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A 21 CM RADIO CONTINUUM SURVEY OF THE GALACTIC PLANE BETWEEN l = 93° AND l = 162°

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Summary. — A 21 cm radio continuum survey of the galactic plane of an area between 93° ≤ l ≤ 162° and | b | ≤ 4° has been carried out with the Effelsberg 100 m radio telescope. Contour maps are presented with a sensitivity in temperature of 0.2 K T_B and an angular resolution of 9′ (HPBW). A list of 236 radio sources stronger than 0.3 Jy is given. The data have been calibrated in respect to the North Celestial Pole by using scans obtained with the Stockert 25 m radio telescope at the same wavelength.

Key words : Radio continuum survey — Galactic radio emission.

1. **Introduction.** — Radio continuum surveys of the section of the galactic plane at high declinations have previously only been available with poor resolution and/or sensitivity. In this area, at longitudes greater than 80°, one expects a major contribution to the radio emission from the Perseus arm ; therefore it should be possible to study weak objects like old supernova remnants and HII-regions in this area, which are more difficult to observe in the galactic centre quadrant with its strong background confusion.

In this paper we present results of a survey made with the Effelsberg 100 m radio telescope. The observations and reduction procedures are described, especially the calibration technique employing low resolution 21 cm data obtained with the Stockert 25 m radio telescope. We have listed point sources and extended objects with linear diameters up to 0°5. A discussion of the properties of these radio sources will be given in a subsequent paper.

2. **Observations.** — The observations were started in 1974 with the Effelsberg 100 m telescope by E. Braunsfurth and K. Rohlfs who made a single coverage of the area 95° ≤ l ≤ 160°, | b | ≤ 4°. Using a scan speed of 4°/min in latitude and a scan separation of 5′ in longitude the observations were completed in 30 hours. The receiver was a single channel cooled parametric amplifier with a system temperature of ~ 60 K. It was operated in the Dicke-mode, comparing the antenna signal with a cold load. A bandwidth of 40 MHz was employed centered at 1 420 MHz with a bandstop filter of 2 MHz bandwidth to reject the HI-line emission. As part of the data was taken in daytime some areas were severely confused by solar emission entering the far sidelobes. Kalberla *et al.* (1980) have described the pattern of the 100 m telescope at 21 cm wavelength and shown that solar emission entering sidelobes as far as 60° away from the main beam can cause ≈ 2 K strong features. Hence additional observations were needed to clarify the situation in some areas and to fill up some gaps. These observations were carried out in 1978, required 30^h and were made only at night time. A two channel receiver was used working in the total power mode at 1 405 MHz with a bandwidth of 40 MHz and ~ 80 K system temperature. The HPBW was 9′. The observed region was slightly extended to l = 93° at the low longitude end and to l = 162° at the high longitude end. The observations covered some 70 % of the total area in a mosaic of small pieces (see Kallas, 1979, for details) arranged to give a complete and reliable picture following considerations of the results of the 1974 observations.

3. **Reduction.** — All data were reduced initially through standard reduction programs (Neidhöfer *et al.*, 1978) based on the NOD2 analysis system (Haslam, 1974). Further reduction stages were necessary to minimize the baseline errors of the individual scans using mainly the method described by Sofue and Reich (1979) where differences between original and convolved data are used to determine baseline corrections. Full details of the complete reduction process are given by Kallas (1979). Finally all useful data were combined in a series of 5° × 8° maps. The temperature scale was determined by mapping the standard calibration sources 3C286 and 3C295 assuming 14.9 Jy or 23.1 Jy respectively. A conversion factor of 1 Jy ≡ 1.5 K T_A for 53 % aperture efficiency was used.

A major problem in calibrating survey data of the galactic plane arises from defining the *zero* level. At high frequency this is often done by making *long* scans up to | b | = 10° or 20° on the assumption that the emission at these latitudes is effectively zero. We have used data from the 21 cm Stockert survey with a resolution of 34′ to calibrate our data. After completion the 21 cm Stockert survey will cover the whole northern sky as described by Reich (1976). The area between 90° to 19° declination was covered by azimuth scans of 140° length starting at the North Celestial Pole with a spacing of 1 min in siderial time. Figure 1 illustrates the course of typical scans. In the area of the Effelsberg survey the Stockert scans run roughly perpendicular to the plane, except for longitudes of 110° or less, and always continue through areas of very low brightness ($b < -20°$, see Fig. 1). A set of 80 scans was selected being separated by ~ 1° at $b = 0°$. From the 820 MHz survey of Berkhuijsen (1972) we determined temperature differences between the North Celestial Pole and the ends of the scans at high negative galactic latitudes. These differences, typically < 0.5 K, were scaled to 1 420 MHz using a spectral index of 2.7. Afterwards the Stockert scans were adjusted by a linear interpolation. Two examples of these scans are given in figure 2.

The Effelsberg 9′ resolution data were convolved to 34′ resolution by Gaussian smoothing. For longitudes $l < 105°$ the baseline found at $l = 105°$ has been used. Around CAS A the spurious structure due to sidelobes affects the process of determining a baseline, therefore a linear interpolation of the baseline from $l = 110°$ to $l = 115°$ has been used. In the area $l = 150°$ to $l = 157.°5$ small scale discrepancies of up to 0.3 K T_B remain even after a correction for small scale ground radiation effects from the 100 m telescope. The errors in the final maps are listed in table I. By comparing the smoothed Effelsberg data with the Stockert scan data at ± 3.°7, ± 2.°7 and 0° latitude, baseline corrections were found and applied to the original data (for details see Kallas, 1979).

4. **Results.** — Figures 3 a-i show the results of our survey in the form of contour maps. The contours are given in main beam brightness temperature assuming a 70 % main beam efficiency (Kalberla *et al.*, 1980). To obtain absolute values of the brightness temperature the pole temperature has to be added. Following the discussion of Berkhuijsen (1971) we extrapolate the value of 6.4 K T_B at 820 MHz to 3.55 K T_B at 1 420 MHz (for details see Kallas, 1979). While the relative error is 0.1 K, the absolute error may be somewhat larger.

In table II we have listed 236 radio sources found within the surveyed area. We distinguish between unresolved point sources (P), slightly extended sources (EP), extended sources (E) with apparent diameters between 11′ and 20′, and very extended objects (VE). Radio structures with extents of more than 30′ are not listed. The peak positions and peak flux density values are given. Integrated flux densities are given for sources where Gaussian fitting could be applied. Because the survey is slightly undersampled we considered only sources with peak flux densities greater than 0.3 Jy. If available we listed flux densities from other catalogues selected from an updated version of the Master Source List of Radio Sources (Dixon, 1970).

5. **Remarks to the contour maps.** — Around CAS A, centered at $l = 111.°7$, $b = -2.°1$, strong sidelobe features are visible between $l \sim 109°$ and $l \sim 115°$. The main structures caused by diffraction at the telescope support legs are indicated in figure 3 c, d. These features appear curved because the telescope was driven in azimuth and elevation while mapping this specific area. At 21 cm wavelength a deep antenna pattern of 2° × 2° extent mapped in azimuth and elevation has been given for the 100 m telescope by Kalberla *et al.* (1980).

Two small areas of the surveyed region have been published already with relative zero levels : One is the area around $l = 127°$, $b = +1°$ (Reich *et al.*, 1979) containing two old supernova remnants G 127.1 + 0.5 and G 126.2 + 1.6 and the other is the region of W3/W4/W5 ($l \sim 131°$ to $l \sim 139°$, $|b| \leq 3°$) containing only data from the 1974 observations (Rohlfs *et al.*, 1977). One feature of their map running from $l \sim 138°$, $b \sim +1°$ to $l \sim 139°$, $b \sim -1°$ is not visible in our map and is probably due to solar radiation picked up by the far sidelobes.

Two more old supernova remnants near CTB 1 ($l = 116.°9$, $b = +0.°2$) namely G 116.5 + 1.1 and G 114.3 + 0.3 have been identified by Braunsfurth *et al.* (1979) from 11 cm measurements. Details of these objects will be given elsewhere (Reich *et al.*, in preparation).

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Table I

Maximum errors of the 21 cm survey	
local scanning effects	0.1 K T_B
noise	0.05 K T_B
scale	5 %
Zero level accuracy :	
a) varying ground radiation within the Effelsberg data (l = 150°-157°5)	0.3 K T_B
b) calibration by Stockert scans	0.2 K T_B

TABLE II.

NO.	POSITION L	B	TYPE	EXTENT L	B	PEAK	FLUX ERROR	INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
1	93.06	2.81	VE			8.5			I,C,B	4CP52.48 4C+52.48 BG 2110+52 NRA0650 NRA0650 DA535	178 179 408 750 1400 1420	18.5 2.0 11.6 48.0 46.0 58.0
2	93.31	.41	P			2.3	.3	2.3		4CP50.55 4C+50.55 NRA0659	178 179 1400	8.5 3.4 2.5
3	93.37	1.72	VE			3.0			C,B	4CP51.44B NRA0655	178 1400	8.7 6.2
4	93.70	2.59	E	11	13	.8	.1	1.3	C			
5	93.98	-1.71	P			.4	.2	.4		4C+49.41	179	2.0
6	94.39	2.66	VE			.5	.1					
7	94.47	-1.53	E	12	13	1.8	.1	3.4				
8	94.77	-.89	P			.5	.1	.5				
9	95.00	.55	P			.4	.1	.4				
10	95.28	.42	P			.5	.1	.5				
11	95.33	-.63	P			.7	.1	.7		CR 50T243.2	178	4.5
12	95.51	3.49	P			.3	.1	.3		4C+54.44	179	2.6
13	95.67	.23	EP	11	10	1.1	.1	1.4		OX+558	1415	1.7
14	95.95	-3.24	P			1.1	.1	1.1		4CP49.42 4C+49.42 BG 2150+49 OX+484 DA566	178 179 408 1415 1420	6.3 6.1 3.3 .9 2.0
15	95.98	3.44	EP	10		.4	.1	.4		OX+536	1415	1.4
16	95.99	-.80	P			.5	.1	.5		4C+51.46 BG 2140+51	179 408	2.7 1.5
17	96.32	2.61	EP	11		.6	.1	.7		OX+544	1415	1.6
18	96.34	-.12	EP	11	11	.4	.1	.6		OX+566	1415	1.6
19	96.47	1.34	E			.4	.1			OX+557	1415	.4
20	96.61	3.38	VE			.5	.1			OX+541	1415	2.8
21	96.73	-.35	E			.3	.1			OX+571	1415	.7
22	97.25	3.33	P			.3	.1	.3				
23	97.52	3.18	P			.7	.1	.7				
24	97.65	-3.53	P			1.3	.1	1.3		NRA0676	750	

TABLE II (continued).

NO.	POSITION L	B	TYPE	EXTENT L	B	PEAK	FLUX ERROR	INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
										NRA0676	1400	.8
25	97.77	-.18	P			.5	.1	.5		4CP53.49 4C+53.49	178 179	4.7 4.6
26	97.94	-2.57	P			.5	.1	.5				
27	98.15	-1.68	E			.3	.1			CP 50T247	178	5.8
28	98.17	2.35	EP		10	.4	.1	.4		4CP55.39 4C+55.39	178 179	2.6 2.6
29	98.84	-1.67	EP		11	.3	.1	.4		CR 54T382	178	3.7
30	99.30	-3.32	P			.3	.1	.3				
31	99.75	2.77	E			.5	.1		C			
32	99.85	-1.36	E	13	13	.3	.1	.5		OY+503	1415	.2
33	100.29	3.37	E			.3	.1			4C+57.37	179	2.0
34	100.39	-2.47	P			.3	.1	.3		OY+516.9	1415	.2
35	100.78	1.76	E			.3	.2					
36	101.03	-2.61	EP		11	.3	.1	.3				
37	101.10	-1.54	P			.6	.1	.6		4CP56.32 4C+56.32 OX+596	178 179 1415	3.8 2.1 .8
38	101.29	.43	P			.4	.1	.4		4C+55.40 BG 2203+55 OY+505	179 408 1415	2.3 1.3 .2
39	101.54	1.45	P			.3	.1	.3				
40	102.57	-2.39	P			.6	.1	.6		OY+537	1415	.4
41	102.92	.29	P			1.1	.1	1.1		4C+56.33 WK444	179 408	4.0 1.9
42	102.93	-3.19	P			.3	.1	.3				
43	103.20	-2.35	E			.3	.1					
44	103.27	-3.28	P			1.6	.2	1.6		4CP53.50 4C+53.50 OY+549	178 179 1415	11.2 10.6 2.0
45	103.69	.36	EP	10		.6	.1	.6		WK448 OY+531	408 1415	1.1 .7
46	103.77	2.20	E			.6	.1			RMHB13	3200	43.0
47	104.58	1.29	VE			1.1	.1			RMHB15	3200	45.0
48	104.71	2.83	E			.7	.1					

TABLE II (continued).

NO.	POSITION L	B	TYPE	EXTENT L	B	PEAK	FLUX ERROR	INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
49	104.71	-.05	E			.3	.1					
50	104.72	3.30	P			1.2	.1	1.2		4C+60.34 BG 2212+60 VR060.22.01	179 408 610	7.9 3.9 3.0
51	105.21	1.50	E			.4	.1			BG 2223+59	408	2.1
52	105.55	.96	P			.3	.1	.3				
53	105.63	.34	E			.7	.1					
54	105.68	2.42	P			.4	.1	.4				
55	105.81	.03	E			.5	.1					
56	106.07	-.97	E			.5	.1					
57	106.80	3.30	EP	10		.5	.1	.6				
58	107.84	2.32	EP		10	.7	.1	.7		OY+664 PK 107+02.1 PK 107+02.1 PK 107+02.1	1415 3240 6630 10630	.5 .6 .6 .4
59	107.96	-1.49	P			2.9	.3	2.9	C	BG 2252+57	408	6.0
60	107.98	-2.14	E			.3	.1		C			
61	108.20	.59	P			2.4	.2	2.4		BG 2247+59 VR059.22.02	408 610	1.5 2.4
62	108.36	-1.06	P			.7	.2	.7	C			
63	108.42	-2.65	E			.5	.1		C			
64	108.53	3.01	E			.3	.1					
65	108.55	-2.73	VE			.5	.1		C	OZ+500	1415	1.8
66	108.75	2.58	P			.3	.1	.3				
67	108.77	-.96	P			1.3	.3	1.3	C			
68	108.98	-1.86	P			1.2	.1	1.2				
69	109.03	1.08	P			.4	.1	.4				
70	109.34	3.62	P			.4	.2	.4	C			
71	109.87	-1.22	E			.4	.3		C			
72	110.11	.04	P			2.0	.3	2.0				
73	110.71	1.22	P			.4	.1	.4				
74	110.75	3.28	EP	10		1.2	.2	1.4		BG 2256+63 VR063.22.03	408 610	3.5 2.4
75	111.25	2.76	E			.4	.1					

TABLE II (continued).

NO.	POSITION L	B	TYPE	EXTENT L	B	PEAK	FLUX ERROR	INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
76	111.54	.82	EP		10	23.3	5.0	24.9	C	BG 2311+61	408	22.0
77	111.63	.38	P			2.0	.8	2.0	C			
78	111.66	2.41	E			.8	.2			BG 2307+62	408	2.1
79	112.45	2.91	P			.3	.1	.3				
80	113.57	-.67	E	13	12	1.8	.3	3.5	C			
81	114.60	.21	EP	11	12	.5	.2	.9				
82	114.63	-.81	EP	11	12	.4	.1	.6				
83	115.75	-1.10	P			.5	.1	.5				
84	115.79	-1.59	EP	10	10	1.5	.1	1.9	C	OZ+684	1415	1.4
85	116.51	2.55	EP		10	4.8	.2	5.2		4CP64.25 3C468.1 4C+64.25 BG 2348+64 NRA0721 NRA0721	178 178 179 408 750 1400	30.0 34.0 30.5 18.4 10.1 5.2
86	116.64	-3.71	E			.3	.1					
87	116.67	-1.91	P			.4	.1	.4		OZ+697	1415	.6
88	116.87	-1.40	E			.4	.1					
89	116.94	-.86	P			.4	.1	.4				
90	117.49	.41	EP		11	.4	.1	.6				
91	117.62	2.26	E	14	14	1.4	.1	3.2				
92	118.50	3.19	P			.4	.1	.4				
93	118.55	-1.27	P			3.9	.2	3.9		4CP60.01 4C+60.01 BG 0012+61 VR061.00.01 DW0012+61 OB+620 DA007	178 179 408 610 1400 1415 1420	10.1 10.2 7.3 6.0 3.9 4.4 5.0
94	118.97	3.28	P			1.0	.1	1.0		BG 0009+65	408	1.6
95	118.97	-3.35	EP		10	.3	.1	.4				
96	119.24	.39	E			.4	.1		C			
97	119.37	1.95	P			.3	.1	.3				
98	119.40	-.91	E	18	21	.7	.1	3.1				
99	119.73	2.38	P			.3	.1	.3				

TABLE II *(continued)*.

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	F
100	120.01	-1.95	P			.3	.2	.3				
101	120.09	1.40	E	13	10	24.4	3.0	42.0		DB 002	10	3
										4C+63.01(WKB)	38	4
										3C010.0	178	1
										4C+63.01	179	
										BG 0022+63	408	
										AJG 112	408	
										VRO63.00.01	610	
										NRA0022	750	
										DKM120.1+01.4	1000	
										NRA0022	1400	
										DA011	1420	
102	120.28	-1.75	P			.4	.1	.4				
103	120.55	1.20	EP	10		2.9	.3	3.1		4C+63.02(WKB)	38	
										4C+63.02	179	
										BG 0026+63	408	
										VRO63.00.02	610	
										NRA0025	750	
										NRA0025	1400	
104	121.02	-1.31	EP	11	10	.4	.1	.5		OB+654	1415	
105	121.20	-2.33	EP	10		2.1	.2	2.2		4CP60.02	178	
										4C+60.02	179	
										BG 0034+60	408	
										VRO60.00.02	610	
										NRA0031	750	
										NRA0031	1400	
										OB+658	1415	
106	121.28	-.22	P			.7	.1	.7		4C+62.01	179	
										BG 0034+62	408	
										VRO62.00.01	610	
										DW0034+62	1400	
107	121.32	.08	P			.3	.1	.3				
108	122.08	-2.96	EP	11	10	.3	.1	.4				
109	122.25	3.44	P			1.6	.1	1.6		4CP66.02	178	
										4C+66.02	179	
										BG 0041+66	408	
110	122.56	-1.77	P			.5	.1	.5		BG 0045+60	408	
111	123.70	-2.65	P			.3	.1	.3		OB+591.1	1415	
112	123.91	1.64	EP	11	10	.4	.1	.5	C			
113	124.07	2.82	E			.3						
114	124.60	-.43	E			.3	.1					
115	124.60	.52	E			.5	.1			BG 0103+63	408	
116	125:00	-1.47	E			.3	.1			4CP61.01	178	
										4C+61.01	179	

TABLE II *(continued)*.

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
										BG 0105+61	408	1.2
										VRO61.01.01	610	3.0
										OC+610	1415	.3
117	125.30	-2.25	E	12	10	.4	.1	.7		4C+60.04	179	3.5
										VRO60.01.01	610	1.8
										OC+612	1415	.6
118	125.44	-1.17	P			.3	.1	.3				
119	125.54	-.36	P			.4	.1	.4		4CP62.02	178	2.0
										4C+62.02	179	2.0
										VRO62.01.01	610	1.0
										OC+618	1415	.5
120	126.66	-.79	EP		10	1.4	.1	1.5		4CP61.02	178	2.8
										4C+61.02	179	2.4
										BG 0119+61	408	2.1
										VRO61.01.02	610	3.0
										DW0119+61	1400	2.1
										OC+633	1415	2.3
121	127.11	3.47	P			.6	.1	.6		4CP65.01	178	2.8
										4C+65.01	179	2.1
										BG 0129+65	408	1.6
122	127.90	1.72	VE			.3	.1					
123	128.03	3.55	P			.4	.2	.4		4C+65.03	179	2.2
										BG 0138+65	408	2.4
124	128.20	2.32	P			.3	.1	.3				
125	128.37	1.42	P			.4	.1	.4				
126	128.72	-1.41	P			.3	.1	.3				
127	129.31	2.79	P			.5	.1	.5		4CP64.01	178	2.7
										4C+64.01	179	2.3
										BG 0148+64	408	1.2
128	129.58	3.40	P			.4	.1	.4		4CP65.04	178	3.3
										4C+65.04	179	3.3
										BG 0152+65	408	1.8
129	130.24	.35	P			.7	.1	.7		4CP62.03	178	3.6
										4C+62.03	179	3.2
										OC+686	1415	.5
130	130.72	3.09	EP	10	10	31.3	3.0	36.6		4C+64.02(WKB)	38	45.0
										3C058.0	178	24.0
										4CP64.02	178	27.4
										4C+64.02	179	7.6
										BG 0201+64	408	35.1
										AJG 113	408	33.0
										NRA0090	750	34.8
										NRA0090	1400	34.2
										DA066	1420	28.0
131	130.85	2.27	P			.4	.1	.4		4C+63.04	179	2.1

TABLE II *(continued)*.

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
										VRO63.02.01	610	1.8
132	130.98	-.81	P			.3	.1	.3				
133	131.09	-.15	P			.4	.1	.4		4C+61.03	179	2.0
										BG 0157+61	408	1.2
										OC+695	1415	.2
134	131.19	.54	P			.5	.1	.5		4CP62.04	178	3.5
										4C+62.04	179	3.4
										BG 0159+62	408	1.8
										VRO62.02.01	610	1.2
135	131.46	1.16	P			1.7	.1	1.7				
136	131.77	3.59	EP		10	.5	.1	.6		4C+64.03	179	2.4
137	132.06	.21	P			1.0	.1	1.0		4C+61.04	179	4.5
										BG 0205+61	408	2.7
										VRO61.02.01	610	2.4
138	132.16	-.72	P			.5	.1	.5				
139	133.00	-1.02	P			.9	.1	.9	C	4CP60.05	178	4.2
										4C+60.05	179	4.6
										BG 0210+60	408	2.4
										VRO59.02.01	610	3.0
										DW0210+59	1400	.7
										DA070	1420	3.3
140	133.43	.07	EP	11	11	1.6	.2	2.3	C			
141	133.87	-1.93	P			.3	.1	.3				
142	134.30	2.85	P			.3	.1	.3		4CP63.05	178	2.3
										4C+63.05	179	2.5
										BG 0231+63	408	1.5
										VRO63.02.02	610	1.8
143	134.52	-2.01	P			.4	.1	.4		OD+531	1415	.4
144	134.75	-1.19	EP	10	10	.3	.1	.4	C			
145	135.79	-2.65	EP		10	.5	.1	.6		4CP57.05	178	2.7
										4C+57.05	179	2.7
146	136.22	-.90	P			3.3	.1	3.3		CL0234+58	26	109.0
										4C+58.08(WKB)	38	73.0
										4CP58.08	178	20.9
										3C069.0	178	23.0
										4C+58.08	179	19.9
										BG 0234+58	408	10.2
										NRA0109	750	6.0
										NRA0109	1400	3.6
										OD+557	1415	3.7
										DA081	1420	2.2
147	136.45	2.52	P			.3	.1	.3				
148	136.50	-.33	EP	10	11	.7	.1	.9		BG 0238+59	408	2.3

TABLE II *(continued)*.

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
149	137.23	-2.64	P			.3	.1	.3				
150	137.59	-3.01	EP		10	.3	.1	.4		4C+56.04	179	2.0
										BG 0237+56	408	1.5
151	138.31	-2.12	EP	11	10	.3	.1	.3		OD+574	1415	.9
152	138.44	.35	E	11	12	.3	.1	.4				
153	140.14	-2.85	P			.3	.1	.3		4C+55.05	179	2.3
154	140.64	1.32	EP		11	.4	.1	.5	C	4CP58.09	178	3.0
										4C+58.09	179	2.7
										BG 0312+58	408	1.5
155	140.85	2.45	P			.4	.1	.4		4C+59.02	179	2.0
										VRO59.03.01	610	1.8
										DA099	1420	1.5
156	141.01	-1.23	P			.3	.1	.3	C			
157	141.24	-1.26	E			.3	.1	.3	C	4CP56.05	178	3.0
										4C+56.05	179	2.4
158	141.89	-1.29	P			.5	.1	.5				
159	142.03	.32	EP	11		.3	.1	.4				
160	142.15	-2.48	EP	10	10	.4	.1	.4		OE+513	1415	.6
161	142.52	.82	P			.5	.1	.5				
162	142.96	1.03	EP		10	.3	.1	.3		4CP57.07	178	2.3
										4C+57.07	179	3.2
163	143.31	-2.04	P			.3	.1	.3	C			
164	143.32	.64	P			.4	.1	.4		4CP56.07	178	3.3
										4C+56.07	179	2.2
165	143.42	-.27	E			.4	.2			4C+56.06	179	2.3
										WK105	408	1.2
166	143.87	-1.05	VE			4.5	.7			DB 023	10	185.0
										4C+55.06(WKB)	38	80.0
										3C086.0	178	21.0
										4CP55.06	178	29.0
										4C+55.06	179	22.6
										NRA0135	750	12.0
										NRA0135	1400	8.3
										OE+539	1415	14.7
										DA102	1420	9.5
167	144.05	2.12	P			.3	.1	.3		4CP57.07A	178	2.0
168	144.14	-.17	E	12	12	.3	.1	.5		4C+55.07(WKB)	38	16.0
										4CP55.07	178	2.9
										4C+55.07	179	2.5
										WK108	408	.8

TABLE II (continued).

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
169	144.83	-2.38	P			.3	.2	.3		OE+538	1415	.3
170	144.90	-3.49	P			.4	.1	.4		4C+52.08	179	2.8
171	144.92	.42	E	11	12	.4	.1	.6				
172	144.99	-.63	EP	10	11	.3	.2	.5				
173	145.08	3.02	P			1.2	.1	1.2		4CP57.08	178	6.8
										4C+57.08	179	6.3
										BG 0347+57	408	4.1
										DW0348+57	1400	1.2
174	145.20	-1.02	P			.5	.2	.5				
175	145.21	-2.33	VE			2.3	.2			4C+53.06	179	6.8
										WK106	408	3.7
										OE+543	1415	2.5
										DA104	1420	3.3
176	145.22	.62	P			.4	.2	.4				
177	145.61	-2.89	P			.3	.1	.3				
178	145.85	1.18	P			.3	.1	.3				
179	145.95	-1.69	P			1.2	.1	1.2		4C+53.07	179	5.8
										WK110	408	3.1
										OE+555	1415	1.1
										DA106	1420	3.3
180	146.26	3.17	VE			.3	.1			4CP57.09	178	3.4
										4C+57.09	179	2.8
										OE+592	1415	1.3
										DA118	1420	10.0
181	146.62	-2.69	P			.5	.1	.5		CR 54T057	178	3.5
										4CP52.09	178	3.2
										4C+52.09	179	3.8
										OE+554	1415	.5
182	146.91	2.21	P			.3	.1	.3				
183	146.93	-.50	P			.5	.1	.5		OE+570	1415	.5
184	147.55	-2.02	EP	11		.3	.1	.3				
185	147.60	-2.78	P			.3	.1	.3		4CP51.09	178	3.3
186	147.95	-2.64	P			.3	.1	.3				
187	148.33	-2.79	P			.3	.2	.3				
188	148.46	-3.04	E			.5	.2	.7				
189	148.66	-1.65	E	10		.5	.1					
190	148.93	1.43	P			.4	.1	.4		4C+54.04	179	2.7
										BG 0401+53	408	1.4

TABLE II (continued).

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
191	149.22	-2.45	E			.3	.1					
192	149.80	3.27	E			.3	.1					
193	150.15	3.10	P			.3	.1	.3		4C+54.05	179	2.3
										OF+524	1415	.4
194	150.38	-1.60	P			4.9	.3	4.9	C	4C+50.11(WKB)	38	17.0
										4CP50.11	178	7.9
										4C+50.11	179	6.9
										BG 0355+50	408	7.1
										BP017	408	4.9
										NRA0150	750	5.5
										NRA0150	1400	4.0
										OE+593	1415	7.6
										DA119	1420	2.0
195	150.54	-3.61	P			.4	.2	.4		4C+49.11	179	2.6
										BP016	408	1.2
										BG 0348+49	408	1.3
										OE+481.1	1415	.4
196	150.61	-.93	E	11	12	8.8	1.0	14.6	C	4CP51.11A	178	13.4
										NRA0156	750	23.6
										NRA0156	1400	25.7
										OE+599	1415	31.0
										DA123	1420	17.1
197	150.93	2.47	E	12	11	.3	.1	.5				
198	151.20	2.14	E			.3	.1					
199	151.32	2.62	P			.7	.2	.7				
200	151.61	-.25	EP	11	10	9.5	1.5	13.0	C	4CP51.12	178	11.9
										4C+51.12	179	2.1
										BG 0407+51	408	7.5
										BP018	408	5.5
										NRA0165	750	19.7
										NRA0165	1400	19.0
										DA127	1420	17.6
201	151.62	2.40	E			.5	.2			CR 54T509	178	2.5
202	153.60	1.90	EP	10	10	.3	.1	.4		OF+543.2	1415	.2
203	153.64	-1.57	P			1.7	.1	1.7		BG 0410+48	408	1.8
										OF+418	1415	2.0
204	154.11	3.36	P			.4	.1	.4		CR 50T071	178	3.6
										4CP51.13	178	3.6
										4C+51.13	179	2.4
										OF+558	1415	.3
205	154.21	1.15	P			.9	.1	.9		4C+50.12(WKB)	38	18.0
										CR 50T069	178	4.7
										4CP50.12	178	4.7
										4C+50.12	179	4.5
										BP020	1407	.4

TABLE II (continued).

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
										OF+542	1415	.7
206	154.29	2.55	VE			.3	.1			NRA0186	750	.7
										NRA0186	1407	.4
										OF+552	1415	.6
207	154.32	.52	P			.4	.1	.4		BP019	1407	.4
208	154.64	2.44	P			.7	.1	.7		OF+554.8	1415	.9
209	154.68	3.39	P			.8	.1	.8		CR 50T073	178	3.1
										4CP51.14	178	3.1
										4C+51.14	179	2.5
										OF+563	1415	.9
210	154.70	1.80	VE			.3	.1			OF+550	1415	.3
211	155.24	2.33	P			.4	.1	.4		4C+50.13	179	2.2
										OF+559	1415	.2
212	155.36	2.61	P			1.6	.2	1.6		DW0436+50	1400	.9
										OF+561	1415	1.4
213	155.55	1.04	P			.3	.2	.3		BP022	408	1.2
214	155.86	3.45	P			1.2	.2	1.2		CL0443+50	26	42.0
										4C+50.14(WKB)	38	25.0
										4CP50.14	178	7.[illegible]
										4C+50.14	179	7.2
										BG 0442+50	408	3.8
										BP024	408	3.4
										NRA0193	750	2.3
										NRA0193	1400	1.3
										OF+571	1415	1.2
215	155.88	.98	P			.8	.1	.8		4CP48.11	178	4.0
										4C+48.12	179	3.3
										NRA0184	750	1.2
										NRA0184	1400	.8
										OF+453	1415	.8
216	156.36	-1.12	P			.5	.2	.5		4C+47.13	179	2.3
										BG 0424+47	408	1.3
217	156.43	1.31	P			1.2	.1	1.2		4C+48.13	179	4.4
										BP023	408	2.0
										NRA0188	750	2.1
										NRA0188	1400	1.3
										OF+458	1415	1.3
218	156.78	3.47	EP		10	.3	.1	.3				
219	156.84	2.92	P			.4	.1	.4				
220	156.92	1.57	P			.3	.1	.3				
221	157.31	-.04	P			.3	.1	.3				
222	157.69	-2.69	P			.4	.1	.4		BG 0423+45	408	1.3

TABLE II (continued).

NO.	POSITION L	POSITION B	TYPE	EXTENT L	EXTENT B	FLUX PEAK	FLUX ERROR	FLUX INT.	REMARK	IDENTIFICATION	FREQ.	FLUX
223	158.16	2.63	P			.5	.1	.5		OF+480	1415	.3
224	158.28	2.92	P			.3	.1	.3				
225	158.33	-2.20	P			.3	.1	.3				
226	158.62	-2.36	P			1.1	.1	1.1		4C+44.11	179	3.2
										BG 0428+44	408	3.6
										OA164	1415	1.2
227	158.78	2.60	P			.3	.1	.3		4CP47.14	178	4.2
										4C+47.14	179	2.2
										BG 0450+47	408	1.6
228	159.14	3.32	P			.4	.1	.4				
229	159.70	3.65	P			1.3	.4	1.3		4C+47.15	179	4.5
										BG 0458+47	408	3.4
230	159.71	.88	P			.7	.1	.7		4C+45.07	179	2.1
										WK123	408	1.7
231	160.56	-1.42	P			.3	.1	.3		OF+466	1415	.6
232	160.71	-1.10	P			.5	.1	.5				
233	161.02	3.70	P			.5	.2	.5	C			
234	161.08	-2.57	P			.3	.1	.3				
235	161.59	1.80	P			.3	.1	.3				
236	161.61	-.18	P			.4	.1	.4				

List of 236 radio sources

Notes to Table II :

Column 1 : Running number of the source.
Columns 2/3 : Peak position in galactic coordinates.
Column 4 : Source type
P : unresolved point source
EP : slightly extended source with the greatest apparent extent less than 11′
E : extended source with an apparent extent greater than 11′ and less than 20′
VE : very extended source with an apparent extent greater than 20′ and less than 30′.

Columns 5/6 : Apparent source extent in L and B given in minutes of arc as the result of Gaussian fitting.

Column 7 : Peak flux density in Jy.

Column 8 : Estimated error of the peak flux density in Jy.

Column 9 : Integrated flux density in Jy as the result of Gaussian fitting.

Column 10 : Remark
Used abbreviations are :
I : Incompletely mapped source
C : Source is within a region of complex emission
B : No background subtractions possible. The peak flux density and the peak position are taken from the contour maps.

Columns 11, 12, 13 : Identifications with sources in other catalogues, the frequency of observation in MHz and the flux density in Jy.

References :

AJG : GREEN : 1974, *Astron. Astrophys. Suppl. Ser.* **18,** 267.
BG : FANTI, FELLI, FICARRA, SALTER, TOFFANI and TOMASI : 1974, *Astron. Astrophys. Suppl. Ser.* **16,** 43.
BP : BATLEY and POOLEY : 1968, *Mon. Not. R. Astron. Soc.* **138,** 51.
CL : KEEN, WILSON, HASLAM, GRAHAM and THOMASSON : 1973, *Astron. Astrophys.* **28,** 197.
CR : CROWTHER : 1966, Ph. D. Dissertation Univ. of Cambridge.
DA : GALT and KENNEDY : 1968, *Astron. J.* **73,** 135.
DB : BRIDLE and PURTON : 1968, *Astron. J.* **73,** 8.
DKM : MILNE : 1971, *Austr. J. Phys.* **24.**
DW : DAVIS : 1967, *Bull. Astron. Inst. Netherlands* **19,** 201.
NRAO : PAULINY-TOTH, WADE and HEESCHEN : 1966, *Appl. J. Suppl.* **116.**
OA : DIXON, MENG, KRAUS : 1965, *Nature* **205,** 755.
OB, OC, OD, OE, OF, OX, OY, OZ : BRUNDAGE, DIXON, EHMAN and KRAUS : 1971, *Astron. J.* **76,** 777.
PK : HIGGS : 1971, *Mon. Not. R. Astron. Soc.* **153,** 315.
RMHB : RAGHAVARAO, MEDD, HIGGS and BROTEN : 1965, *Mon. Not. R. Astron. Soc.* **129,** 159.
VRO : WEBB and DICKEL : 1971, *Astron. J.* **76,** 223.
WK : WINDRAM and KENDERDINE : 1969, *Mon. Not. R. Astron. Soc.* **146,** 265.
3 C : BENNETT : 1962, *Mem. R. Astron. Soc.* **68,** 163.
4 C : GOWER, SCOTT and WILLS : 1967, *Mem. R. Astron. Soc.* **71,** 49.
4 CP : CASWELL : 1966, Ph. D. Dissertation Univ. of Cambridge.
4 C (WKB : WILLIAMS, KENDERDINE and BALDWIN : 1966, *Mem. R. Astron. Soc.* **70,** 53.

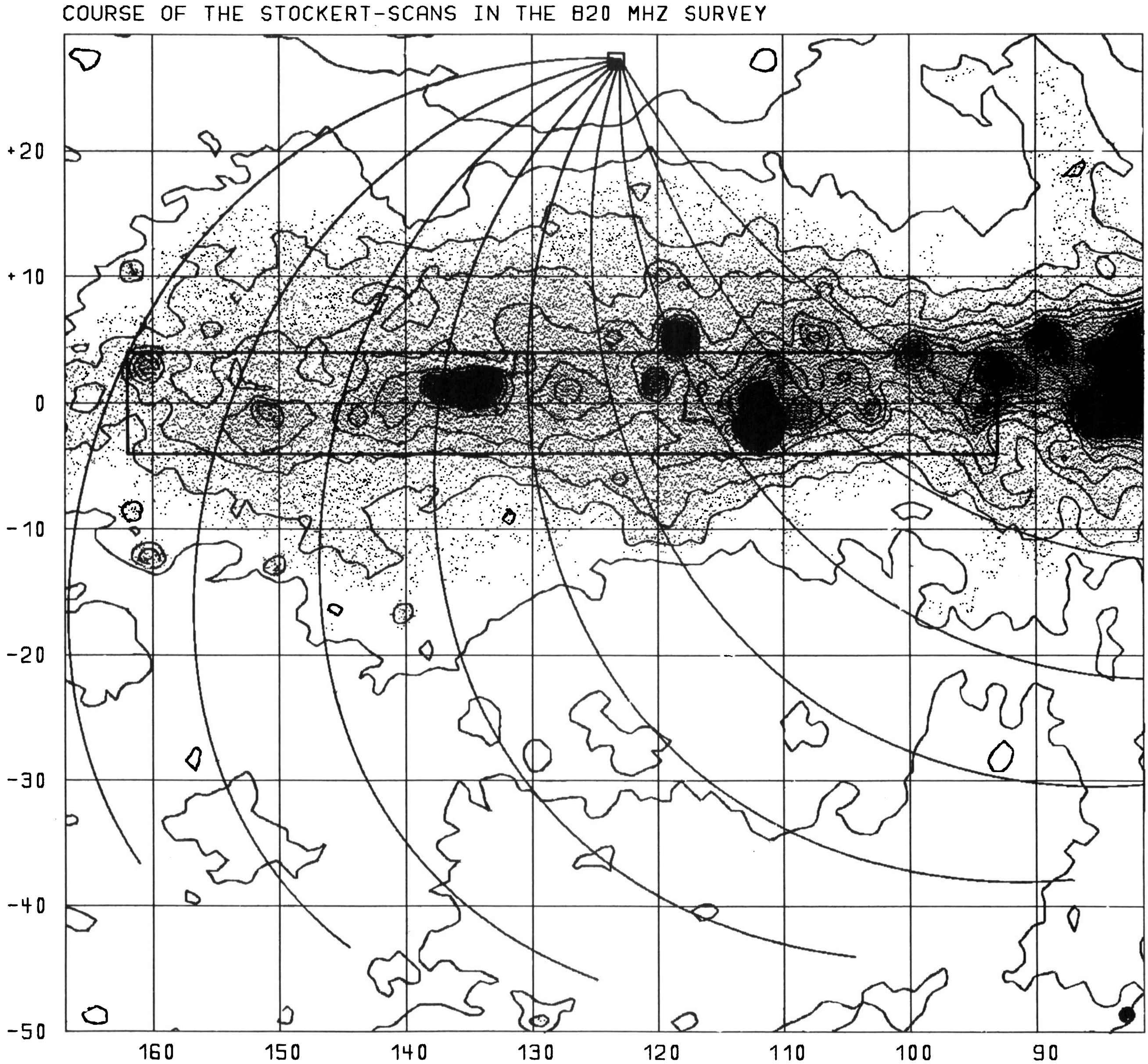

FIGURE 1. — The 820 MHz data of Berkhuijsen (1972) with a HPBW of 1°.2 plotted in steps of 1 K T_B with the course of some Stockert azimuth scans superimposed. The area of the 21 cm Effelsberg survey is also indicated. The filled circle in the right lower corner of the map indicates the HPBW.

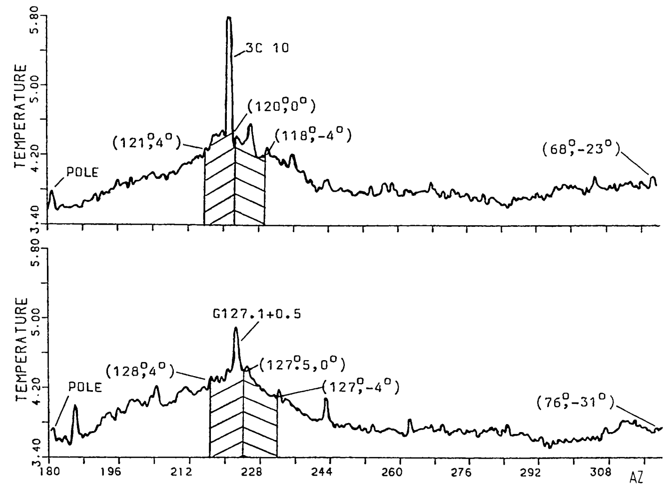

FIGURE 2. — Two examples of Stockert scans used to calibrate the Effelsberg data. The Effelsberg survey area of $|b| \leq 4°$ is shaded. Brightness temperature is plotted against azimuth. The coordinates given in brackets indicate galactic coordinates.

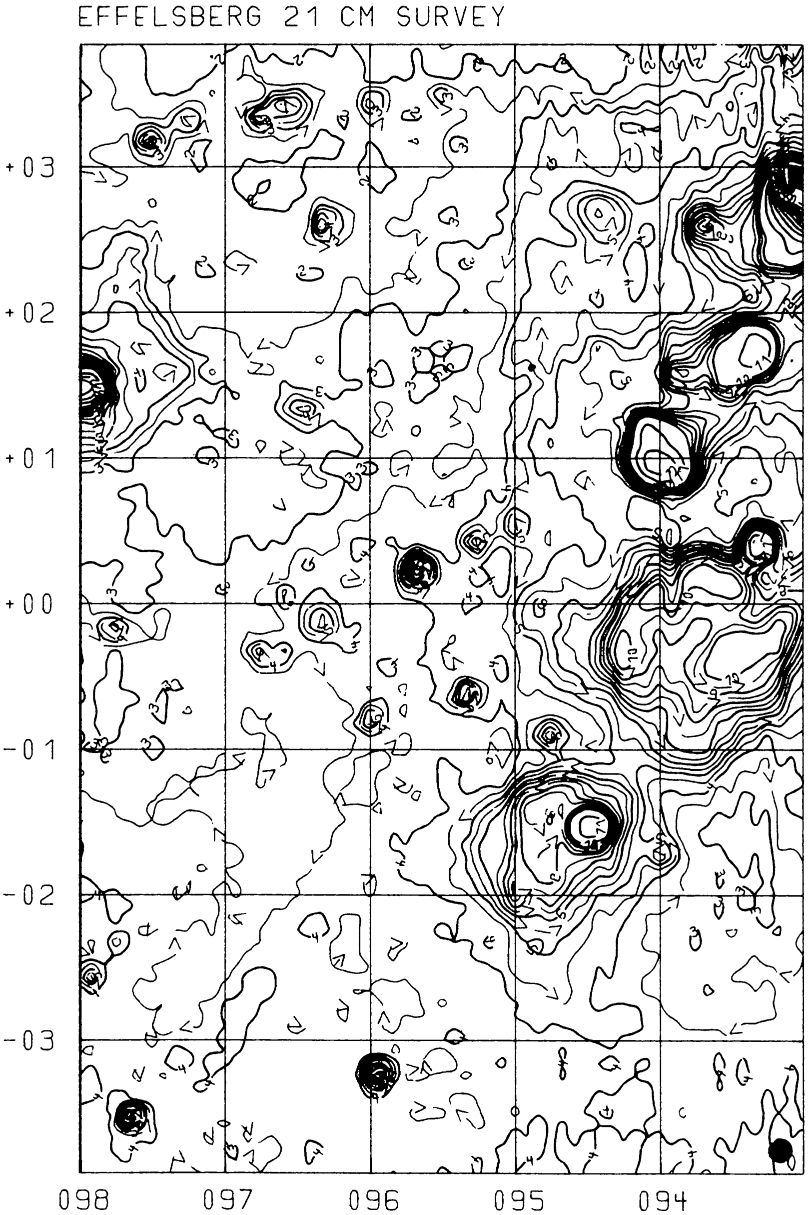

FIGURE 3a.

FIGURE 3a-i. — Contour maps of the 21 cm continuum emission of the galactic plane for $93° \leq l \leq 162°$, $|b| \leq 4°$. The contours are given in steps of 0.2 K T_B (main beam brightness temperatures). The contours are labelled from 1 to 10 ; multiplied by 0.4 K T_B, they give temperature relative to the North Celestial Pole. Above 4 K T_B (label 10) the step in temperature is 1.6 K T_B. Arrows in unlabelled contours enclose a minimum if pointing in a clockwise direction and *vice versa*. The filled circle in the right lower corner of each map indicates the HPBW.

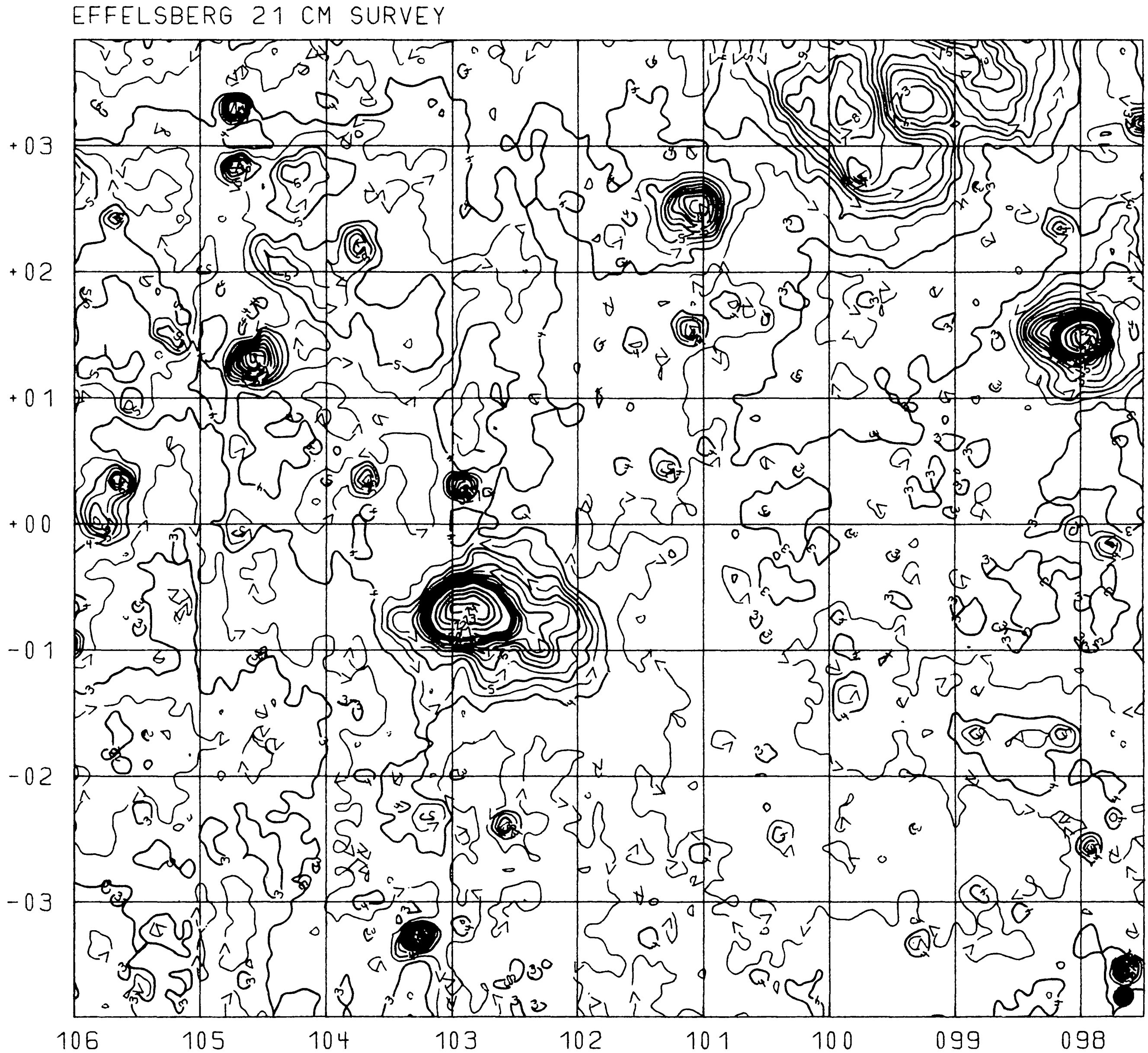
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
106
105
104
103
102
101
100
099
098

FIGURE 3b.

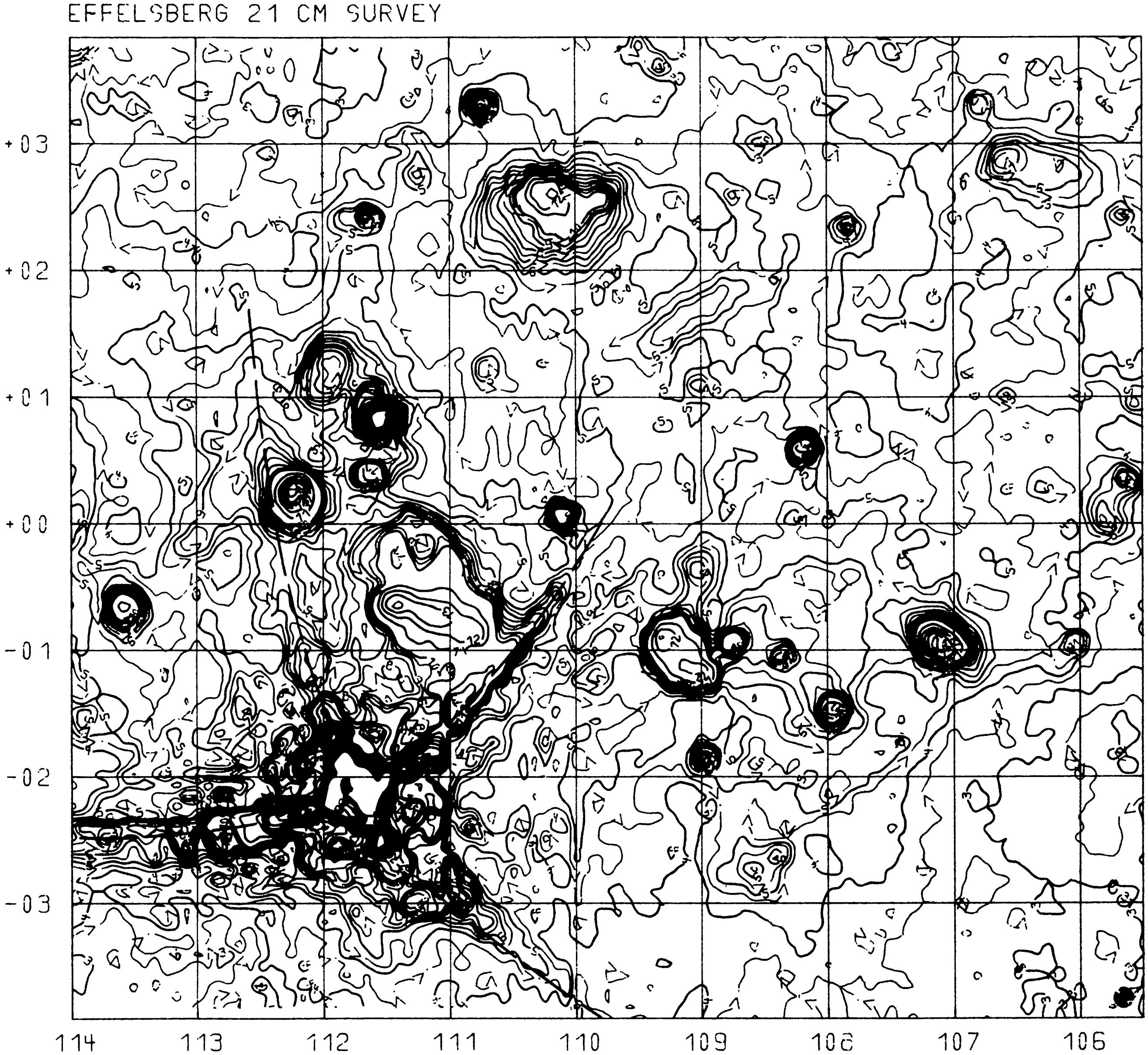
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
114
113
112
111
110
109
108
107
106

FIGURE 3c.

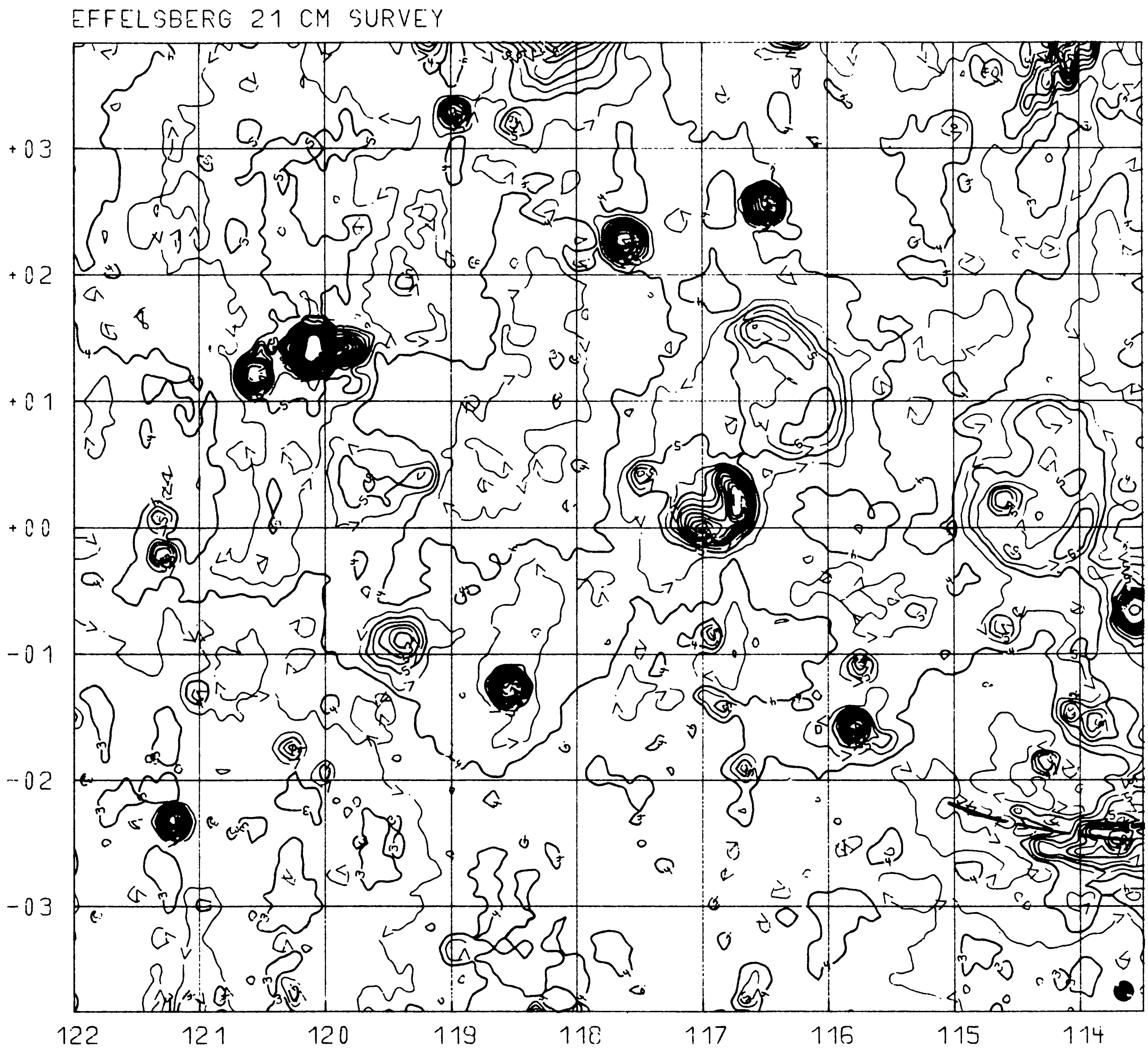
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
122
121
120
119
118
117
116
115
114

FIGURE 3d.

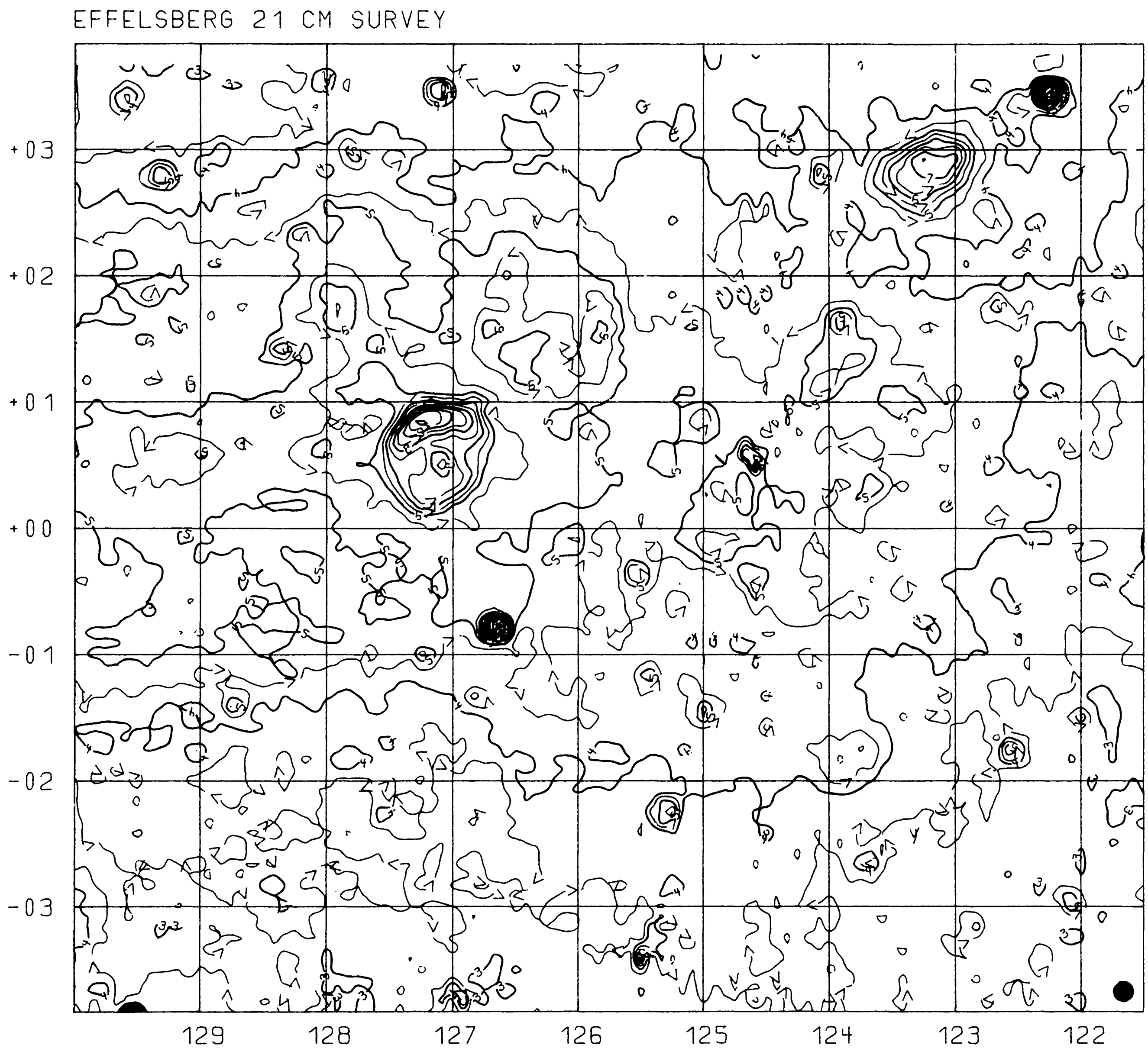
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
129
128
127
126
125
124
123
122

FIGURE 3e.

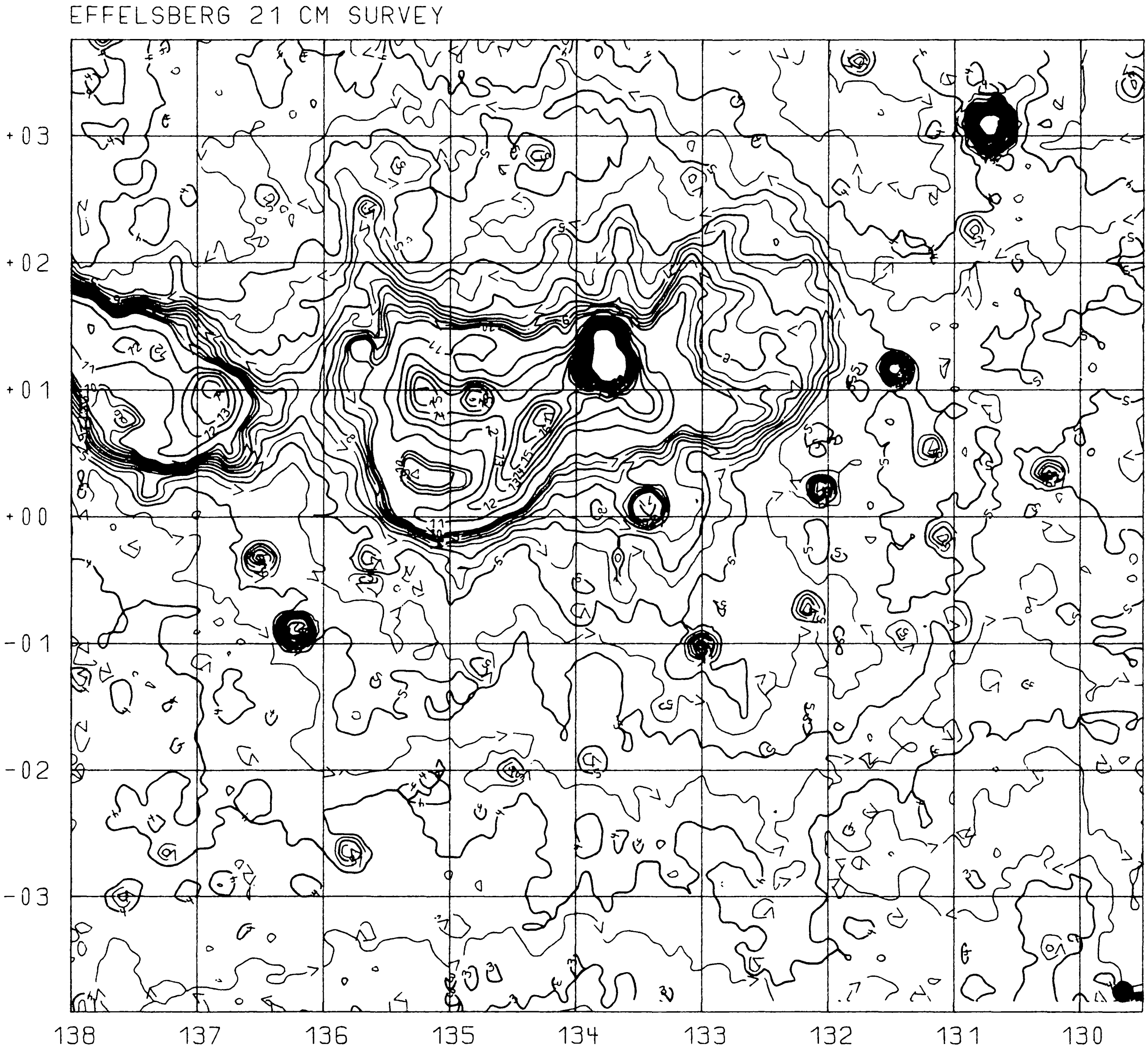
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
138
137
136
135
134
133
132
131
130

FIGURE 3f.

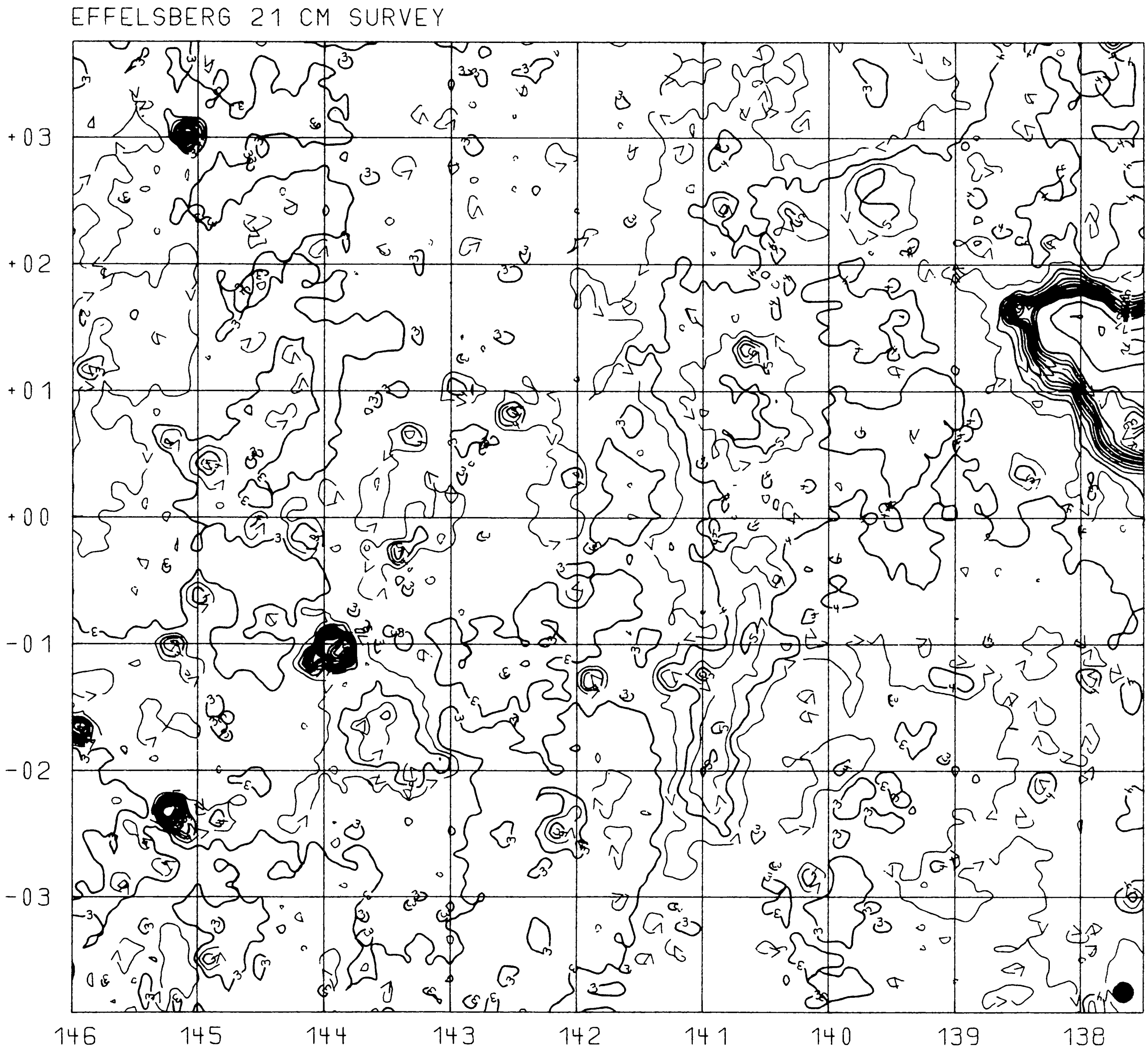
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
146
145
144
143
142
141
140
139
138

FIGURE 3g.

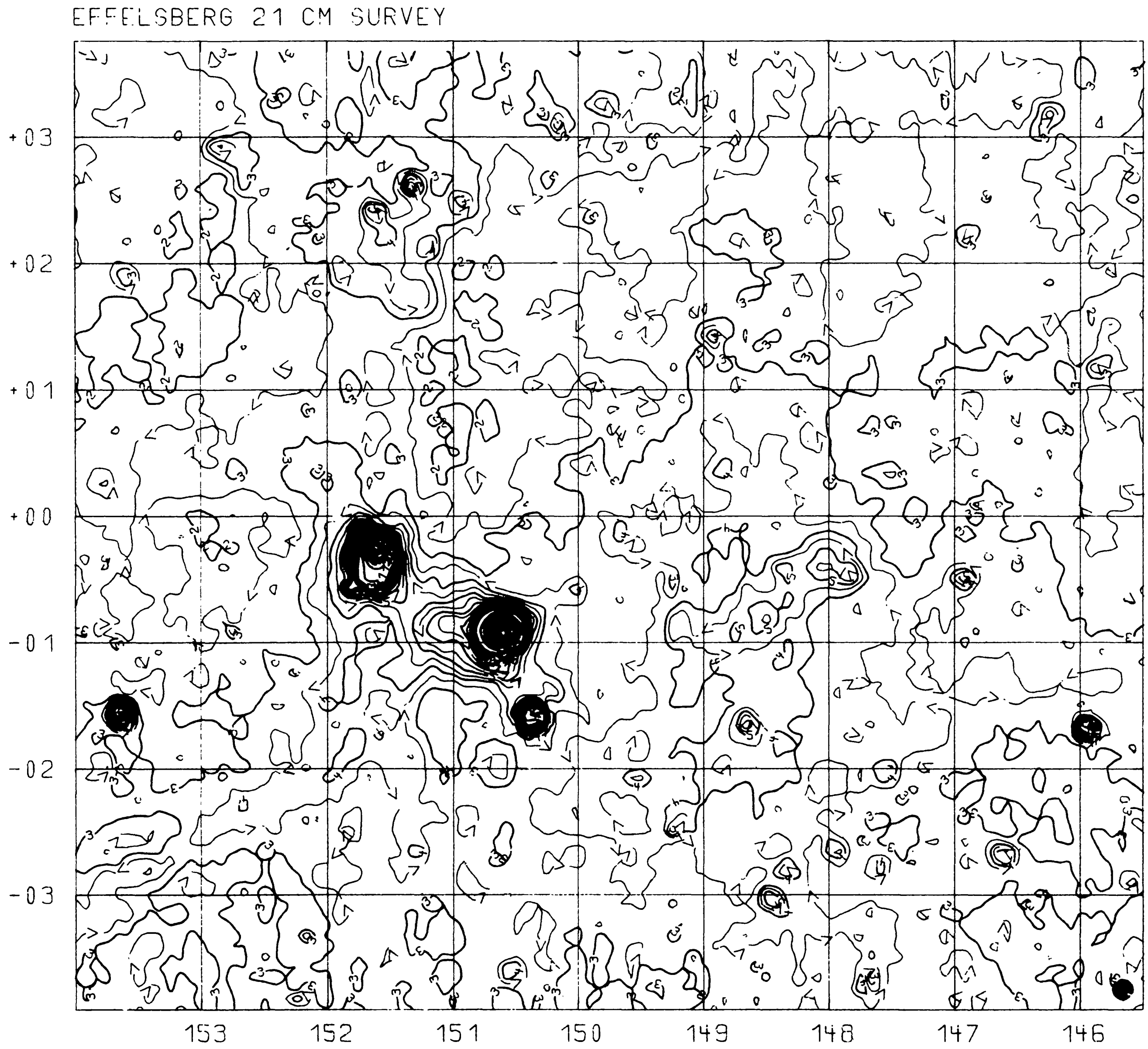
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
153
152
151
150
149
148
147
146

FIGURE 3h.

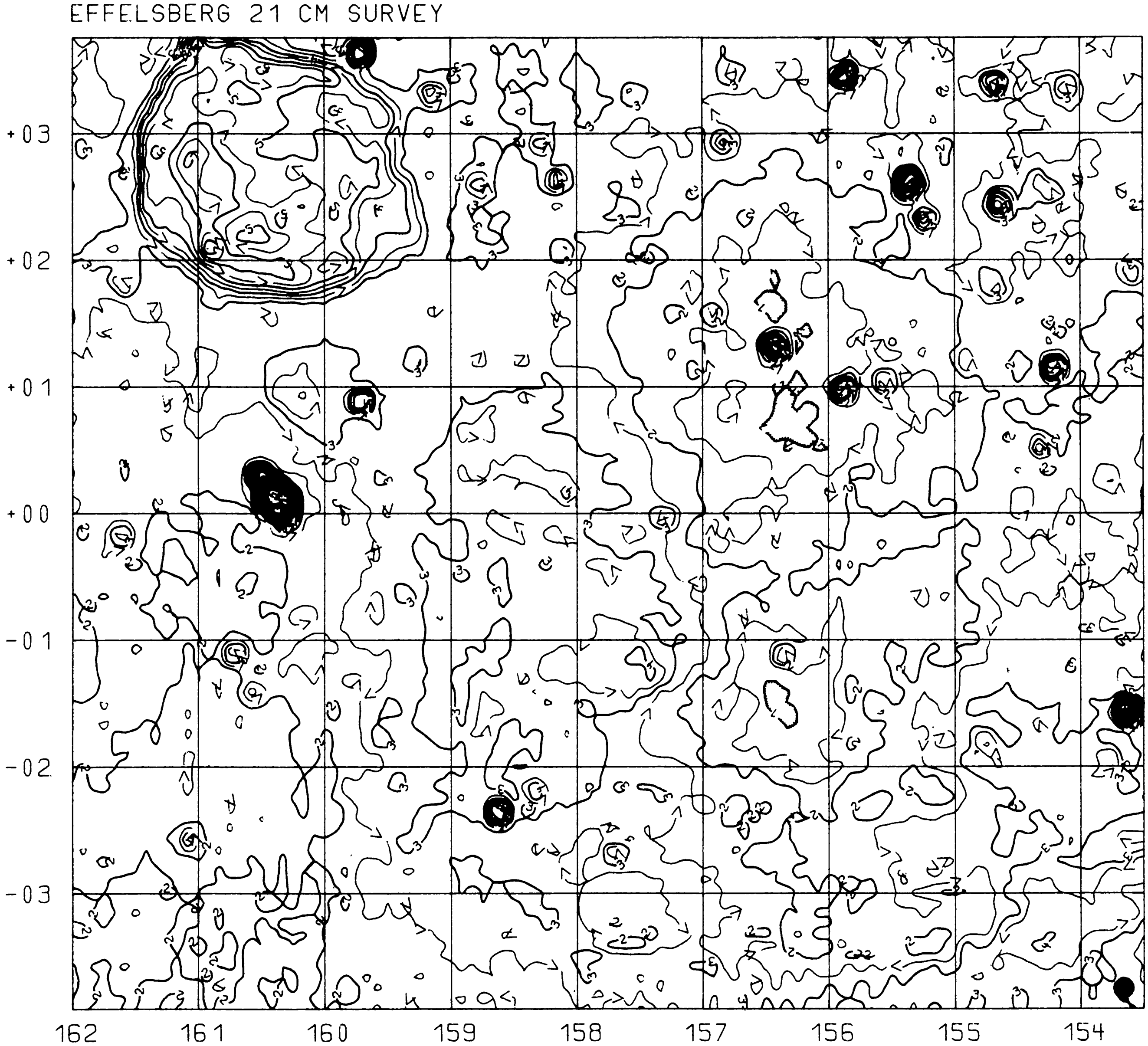
EFFELSBERG 21 CM SURVEY
+03
+02
+01
+00
-01
-02
-03
162
161
160
159
158
157
156
155
154

FIGURE 3i.