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ASDAR MONITORING REPORT

JULY - SEPTEMBER 1995

S.G. Smith

Headquarters, Bracknell

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## **THE ASDAR CENTRE**

### **ASDAR MONITORING REPORT : JULY - SEPTEMBER 1995**

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Produced by :

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

Tel : 01344 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

Data from fourteen ASDAR units were received in the SDB during the period, one more than 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 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, 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 Telecommunications System. Some reports are also received at Bracknell but not stored in the SDB (see 4(i) below)

d) Temperature biases - there had been 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 was traced to a software error. To correct this, the ASDAR Conditioning Module was changed for KL012UMZ on 4th August, for KL014URZ on 7th August and for KL013UPZ on 29th September. Statistics show that the first two of these ASDARs are now reporting unbiased temperatures. It will take a little longer for statistics to be gathered to show that the error has been corrected for KL013UPZ.

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) The number of reports received per day from BA025LFZ, BA028LLZ, BA029LYZ and LH005VNZ has continued to be less than from other units. This may be due to problems with the antenna. The antenna on BA029LYZ was replaced on 20th July which gave some improvement.

g) No reports were received from BA027LJZ until 1st September due to an antenna fault.

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

a) A number of units occasionally had a single report containing a spuriously high wind speed near the ground on ascent or descent (eg a report near the ground having a speed of 60 knots with the reports immediately before and after recording less than 20 knots.) This feature has not been noticed prior to this period and the reason for it is as yet unknown.

b) The quality of wind reports from BA010PUZ from mid-July to mid-September was poorer than for the other units. This was largely due to a relatively large number of erroneous "LW" reports (see above) and of erroneous high speeds near the ground (also see above.) There were also a relatively high number of missing or out-of-range air data parameters during the period. Due to the poor quality, wind reports from this unit were excluded from the numerical weather prediction (NWP) models from August onwards. The Air Data Computer was changed in August in an attempt to remedy the problems. It is not known what has caused the number of erroneous reports to fall since mid-September.



c) There were a batch of poor quality reports from KL012UMZ on 12th, 14th-15th and 17th August. The Air Data Computer was changed twice to remedy the problem and quality has been satisfactory since. However, based on August's statistics, winds from this unit were omitted from the NWP in September.

d) There were erroneous wind speeds and temperatures from BA028LLZ on 16th July which were cured by changing the Air Data Computer.

#### 4) MONITORING RESULTS

##### i) Data Availability

ASDAR reports are received via different collecting centres depending on the location of the aircraft. The majority are from Darmstadt (EESA) and Washington (KWBC). 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 different centres, the totals are likely to include some duplicates.

As this report was being prepared, it was discovered that there are some reports that are not being stored in the SDB which are being stored in a different data-bank (the MetDB). The SDB contains only reports that are sent in character format, while the MetDB in addition stores reports that are sent in "BUFR" (a form of binary) code. It appears that at present about 10% of reports that are stored in the MetDB are not stored in the SDB. Hence the number of reports received that are quoted in this report and have been given in previous reports may be an underestimate of the true number by up to about 10%. It is also worth noting that there is duplication of ASDAR reports in the MetDB, where reports have been sent in both BUFR and character form as well as where the same report has been sent by different collecting centres.

Units not reporting for more than 7 consecutive days during the period were :-

BA009BMZ : Jul 25th - Aug 8th - aircraft maintenance

BA027LJZ : No reports until 1st September - antenna fault. Antenna replaced.

BA028LLZ : Jul 3rd - 13th - aircraft maintenance

BA029LYZ : Jul 15th -24th -aircraft maintenance

Over the 3 month period as a whole an average of 1522 reports per day were received in the SDB from all units combined, compared with 1449 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 with the rest also flying to Asia, Africa, Australasia and South America. Figure 3 shows the coverage for one particular day in the period, September 29th.

#### iii) Data Timeliness

Speed of data receipt continues to be good with 75.5% of reports being received within one hour of observation time and 98.0% within two hours, over all reporting units. Average delay was 47 minutes. The receipt delay is taken to be "time of receipt in SDB - time of report" and reports where the time is missing are ignored.

#### 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, statistics have been compiled of 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. The pressure differences for ascent and descent 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.

All the reporting units achieved the "report every 7 minutes" target in level flight and 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 6 of the units. (The maximum mean separation over all units was 10.3 hPa.)

### 5) DATA QUALITY

Figures 4 to 17 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. 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, problems with the Air Data Computer (ADC) caused corrupt data to be received from one ASDAR on 16th July, another in mid-August and suspected problems with the ADC caused intermittent corrupt data from another unit from mid-July to mid-September.

ii) The total number of reports received in the Synoptic Data Bank at Bracknell increased by 5% in the latest quarter compared to the previous three month period, with the number of units reporting increasing by one.

iii) Statistics produced have shown that long-term temperature biases affecting the "KL"-prefixed units have now been removed from two of the three units. Those from the third should also now have been removed as from the end of the period.

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 about half of the units.

## 7) AMDAR DATA FROM DUTCH AIRCRAFT

AMDAR coded data from Dutch aircraft are also being monitored. In the latest quarter nine units reported : KL103FD, KL130CA, KL131CB, KL132CC, KL133CD, KL134CE, KL135CF, KL136CG and KL137CH. 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 identifier reported as PH012UMZ before 11/5/93



Table 2 : Summary of data received

UNIT	No. reports	NR	AV
BA000NEZ	12238	5	141
BA001LLZ	11670	7	137
BA008DJZ	12876	4	146
BA009BMZ	10422	18	141
BA010PUZ	14417	1	158
BA025LFZ	8277	3	93
BA026LGZ	10698	0	116
BA027LJZ	2977	64	106
BA028LLZ	5493	16	72
BA029LYZ	6626	11	82
KL012UMZ	12385	2	138
KL013UPZ	14154	1	156
KL014URZ	11039	4	125
LH005VNZ	6737	16	89

TOTAL 140009

KEY :

NR : Number of days with no reports

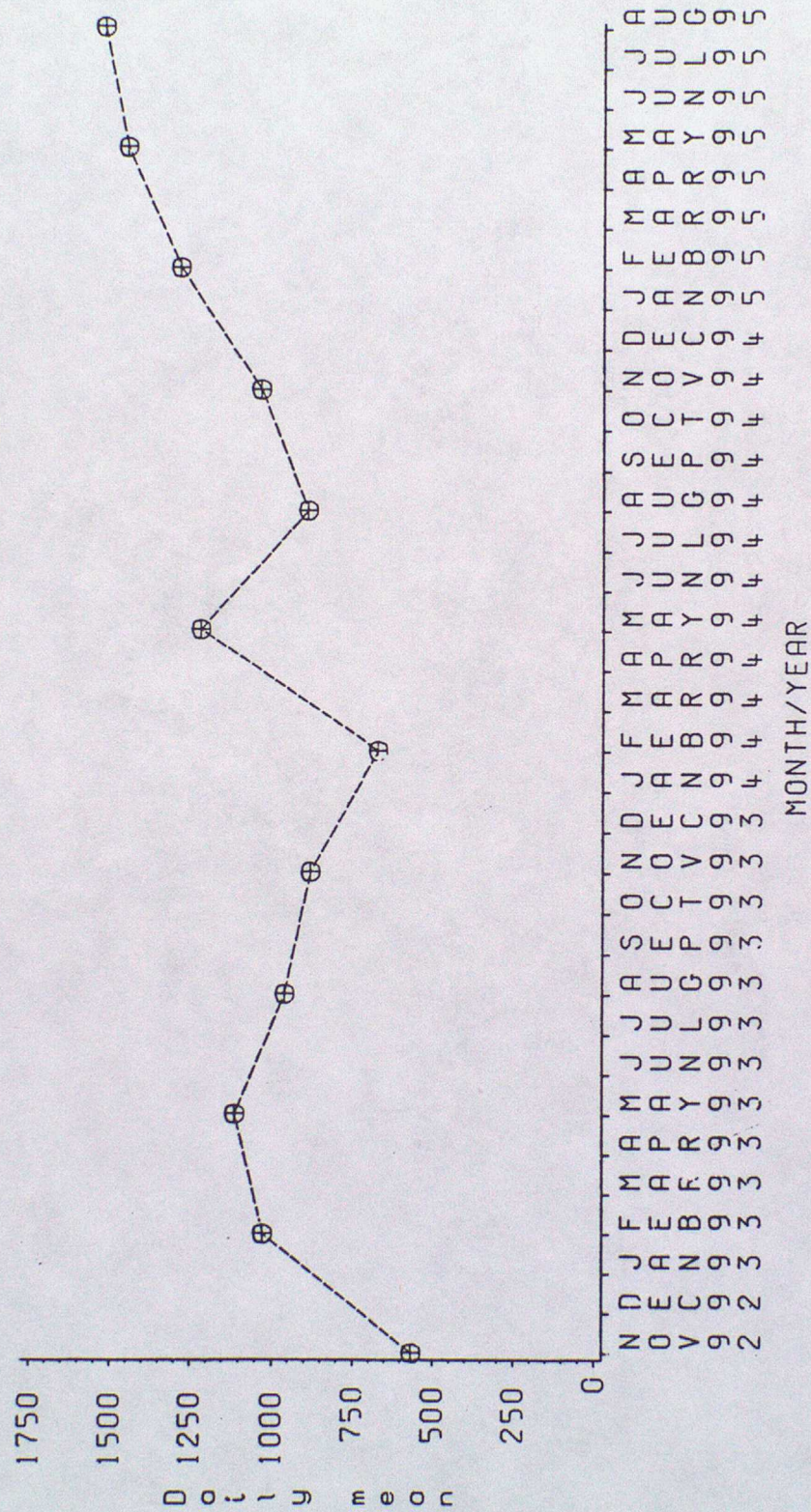
AV : Average number of reports per day (excluding days with no reports)



# 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

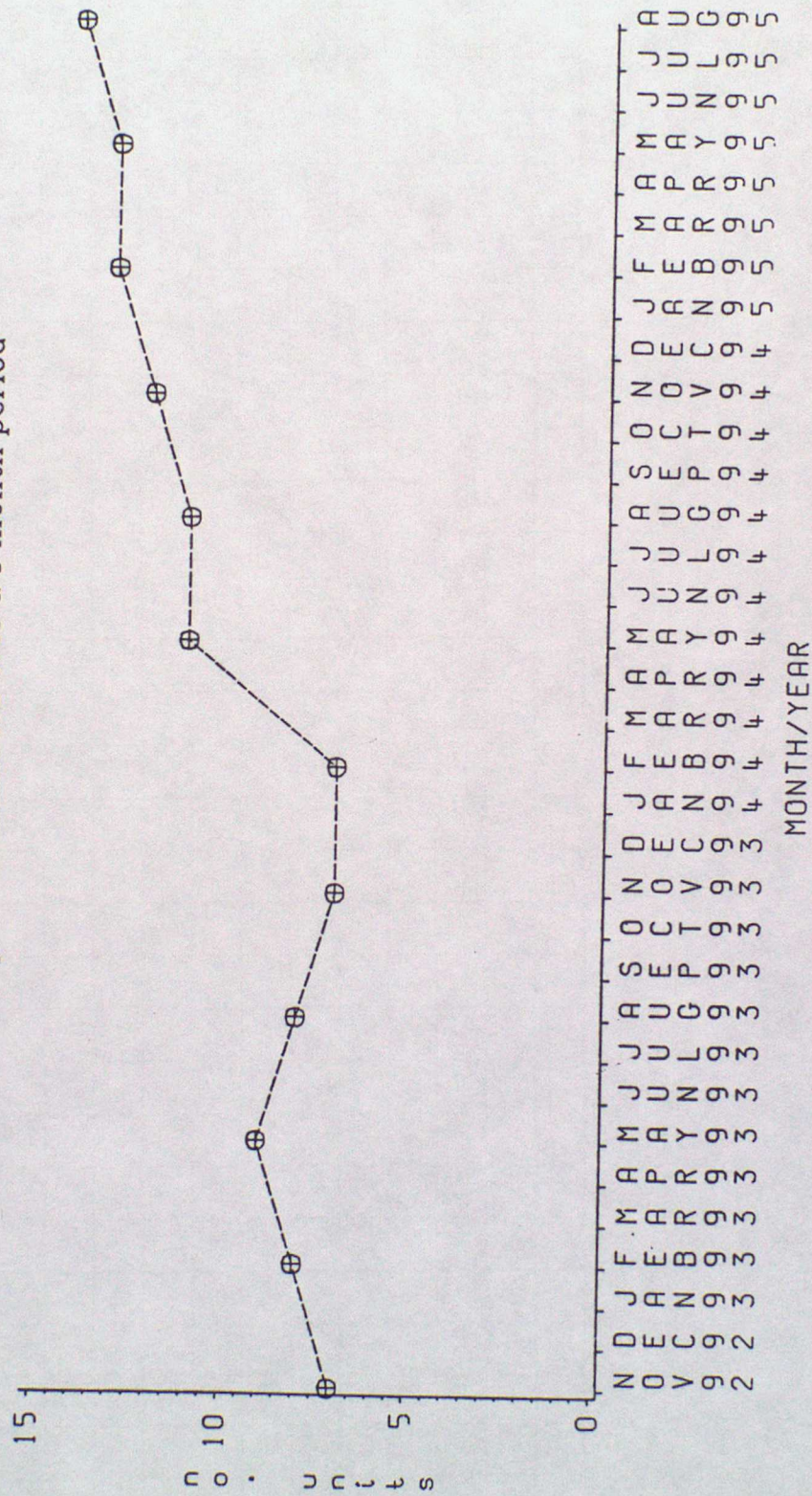




FIGURE 3

ASDAR COVERAGE - 29 SEPTEMBER 1995

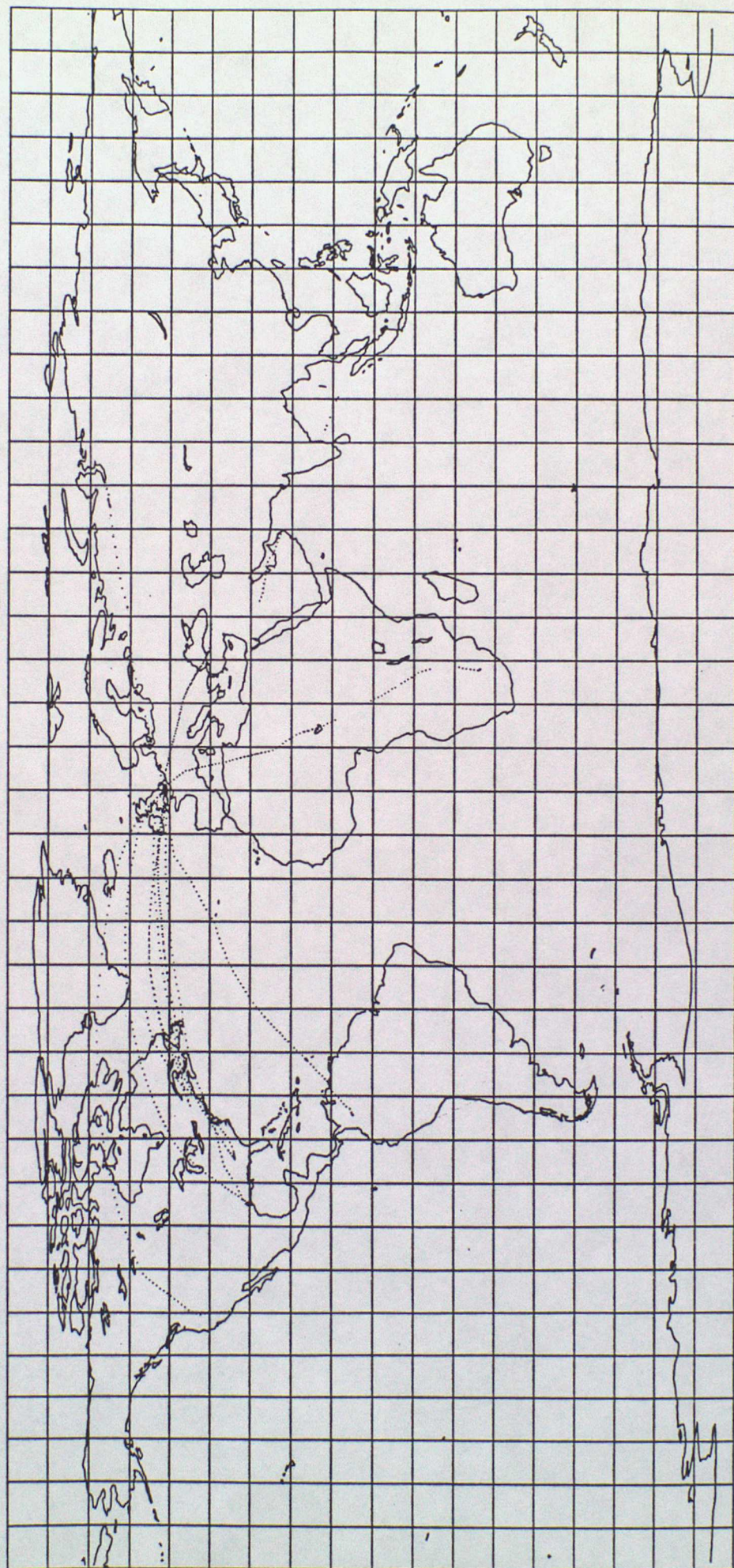




FIGURE 4 : BA000NEZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

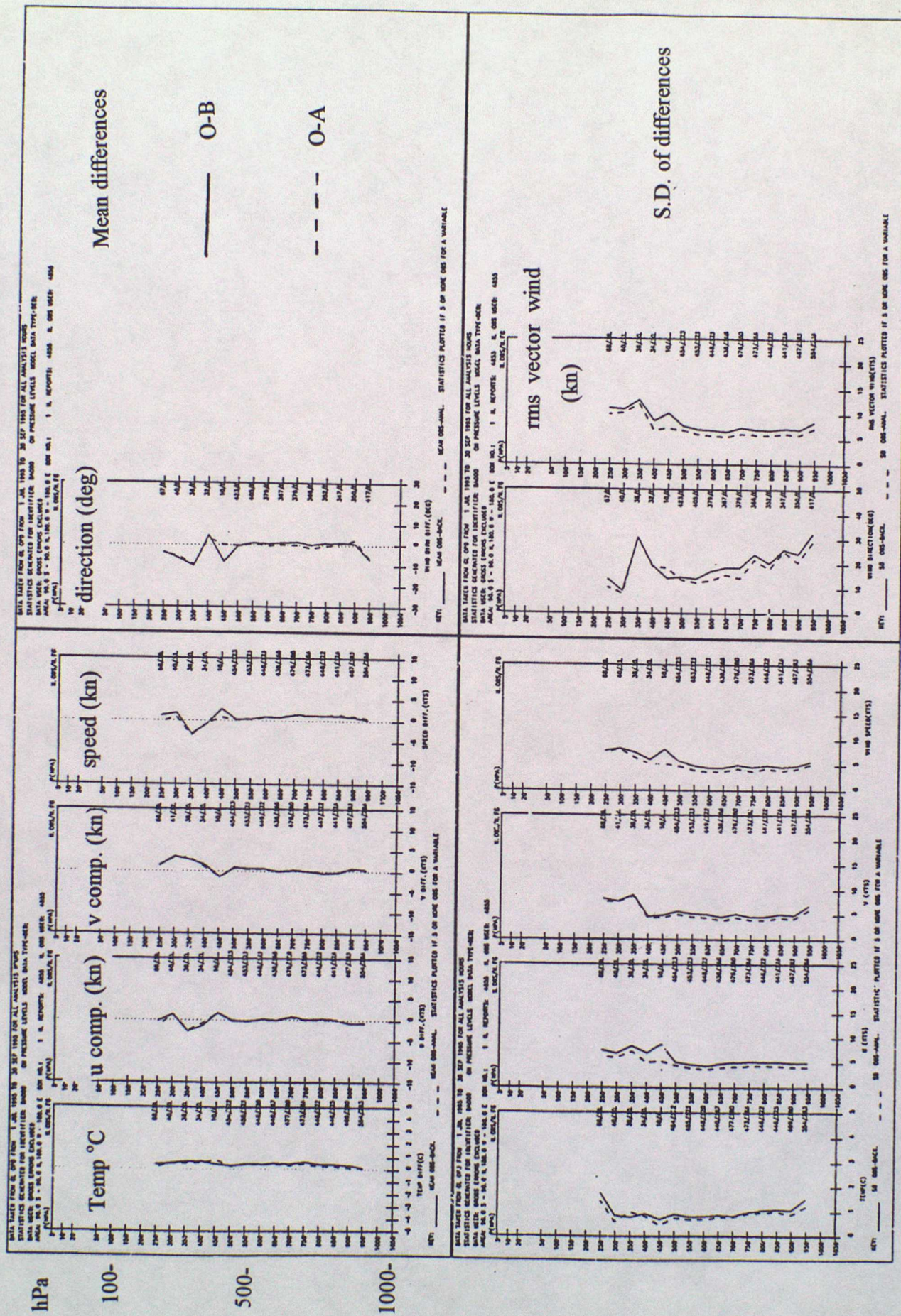




FIGURE 5 : BA001LLZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

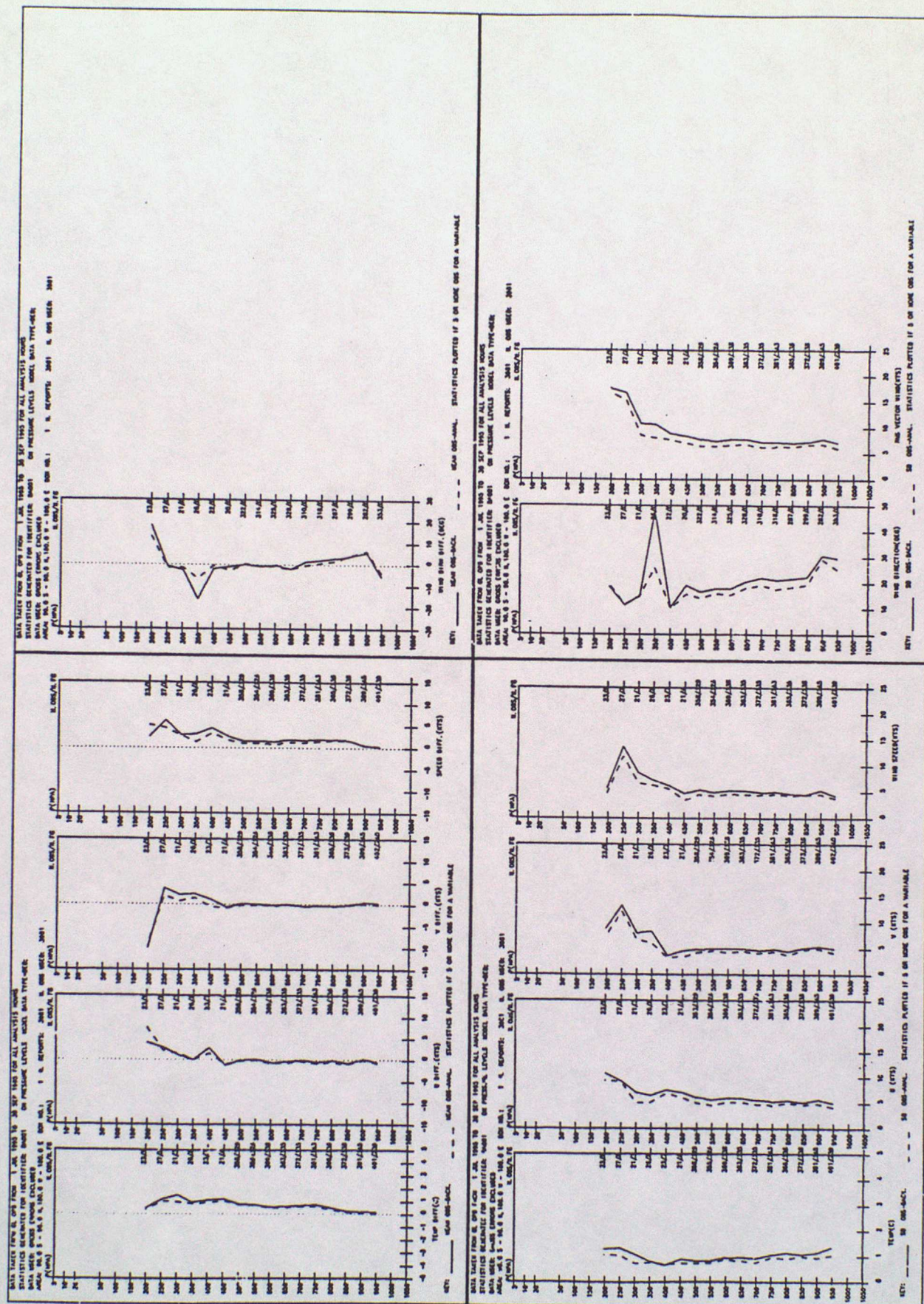




FIGURE 6 : BA008DIZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

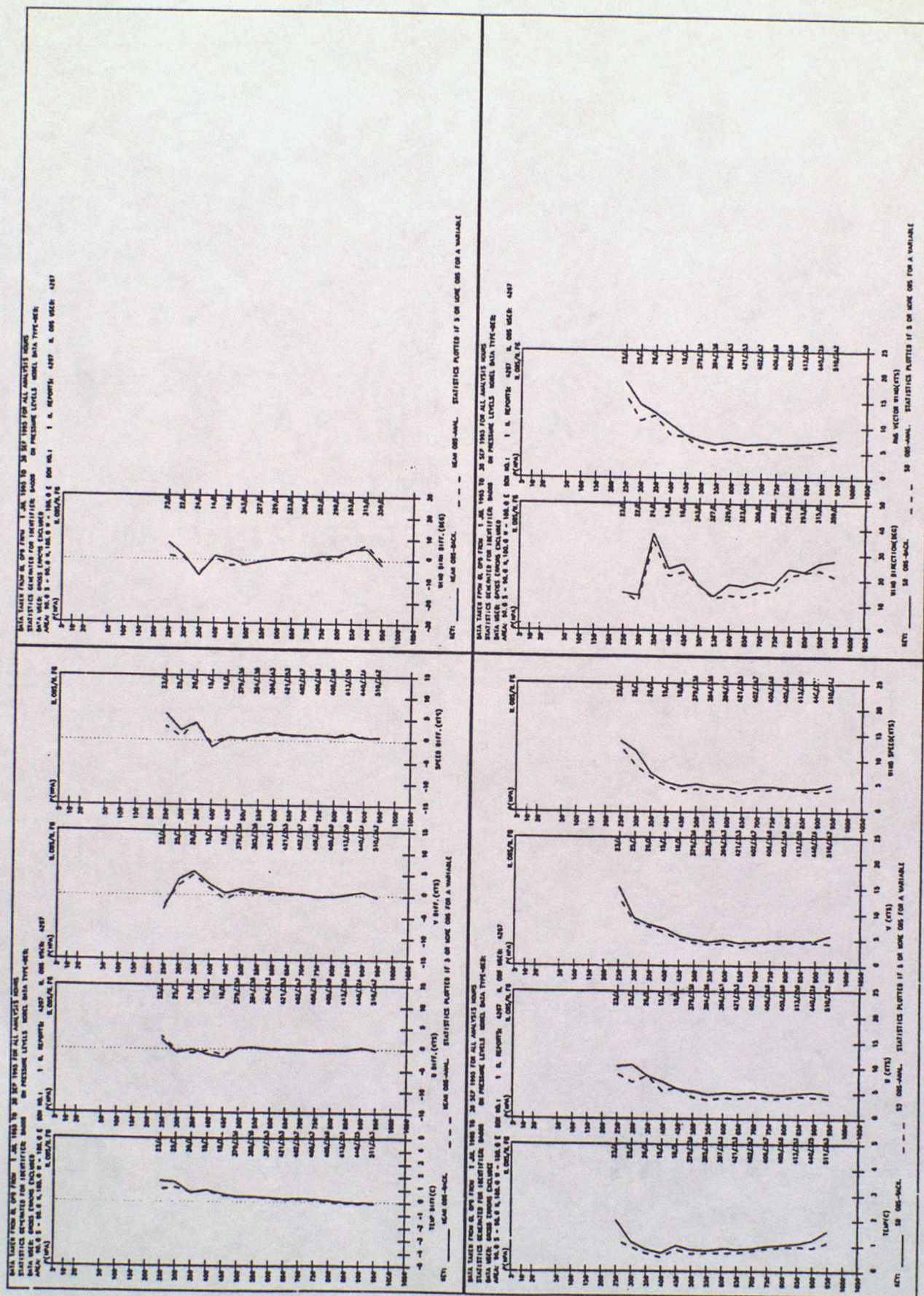




FIGURE 7 : BA009BMZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

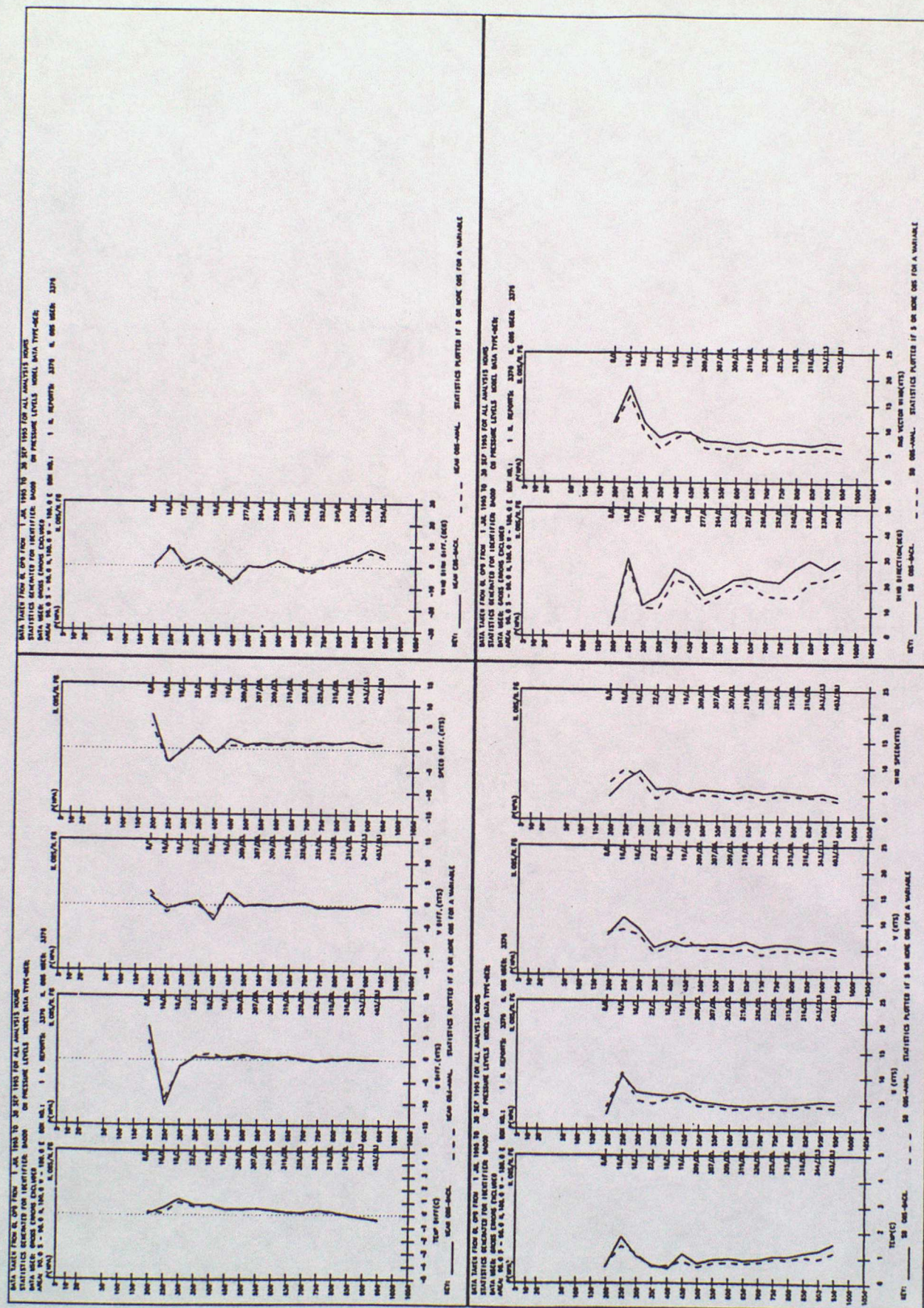
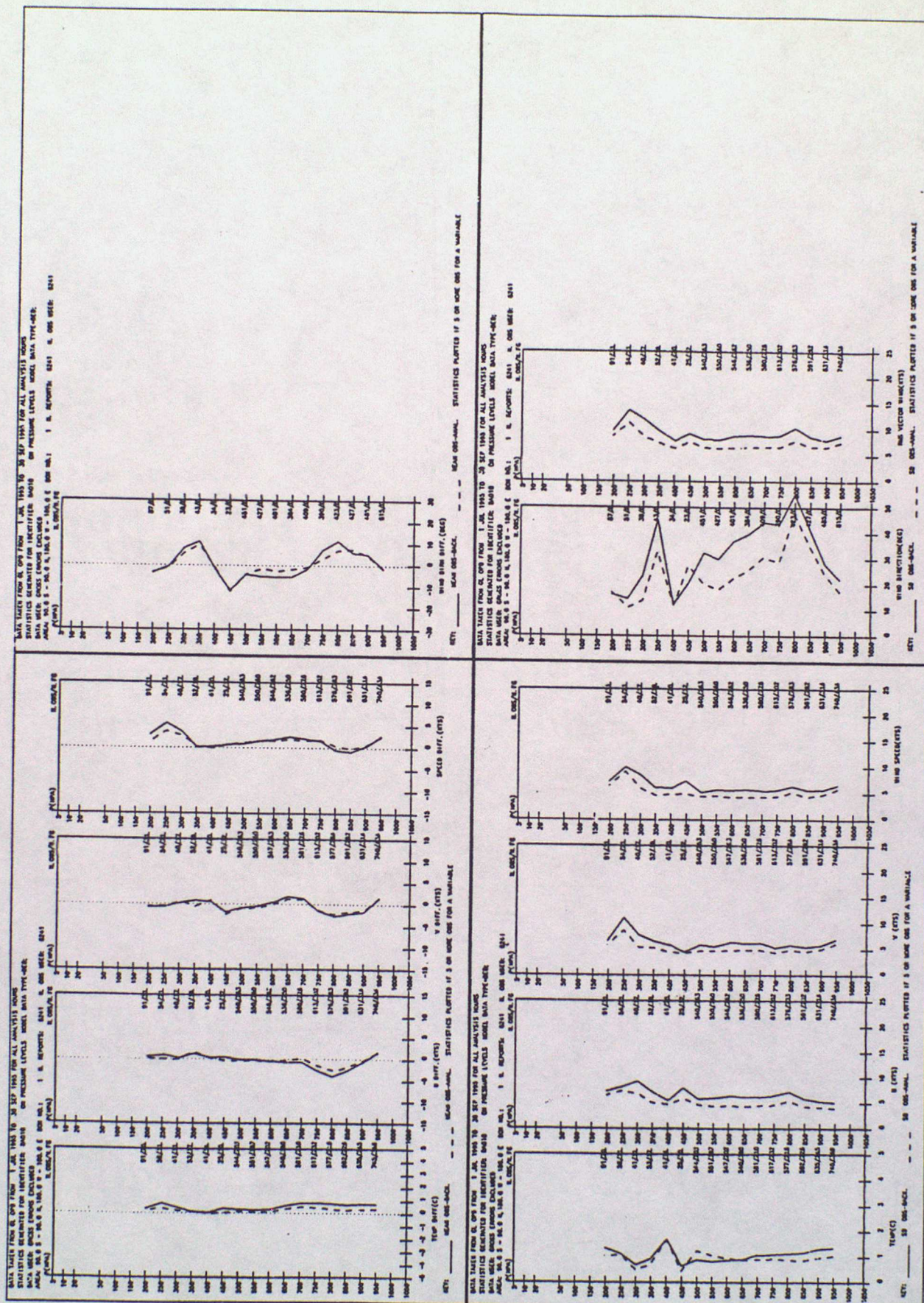




FIGURE 8 : BA010PUZ - MODEL COMPARISON RESULTS (950 - 150 hPa)









[illegible]



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

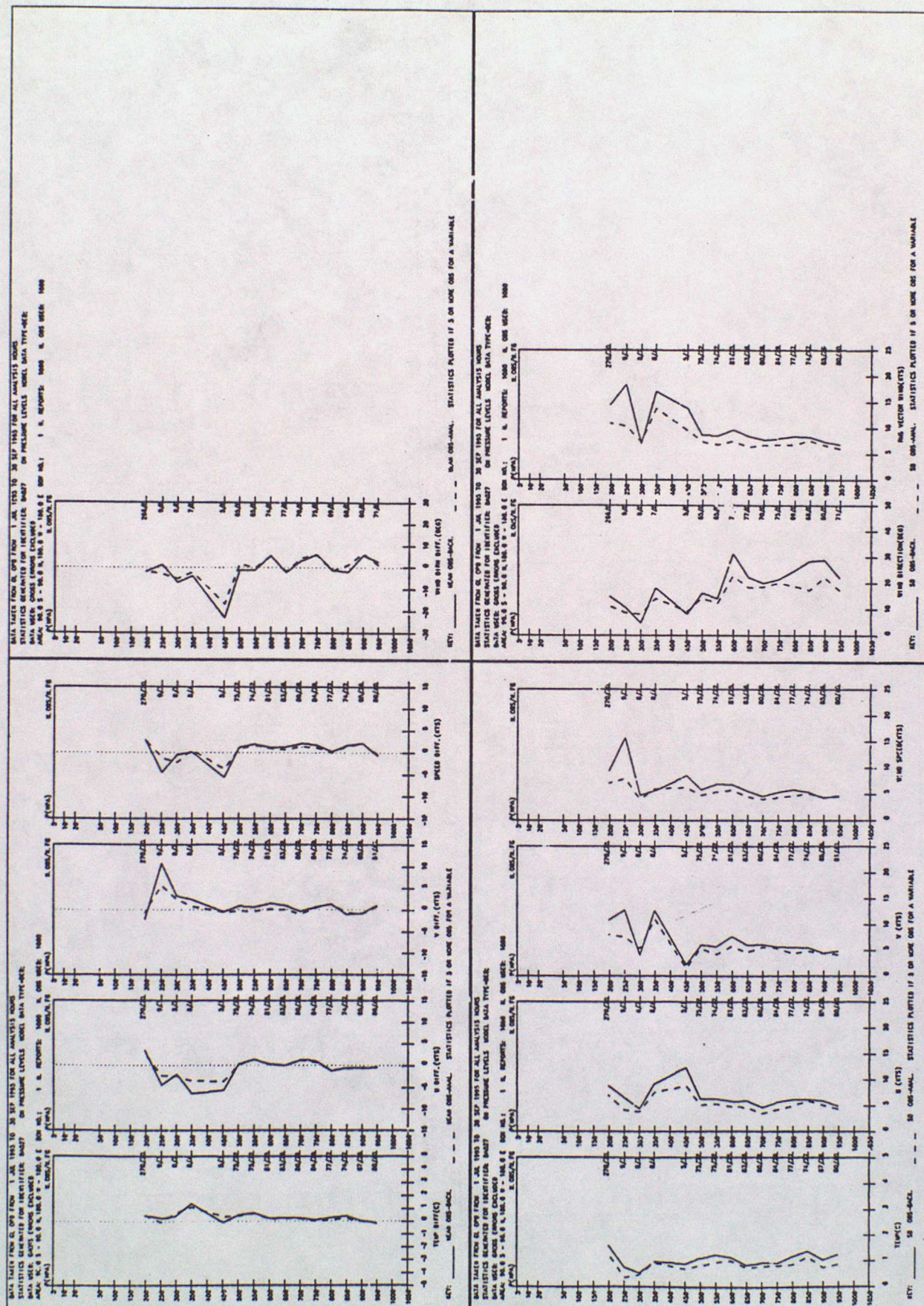




FIGURE 12 : BA028LLZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

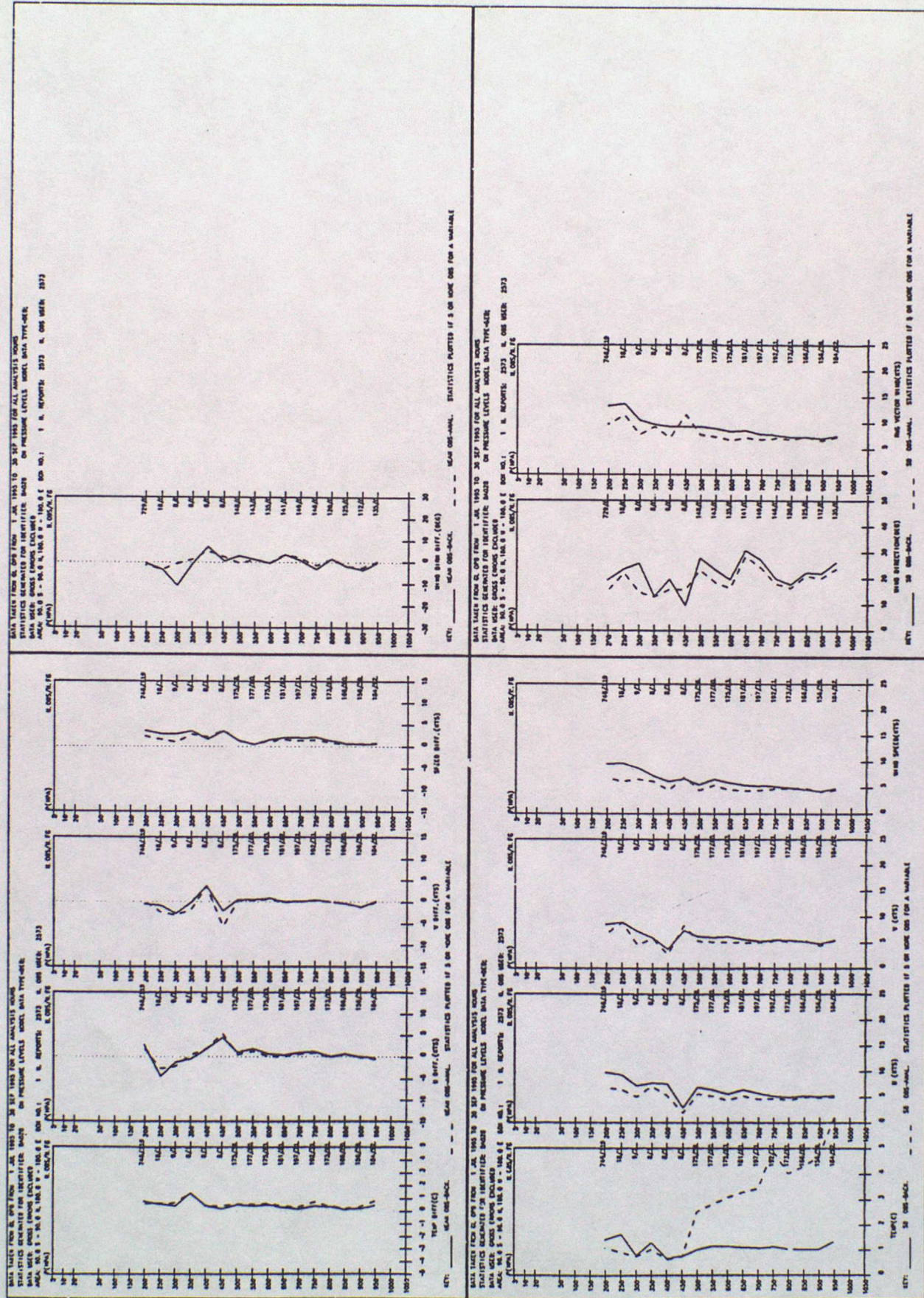
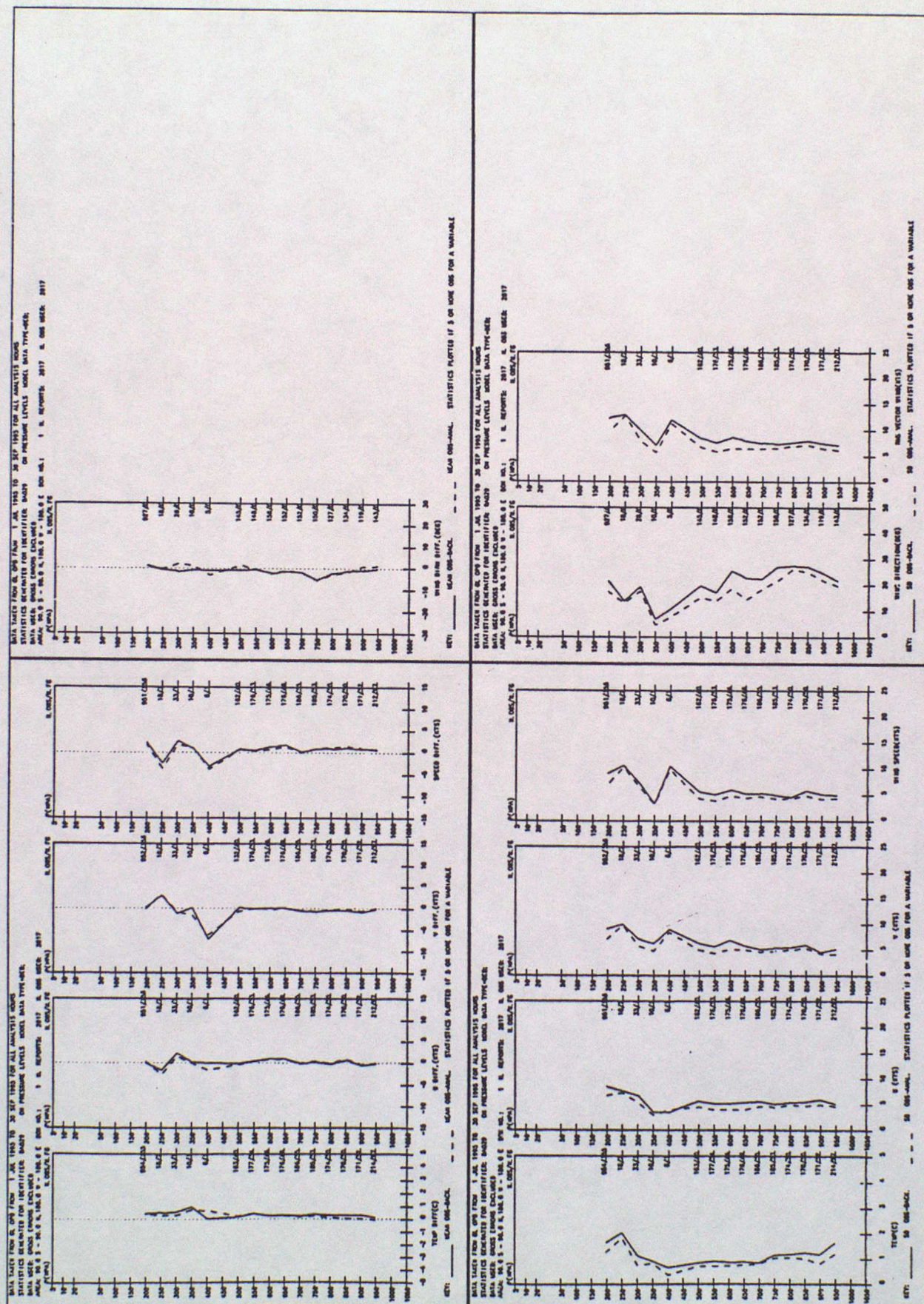




FIGURE 13 : BA029LYZ - MODEL COMPARISON RESULTS (950 - 150 hPa)





[illegible]



FIGURE 15 : KL013UPZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

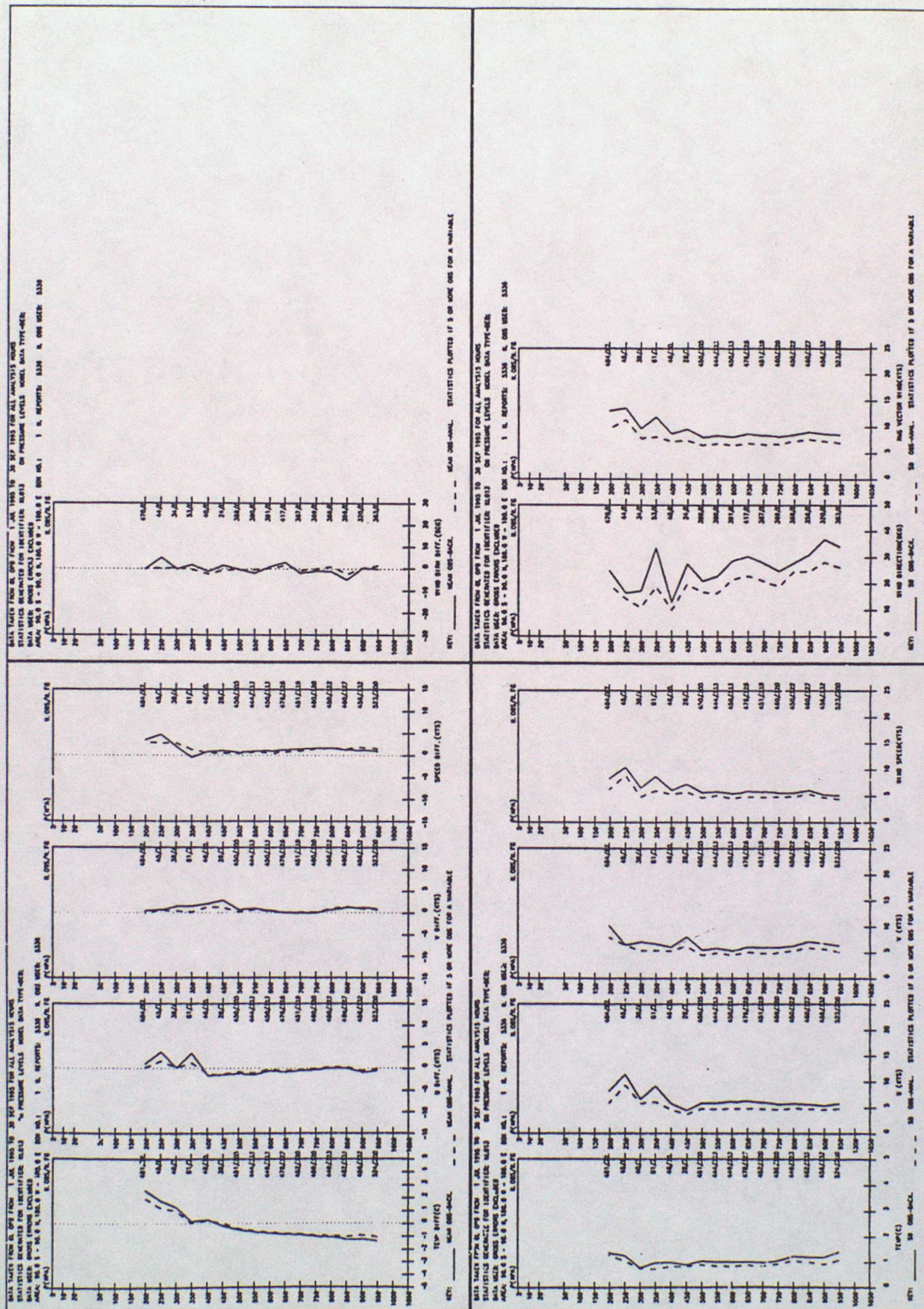




FIGURE 16: KL014URZ - MODEL COMPARISON RESULTS (950 - 150 hPa)

