THE FIRST INTERNATIONAL TOVS STUDY CONFERENCE CASE STUDY REPORT

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1. Background

The TOVS processing software employed by the New Zealand Meteorological Service is basically that supplied in 1979 by the Cooperative Institute for Meteorological Satellite Studies in Madison, WI. Extensive adaptation of the package has taken place in order to allow running on a DEC PDP 11/70 computer with its 16-bit word length and 32 Kbyte addressable memory. Although many modifications have also been made for reasons of speed and convenience the processing/retrieval strategy remains essentially unchanged except for the addition of a precipitation check in the microwave processing (Phillips, 1980). Consequently only a brief description of this processing is given below.

2. Retrieval Algorithm

This early version of the TOVS Export Package uses, for the retrieval of standard-level temperatures and mixing ratios, a set of coefficients, latitudinally stratified and derived from satellite/radiosonde colocations. Limb corrections are also applied through a regression procedure. All coefficients currently in use for NOAA-7 retrievals were provided by the CIMSS in August 1981; although NESDIS/Operations produce updated coefficients weekly it has not been thought necessary to obtain these updated values routinely.

3. Ancillary Information

No ancillary information is used in the retrieval.

4. Surface Effects

Surface effects are included only in the microwave processing where values are corrected for non-unity surface emissivity over the sea during limb correction.

5. Cloud Contamination

The presence of cloud is treated by W.L. Smith's N* procedure: 8 spot-pairs, formed from a centre spot and its 8 neighbours taken one at a time, are used to produce eight N* retrievals, together with a centre-spot retrieval made assuming the spot to be cloud-free. The 'best' retrieval is then selected on the basis of closest agreement with a microwave-only retrieval.

6. Forecasting Outputs

a. NWP

A selection of satellite soundings is included in the analysis used for NWP. The selection is made in such a way that the separation of soundings used is comparable with the NWP grid spacing (381 km at 60°S). There is no discrimination between sounding types at present, clear, partly-cloudy and microwave-only retrievals all being treated equally, with location alone determining selection. Standard level thicknesses from 1000 mb to 100 mb are used in the analysis; humidity is not considered sufficiently accurate for inclusion at present.

b. Satellite-only Analysis

An objective analysis of 1000-500 mb thickness is produced from all retrievals which have passed the various quality control checks and is superimposed upon the rectified AVHRR image for the same series of orbits. Only satellite soundings are used in this analysis - the first guess being zonal field generated from the same data. Where soundings are absent, between passes or through quality control rejection, contouring is suspended to avoid misleading the users. Although 1000-500 mb thickness is the 'standard product' provided routinely, forecasters have the option of displaying various other temperature and moisture variables in the same way.

c. The soundings selected for the NWP above are also automatically plotted, along with conventional observations and 'SATEMS' transmitted from Washington, on the 1000-500 mb thickness chart for manual analysis.

7. Case Study Processing

As of April 1983 only the New Zealand region data set has been processed. The 'INGEST' files were reformatted for input to task 'TOVPRE' of the Madison suite and the four passes processed in the normal (operational) way. Analyses of the various parameters requested by the conference organisers have been generated and displayed as described above but without the AVHRR background. These analyses are appended (Figures 2-9) for intercomparison and discussion at the conference.

8. Synoptic Situation

Figure 1 shows surface charts which may assist other participants. During the study period a depression was passing south of New Zealand with associated fronts moving over the country, interacting with the mountains of the South Island, and weakening as they moved through a long-wave ridge area associated with a slow-moving anticyclone to the northwest. A more pronounced trough lay to the east and a third was southwest of Tasmania.

9. Comments

The retrieved thickness patterns (Figures 2-6) appear good in the sense that the warm ridge over New Zealand (particularly for 1000-500 mb and 500-300 mb) coincides with the satellite-observed cloud bands (not shown) and the weakening of this ridge between passes is also consistent with the decay of

the fronts. The cold trough down stream is clearly identified by the first orbit and the warm flow ahead of the system southwest of Tasmania is located by the last orbit (Figure 3, lower).

Water vapour patterns (Figures 7-9) are plausible, with higher values occurring along frontal cloud bands and lower values in colder, subsiding air behind troughs. However, the marked meriodional gradient located near 45°S appears anomalous; it may be that this is related to the method of coefficient selection by the retrieval algorithm. Also the magnitudes appear rather inaccurate on first inspection, although a proper assessment based on all available radiosondes has not yet been carried out.

Reference

Phillips, N., 1980: Two examples of satellite temperature retrievals in the North Pacific. Bull. Am. Meteorol. Soc., GI, 712-717.

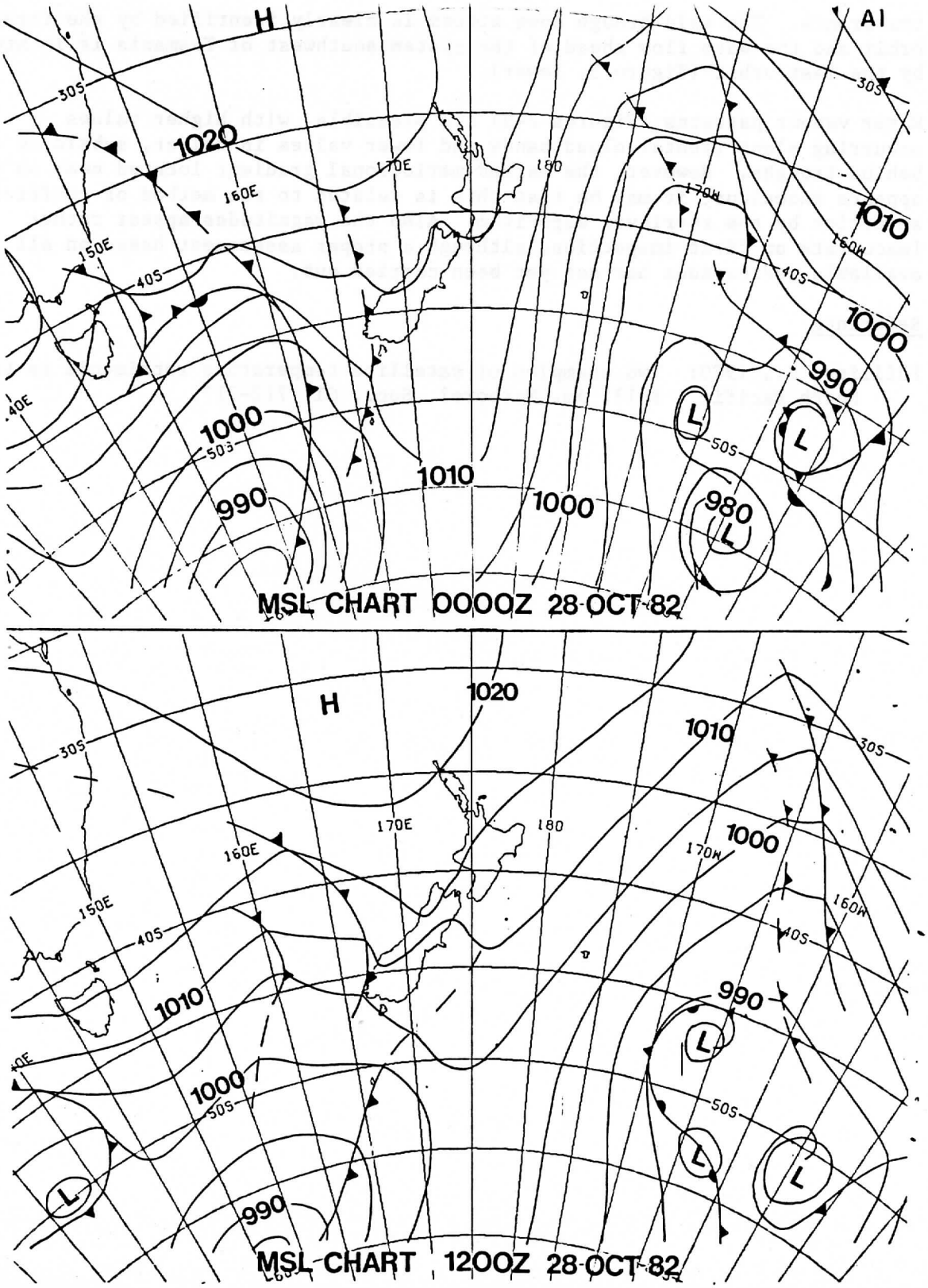
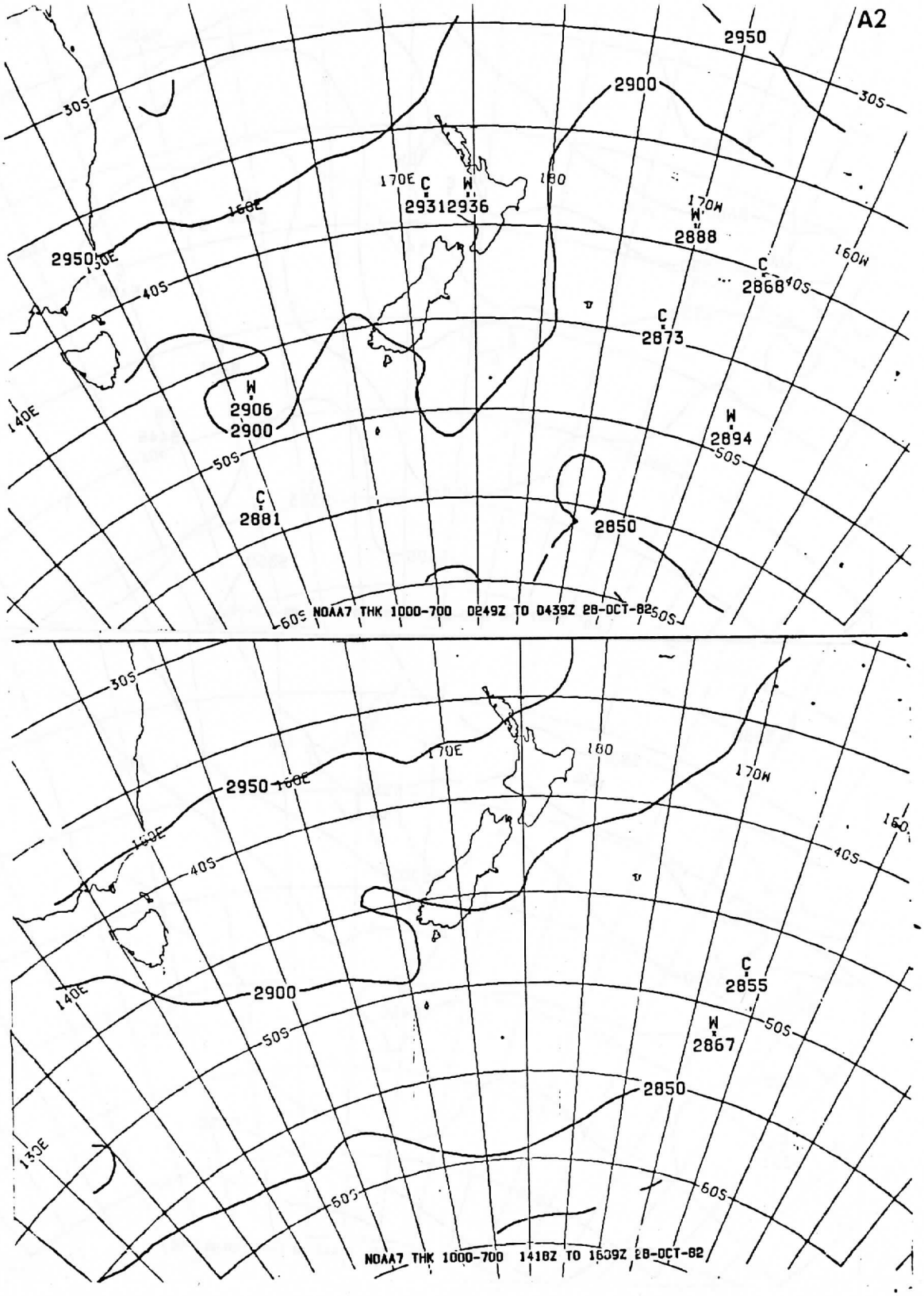

H
1020
1010
1000
990
980
L
30S
40S
50S
150E
160E
170E
180
170W
160W
MSL CHART 0000Z 28 OCT 82
MSL CHART 1200Z 28 OCT 82

Figure 1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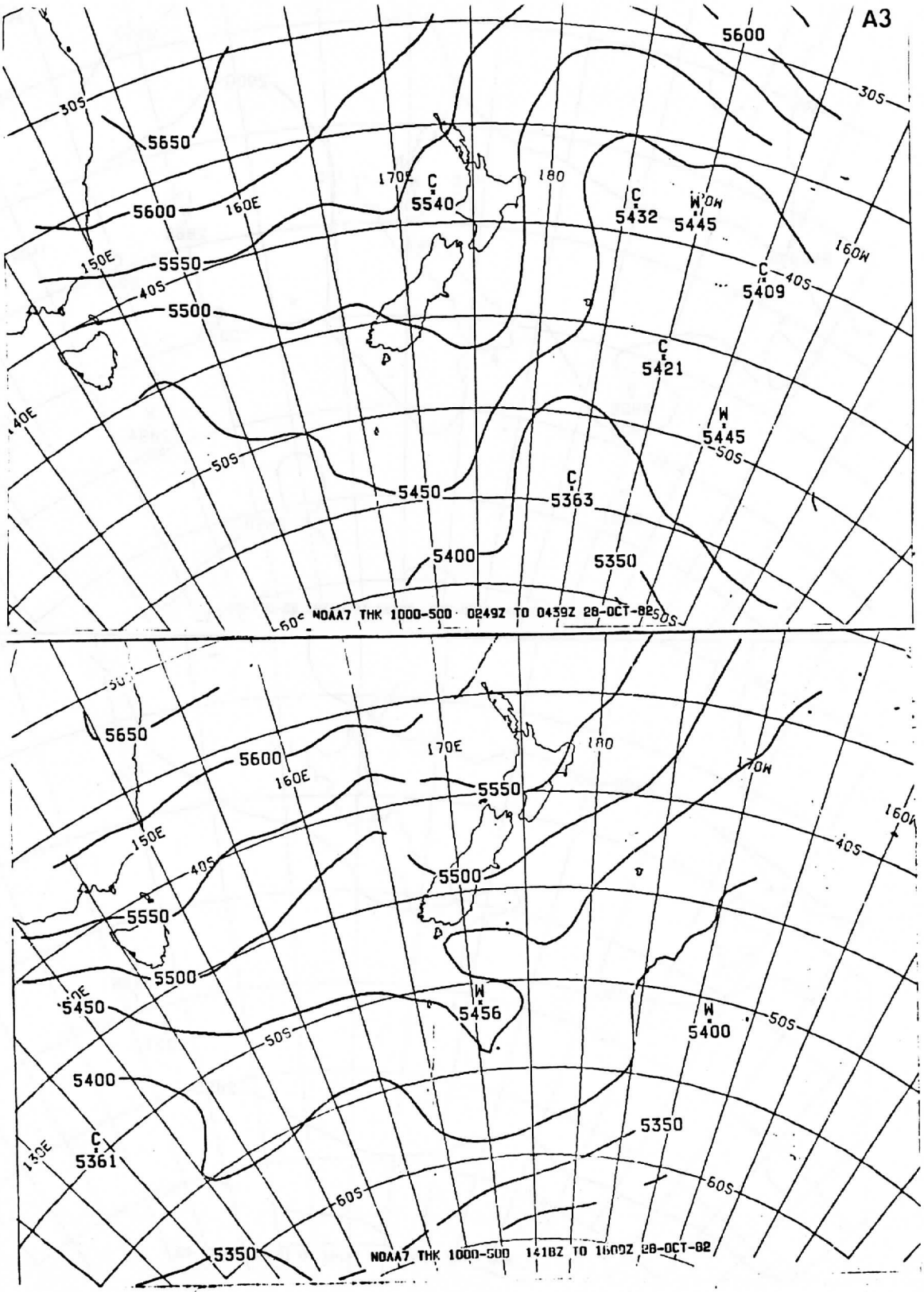
30S
170E
180
170W
160W
160E
140E
40S
50S
60S
2950
2906
2900
2881
2873
2868
2888
2894
2850
NOAA7 THK 1000-700 0249Z TO 0439Z 28-OCT-82
2855
2867
NOAA7 THK 1000-700 1418Z TO 1609Z 28-OCT-82

Figure 2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5650
170E
180
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5432
W 10W
5445
160E
5600
160W
150E
5550
40S
5409
40S
5500
5421
140E
W
5445
50S
50S
5450
5363
5400
5350
NOAA7 THK 1000-500 0249Z TO 0439Z 28-OCT-82
5650
5600
170E
180
160E
5550
170W
150E
160W
40S
5500
5550
5500
W
5456
W
5400
5450
50S
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5400
5350
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5361
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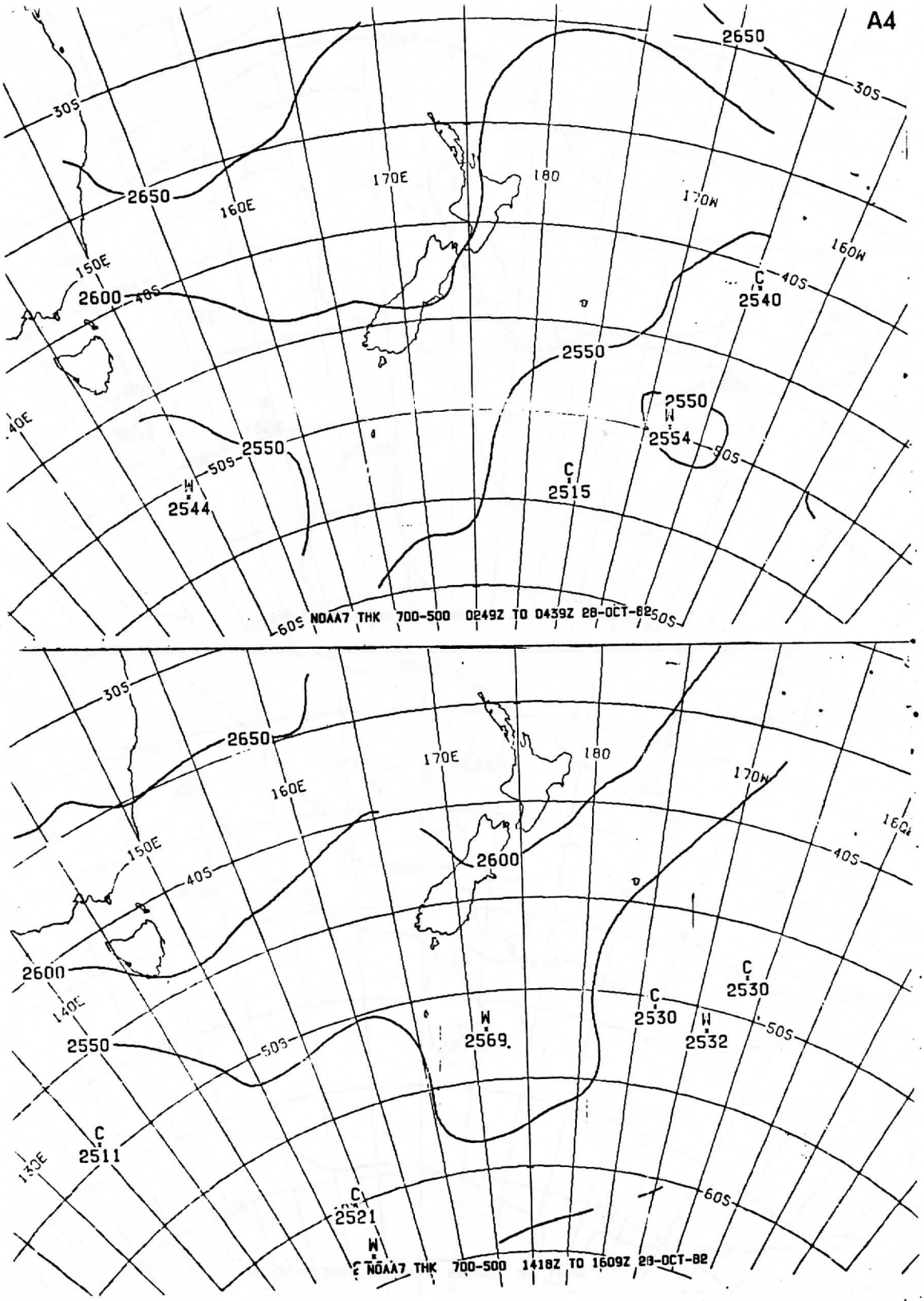
60S
5350
NOAA7 THK 1000-500 1418Z TO 1609Z 28-OCT-82

Figure 3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180
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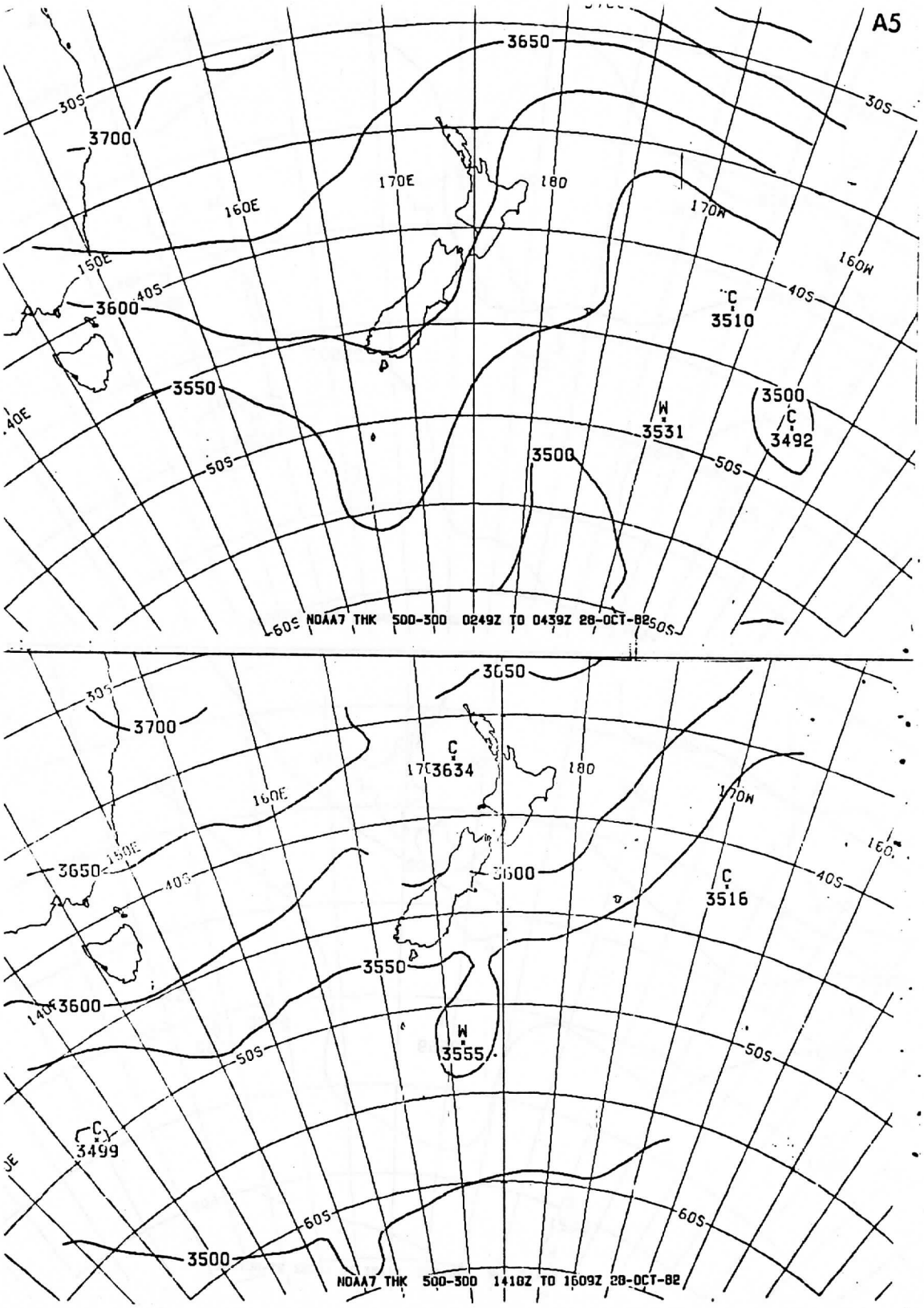
160E
160W
150E
2600
40S
C
2540
2550
2550
W
2554
90S
40E
2550
50S
C
2515
W
2544
60S
NOAA7 THK 700-500 0249Z TO 0439Z 28-OCT-82
50S
30S
2650
170E
180
170W
160E
150E
40S
2600
2600
140E
C
2530
C
2530
W
2532
50S
2550
W
2569
50S
C
2511
C
2521
W
60S
NOAA7 THK 700-500 1418Z TO 1609Z 28-OCT-82

Figure 4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30S
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60S
150E
160E
170E
180
170W
160W
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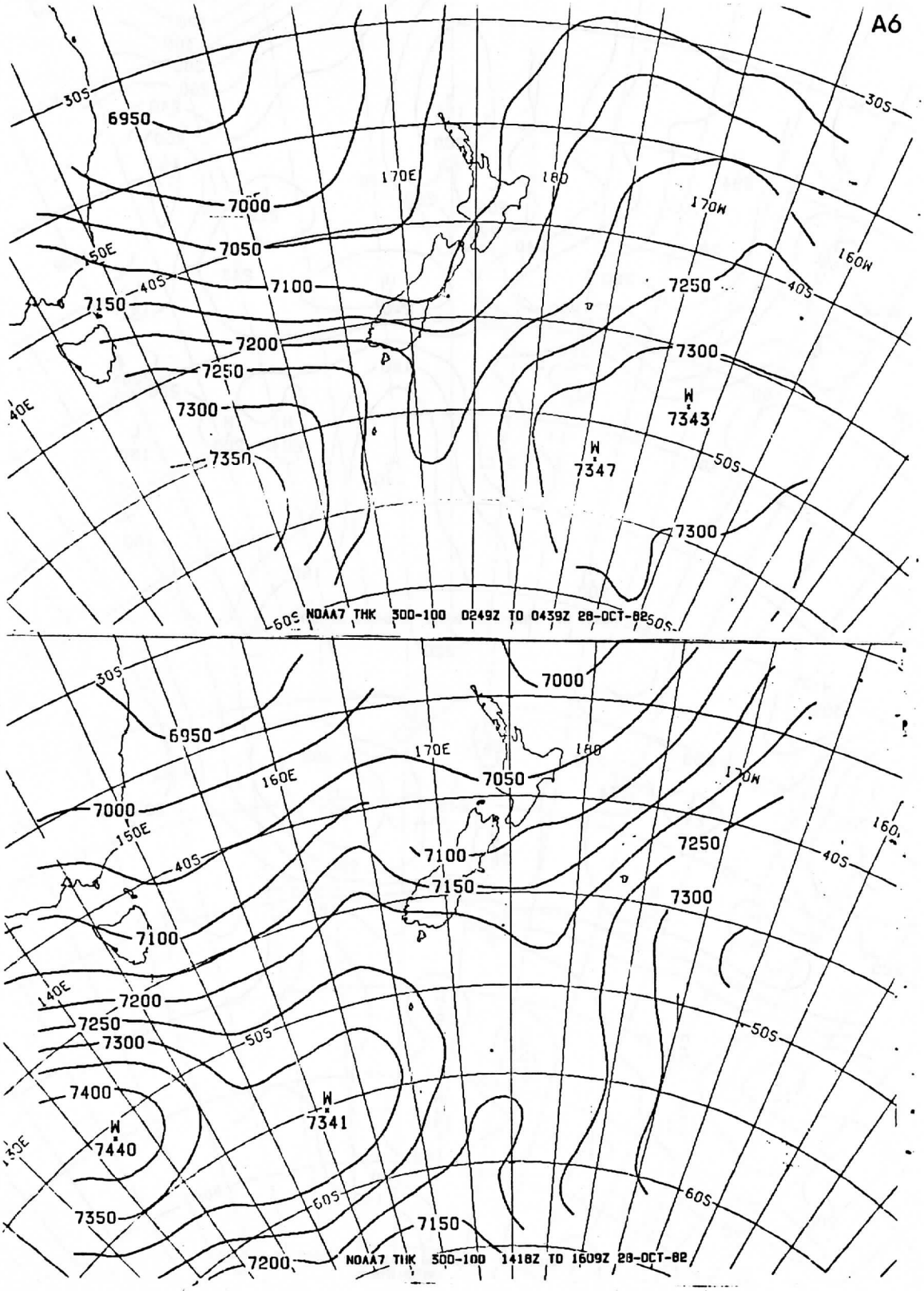
NOAA7 THK 500-300 1410Z TO 1609Z 28-OCT-82

Figure 5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7000
7050
7100
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7200
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7300
7350
170E
180
170W
160W
150E
140E
40S
50S
60S
W
7343
W
7347
NOAA7 THK 300-100 0249Z TO 0439Z 28-OCT-82
160E
7400
W
7440
W
7341
NOAA7 THK 500-100 1418Z TO 1609Z 28-OCT-82

Figure 6

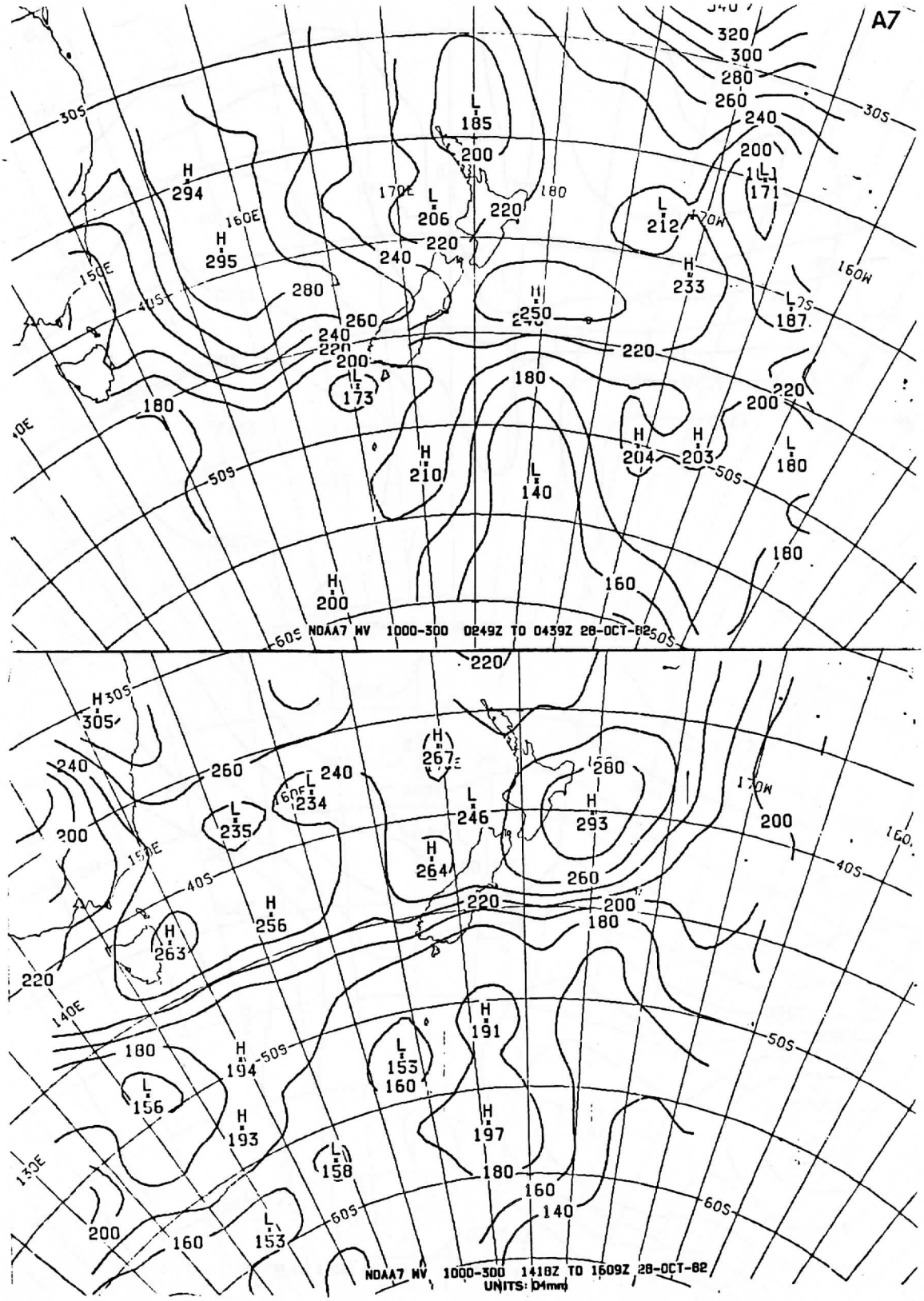
A7
NOAA7 HV 1000-300 0249Z TO 0439Z 28-OCT-82
NOAA7 HV 1000-300 1418Z TO 1609Z 28-OCT-82
UNITS: 04mm

Figure 7

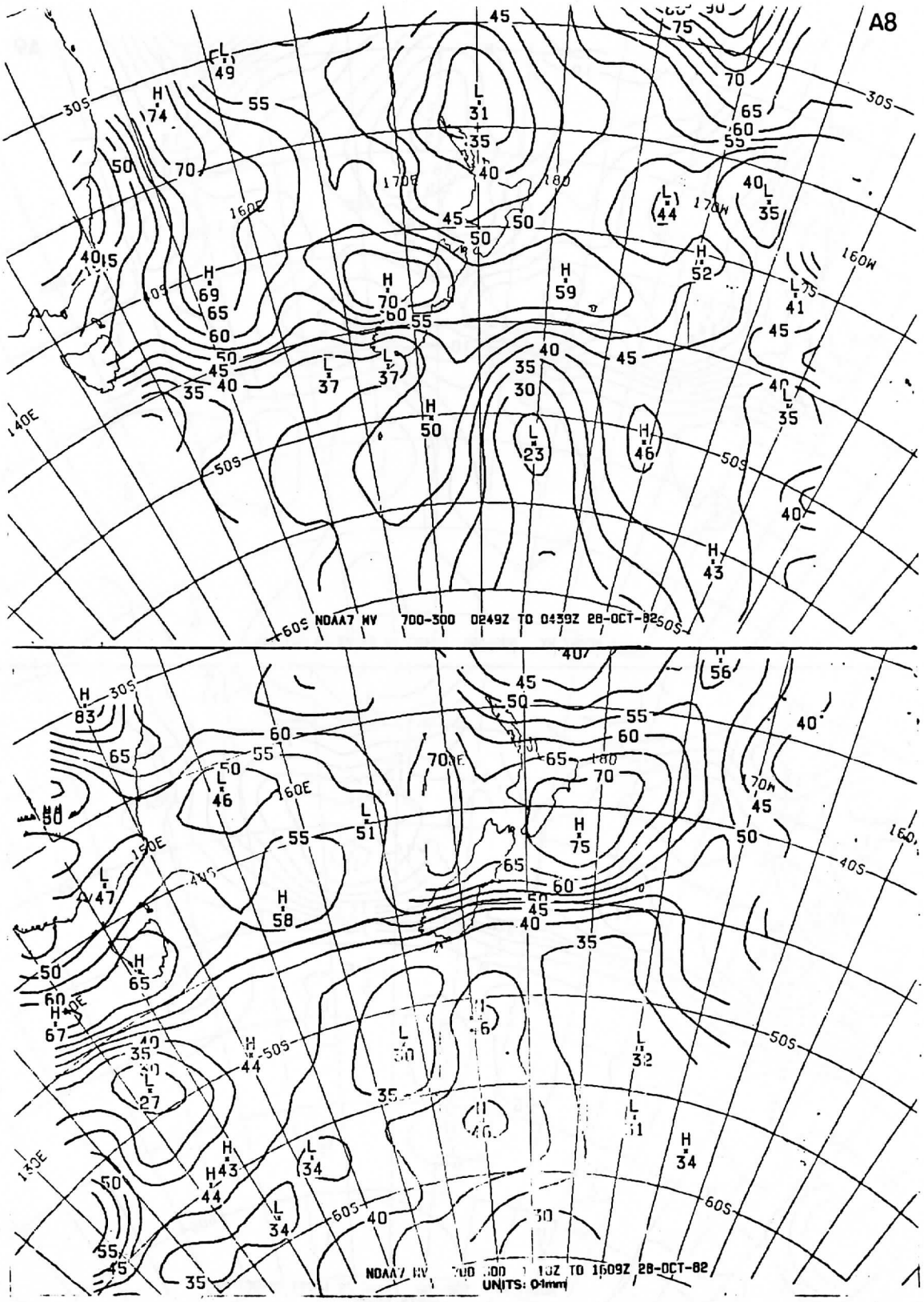

Figure 8

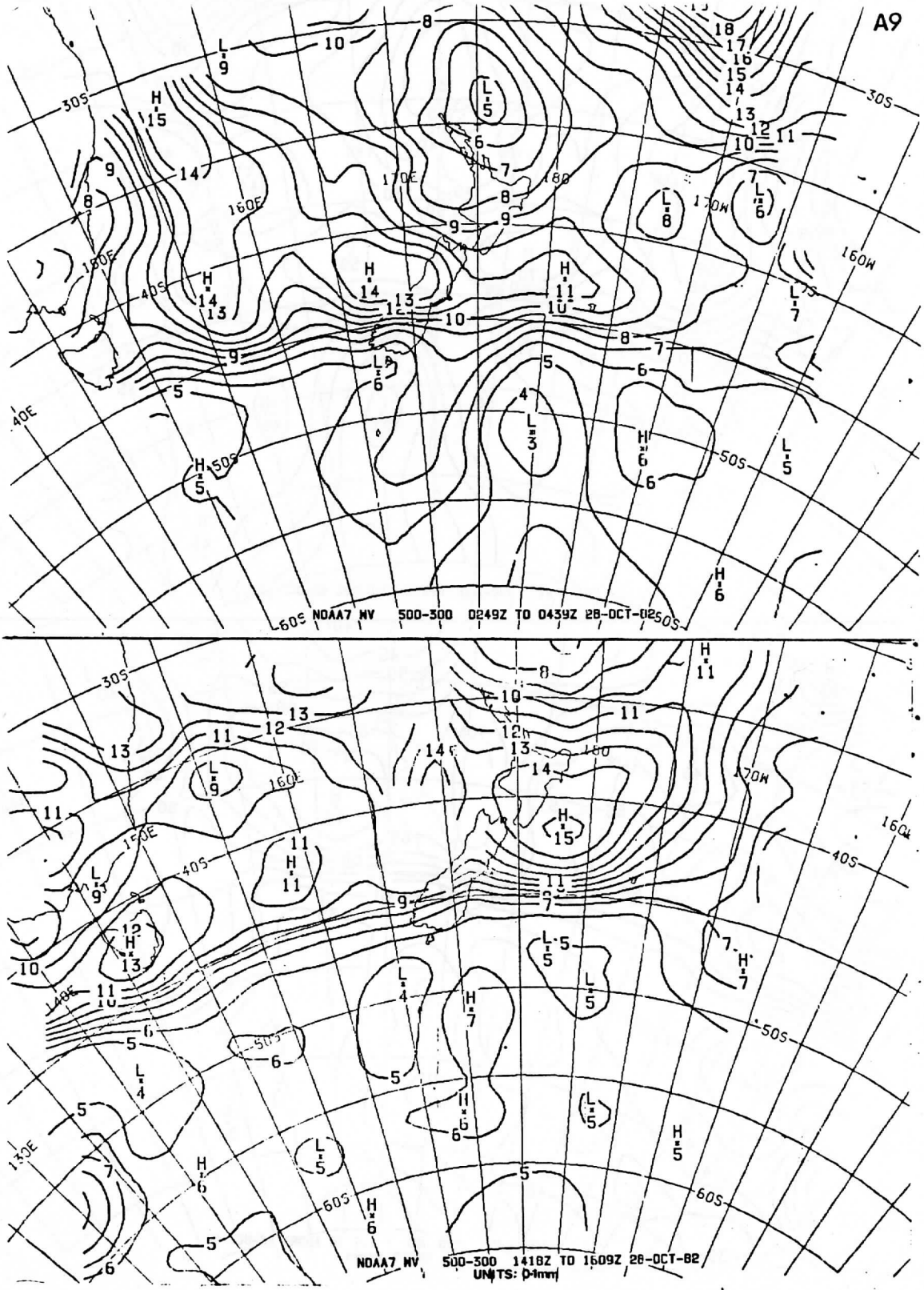
A9
NOAA7 MV 500-300 0249Z TO 0439Z 28-OCT-82
NOAA7 MV 500-300 1418Z TO 1609Z 28-OCT-82
UNITS: D-1mm

Figure 9

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