Institute of
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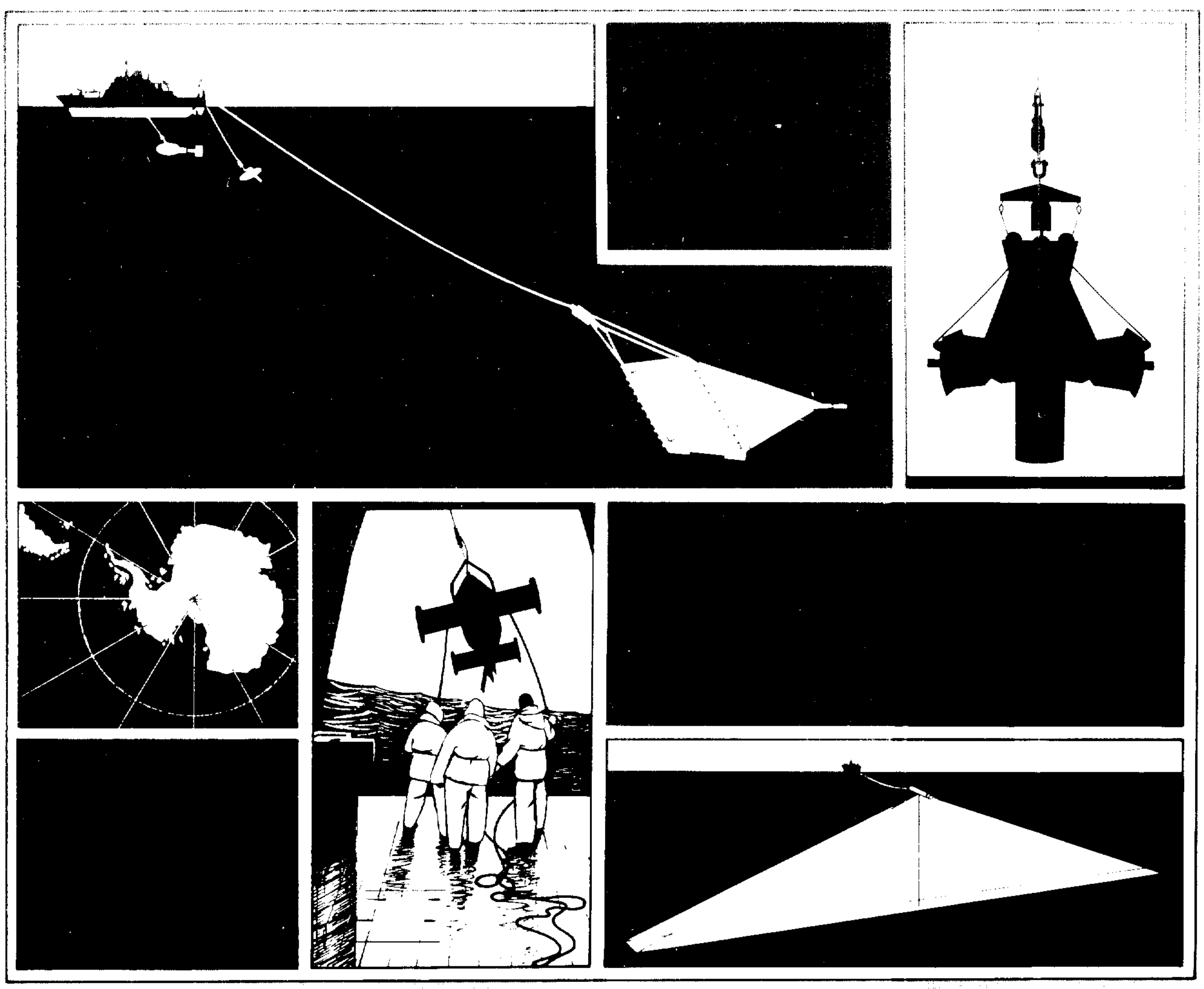
J F Read, R T Pollard, T J P Gwilliam & C Hirst

Report No 284 1991



Natural Environment Research Council

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ABSTRACT

During *RRS Discovery* cruise 181 (1 April 1989 - 2 May 1989) SeaSoar CTD data were collected in the north east Atlantic Ocean. Four major sections were worked inside a box; 41-54°N, 20-7°W, to study variations in the T/S relationship and newly ventilated mode water. Calibration and processing of the data are described in this report and the data are presented in the form of contour plots of potential temperature, salinity, density, fluorescence and Brunt-Vaisala frequency. Plots of θ/S curves are also included for the major sections.

KEYWORDS

CTD OBSERVATIONS
DENSITY
DISCOVERY/RRS - cruise(1989)(181)
FLUORESCENCE
POTENTIAL TEMPERATURE
SALINITY
SEASOAR
T/S ANALYSIS

ISSUING ORGANISATION

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INTRODUCTION

RRS Discovery sailed from Barry on 1st April 1989 at 1500 (91/1500, ie. day of year/GMT)for cruise 181 to the North East Atlantic. The full objectives are described in the cruise report. Those pertaining to the use of SeaSoar are as follows:

1. To examine the T/S relationships and the variations of the newly ventilated mode water within an area outlined by full depth CTD casts

2. To examine the latitudinal variation of the mixed layer depth and the variability of the properties of the upper ocean water (temperature, salinity and chlorophyll 'a').

3. To conduct SeaSoar trials to test the performance of the fairing, fish and depressor with the aims of improving its performance and increasing its maximum depth and duration of tow.

4. The ship also carried new computing hardware so new improved software was developed and tested.

The IOSDL SeaSoar is designed to carry a Neil Brown Instrument Systems (NBIS) mark III shallow CTD and a fluorometer. IOSDL has two shallow CTDs; termed 'new' and 'old', initially the new shallow CTD was fitted, with platinum resistance thermometer probe (PRT) calibrated in-situ at the laboratory. The first few deployments were intended to be performance trials and to measure the required parameters (pitch, roll, wing angle, bridle angle, propeller revolutions and vehicle strain) the fish was fitted with additional sensors and a telemetry pack took the place of the fluorometer.

The first SeaSoar deployment (run 1) took place in the Bay of Biscay after two moorings had been laid. During this run the SeaSoar was not 'flown' as normal (ie. undulating between the surface and 350 m) but towed horizontally at different depths. The scientific data were not processed from this run. The next five runs took place between CTD stations that were spaced approximately 75 km apart. Runs 2 and 3 were on the east - west section at about 41.5°N while runs 4, 5 and 6 were on the north - south 'BOFS line" (Biogeochemical Ocean Flux Study) at about 20°W. Details of deployments are given in table 1 and figures 1 and 2.

After this the telemetry pack was removed and the fluorometer installed.

It was obvious that a front had been crossed between CTD stations 11841 and 11842 at the northern end of the BOFS line, so the SeaSoar was deployed and towed south until the front had been crossed, then back to the north. It was recovered and redeployed for the next three CTD stations to the end of the BOFS line.

The SeaSoar was deployed again on 113/0654 for a section south down 17°W, but halfway through the deployment several sensors started giving bad readings. The SeaSoar was recovered and it was found that the fluorometer had flooded with sea water. The fluorometer was removed but after redeployment the temperature data were still noisy and 3 hours later at 113/1020 the fish had to be recovered. The ship remained hove-to to avoid a break in the section while the new shallow CTD was replaced with the old shallow CTD. The PRT on this instrument had also been calibrated in-situ at IOSDL. Redeployment took place at about 113/1450, however after only 7 hours the PRT failed on this CTD as well and the SeaSoar was recovered at 113/2125 to have the old shallow CTD replaced by the new shallow CTD with a new uncalibrated temperature sensor. While this change was being made the ship had to continue south because of time constraints. The SeaSoar was deployed again at 114/0200. During the next eighteen hours a spare fluorometer was located and the connections obtained from RVS. At 114/2050 the SeaSoar was recovered to install the new fluorometer and deployed at 114/2245.

The SeaSoar was then towed south to 44°N, 17°W, north east to 47°N, 14°W and south east to 44°N, 11°W over the next four days. After this the flight pattern became unstable and it was thought that the hydraulics system might have failed. The SeaSoar was recovered at 118/1540 and it was found that the ballast weight had come loose and that there was water in the hydraulics. After repairs had been made, the SeaSoar was deployed at 118/2117 and towed back to the shelf edge where it was recovered at 120/1421 for mooring work.

After recovery of two moorings and deployment of a two year trial mooring there was just time for a short SeaSoar run. The start was delayed because of the failure of a graphite filled wire in the conductivity cell. This was repaired although it caused a shift in the calibration, and the SeaSoar was deployed at 122/0005 to run up onto the shelf break and back out to sea before it was necessary to stop scientific work, recover the SeaSoar at 122/0900, and return to Barry.

DATA CAPTURE AND REDUCTION

All CTD and fluorometer data were logged on the NBIS deck unit and recorded to a digidata tape for back up purposes. The data were also displayed on a BBC microcomputer for real time control of the system. The data were logged by a level A interface where the 8 Hz data were despiked and averaged to 1 Hz and the results were then logged by the level B computer onto back up tapes and transferred to the new level C system. The *RRS Discovery* carried three new SUN 3/60 workstations in place of the Plessey level C computer. The data were initially stored in RVS type binary files from where they were transferred to PSTAR type binary files using the DATAPUP programme every 4 hours.

Once the data were in PSTAR format the processing procedure followed the same route as described by Pollard, Read and Smithers (1987), with the exception that the UNIX based SUN system allowed the use of 'execs' so that all the programmes could be run in one step. This greatly increased the speed of processing and reduced the risk of operator error. A new programme STRIPED was developed for semi-interactive despiking of SeaSoar data. The use of graphics terminals reduced the repeated production of plots, and colour plotting aided the immediate scientific interpretation of the data.

The processed files are listed in table 2. The times do not necessarily agree with those given for the SeaSoar deployments in table 1 as computer logging was started after the SeaSoar was fully deployed and 'flying'.

CTD CALIBRATION

The initial calibrations applied by CTDCAL were as follows:

Pressure (dbar)	$P = 0.0 + P_{raw} * (0.01 * 1.0)$	
Temperature (°C)	$T = 0.006655 + T_{raw} * (0.0005 * 0.999433)$	('new' shallow CTD)
Conductivity	$C = 0.0 + C_{raw} * (0.001 * 1.0)$	
Temperature (°C)	$T = 0.0036 + T_{raw} * (0.0005 * 0.999945)$	('old' shallow CTD)

After the failure of the two PRT sensors a best estimate of the calibration for the new probe was made of:

Temperature (°C) $T = -0.055 + T_{raw} * (0.0005 * 1.0)$

An in-situ calibration of this probe was made after the cruise at the laboratory which gave the constants:

$$T = -0.0461 + T_{raw} * (0.0005 * 0.99799)$$

It was decided that this was sufficiently similar to the calibration used that it was not necessary to rework all the raw data.

Absolute Salinity Calibration

The first six short runs were checked against the CTD casts at the beginning and end of each run and it was found that no further correction was necessary. During the longer runs a check was made by comparing the θ/S curves with suitable CTD casts and previous SeaSoar profiles and a fairly constant offset was applied from this. For an absolute calibration surface salinity samples were taken approximately every hour and were compared with the near surface SeaSoar values by the procedure outlined by Pollard, Read, Smithers and Stirling (1987). Figure 3 shows the SeaSoar surface temperature and salinity, the sample (bottle) salinity and the salinity difference (bottle-SeaSoar), and table 3 summarises the corrections that were applied to obtain the final calibration.

Chlorophyll 'a' Calibration of Fluorometer

Two different fluorometers were used which required two different calibrations:

i) IOSDL Fluorometer

The IOSDL fluorometer only worked for the relatively short section (336 km) along 20W and during this time very few chlorophyll 'a' samples were taken (seven). They were spread over 1.3 days so were insufficient to determine the diurnal pattern of fluorescence. The initial calibration (provided by Dr. M. Fasham, from *RRS Discovery* cruise 175) used was:

Fluorescence (mg/m^3) $F = -2.325 + F_{raw} * (0.001 * 1.897)$

The values given by this equation were high relative to the chlorophyll 'a' samples, so a further correction was made of:

$$F = F * 0.3$$

ii) RVS/PML Fluorometer (Aquatracka SA240)

The PML fluorometer was calibrated against surface chlorophyll 'a' samples taken between 113/2328 to 122/0759. The data were quite scattered but the best fit suggested that the response of the fluorometer varied with time and with depth. The time response was approximately sinusoidal between day and night, while the depth response was linear between 0-30 dbar, below this it was assumed to be constant. To fit these observations, the following calibration (supplied by Dr. R. D. Pingree) has been applied.

$$\text{chl 'a'} = [10^{(V/1.59 - 1.0)}] / R$$

where v = fluorometer output in volts,

R = response with time and depth = $[(30-p)R_s + p R_n] / 30$ $\quad P < 30$

$R = R_n$ $\quad P > 30$

where p = pressure

R_S = surface response of sensor = $1.25 \sin \theta (t) + 2.25$

where θ (t) is given in the table below

R_n = night-time response of the sensor = $1.25 \sin \pi/2 + 2.25 = 3.5$

TIME (GMT)	t	θ (t) (radians)
0000-0430	0-4.5	$\pi/2$
0430-0700	4.5-7.0	$(7.0\text{-t}) \pi/5$
0700-1130	7.0-11.5	$(7.0\text{-t}) \pi/9$
1130-1330	11.5-13.5	$-\pi/2$
1330-1730	13.5-17.5	$(\text{t-}17.5) \pi/8$
1730-2400	17.5-24.0	$(\text{t-}17.5) \pi/13$

DATA PRESENTATION

The SeaSoar data were edited and calibrated in 4 - hourly files and every 12 hours these were appended together, gridded (4 km * 8 dbar) and contoured, as described by Pollard, Read, Smithers and Stirling (1987). During cruise 181 the data were further appended, where applicable, for colour contouring. Thus the data along each line of (approximate) longitude were appended together (table 2, fig. 1). The contoured sections presented here are approximately 200 km extracts from these files. Data are presented (reading down and from left to right, for each double page) with contour intervals and labelling intervals (in bold) as follows:

i) potential temperature vs pressure (0.2, **1.0** °C)

ii) salinity vs pressure (0.02, **0.1**)

iii) density (sigma0) vs pressure (0.02, **0.1** kg/m^3)

iv) fluorescence vs pressure (0.1, **0.5**)

v) salinity vs density (0.02, **0.1**)

vi) Brunt-Vaisala frequency (0.5, **1.0** c.p.h)

Note that the data for plot vi) (Brunt-Vaisala frequency) were further smoothed by averaging over 12 km.

Data from the sections are also presented in θ/S plots. The data are offset by 0.2 ppt every four profiles (20 km).

ACKNOWLEDGEMENTS

The first two weeks of the cruise were troubled by bad weather and it is thanks to the experience and skill of the ships master; Mike Harding, the officers and crew that scientific work continued unimpeded. M. Conquer and R. Lampitt determined salinities, R. Head analysed the chlorophyll 'a' samples and R. Pingree and J. Newman worked up the PML fluorometer calibration. A. Brook and A. Cormack worked hard on UNIRAS to provide colour plots.

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TABLE 1

SeaSoar Deployments

Deployment No	Start Time	End Time	Duration hr:min	Distance km	Comments
1	05/2138	05/2321	1:43	45	'new shallow'. CTD deck unit fault. Between CTD stations 11802-03
2	09/1018	09/1517	5:00	76	Between CTD stations 11814-15
3	10/1441	10/1926	4:45	70	Between CTD stations 11818-19
4	13/1450	13/2040	5:50	81	Between CTD stations 11824-25
5	14/1406	14/1941	5:35	84	Between CTD stations 11827-28
6	16/1143	16/1633	4:50	72	Between CTD stations 11831-32
7	19/2101	20/0811	11:10	161	Telemetry off, fluorometer on Between CTD stations 11842-43
8	20/1135	20/1748	6:13	91	Between CTD stations 11843-44
9	20/2115	21/0311	7:56	84	Between CTD stations 11844-45
10	23/0654	23/1018	3:24	71	Fluorometer flooded on deployment. Recovered because PRT failed
11	23/1450	23/2110	6:20	108	'old shallow' CTD, recovered because PRT failed
12	24/1441	24/2050	6:09	280	'new shallow' CTD, uncalibrated PRT. Recovered to add fluorometer
13	24/2221	28/1612	89:51	1330	Recovered because hydraulics failed & ballast weight loose
14	28/2120	30/1440	41:20	626	Recovered for mooring work
15	01/2343	02/0930	9:47	145	Conductivity cell failed on deployment, repaired & redeployed
			8d 17h 53m	3324	

TABLE 2

SeaSoar Files

Dept No	Section Name	Start Time	End Time	Start Lat(N),Long(W)	End Lat(N),Long(W)	Gridded File no
1	001	05/2115	06/0107	45°01.85',07°00.34'	44°38.18',06°59.61'	
2	002	09/1009	09/1520	42°05.45',11°13.61'	42°02.27',12°06.10'	002
3	003	10/1444	10/1929	41°50.95',14°48.32'	41°47.66',15°38.41'	003
4	004	13/1450	13/2044	41°31.42',20°19.47'	42°10.64',20°18.10'	004
5	005	14/1357	14/1946	43°26.22',20°09.19'	44°03.94',20°02.70'	005
6	006	16/1104	16/1637	45°58.19',19°52.69'	46°36.47',19°49.95'	006
7	20W	19/2045	10/0811	51°57.69',19°27.91'	52°39.32',19°35.88'	701,702
8		20/1135	20/1748	52°38.78',19°35.72'	53°19.75',19°29.14'	008
9		20/2114	21/0311	53°20.79',19°36.89'	54°00.00',19°34.24'	
10	010	23/0514	23/1021	52°02.89',17°14.09'	51°29.39',17°09.16'	010
11		23/1441	23/2132	51°31.73',16°57.55'	50°38.98',16°55.69'	
12	17W	24/0209	24/2050	49°53.59',17°04.06'	47°22.81',17°03.16'	011-12
13		24/2221	26/0100	47°23.38',17°03.22'		013-14
	15W	25/2100	27/1300			015-17
	12W	27/0900	28/1612		43°44.90',11°22.86'	018-20
14	9W	28/2120	30/1440	43°25.10',11°12.37'	47°16.61',06°40.38'	021-23
15	024	01/2343	02/0930	47°23.56',06°46.38'	47°46.06',07°46.74'	024

TABLE 3

SeaSoar Final Salinity Calibration

Deployment	Start time	End time	Salinity Offset
1 - 6			none
7 - 9			+ 0.026
10 - 11			none
12			+ 0.046
13		25/0630	+ 0.046
	25/0630	27/0230	+ 0.042
	27/0230		+ 0.047
14			+ 0.047
15			+ 0.064

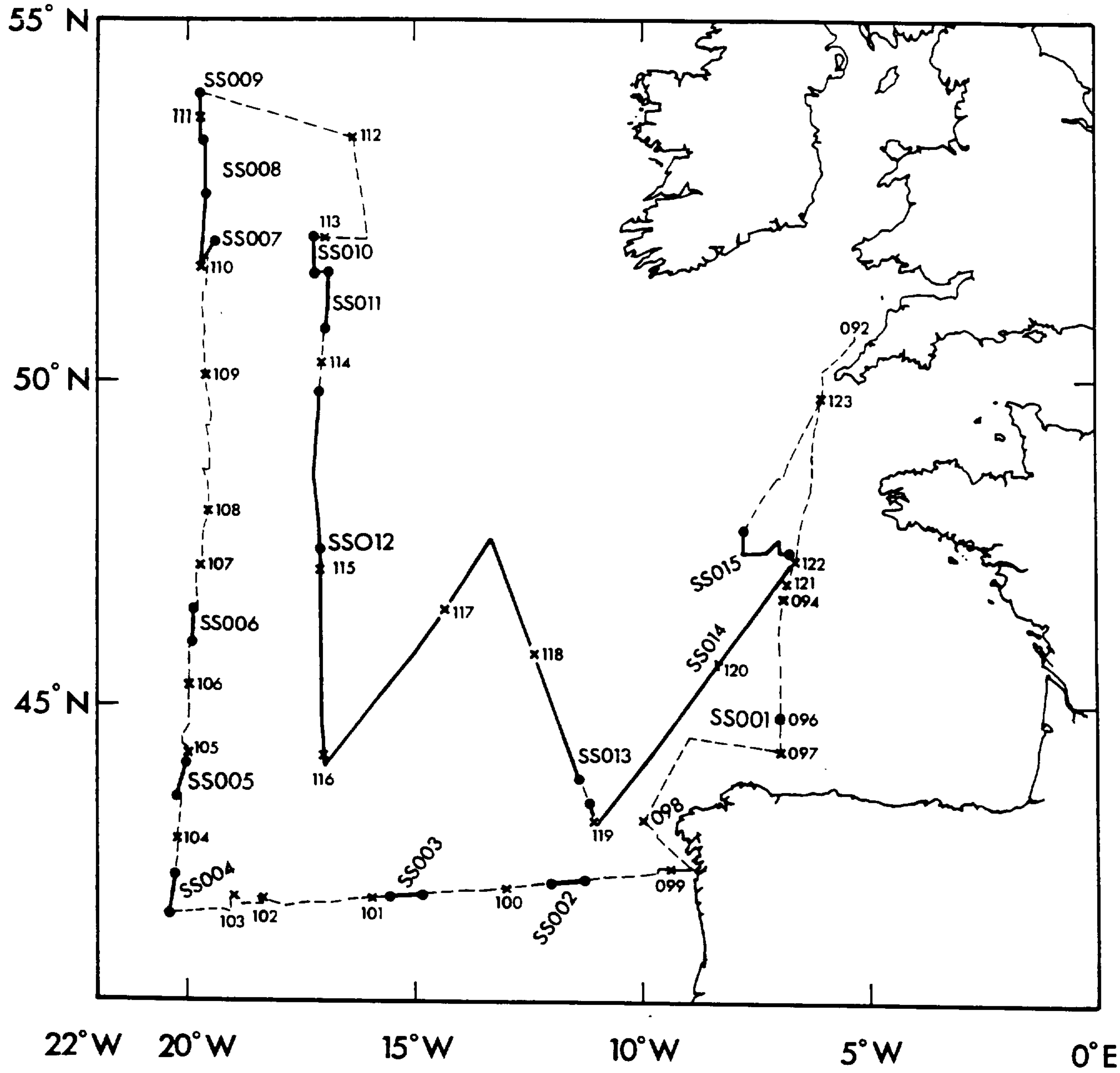


Fig. 1   Track plot of SeaSoar Deployments

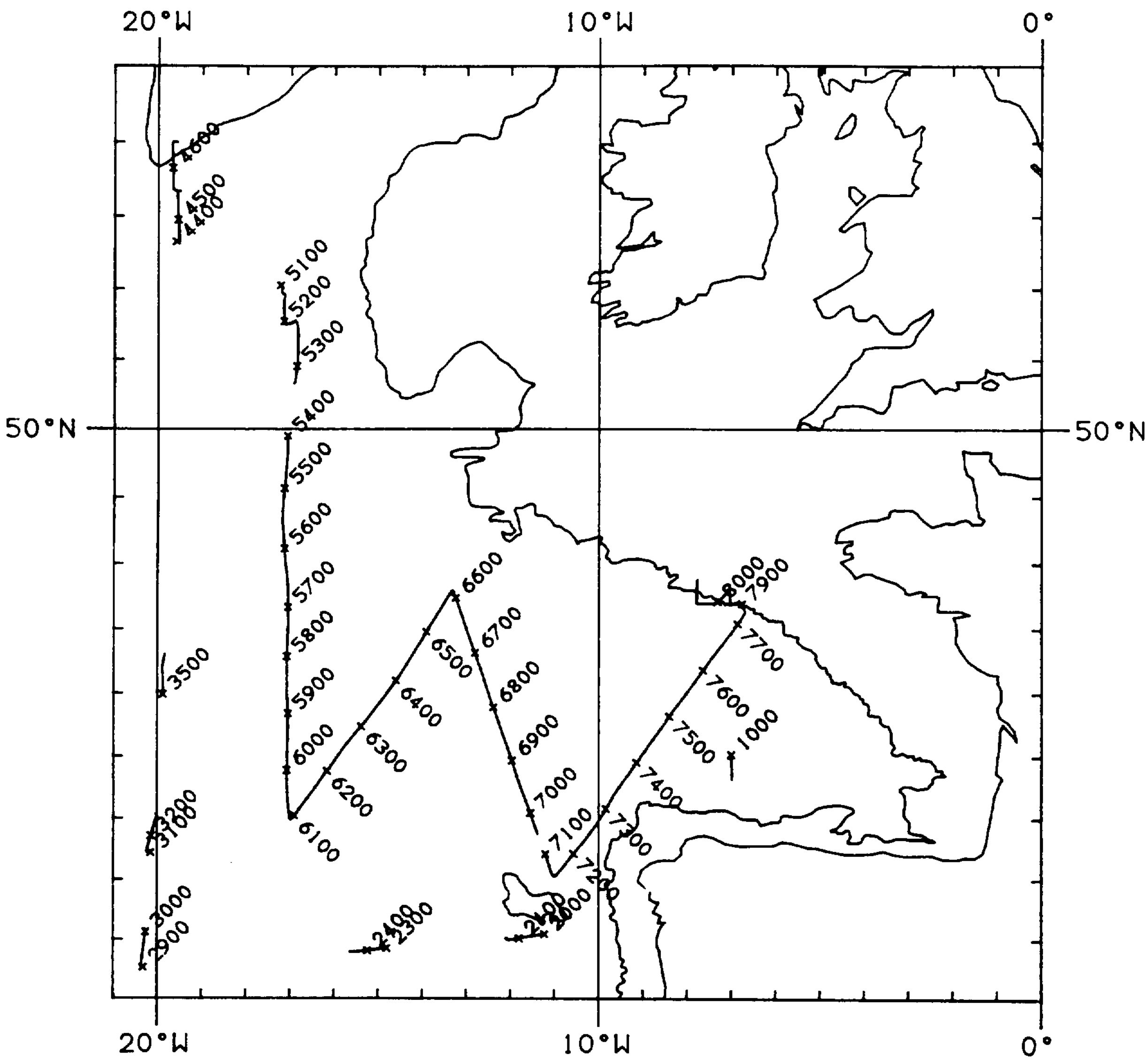


Fig. 2 SeaSoar track annotated with distrance run

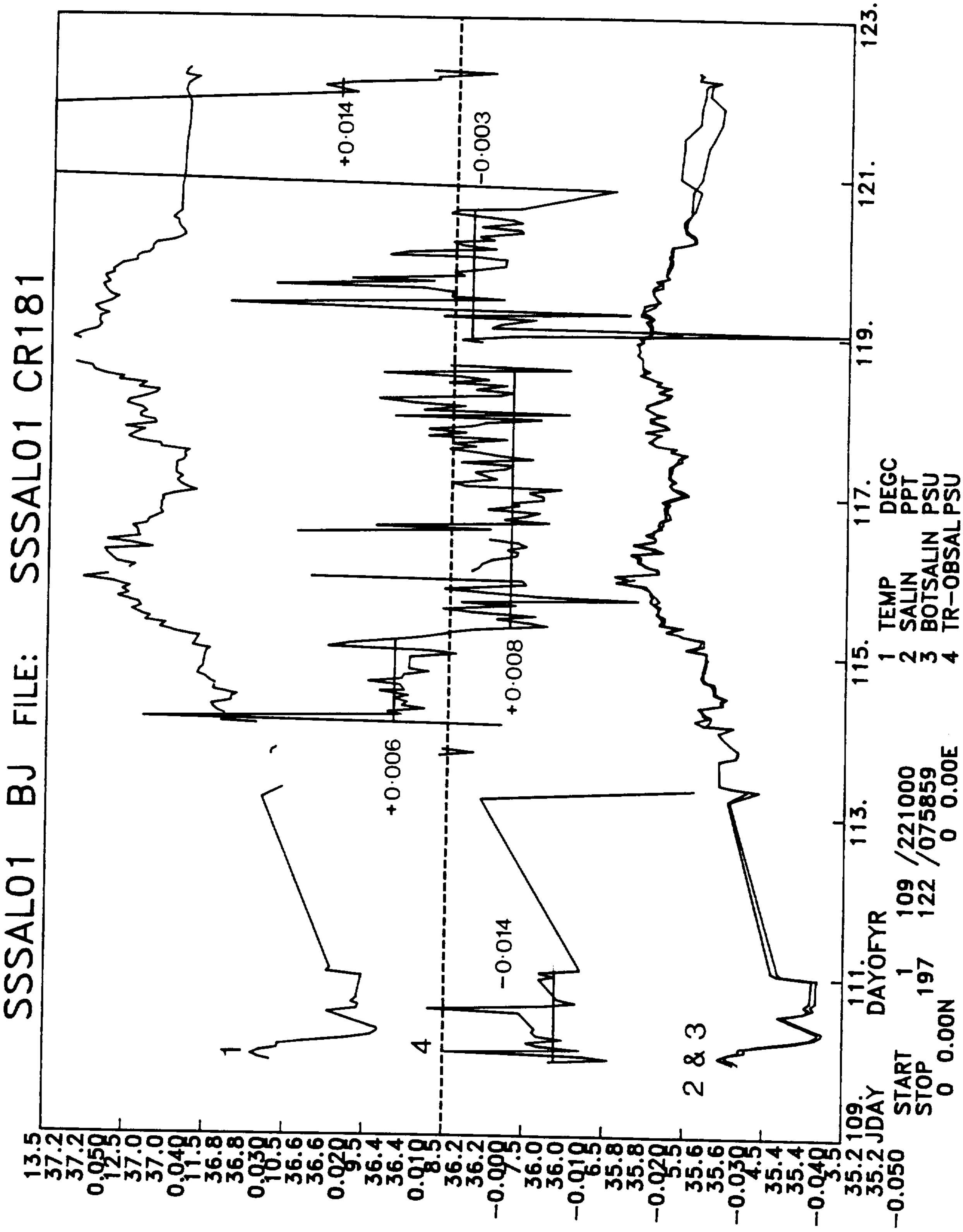
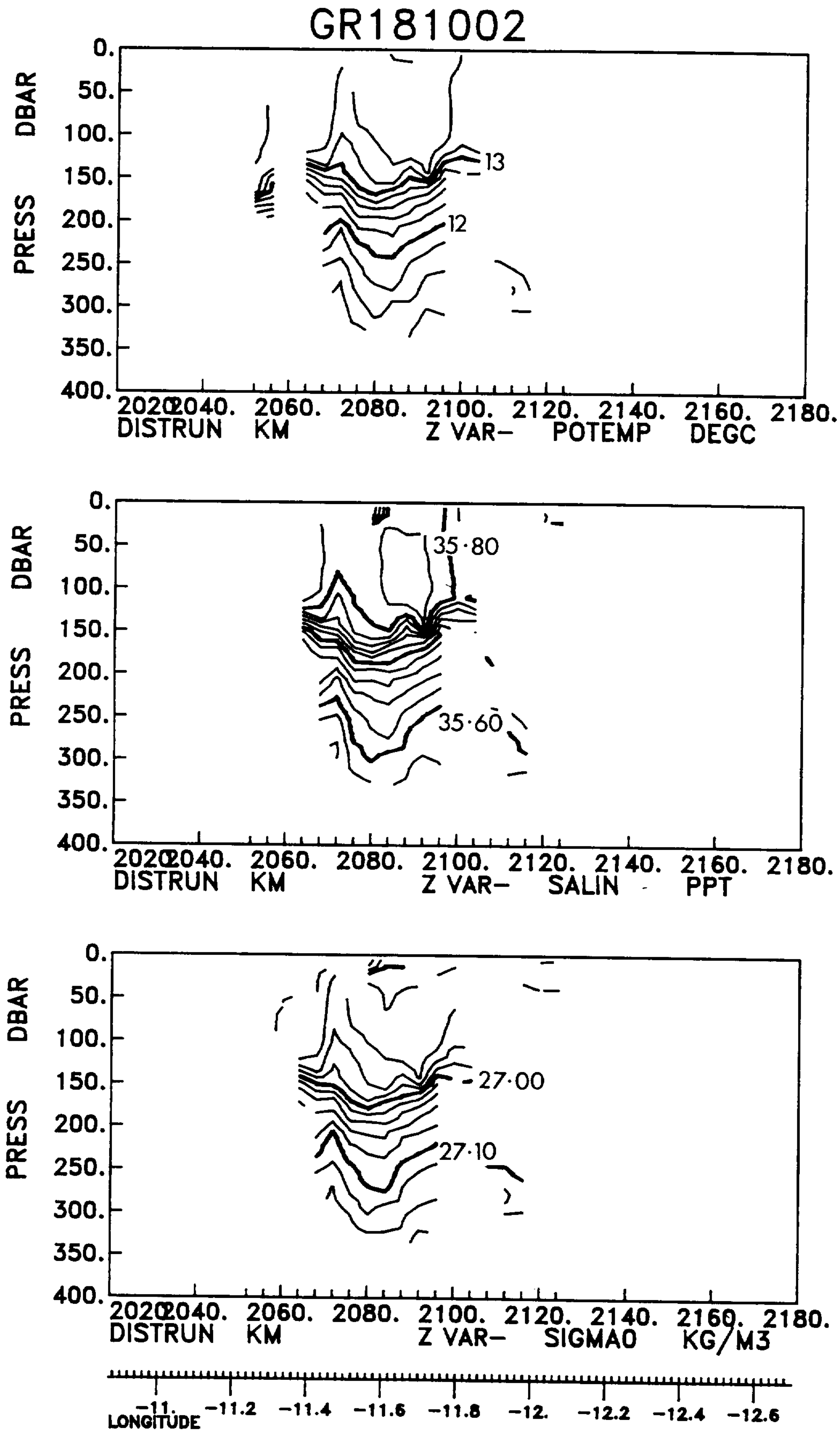


Fig. 3 Comparison of SeaSoar and bottle surface salinities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13
12
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DISTRUN KM Z VAR– POTEMP DEGC
35·80
35·60
DISTRUN KM Z VAR– SALIN PPT
27·00
27·10
DISTRUN KM Z VAR– SIGMA0 KG/M3
LONGITUDE
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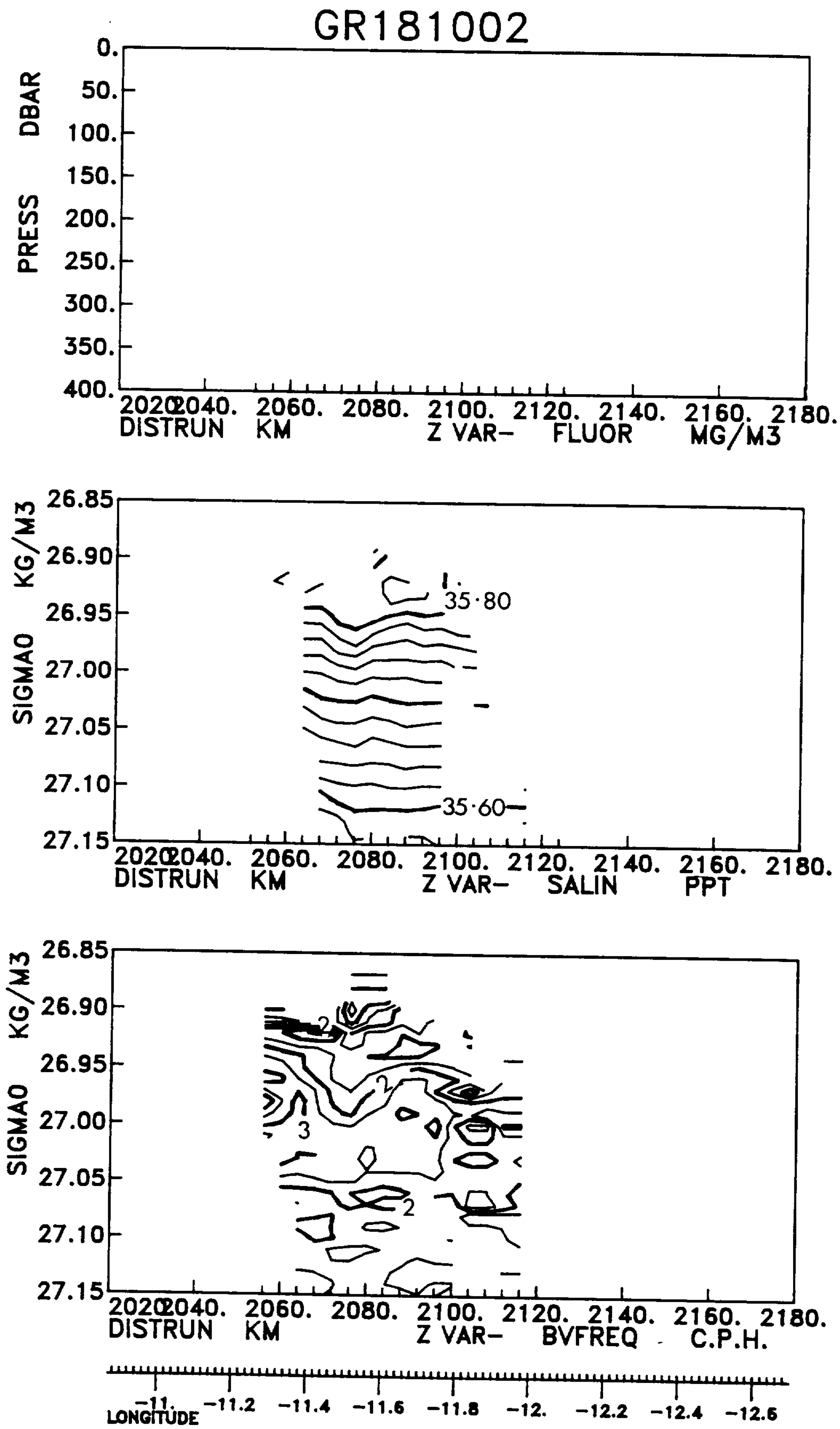
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DISTRUN KM Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
26.85
26.90
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2020 2040. 2060. 2080. 2100. 2120. 2140. 2160. 2180.
DISTRUN KM Z VAR- SALIN PPT
SIGMA0 KG/M3
26.85
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2020 2040. 2060. 2080. 2100. 2120. 2140. 2160. 2180.
DISTRUN KM Z VAR- BVFREQ C.P.H.
LONGITUDE
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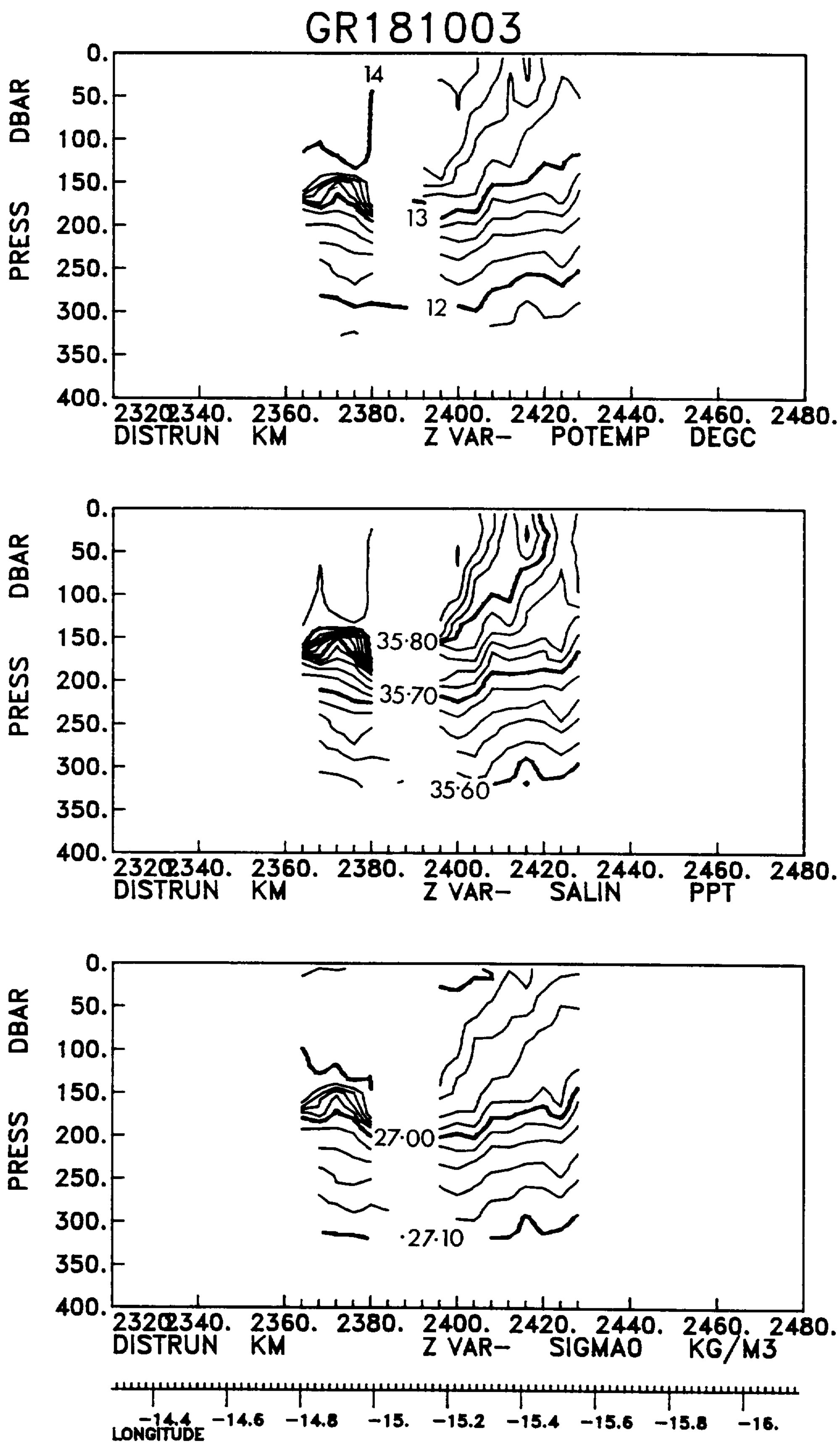
-12.6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·27·10
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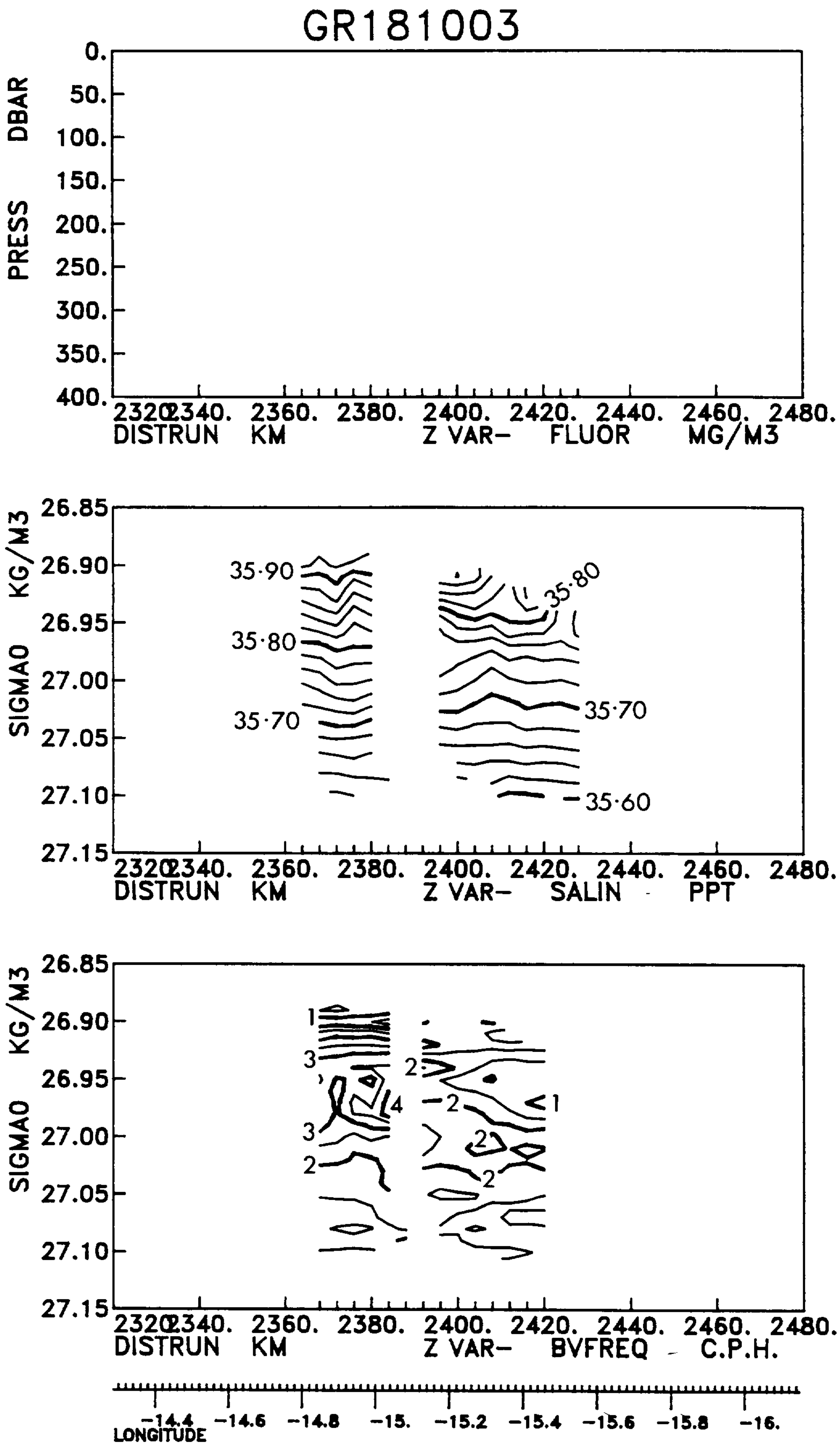
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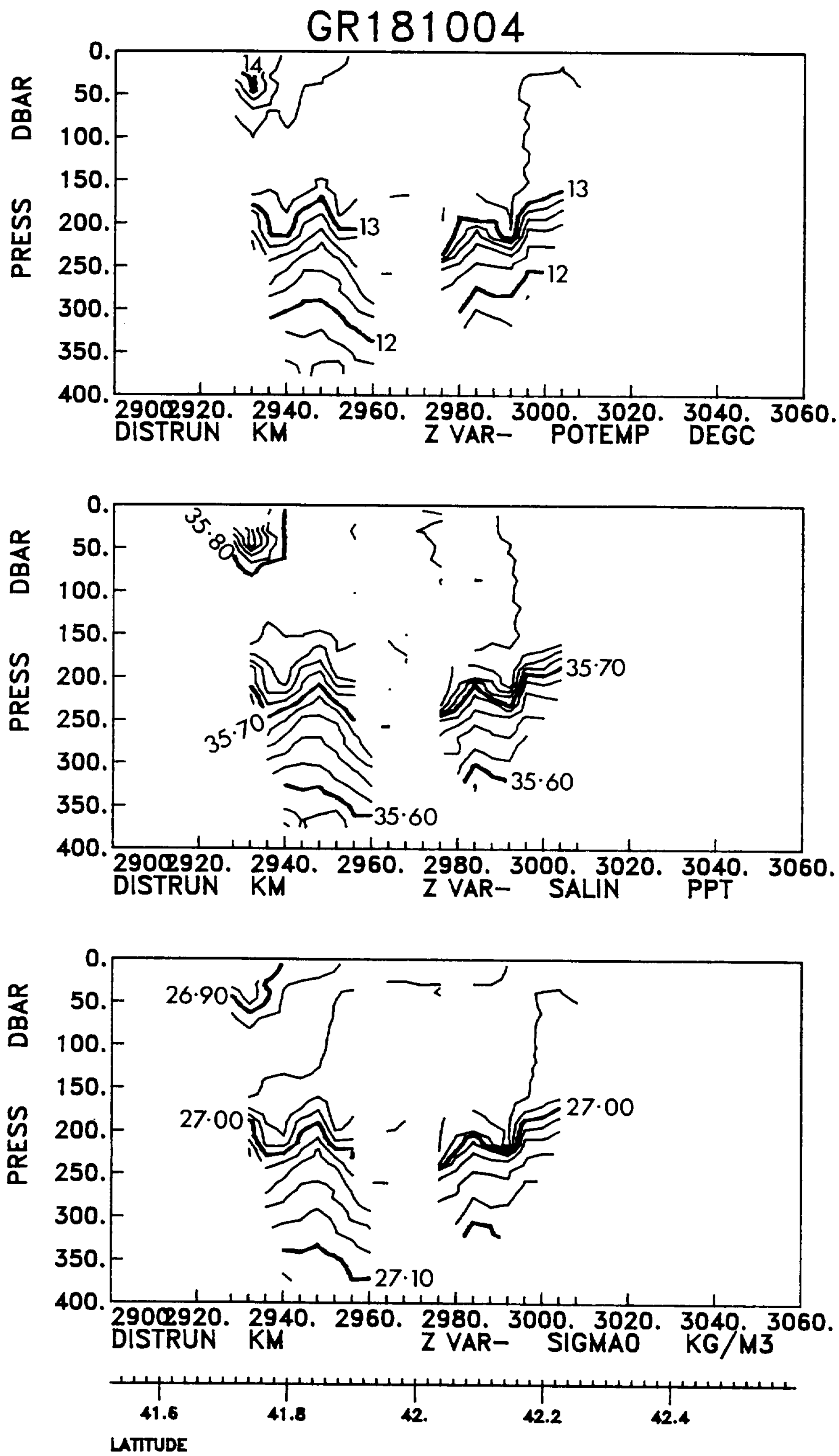
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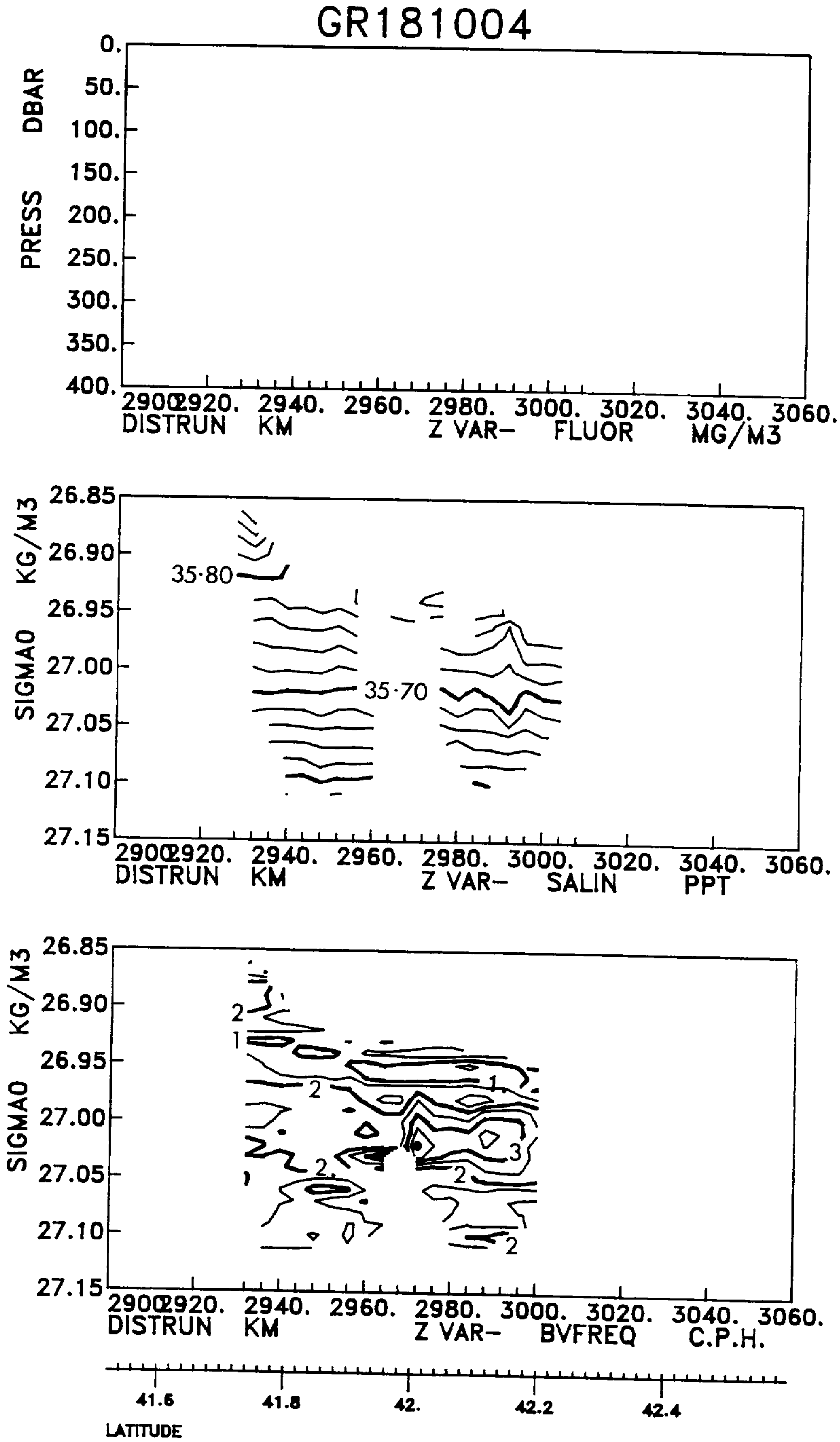
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26.90
26.95
27.00
27.05
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27.15
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1
3
2
2
2
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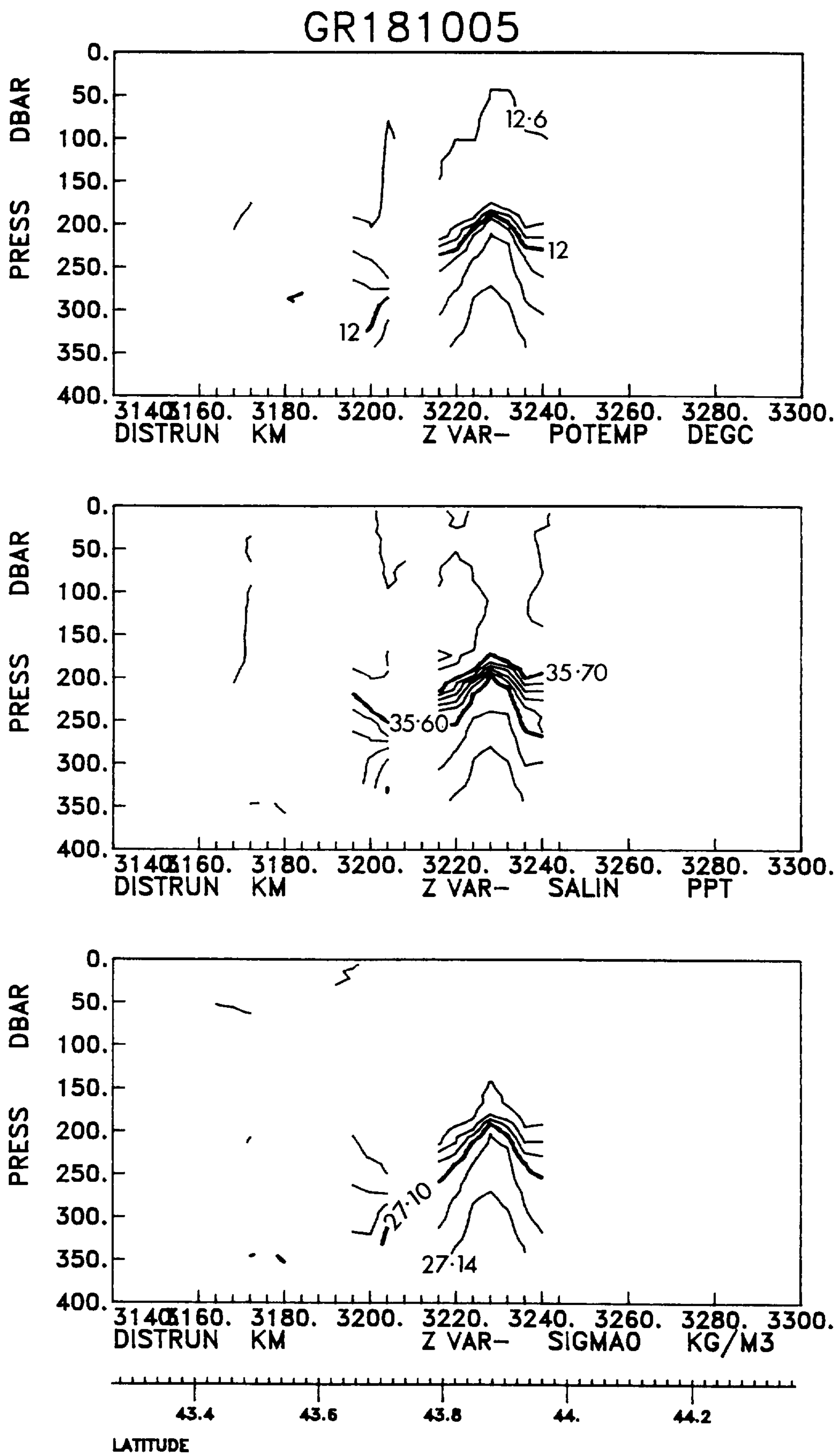
DISTRUN KM Z VAR- BVFREQ C.P.H.
41.6
41.8
42.
42.2
42.4
LATITUDE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350.
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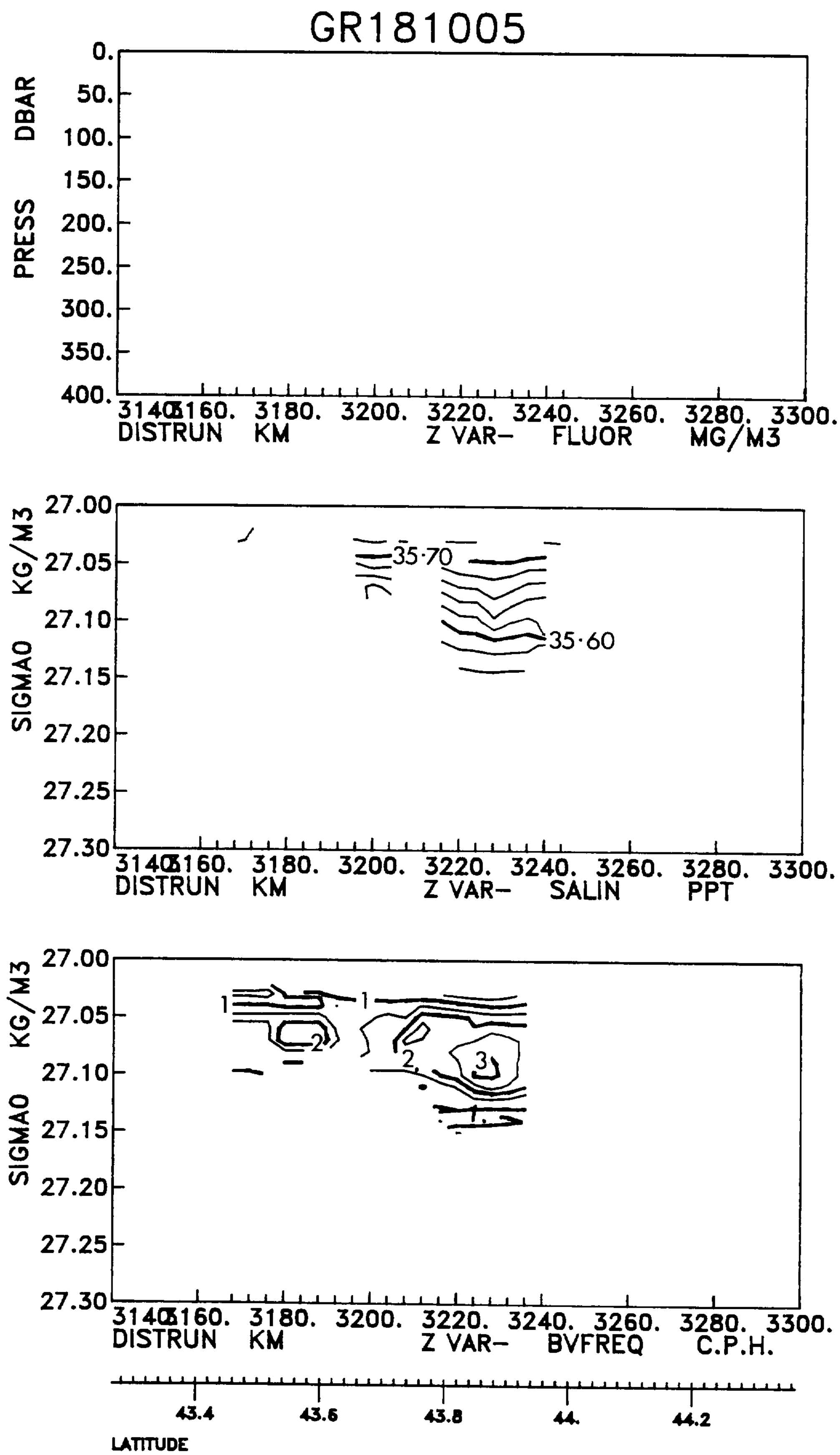
12·6
12
12
3140. 3160. 3180. 3200. 3220. 3240. 3260. 3280. 3300.
DISTRUN KM
Z VAR- POTEMP DEGC
35·70
35·60
Z VAR- SALIN PPT
27·10
27·14
Z VAR- SIGMAO KG/M3
43.4
43.6
43.8
44.
44.2
LATITUDE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DISTRUN KM Z VAR- FLUOR MG/M3
27.00
27.05
27.10
27.15
27.20
27.25
27.30
SIGMA0 KG/M3
35·70
35·60
3140.3160. 3180. 3200. 3220. 3240. 3260. 3280. 3300.
DISTRUN KM Z VAR- SALIN PPT
27.00
27.05
27.10
27.15
27.20
27.25
27.30
SIGMA0 KG/M3
1
1
2
2
3
1
3140.3160. 3180. 3200. 3220. 3240. 3260. 3280. 3300.
DISTRUN KM Z VAR- BVFREQ C.P.H.
43.4
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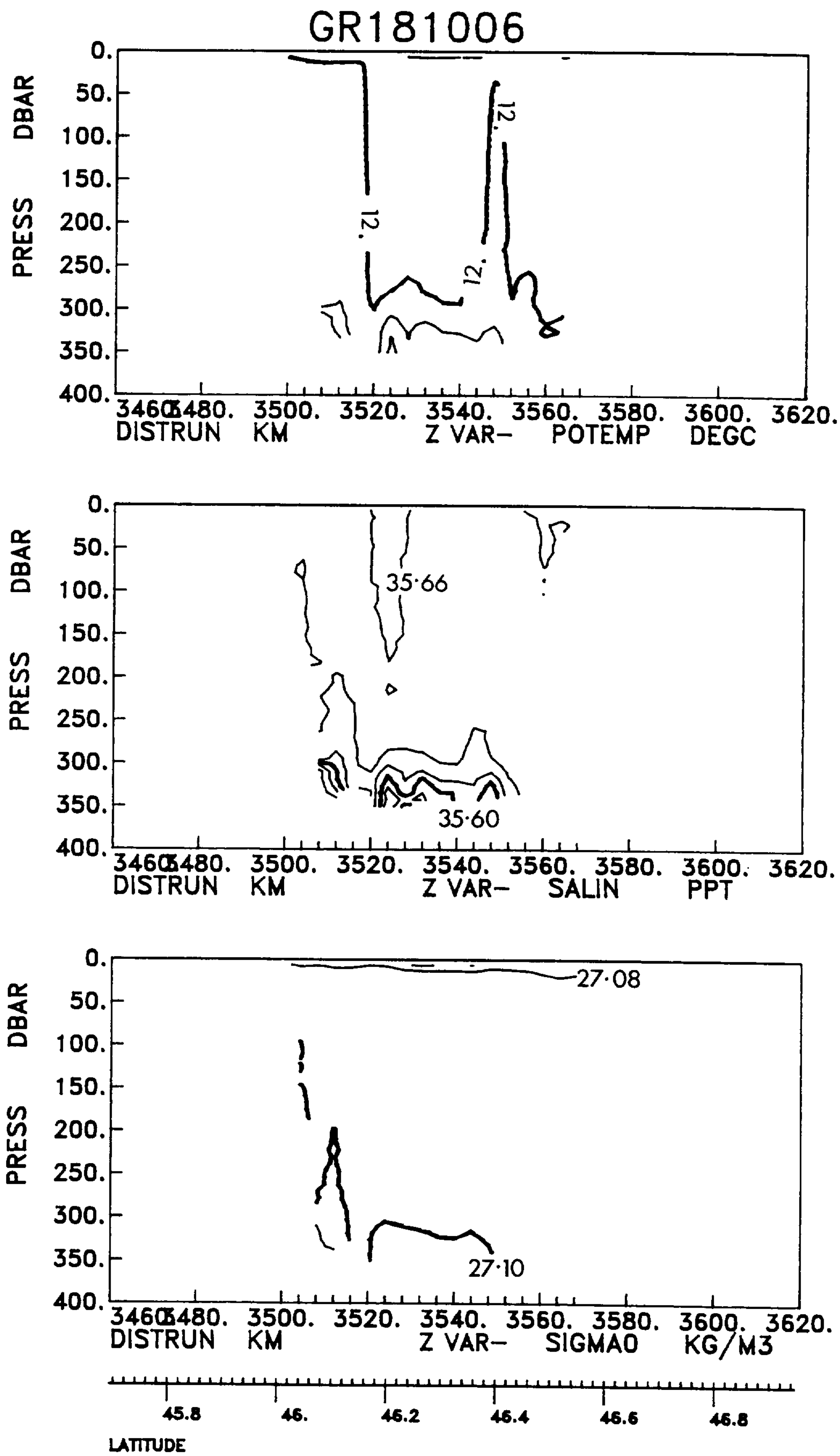
43.8
44.
44.2
LATITUDE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12.
12.
12.
3460.3480. 3500. 3520. 3540. 3560. 3580. 3600. 3620.
DISTRUN KM Z VAR- POTEMP DEGC
35·66
35·60
DISTRUN KM Z VAR- SALIN PPT
27·08
27·10
DISTRUN KM Z VAR- SIGMA0 KG/M3
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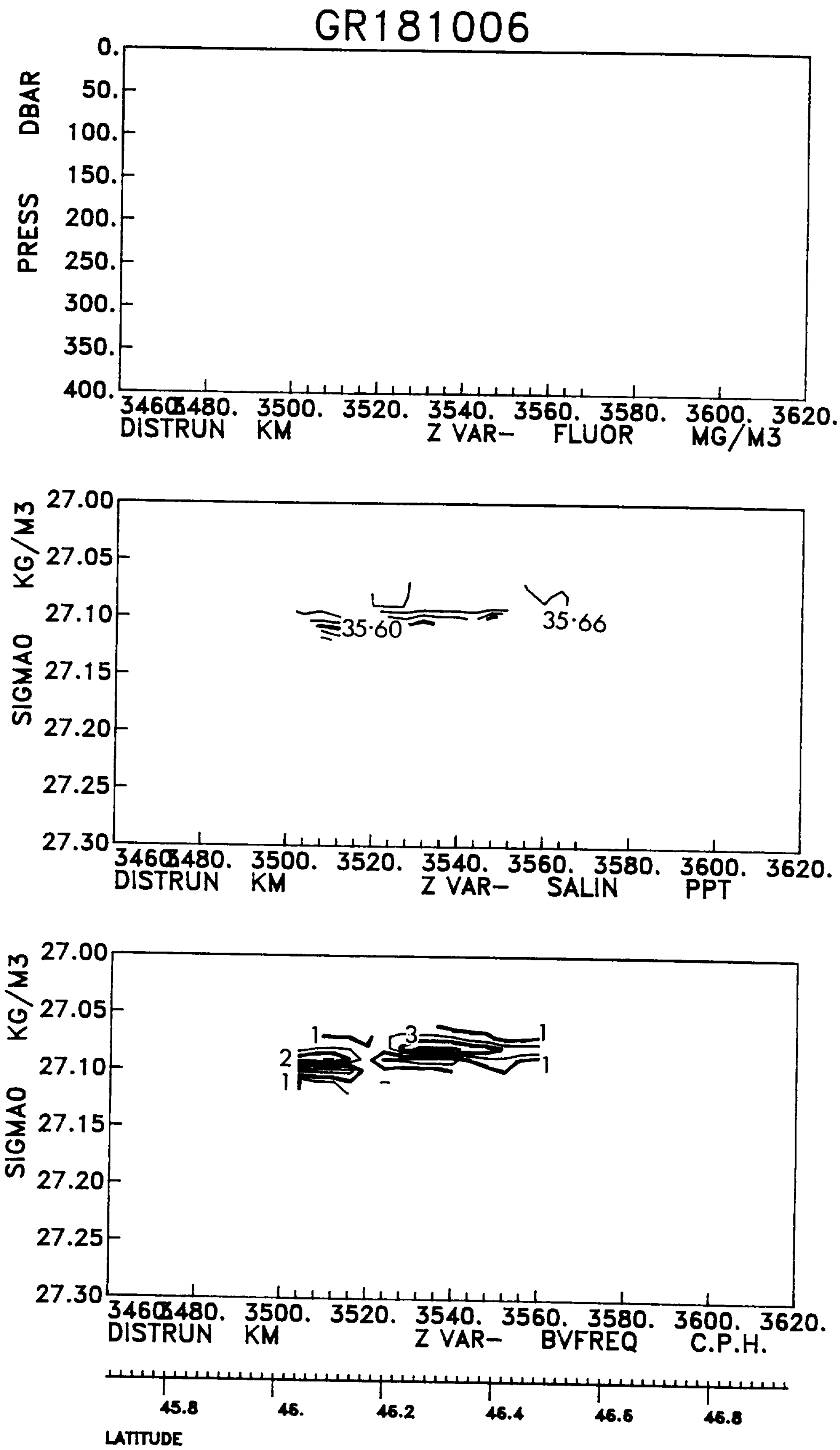
46.4
46.6
46.8
LATITUDE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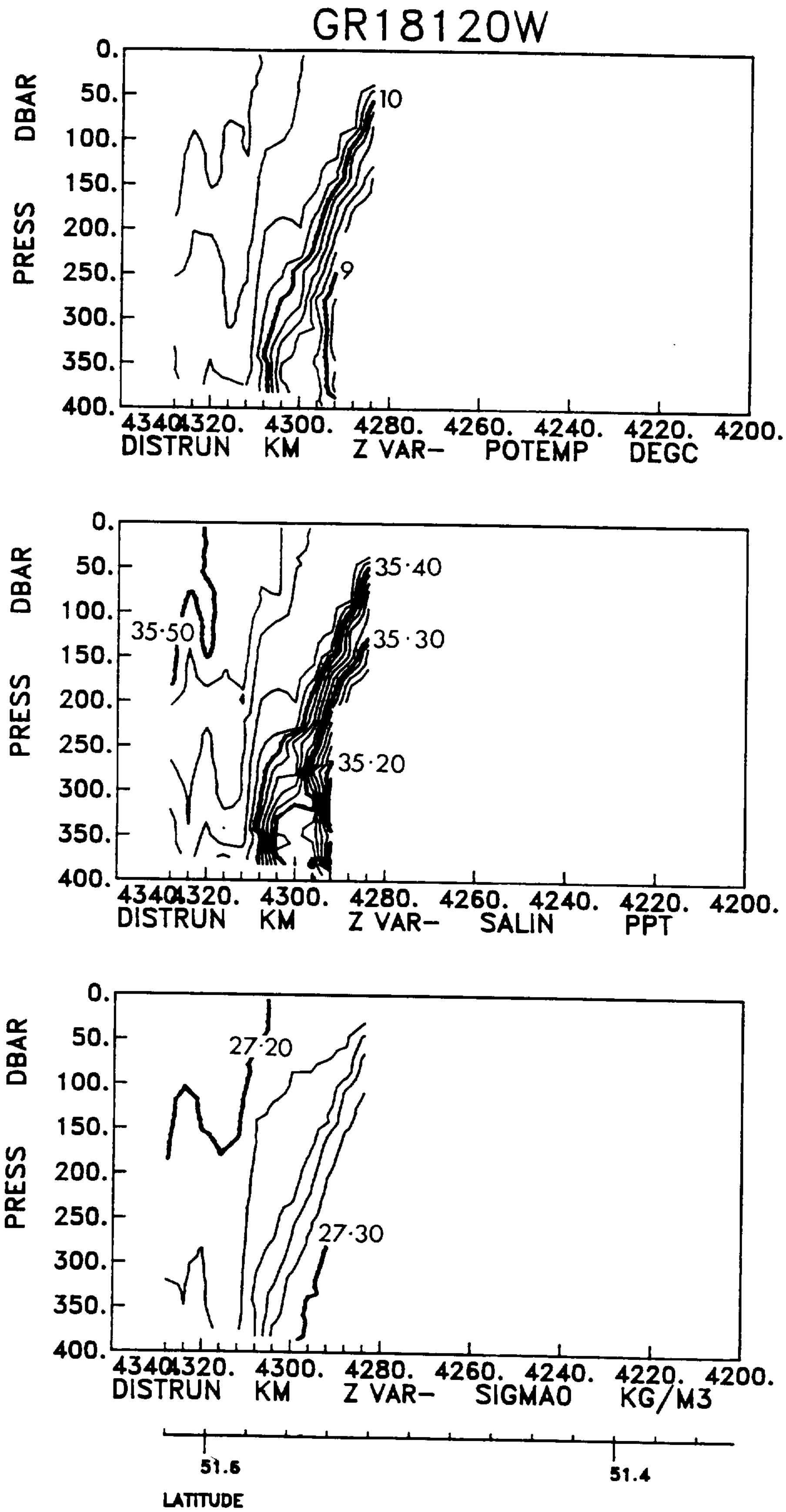
DISTRUN KM Z VAR- FLUOR MG/M3
SIGMAO KG/M3
27.00
27.05
27.10
27.15
27.20
27.25
27.30
35·60
35·66
3460. 3480. 3500. 3520. 3540. 3560. 3580. 3600. 3620.
DISTRUN KM Z VAR- SALIN PPT
SIGMAO KG/M3
27.00
27.05
27.10
27.15
27.20
27.25
27.30
1
2
1
3
1
1
3460. 3480. 3500. 3520. 3540. 3560. 3580. 3600. 3620.
DISTRUN KM Z VAR- BVFREQ C.P.H.
45.8
46.
46.2
46.4
46.6
46.8
LATITUDE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300.
350.
400.
10
9
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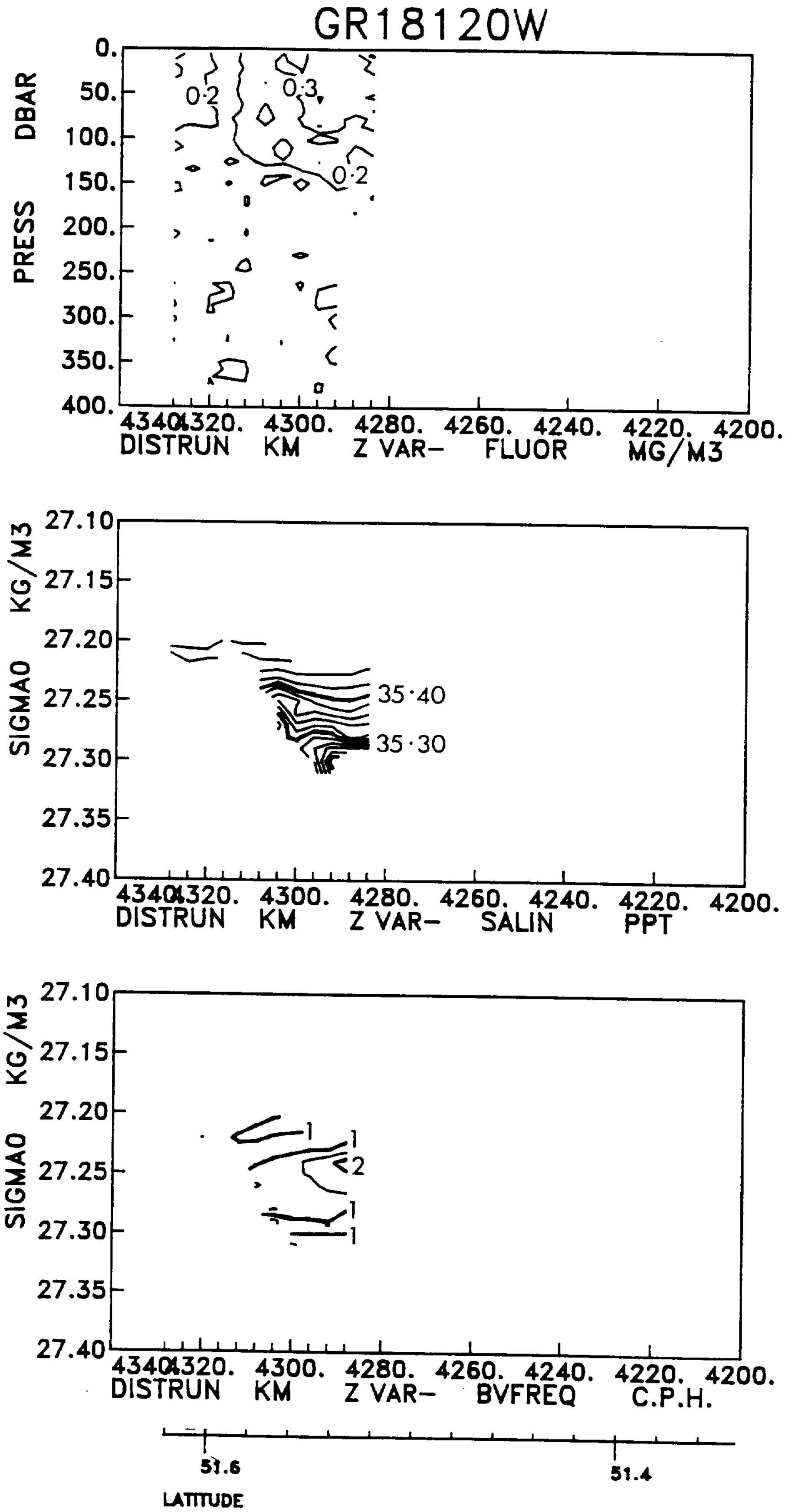
DISTRUN KM Z VAR- POTEMP DEGC
35·40
35·50
35·30
35·20
DISTRUN KM Z VAR- SALIN PPT
27·20
27·30
DISTRUN KM Z VAR- SIGMAO KG/M3
51.6
51.4
LATITUDE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PRESS DBAR
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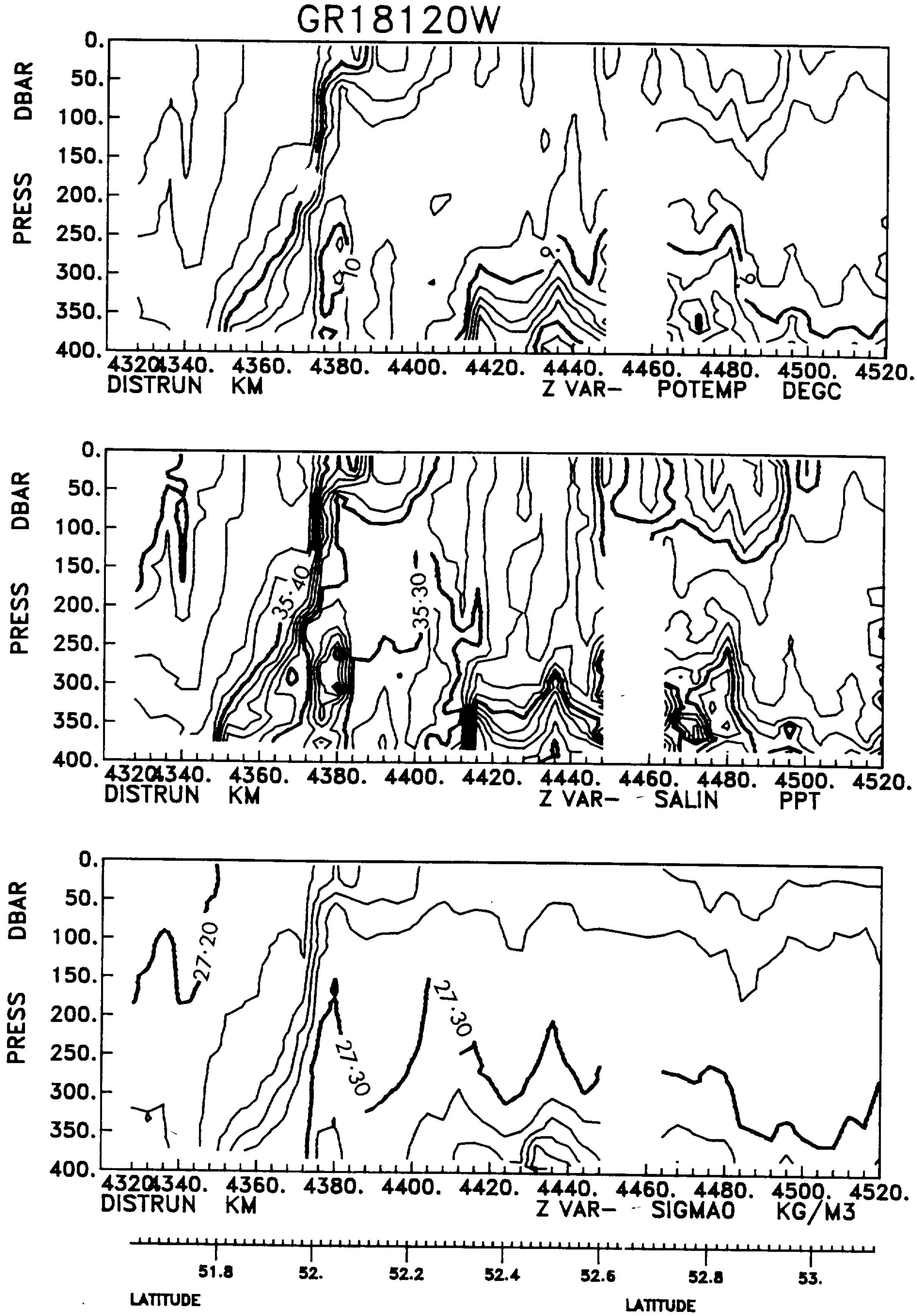
50.
100.
150.
200.
250.
300.
350.
400.
0·2
0·3
0·2
4340.4320. 4300. 4280. 4260. 4240. 4220. 4200.
DISTRUN KM Z VAR– FLUOR MG/M3
SIGMAO KG/M3
27.10
27.15
27.20
27.25
27.30
27.35
27.40
35·40
35·30
4340.4320. 4300. 4280. 4260. 4240. 4220. 4200.
DISTRUN KM Z VAR– SALIN PPT
SIGMAO KG/M3
27.10
27.15
27.20
27.25
27.30
27.35
27.40
1
1
2
1
1
4340.4320. 4300. 4280. 4260. 4240. 4220. 4200.
DISTRUN KM Z VAR– BVFREQ C.P.H.
51.6
51.4
LATITUDE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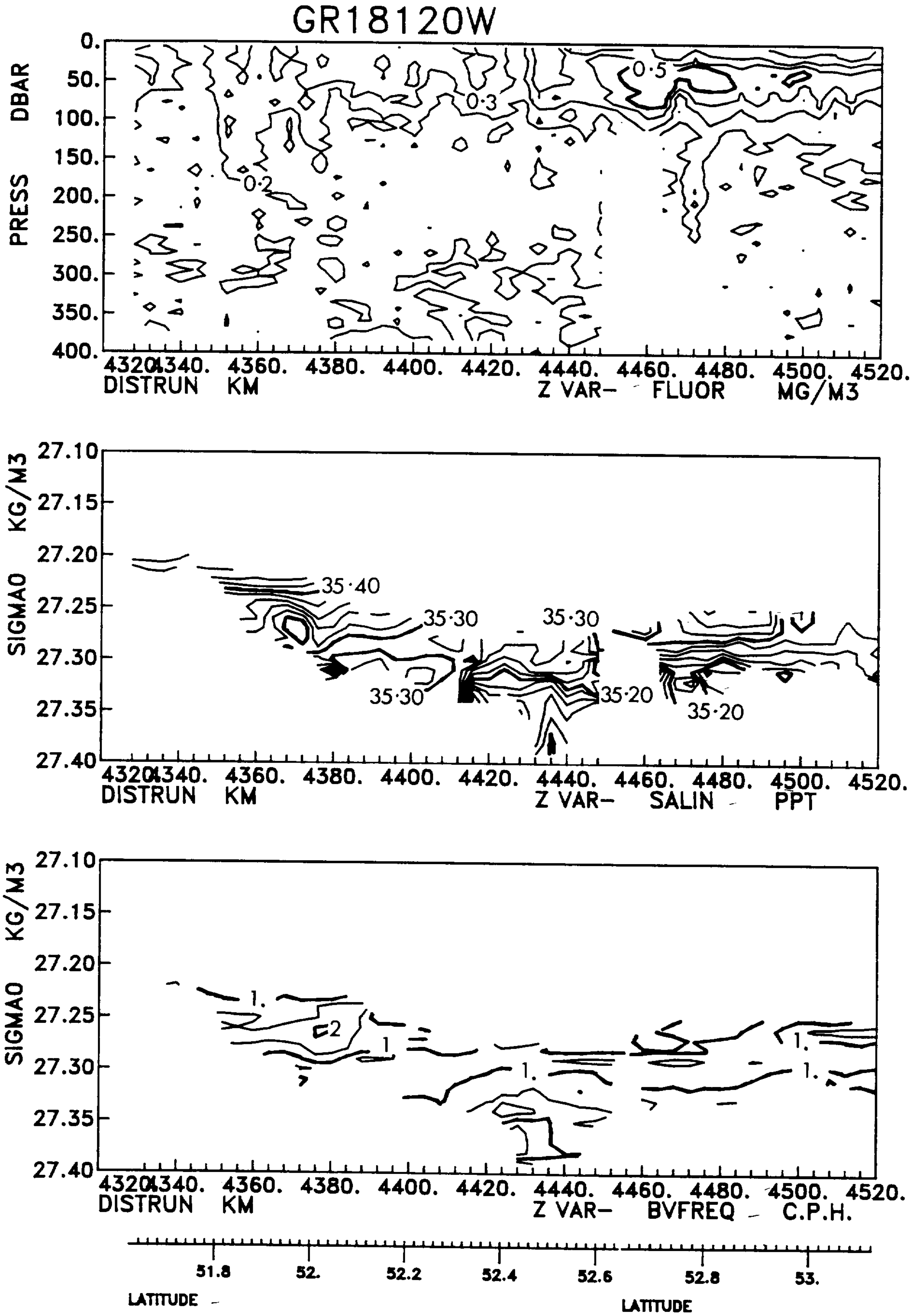
DISTRUN KM
Z VAR- POTEMP DEGC
10
9.
35.40
35.30
Z VAR- SALIN PPT
27.20
27.30
Z VAR- SIGMA0 KG/M3
51.8
52.
52.2
52.4
52.6
52.8
53.
LATITUDE
LATITUDE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250.
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350.
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PRESS DBAR
0·5
0·3
0·2
4320.4340. 4360. 4380. 4400. 4420. 4440. 4460. 4480. 4500. 4520.
DISTRUN KM
Z VAR- FLUOR MG/M3
27.10
27.15
27.20
27.25
27.30
27.35
27.40
SIGMA0 KG/M3
35·40
35·30
35·30
35·30
35·20
35·20
4320.4340. 4360. 4380. 4400. 4420. 4440. 4460. 4480. 4500. 4520.
DISTRUN KM
Z VAR- SALIN PPT
27.10
27.15
27.20
27.25
27.30
27.35
27.40
SIGMA0 KG/M3
1.
2
1
1.
1.
1.
4320.4340. 4360. 4380. 4400. 4420. 4440. 4460. 4480. 4500. 4520.
DISTRUN KM
Z VAR- BVFREQ C.P.H.
51.8
52.
52.2
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52.8
53.
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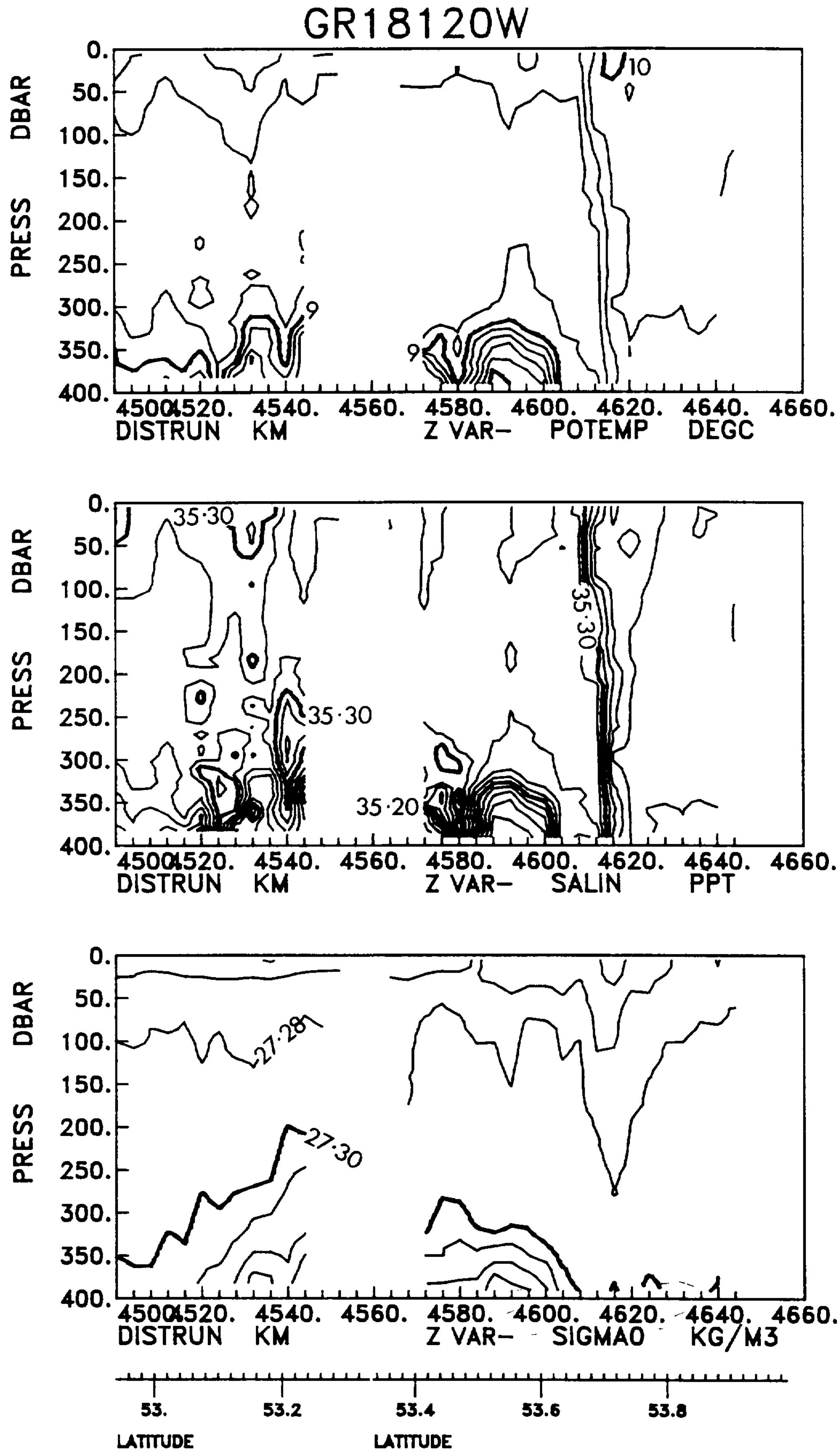
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250.
300.
350.
400.
10
9
9
4500.4520. 4540. 4560. 4580. 4600. 4620. 4640. 4660.
DISTRUN KM Z VAR- POTEMP DEGC
35·30
35·30
35·30
35·20
DISTRUN KM Z VAR- SALIN PPT
27·28
27·30
DISTRUN KM Z VAR- SIGMA0 KG/M3
53.
53.2
53.4
53.6
53.8
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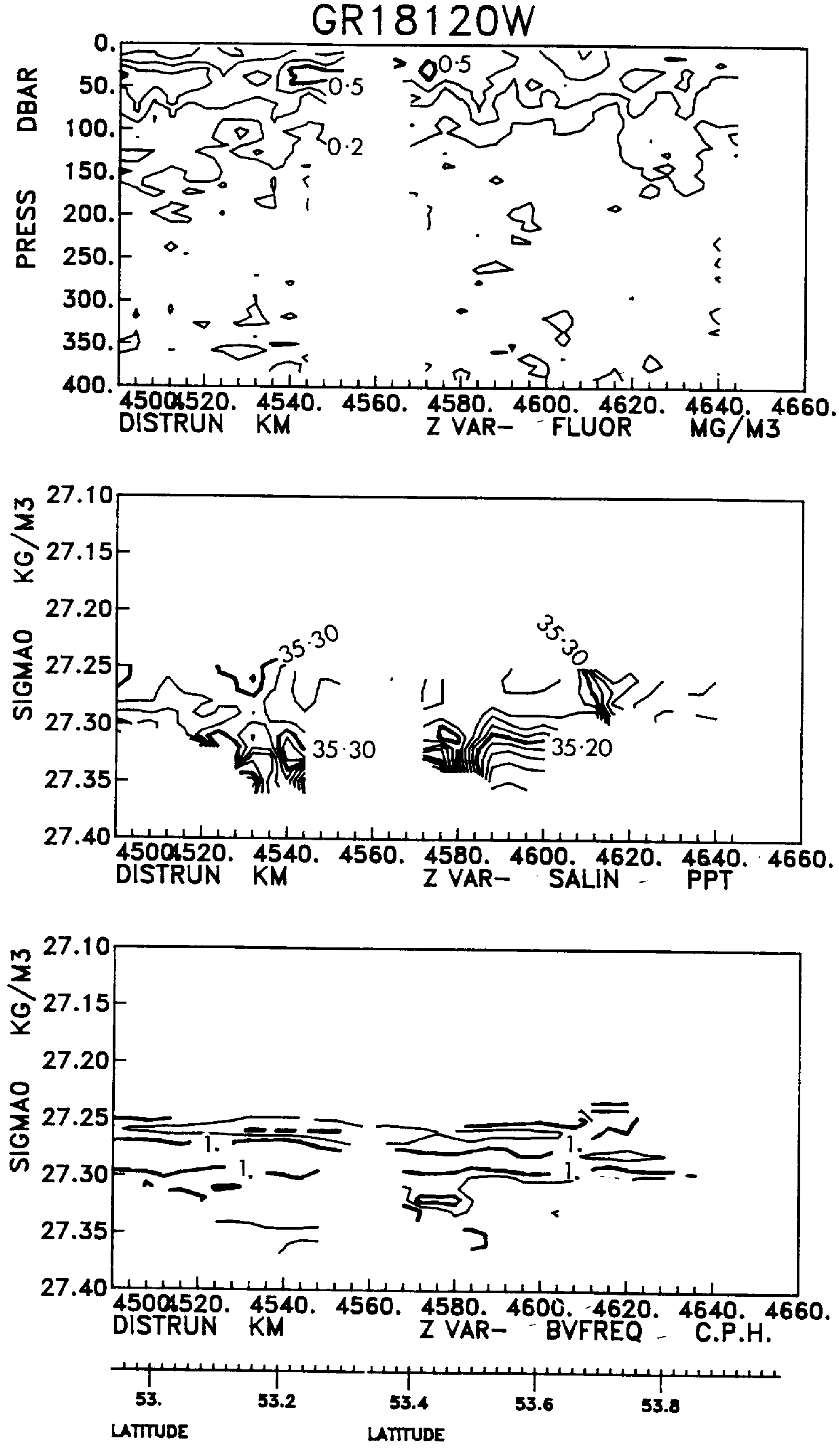
LATITUDE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250.
300.
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0·2
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DISTRUN KM Z VAR- FLUOR MG/M3
27.10
27.15
27.20
27.25
27.30
27.35
27.40
SIGMA0 KG/M3
35·30
35·30
35·30
35·20
4500.4520. 4540. 4560. 4580. 4600. 4620. 4640. 4660.
DISTRUN KM Z VAR- SALIN PPT
27.10
27.15
27.20
27.25
27.30
27.35
27.40
SIGMA0 KG/M3
1.
1.
1.
1.
4500.4520. 4540. 4560. 4580. 4600. 4620. 4640. 4660.
DISTRUN KM Z VAR- BVFREQ C.P.H.
53.
53.2
53.4
53.6
53.8
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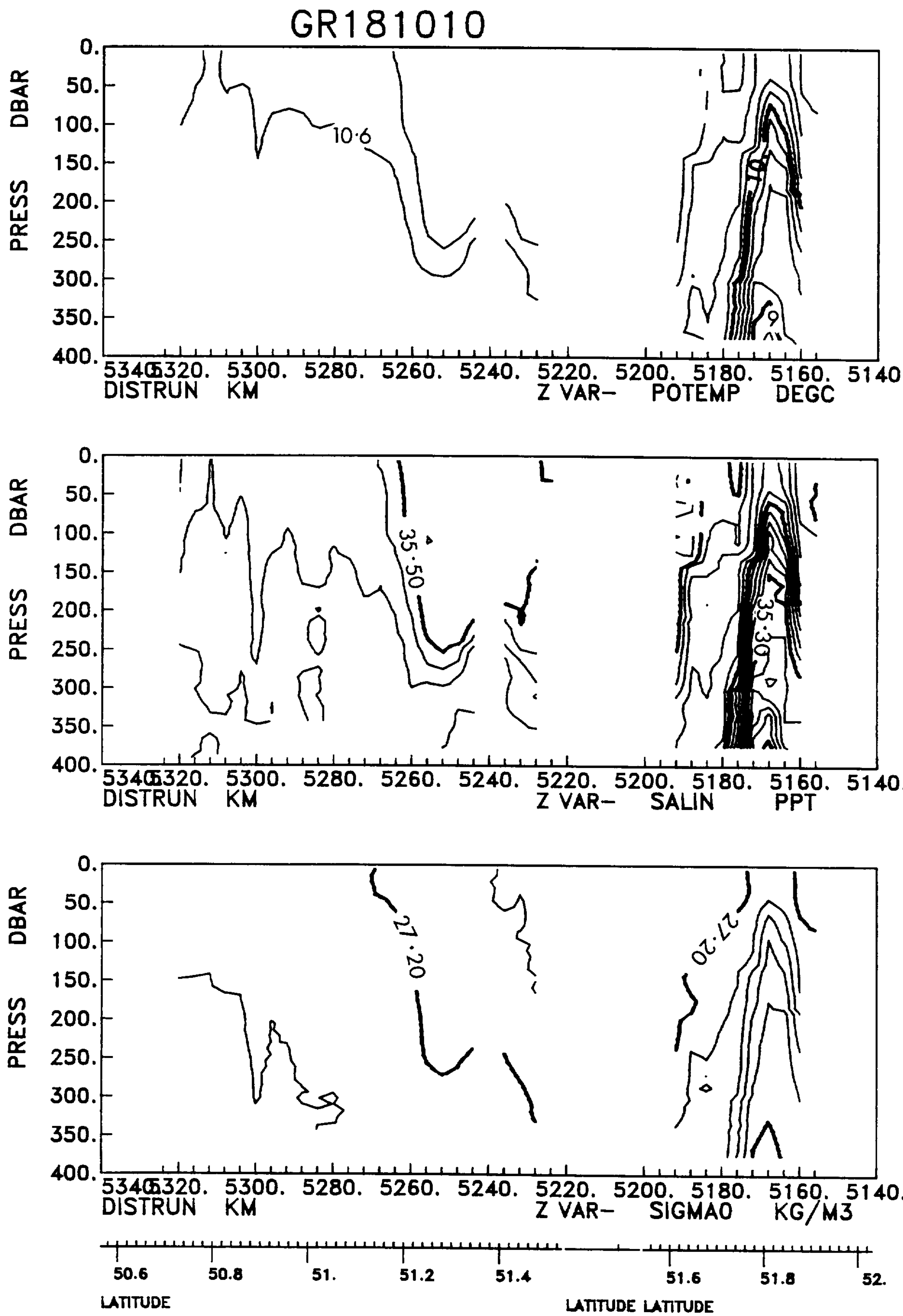
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10·6
9
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DISTRUN KM
Z VAR- POTEMP DEGC
35·50
35·30
Z VAR- SALIN PPT
27·20
Z VAR- SIGMA0 KG/M3
50.6 50.8 51. 51.2 51.4 51.6 51.8 52.
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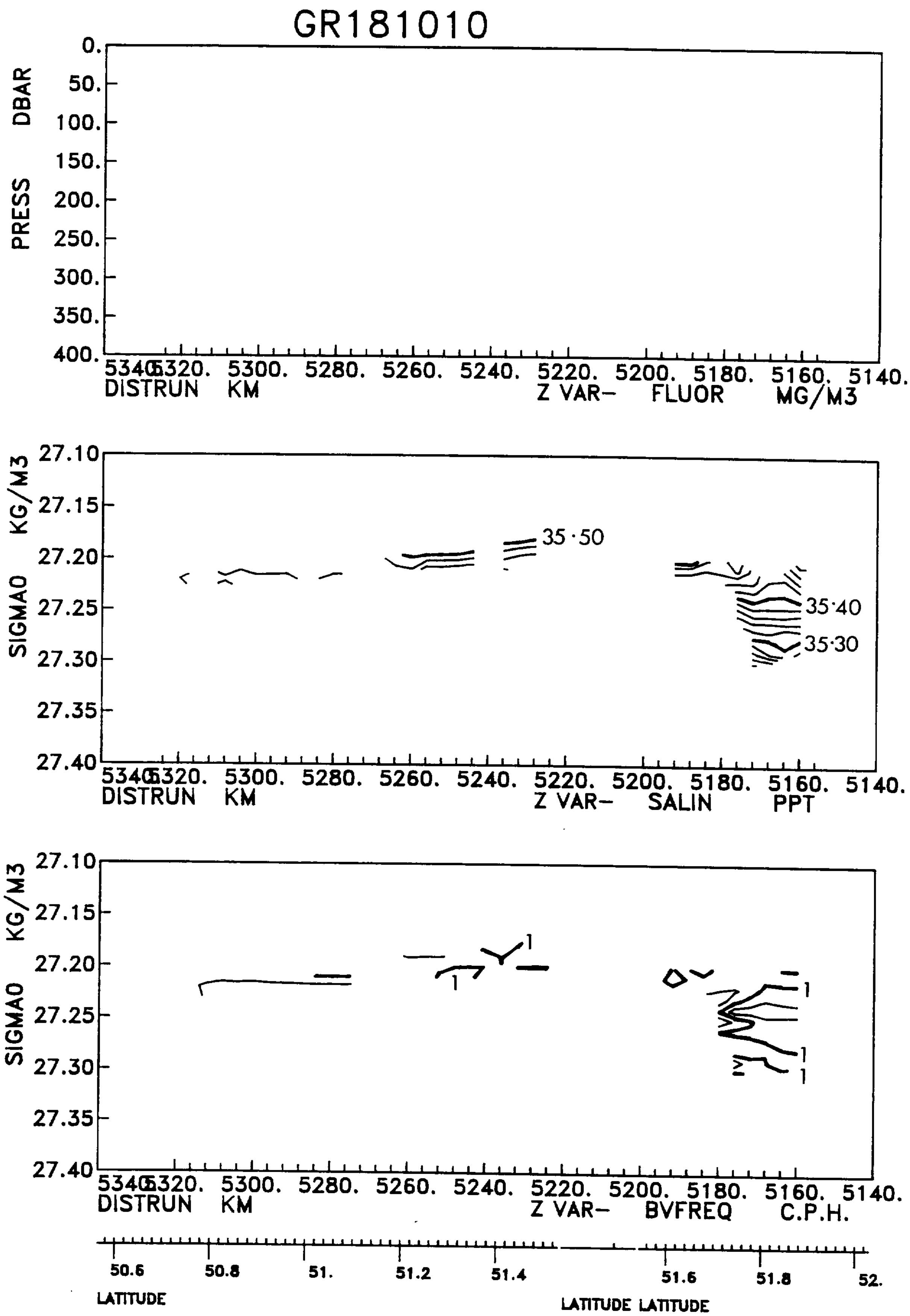
LATITUDE LATITUDE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DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
27.10
27.15
27.20
27.25
27.30
27.35
27.40
35·50
35·40
35·30
Z VAR- SALIN PPT
1
Z VAR- BVFREQ C.P.H.
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50.8
51.
51.2
51.4
51.6
51.8
52.
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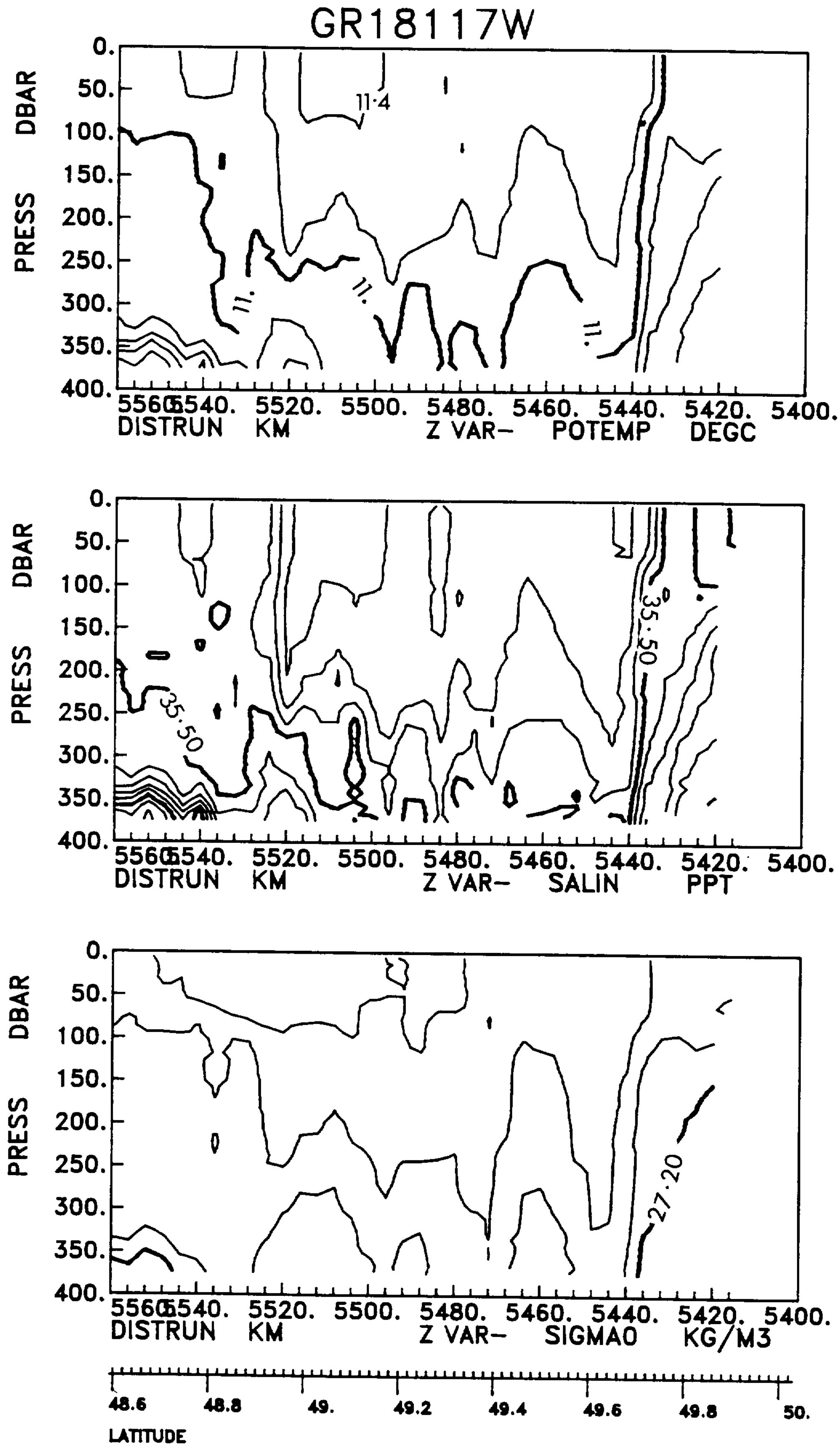
LATITUDE LATITUDE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300.
350.
400.
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11·4
11.
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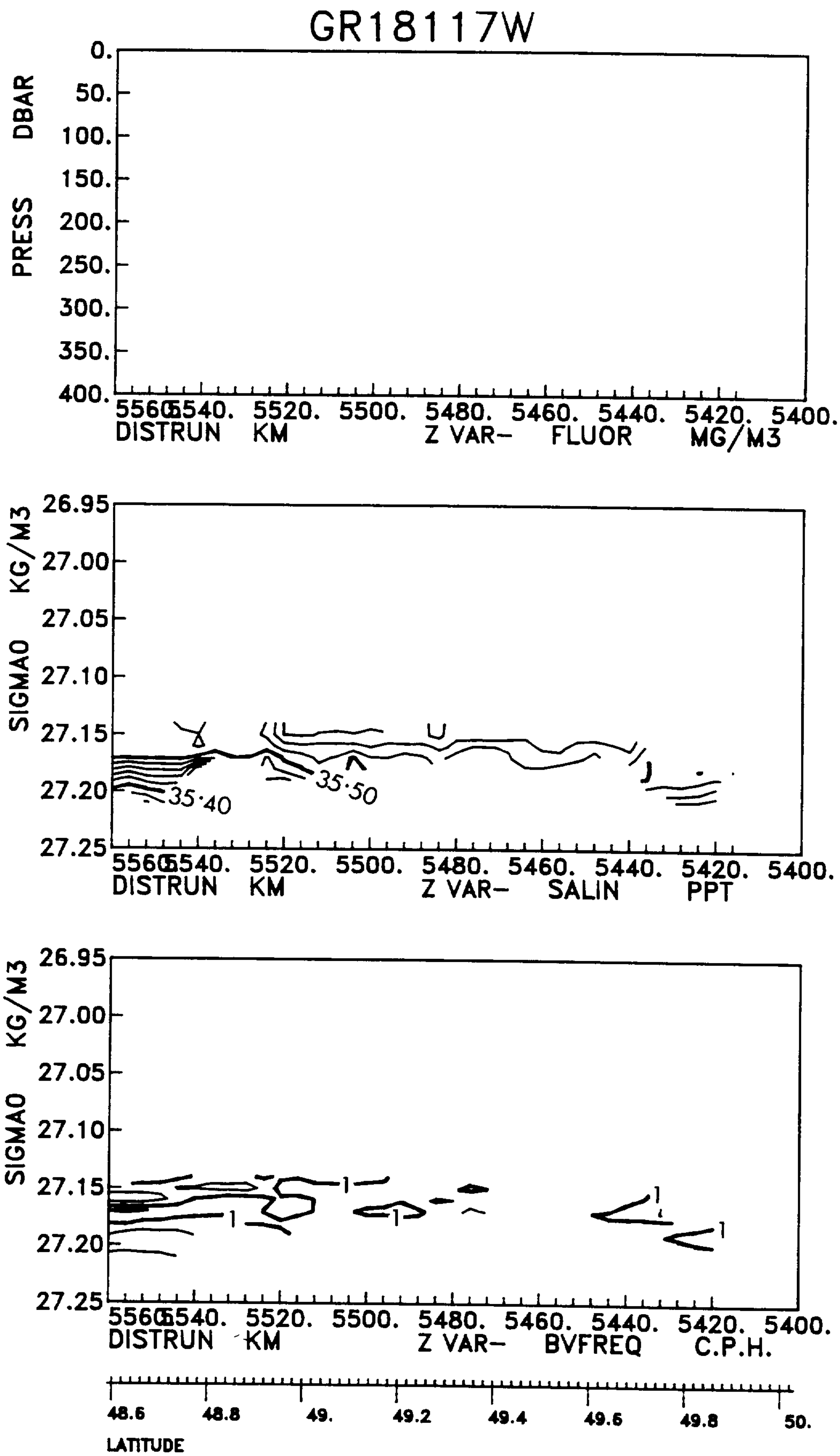
DISTRUN KM Z VAR- POTEMP DEGC
35·50
DISTRUN KM Z VAR- SALIN PPT
27·20
DISTRUN KM Z VAR- SIGMA0 KG/M3
48.6 48.8 49. 49.2 49.4 49.6 49.8 50.
LATITUDE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DISTRUN KM Z VAR- FLUOR MG/M3
SIGMAO KG/M3
26.95
27.00
27.05
27.10
27.15
27.20
27.25
35·40
35·50
5560 5540. 5520. 5500. 5480. 5460. 5440. 5420. 5400.
DISTRUN KM Z VAR- SALIN PPT
SIGMAO KG/M3
26.95
27.00
27.05
27.10
27.15
27.20
27.25
5560 5540. 5520. 5500. 5480. 5460. 5440. 5420. 5400.
DISTRUN KM Z VAR- BVFREQ C.P.H.
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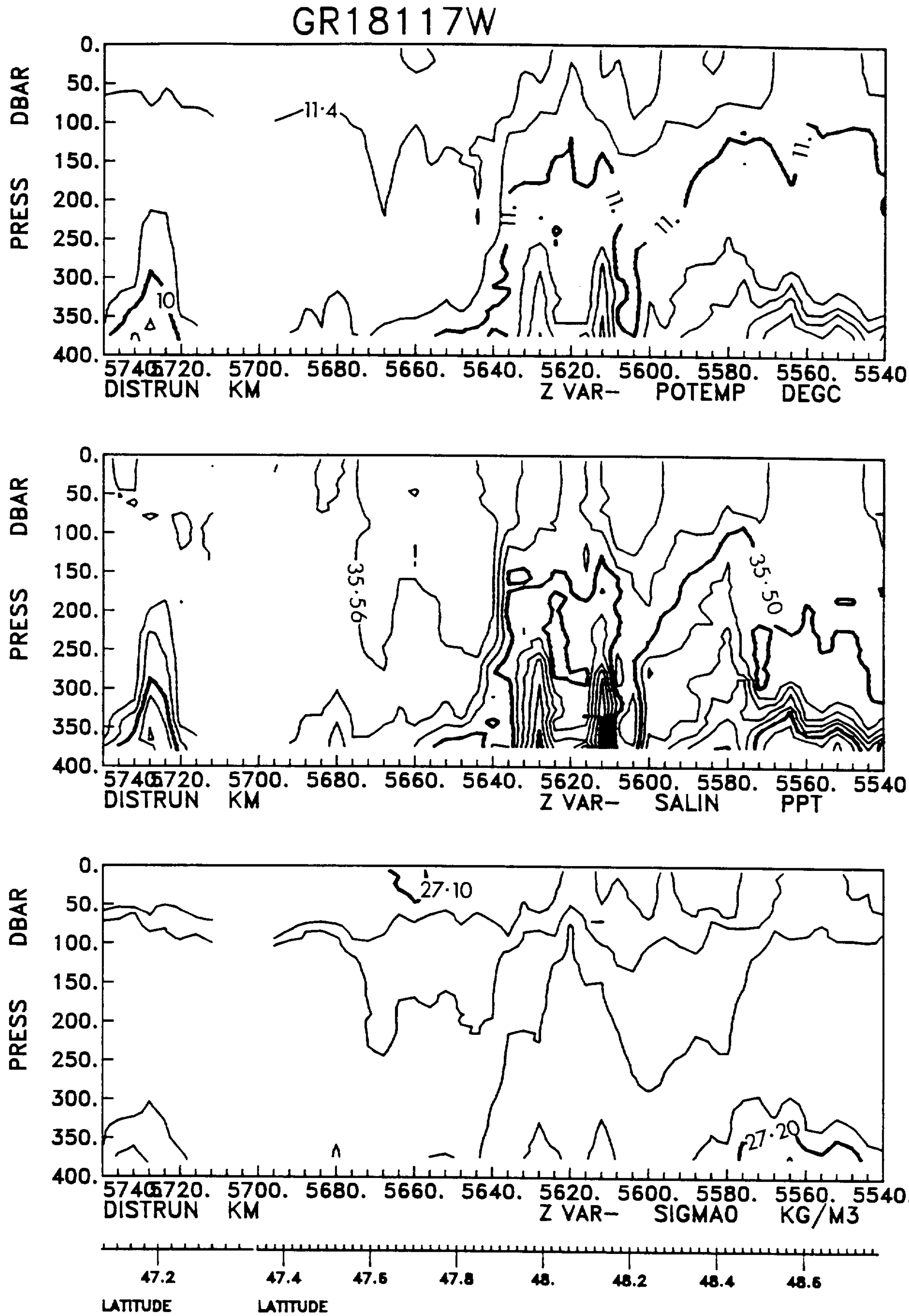
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DISTRUN KM
Z VAR– POTEMP DEGC
35·56
35·50
Z VAR– SALIN PPT
27·10
27·20
Z VAR– SIGMA0 KG/M3
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47.6
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48.4
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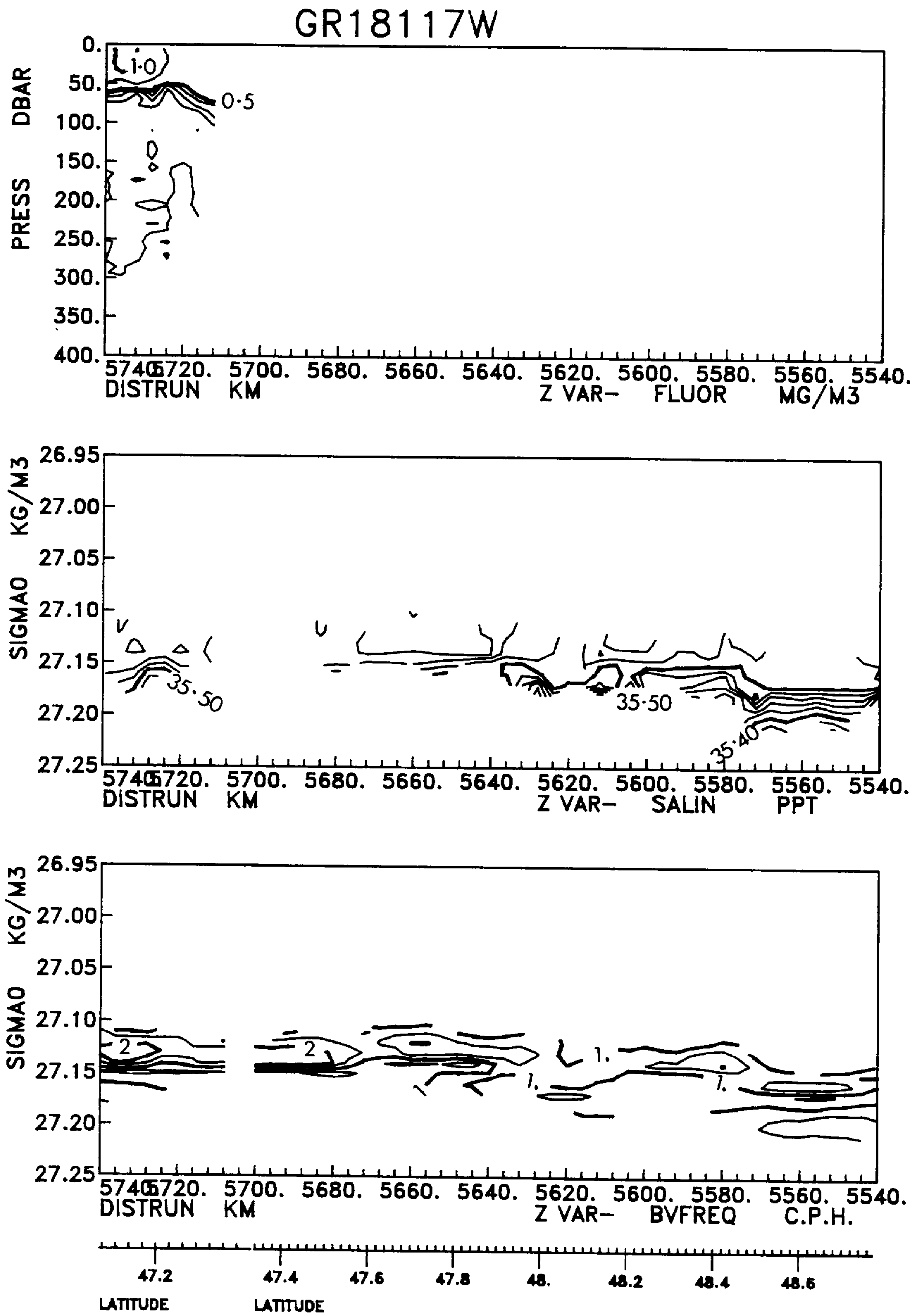
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DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMAO KG/M3
26.95
27.00
27.05
27.10
27.15
27.20
27.25
35·50
35·50
35·40
Z VAR- SALIN PPT
2
2
1.
1.
1.
1.
Z VAR- BVFREQ C.P.H.
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47.4
47.6
47.8
48.
48.2
48.4
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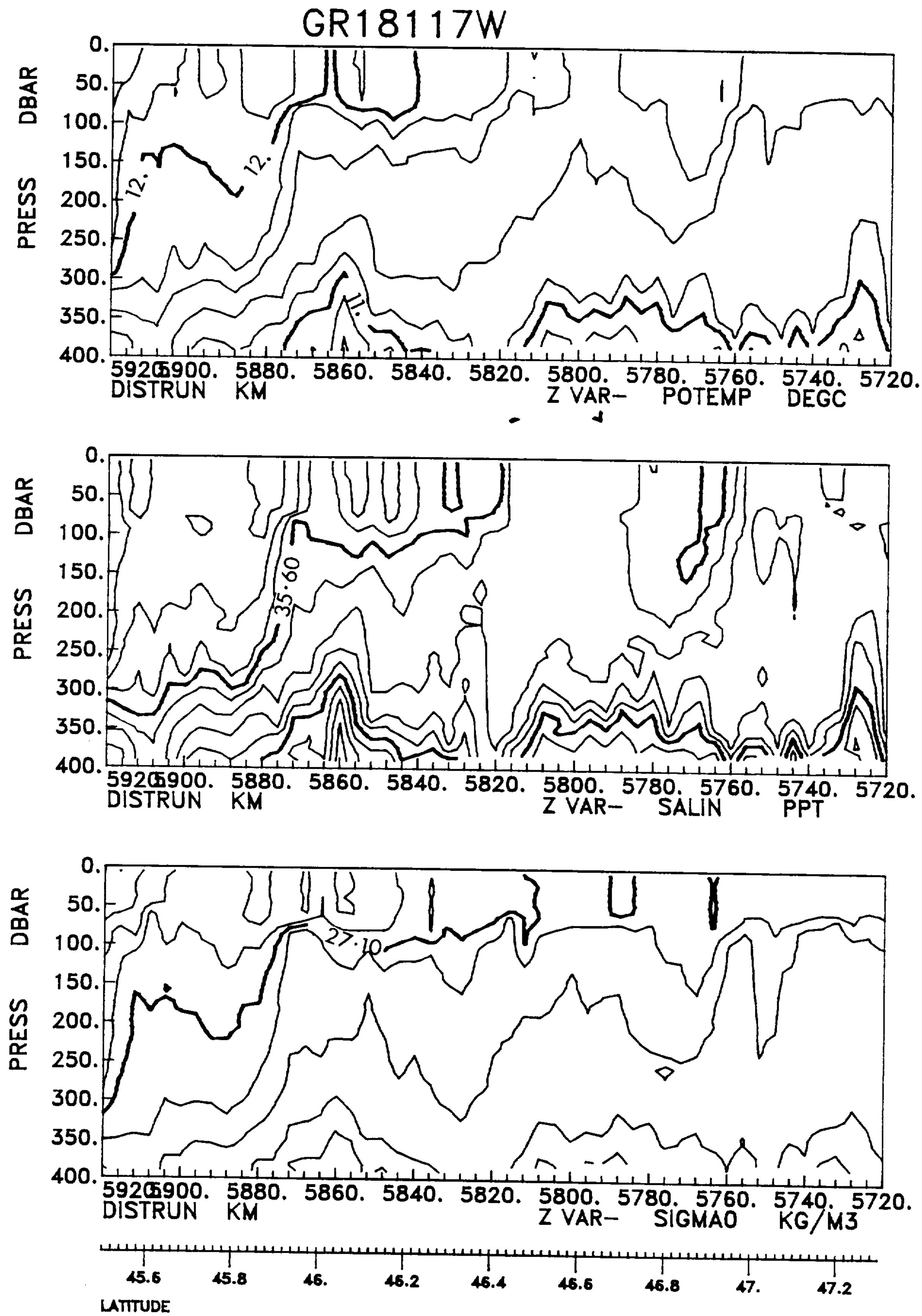
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400.
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12.
12.
11.
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DISTRUN KM
Z VAR– POTEMP DEGC
35.60
Z VAR– SALIN PPT
27.10
Z VAR– SIGMA0 KG/M3
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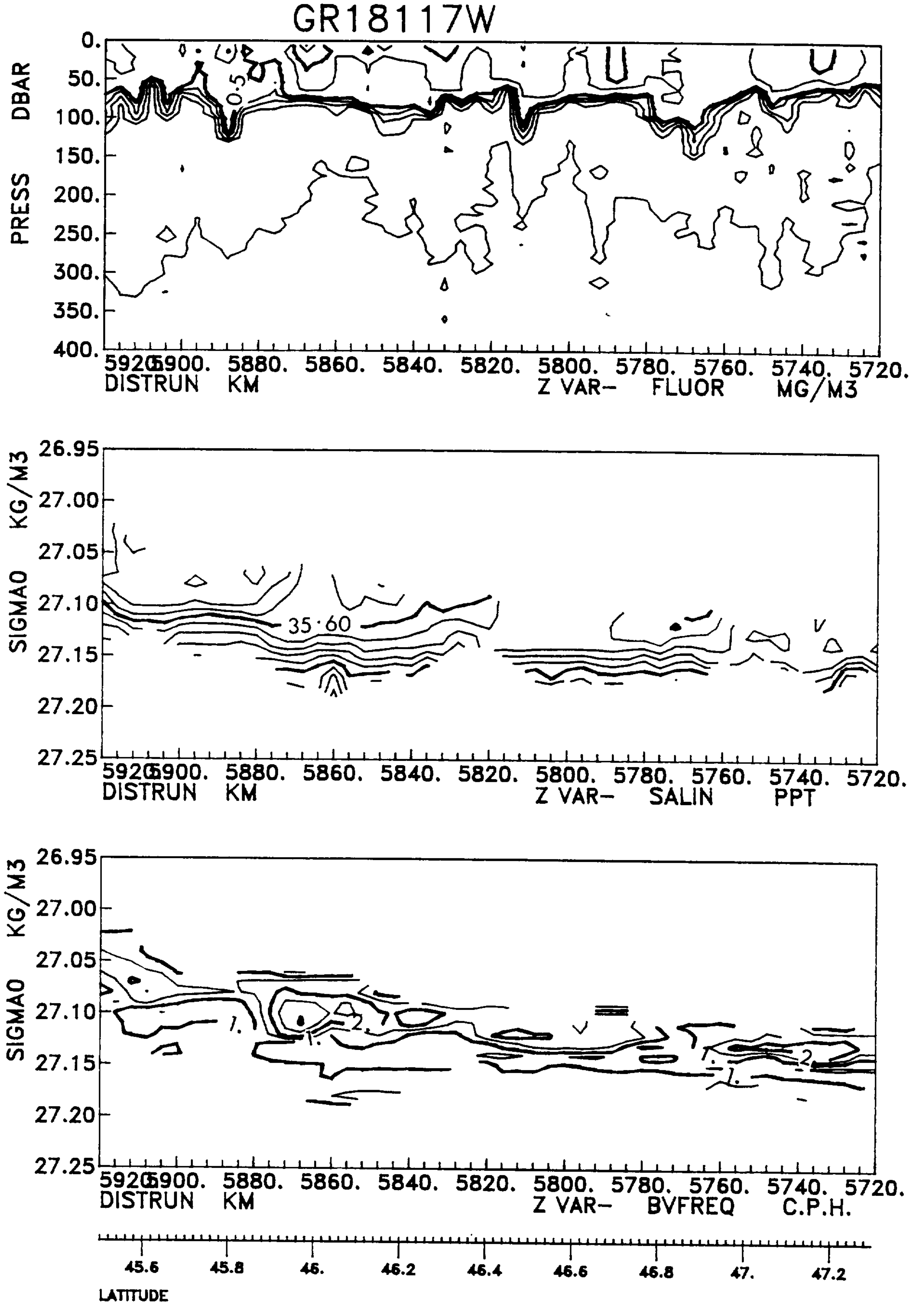
45.8
46.
46.2
46.4
46.6
46.8
47.
47.2
LATITUDE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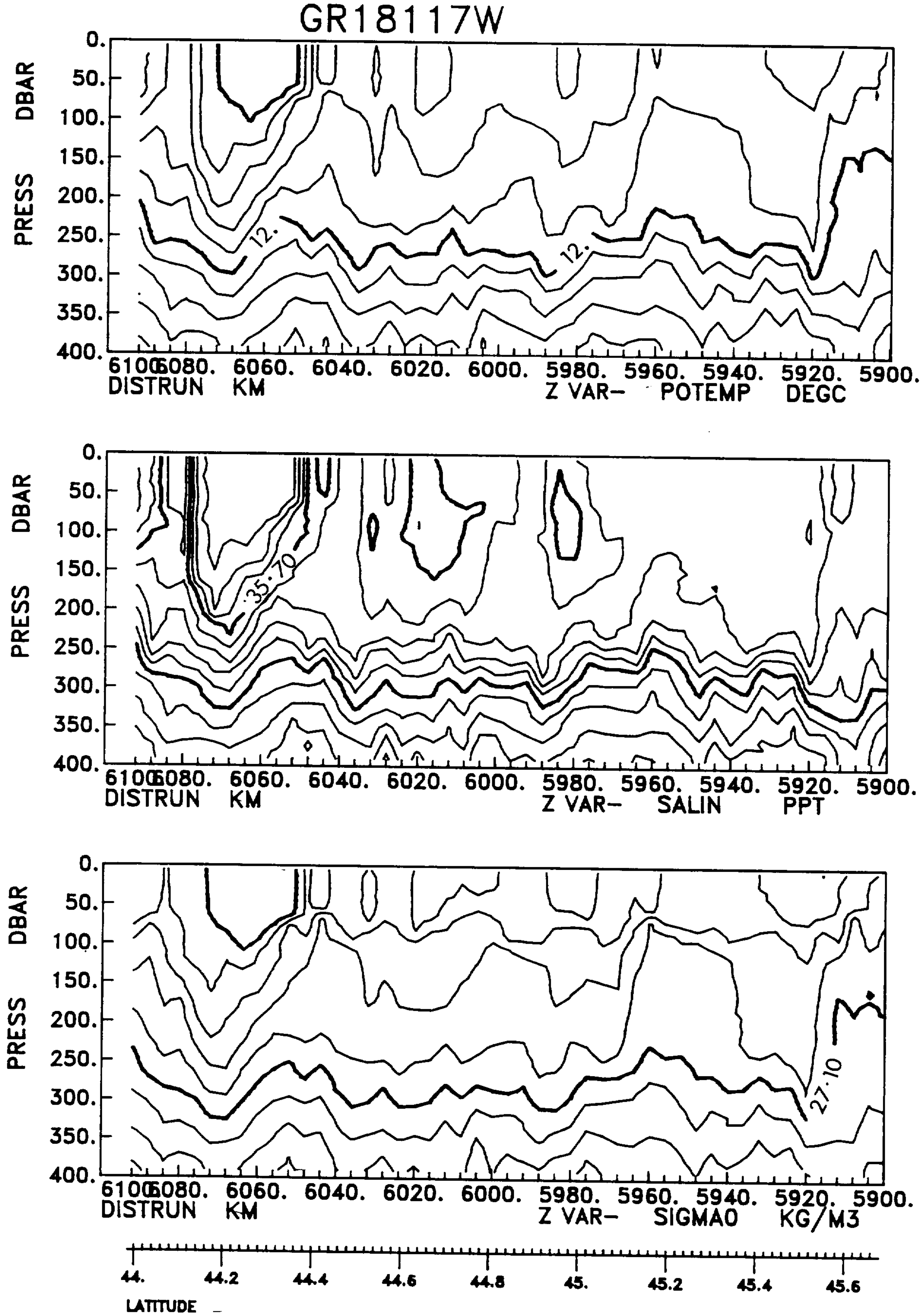
DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMAO KG/M3
26.95
27.00
27.05
27.10
27.15
27.20
27.25
35·60
5920.5900. 5880. 5860. 5840. 5820. 5800. 5780. 5760. 5740. 5720.
DISTRUN KM
Z VAR- SALIN PPT
SIGMAO KG/M3
26.95
27.00
27.05
27.10
27.15
27.20
27.25
1.
2.
5920.5900. 5880. 5860. 5840. 5820. 5800. 5780. 5760. 5740. 5720.
DISTRUN KM
Z VAR- BVFREQ C.P.H.
45.6
45.8
46.
46.2
46.4
46.6
46.8
47.
47.2
LATITUDE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250.
300.
350.
400.
PRESS DBAR
12.
12.
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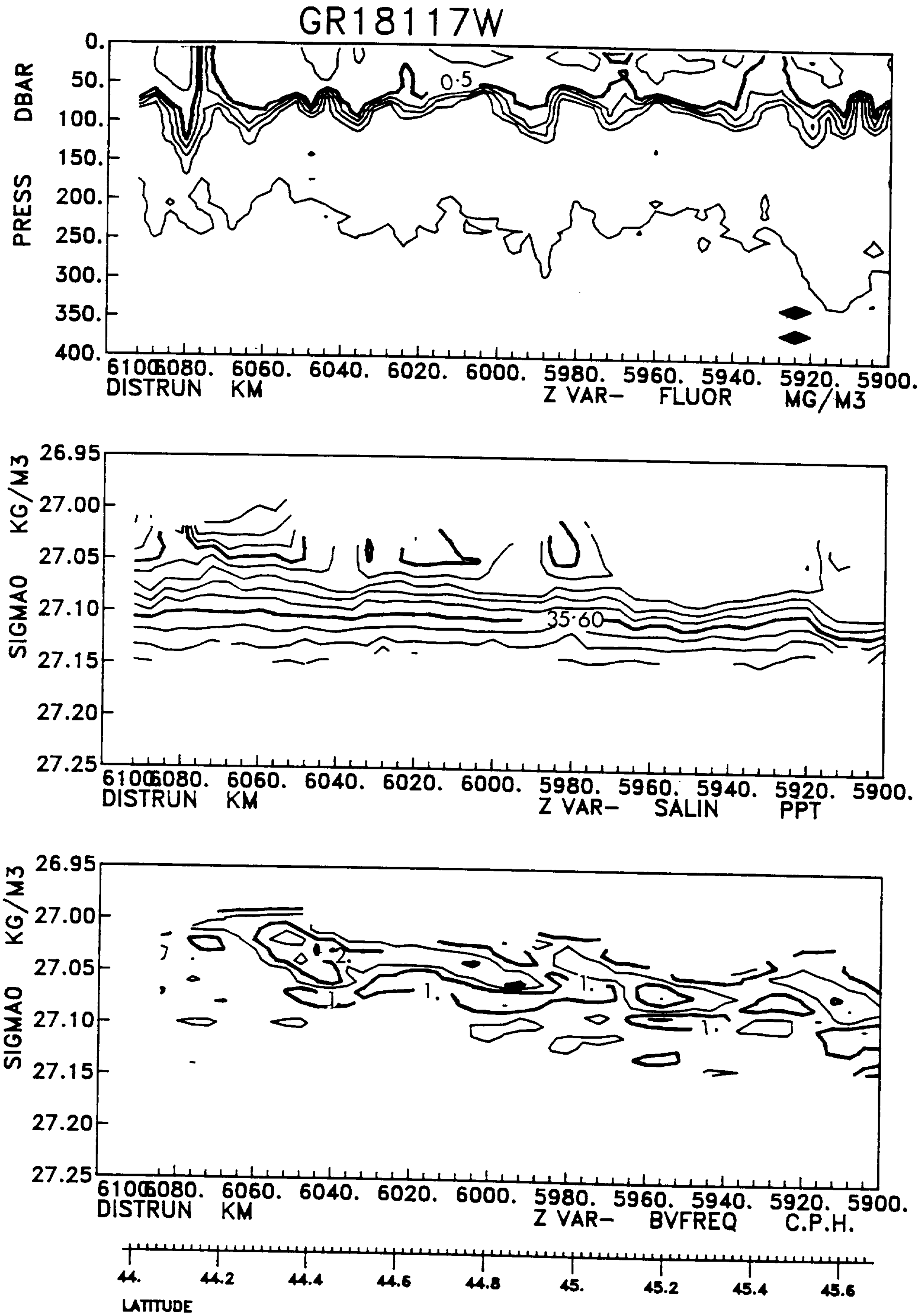
DISTRUN KM
Z VAR- POTEMP DEGC
35.70
Z VAR- SALIN PPT
27.10
Z VAR- SIGMA0 KG/M3
44. 44.2 44.4 44.6 44.8 45. 45.2 45.4 45.6
LATITUDE


GR18117W
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150.
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300.
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400.
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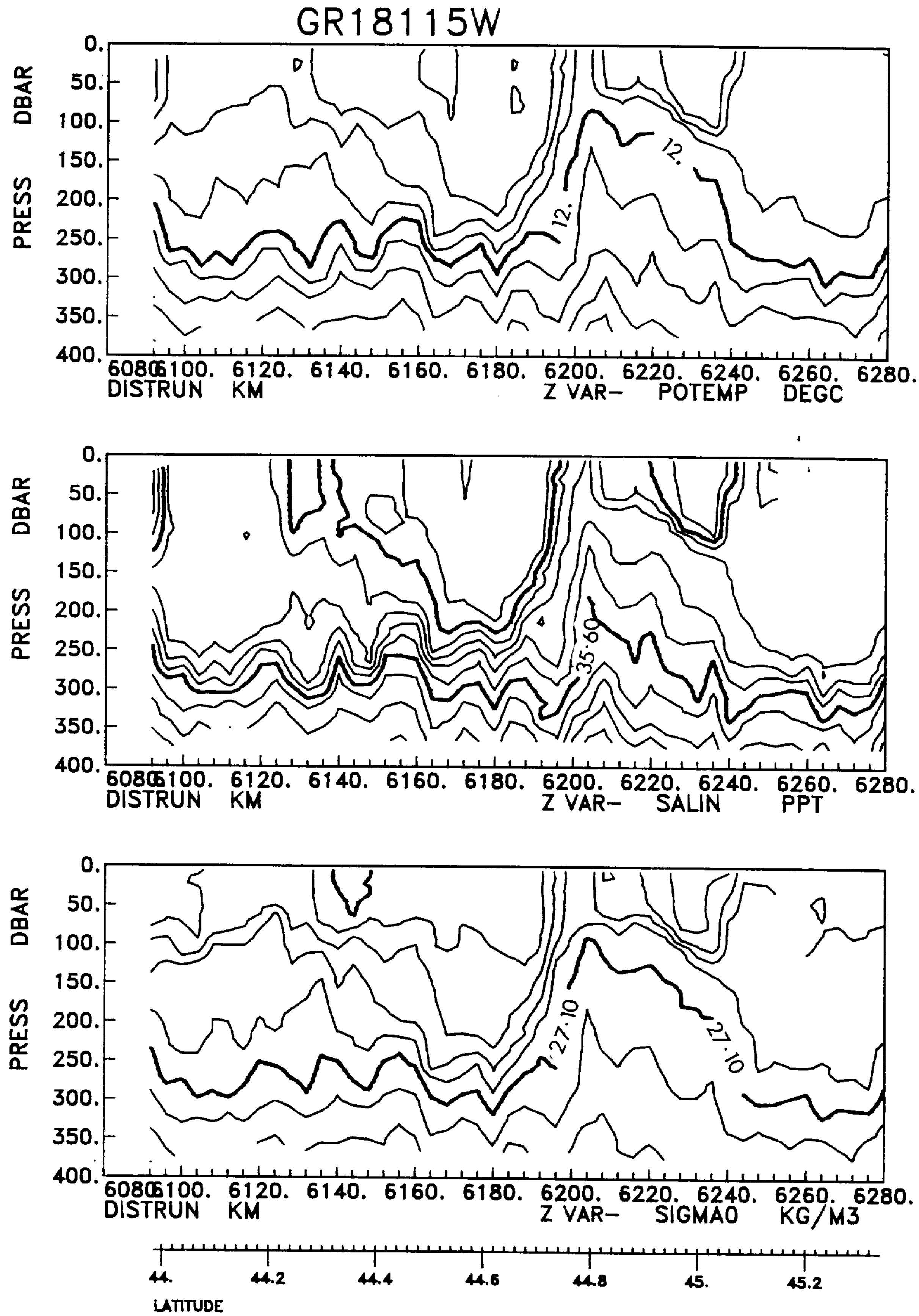
DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMAO KG/M3
26.95
27.00
27.05
27.10
27.15
27.20
27.25
35.60
6100 6080. 6060. 6040. 6020. 6000. 5980. 5960. 5940. 5920. 5900.
DISTRUN KM
Z VAR- SALIN PPT
SIGMAO KG/M3
26.95
27.00
27.05
27.10
27.15
27.20
27.25
2.
1.
1.
1.
1.
6100 6080. 6060. 6040. 6020. 6000. 5980. 5960. 5940. 5920. 5900.
DISTRUN KM
Z VAR- BVFREQ C.P.H.
44.
44.2
44.4
44.6
44.8
45.
45.2
45.4
45.6
LATITUDE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12.
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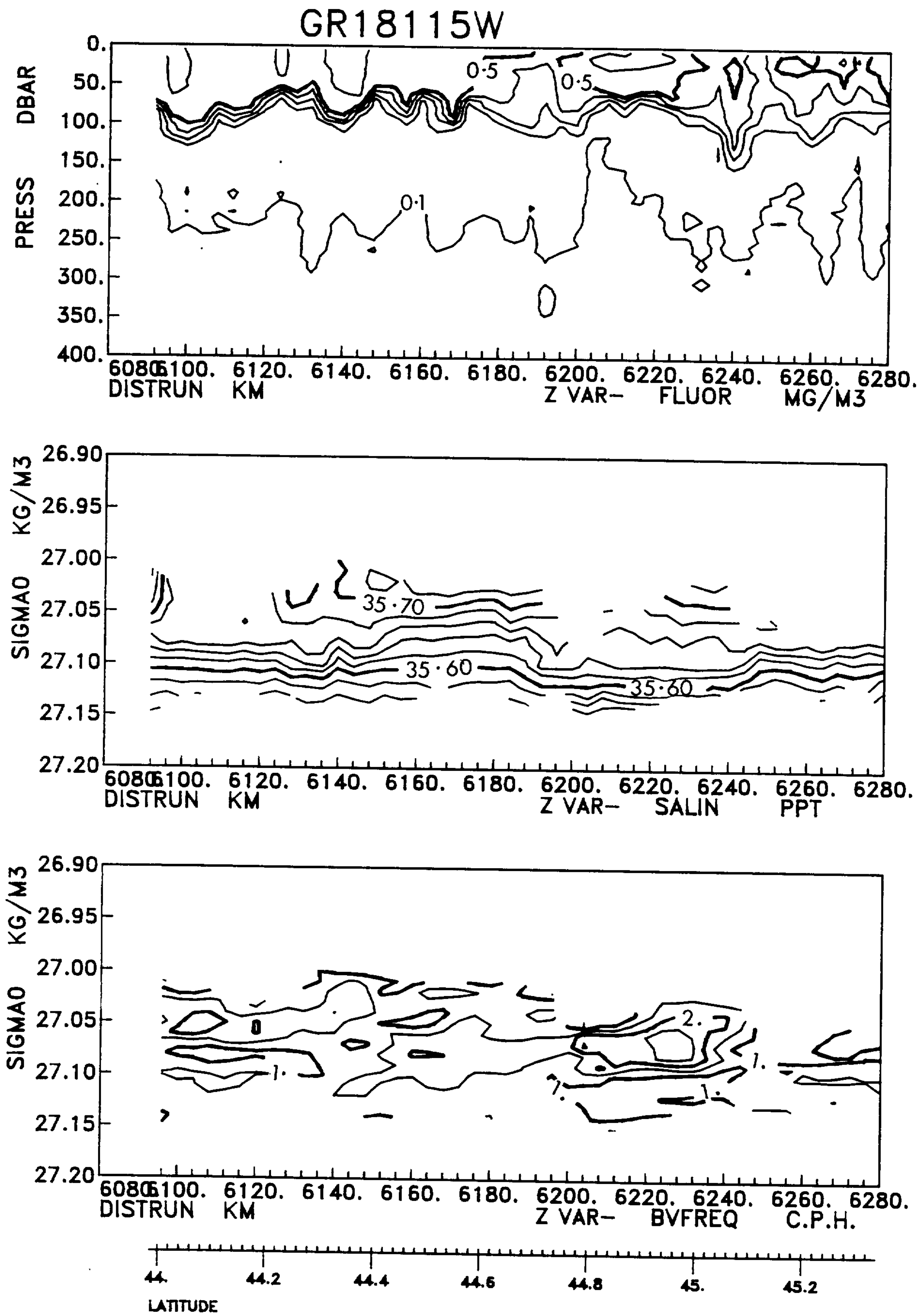
DISTRUN KM
Z VAR- POTEMP DEGC
PRESS DBAR
35.60
6080.6100. 6120. 6140. 6160. 6180. 6200. 6220. 6240. 6260. 6280.
DISTRUN KM
Z VAR- SALIN PPT
PRESS DBAR
27.10
27.10
6080.6100. 6120. 6140. 6160. 6180. 6200. 6220. 6240. 6260. 6280.
DISTRUN KM
Z VAR- SIGMA0 KG/M3
44. 44.2 44.4 44.6 44.8 45. 45.2
LATITUDE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50.
100.
150.
200.
250.
300.
350.
400.
PRESS DBAR
0·5
0·5
0·1
6080.6100. 6120. 6140. 6160. 6180. 6200. 6220. 6240. 6260. 6280.
DISTRUN KM
Z VAR– FLUOR MG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
SIGMA0 KG/M3
35·70
35·60
35·60
6080.6100. 6120. 6140. 6160. 6180. 6200. 6220. 6240. 6260. 6280.
DISTRUN KM
Z VAR– SALIN PPT
26.90
26.95
27.00
27.05
27.10
27.15
27.20
SIGMA0 KG/M3
2.
1.
1.
1.
1.
6080.6100. 6120. 6140. 6160. 6180. 6200. 6220. 6240. 6260. 6280.
DISTRUN KM
Z VAR– BVFREQ C.P.H.
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44.2
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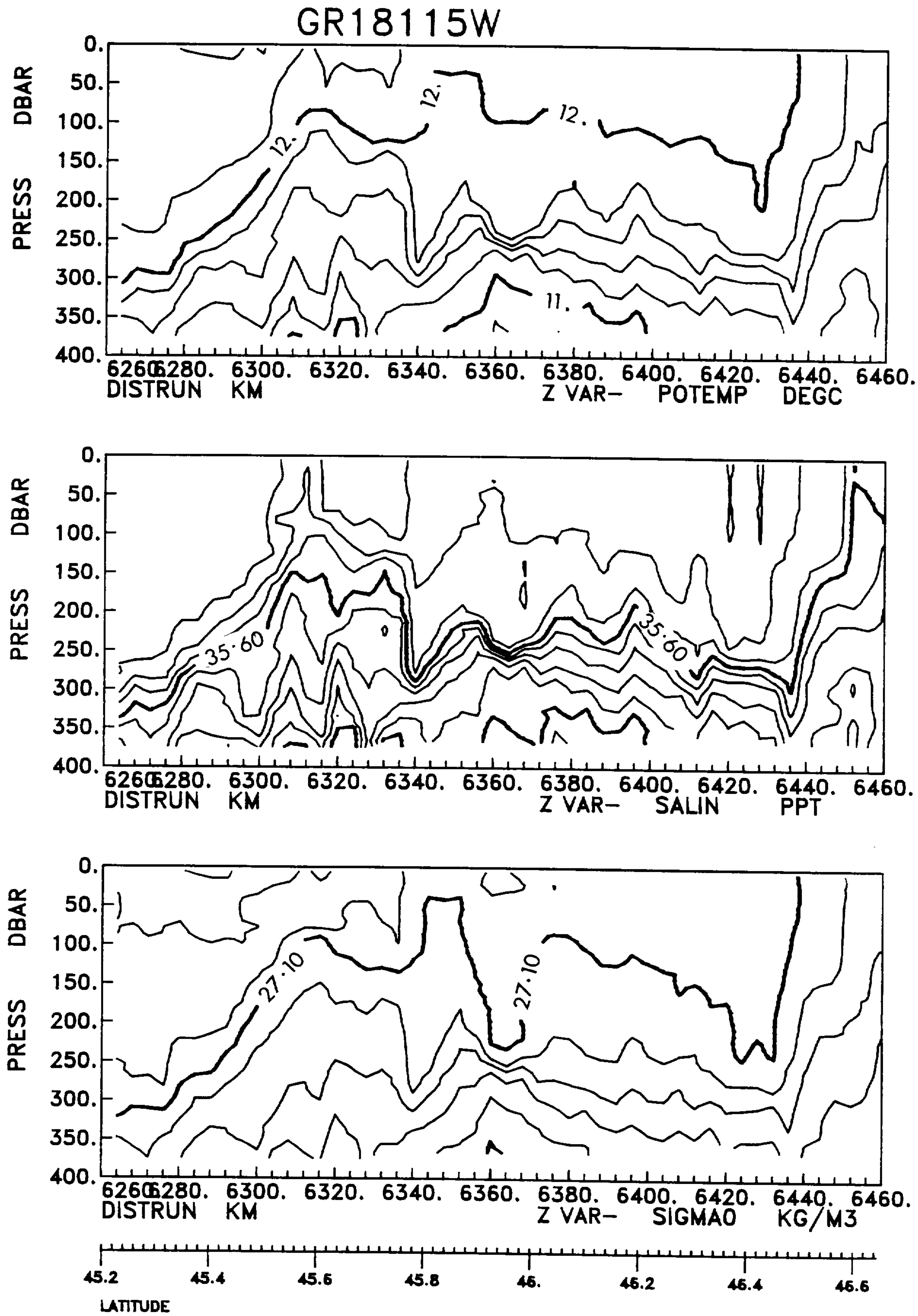
44.6
44.8
45.
45.2
LATITUDE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300.
350.
400.
12.
11.
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DISTRUN KM
Z VAR- POTEMP DEGC
35·60
Z VAR- SALIN PPT
27·10
Z VAR- SIGMA0 KG/M3
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45.6
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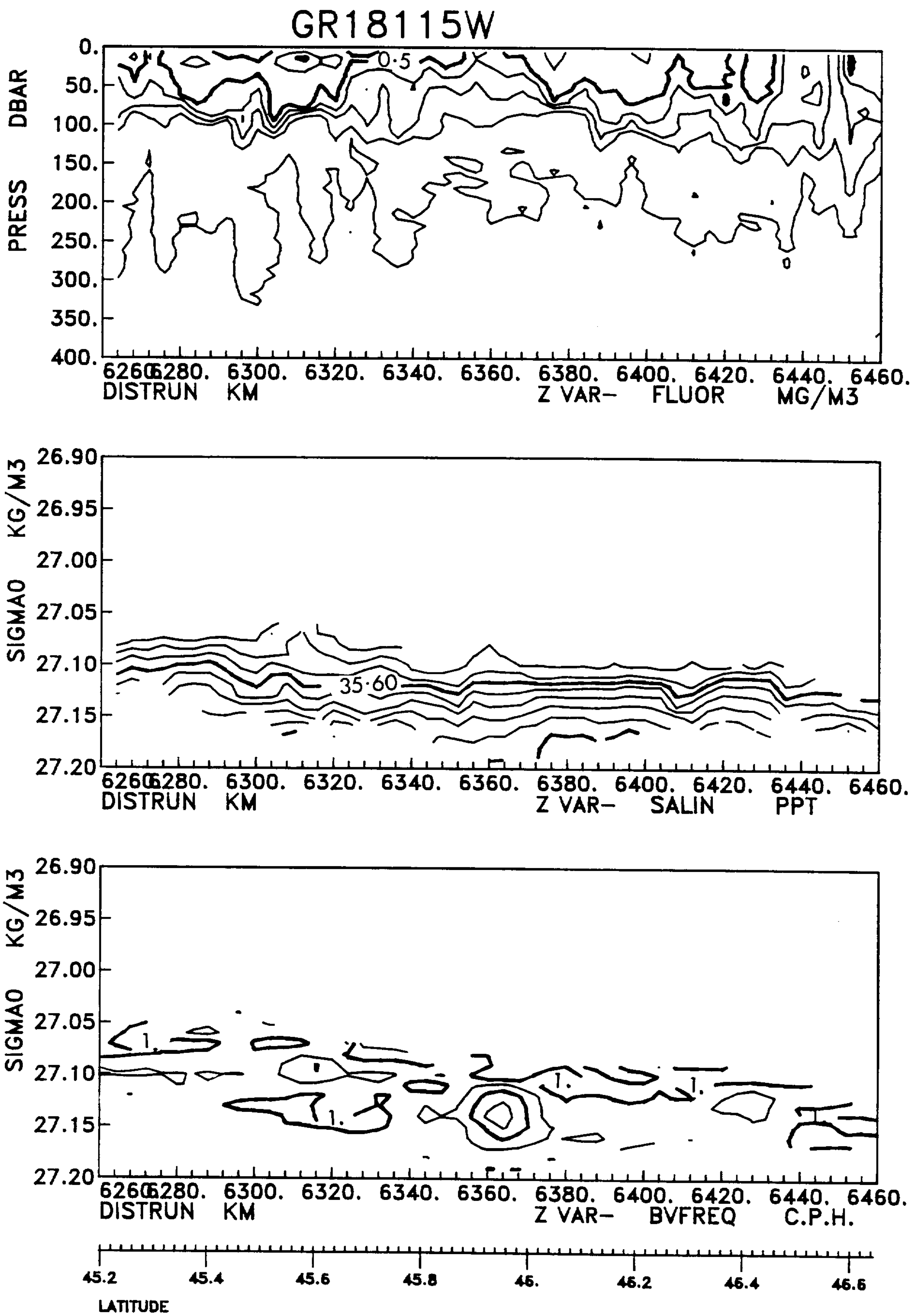
46.4
46.6
LATITUDE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DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
26.90
26.95
27.00
27.05
27.10
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DISTRUN KM
Z VAR- SALIN PPT
SIGMA0 KG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
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DISTRUN KM
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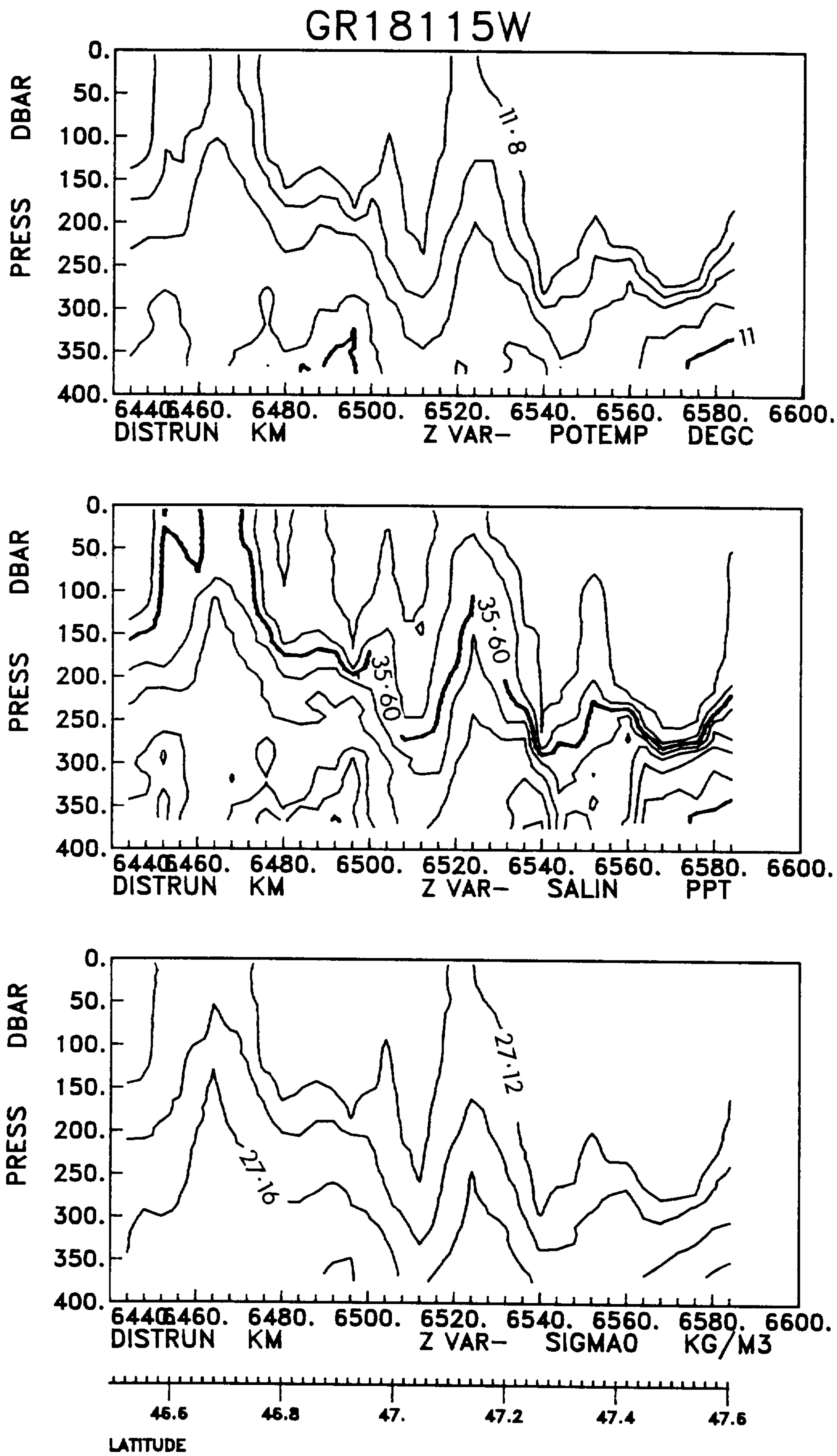
46.6
LATITUDE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DISTRUN KM Z VAR- POTEMP DEGC
11.8
11
DISTRUN KM Z VAR- SALIN PPT
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27.12
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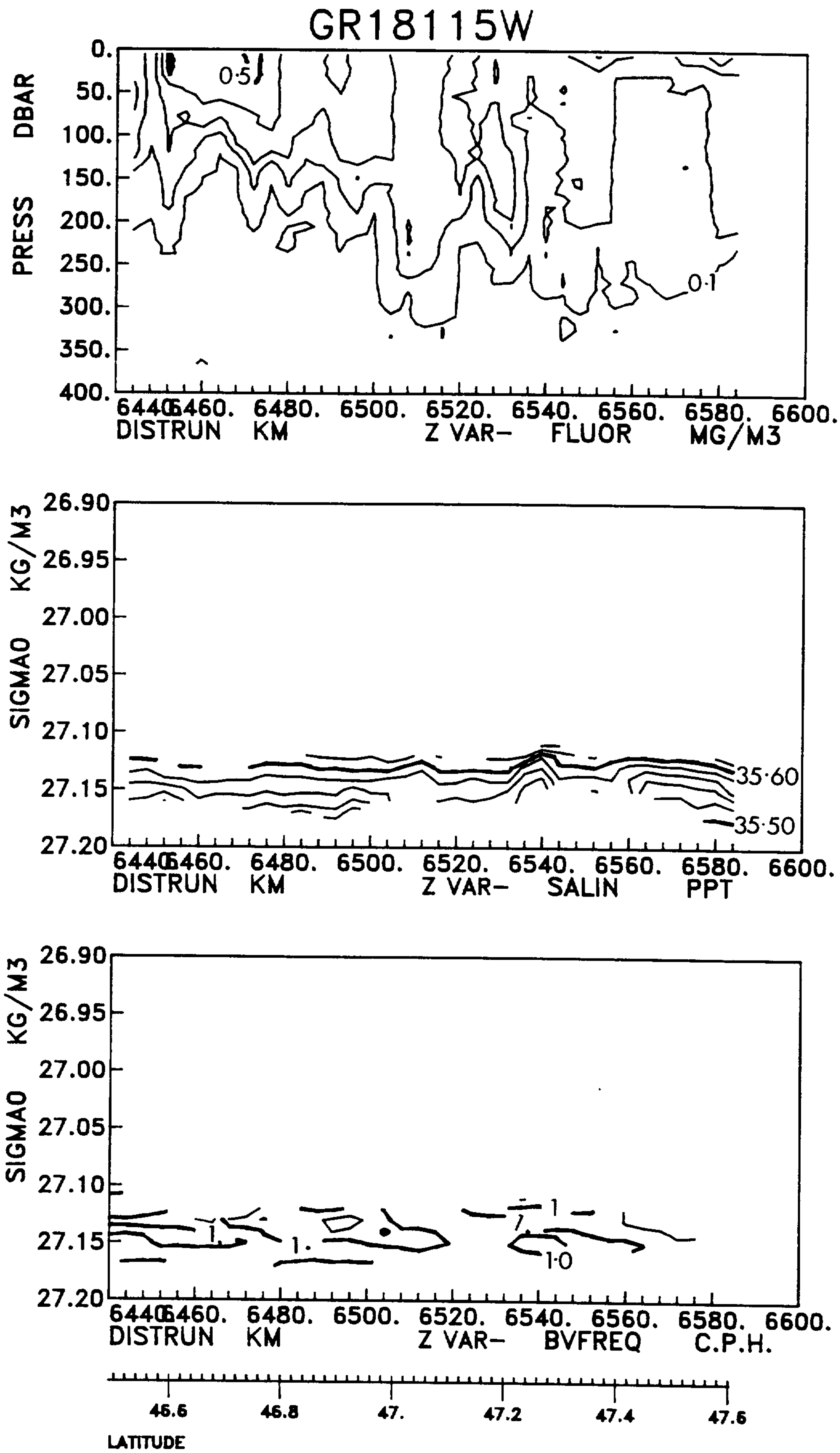
LATITUDE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DISTRUN KM Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
35·60
35·50
6440.6460. 6480. 6500. 6520. 6540. 6560. 6580. 6600.
DISTRUN KM Z VAR- SALIN PPT
SIGMA0 KG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
1.
1.
1
1·0
6440.6460. 6480. 6500. 6520. 6540. 6560. 6580. 6600.
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47.2
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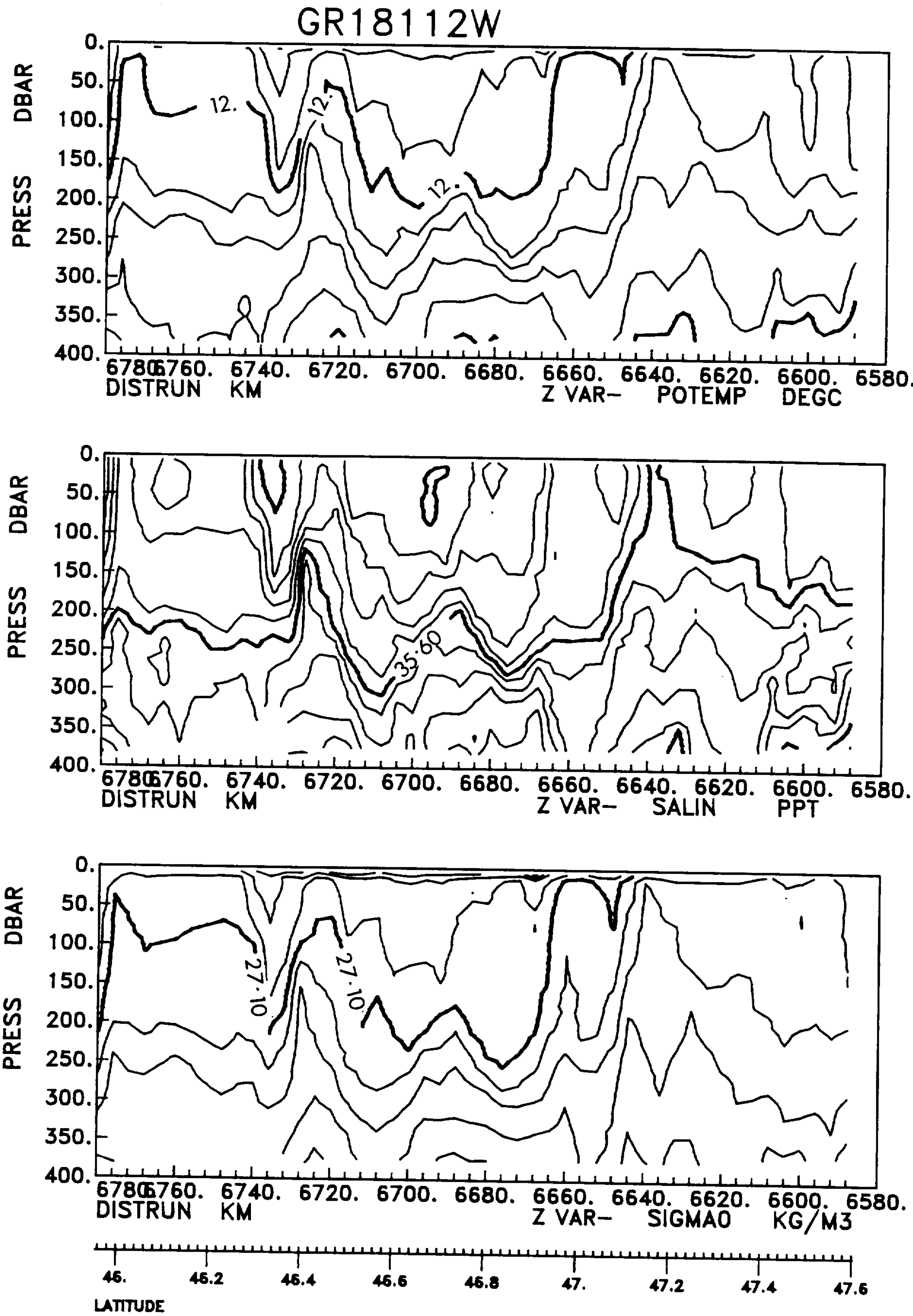
47.6
LATITUDE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DISTRUN KM
Z VAR– POTEMP DEGC
35.60
Z VAR– SALIN PPT
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Z VAR– SIGMA0 KG/M3
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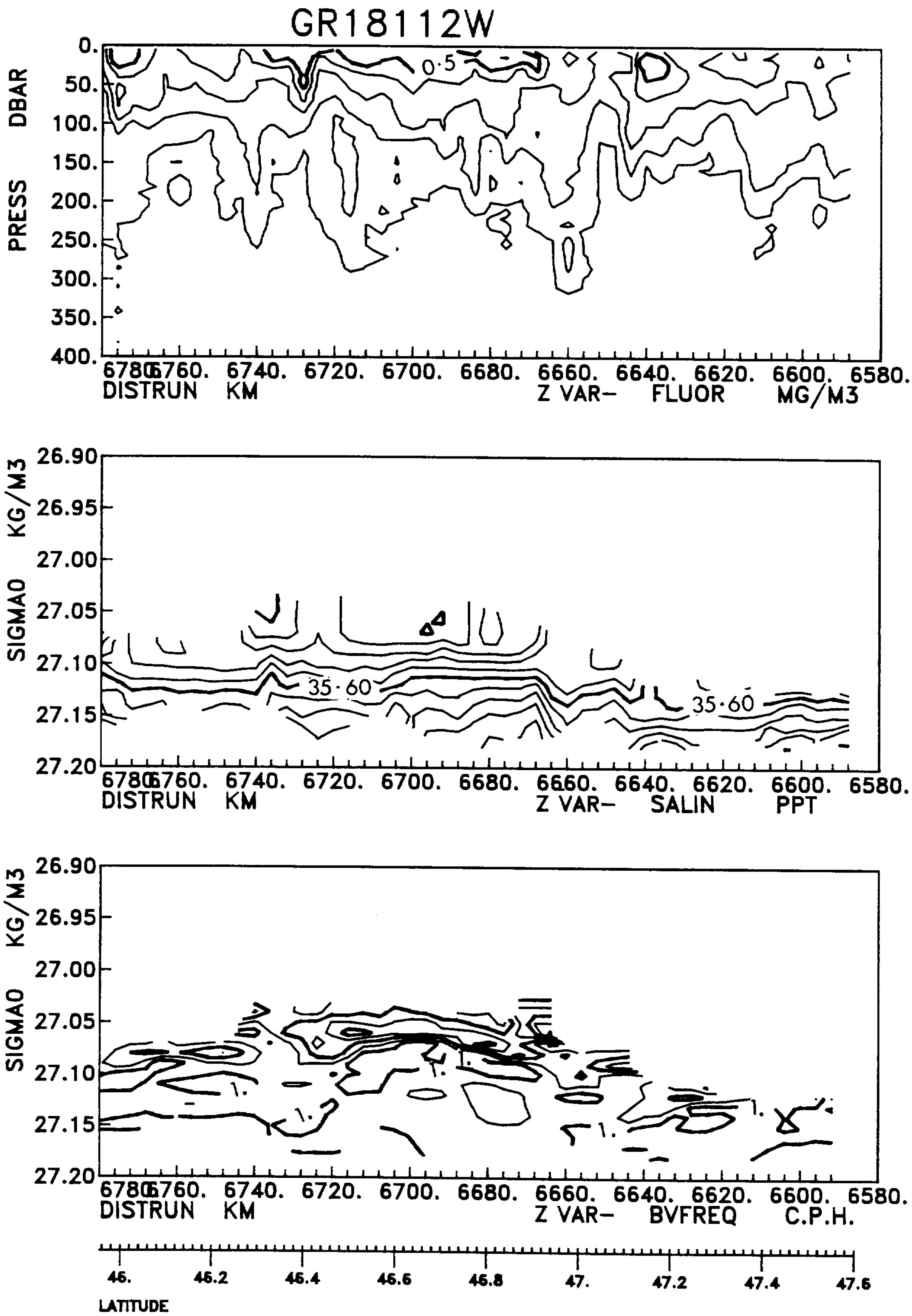
LATITUDE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Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
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27.00
27.05
27.10
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27.20
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35.60
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DISTRUN KM
Z VAR- SALIN PPT
SIGMA0 KG/M3
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26.95
27.00
27.05
27.10
27.15
27.20
1.
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DISTRUN KM
Z VAR- BVFREQ C.P.H.
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46.2
46.4
46.6
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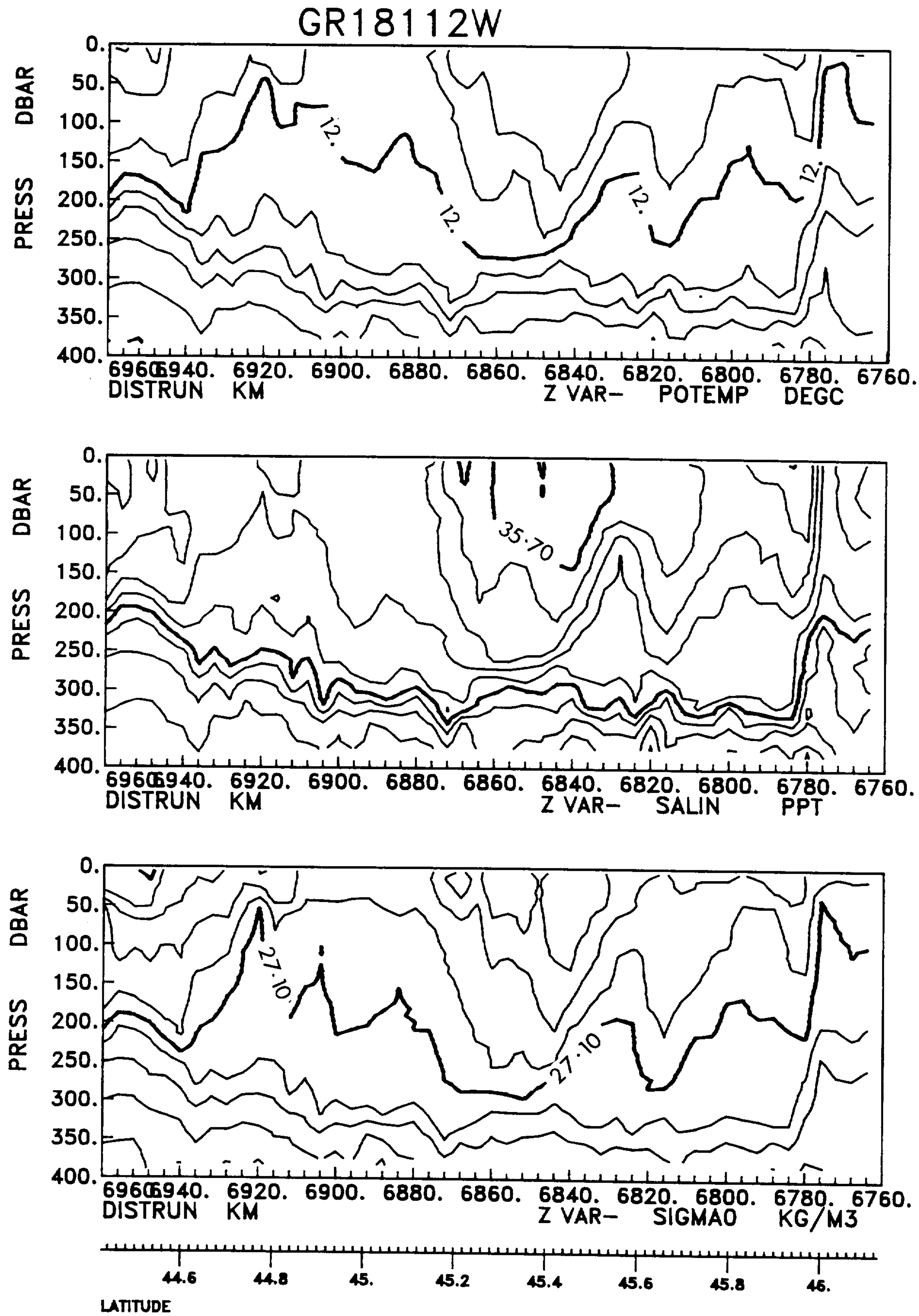
47.2
47.4
47.6
LATITUDE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Z VAR- POTEMP DEGC
12.
DISTRUN KM
Z VAR- SALIN PPT
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Z VAR- SIGMA0 KG/M3
27.10
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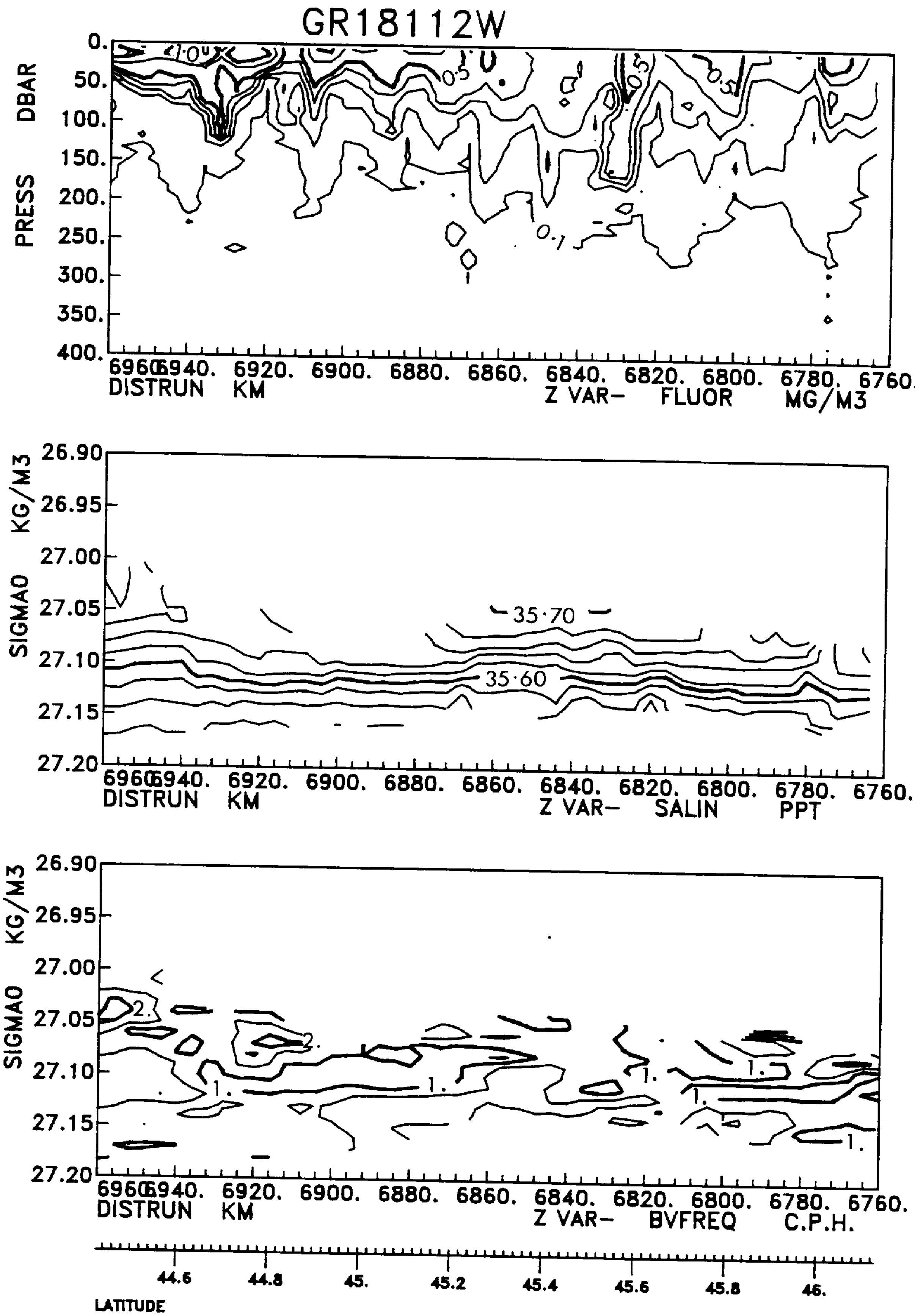
LATITUDE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DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
35·70
35·60
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DISTRUN KM
Z VAR- SALIN PPT
SIGMA0 KG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
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2.
1.
1.
1.
1.
1.
1.
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DISTRUN KM
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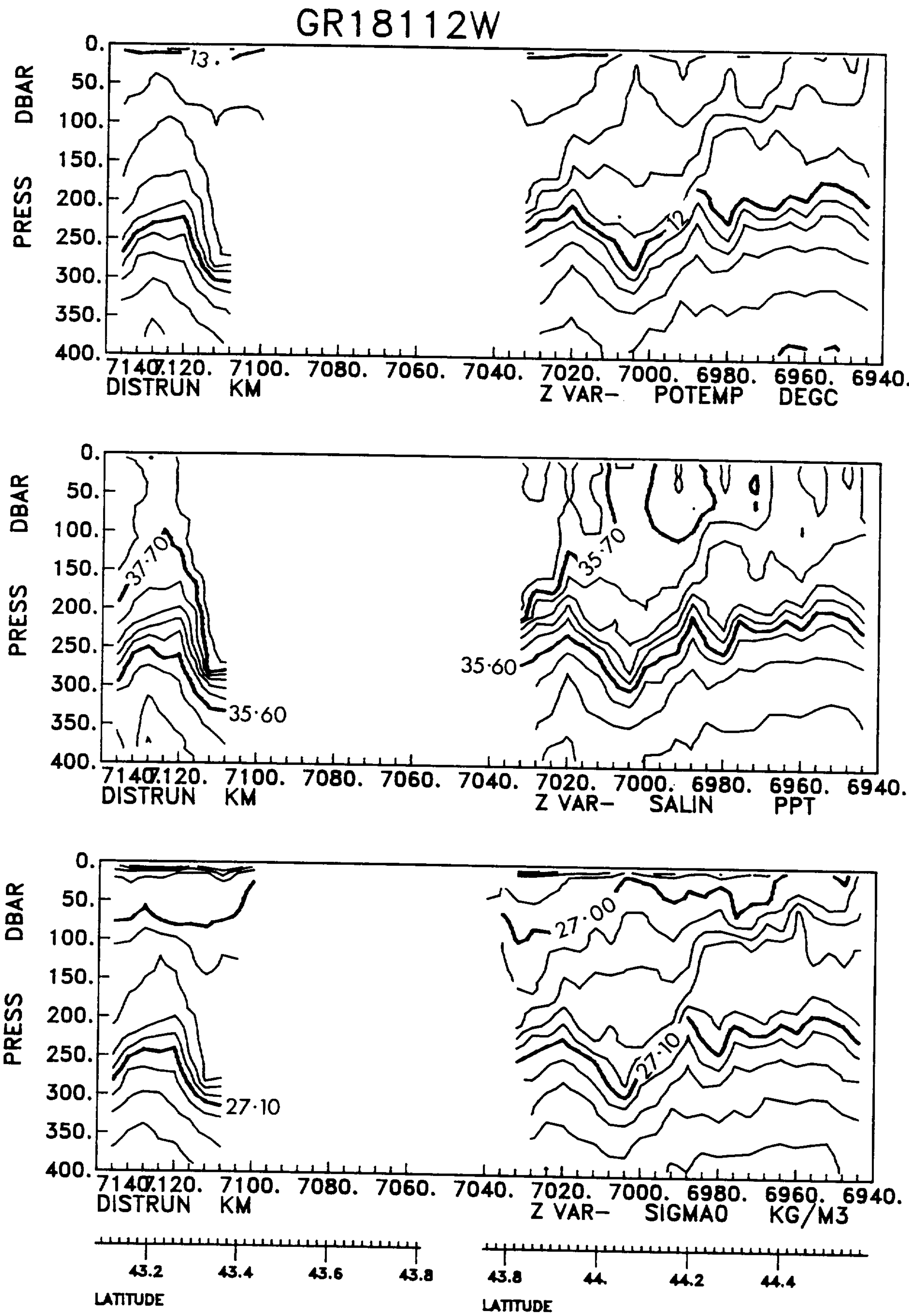
46.
LATITUDE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DISTRUN KM
Z VAR- POTEMP DEGC
13.
12
Z VAR- SALIN PPT
37.70
35.70
35.60
35.60
Z VAR- SIGMA0 KG/M3
27.00
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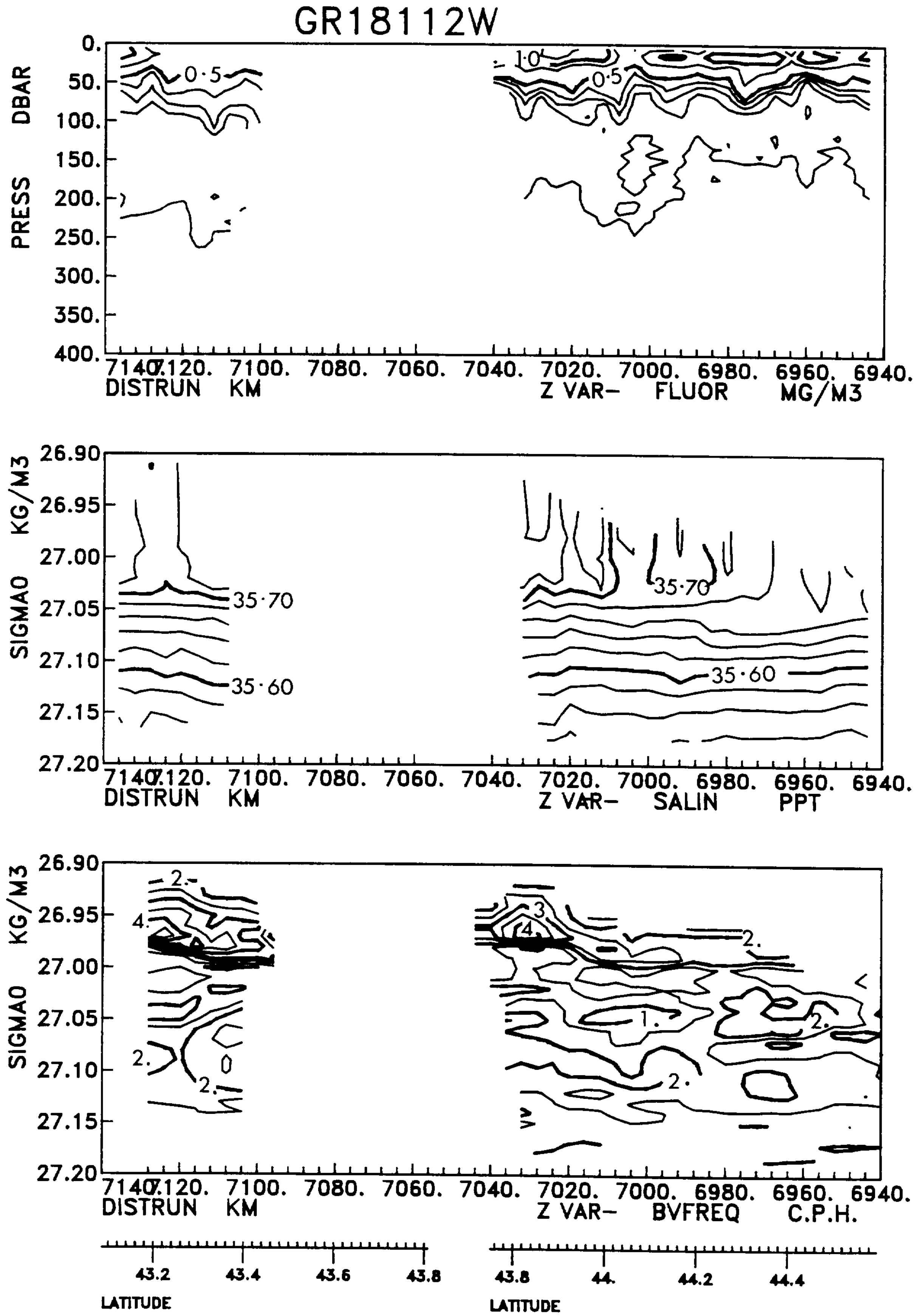
43.4
43.6
43.8
LATITUDE
43.8
44.
44.2
44.4
LATITUDE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DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMAO KG/M3
26.90 26.95 27.00 27.05 27.10 27.15 27.20
35·70
35·60
Z VAR- SALIN PPT
2.
4.
3
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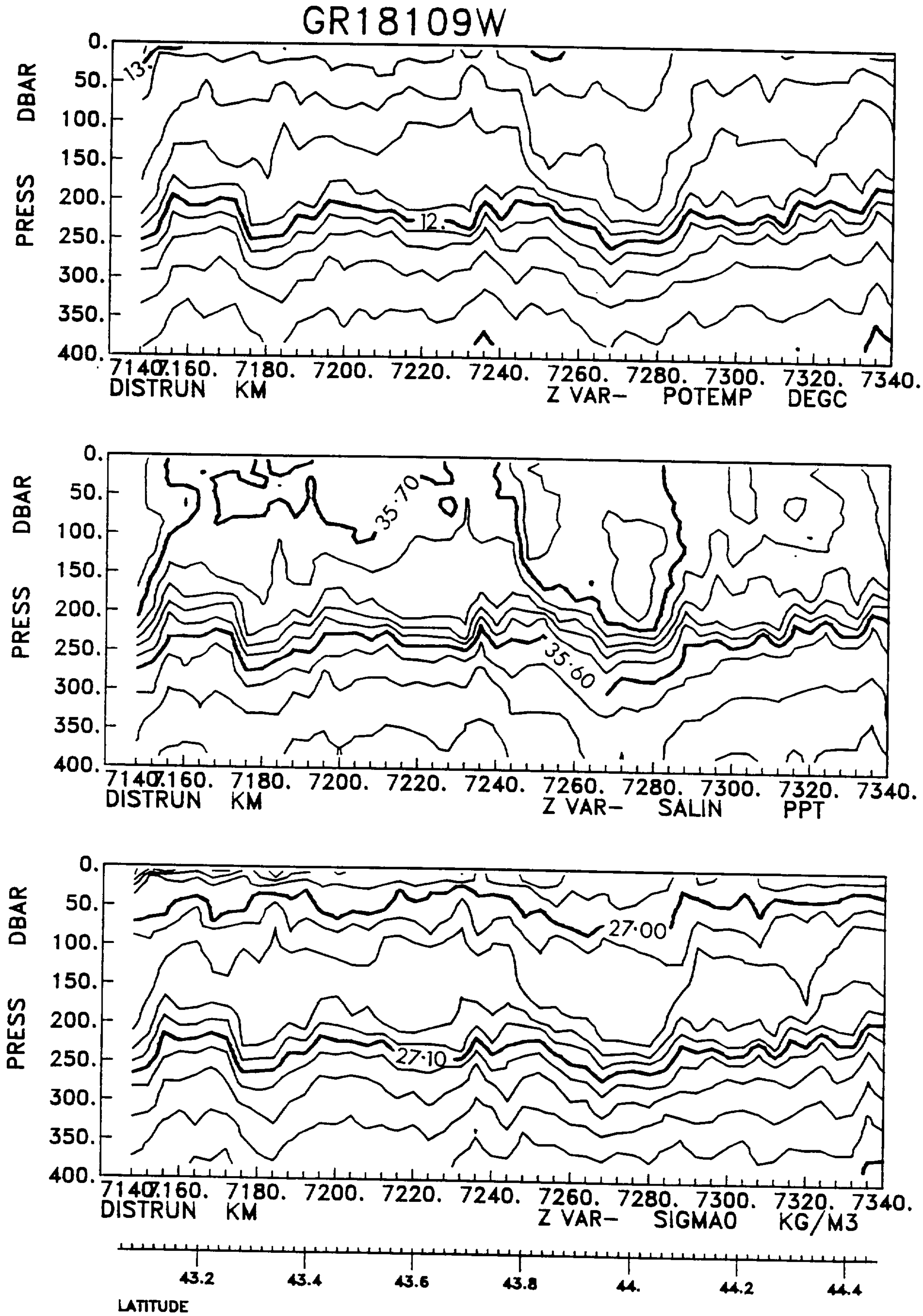
Z VAR- BVFREQ C.P.H.
43.2 43.4 43.6 43.8
LATITUDE
43.8 44. 44.2 44.4
LATITUDE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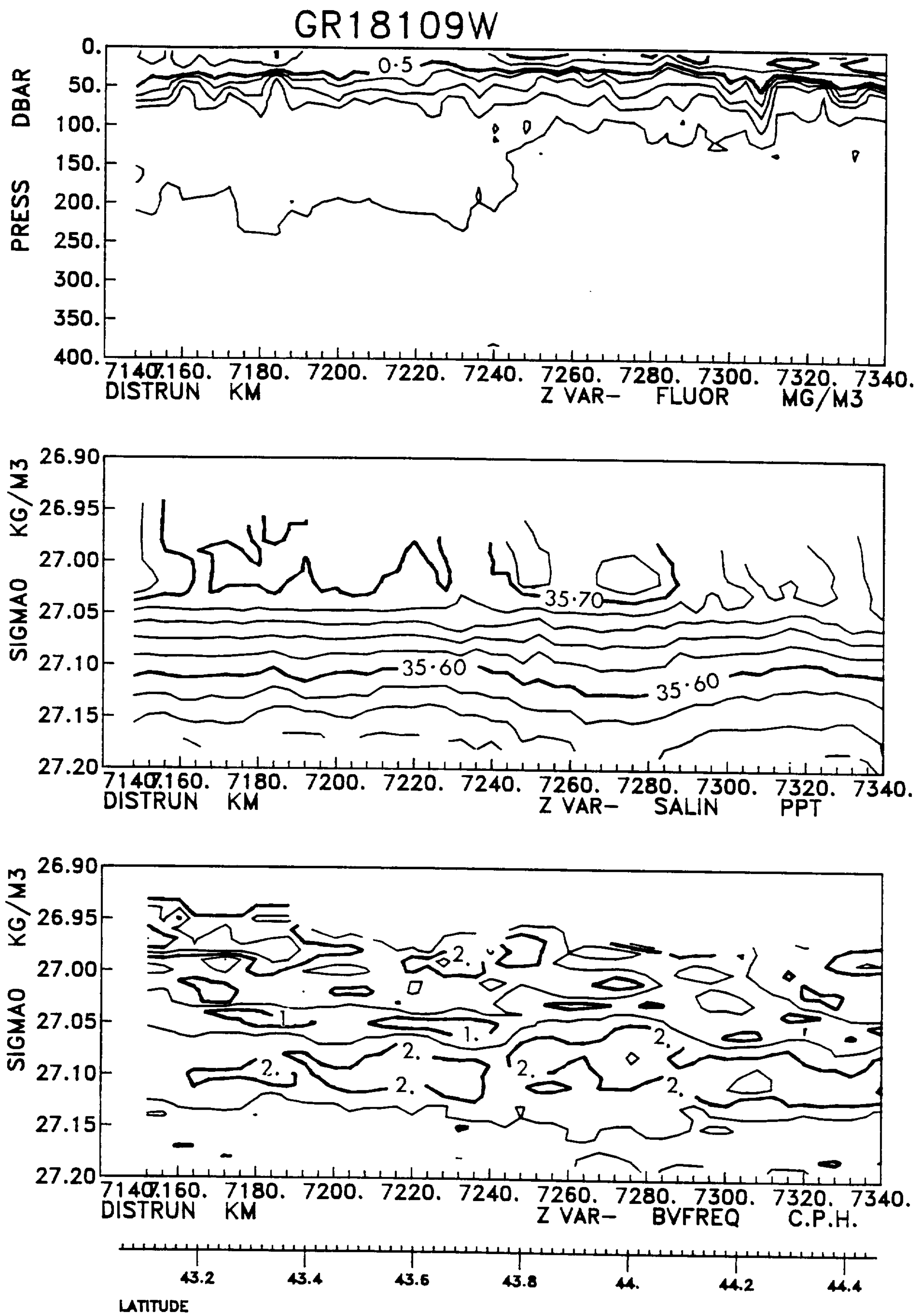
DISTRUN KM
Z VAR- POTEMP DEGC
PRESS DBAR
0. 50. 100. 150. 200. 250. 300. 350. 400.
35·70
35·60
7140.7160. 7180. 7200. 7220. 7240. 7260. 7280. 7300. 7320. 7340.
DISTRUN KM
Z VAR- SALIN PPT
PRESS DBAR
0. 50. 100. 150. 200. 250. 300. 350. 400.
27·00
27·10
7140.7160. 7180. 7200. 7220. 7240. 7260. 7280. 7300. 7320. 7340.
DISTRUN KM
Z VAR- SIGMAO KG/M3
43.2 43.4 43.6 43.8 44. 44.2 44.4
LATITUDE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7220.
7240.
7260.
7280.
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7320.
7340.
DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
35.70
35.60
35.60
Z VAR- SALIN PPT
1.
1.
2.
2.
2.
2.
2.
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44.4
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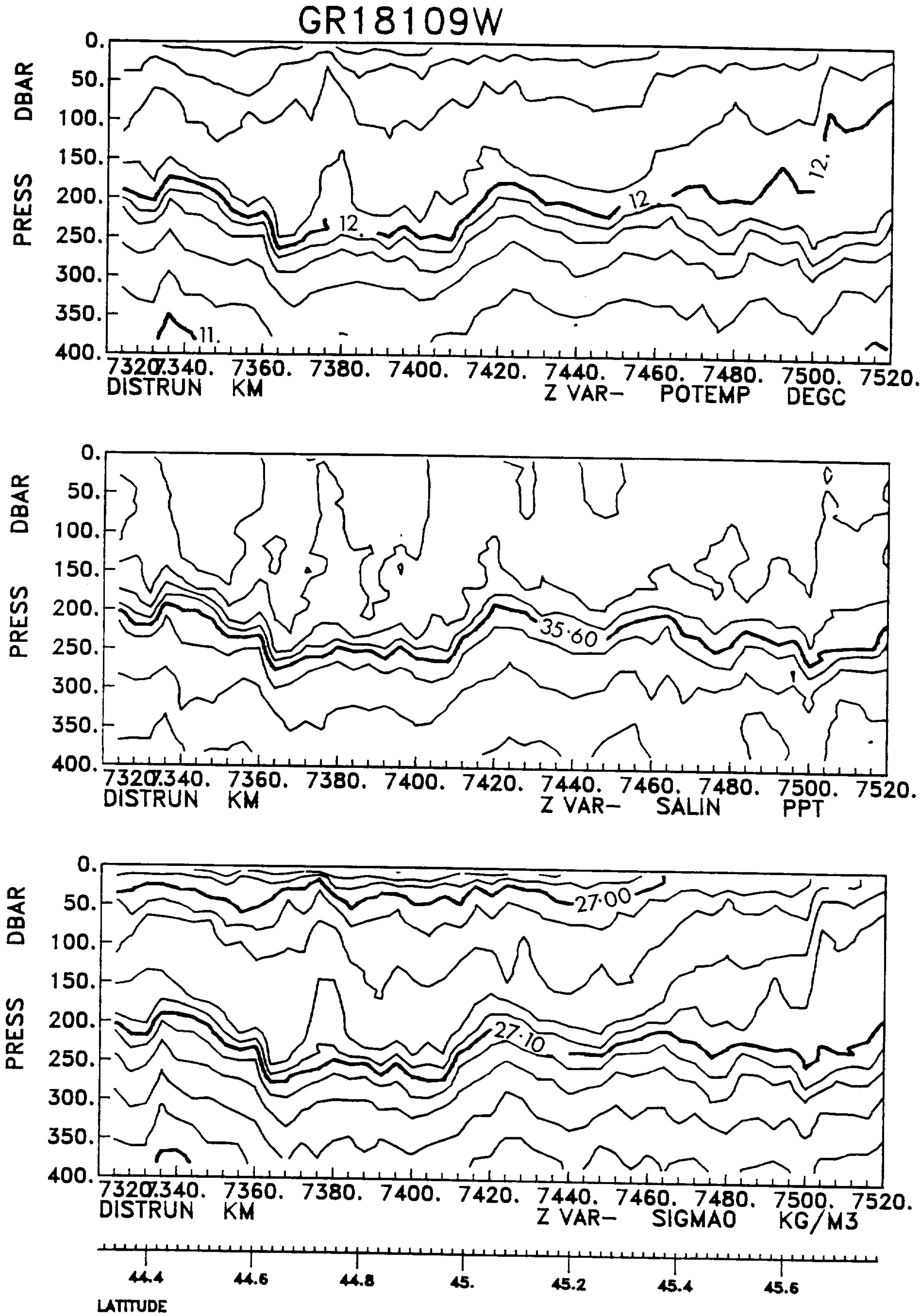
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Z VAR- POTEMP DEGC
35·60
Z VAR- SALIN PPT
27·00
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Z VAR- SIGMA0 KG/M3
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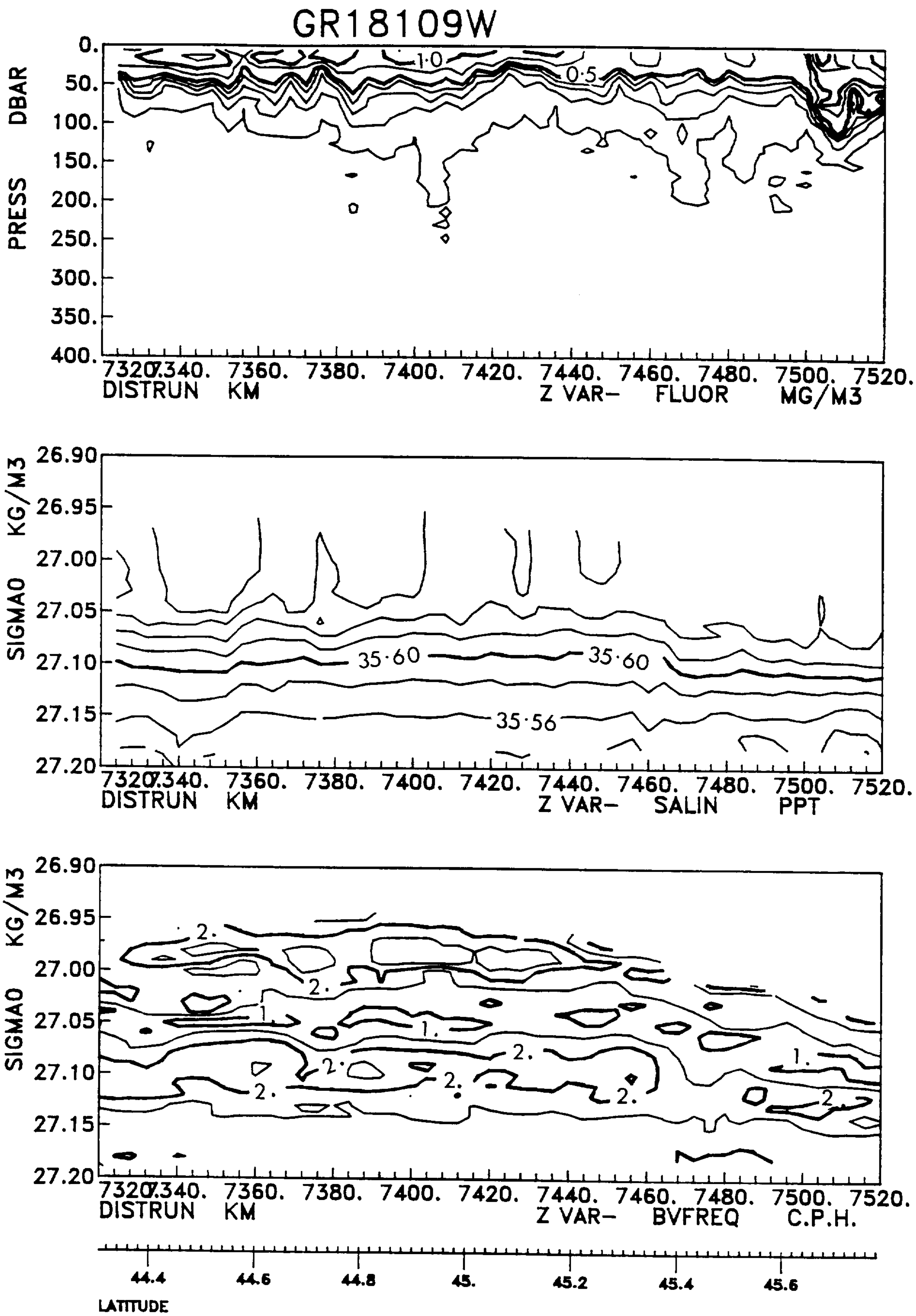
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DISTRUN KM
Z VAR- FLUOR MG/M3
SIGMA0 KG/M3
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26.95
27.00
27.05
27.10
27.15
27.20
35·60
35·56
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Z VAR- SALIN PPT
2.
1.
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44.8
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45.2
45.4
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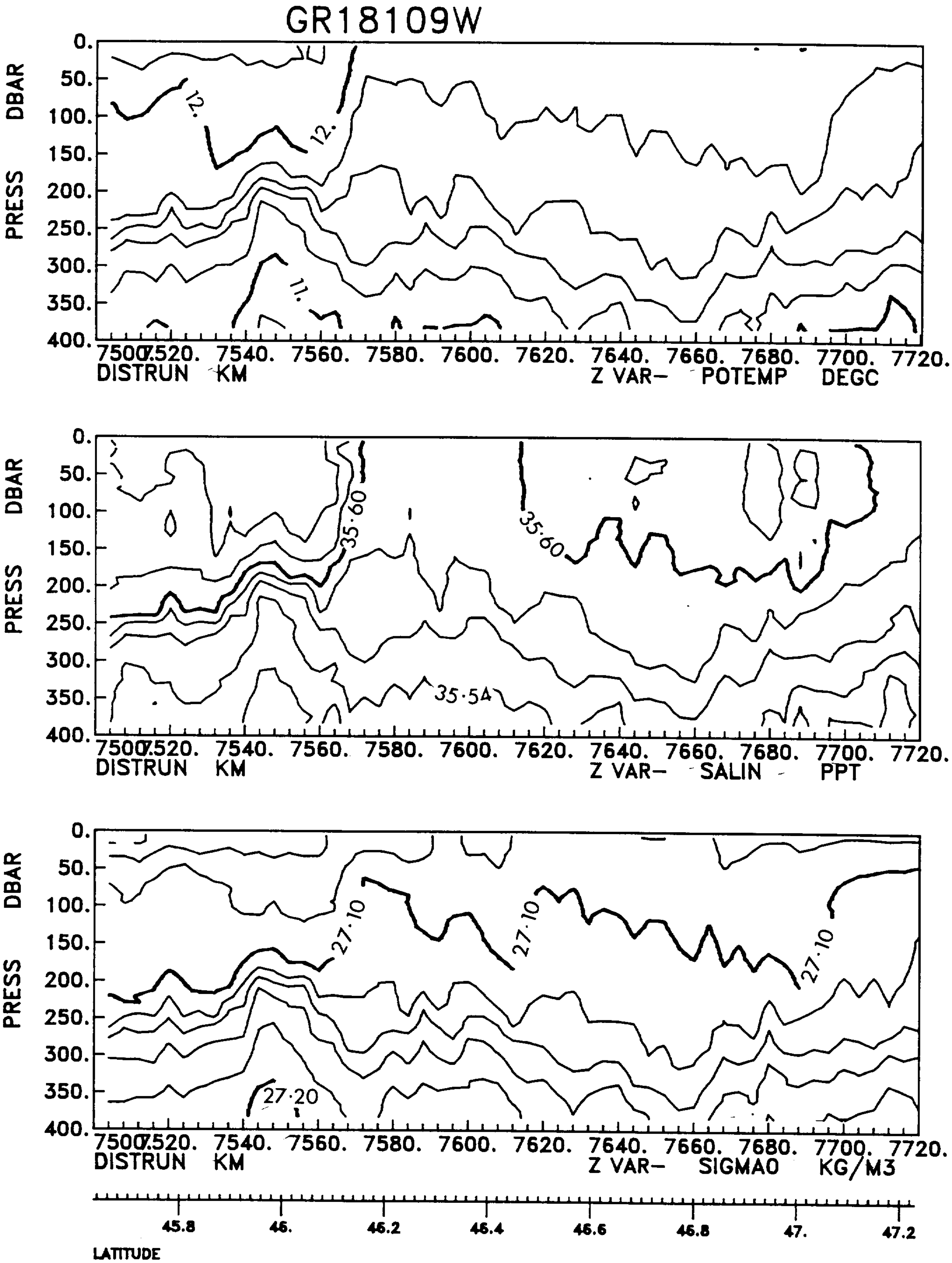
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PRESS DBAR
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35·54
DISTRUN KM
Z VAR- SALIN PPT
PRESS DBAR
27·10
27·10
27·10
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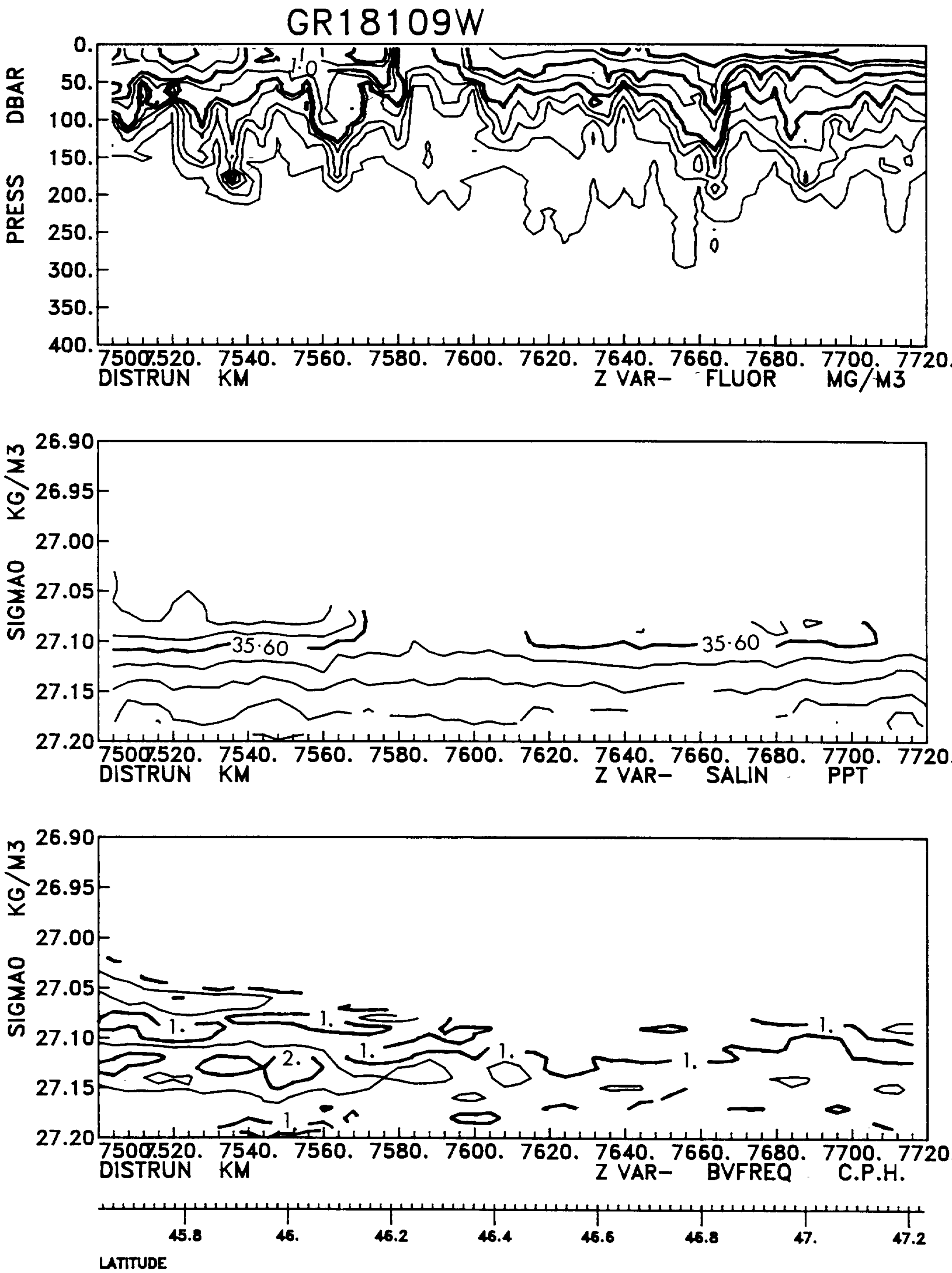
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SIGMA0 KG/M3
26.90
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27.00
27.05
27.10
27.15
27.20
35·60
35·60
Z VAR- SALIN PPT
1.
2.
Z VAR- BVFREQ C.P.H.
45.8
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46.2
46.4
46.6
46.8
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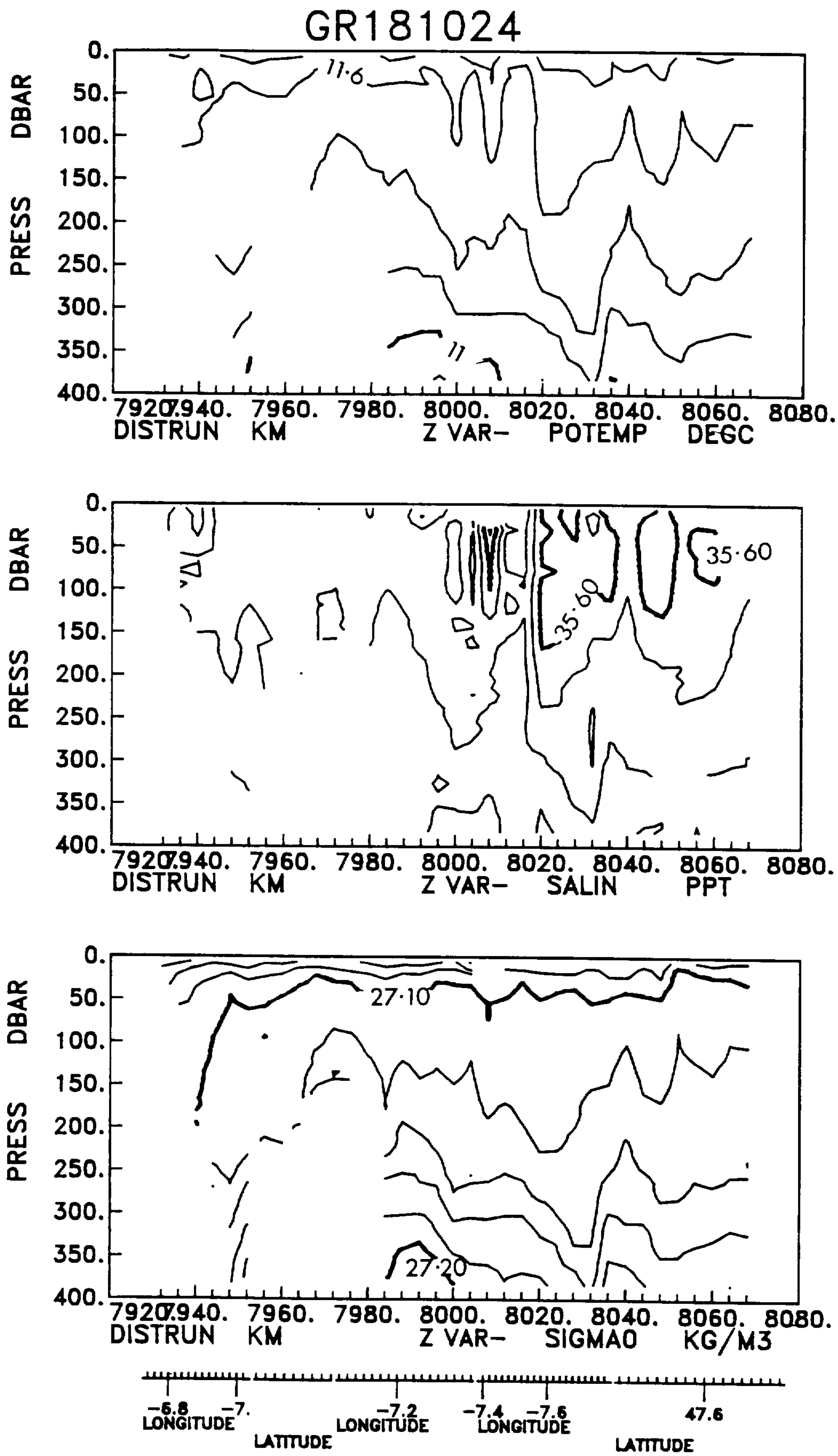
LATITUDE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Z VAR- SIGMAO KG/M3
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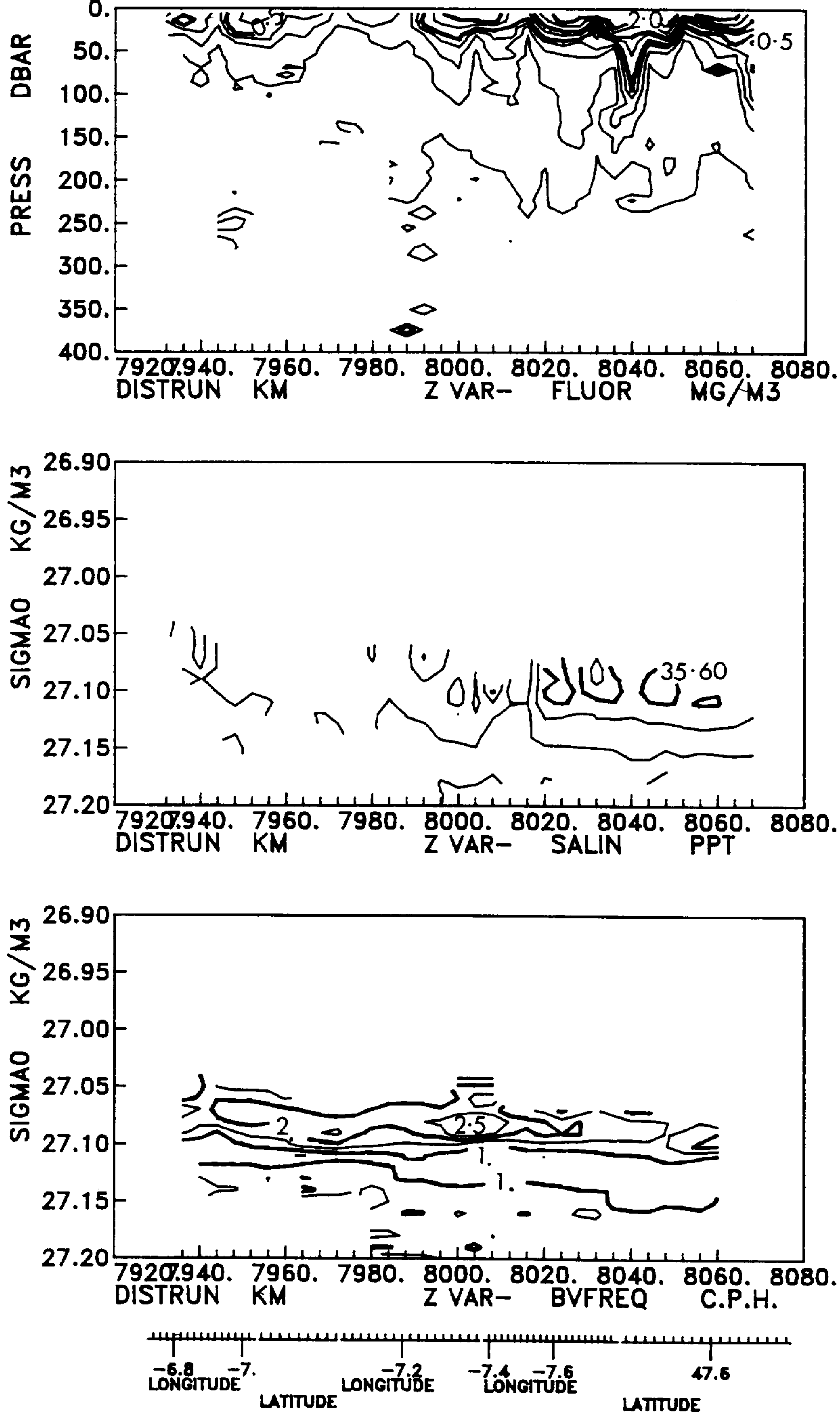
LATITUDE
LONGITUDE
LONGITUDE
LATITUDE
47.6

GR181024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DISTRUN KM Z VAR- FLUOR MG/M3
26.90
26.95
27.00
27.05
27.10
27.15
27.20
SIGMAO KG/M3
35.60
DISTRUN KM Z VAR- SALIN PPT
2.
2.5
1.
DISTRUN KM Z VAR- BVFREQ C.P.H.
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LATITUDE
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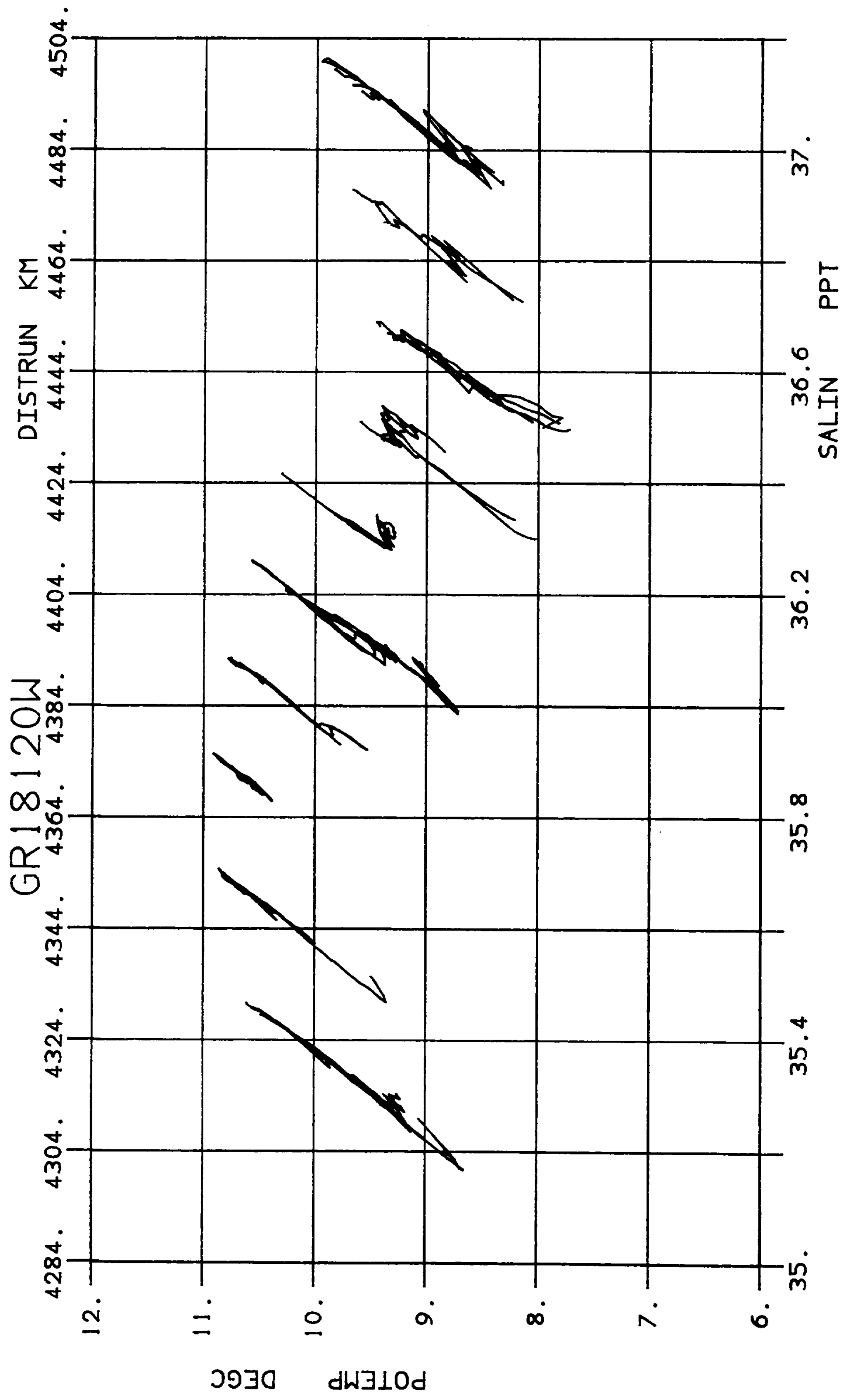
LATITUDE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4464.
4484.
4504.
SALIN PPT
35.
35.4
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36.2
36.6
37.
POTEMP DEGC
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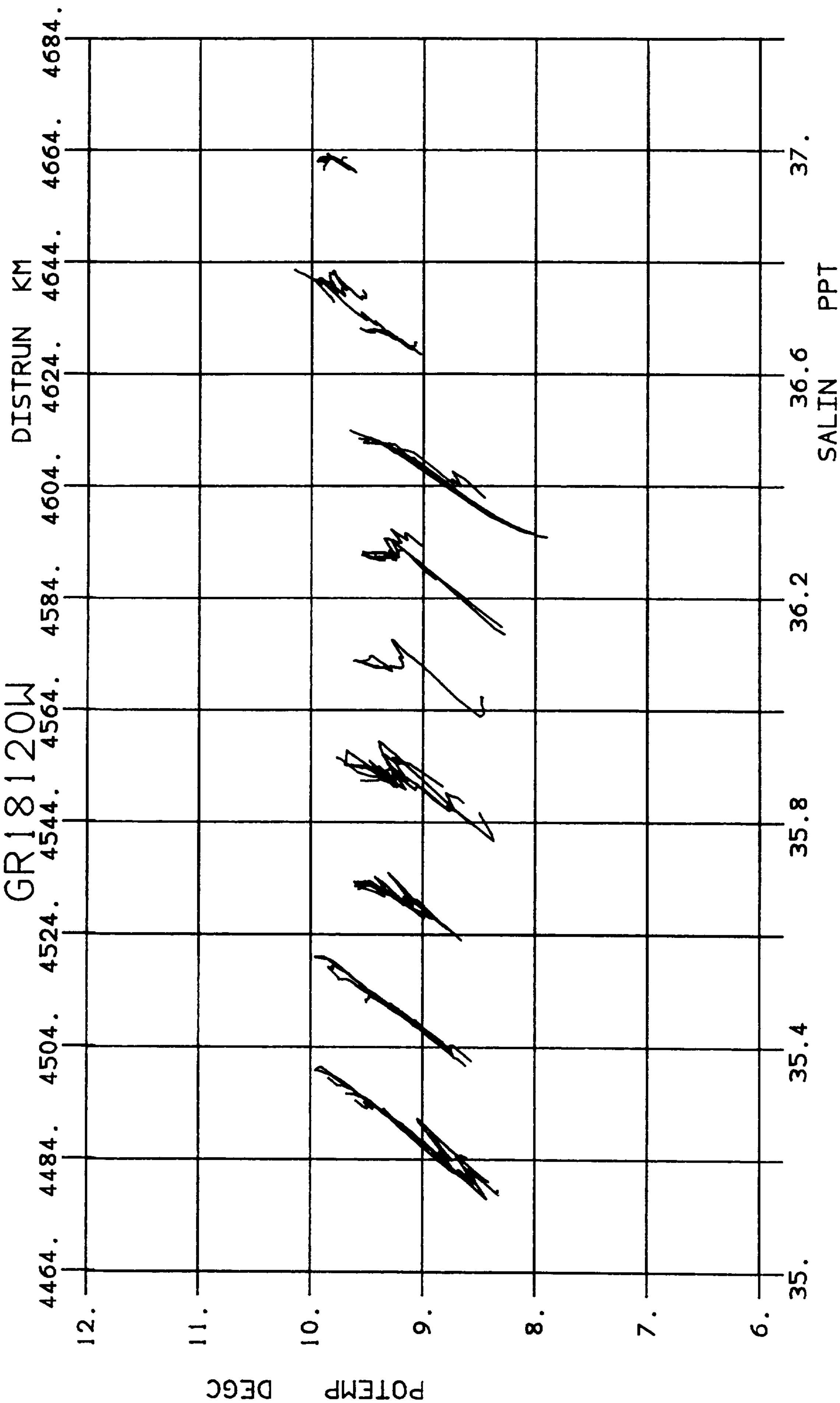
11.
10.
9.
8.
7.
6.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4684.
SALIN PPT
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36.6
37.
POTEMP DEGC
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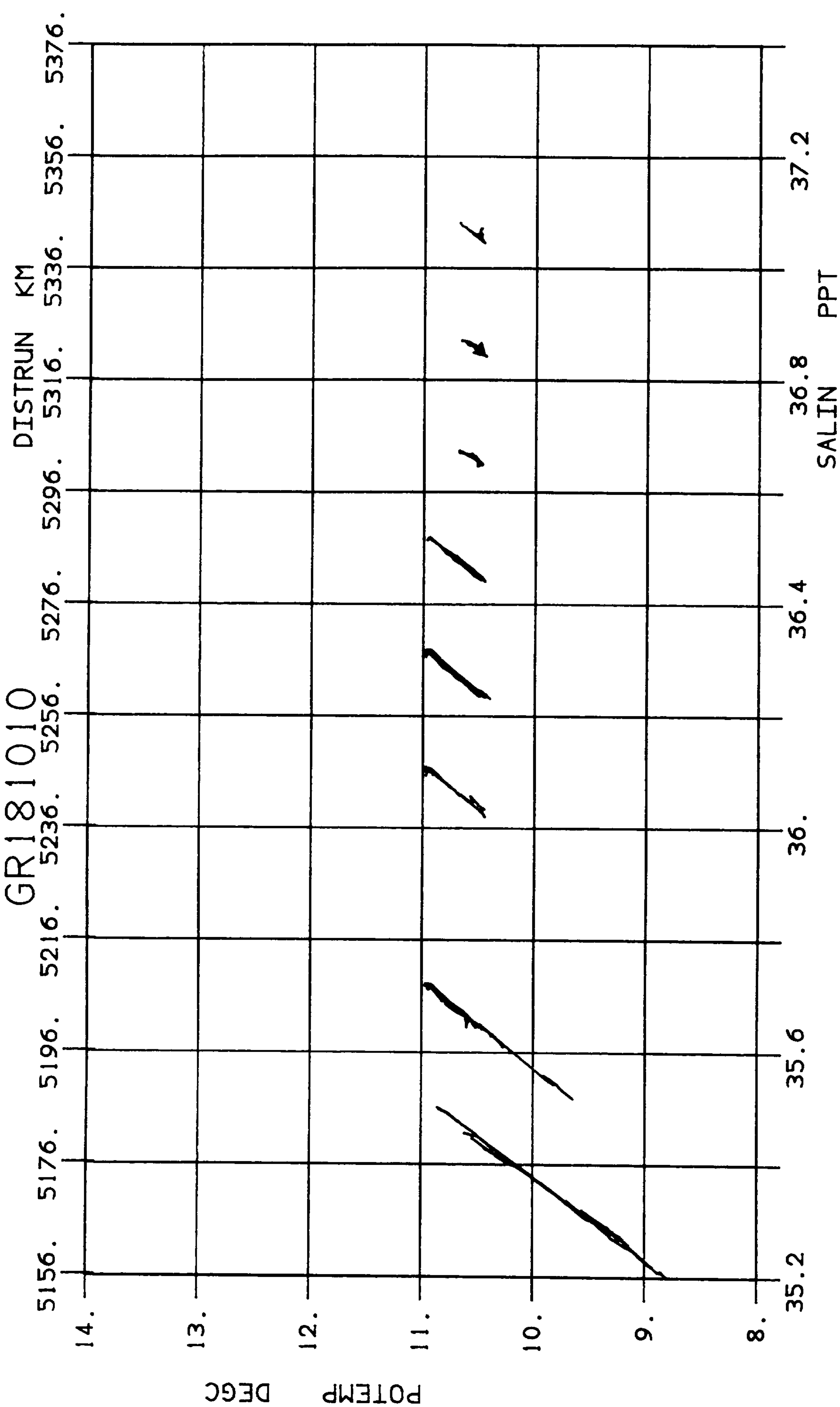
11.
10.
9.
8.
7.
6.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POTEMP DEGC
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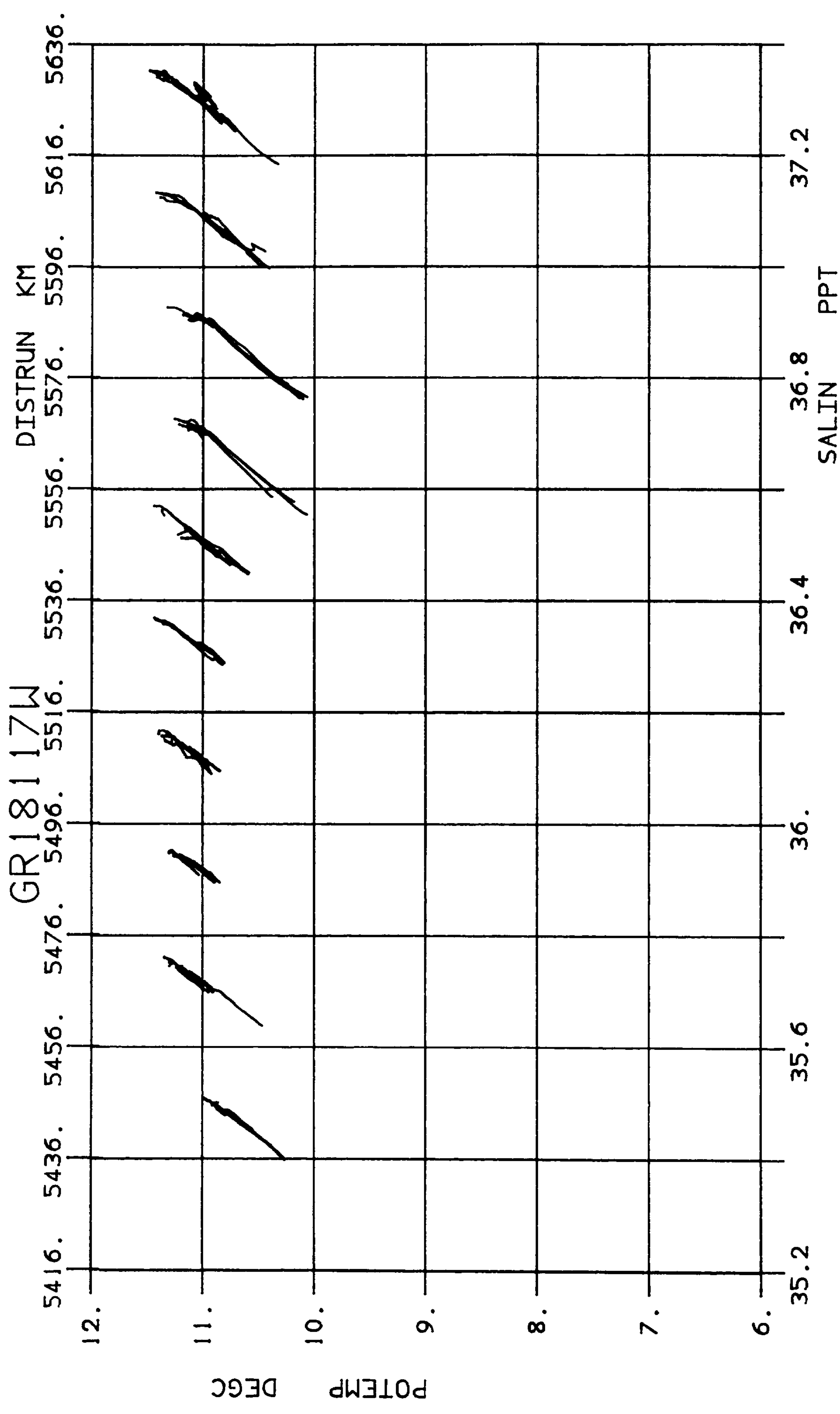
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5576.
5596.
5616.
5636.
SALIN PPT
35.2
35.6
36.
36.4
36.8
37.2
POTEMP DEGC
12.
11.
10.
9.
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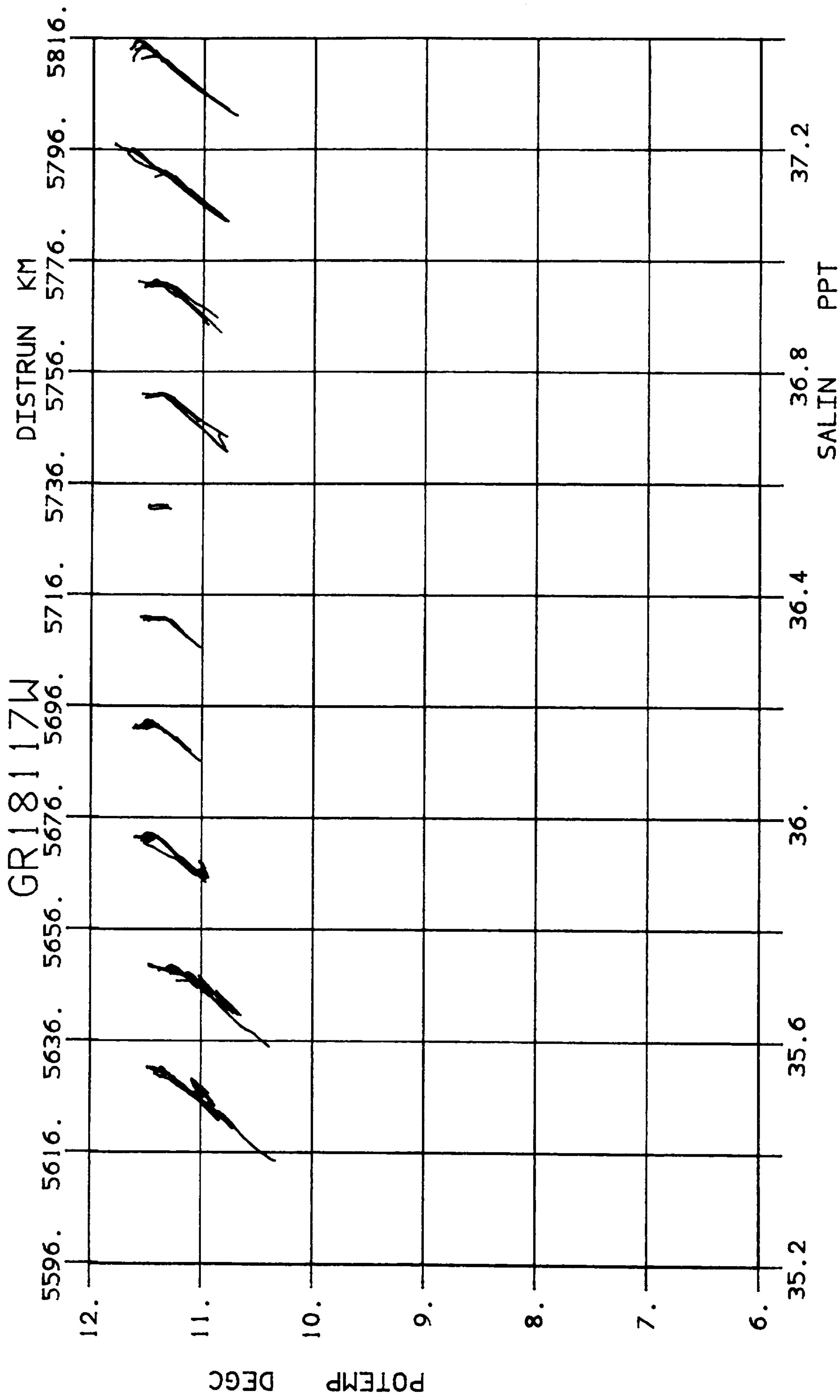
6.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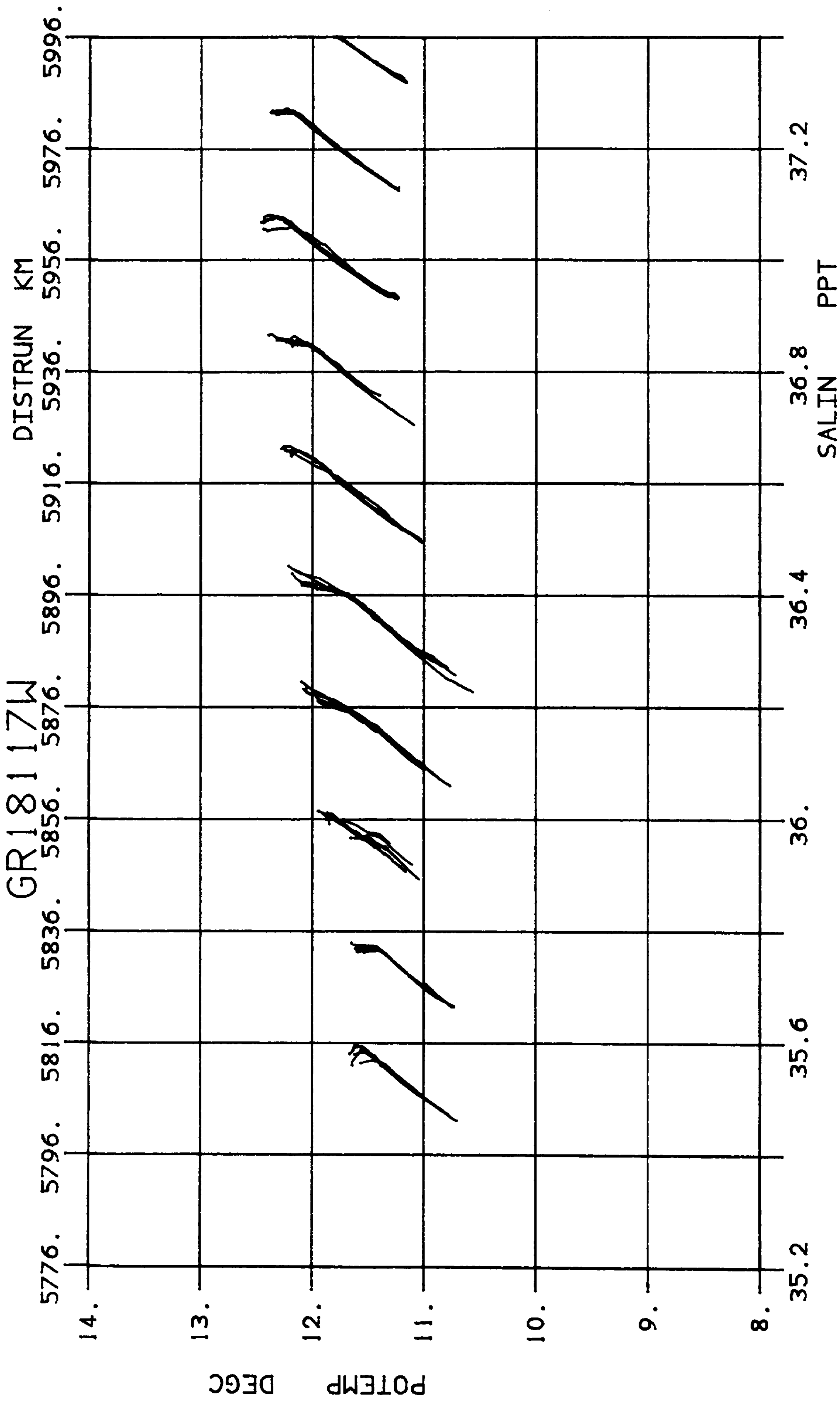
POTEMP DEGC
12. 11. 10. 9. 8. 7. 6.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POTEMP DEGC
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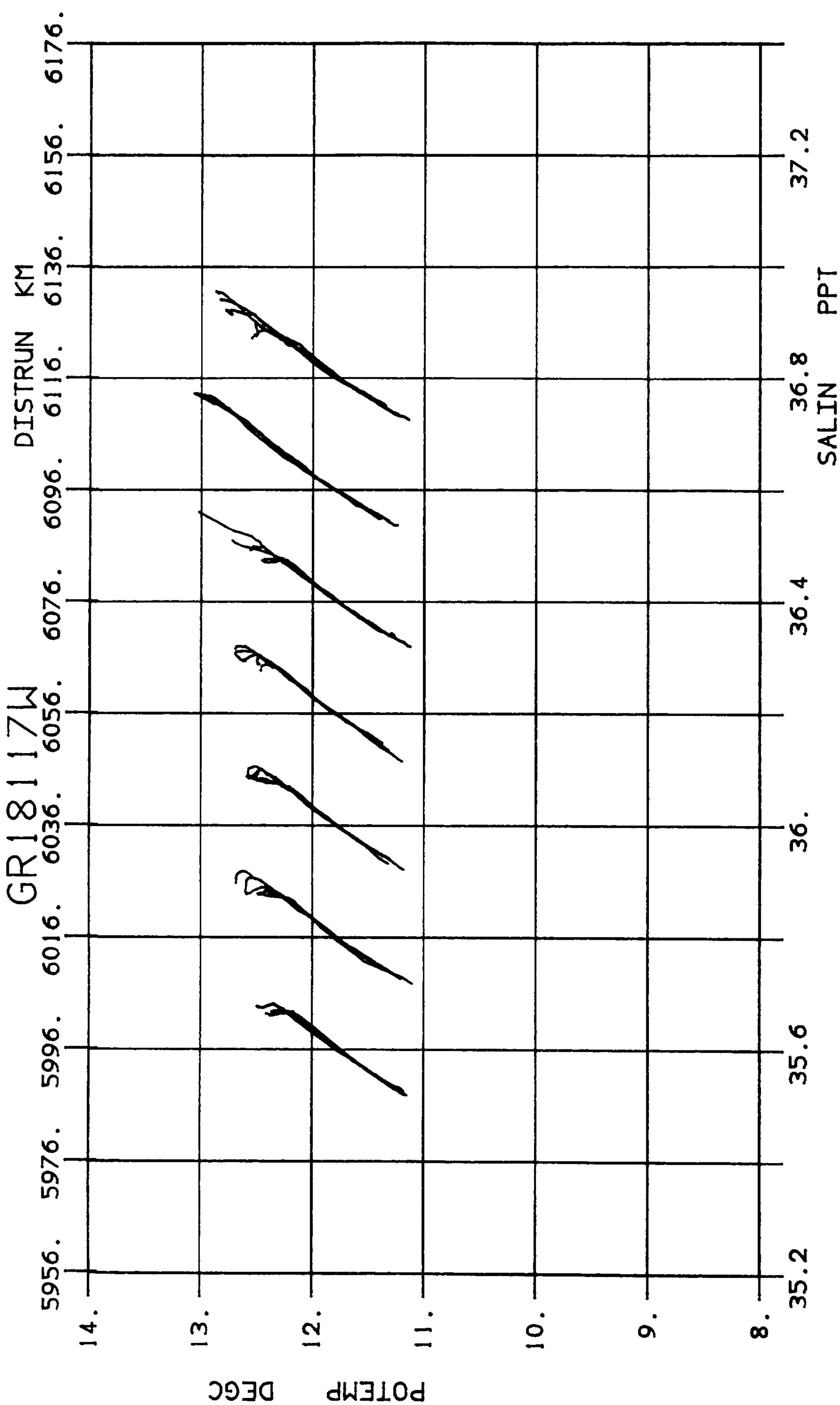
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6156.
6176.
SALIN PPT
35.2
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37.2
POTEMP DEGC
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13.
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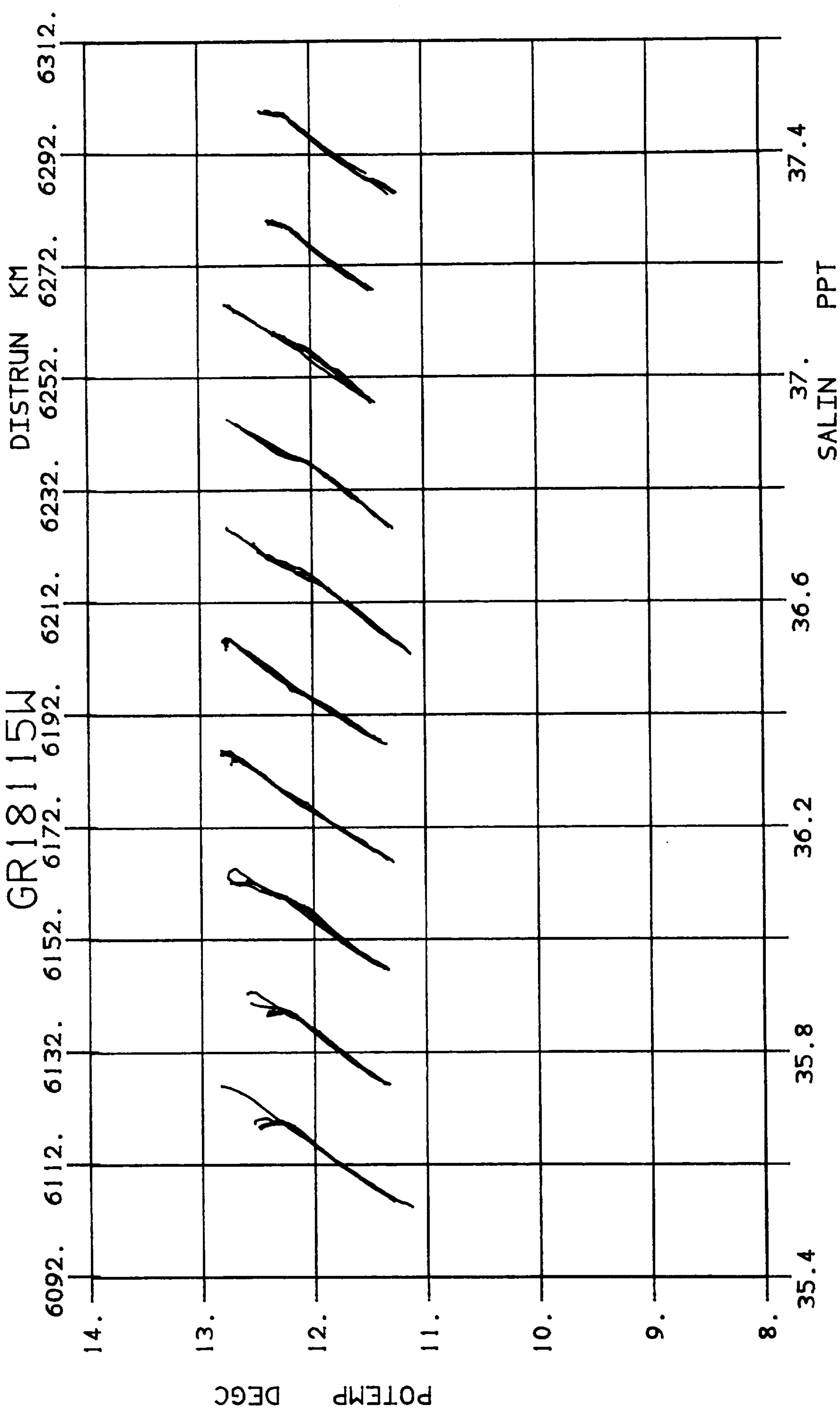
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6292.
6312.
SALIN PPT
35.4
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37.4
POTEMP DEGC
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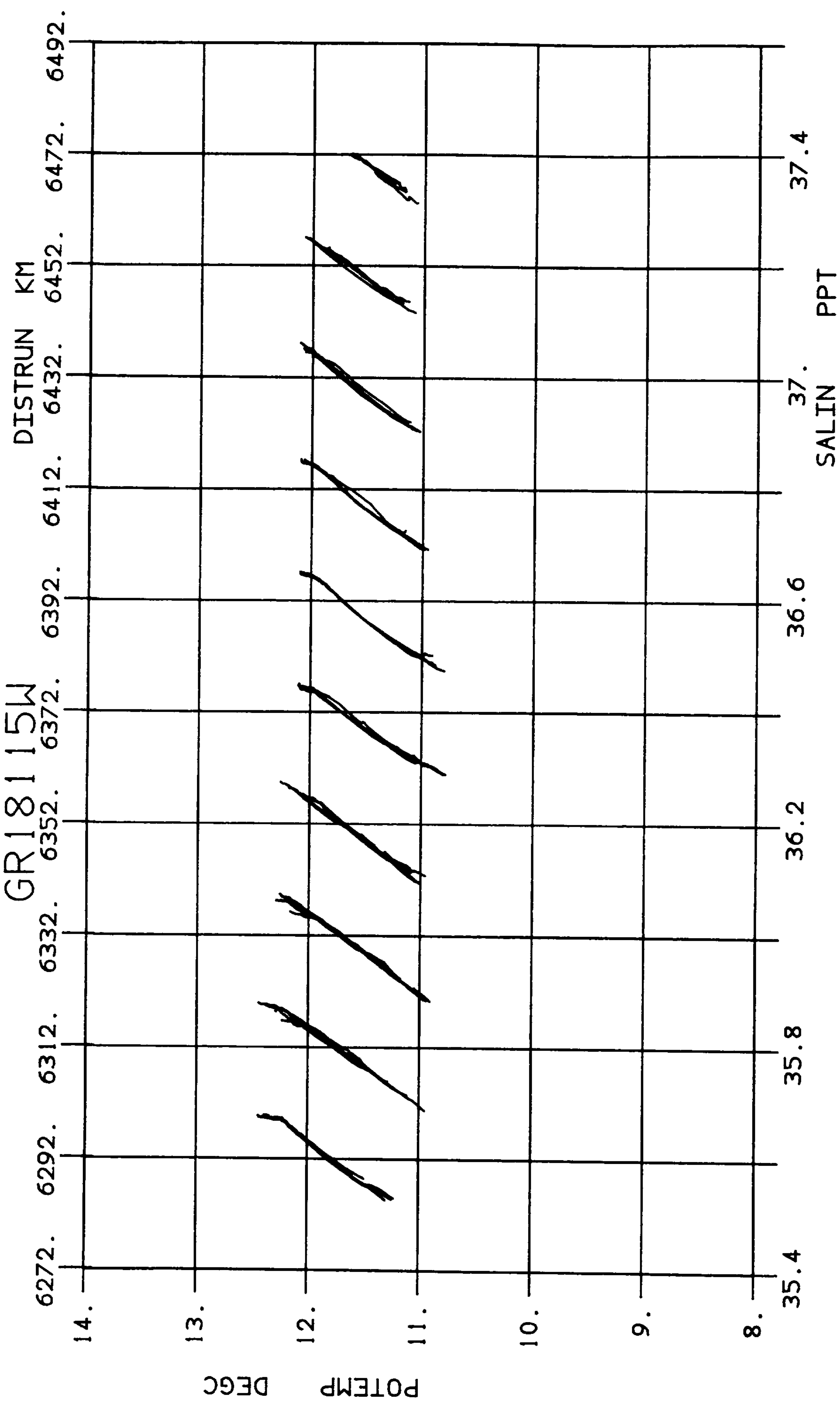
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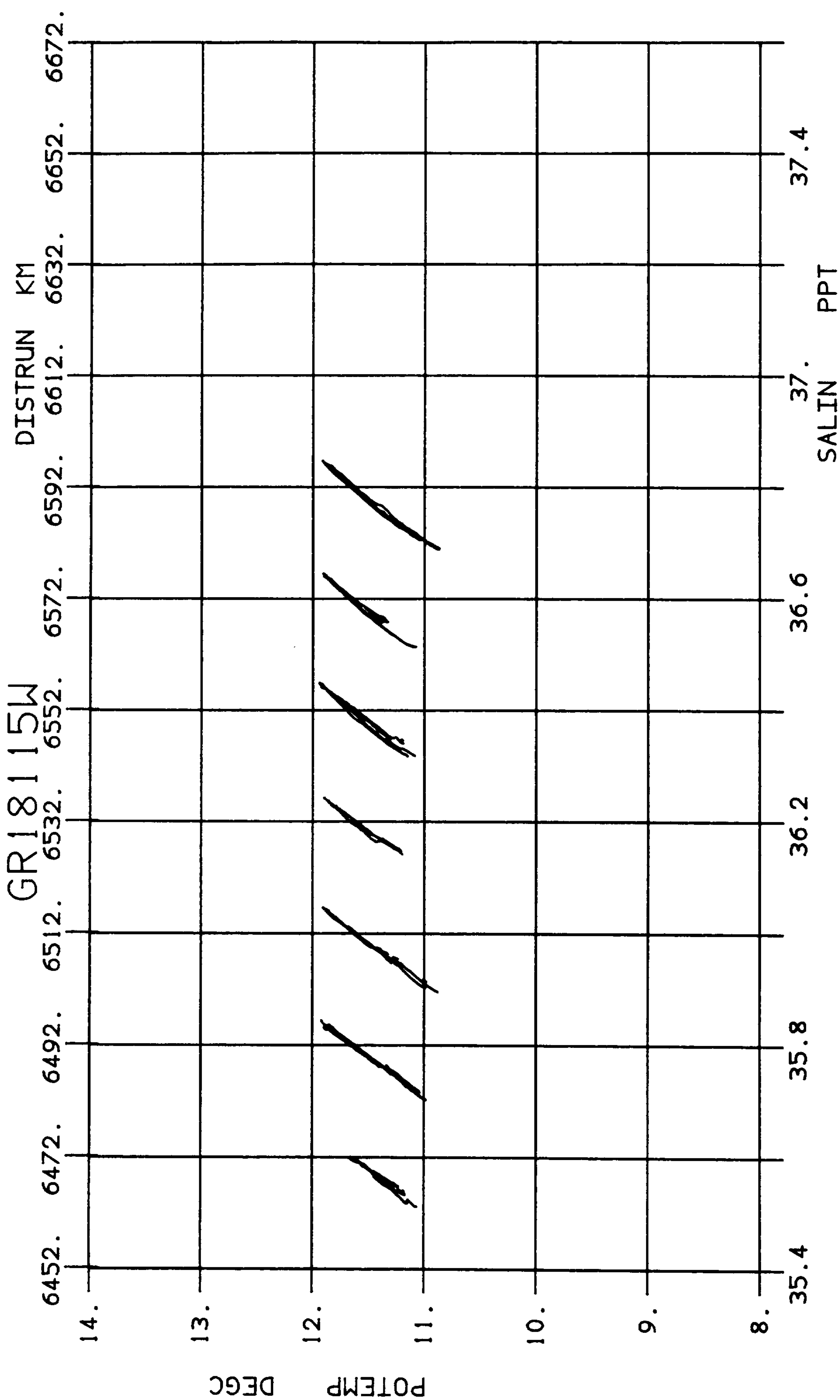
37.4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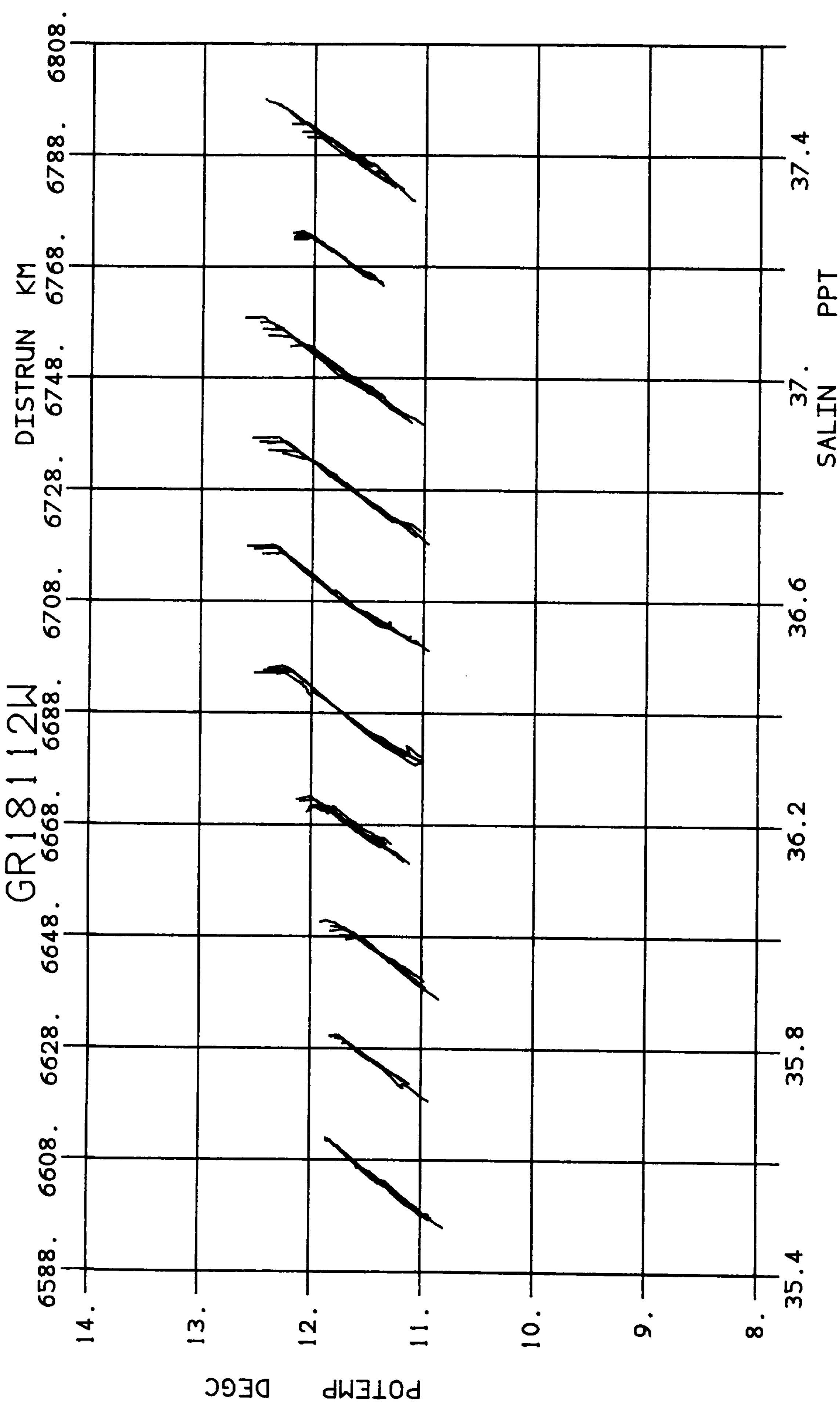

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SALIN PPT
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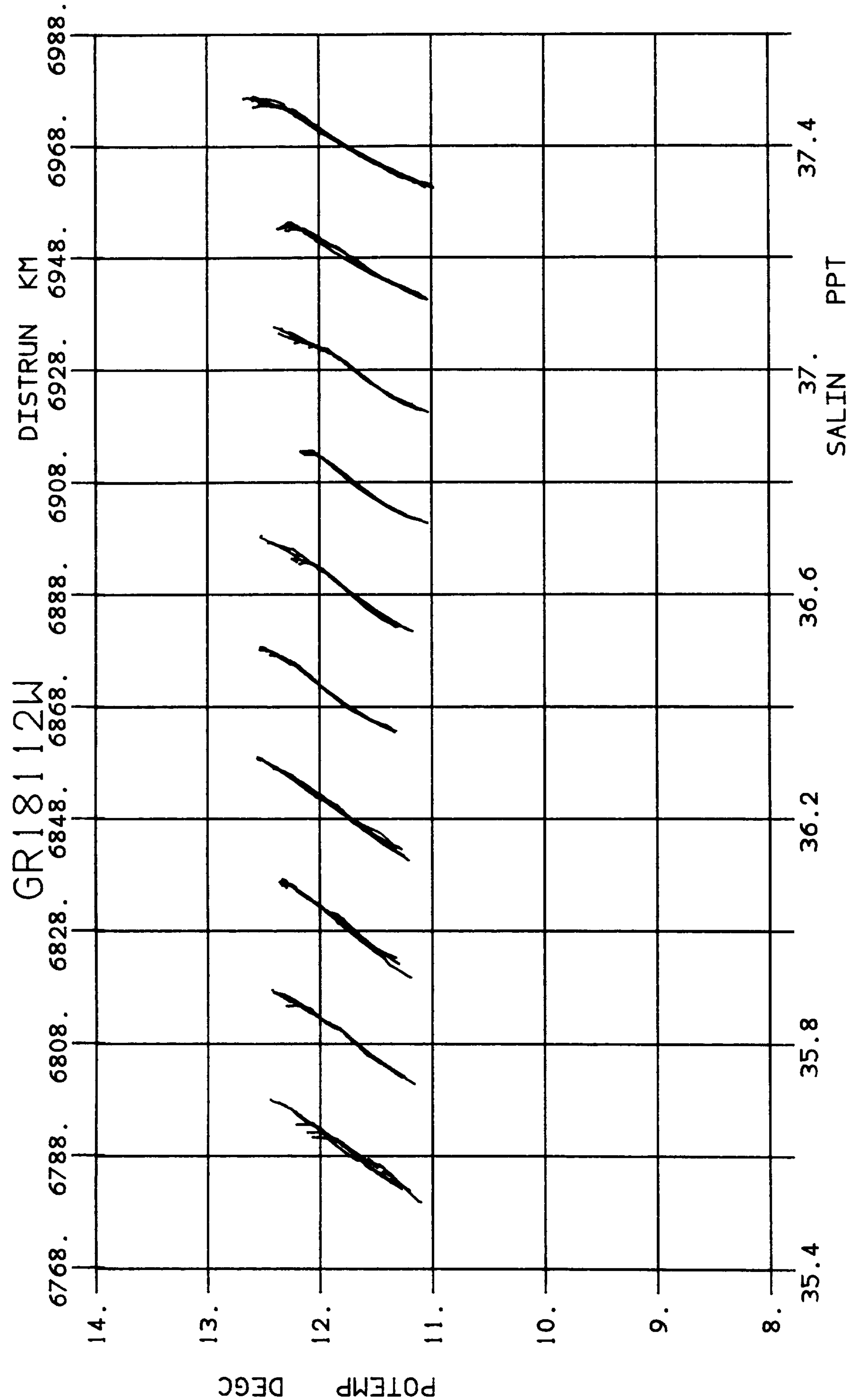
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SALIN PPT
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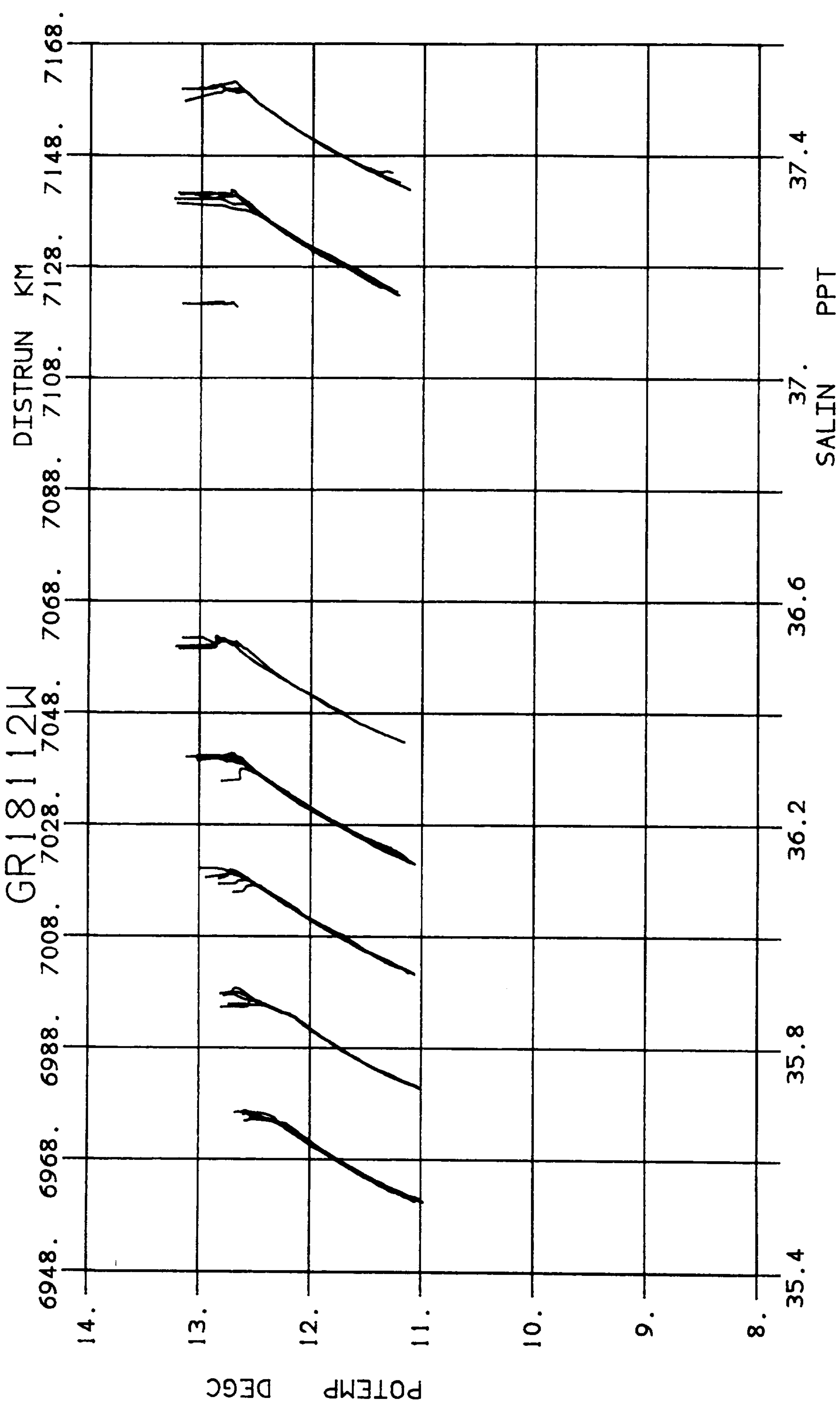
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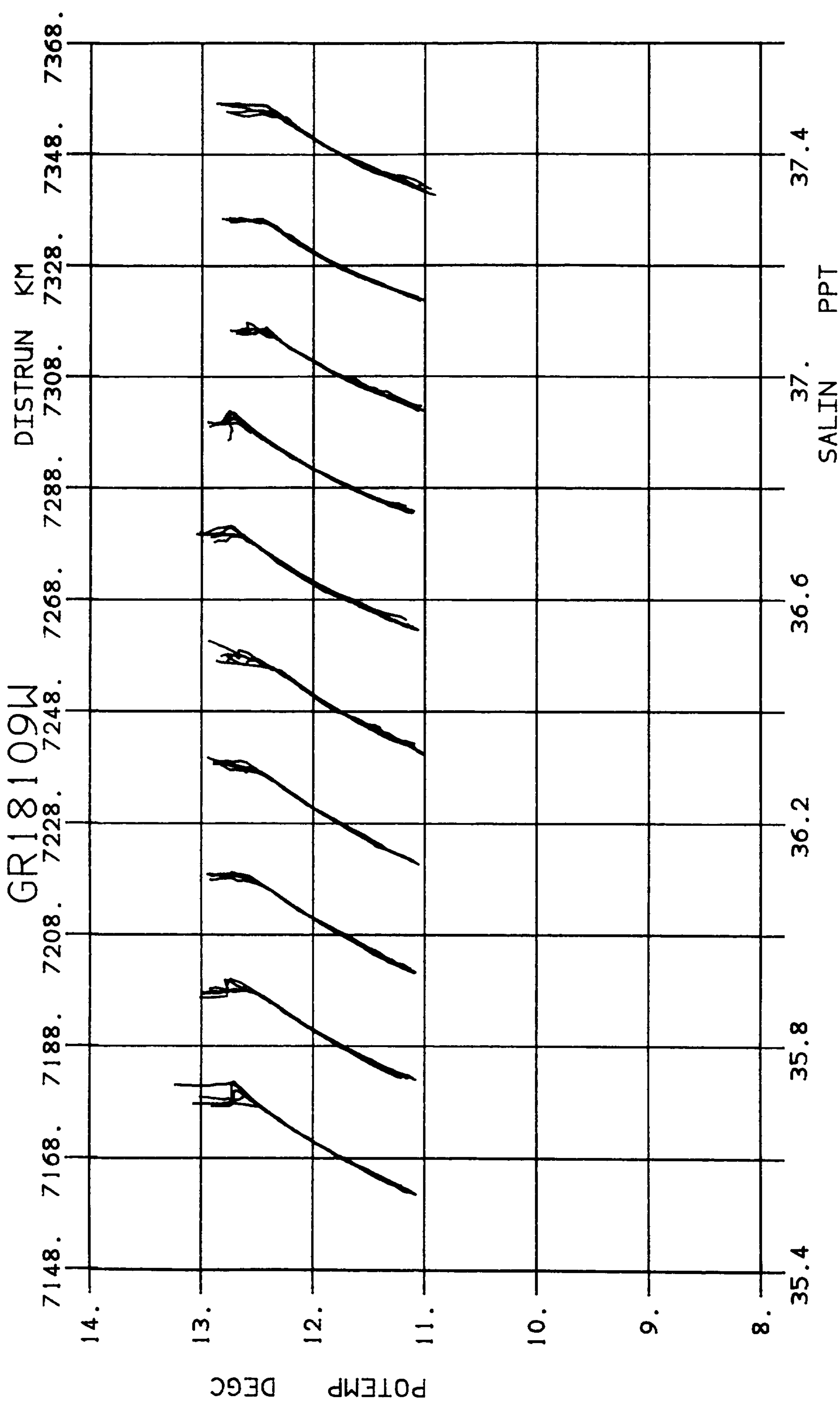
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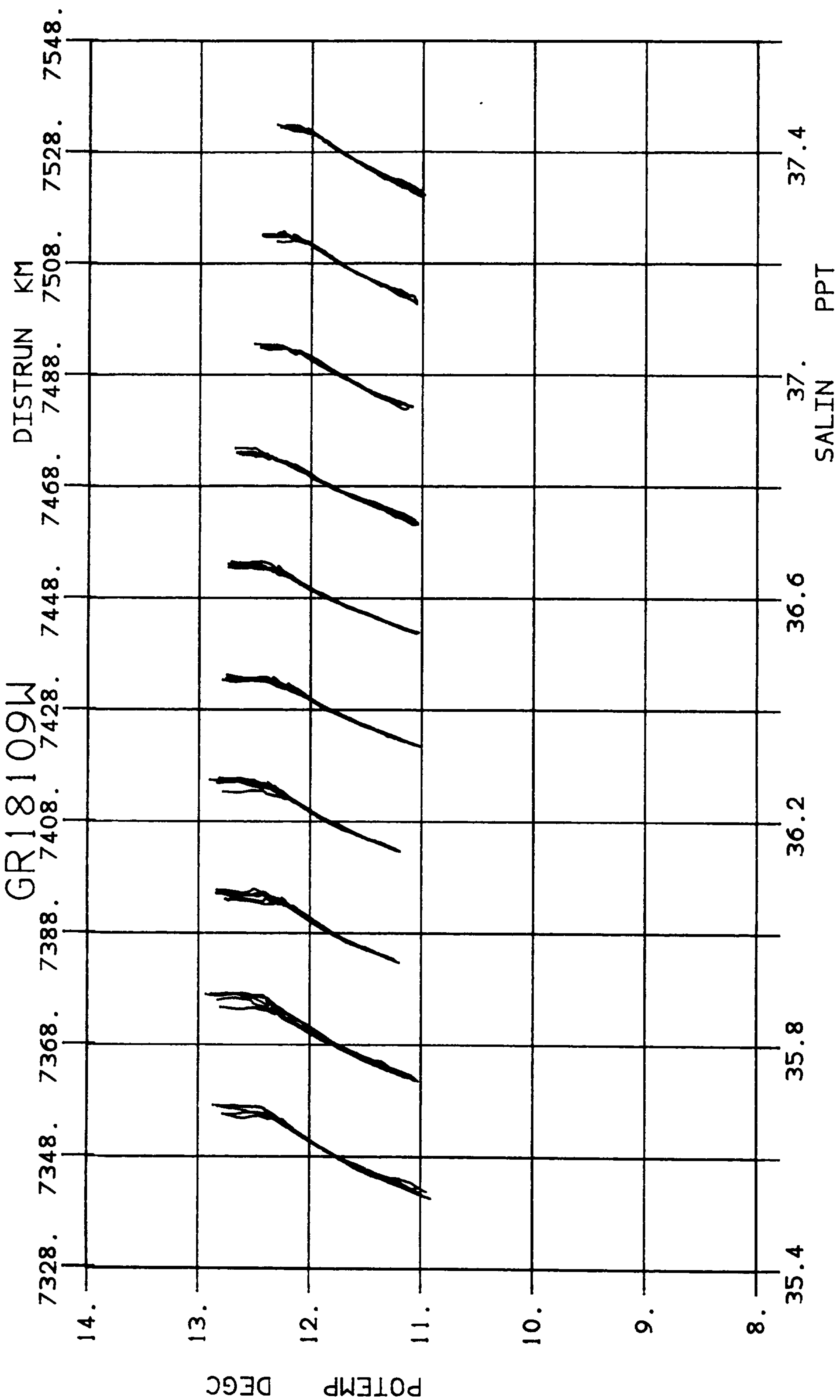
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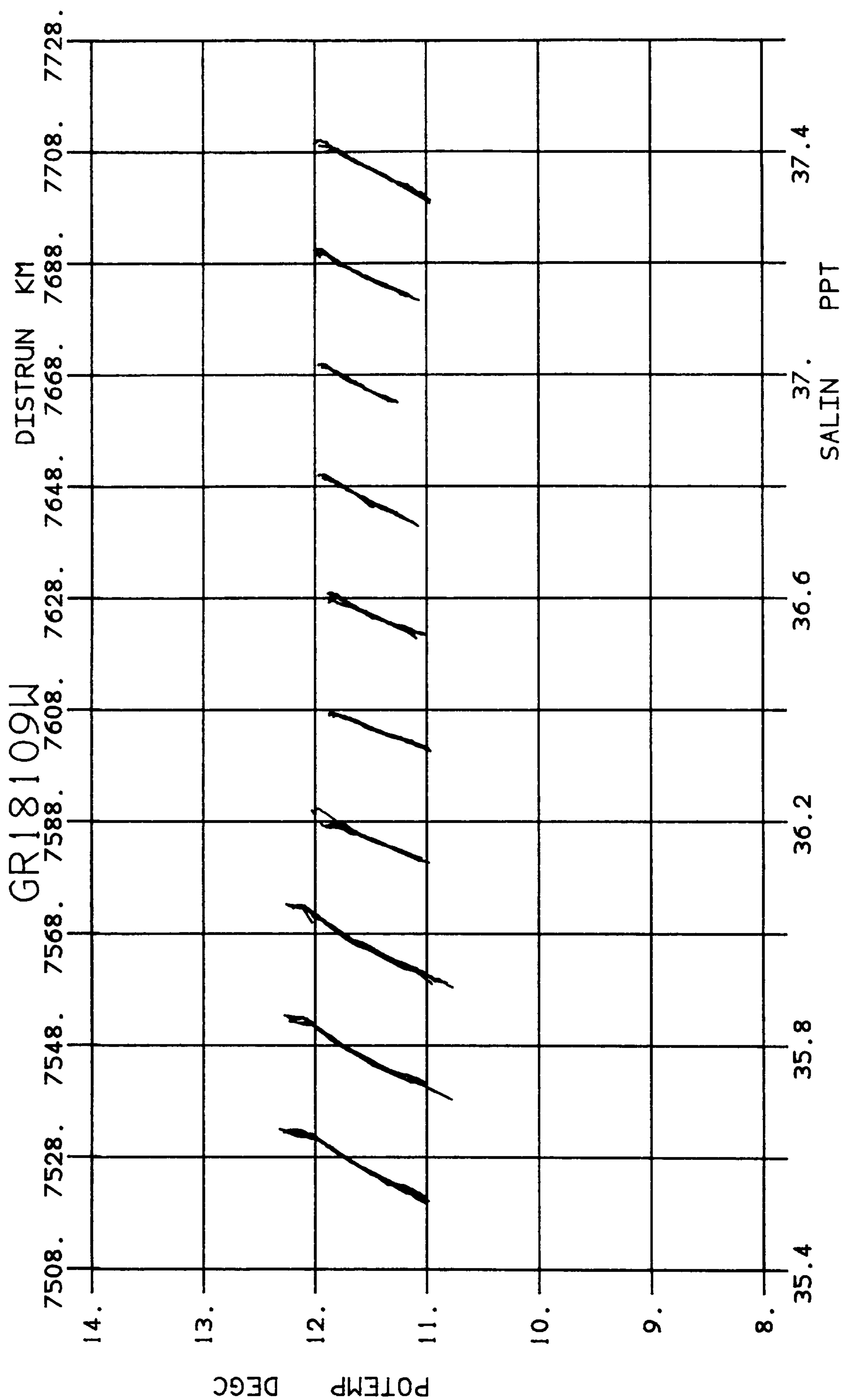
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SALIN PPT
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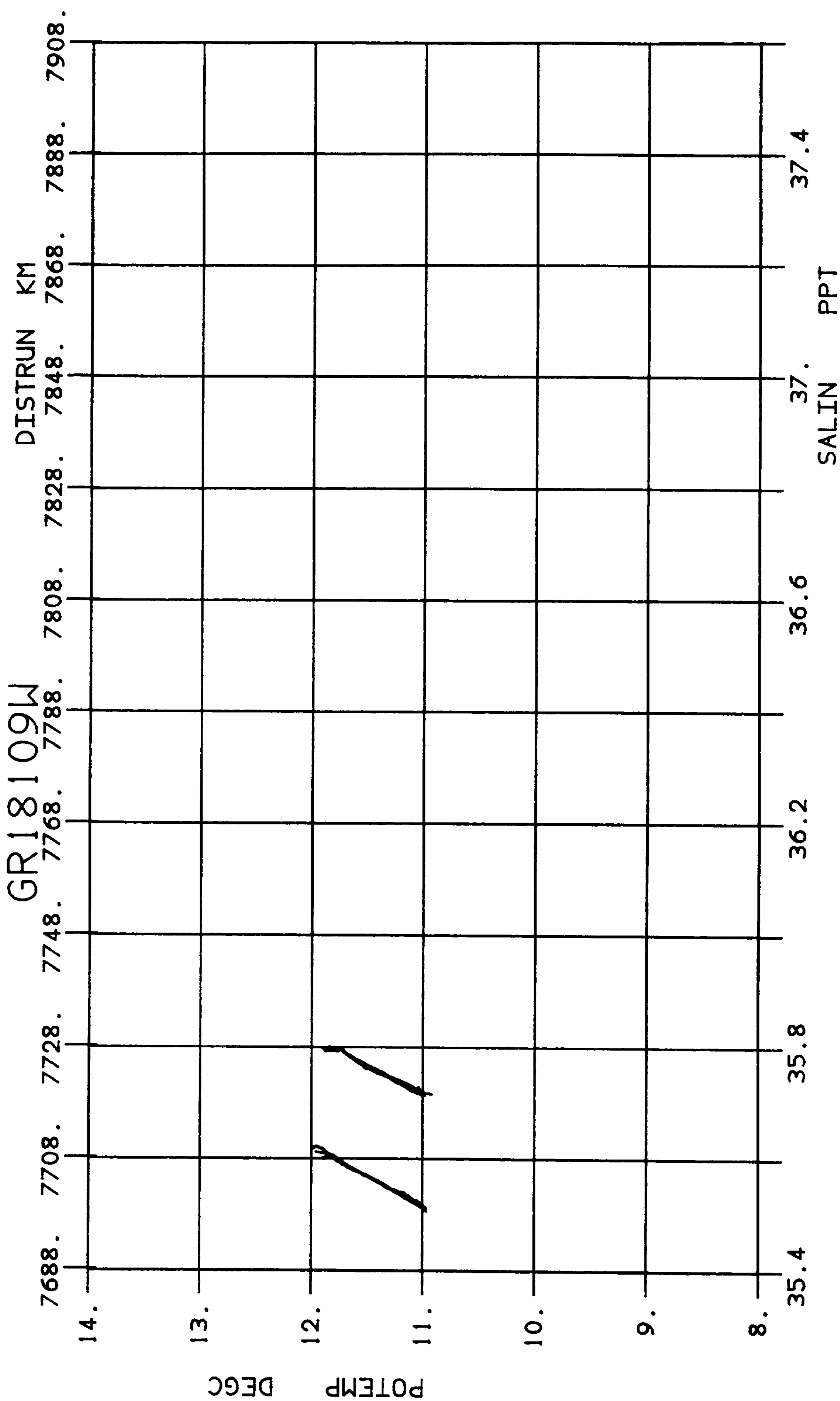
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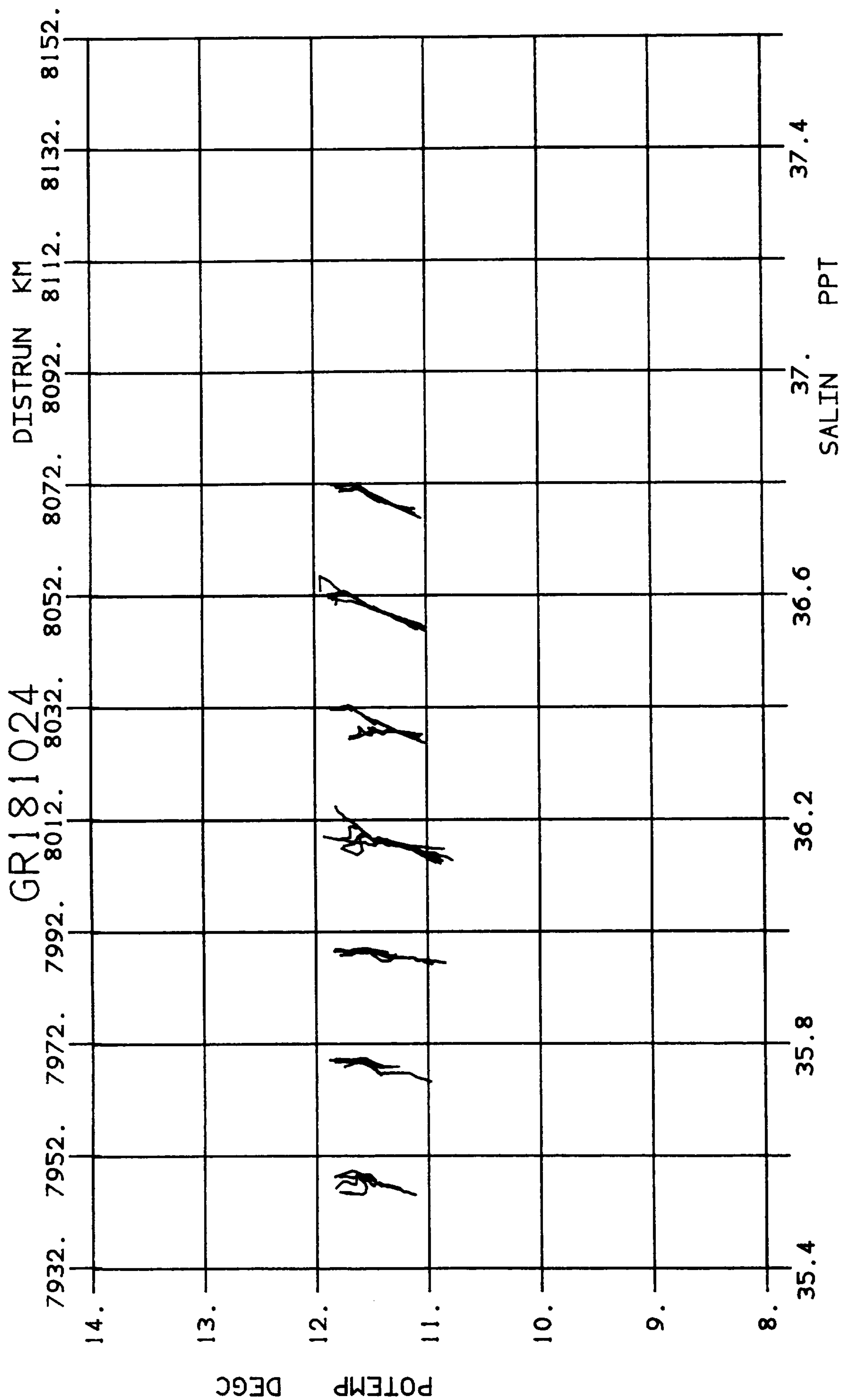
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POTEMP DEGC
14. 13. 12. 11. 10. 9. 8.