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OBSERVATION PROVISION BRANCH

REPORT ON ASDAR MONITORING RESULTS

OCTOBER-DECEMBER 1994

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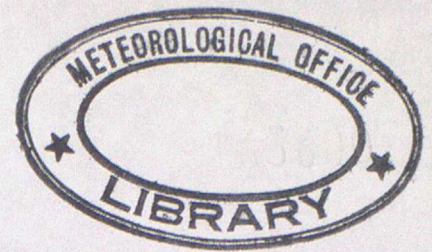
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THE ASDAR CENTRE

REPORT ON ASDAR MONITORING : OCTOBER - DECEMBER 1994

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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 twelve ASDAR units were received in the SDB during the period, one more than in the previous period. However, one of the units, the one new unit (BA029LYZ), only produced reports on 2 days in mid-December.

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. However, not all "LW" reports give incorrect values.

c) Missing reports (occasionally whole flights 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 Telecommunications System. The reasons for this are being investigated.

d) Temperature biases - there are positive temperature differences for KL012UMZ 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.

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. (No values for KL012UMZ are available for August - October since the aircraft was out of service). During August, a new temperature probe was fitted to BA009BMZ and this has significantly reduced the positive bias.

Unit KL012UMZ also has an anomalous negative temperature bias in the ascent/descent phases (see fig 2). The marked change in the bias for BA009BMZ is again evident, the bias now removed.

e) 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.

f) Receipt of reports from two of the units, BA025LFZ and LV005VNZ has been patchy, due to suspected problems with their antennae. The antenna for the former was changed on 14th December which has improved its report availability. The same operation for LV005VNZ had been carried out in late October leading to some improvement in data receipt.

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

a) It has been noted that a number of reports that contain erroneous values (more especially of wind speed and direction) are associated with reports that are received between (i.e. in addition to) the standard 7 minute reports during level flight. This seems particularly true for BA026LGZ and LH005VNZ. The reason for this is not known.

b) 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.



#### 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, the average number of reports received per day and an estimate of the number of complete ascents and complete descents that were not received.

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 :-

BA025LFZ : Oct 17th - 25th, Oct 27th - Nov 20th, Nov 30th - Dec 15th (suspected antenna fault)

BA027LJZ : Nov 26th - end of period (fault being investigated by British Airways)

BA029LYZ :- Dec 20th - Jan 2nd (suspected communications problem. Data were not being received via EESA)

KL012UMZ : Jul 15th - Nov 5th (aircraft out of service)

Over the 3 month period as a whole an average of 1035 reports per day were received from all units combined, compared with 889 in the previous three-month period. Fig 3 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 3 are not strictly comparable.

##### 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, BA027LJZ, BA028LLZ 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 75.9% of reports being received within one hour of observation time and 99.4% 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 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 4 to 14 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 4 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.



## 6) SUMMARY

- i) Overall timeliness and quality of the data from the existing operational units remain high.
- ii) Availability of data improved in the latest quarter compared to the previous three month period. Reports from one new unit were received in the latest quarter compared to the previous quarter.
- iii) Temperatures from 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 most of the units.

## 7) AMDAR DATA FROM DUTCH AIRCRAFT

AMDAR coded data from Dutch aircraft are also being monitored. These aircraft have call sign of the form KL1nnaa where nn are two digits and aa are two alphabetic characters. 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.

The number of units reporting varied considerably during the period, varying from 19 reporting on at least one day during October to 6 reporting on at least one day during December. Due to the fact that there are frequent gaps in the sequences of reports, it is difficult to monitor their quality or to produce meaningful statistics. However, visual checks of the reports suggest there are no obvious problems with the quality of data from any of the units.



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
Lufthansa	747	LH005VNZ	23/ 6/93

@ Unit identifier reported as BA000NDZ before 4/10/92

= Unit identifier reported as PH012UMZ before 11/5/93



Table 2 : Summary of data received and missing data

UNIT	No. reports	Percentage via				AV	No. missing events	
		KWBC	EESA	RJTD	NR		AS	DS
BA000NEZ	12311	42	58	0	9	148	13	27
BA001LLZ	11216	53	47	0	8	134	24	46
BA008DJZ	10453	51	49	0	14	134	15	21
BA009BMZ	11883	55	45	0	17	158	27	21
BA010PUZ	12929	48	52	0	5	149	15	33
BA025LFZ	1524	20	80	0	53	39	18	6
BA026LGZ	8373	19	81	0	10	102	31	34
BA027LJZ	5521	28	72	0	41	108	17	23
BA028LLZ	10258	34	66	0	5	118	40	49
BA029LYZ	103	100	0	0	-	-	-	-
KL012UMZ	6645	30	70	0	44	138	21	26
LH005VNZ	3965	14	86	0	23	57	42	54
TOTAL	95181							

KEY :

NR : Number of days with no reports

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

AS : Complete ascent missing

DS : Complete descent missing



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	25.5	43.1	30.9	0.2	0	0.2	0	549	50
BA001LLZ	21.7	42.8	35.0	0.3	0.2	0	0	233	52
BA008DJZ	24.6	49.4	25.4	0.4	0.1	0	0	225	46
BA009BMZ	25.2	48.7	25.2	0.4	0.5	0	0	312	47
BA010PUZ	29.9	50.8	18.6	0.3	0.3	0.1	0	561	44
BA025LFZ	33.7	41.7	23.4	1.2	0.1	0	0	184	46
BA026LGZ	36.1	42.9	20.2	0.5	0.3	0	0	204	44
BA027LJZ	32.7	41.8	25.0	0.3	0	0.2	0	497	46
BA028LLZ	28.2	41.6	29.9	0.2	0	0.1	0	488	49
KL012UMZ	34.1	53.7	11.9	0	0.2	0	0	265	40
LH005VNZ	41.4	44.7	13.7	0.2	0.1	0	0	246	37
OVERALL	30.4	45.5	23.5	0.3	0.2	0.1	0	561	46

Note :

Statistics from BA029LYZ are omitted due to lack of data.



Table 4 : Summary of reporting frequencies

Unit	<-LEVEL FLIGHT- X --- ASCENT --->				<--- DESCENT ---->							
	No.	Mean	Min	Max	No.	Mean	Min	Max	No.	Mean	Min	Max
BA000NEZ	50	7.0	6.8	7.0	57	9.4	8.4	11.1	61	10.4	8.8	13.0
BA001LLZ	74	7.0	6.5	7.0	46	9.4	8.8	10.3	44	10.4	8.8	11.9
BA008DJZ	41	7.0	6.2	7.0	38	9.4	8.4	11.1	55	10.2	8.8	11.9
BA009BMZ	65	6.3	4.9	7.0	35	9.9	9.2	10.0	45	10.3	8.8	13.0
BA010PUZ	51	7.0	7.0	7.0	70	9.5	8.4	13.8	65	10.1	8.8	13.0
BA025LFZ	3	6.7	6.1	7.0	6	9.6	8.8	10.0	22	10.3	8.8	11.9
BA026LGZ	67	7.0	5.6	7.0	48	9.2	8.0	10.0	42	10.4	8.8	13.0
BA027LJZ	45	7.0	6.3	7.0	29	9.2	8.0	10.0	23	10.0	8.8	10.7
BA028LLZ	72	7.0	6.1	7.0	45	9.3	8.0	10.0	48	10.2	7.7	13.0
KL012UMZ	0	-	-	-	18	9.4	7.7	10.7	18	10.3	8.8	13.0
LH005VNZ	37	6.9	5.1	7.0	31	9.3	8.4	10.0	4	10.4	9.6	10.7

Notes :

- 1) KL012UMZ - no data for level flight since levels fluctuate frequently (see text)
- 2) Statistics for BA029LYZ are omitted due to lack of data.

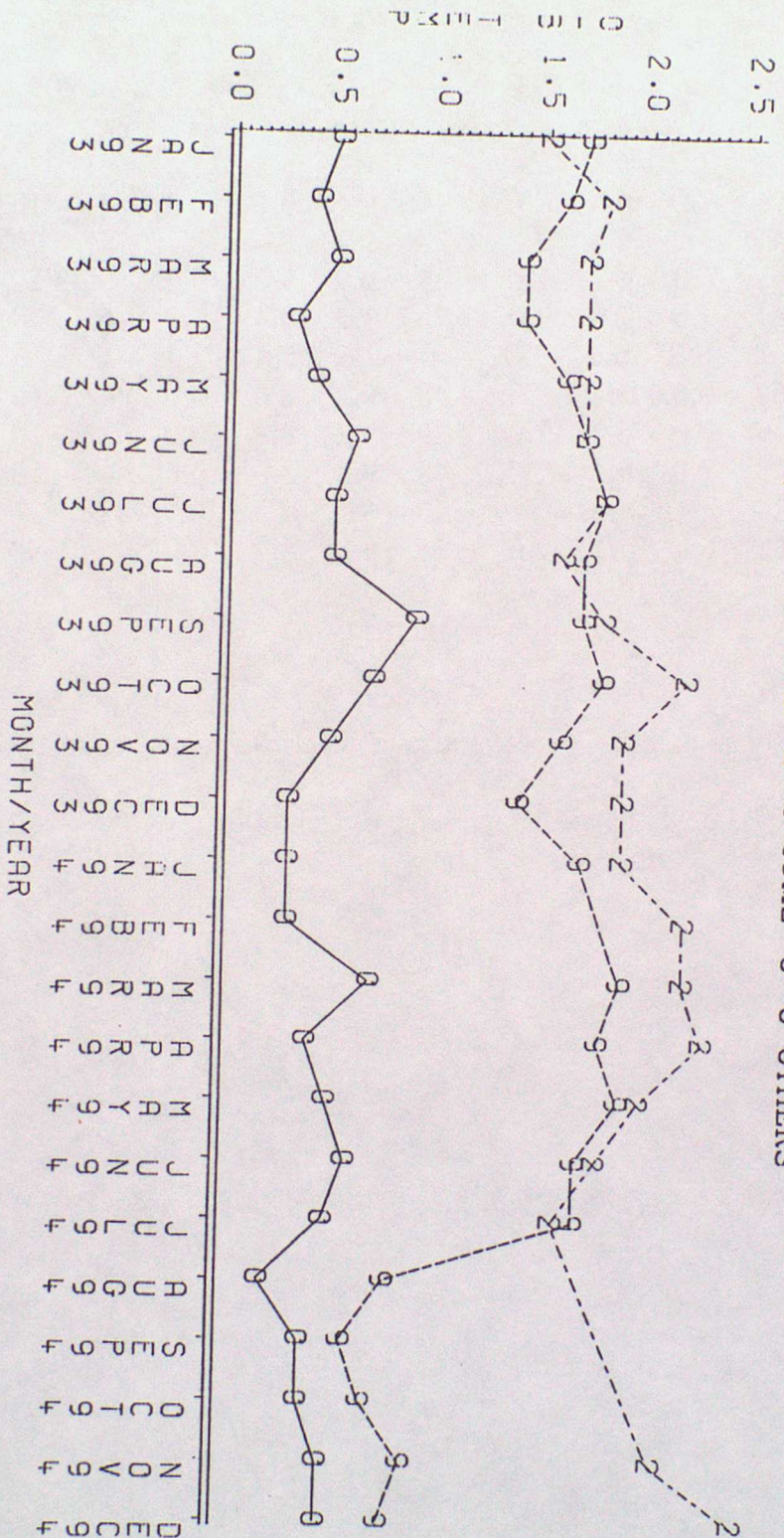


# Figure 1

Monthly mean ASDAR O-B temperatures (deg C)

150-350 hPa

Key : 9--9 9BMZ 2--2 2UMZ 0--0 OTHERS



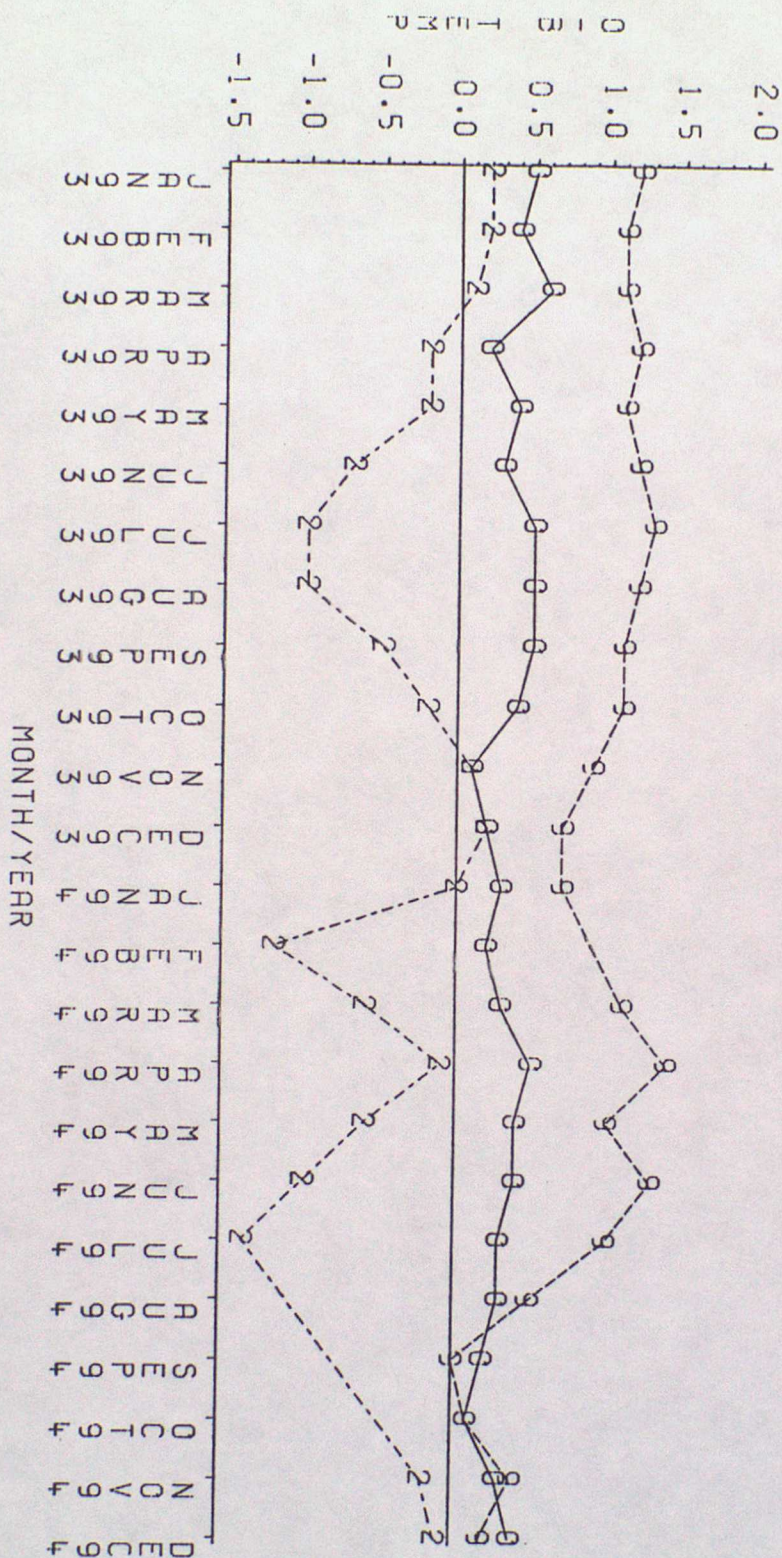


# Figure 2

Monthly mean ASDAR 0-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

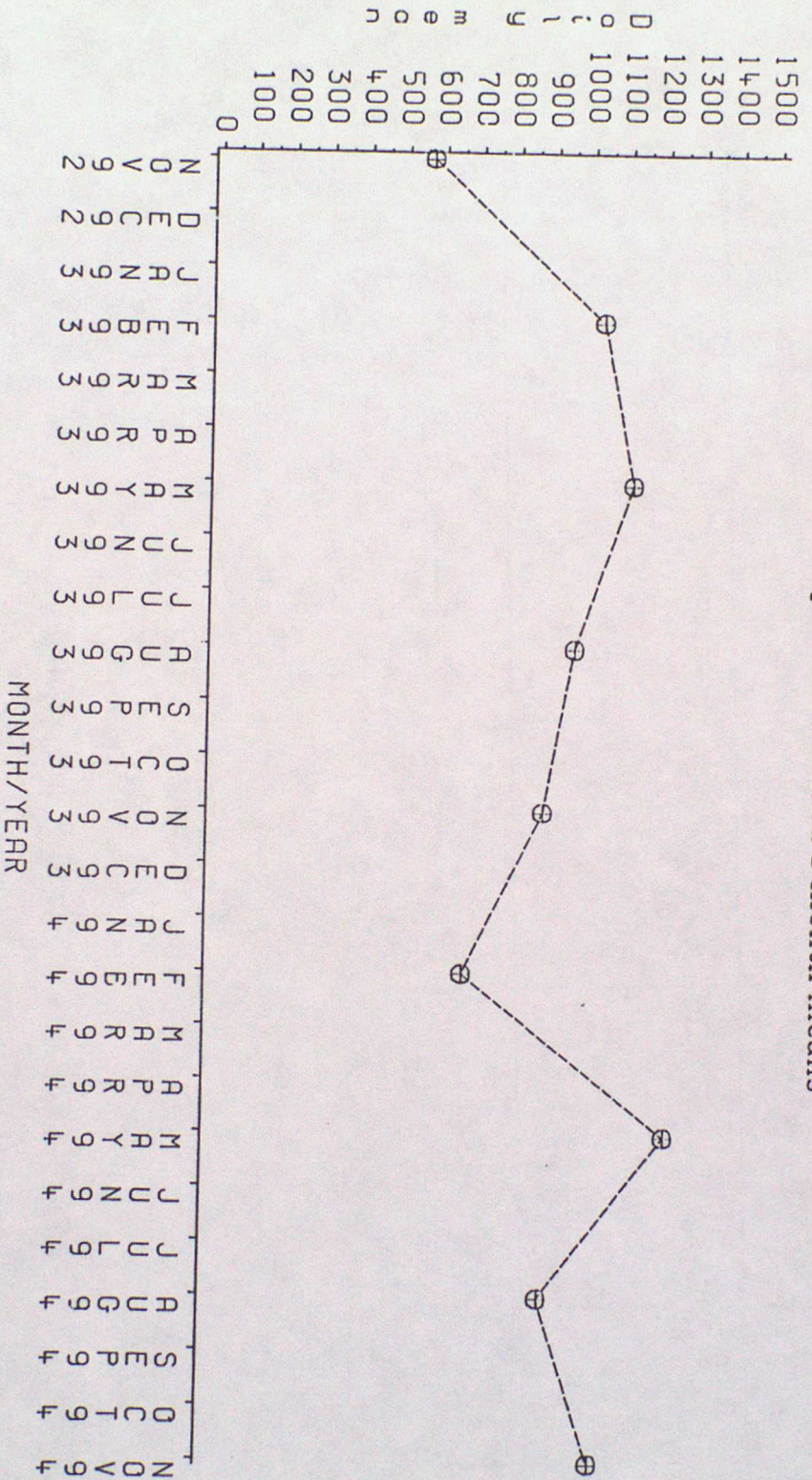




FIGURE 4 : BA000NEZ - MODEL COMPARISON RESULTS (950-150 hPa)

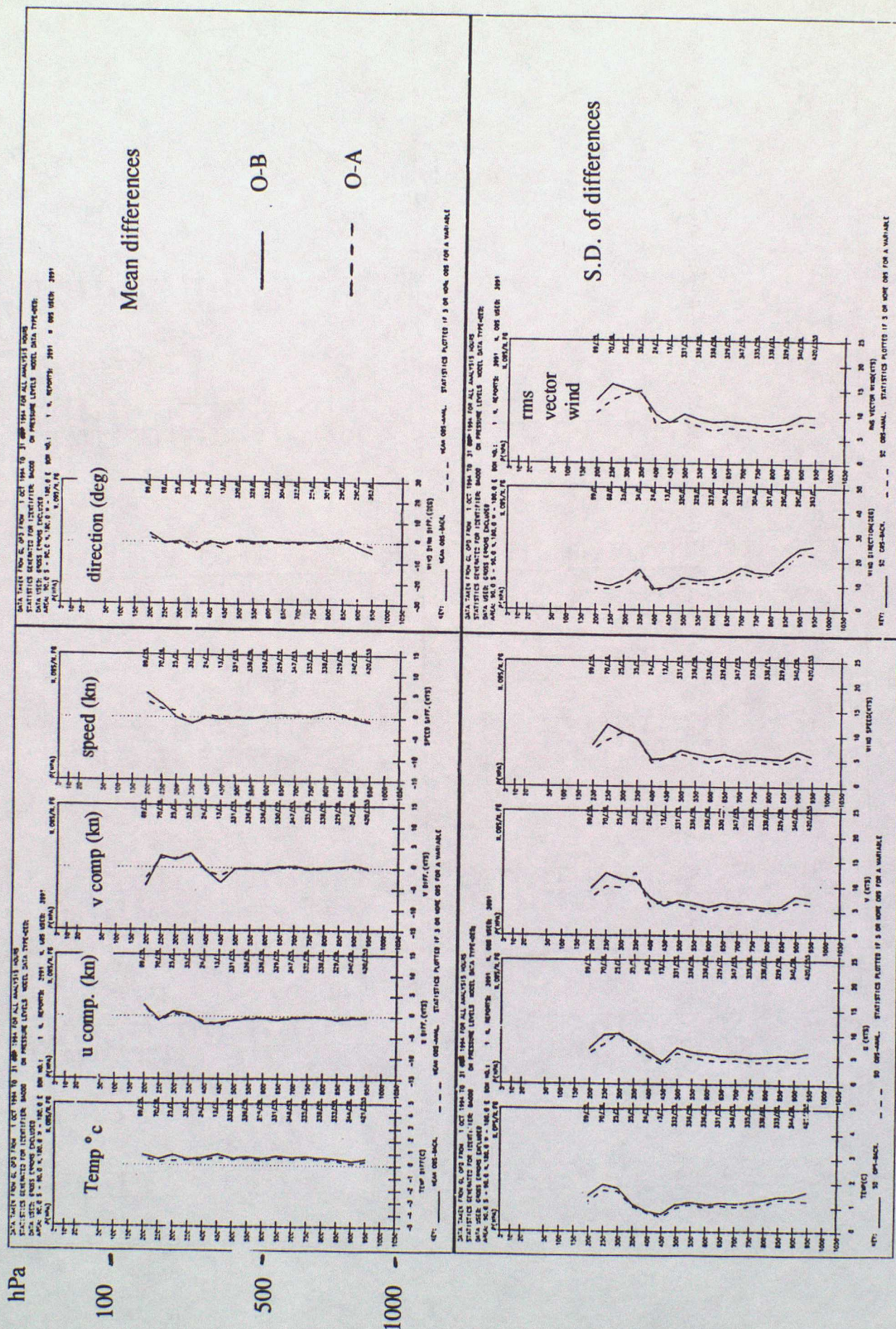




FIGURE 5 : BA001LLZ - MODEL COMPARISON RESULTS (950-150 hPa)

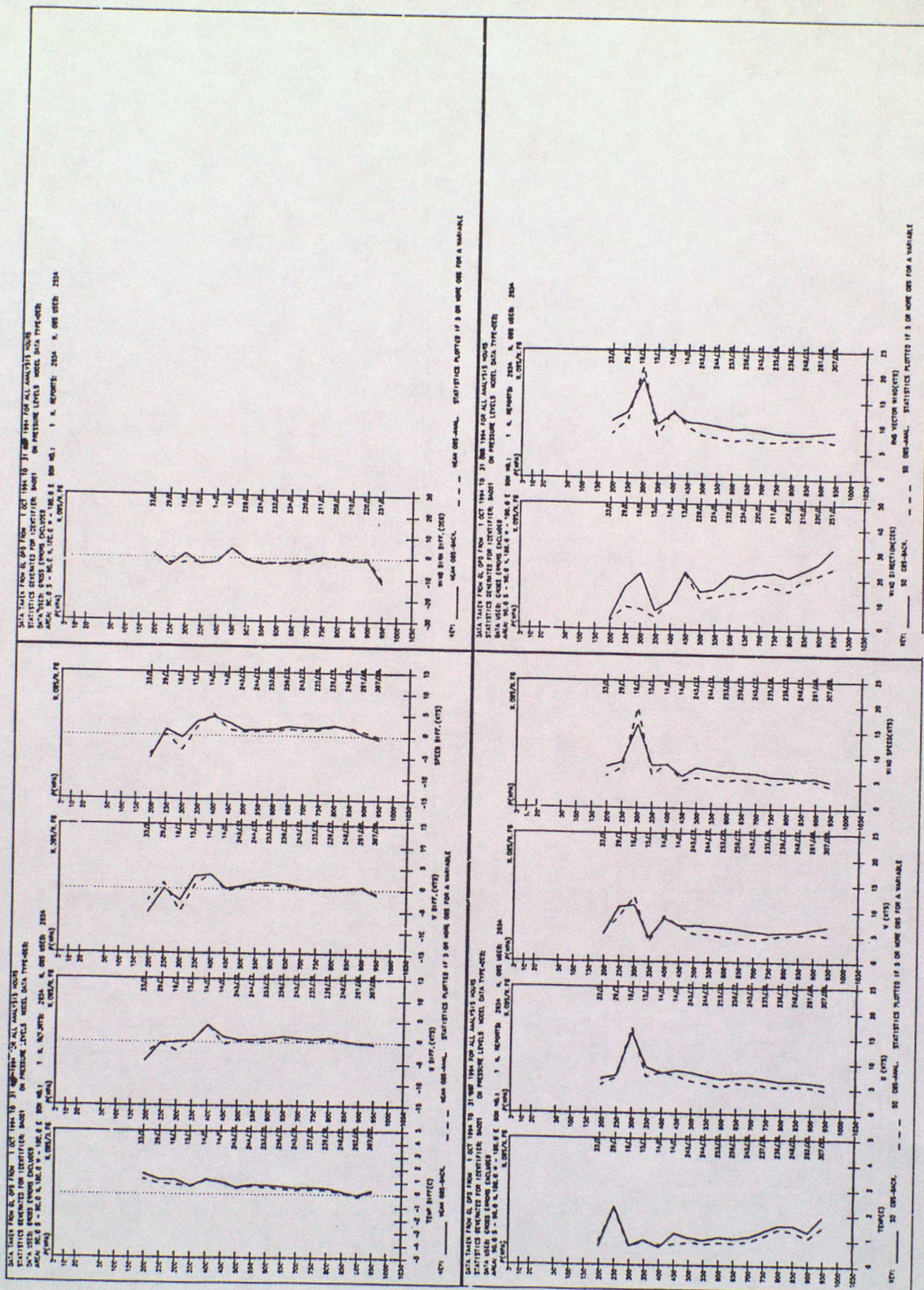




FIGURE 6 : BA008DJZ - MODEL COMPARISON RESULTS (950-150 hPa)

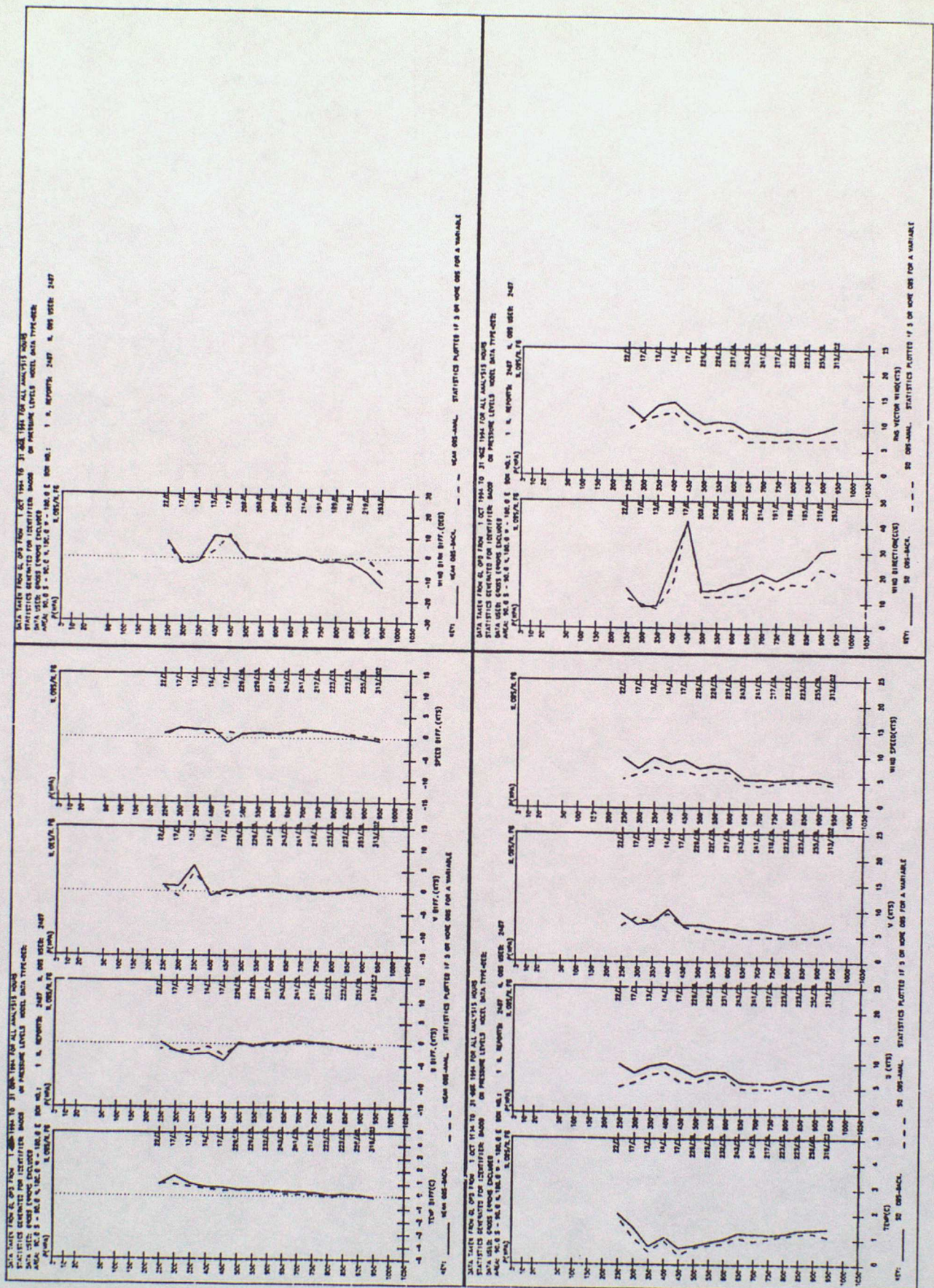




FIGURE 7 : BA009BMZ - MODEL COMPARISON RESULTS (950-150 hPa)

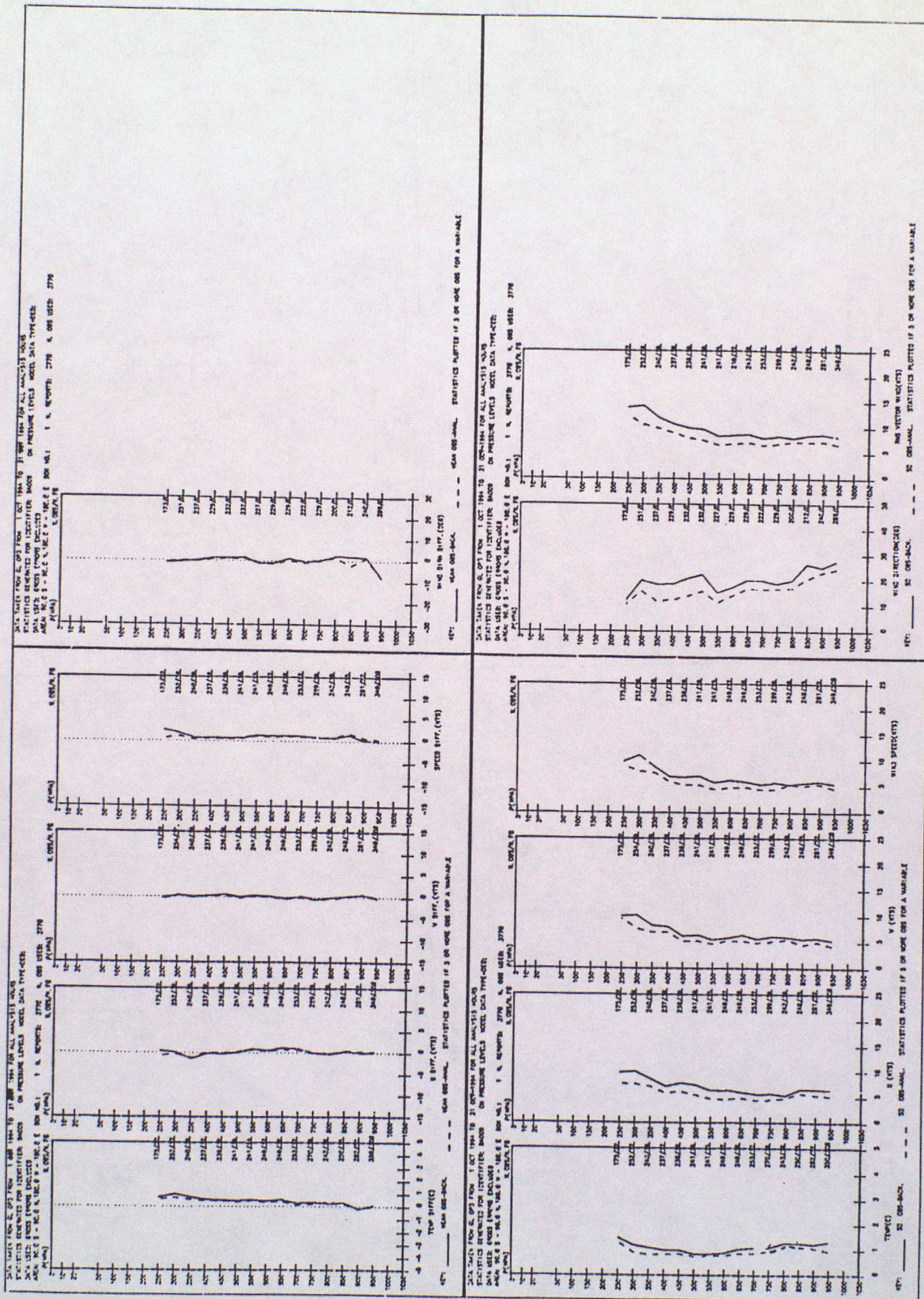




FIGURE 8 : BA010PUZ - MODEL COMPARISON RESULTS (950-150 hPa)

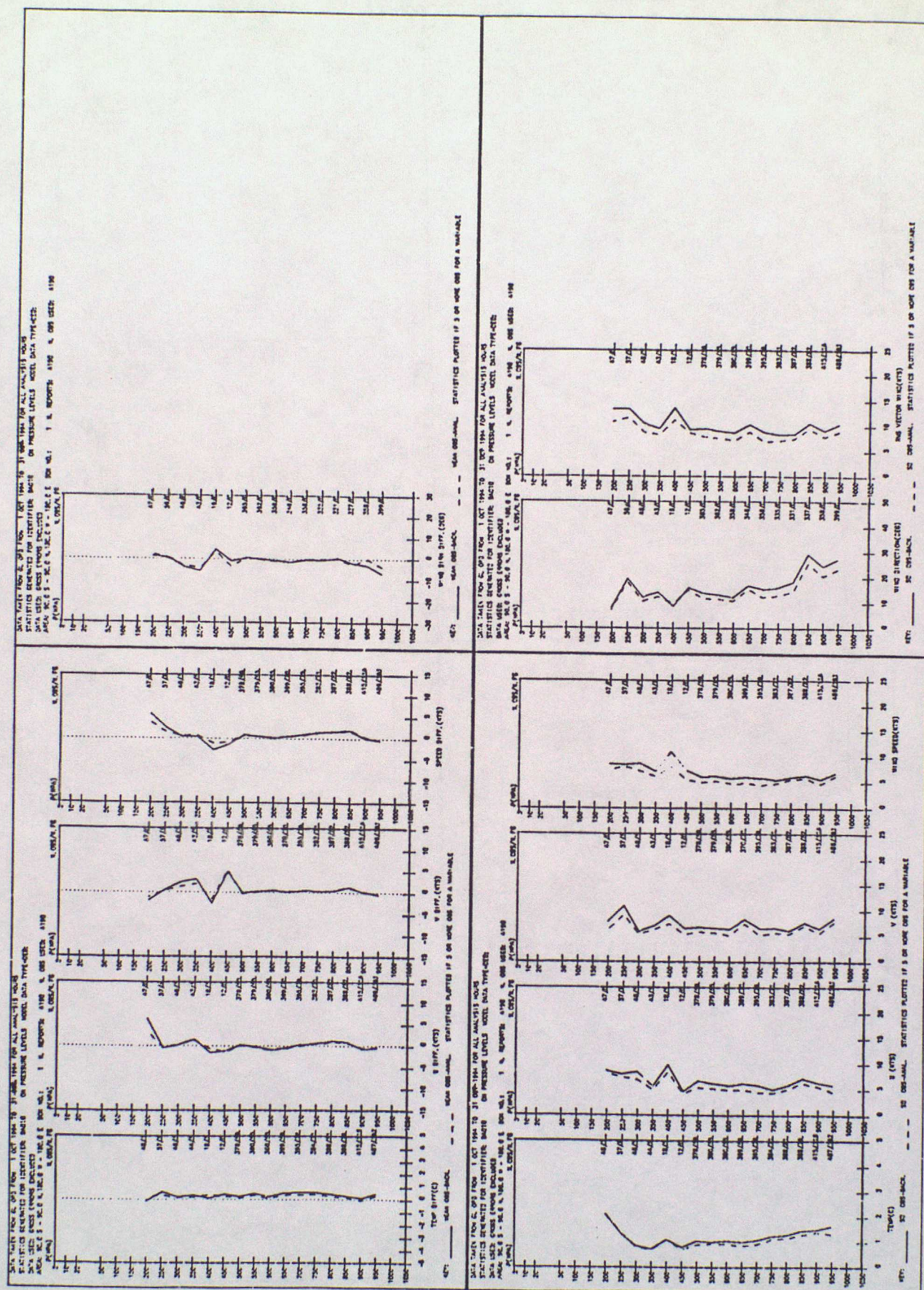




FIGURE 9 : BA025LFZ - MODEL COMPARISON RESULTS (950-150 hPa)

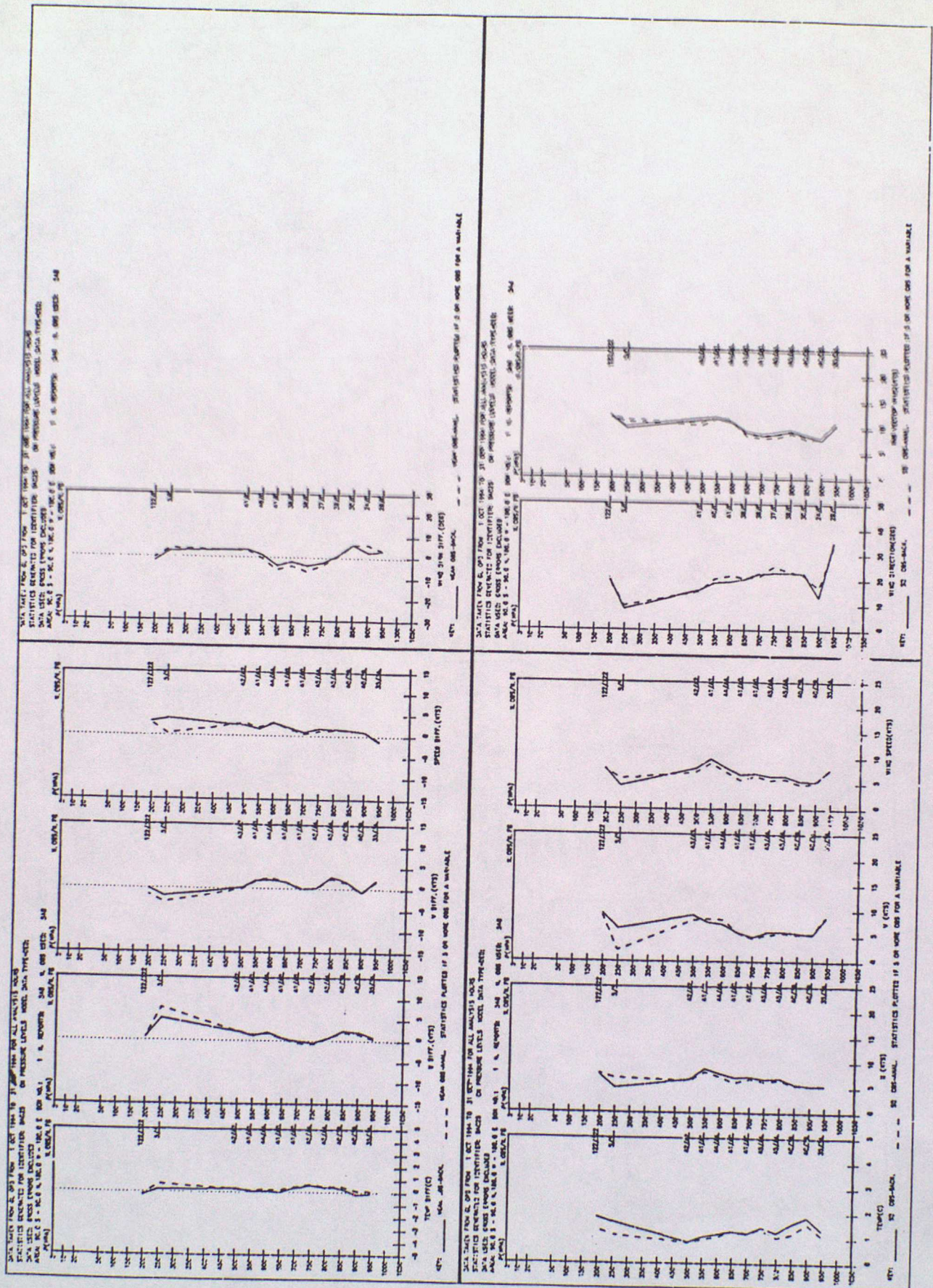




FIGURE 10 : BA026LGZ - MODEL COMPARISON RESULTS (950-150 hPa)

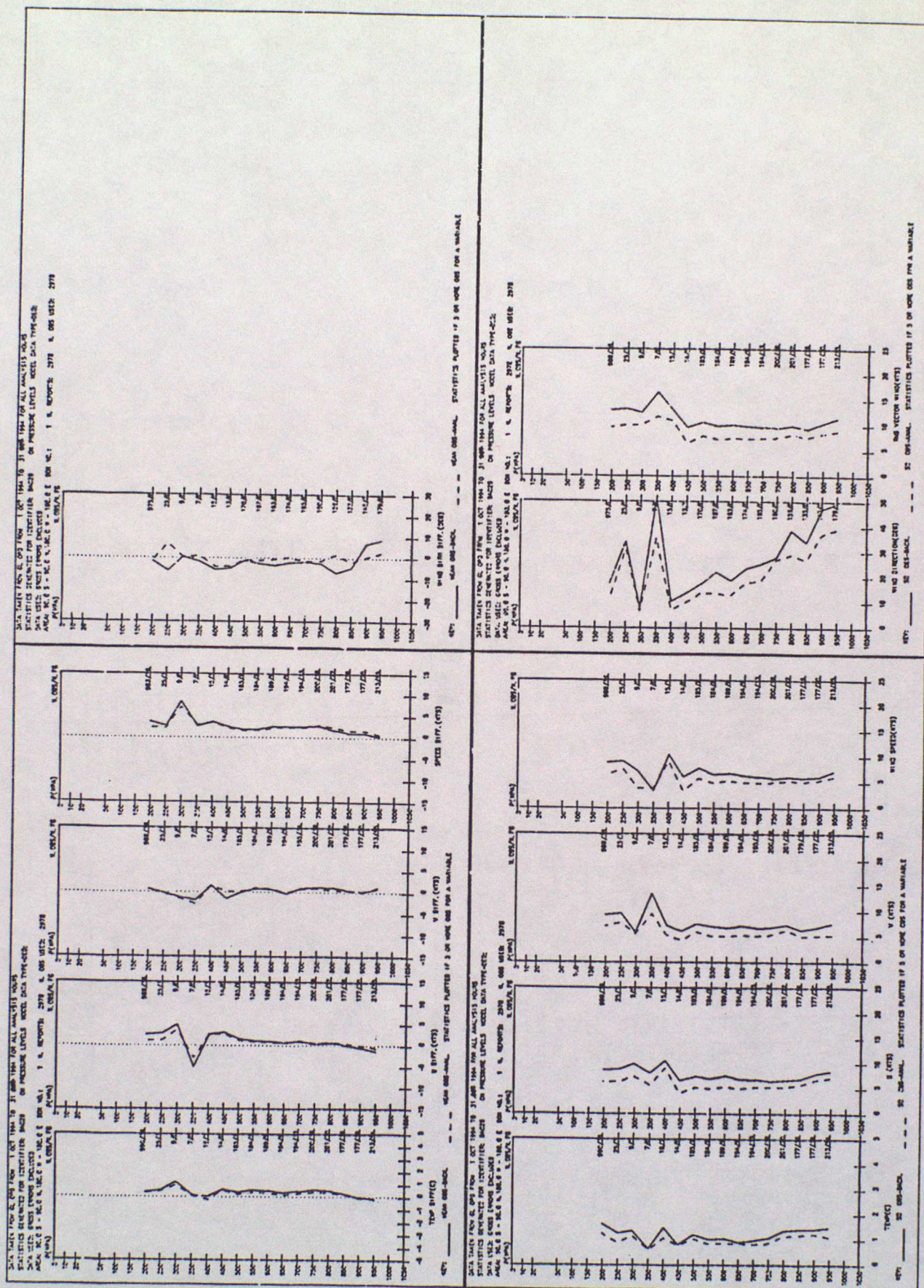




FIGURE 11 : BA027LJZ - MODEL COMPARISON RESULTS (950-150 hPa)

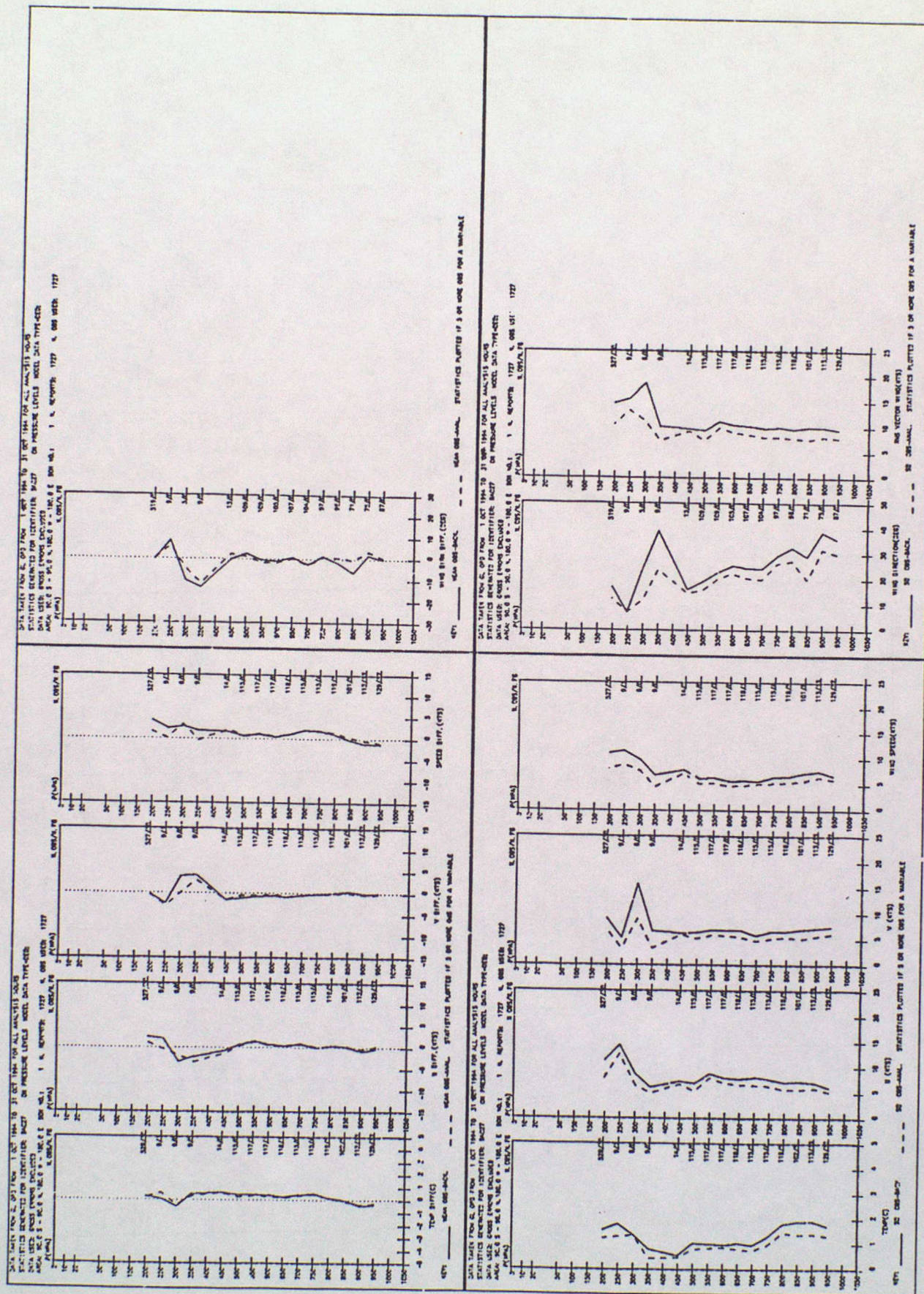




FIGURE 12 : BA028LLZ - MODEL COMPARISON RESULTS (950-150 hPa)

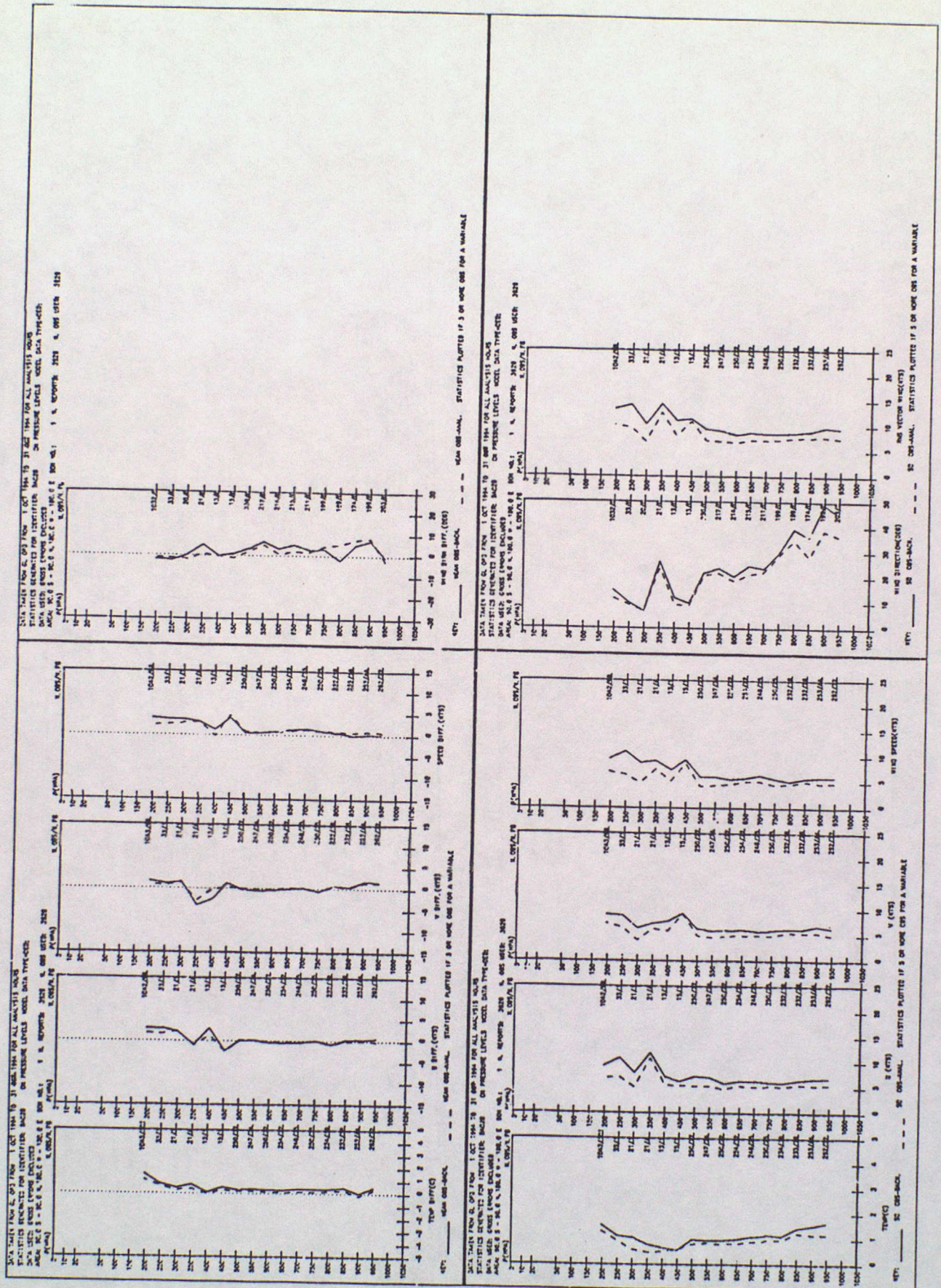




FIGURE 13 : KL012UMZ - MODEL COMPARISON RESULTS (950-150 hPa)

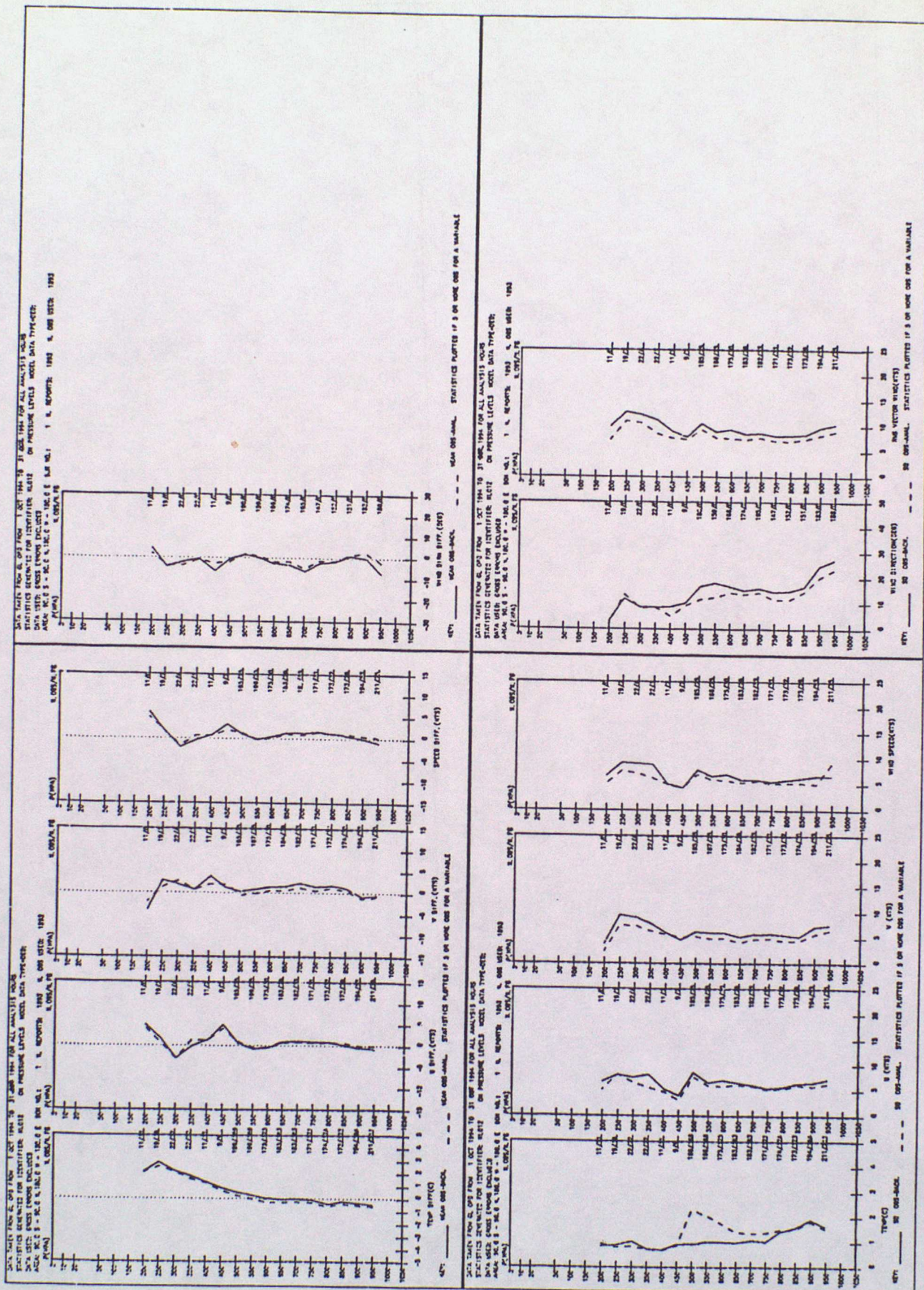




FIGURE 14 : LH005VNZ - MODEL COMPARISON RESULTS (950-15)

