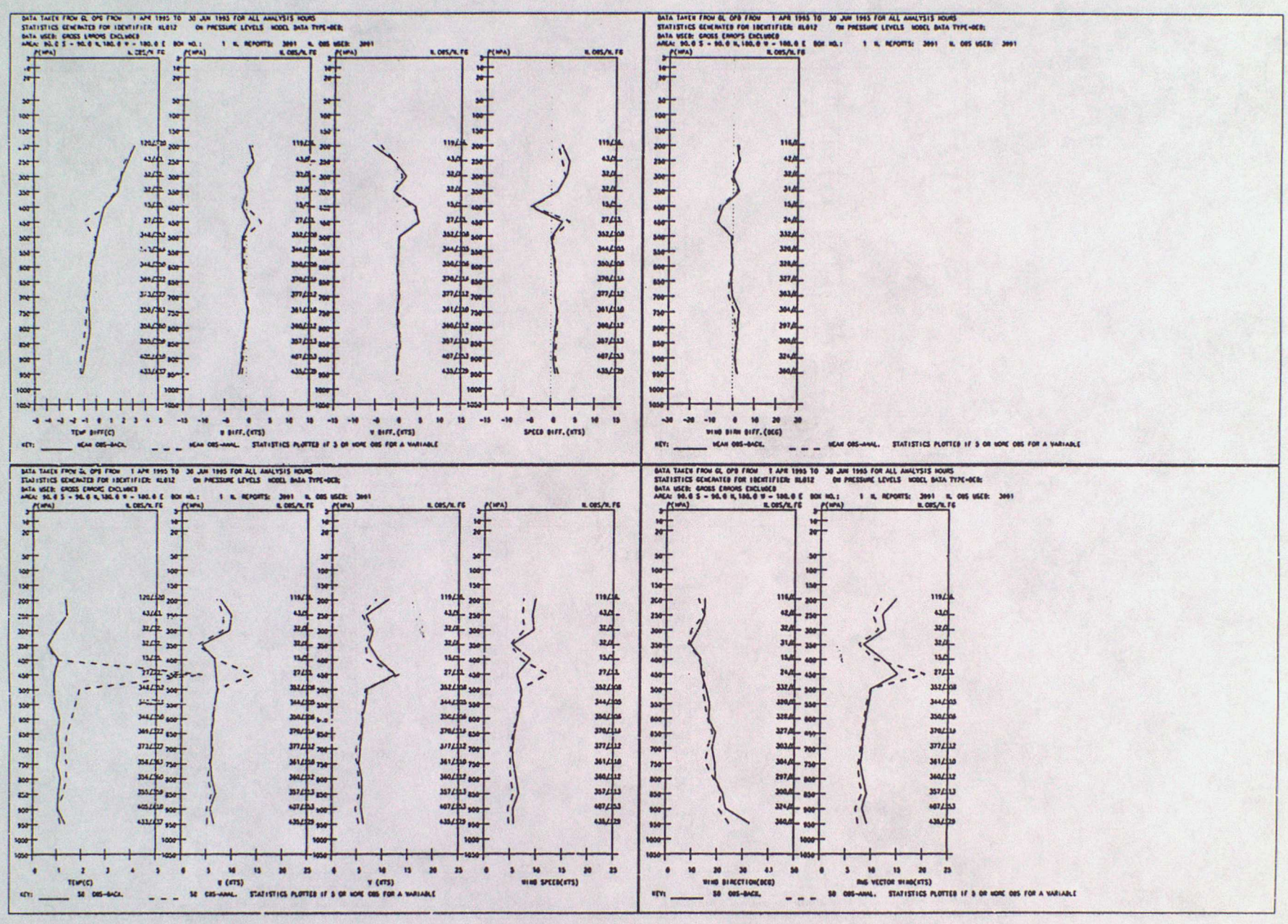

FIGURE 13 : KL013UPZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

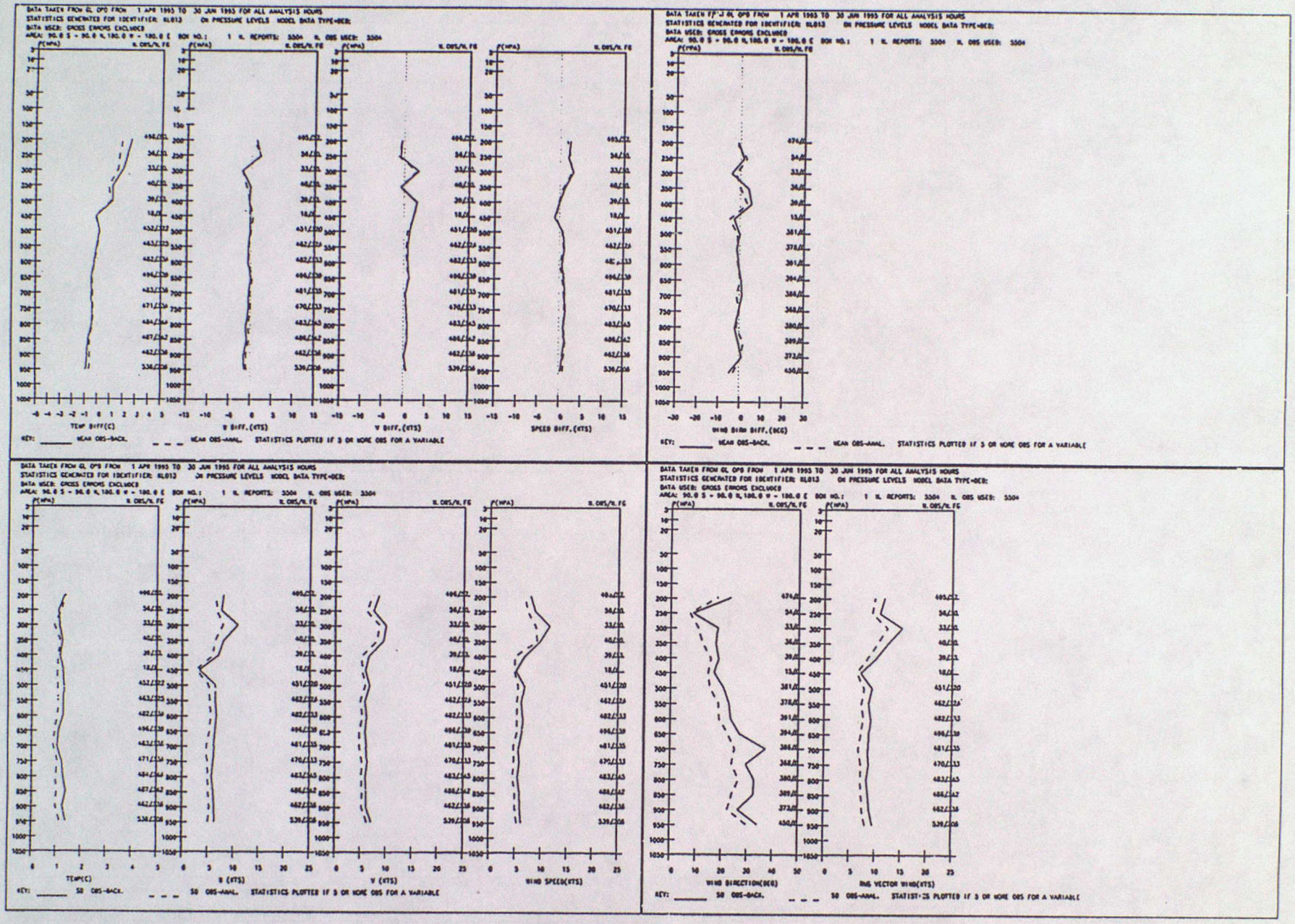

FIGURE 14 : KL014URZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

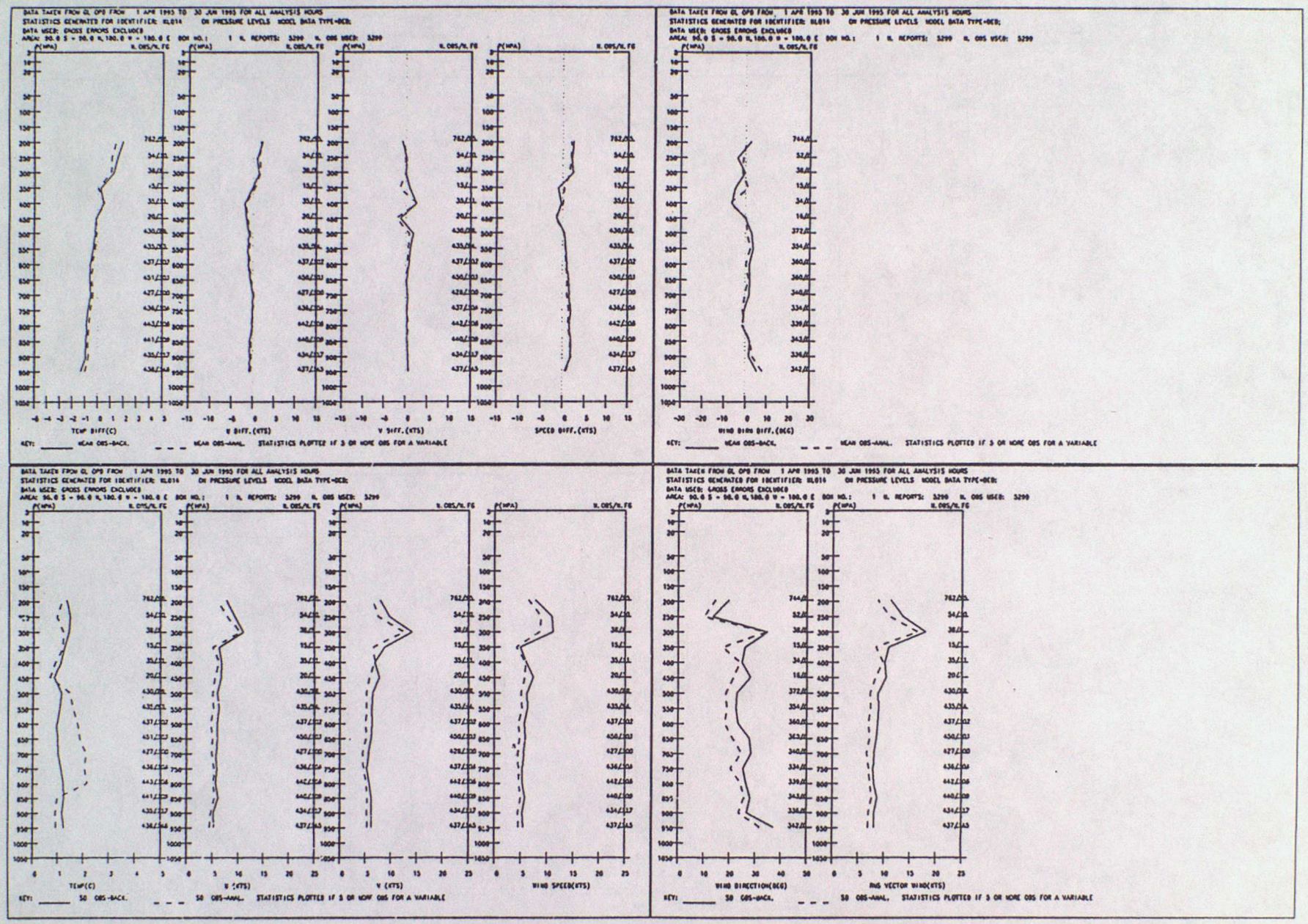

FIGURE 15 : LH005VNZ - MODEL COMPARISON RESULTS (950 - 150 hPa)