

A.A.V.S.O.

SOLAR DIVISION BULLETIN.

Neal J. Heines, Editor

June 1953  
Number 87

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P.O.Box 2353  
Paterson N.J.

REPORT OF THE SOLAR DIVISION TO  
THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS.

Meeting at the University of Michigan

Ann Arbor, Michigan, May 22-23,  
1953.

Membership ----- 195; Observers 91; Research Affiliates 104  
Membership Distribution----- 31 States, 12 Foreign Countries  
Report Blanks Issued----- 654; Incl. duplicates & Gleissberg Project  
Reports Distributed----- 467; S.D. 322, Gleissberg Project 145  
Number of Observations----- 9208; to 4/1/53; 6472 S.D. 2736 Gleissberg  
Observations to date----- 117457; Total to April 1, 1953  
Communications Sent----- 1584; To 4/1/53. Total to date, 17,707  
Communications Received----- 986; To 4/1/53. Total to date, 13,884  
Number of Solar Divisions Bulletins Issued; 7 Editions, 1365 Copies  
Number of Reductions Reports Distributed for this seven month period, 1380

\* THE AMERICAN AND ZURICH RELATIVE SUNSPOT-NUMBERS FOR THIS SEVEN MONTH PERIOD ARE AS FOLLOWS;

	<u>R<sub>A</sub></u>	<u>R<sub>Z</sub></u>		<u>R<sub>A</sub></u>	<u>R<sub>Z</sub></u>
1952- Sep.	26.6	27.0	Dec.	33.5	34.6
Oct.	22.6	23.7	1953-Jan.	26.6	25.5
Nov.	22.5	22.1	Feb.	4.0	2.9
Mar.	7.9	9.9	(Apr.	24.8	27.2)

Range 34.6 - 2.9

\* R<sub>A</sub>, determined at A.A.V.S.O. Solar Division Headquarters by Heines.

## CONDITION OF THE PRESENT SUNSPOT CYCLE.

Since August of 1952, there has been an irregular decline in sunspot activity. The Sunspot-Number for the month of August was 53.2, September 26.0, October and November had like values; namely, 22.5, in December the number was 33.5; January, 1953, 26.6; and then a sudden decline in February to 3.6; followed by 7.9 in March. April brought a higher value; namely, 24.9. The pattern for minimum might develop into a tertiary minimum, as did the maximum phase.

## HOW CLOSE IS MINIMUM?

In 1950 your Solar Division Chairman obtained minimum predictions and published same in Bulletin No. 58. These predictions follow;

## \* -SUNSPOT MINIMUM PREDICTIONS-

National Bureau of Standards (CRPL)	---- Early, 1955
**M. Waldmeier (Zurich)	----- Second Half 1954 or early 1955
W. Gleissberg	----- Not sooner than 1954
H. W. Newton (R.A.S. England)	----- 1954 - 1955
Stewart-Cook	----- 1954.6
N. J. Heines	----- Between 1954.7 - 1955.3

\*Solar Division Bulletin No. 58, Nov. 1950, p. 148.

\*\*In my opinion not the present sunspot-activity is to be considered extra ordinary, but rather have the past months of very low activity been unexpected. (Letter to N.J.H., May 5, 1953)  
Therefore, I should like to maintain my former opinion according to which the sunspot minimum will not set in before the second half of the year, 1954.

In Solar Division Bulletin No. 86 for May 1953, we published Prof. Gleissberg's Latest predictions based on Probability Laws. For the benefit of those present who do not receive our bulletin, we repeat Prof. Gleissberg's predictions.

"In 1950 a prediction concerning the epoch of the coming sunspot minimum was published by me and one of my collaborators in, 'Zeitschrift fur Astrophysik', Vol. 28, pp. 17-27. This prediction reads as follows: "It is to be expected with a probability of 0.96 (i.e., of 42 to 1) that the minimum will occur not more than 18 months after the time when the smoothed relative sunspot numbers, on the decending phase of the present sunspot cycle, will have fallen below 38."  
As Prof. M. Waldmeier, of Zurich, has just published the definitive relative numbers for 1952, we can calculate the smoothed monthly numbers until June, 1952. For the first six months of 1952 they are: January 43.2, February 42.0, March 39.4, April 36.0, May 33.6, June 31.9.

From these data we see that the smoothed relative sunspot numbers have fallen below 38 in April, 1952. The above prediction, therefore, leads

to the conclusion that the minimum will occur probably before OCTOBER, 1953."

Signed,  
W. Gleissberg.

We also repeat a statement by Prof. Gleissberg, published before in one of our Solar Division Bulletins in which he stated, "The coming minimum will be of short duration, followed by a maximum only slightly lower than that of the preceding maximum of 1947, which was the second highest, of all known maxima."

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Prof. H. W. Newton, director of Greenwich Observatory in England, published, in The Observatory, Vol. 73, No. 872, for February, 1953, the following;

The degree and character of solar activity during 1952 denotes a marked progression towards sunspot minimum. The mean sunspot "number" for the year is 30, i.e. less than half the value for 1951 and only one-fifth that of the maximum year of the present cycle, 1947. For the past seven minima years, the mean sunspot number is 5.0 (range 1.4 to 9.6), so at least another year, if not longer, should elapse before the lowest point of the frequency curve is reached. Symptomatically, a year or eighteen months before minimum, the number of spotless days increases sharply to a peak representing on the average about 66 per cent spotless days for the year of minimum. There is, however, a considerable range from one minimum to another (43 to 85 per cent for the past seven minima). The small number of spotless days (5 per cent) during 1952 suggests that this rise has scarcely begun. Furthermore, no small high-latitude spots have yet appeared. The average time-interval for these small precursor spots to appear before the minimum epoch is 0.8 years (range 0.0 to 1.7 years for the past seven cycles).

The not inconsiderable value of 30 for the mean sunspot number for 1952 implies a moderate succession of spots, and of these, there were 13 groups that had an area on one or more days during disk passage of 500 millionths or greater of the Sun's hemisphere. Two of these groups attained an area of 1000 units. These crossed the central meridian on July 15.1 and November 21.9 U.T. respectively.

Notwithstanding these 13 sizable spots, solar flares were infrequent and no really important flare appears to have occurred during the year. Large U.V. radiation effects on the ionosphere associated with intense flares scarcely escape detection by one means or another. It may be added that no geomagnetic crochet was recorded at Abinger.

#### SOLAR DIVISION ACTIVITY

The Solar Division is still actively engaged in the following projects; The Sunspot Counts for the Central Radio Propagation Laboratory, Na-

tional Bureau of Standards; Granular Surface and Color in Sunspots, Dr. James C. Bartlett Jr.; Unusual Configuration and Colors in Sunspots, Dr. Walter O. Roberts; High Altitude Observatory, Climax, Colo.; Foreshortening Project, Prof. W. Gleissberg; University Observatory, Bayazyt - Istanbul, Turkey; Migratory Birds; Sunspot Delineation; Sunspot Area Measurements; Solar Division Headquarters.

In addition Solar Division Headquarters has supplied the United States Weather Bureau with sunspot data for a research project dealing with the possibility of a Weather Bias with sunspot activity.

Also we are converting sunspot counts of the north and south sunspot belts into relative numbers for Prof. Hurd C. Willett of the Massachusetts Institute of Technology for his studies of solar influences in the upper atmosphere.

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The Central Radio Propagation Laboratory of the National Bureau of Standards have again asked me to convey to the observers of the A.A.V.S.O. Solar Division their sincere appreciation and thanks for their contributions to the Solar Program.

In closing the Executive Committee, the Council of the A.A.V.S.O.. join me in thanking you for another period of fine observing and continued interest. We especially wish to thank Mrs. Margaret Mayall and her assistant for the fine spirit of cooperation and guidance.

Respectfully submitted,

Neal J. Heines

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### STATISTICS

The total number of sunspot groups for the month of April was 6  
Zurich's Provisional Sunspot Number " " " " " " 27.2

The Mean Monthly Sunspot Area (U.S. Naval Observatory) Not released

\*The highest sunspot group number as assigned at Solar Division Headquarters was No. 20. It was observed on May 19th, Tuesday, at 12:05 U.T. at the edge of the sun's east limb, in the north belt. It's classification was bi-polar and of higher latitude than most recent spots.

\*Group counting reference for observers.

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Predictions of smoothed Zurich monthly sunspot numbers for the next six months are as follows;

May 20

Aug. 17

June 19

Sep. 16

July 18

Oct. 16

Released by Prof. M. Waldmeier, Director Federal Observatory at Zurich, Switzerland, and transmitted the Swiss Broadcasting Corporation on May 4, 1953, via Short Wave Radio.

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# PUBLICATIONS

1. "SOLAR LIMB DISTORTION" - - - - - Prof. M. Waldmeier  
A timely and important contribution. This paper will be published in the Solar Division Bulletin soon, as well as No. 2. (Below)
2. "OBSERVATIONS OF LIMB DISTORTIONS POINT TO MOST ACTIVE SOLAR AREAS". - - - - - Preliminary results of a study by H. Bondy
3. A series of papers reprinted from THE BULLETIN OF THE CENTRAL ASTRONOMICAL INSTITUTE OF CZECHOSLOVAKIA.
  - (a) "Planetary Influences on the SUN X"
  - (b) "The Statistics of Spots on the Rotating Sun"
  - (c) "Asymetries Solaires I"
  - (d) "On Breaks in the 11-Year Cycles of Sunspots"
4. Abstracts printed in THE ASTRONOMICAL JOURNAL A.A.S.  
Vol. 58, 1953 March, No. 1206; No. 2.
  - (a) "Isophotal Contour Photometry of a Solar Flare"  
Roberts & Billings
  - (b) "Solar Limb Flares and the Yellow Coronal Line"  
Roberts & Dolder
5. "FORTY-YEAR SEA LEVEL PRESSURE AND SUNSPOTS" - - G. W. Brier  
Reprint from TELLUS Vol. 4, No. 3.  
A Comprehensive Study.
6. "SUNSPOT CYCLES" - - - - - C. N. Anderson  
Reprinted in CYCLES MAY ISSUE 1953, pp. 147-149  
An interesting study of Sunspot Numbers with Alternate Cycles Reversed.  
A new approach involving unit-fractions complete with new tables.

Monthly Means  $R_a$ -24.8  
 $R_z$ -27.2

American Sunspot Number  
Reductions  
April 1953

A.A.V.S.O.  
Solar Division

N.J.H. 5/15/53

W.A.R. 5/15/53

DAILY																																Ri											
observer	Ki	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Mean	No.										
Adams	0.70		65	75	75				54	43	25			0		0	0	0	0	0	0	0	11			76		41	41			33.7	15										
Barlett	1.51	43	50	57		59			34			0				0	0	0	0	0	0	0	18	30	19	19							19.1	13									
Beardsley	0.74					54					0	0													39					90	68	41.8	6										
Beetle	X 1.06		50	73		38							0	0		0		0	0	0	0	0				37	58	62				28.9	11										
Bissette	1.45																0	0		0	0	0	12					31	32	32			13.4	8									
Bollmeyer	X 0.81					55	50					0		0	0		0				0	0	12		28			54		47			22.4	11									
Bandy	1.22			60	53	39	29		31			0				0	0						12		33	46	63			36			31.1	12									
Brennan	X 0.93		54			72	47	33								0			0	0	0	11		36		53						27.8	11										
von Brunsart	X *	56		60	65	32	32	45	46	15		0	0				0	0	0	0	0	11	19	24	43	63	80	71	57	48			29.2	16									
Buckstaff	X 1.11		47			37	32	56				0	0	0	0		0	0			0	0	13	14				47	49			18.4	16										
Chessapis	0.74	78	66	74	70	54		47		30	19		0	0	0	0	0				0	0		17	57	61	78		62	54	50			37.1	22								
Cragg	X 0.92	42	51	62	71			74	63	41	38	13	0	0	0	0	0	0	0	0	0	11	19	32	44	63	65		63		57		34.7	23									
DeKinder	X 0.80		65	72	82	50	47		41	15			0	0	0	0				0	0				40						59		37.2	11									
Detjen	1.39			43	33	28			28	14					0		0					0	14	27		33	51	56	41	37			27.4	11									
Elias	0.60	50	55	71	73	65	42	62	53	25	25	11	0	0	0	0	0	0	0	0	0	0		18	52	64	72		72	63	54			39.6	19								
Estremadaya	X *	51	58	68			50					0	0			0					0	0							51		49		29.7	11									
Estremadaya	X 0.80	76	79	73	38	62	55	57	52	33	17	0	0								0	17	36	45	50	66	64	70	52	53			46.8	19									
Evans	X *	56	54			28	44		54	43	26				0	0		0						16	30					34	34			28.1	12								
Fernald	X 1.02			65	47		39		38	48			0		0	0	0	0	0	0	11		15	21					44		46		23.4	16									
Focas	X 0.60		58	71	77	50	42	60	48				0	0	0	0	0	0	0	0	0	12	19	34	45	72		56	54	47		28.8	21										
Galbraith	X *	46	46				34	19	17	14	0	0																	93		33		24.2	10									
Haines	X *						77	34						0	0	0	0				0	12		38				67				22.8	10										
Heines	X 0.97	52		55	48	35	29		50	24	13		0	0	0	0	0	0	0	0	0	14	34	42	68	67	69	61	51	60			33.6	23									
Koyama	X 0.70	61			100	82			60	44				0	0	0	0	0	0	0	11		11	17	31	77	94		85	52			41.7	15									
Loebnick	X 1.02					25						0			0											20	41		44	44			29.0	6									
Luft	X 0.98			70	77	46	50					0		0	0	0	0				0	12		37	84	114			50	50			26.3	13									
Macris	X 0.77	47	74	71	76	50	42	54	45	30		14	0	0	0	0	0	0	0	0	0	11	17	33	45	70		67	59	65		32.5	22										
Maher	X 0.90	40																			11			32				49	39		42		35.5										
Moore	X 0.76						37		22	17					0	0					0	14										12.8	7										
Olson	0.68			57	60	47	18		60	39						0	0		0		0	13	32	41								34.9	10										
Pierson	X 0.83	32		65		29	27					13	0		0	0					0	15		33		52	51		46			24.0	13										
Pierson Jr	0.89	13		38		24	45		19			12	0		0	0					0	0		31		55		44	42	41			24.3	15									
Pilsworth	X 0.86		57	72		50		64	56					0	0				0		0	14	33	36			55					33.6	13										
Rosebrugh	X 0.68	50		69	82	53	43		35	39		12	0		0	0				0	14	17	40	25	71	69	50	74	43			36.2	21										
Smith	X *		50				39	51	33	20				0	0		0	0			0	17	24				78					16.7	11										
Strayhorn	2.06			42			86	49	46			0	0	0	0		0				0	20	31				72	58				40.2	9										
Stryker	X 1.06			25		27		35				0			0	0					0	11	11	14	38	40	28	32	32			17.4	16										
Sullivan	0.60	59	62			42	46	59	48		21	33	0			0	0		0					42	44	56			59			44.8	12										
Thomas	X 0.84	49	48	54	48	40	34		40		13			0	0		0	0	0	0	11		31	33			35	58	58			28.8	19										
Trathen	X 1.28	35	38	26	16	14	12	46	34	23	12	0	0	0	0	0				0	0	11	14	18	31		43	33	35	33			17.8	22									
Thrussell	X 1.47	38		40	46	28	34	44	26		14			0	0	0	0	0	0	0	0	12	29	32	47	52	49		32			22.1	20										
Venter	X 1.28			51	43	24	19	18	16			0	0	0	0	0	0	0	0	0	0	11	13	29	86	45	48	36	49	35			20.0	23									
Warren	X 1.10			22	21	21						0					0				0		13	16	18	31	42	39	46	38			23.6	13									
Wells	X *																															36.0	2										
Williams	X 0.92			47		31						0			0					0						32	35		35	37			24.1	9									
Wilson	X *									17		0			0		0					14	15	29	29	50			37	37			22.8	10									

$R_a$  43 50 55 51 36 34 46 37 26 15 4 0 0 0 0 0 0 0 0 0 0 1 12 22 32 40 54 54 44 45 44 24.8  
 $R_z$  37 48 48 58 31 31 38 43 30 21 12 0 0 0 0 0 0 0 7 7 0 0 9 27 33 45 57 66 63 57 49 27.2

X \* Insufficient Data Available  
Standard Observer

/ Observations rejected because of poor visibility and sky conditions

"A STUDY OF SOLAR INDICES"

SOLAR RADIO NOISE.

General: No other branch in astronomy has made greater progress in the last 10 years than Radio Astronomy. While the Schmidt telescope and Lyot's coronagraph caused a revolution in the astronomy of the "known", the radio telescope discovered undreamed of "continents" in our universe.

A few attempts to receive "Herzlian Waves" from space were made around 1900, following theoretical considerations of Maxwell's predicted electromagnetic waves. But it was not until 1932, when K. G. Yansky of Bell Telephone Laboratories conducted his epoch making experiments to find the sources and direction of "atmospherics" (static). Yansky found not only what he sought, but in addition a distinct source of noise in the sky, which showed diurnal motion. It turned out that this noise came from the central portions of our Milky Way--now called Galactic Noise. But another 10 years elapsed before further progress was made and sadly enough, because of the war. In 1942, solar noise was accidentally discovered by British radar experts. A frightening experience occurred when it was thought that the Germans had discovered an effective way to jam radar waves; however, the villain turned out to be a large sunspot area. In America, Grote Reber published his galactic noise contours and also reported that the sun was a radio transmitter. Because of war secrecy, the work of British radio engineers was not published until 1946 by Southworth, Appleton and Hey. (32)

Since then, a worldwide network of radio telescopes were built, working on wavelengths from 1 cm up to about 20 m. Atmospheric absorption is the lower-end limiting factor, while the ionosphere reflects the longer waves back into space. Basically, radio astronomy employs two methods: a) observations by radar-like instruments using a transmitter and recording the reflected pulses through an antenna, called here radio telescope. Meteors and particularly their ionized paths through our atmosphere are studied thus. Echoes from the moon have been achieved and there is a theoretical possibility that some other planetary echoes may be received some day, including the Gegenschein/zodiacal counter glow/(33). The other method b) consists in receiving radio waves by means of large antennae, i.e. telescopes from cosmic bodies which act as their own transmitters. This field is subdivided for practical reasons into: I) Solar Radio Noise; II) General Galactic Noise (Milky Way interstellar matter and gas); III) Radiation from discrete sources (Radio "stars", ex-novae, far away galaxies); IV) Radiation from the moon.

Solar Radio Noise: About one dozen observatories the world over report their regular observations in the Quarterly Bulletin on Solar Activity (IAU). The wavelengths used range from 3.7m (81 Mc/s) down to about 3cm (9400 Mc/s). The measured intensities, called flux, are expressed in watts per unit area per cycle per second. A simple formula permits one to convert the flux into kinetic temperature  $T$  of the solar surface (or any other radiating body). Actually the intensities recorded can be checked in a practical way against the true temperature of the antenna, and calibrations thus made. Polarizations, variability, and outstanding

occurrences (bursts) are also reported in the QBSA.

It was soon realized, that the solar noise is essentially of two kinds (a) a steady component and b) a variable component. A further subdivision could be made according to C. W. Allen (34) 1) quiet thermal noise, 2) steady sunspot noise, 3) noise storms and bursts, 4) outbursts, 5) nonpolarized bursts. However, it must be understood that the individual components cannot always be separated from the recorded intensities.

Fundamentally, the physicist considers two ways in which atomic particles may be accelerated to emit radio waves. One is due to a thermal process whereby accelerated particles (electrons and protons) through their collisions emit part of their energies in the form of random radio waves. The other process called non-thermal may be caused by collisions due to a changing electric and magnetic field whereby the emitted radio waves come in phase and their resultant intensity is enormously increased (35). We know that there are high temperatures on the solar surface and particularly in the corona. Large electromagnetic forces in and around sunspots are also well known. Recent studies at Mt. Wilson show also that magnetic fields are not exclusively limited to visible sunspot areas (36).

According to Kirchhoff's laws, the emission from any body depends on its temperature and on fractional absorption coefficient. The basic radiation laws plus the knowledge of solar electron densities and temperature, together with the knowledge of the properties of our own ionosphere permit the physicist to deduce the areas, where a particular radiation originates. Thus the 1cm waves come from a region just above the photosphere; the 10cm waves from the chromosphere and partly from the corona and the longer waves exclusively from the corona.

Quiet Thermal Noise: The undisturbed sun radiates a steady radio noise which never reaches zero. The intensity of this emission depends on the frequency, the sunspot cycle and position on or near the solar disc. (Near the solar disc because radiation reaches us also from coronal regions far beyond the solar limb.) The position on the solar disc is also important, because so-called limb darkening and even "limb brightening" is far more important for radio waves than the visible light. So far, however, theoretical considerations do not agree well with actual observations. The minimum values of recorded solar flux are used to determine this "final minimum flux". The data obtained at the National Research Council at Ottawa, Canada (Covington) on the 10.7cm waves, prove conclusively that the fundamental solar noise runs parallel with the sunspot cycle. The following data show this minimum activity at zero sunspots:

	Mean Flux at zero sunspots:	No. of obs.:	Lowest Flux:
1950	.71	2	.69
1951	-	-	.71
1952	.65	16	.60
1953 (first 3 mos.)	.61	26	.552

(Flux is expressed in watts/m<sup>2</sup>/cycle/sec Bandwidth (x10<sup>-20</sup>) 2 polarizations)



Steady Sunspot Noise: At decimetre wavelengths the steady level of radio emission varies slowly from day to day in close agreement with the number and area of sunspots (see graphs). Longer waves agree only fairly with the central meridian passage of larger sunspots, but this should not be too surprising since they originate far above sunspots. However, the beam of this radiation is obviously narrower.

I have been able to study particularly Mr. A. E. Covington's data and papers, and am greatly indebted to him for this. I wish therefore to express my sincerest thanks to Mr. Covington for the data and also for an unpublished article and calculations. During a partial solar eclipse on November 23, 1946, Mr. Covington has on occasion recorded a decrease in solar noise three minutes before first contact, indicating the extended area of the emitting source. Furthermore, a decrease of 25% in intensity was recorded when a large sunspot group was eclipsed. From different observations it was deduced that the "radio spot" is about 5 times larger than the visible spot and that it has in a simplified form a spherical shape. This explains why "Radio spots" still emit when the visible spots are behind the limb. It also explains why correlation with sunspot areas corrected for the foreshortening effect is of a high order (see my graphs). According to Waldmeier and Muller, the cause of "radio spots" is thermal radiation in the so-called coronal condensations which are to be found over larger sunspots. (37) Correlation of the 10.7cm radiation with true sunspot areas and numbers ( $r$ ) is high, the correlation coefficient is better than .80. However, since not all sunspots are emitting radio waves while some "radio spots" are apparently not connected with any visible spot, no 1 to 1 ratio can be had. "Radio spots" seem to have longer lives than visible spots and their temperature is many times higher.

Solar Noise Bursts: (S.N.B.) While the longer waves show very complex noise fluctuations called noise storms and bursts; outbursts, nonpolarized bursts (34), the 10 cm radiation shows mostly simple and slow regular variations called bursts. According to Covington, there are mainly two types: a) the simple burst, which shows a gradual rise and fall in intensity superimposed on the steady flux, and b) the complex burst, which shows in 80% of all cases 2 maxima and in a few others more. (38) (39) Several simple bursts following each other are called a group. The most frequent duration of bursts is 5 minutes and their most frequent intensity is  $1/10 - 1/2$  that of the quiet sun. Still it must be understood that there is a great range in both duration and intensity of various bursts and there is rather a low correlation coefficient between duration and intensity. The study of solar noise bursts is of great importance for our own radio communications since all major S.N.B. coincide with flares and Sudden Ionospheric Disturbances (S.I.D.) (fade-outs). An example of an unusually strong burst occurred on January 22, 1951 (as observed at Ottawa on 2800 Mc/s) while a limb flare was observed at Huancayo, Peru. Concurrently, a Sudden Ionospheric Disturbance was recorded and also a terrestrial magnetic pulse at Cheltenham.

Radio astronomy is still in its infancy. Even the largest telescopes (antennae) have at best a resolution power of the order of one minute of arc. Interference methods have been used extensively, but the pin-pointing of active solar areas must still wait.

An interesting sideline consideration is the possibility that radio waves may be the mysterious forces causing certain long period changes on earth, like the tree rings or other uncertain meteorological phenomena which seemingly follow the sunspot cycle. Waldmeier particularly suggests that the 5m waves which show the highest "radio spot" intensities might act as a sort of high frequency therapy influencing the growth of plant cells (40). It is understood that the variable ultraviolet radiation together with soft X-rays and corpuscular radiation, which follow the solar cycle, cannot penetrate the atmosphere while the visible light varies at best only 1 or 2%. This leaves only the radio waves which penetrate down to the troposphere.

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- 38) Waldmeier and Muller - "Die Sonnenstrahlung im Gebiet von 10cm" Ast. Mit. No. 168; also Z.F.A. Bd. 27, pps. 58-72, 1952
- 39) A. E. Covington - "Some Characteristics of the 10.7 centimetre Solar Noise I and II" - J.R.ASTR. Soc. Can. Vol. 45, 1951
- 40) A. E. Covington - "Circular Polarization of 10.7 centimetre Solar Noise Bursts" - J.R.ASTR. Soc. Can. Vol. 45, 1951
- 41) Waldmeier - "Radioastronomie" - Astr. Mit. No. 166, 1949

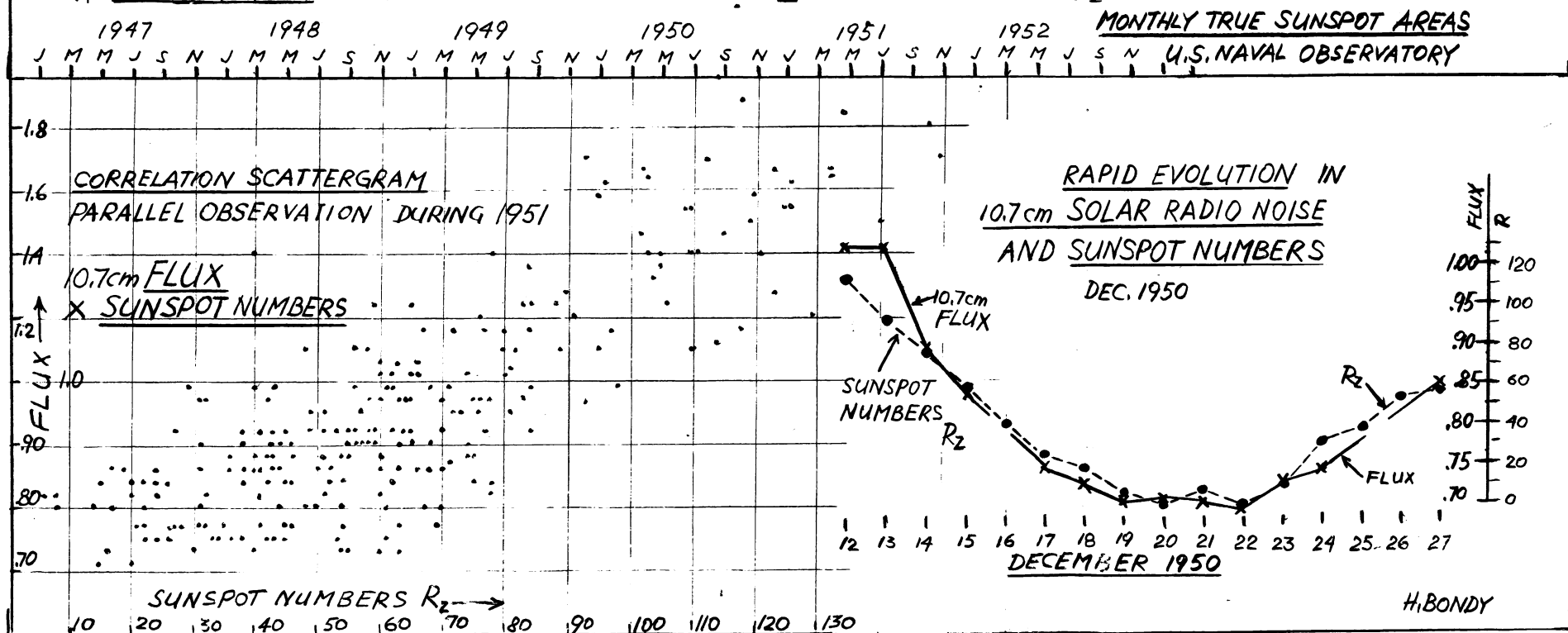
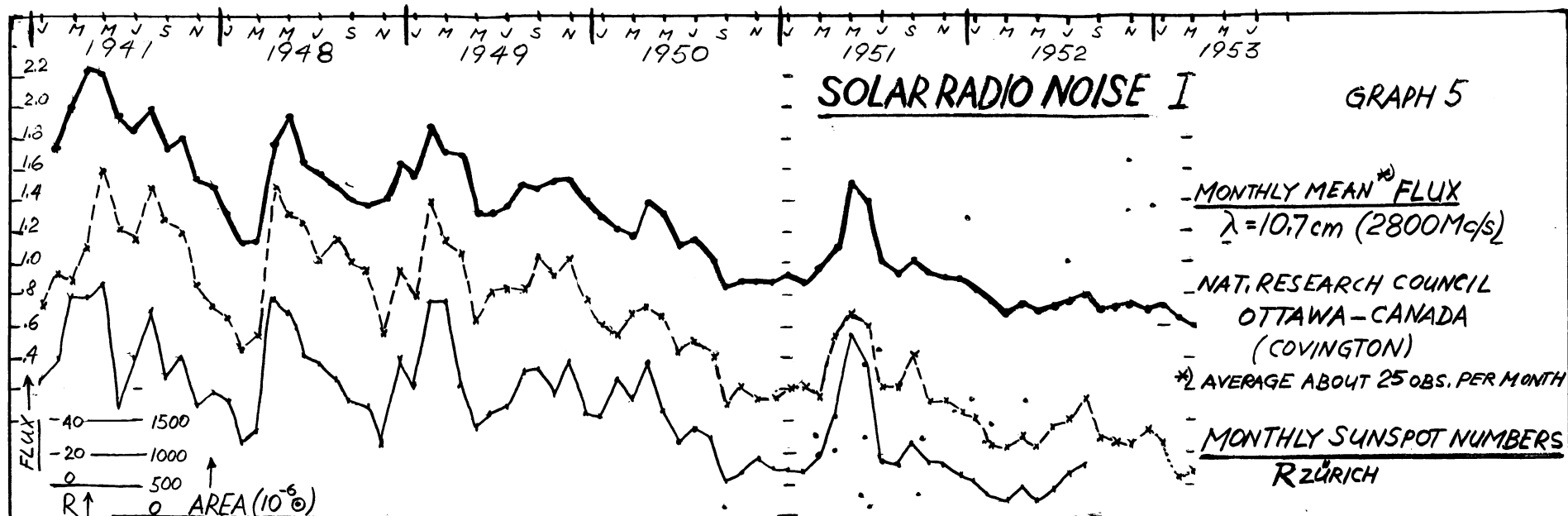
Also by A. E. Covington:

- "Solar Noise Observations on 10.7 centimetre" - Proc. Inst. Radio Eng., Vol. 36, Pps. 454, 1948
- "Micro-Wave Solar Noise Obs. During the Partial Eclipse of Nov. 23, 1946" - Nature, No. 4038, March 22, 1947.

ERRATA: In my previous paper on the Corona (Solar Division Bulletin No. 85), I stated that the yellow coronal line is due to CA XV. Dr. B. Bell of Harvard Observatory pointed out to me that theoretical considerations no longer permit such identification because the actual observations do not support such an origin. The origin of the yellow line is thus unknown.

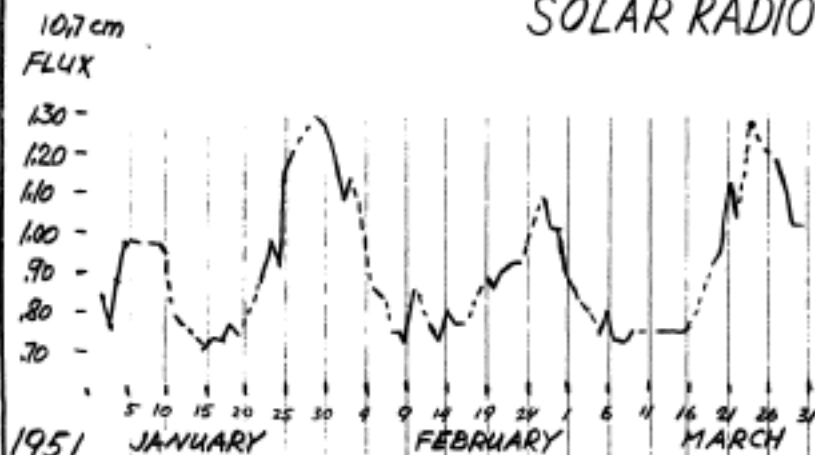
On page 2 of the same paper, line 9, the sentence should read only: "What is it that counteracts so greatly gravitational forces?" The following Reference Numbers should be corrected: 27 should be 28; 28 should be 30; 29 should be 27; 30 should be 29. Number 32 is not a reference number.

Please correct your copies accordingly.



# SOLAR RADIO NOISE II

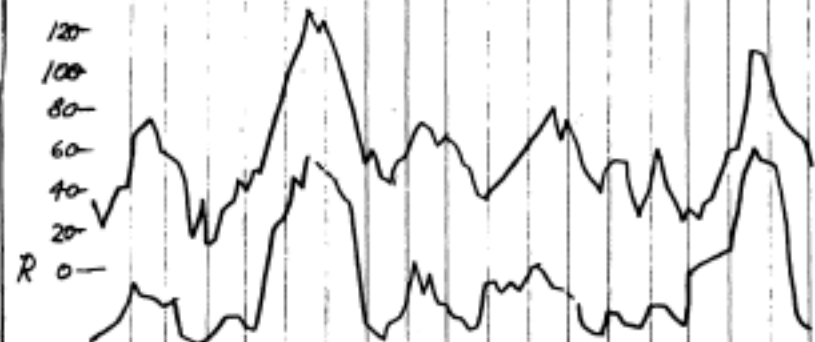
GRAPH 6



DAILY 10.7cm (2800 Mc/s)  
FLUX

NAT. RES. COUNCIL  
OTTAWA CANADA

--- MISSING DATES



DAILY  
SUNSPOT NUMBERS  $R_z$  ZÜRICH

- 2000

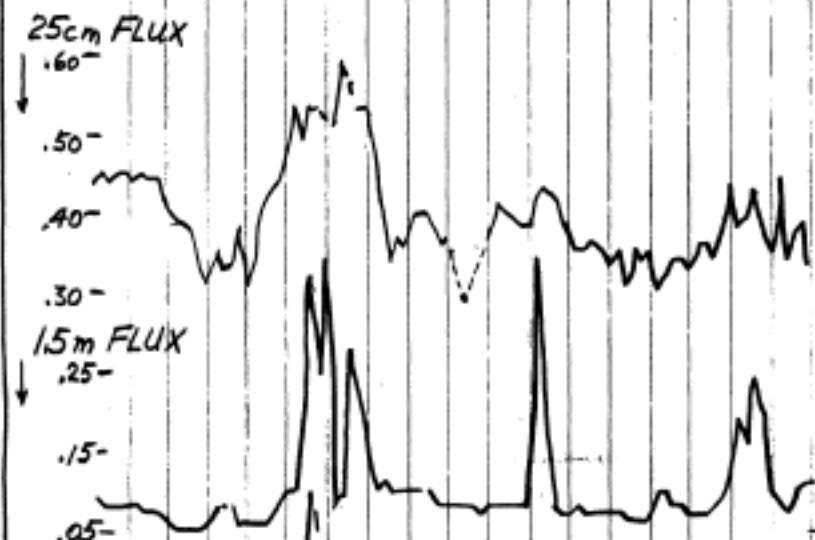
- 1500

- 1000

- 500

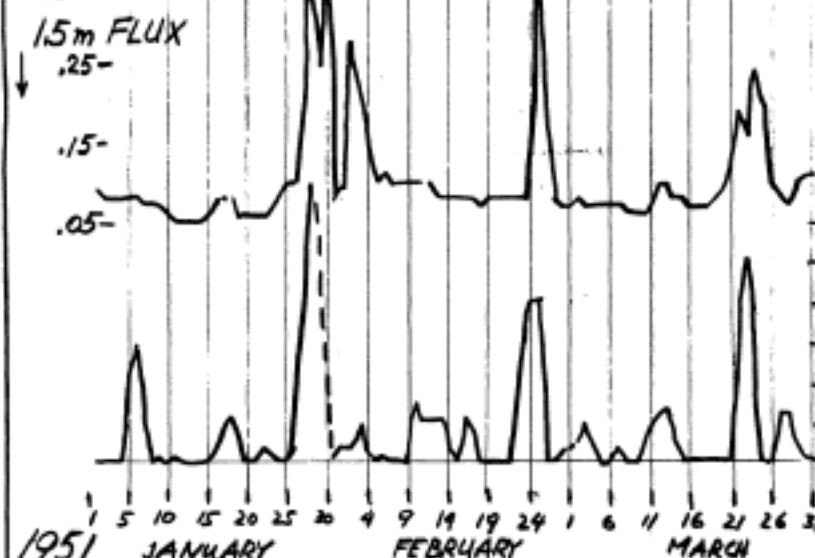
- 0 AREA ( $10^{-6} \odot$ )

DAILY  
TRUE SUNSPOT AREAS  
U.S. NAVAL OBSERVATORY



DAILY 25cm (1200 Mc/s)  
FLUX

RADIOPHYSICS LAB. - SYDNEY  
AUSTRALIA



DAILY 1.5m (200 Mc/s)  
FLUX

COMMONWEALTH OBSERVATORY  
CANBERRA AUSTRALIA

1500

1000

500

- 0 AREA ( $10^{-6} \odot$ )

DAILY SUNSPOT AREAS  
IN CENTRAL ZONE  $\frac{1}{4}$  RAD ( $15^\circ$ )  
U.S. NAV. OBS.

H. BONDY