OBSERVATION PROVISION BRANCH

REPORT ON ASDAR MONITORING RESULTS

JANUARY - MARCH 1994

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DUPLICATE ALSO

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.

AMDAR coded data from Dutch aircraft are also being monitored. This monitoring has taken the form of visual inspection of sequences of reports. The quality so far has appeared satisfactory. However 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. In the interim any statistics (eg of observation against model fields) are distorted by the fact that a significant number of reports are assigned to the wrong day.

2). OPERATIONAL UNITS

Seven ASDAR units reported during the period, the same number as the previous period.

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

AIRLINE	AIRCRAFT TYPE	IDENTIFIER	OPERATIONAL DATES START	END
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	
Continental Airlines	747	CO00624Z$	17/10/91+	2/ 4/93
Continental Airlines	DC 10	CO00768Z	20/10/91	14/11/93
KLM	747	KL012UMZ=	23/ 4/92	
Lufthansa	747	LH005VNZ	23/ 6/93	

@ Unit identifier reported as BA000NDZ before 4/10/92.
$ Unit identifier changed from CO006PEZ on 19/11/91.
+ Some observations were received from this unit on 3/6/91 but it was not considered to be operational at that time.
= 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) which is a long-term feature.

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.

ii) New problems

a) There were problems with the DPU battery on unit BA008DJZ for much of the period which led to loss of data. However the problems were resolved by the end of the period.

b) Unit KL012UMZ failed to report position, temperature or wind information for many reports between 6th February and 15th March due to a malfunction with its AC Module.

c) Reports from LH005VNZ were received only between 11th - 25th January due to a suspected DPU fault which Matra Marconi are investigating.

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 :-

BA001LLZ : Mar 5th - Mar 31st (routine aircraft maintenance)

BA008DJZ : Dec 24th - Mar 10th (routine aircraft maintenance followed by problems with the DPU battery)

BA009BMZ : Jan 22nd - Feb 20th (routine aircraft maintenance)

KL012UMZ : Jan 24th - Feb 4th (routine aircraft maintenance)

LH005VNZ : Only reported between 11th - 25th January (suspected DPU fault)

Over the 3 month period as a whole an average of 670 reports per day were received from all units combined, compared with 881 in the previous three-month period. Fig 3 displays the average daily number of ASDAR reports received since the end of 1992. The number of units producing data over three month periods has remained fairly constant at 7-8 from the end of 1992 to date.

ii). Data Coverage

All the aircraft carrying ASDAR units during the period flew predominately between Europe and North America or within these regions.

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 79% 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. The mean frequency for near-ground descent was slightly poorer than the specified criterion for four 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 9 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.

Note that values for LH005VNZ and for the higher levels for BA008DJZ are not available due to lack of data.

6). SUMMARY

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

ii) Availability of data was poorer than previous three month periods ; although seven units reported during the period, the same as the previous three months, one unit (LH005VNZ) reported on only 12 days and four of the others did not report for long periods due to routine aircraft maintenance.

iii) Problems with the AC module on KL012UMZ resulted in a significant number of reports having missing information for position and/or meteorological element values.

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

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 four units.

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

TABLE 1 : SUMMARY OF DATA RECEIVED AND MISSING DATA : JANUARY - MARCH 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	15391	17	83	-	2	175		16	27	0	2
BA001LLZ	7348	20	80	-	39	144		10	26	0	2
BA008DJZ	2391	43	57	-	72	133		4	6	0	0
BA009BMZ	6748	45	55	-	44	147		15	15	0	1
BA010PUZ	14419	40	60	-	12	185		20	22	2	1
KL012UMZ	13573	35	65	-	14	179		30	45	0	0
LH005VNZ	447	-	100	-	78	37		-	-	-	-
TOTAL	60317										

NOTES

* Days with no reports are excluded for averaging purposes.

Analysis of missing events for LH005VNZ not carried out due to paucity of data

KEY TO "MISSING DATA" TABLE HEADINGS

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

TABLE 2 : SUMMARY OF DELAY FREQUENCIES : JANUARY - MARCH 1994

UNIT	NUMBER OF REPORTS	PERCENTAGE FREQUENCIES OF DELAY (MINUTES)							MAXIMUM DELAY	MEAN DELAY
		0-30	31-60	61-120	121-180	181-360	361-720	>720		
BA000NEZ	15391	34.7	46.1	17.8	0.4	0.7	0.1	0.2	957	45
BA001LLZ	7348	35.6	44.0	19.3	0.4	0.6	0.1	-	450	44
BA008DJZ	2391	29.4	49.0	20.3	1.1	0.2	0.0*	-	367	45
BA009BMZ	6748	26.8	49.4	21.8	0.3	0.8	0.1	0.8	920	53
BA010PUZ	14419	29.3	48.3	20.6	0.6	1.0	0.2	0.1	917	47
KL012UMZ	13573	34.9	47.6	16.5	0.5	0.4	-	0.2	916	43
LH005VNZ	447	32.9	25.5	3.6	-	-	3.4	34.7	1439	524
TOTALS	60317	32.5	47.0	18.8	0.5	0.7	0.1	0.5	1439	49

NOTE

* Percentage between 0 and 0.05.

TABLE 3 : SUMMARY OF REPORTING FREQUENCIES : JANUARY - MARCH 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	80	4.6	3.0	6.0	54	9.9	9.6	10.0	43	10.3	8.4	11.9
BA001LLZ	46	6.4	4.7	7.0	27	9.9	9.6	10.0	21	10.2	8.8	11.9
BA008DJZ	9	6.9	6.5	7.0	10	9.3	8.8	10.0	13	10.0	8.8	10.7
BA009BMZ	36	6.2	4.7	7.0	27	9.9	9.6	10.0	25	10.2	8.8	11.9
BA010PUZ	69	4.4	3.3	6.5	55	9.9	9.6	10.0	52	10.0	7.7	11.9
KL012UMZ	0 *	-	-	-	27	9.9	9.6	10.0	19	10.2	9.6	10.7
LH005VNZ	3	-	-	-	2	-	-	-	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

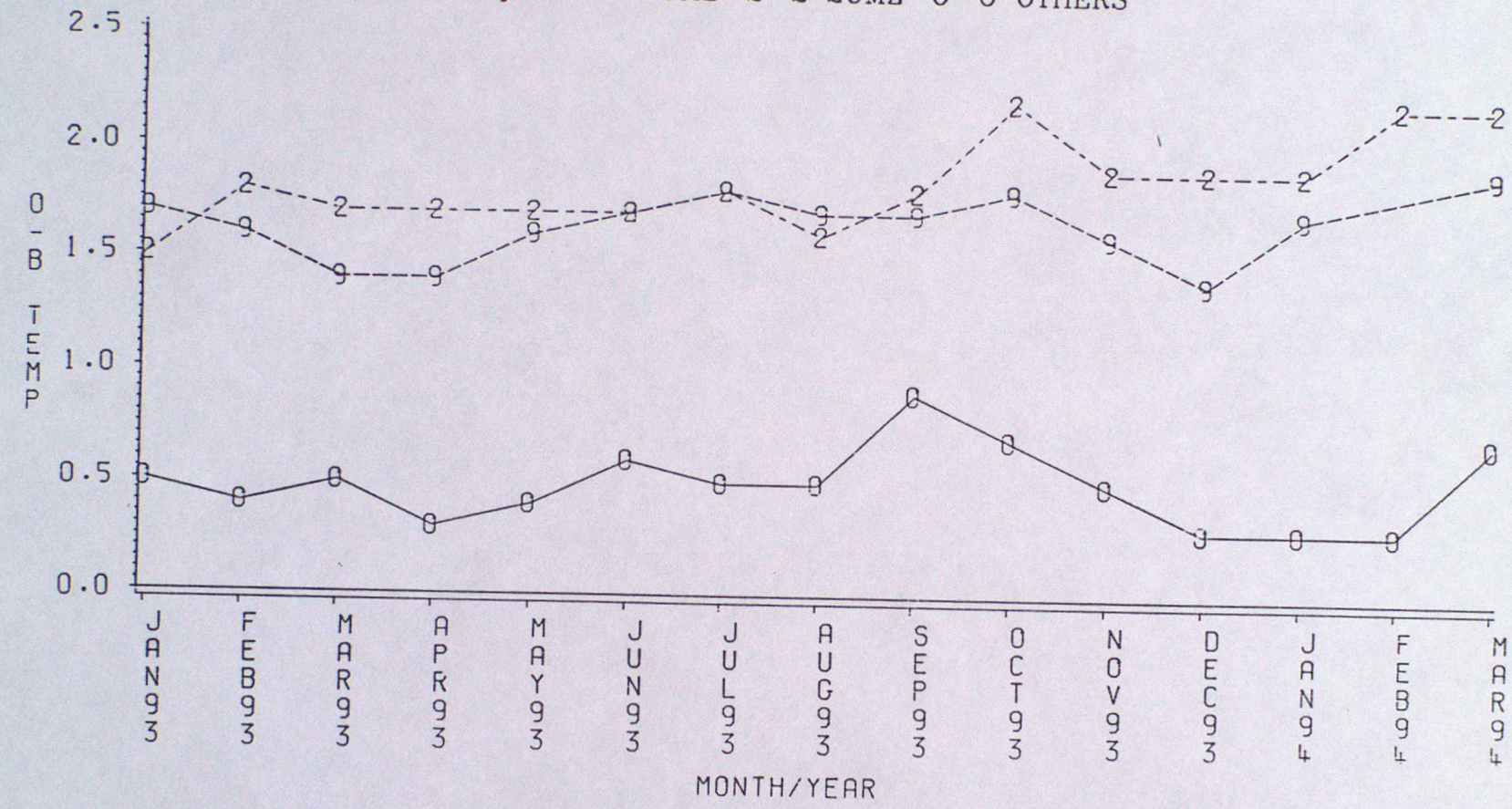


Figure 2

Monthly mean ASDAR O–B temperatures (deg C)

400–950 hPa

Key : 9--9 9BMZ 2--2 2UMZ O—O OTHERS

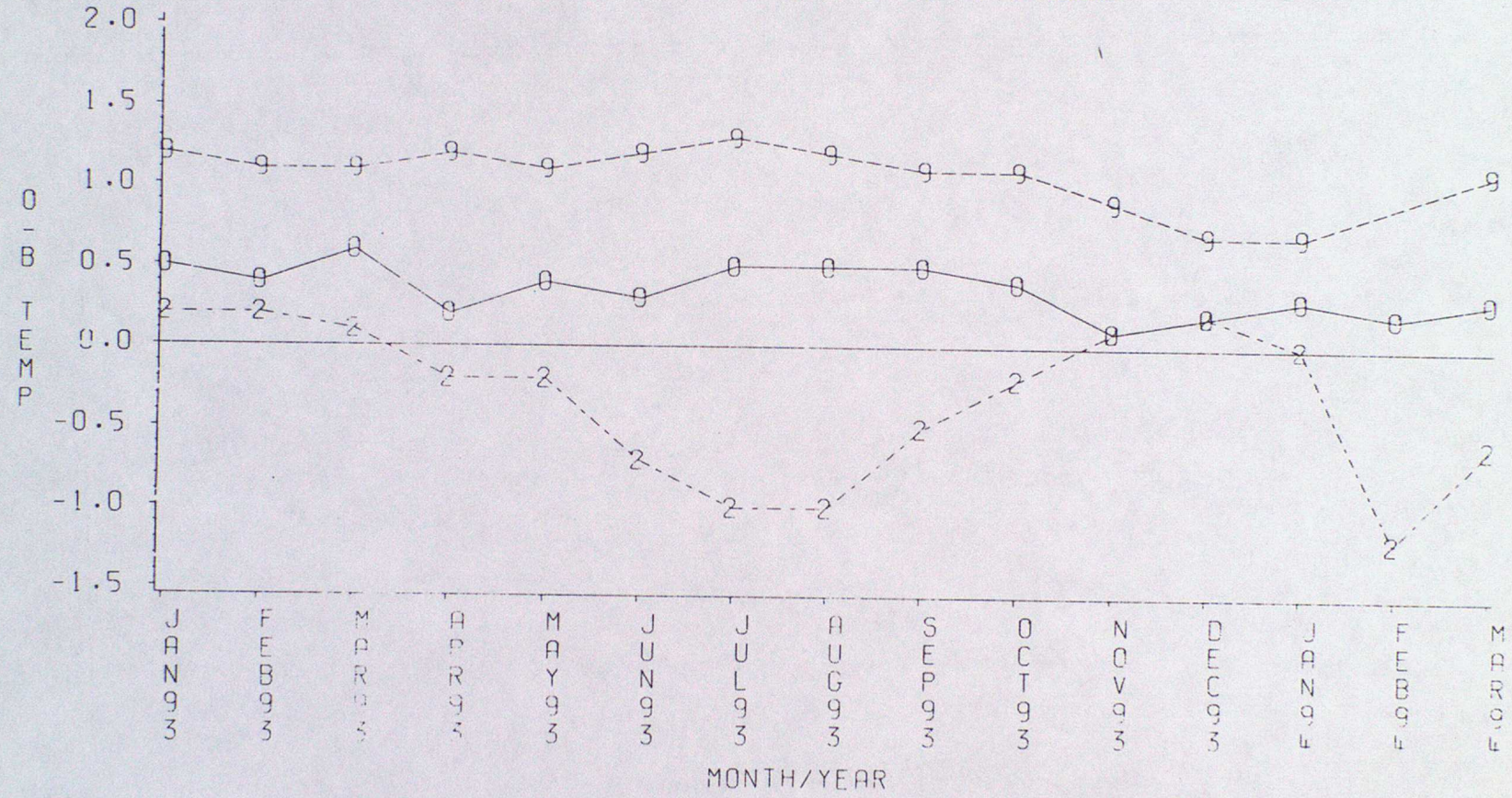
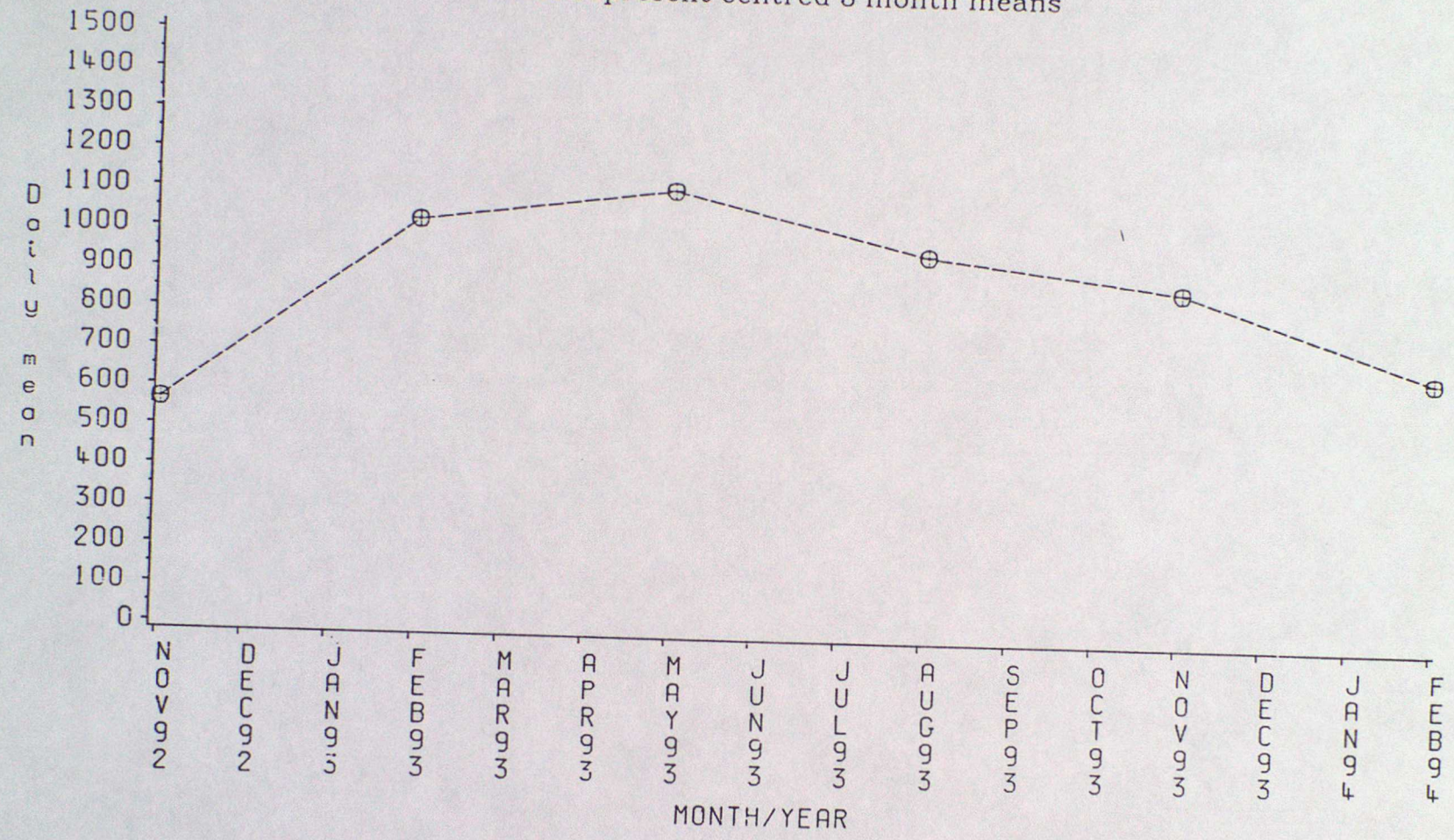


Figure 3

Average daily number of ASDAR reports

Values represent centred 3 month means



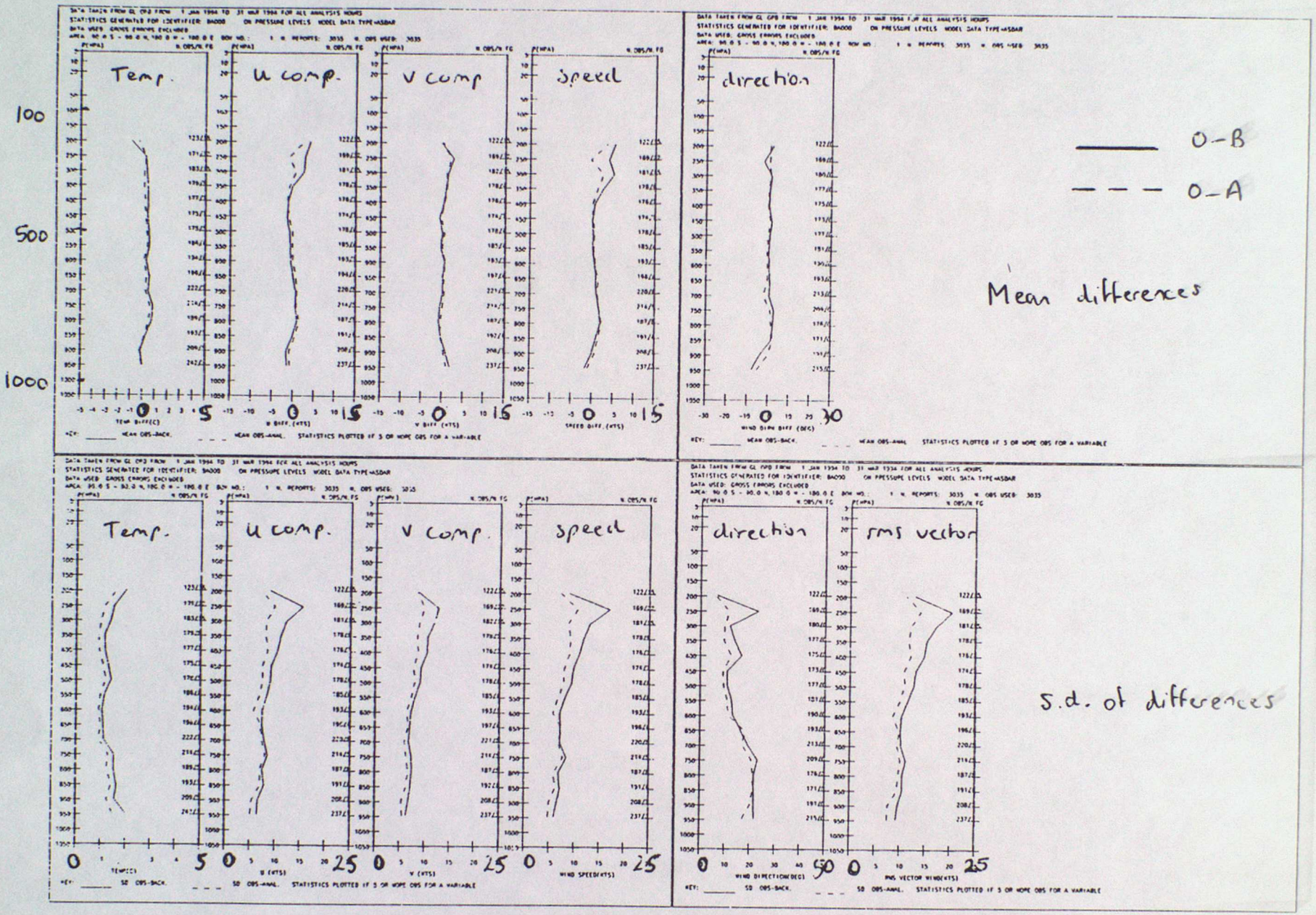


FIGURE 4 : BA000NEZ - MODEL COMPARISON RESULTS (950-150 hPa)

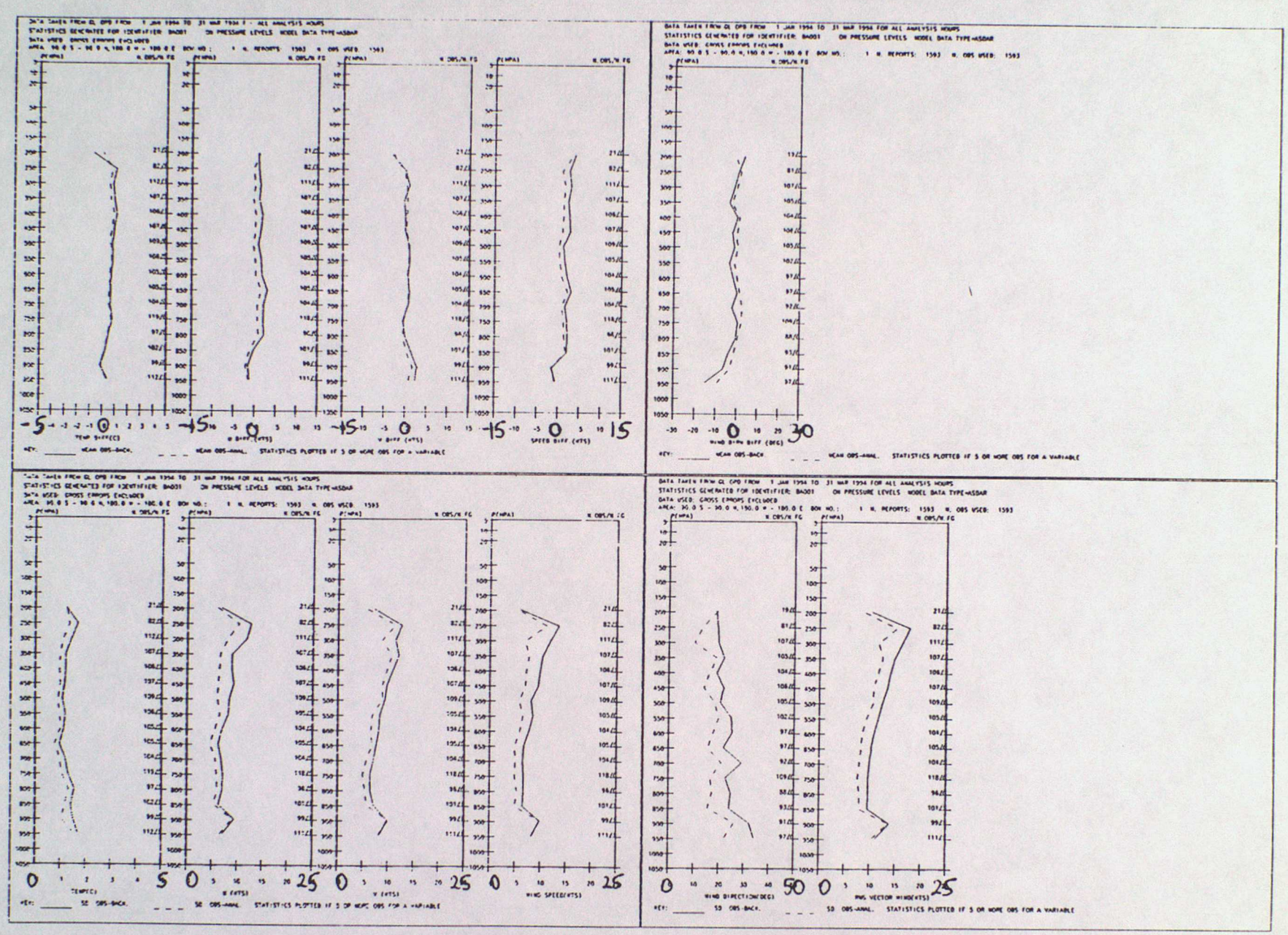


FIGURE 5 : BA001LL2 - MODEL COMPARISON RESULTS (950-150 hPa)

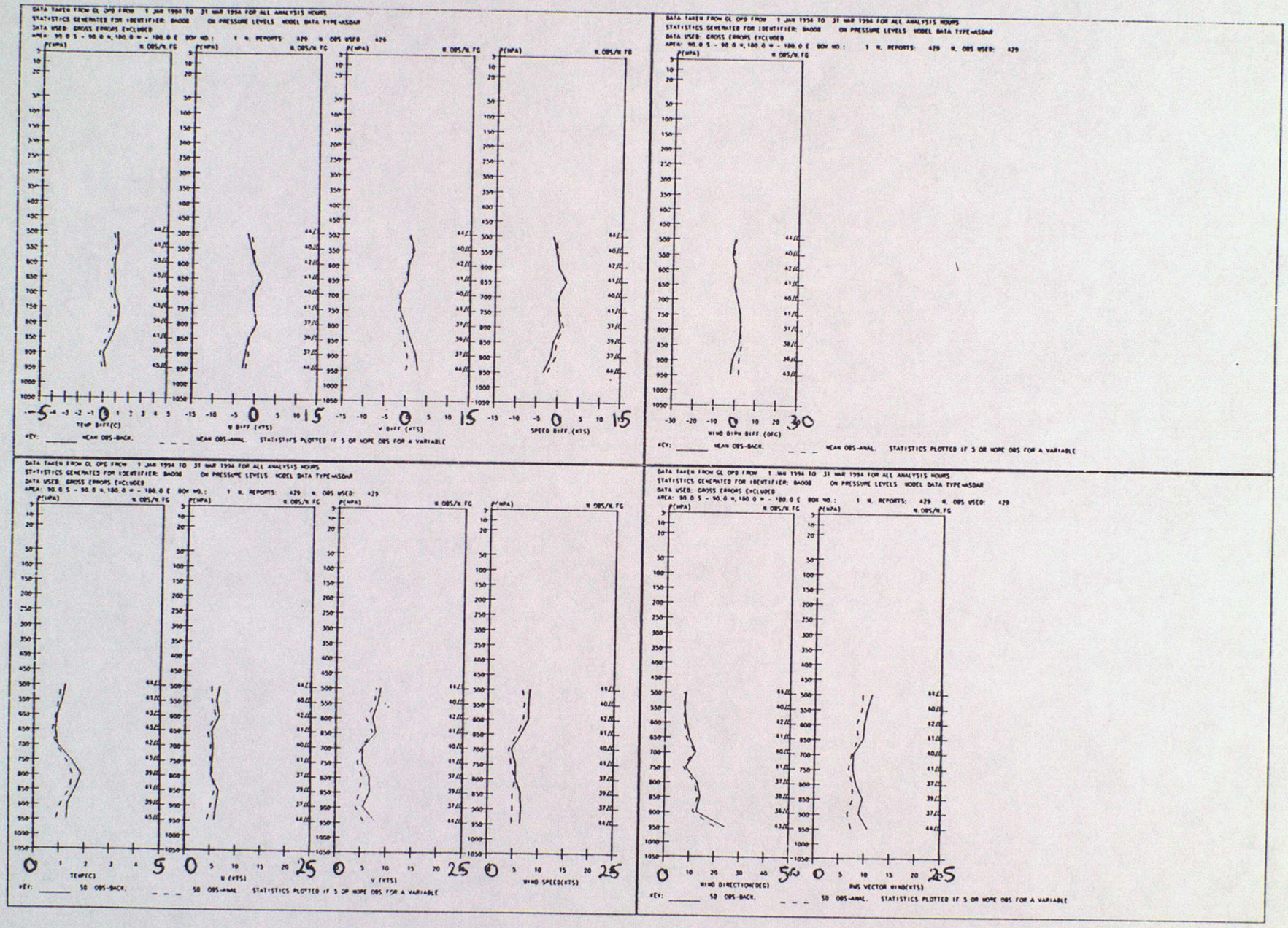


FIGURE 6 : BA008DJZ - MODEL COMPARISON RESULTS (950-150 hPa)

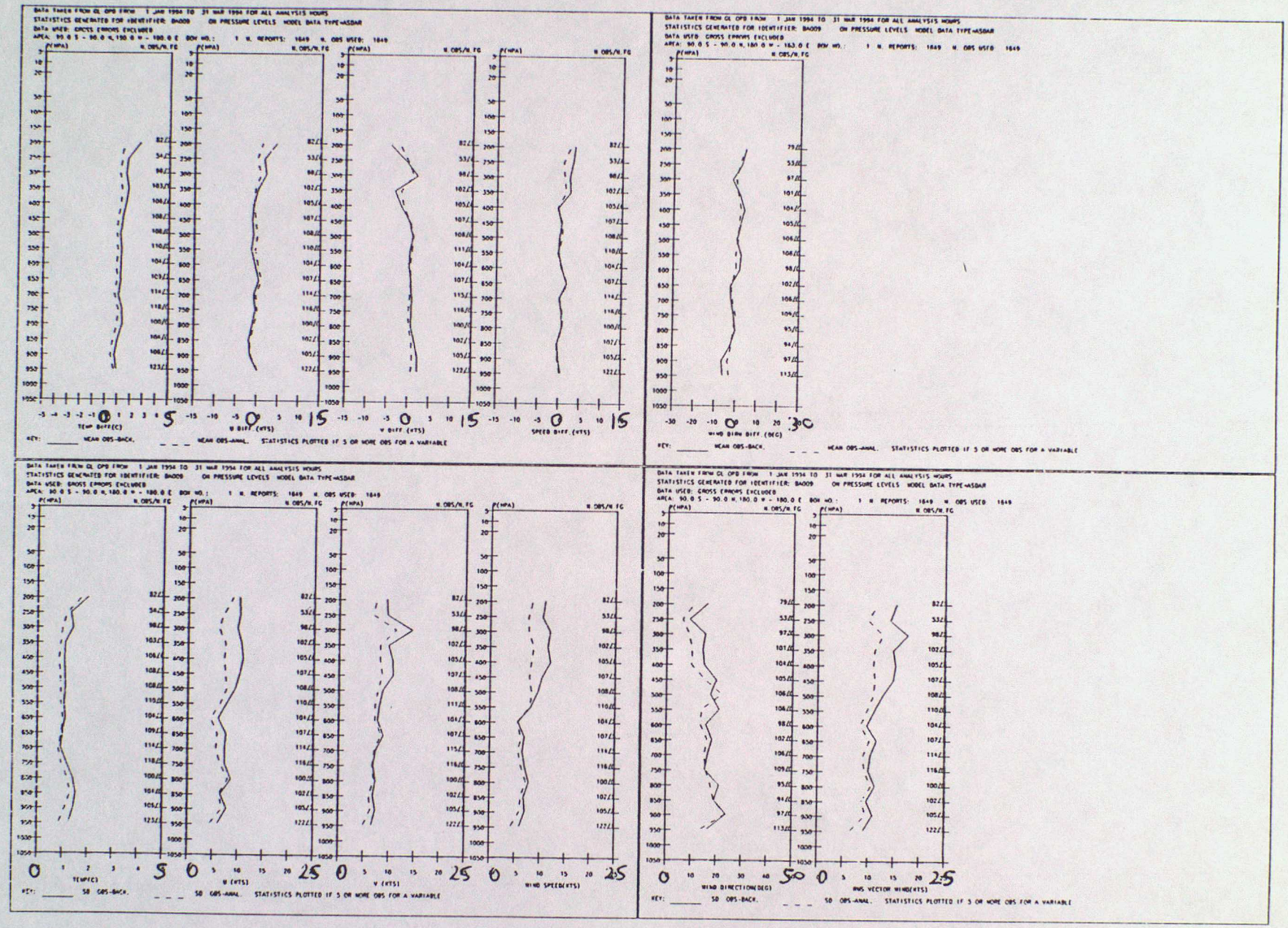


FIGURE 7 : BA009BMZ - MODEL COMPARISON RESULTS (950-150 hPa)

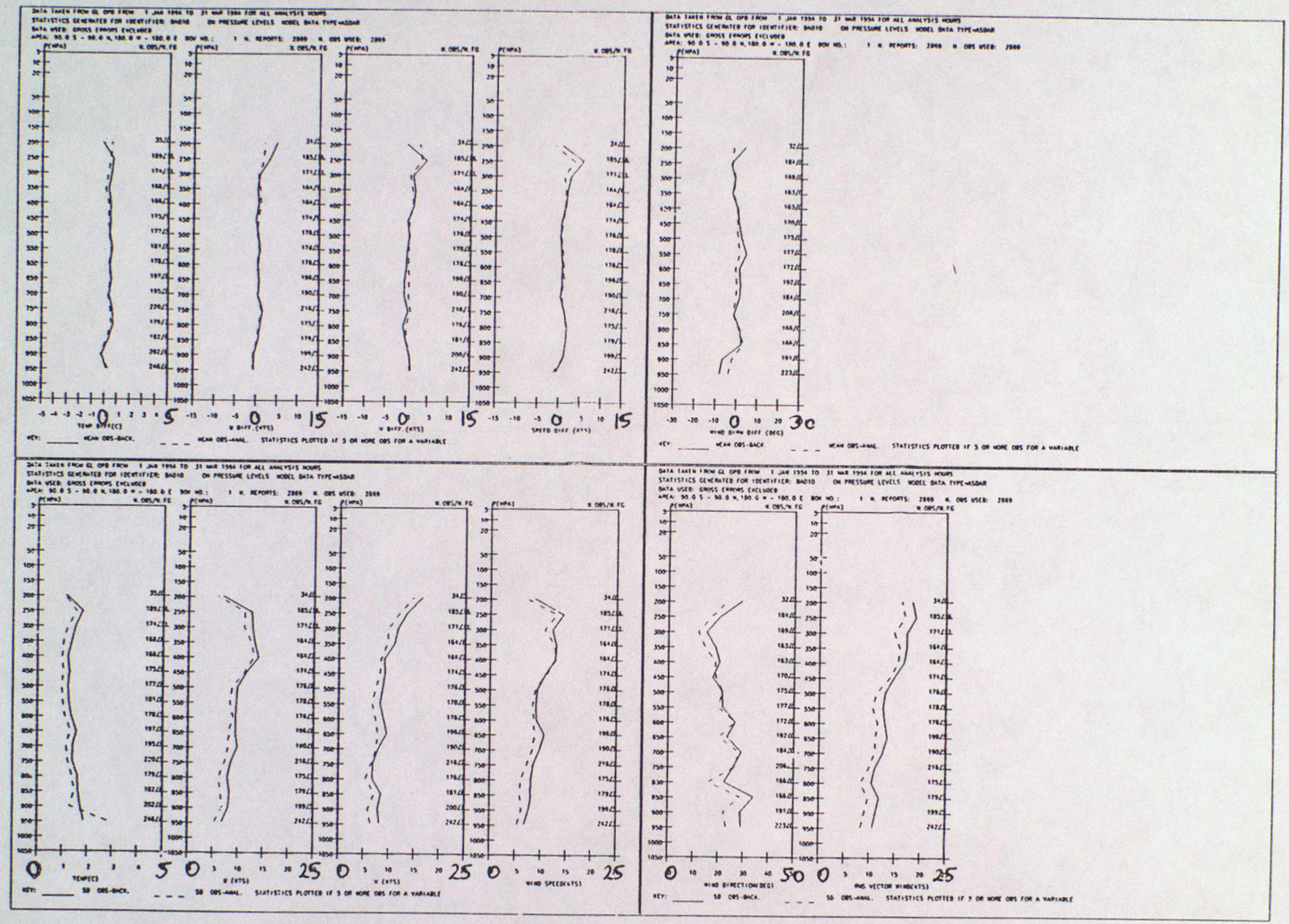


FIGURE 8 : BA010PUZ - MODEL COMPARISON RESULTS (950-150 hPa)

FIGURE 9 : KL012UMZ - MODEL COMPARISON RESULTS (950-150 hPa)