OBSERVATION PROVISION BRANCH

REPORT ON ASDAR MONITORING RESULTS

APRIL - JUNE 1994

S. G. Smith

Headquarters, Bracknell

THE ASDAR CENTRE

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CONTENTS

Produced by :

Geoff Smith
Meteorological Office
Met O OP (Quality Assurance)
Room 131
London Road
Bracknell
Berkshire
RG12 2SZ

Tel : 0344 854627

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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

Eleven ASDAR units reported during the period, four more than in the previous period.

The following table shows the carriers, types of aircraft, identifiers and the dates on which observations were first received for current operational units :-

AIRLINE	AIRCRAFT TYPE	IDENTIFIER	OPERATIONAL 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
KLM	747	KL012UMZ=	23/ 4/92
Lufthansa	747	LH005VNZ	23/ 6/93

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

3). LIST OF OUTSTANDING PROBLEMS

A list is given below of known faults and anomalies present during the latest three month period :-

- that were also present in the previous period (long term) and

- that became apparent in the latest 3-month period (new)

All have been reported to the ASDAR Technical Centre, who inform the relevent bodies where appropriate. For faults where a specific unit is not mentioned, the fault is present for more than one unit (usually several).

i) Long term problems

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

b) Occasional erroneous data eg impossibly strong wind speeds.

c) Missing reports (occasionally whole flights missing).

d) Spurious observations - reports received while aircraft are on the ground but flight level indicates aircraft is airborne ; usually such reports are from KL012UMZ.

e) Temperature biases - there are positive temperature differences for KL012UMZ relative to numerical forecast model fields of about 2.0 deg C at cruise levels. There are also positive temperature differences of about 1-2 deg C for BA009BMZ at all 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. Fig 1 shows a time series plot of monthly mean differences at the cruise levels for KL012UMZ (=2UMZ), BA009BMZ (=9BMZ) and all other units combined.

Unit KL012UMZ also has an anomalous negative temperature bias in the ascent/descent phases (see fig 2).

f) Varying cruise flight levels - cruise flight levels reported from KL012UMZ 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.

g) Reports from LV005VNZ were received after 29th April following three months with no data but receipt is still patchy.

ii) New problems

a) On a number of days, one or more reports (but generally less than 6) for a particular unit have erroneous wind speeds and directions which are associated with 'maximum wind' reports (phase of flight = 'LW'). This feature may have occurred before but seems to have occurred more frequently in the last few months - about 12 times overall in the 3 months, to units BA025LFZ, 26LGZ,

27LJZ and 28LLZ plus KL012UMZ and LV005VNZ. Typically wind speeds from these reports are 50 - 100 knots higher than the reports before and after and the directions are also inconsistent.

b) A significant number of reports from BA028LLZ are not being received.

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 1 shows for each unit the number of reports received in the SDB, the number of days when no reports were received, the average number of reports received per day and an estimate of the number of complete ascents, complete descents, level flight stage and complete flights that were not received.

As reports received are not checked to flight schedules it is likely that the absence of some complete flights will be missed. 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 :-

BA028LLZ : Jun 14th - Jun 22nd

LH005VNZ : Jan 26th - Apr 29th

Over the 3 month period as a whole an average of 1218 reports per day were received from all units combined, compared with 670 in the previous three-month period. Fig 3 displays the average daily number of ASDAR reports received since the end of 1992.

ii). Data Coverage

Most of the aircraft carrying ASDAR units during the period flew predominately between Europe and North America or within these regions. However the 4 new units BA025LFZ - BA028LLZ also flew to Asia, Africa, Australasia and South America and LH005VNZ to Africa and Asia.

iii). Data Timeliness

Table 2 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% of reports being received within one hour of observation time and 98 % 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 3 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. BA000NEZ and BA010PUZ are notable for their high frequencies of reporting in level flight, both with means of about once every 4.5 minutes.

5). DATA QUALITY

Figures 4 to 14 show for each individual unit 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. Hand-written headings have been added to fig 4 to clarify the charts.

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. Note that some values of O-A for some units appear anomalous which is almost certainly due to incorrect values being stored in the data-base. This is being investigated.

6). SUMMARY

i) Overall timeliness and quality of the data from the existing operational units remain high.

ii) Availability of data was significantly higher than previous three month periods principally because of the introduction of four new units, making eleven in total.

iii) Temperatures from BA009BMZ and KL012UMZ compared to model background temperatures continued to be somewhat anomalous.

iv) Some wind speeds and directions associated with maximum wind speed reports (phase of flight = 'LW') were erroneous.

v) 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 the majority of the units.

vi) Spurious reports from the ground continue to be received, particularly from KL012UMZ.

vii) Receipt of data from LH005VNZ continues to be patchy after a long period of outage ; that for one of the new units, BA028LLZ, is also rather poor.

7). AMDAR data from Dutch aircraft

AMDAR coded data from 16 Dutch aircraft are also being monitored. These 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. Unfortunately, many reports are being assigned to the wrong day within the Met Office data-bank due to deficiencies with regard to the coding of the date for aircraft reports. The data-bank team are aware of this problem but any solution is likely to be long term and cannot be completely successful without a change in the format of the code.

All sixteen of the Dutch units reported during the 3 month period. Due to the fact that reports are often assigned to the wrong day, that the observation area has been limited to 80 deg W - 40 deg E, 90 - 35 deg N and excludes profiles near Amsterdam airport up to, and down from, 10000 feet the sequence of reports is often broken and the number of reports received is much less than obtained from ASDAR units.

During June, the maximum number of reports from one unit was obtained from KL106FG (1102 reports) and minimum from KL111FL (18). The maximum number of reports in one day over all the units was 458, minimum 14. The maximum number of units reporting in one day was 11 and minimum 2.

A visual check of the data suggests there are no obvious problems with the quality of data from any of the units. In view of the fact that so many reports have been assigned to the wrong day and there are frequent breaks in data, statistics of the form given for the ASDAR units are not presented.

TABLE 1 : SUMMARY OF DATA RECEIVED AND MISSING DATA : APRIL - JUNE 1994

UNIT	NO. REPORTS RECEIVED	PERCENTAGE VIA KWBC	EESA	RJTD	"NO REPORT" DAYS	AVE NO. PER DAY*	<- NO. OF MISSING EVENTS -> ASC	DES	LF	CF
BA000NEZ	16682	18	82	-	6	196	17	26	0	0
BA001LLZ	10564	45	55	-	10	130	22	43	0	1
BA008DJZ	8798	47	53	-	12	111	23	23	0	0
BA009BMZ	12179	50	50	-	9	149	39	33	0	0
BA010PUZ	15699	39	61	-	5	183	36	37	0	0
BA025LFZ	8957	20	80	-	2	121	38	40	0	0
BA026LGZ	8766	32	68	-	3	127	32	29	0	1
BA027LJZ	8026	27	73	-	3	115	27	40	0	1
BA028LLZ	4150	18	82	-	19	74	35	37	0	0
KL012UMZ	15459	39	61	-	2	174	28	62	0	0
LH005VNZ	1547	13	87	-	52	40	-	-	-	-
TOTAL	110827									

NOTES

* Days with no reports are excluded for averaging purposes.
Missing data statistics for LH005VNZ are omitted due to intermittent nature of reports

ASC : Complete ascent
DES : Complete descent
LF : Level flight
CF : Complete flight

TABLE 2 : SUMMARY OF DELAY FREQUENCIES : APRIL - JUNE 1994

UNIT	NUMBER OF REPORTS	<---------PERCENTAGE FREQUENCIES OF DELAY-------> 0-30	31-60	61-120	121-180	181-360	361-720	>720	MAXIMUM DELAY	MEAN DELAY
		<----------MINUTES---------->								
BA000NEZ	16682	34.0	46.2	17.6	0.9	0.9	0.3	0.0*	841	45
BA001LLZ	10564	31.7	44.3	22.8	0.8	0.4	0.0*	-	408	47
BA008DJZ	8798	29.3	46.7	22.6	0.9	0.4	0.1	0.1	1432	47
BA009BMZ	12179	30.4	47.9	18.5	0.5	1.2	0.6	0.0*	872	47
BA010PUZ	15699	31.3	47.9	18.5	0.5	1.2	0.6	0.0*	751	48
BA025LFZ	8957	33.2	42.0	20.8	2.1	1.6	0.3	-	538	50
BA026LGZ	8766	28.9	40.7	28.7	1.2	0.5	-	-	287	50
BA027LJZ	8026	30.7	43.8	24.2	0.8	0.4	0.1	0.0*	1305	48
BA028LLZ	4150	35.0	43.5	19.9	1.1	0.5	-	-	208	43
KL012UMZ	15459	35.8	48.9	13.8	0.7	0.8	0.0*	0.0*	1389	41
LH005VNZ	1547	42.0	42.1	14.0	0.6	0.8	0.5	-	397	42
TOTALS	110827	32.0	45.2	20.7	1.0	0.8	0.2	0.0*	1432	47

NOTE

* Percentage between 0 and 0.05.

TABLE 3 : SUMMARY OF REPORTING FREQUENCIES : APRIL - JUNE 1994

	<-----LEVEL FLIGHT----->				<--ASCENT (1st 10 OBS)->				<DESCENT(10 OBS AFTER 890hPa)>			
UNIT	N.O.S.	MEAN	MIN	MAX	N.O.S.	MEAN	MIN	MAX	N.O.S.	MEAN	MIN	MAX
		<----MINUTES--->				<-----hPa------>				<------hPa----->		
BA000NEZ	81	4.8	2.9	7.0	63	9.9	8.8	12.3	58	10.5	8.8	11.9
BA001LLZ	66	7.0	6.1	7.0	42	9.3	8.8	11.1	42	10.2	8.8	11.9
BA008DJZ	55	7.0	6.5	7.0	31	9.4	8.8	11.1	46	10.0	8.8	11.9
BA009BMZ	70	6.4	5.1	7.0	36	10.0	9.6	12.3	49	10.1	8.8	11.9
BA010PUZ	78	4.5	3.1	6.3	52	9.9	9.2	10.0	55	10.3	8.8	11.9
BA025LFZ	44	6.2	4.1	7.0	30	9.7	8.0	10.0	27	10.4	8.4	11.9
BA026LGZ	47	7.0	7.0	7.0	39	9.3	8.0	10.3	40	10.3	8.8	11.9
BA027LJZ	50	7.0	6.5	7.0	39	9.3	8.0	11.5	33	10.1	8.8	11.9
BA028LLZ	39	7.0	5.1	7.0	18	9.3	8.0	10.3	17	10.2	8.8	11.9
KL012UMZ	1 *	-	-	-	65	9.9	9.6	12.3	33	10.0	7.7	13.0
LH005VNZ	14	7.0	6.5	7.0	11	9.6	8.8	10.0	0	-	-	-

KEY TO "REPORTING FREQUENCY" TABLE HEADINGS

N.O.S. : Number of samples.

NOTE

* KL012UMZ - cruise flight levels fluctuate frequently (see text)

Figure 1

Monthly mean ASDAR O−B temperatures (deg C)

150−350 hPa

Key : 9−−9 9BMZ 2−-2 2UMZ 0−0 OTHERS

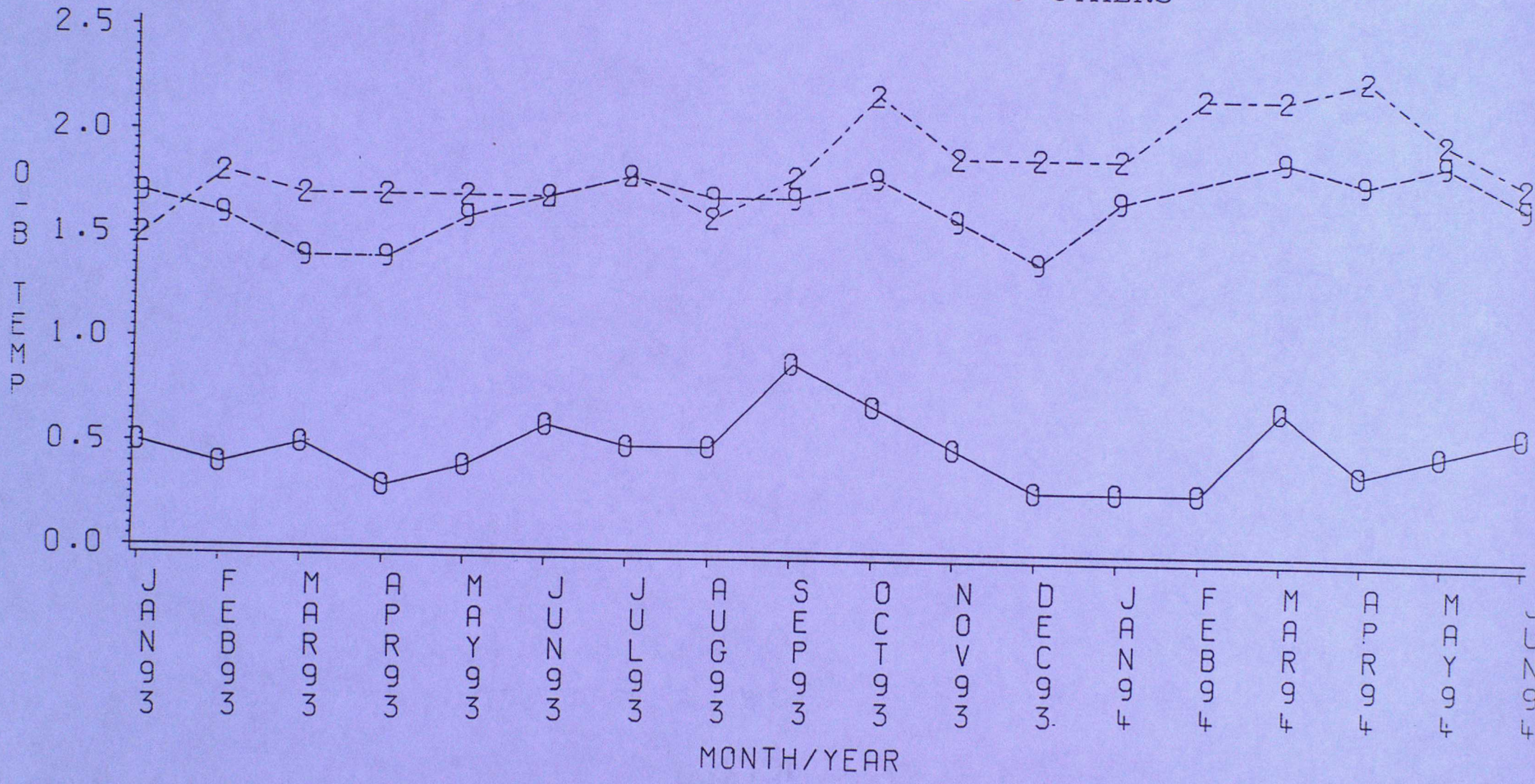


Figure 2

Monthly mean ASDAR O−B temperatures (deg C)

400−950 hPa

Key : 9−−9 9BMZ 2−·2 2UMZ 0−0 OTHERS

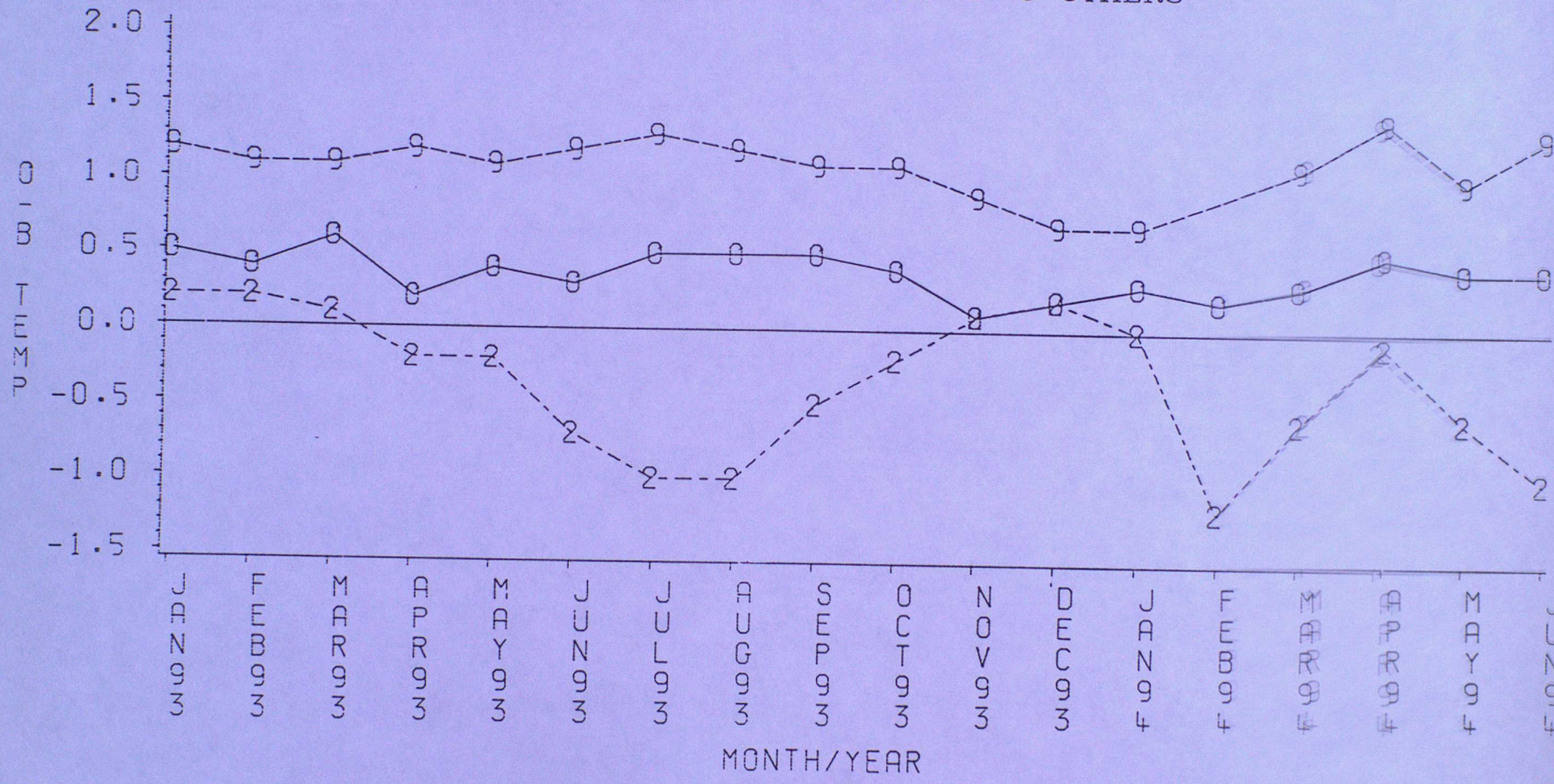
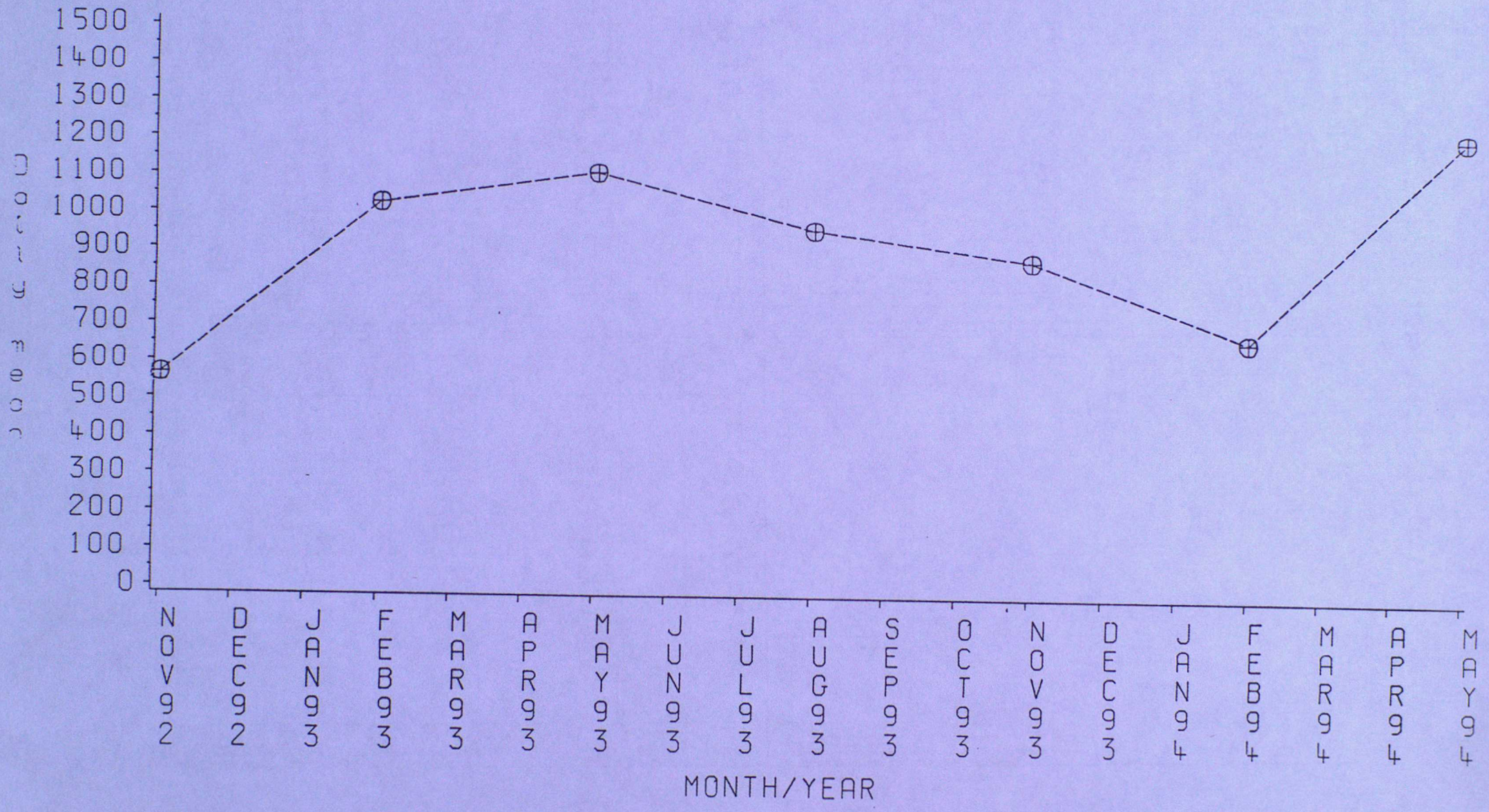


Figure 3

Average daily number of ASDAR reports

Values represent centred 3 month means



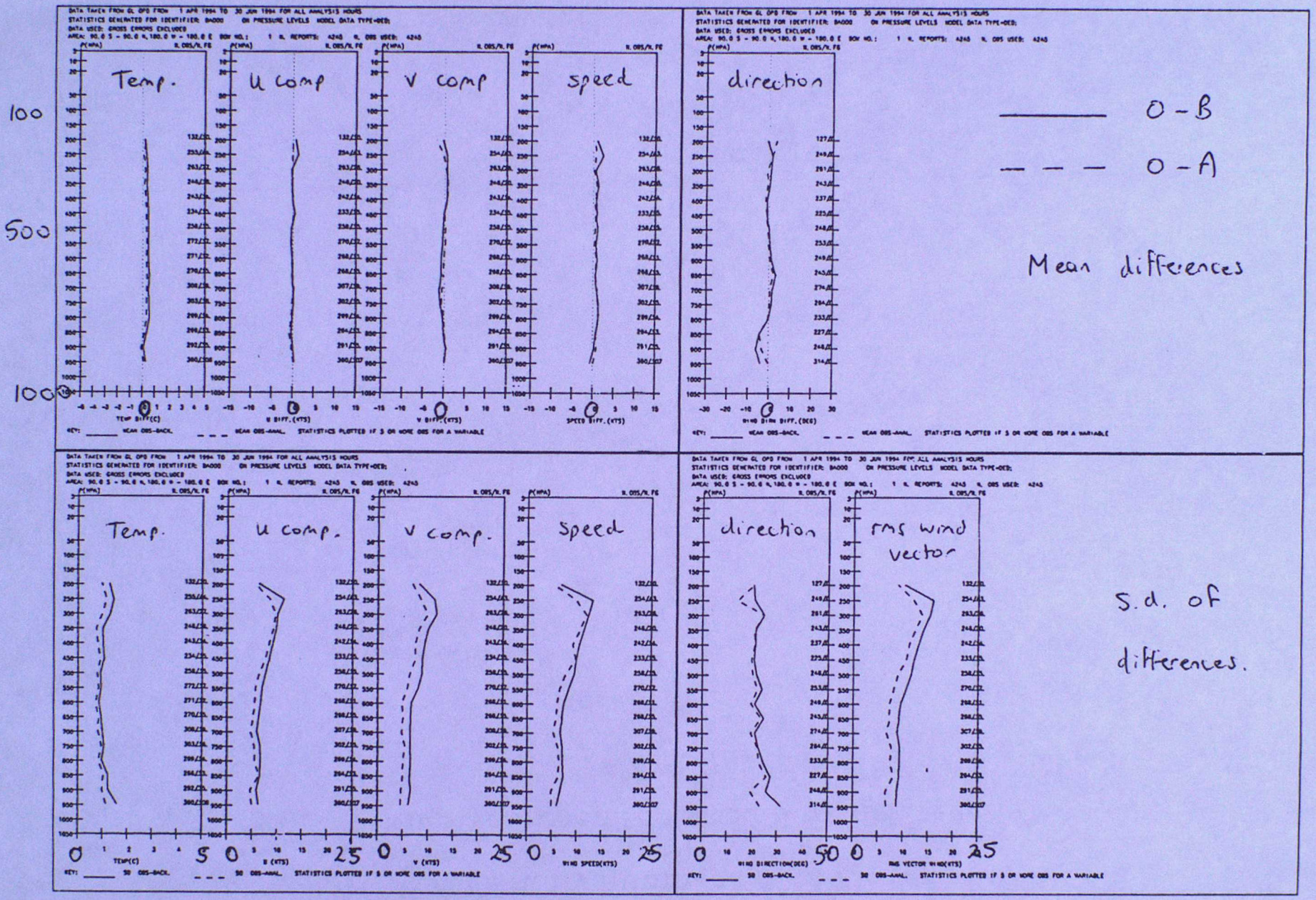


FIGURE 4 : BA000NEZ - MODEL COMPARISON RESULTS (950-150 hPa)

FIGURE 5 : BA001LLZ - MODEL COMPARISON RESULTS (950-150 hPa)

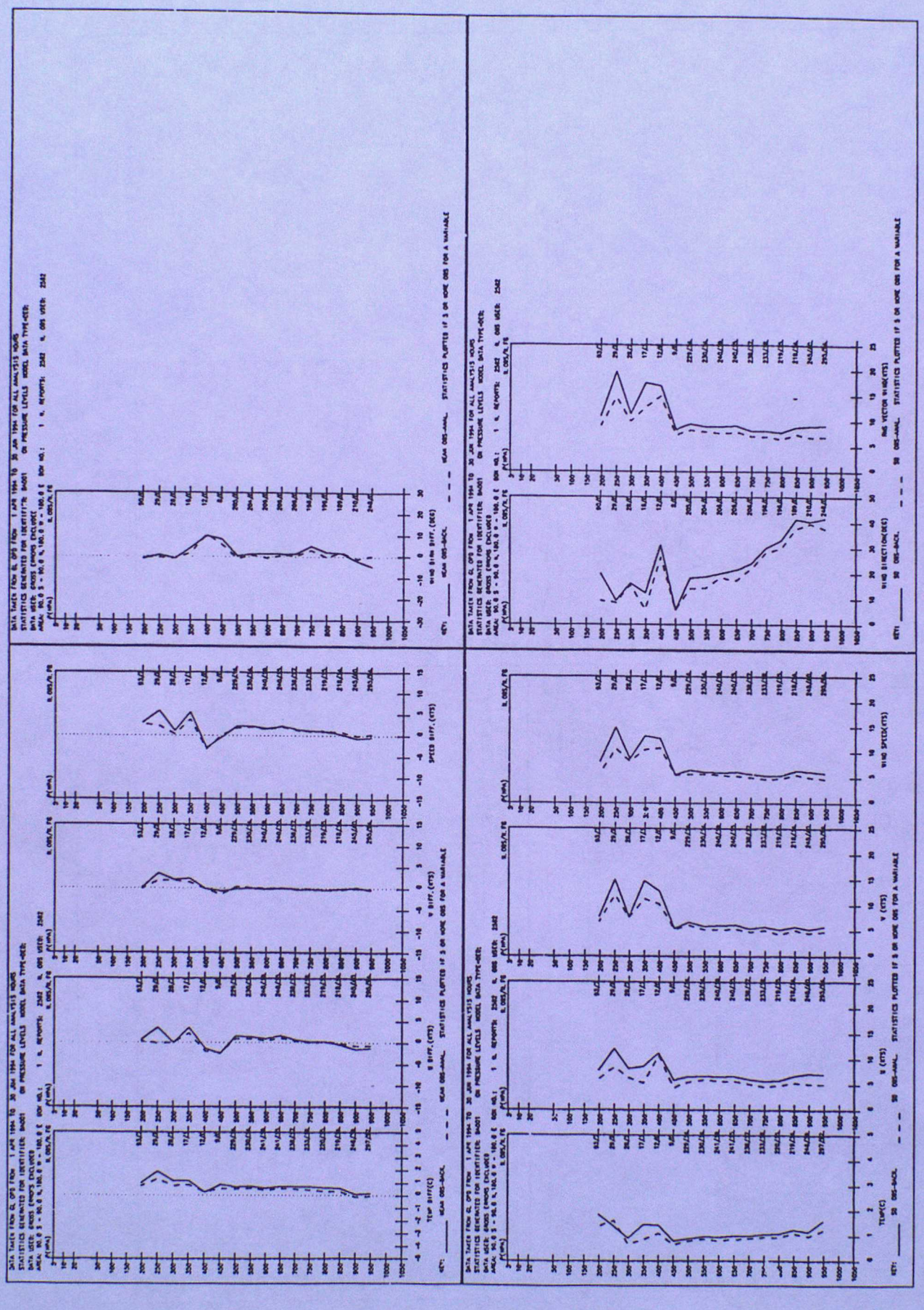
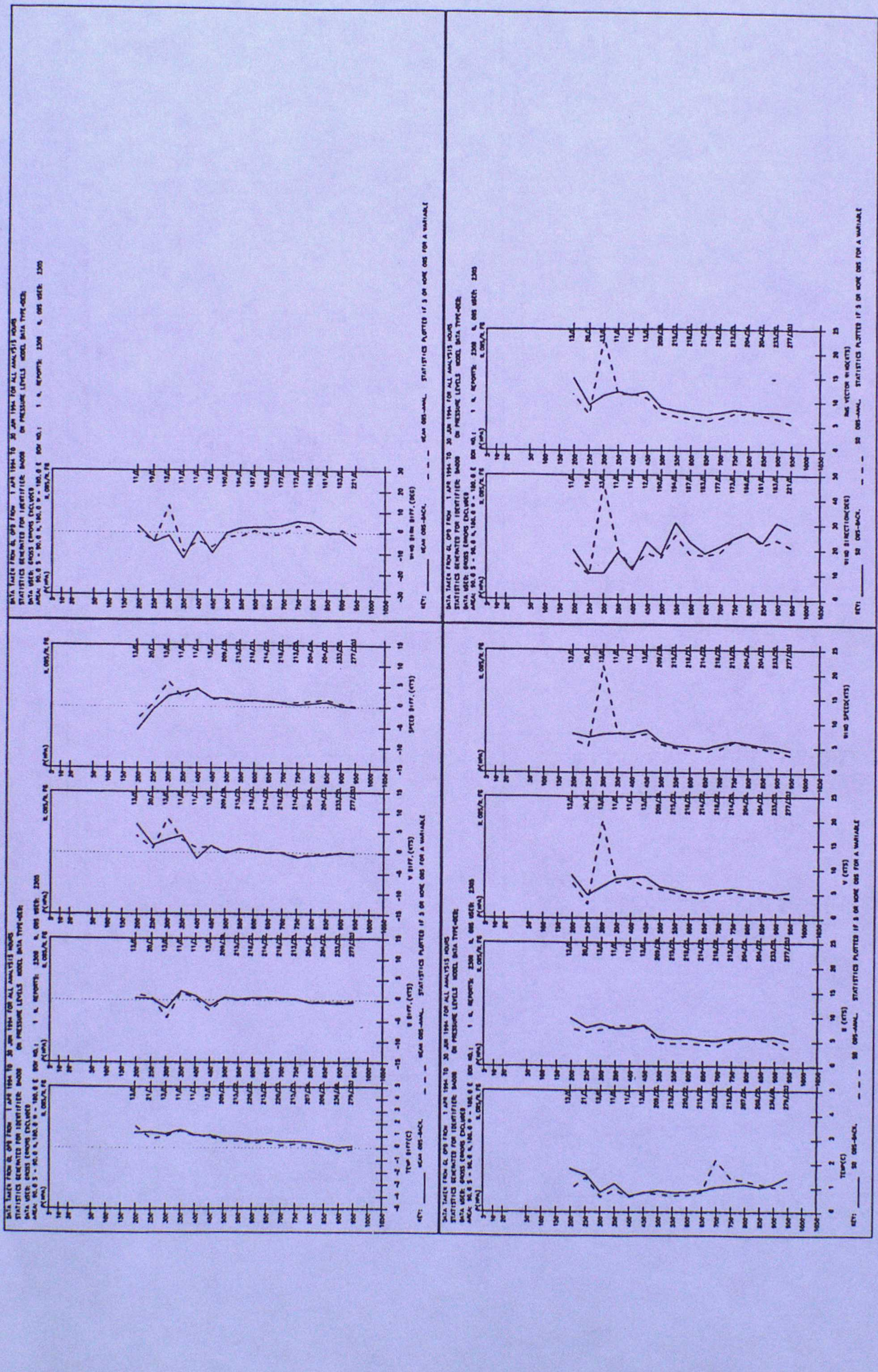


FIGURE 6 : BA008DJZ - MODEL COMPARISON RESULTS (950-150 hPa)



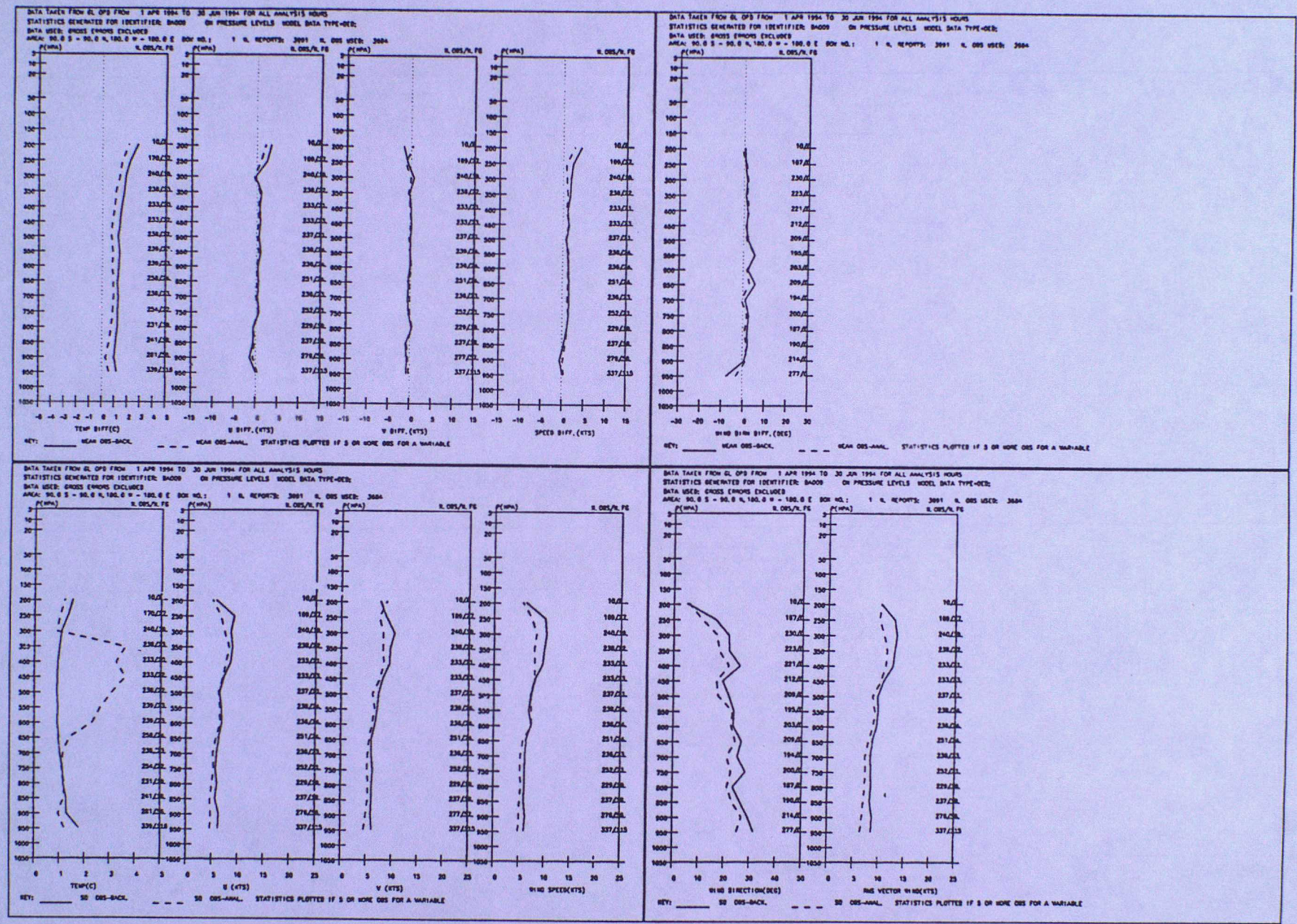
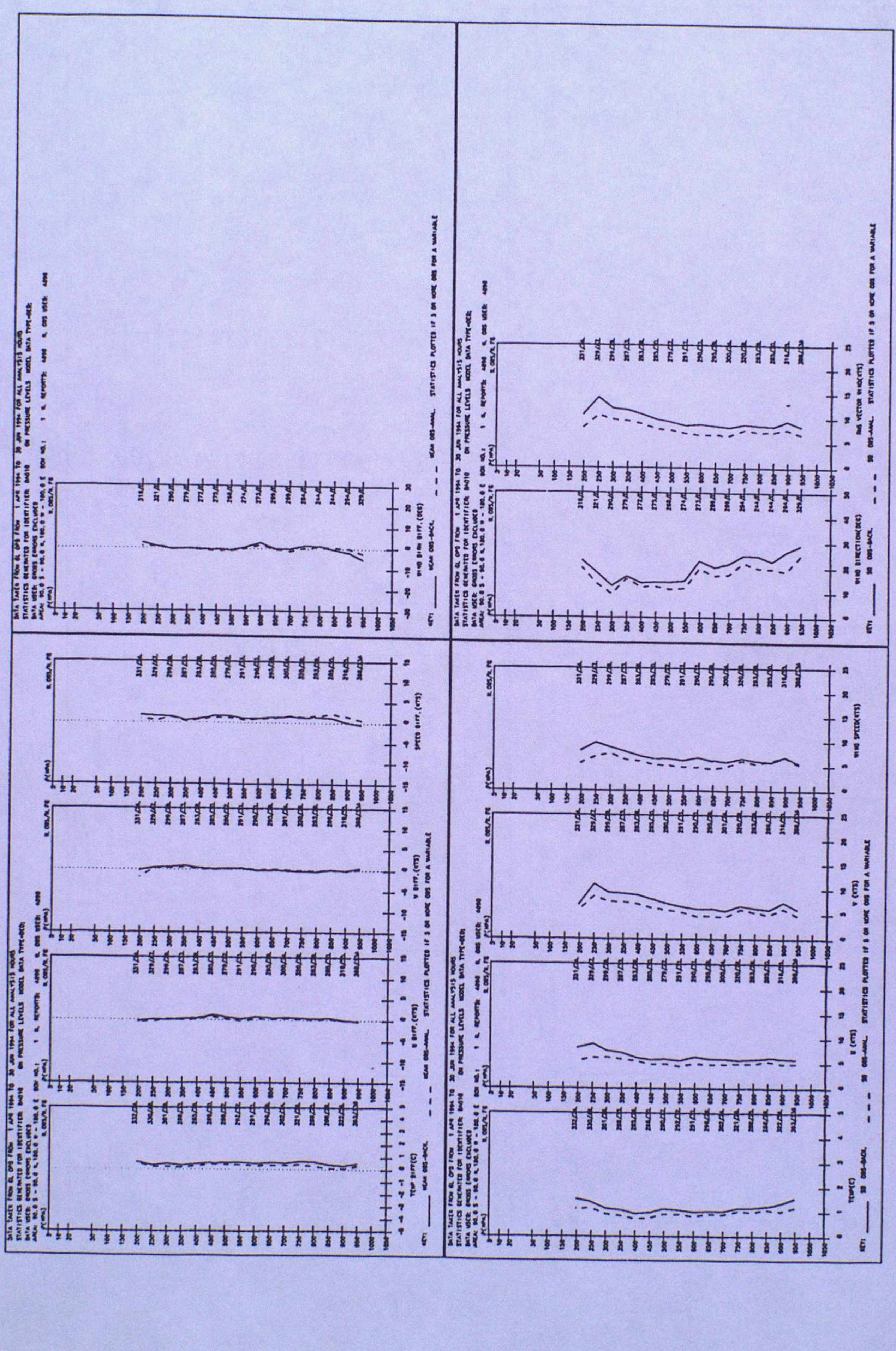


FIGURE 7 : BA009BMZ - MODEL COMPARISON RESULTS (950-150 hPa)

FIGURE 8 : BA010PUZ - MODEL COMPARISON RESULTS (950-150 hPa)



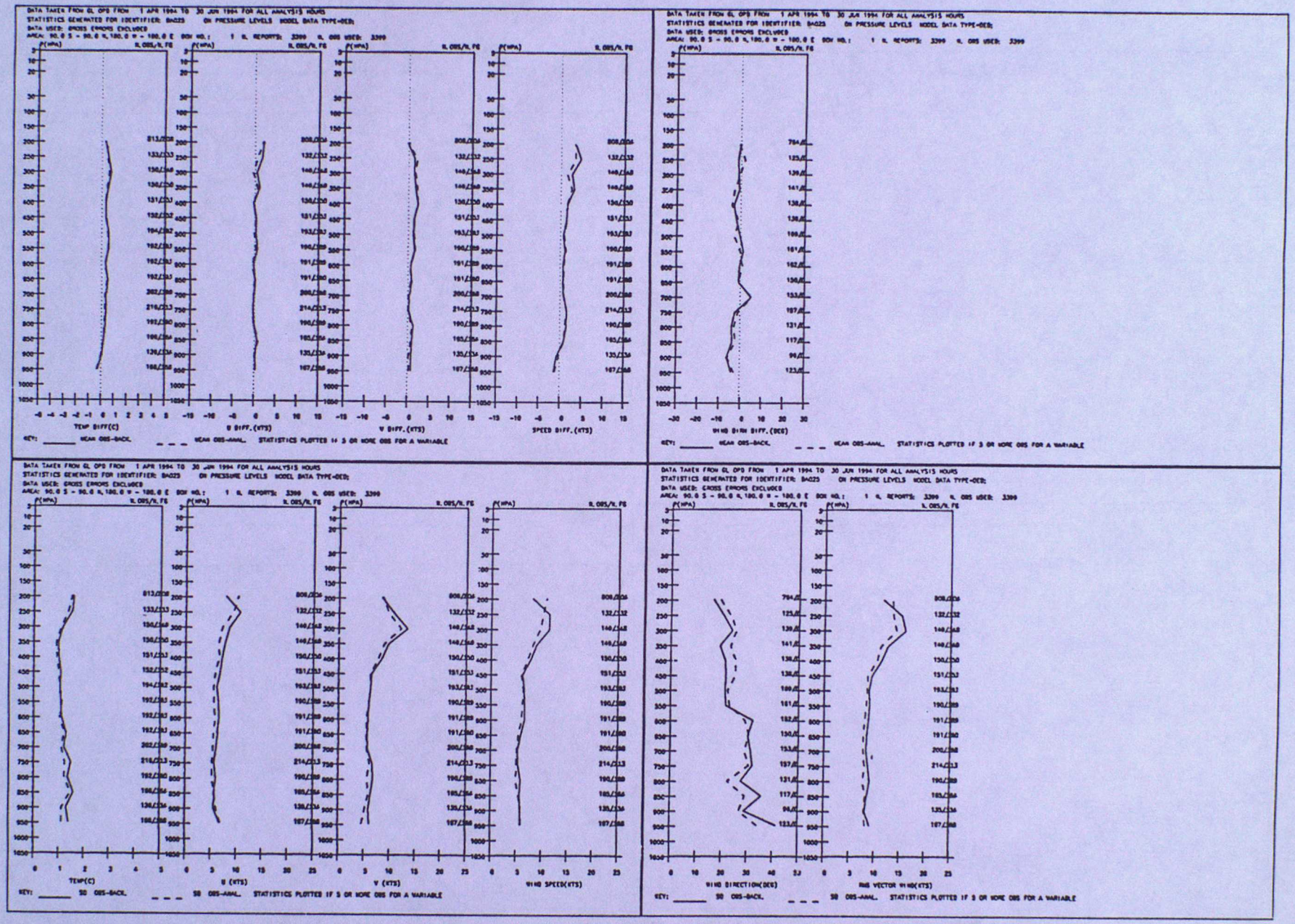


FIGURE 9 : BA025LFZ - MODEL COMPARISON RESULTS (950-150 hPa)

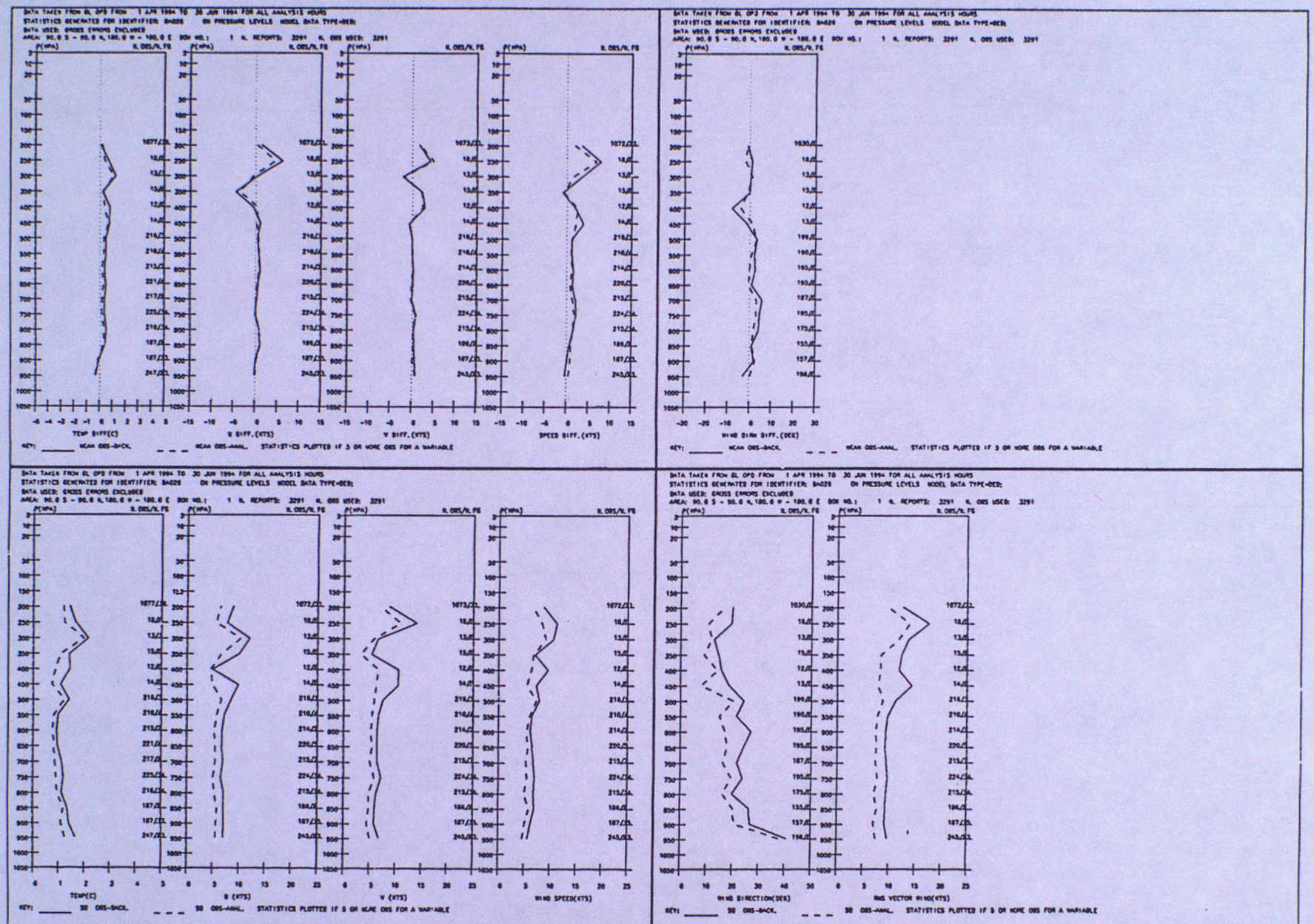


FIGURE 10 : BA026LGZ - MODEL COMPARISON RESULTS (950-150 hPa)

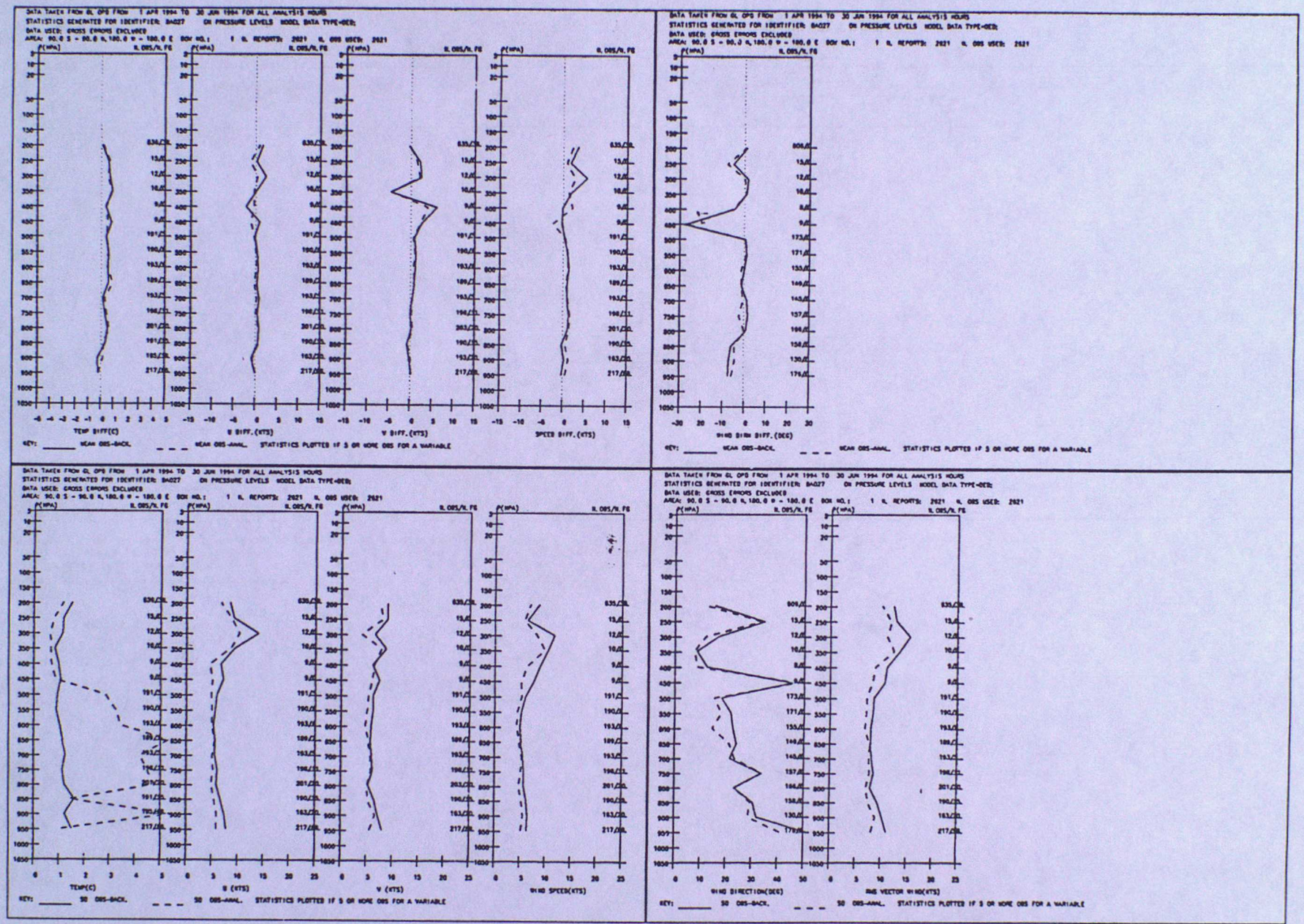
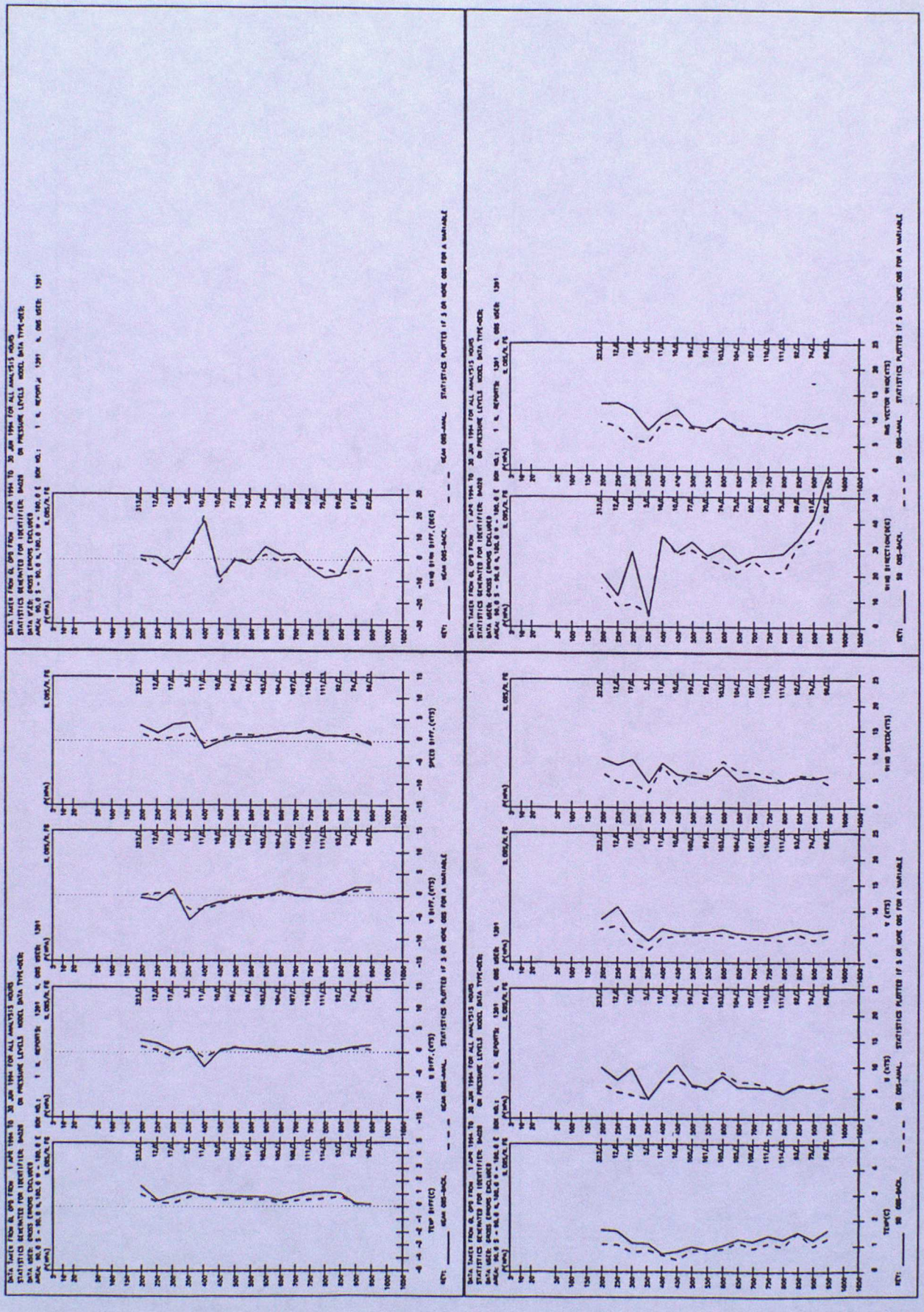


FIGURE 11 : BA027LUZ - MODEL COMPARISON RESULTS (950-150 hPa)

FIGURE 12 : BA028LLZ - MODEL COMPARISON RESULTS (950-150 hPa)



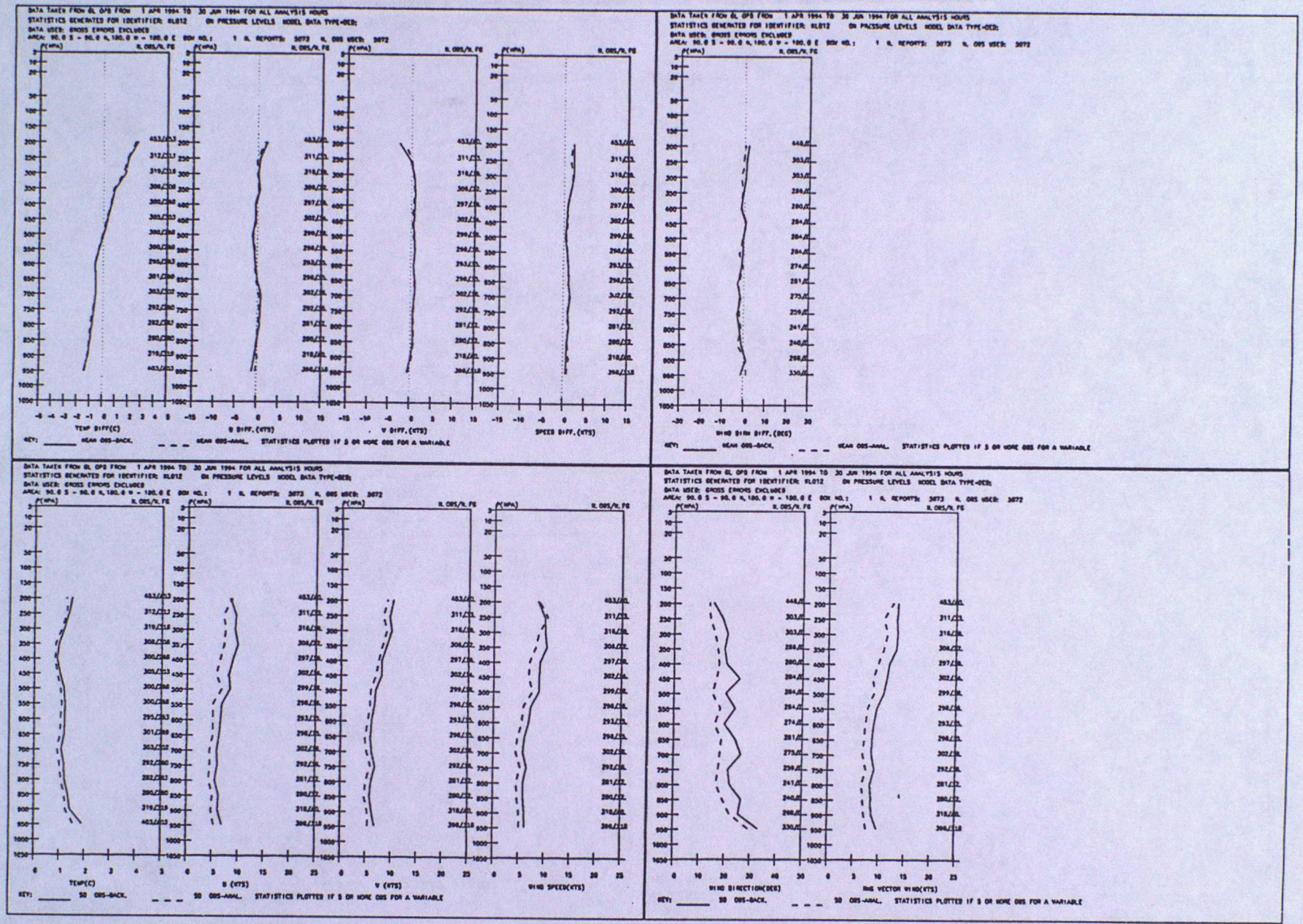


FIGURE 13 : KL012UMZ - MODEL COMPARISON RESULTS (950-150 hPa)

FIGURE 14 : LH005VNZ - MODEL COMPARISON RESULTS (950-150 hPa)