A.A.V.S.O.

SOLAR DIVISION BULLETIN.

Neal J.Heines,Editor.

April 1953. P.O.Box 2353.
Number 85. - Page 242 - Paterson N.J.

For a number of observers, this will be their first experience with the activity, or inactivity, of the minimum portion of a Sunspot Cycle. After having observed a maximum, the second highest of all known maxima, it is a strange experience to find the sun's disk void of sunspots for days at a time, yes, even weeks.

We have been asked, "How long is this going to last"? This we cannot answer with any degree of accuracy. Authority declares that this will be a short minimum.

Bulletin No. 77, August 1952, Suplements 1-2, contains two graphs of, EPOCHS AND INTERVALS OF SUNSPOT MINIMA, and MAXIMA. These will give you a fairly good picture of what is to be expected.

To supplement these we show below the number of days, spotted and spotless, for the declared year of minimum, 1944, as observed at Solar Division Headquarters.

LAST DECLARED MINIMUM
1944

Days with Sunspots

J	F	M	A	M	J	J	A	S	O	N	D
10	1	13	2	4	14	11	25	24	29	22	25

Days Without Sunspots

J	F	M	A	M	J	J	A	S	O	N	D
21	28	18	28	27	16	20	6	6	2	8	6

STATISTICS

The total number of sunspot groups for the month of February was 1.
Zurich's Provisional Sunspot Number " " " " " " 2.9
The Mean monthly sunspot Area (U. S. Naval Observatory) Not released
*The highest sunspot group number as assigned at Solar Division Headquarters was No. 8. It was observed on March 14th (Saturday) in the Central Zone about one day from the Central Solar Meridian, and was very near to the Solar equator.
*Group counting reference for observers.

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

Mar.	22	Jun.	17
Apr.	21	Jul.	15
May	19	Aug.	14

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

Difinitive Sunspot-Numbers for 1952

	J	F	M	A	M	J	J	A	S	O	N	D
MEAN	40.7	22.7	22.0	29.1	23.4	36.4	39.3	54.9	28.2	23.8	22.1	34.3

YEARLY MEAN 31.5

Released by Prof. M. Waldmeier

Comparison of Sunspot Numbers of Median of Regular Observers with Observations of C. F. Fernald of Wilton, Maine.

Grouped by months and by rating of seeing as given by C F F.

Number given under each heading is : 1. Number of days CFF made observations with seeing conditions of that rating. Day is put into the best seeing rating given for the day, where two or more observations were made. 2. Sum of CFF spot numbers for those days. 3. Sum of median spot numbers (Ra) for those days.

1951	Poor	Fair	Good	Excellent.
January	7- 383- 450	1- 0- 16	1- 39- 39	0
February	3- 122- 173	4- 154- 238	5- 149- 213	0
March	4- 232- 261	8- 229- 353	6- 228- 261	0
April	2- 226- 285	3- 265- 334	11- 908- 961	0
May	0	7- 496- 510	11- 856-1092	6- 514- 494
June	0	2- 278- 239	14-1178-1111	7- 875- 701
July	0	1- 64- 67	6- 257- 333	13- 654- 825
August	1- 36- 55	1- 0- 8	10- 786- 798	14- 513- 579
September	3- 112- 134	2- 170- 193	11-1027-1068	7- 709- 721
October	1- 40- 45	5- 138- 232	10- 327- 417	4- 253- 257
November	8- 366- 440	1- 49- 79	7- 346- 415	0
December	4- 147- 183	4- 39- 128	0	0
Totals	33-1664-2026	29-1882-2397	92-6101-6708	51-3518-3577

1952	Poor	Fair	Good	Excellent
January	0	2- 25- 36	1- 52- 50	0
February	2- 65- 78	4- 35- 69	0	0
March	0	0	5- 187- 231	3- 105- 99
April	1- 16- 21	2- 57- 66	15- 354- 402	2- 42- 59
May	1- 0- 9	1- 11- 28	10- 268- 235	10- 277- 269
June	0	2- 91- 103	7- 216- 96	15- 806- 664
July	0	2- 42- 43	11- 314- 363	17- 712- 715
August	0	2- 163- 147	10- 615- 549	16- 827- 796
September	3- 75- 108	1- 38- 47	11- 274- 295	11- 252- 261
October	3- 81- 68	6- 110- 137	9- 225- 198	3- 105- 88
November	3- 66- 64	4- 78- 90	7- 126- 158	3- 73- 53
December	2- 81- 104	7- 176- 189	1- 12- 15	0
Totals	15- 384- 452	33- 826- 955	87-2643-2591	80-3199-3004

Year	Days observed	Poor	Fair	Good	Excellent
1946	267	12.0%- 85.8	26.6%- 98.4	52.5%-104.0	8.9% - 116.0
1947	260	19.6%- 88.8	33.4%- 92.0	38.9%-105.5	8.1% - 115.5
1948	206	17.9%- 88.8	21.4%- 95.0	43.2%-103.0	17.5% - 117.0
1949	247	16.6%- 95.8	18.2%-104.0	43.7%-106.5	21.5% - 114.0
1950	215	19.5%- 77.5	21.4%- 90.8	40.0%-100.5	19.1% - 103.5
1951	215	15.3%- 82.1	18.2%- 78.6	42.8%- 91.0	23.7% - 98.5
1952	215	7.0%- 84.9	15.3%- 86.5	40.5%-102.0	37.2% - 106.5

Comments.

In the third table summarizing the seven years, the percentage stated is that of the total days of observing that seeing was of the stated quality. For 1952 it should be noted that very little observing was done in the first three months of the year, which is at least partially responsible for the high percentage of excellent seeing in that year. The second figure is the ratio of spot number of CFF to the median. For the years 1948-9-50 this is multiplied by k factor to get onto comparative basis. For 1951-2 CFF's k was 1.02 so no multiplication was done.

Seven year totals. 1946 to 1952.

	Poor	Fair	Good	Excellent
January	38- 72.9% 3222-4422	20- 78.1% 1330- 1724	16- 90.5% 1120- 1237	1-137.5% 33-24
February	27- 68.4% 2043- 2994	34- 81.8% 2852- 3482	31- 84.7% 2814- 3436	4- 95.0% 829- 872
March	30- 71.6% 2990- 4176	41- 79.7% 3693- 4639	50- 92.0% 4559- 4964	10- 98.1% 1054- 1073

	Poor	Fair	Good	Excellent
April	15- 81.5% 2066- 2540	31- 85.6% 3534- 4121	75- 90.2% 7625- 8452	12- 94.8% 1682-1773
May	10- 78.6% 1207- 1538	27- 87.0% 2875- 3301	69- 87.0% 7933- 9091	48- 87.3% 4500- 5157
June	6- 70.1% 400- 570	19- 88.0% 1990- 2261	82- 91.7% 8836- 9621	57- 99.6% 6098- 6120
July	4- 72.7% 414-570	26- 86.7% 3031- 3499	89- 88.9% 9666-10883	61- 94.4% 5874- 6233
August	7- 85.0% 896- 1055	29- 88.8% 3478- 3916	79- 92.7% 9617- 10377	70- 92.3% 7813- 8482
September	21- 80.0% 1540- 1922	36- 84.2% 4593- 5440	76- 89.5% 8118- 9068	33- 96.9% 1742- 1802
October	28- 75.5% 2348- 3115	45- 79.4% 3857- 4858	62- 91.3% 6851- 7510	9-104.1% 621- 596
November	32- 80.6% 2578- 3199	23- 89.7% 2345- 2615	51- 86.8% 4964- 5711	4- 86.2% 137- 159
December	32- 76.1% 2553- 3355	34- 86.0% 2870- 3337	23- 85.4% 2569- 3007	3- 87.4% 471- 539
Totals	250- 75.4% 22257-29456	365- 82.3% 36448-43193	703- 89.8% 74772-83357	112- 93.9% 30854-32830

In each block first figure is number of observations of that kind of seeing in that month, second is percentage of CFF spot numbers to mean. The bottom two figures are spot counts of CFF and mean, or Ra.

Seven year grand totals.

January	75-	5705-	7407-	77.0%
February	96-	8638-	10784-	80.0%
March	131-	12296-	14852-	82.8%
April	133-	14907-	16186-	92.3%
May	154-	16515-	19087-	86.8%
June	164-	17324-	18572-	93.5%
July	180-	18985-	21185-	89.6%
August	185-	21804-	23830-	91.5%
September	166-	15993-	18232-	87.5%
October	144-	13677-	16079-	85.0%
November	110-	10024-	11684-	85.9%
December	92-	8463-	10238-	82.6%
Total	1630-	164331-	188136-	87.5%

First figure is number of observations, second my spot count, third mean or Ra spot counts, fourth ratio of the two.

Comments.

Combining the figures of the last seven years may not mean too much, altho I think the ratios may have significance. That is, we have here a definite figure indicating the adverse influence of the winter months, January and February, and to a lesser degree December and March.

PUBLICATIONS

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2. Solar Ephemeris And Polaris Tables 1953 - - - - H. J. Shea, Ed. C. Berger
   123 p. illus. paper - 50 cents
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3. Advances in Geophysics. Vol. I. - - - - - - - - - Dr. H. E. Landsberg Ed.
   XL & 362 pp. illus. $7.80
   Academic Press, New York

4. The Sun - Herbert Zim
   Morrow 64p. illus. $2.00
   Sunspots, eclipse, and the part the sun plays in our every day life
   Good Gift for your children

5. Astronomy For Everyman - - - - - - - - - - - - - Martin Davidson
   Pub. Dutton - 494 pp. illus. $5.00
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6. Prism and Lens Making, 2d Ed. - - - - - - - - - - - F. Twyman
   London, Hilger and Watts 1952
   (U. S. distrib.:Jarrell-Ash, Boston) 629 pp. $11.25

7. The Heat of the Summer 1952 In The Eastern States- and Solar Influences - - - - - - - - - - - - - Franz Baur
   Translated from the German by Prof. H. Landsberg
   Short Article.
   Bulletin American Meteorological Society
   Vol. 34 No. 1 January 1953

8. On The Comparative Increases of the F-1 and F-2 Ionizations From Sunspot Minimum to Sunspot Maximum. M. Ghosh.
   Journal of Geophysical Reseasch Vol 58., No.1, Mar.1953.
   pp. 41 - 51.

Monthly Means RA- ~~3.6~~ 40 Rz-2.9

American Sunspot Number Reductions

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

N.J.H. 3/12/53 — February 1953 — W.A.R 3/15/53

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	Mean	No
Adams		.070	0		12	12		12	12	/12							0		0	0		0	0	0	0		/0	0	0	0	3.0	16
Bartlett		1.51	0			15	27	12		0	0	0		0	0	0			0	0	/0		0	0	0		/0	0	0	0	3.0	18
Beardsley		0.74										25				0		0	0	0				0	0	0				0	2.8	9
Beetle	X	1.06	0	/11	/11	11						11	12			0						0		0	0		0			/0	3.8	9
Bissette		1.45																		0	0							0	0		0.0	4
Bollmeyer	X	0.81										/0				0				0	0	0		0	0	0			0	0	0.0	9
Bondy		1.22	0				11									0			0		0	0		/0	0	0	0		0	0	1.0	11
Brennan	X	0.93				12			11	23	12			0													0	0			8.3	7
von Bronsart		*		13		/13	/13		29	/12								0	0			/0	0				0	0	0	0	4.7	9
Buckstaff	X	1.11	0	11	/11					11					0		0	0	0	0			0	0	0			0	0	0	1.6	14
Chassapis		0.74	0	0	11	11	11	11	34	23	11	24	11	0	0	0	/0	0								0	0			0	8.2	18
Cragg	X	0.92	0	11	12		/11	11	11	11	11	11	11	0	0	0	0	0	0		0	/0	/0	0			0	0	0	0	4.2	21
DeKinder	X	0.80			11		11	11				11	11		/0	/0		0	0	0	0	0	0	0	0		0		0	0	3.4	16
Detgen		1.39													0	0								0	0			0	0	0	0.0	8
Elias		0.60	0	/11	11	11	11			11	11		22	0	0		0	0	0		0	0	0	0	0	0	0			/0	4.0	19
G. Estremadoyro		*		17	0			0	13	18	0		0	0		0			0				0	0	0	0				/0	3.4	14
V. Estremadoyro	X	0.80	13	/26		15		30		14	/43	/27	29	0	/13		/13	/13	0	/0	0	0	0	0	0	0	0	0	0	0	5.9	17
Evans		*			11	11			11	11	22						0		0	0				0							7.3	9
Fernald	X	1.02					0	11					/0			0			0	/0	0				0	0	0			0	1.2	9
Foces	X	0.60	0	11	11	11	11	11	22	11	/11		22	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	4.4	25
Galbraith		*	0	11	11	11	11	/11	12	/11	37	11	23	0	0	0	/0	0	0	0	0	0	0	0		0	0	0	0	0	5.3	24
Haines		*									62				/0	0	0		0	0	0										10.3	6
Helnes	X	0.97	0	12		11	11	11		11	11	11	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	3.2	24
Koyama	X	0.70			11		/11	11	11	23	11	39	11	33			/0				0	/0		0		12			0	/0	13.5	12
Loebbick	X	1.02	0			11					0	0				0		0	0	0	0			0	0	0		0		0	0.8	14
Luft	X	0.98	/0	/12			/11					/11	/12			0							0	0	0	0				0	0.0	6
Macris	X	0.77	0	11	11	11	11		22	11	/11	/11	11	0	0	0	0	0	0	0	/0	0	0	0	0	0	0	0	0	0	3.6	24
Maher	X	0.90	0		11	11				11	11	11	11	0	0		0	0		0	0	0	0	0	0	0	0	0	0		3.1	21
Moore	X	0.76									23				0				0	0					0						4.6	5
Olson		0.68	/0				13	12			/11		23							/0	0	0		0	/0	0	0		0	0	4.8	10
Pierson	X	0.83	0													/0								/0	0					0	0.0	3
Pierson Sr.		0.89	11	/0								/0	/0		0			/0	/0	0				/0	0	11	0		11	0	4.1	8
Pilsworth	X	0.86	0								23				0		0							0	0						3.8	6
Rosebrugh	X	0.68	0	11			11			/11	11	11	/0		0	0		0	0	0	0	0		0	0	0	0			0	2.6	17
Smith		*		11	11	11					11				0		0	0	0	0					0				0		4.0	11
Strayhorn		2.06					13				13	/12				/0															13.0	2
Stryker	X	1.06	0			/11	11	11		0	0	0		0	0	0		0	0	0			0	0	0	0		0	0	0	1.2	19
Sullivan		0.60	0		14	14		/13		12	31		25		12		0		0	0		0	0	0	0		0	0	0		6.4	17
Thomas	X	0.84	0		11	11		11	11	11	11		26	0	0		/0	0		0	0	0	0		0	0	0	0		0	4.6	20
Thrussell	X	1.47	/0	0			11	11	11		11				0			0		0				/0		/0	0		0	0	4.0	11
Trathen	X	1.28	0	0	11	11		11	/11	11	11	/11	/0	0	0	/0	0	0	0	0	0	0	0	0	0	0	0	0	0	/0	2.5	22
Venter	X	1.28					11	11	11	11	/11					0	0	0	0	0	0	0	0	0	0	0	0		0	0	2.4	18
Warren	X	1.10				0	11	13			0	0				0		0	0	0				0	0				0	0	1.8	13
Williams	X	0.92					12					11				0		0					0		0	0	0				2.9	8
Wells		*																													0.0	0
Wilson		*	/0			11						0	0			0			/0	0	0			0	0	0	0		0	0	0.9	12
RA			1	9	10	10	10	12	13	11	13	10	8	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	~~3.6~~ 4.0	
Rz			0	7	8	8	8	8	14	8	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.9	

* Insufficient Data Available

X Standard Observer

/ Observations rejected because of poor visibility and sky conditions

NBS 573 CRPL Tabulation Sheet

U.S. GOVERNMENT PRINTING OFFICE 1948—O—803310

"A STUDY OF SOLAR INDICES"

THE CORONA

GENERAL: The sight of the corona during a solar eclipse is undoubtedly one of the greatest thrills a nature lover may ever experience. C. A. Young in his classic "The Sun" (p. 238-273) mentions that already Philostratus and Plutarch had observed and described the corona during total eclipse. Until the early part of the last century, astronomers believed the corona to be the moon's atmosphere. When this was disproved, it was considered to be either of terrestrial origin or merely an optical phenomenon like a halo or a rainbow. During the 1869 eclipse, C. A. Young, the pioneer in solar astrophysics, and Prof. Harkness discovered independently that the corona emitted a characteristic bright green spectral line. Thus "the existence of this bright line demonstrated the presence in the corona of an incandescent gas, and this of course can only be near the sun" (Young). The next twenty years convinced astronomers that there were not only changes in the corona from one eclipse to another, but that certain characteristic shapes depending on the sunspot cycle were apparent. The "sunspot minimum" corona has long equatorial streamers and short "polar brushes". The "sunspot maximum" corona is more jagged, but also more evenly distributed around the solar limb. (For drawings see Young's book; for photographs see Menzel's "Our Sun" p. 189-222).

The Progress in the study of the corona was very slow, since observations could be made only during the few minutes of solar eclipses. All efforts to observe the corona otherwise failed until the French "Schmidt", Dr. Bernhard Lyot (1897-1952) succeeded in building a telescope called the CORONAGRAPH in 1930. The success of this instrument consists primarily in the elimination of all possible light scattering. Therefore high altitudes are necessary for coronagraphs and above all the extreme perfection of a single element objective lens. Chromatic aberration is eliminated by means of the spectroscope or monochromatic filters. Recently Baker designed a 16" achromatic coronagraph, still using, however, a single element objective lens. (For technical details see "Our Sun").

Another ten years elapsed before Lyot's great invention and the importance of the corona began to be realized. This came about when it became clear that the corona is the hottest body in the universe, excepting the stars' accessible interiors. The temperature of the order of one million degrees is not important in itself, but rather the cause of the powerful ultraviolet and soft X-Ray radiation, which vitally conditions the earth's ionosphere. Actually it was during the war years, when the first American and German coronagraphs came into operation, in order to permit the best possible forecasting of usable radio frequencies. (More about the ionosphere later on). The mystery of the coronal lines was solved by Edlen, a Swedish physicist in 1942. This was the greatest single step since Lyot's invention in the study of the corona.

THE CORONA: The corona with its streamers has been observed to reach into distances of several solar diameters (in 1878 up to $6^{o}-7^{o}$). The limits of this outermost solar atmosphere are not known, and it is possible that it merges into, or simply continues as what is known as the Zodiacal Light. The liminosity seems to decrease rapidly from the solar limb, though when comparing this decrease with that of density in the photosphere, it becomes unbelievably slow. The density in the photosphere falls down to 1% in a layer of only 1500 km, while the density of the corona reaches this 1% value 700,000 km away (approx. 1 solar radius). What is it that counteracts so greatly gravitational forces and the molecular weight? It is the extreme temperature in the corona (23). The luminosity of the corona is estimated to be one millionth of that of the sun or about 50% of the luminosity of the full Moon. 99% of its light consists of a continuum. The light in the inner corona is scattered photospheric light with some emission lines superimposed. This light is also partially polarized in the radial direction. While the inner corona's light is scattered by free electrons, the outer corona's light is scattered by dust particles and shows Fraunhofer lines. The temperature of the order of one million degrees has been proven in many ways so that there cannot be any reasonable doubt about it. However, one must not forget that this refers to kinetic temperature in a highly difused gas and not to temperature one could measure with a thermometer. It is this high temperature which broadens the spectral lines by the Doppler shift by approx. 100^{o}, washing them out completely and leaving a bare continuum. Of course, at this temperature the corona not only scatters light, but also emits its own light. It is not hydrogen or any of the lighter elements which are completely stripped of all electrons, but the heavier elements like calcium, iron, and nickel which emit light. These are also ionized to an unbelievable degree and it takes the million degree temperature to strip 9-13 elections off an iron atom. A further consequence is that at this temperature the radiation is strongest in the far ultraviolet and soft X-Ray region. This powerful radiation cannot be observed, because it is absorbed in our atmosphere where it creates the ionosphere. Luckily, we can observe even without a space satellite what rockets have already shown; namely, the hottest regions of the corona by observing the regions of bright coronal lines.

Coronagraph observations: The first coronagraph -Lyot's- is at Pic du Midi, the French Pyrenees. Since 1938, the Swiss have their coronagraph at Arosa, in the Alps, where Prof. Waldmeier makes all the observations himself. The first American coronagraph of the Harvard and Colorado University is at the High Altitude Observatory at Climax, Colorado and has been in operation since May 1941. Germany has its observatory at Wendelstein (another one at Zugspitze is no longer in use); Austria has one at Kanzelhoehe, these last two are parts of the Fraunhofer Institut, Freiburg, and Japan has its coronagraph at Mt. Norikura. A second and third American coronagraph is at Sacramento Peak, New Mexico. The new and by far the largest 16" "achromatic" coronagraph is or should be in operation soon.

All these observatories are high altitude stations in order to minimize light scattering by atmospheric dust. In fact, atmospheric and instrumental light scattering must not exceed 250 millionths of the intensity of the continuum in the center of the solar disc in order to make useful estimates of the coronal lines (24). The principal spectral lines used in regular observations are: a) the Green line at 5303A° of Fe XIV-i.e. iron atoms stripped of 13 electrons. The necessary energy to strip another electron from Fe XIII is 355 electron volts (it takes 13½ electron volts to ionize hydrogen, i.e. to strip it of its single electron). The green line 5303A° is by far the most prominent line except during minimum, when b) the first Red line at 6374 A of Fe X, iron stripped of 9 electrons becomes more prominent, being visible around the whole solar disc; c) a second Red line at 6702 A, which is regularly observed at Climax and Sacramento Peak, requires even higher energy - namely, 422 electron volts to create the ion of Ni XV (nickel stripped of 14 electrons; the necessary energy to do this "stripping" is called the Ionization Potential); d) the so-called Yellow line at 5694A of Ca XV (calcium stripped of 14 electrons) is perhaps the rarest of them all (30) (31), but very significant, since it indicates by far the hottest areas in the corona. The ionization potential for Ca XV is 814 electron volts,(23) the highest of all. A short table follows.

The most prominent coronal lines:

	COLOR:	WAVELENGTH:	ATON (ion):	IONIZATION POTENTIAL:
I	Green	5303 A	Fe XIV	355 el. volts
II	first Red	6374 A	Fe X	233 el. volts
III	sec. Red	6702 A	Ni XV	422 el. volts
IV	Yellow	5694 A	Ca XV	814 el. volts

The green line 5303 A is usually observed 30" - 40" from the solar limb. This line occasionally reaches heights of 5', approx. 230,000 km, rarely ever much higher. (This refers to the distance it still is visible.) The corona rotates with the sun, as observation of its green line has shown. Its synodic rotation at 24° latitude is 27.9 days (25). While strong coronal lines usually avoid regions of prominences, they occassionally resemble the so-called sunspot prominences. These so-called "coronal condensations" show motions of matter of the order of 100 km and more, through the Doppler shift. However, this streaming is rather exceptional (26) (27).

The coronal lines show through their variable intensity a distribution sinilar to the prominences; namely, 2 zones (28). The principal zone resembles the zone of sunspots and faculae. Like these photospheric phenomena, this zone moves from high latitude at the beginning of a new cycle towards the equator where it dies at the end of the cycle (Sporer's law). Its intensity, "height" and temperature follow (32) the sunspot cycle. The second zone develops after spot maximum, moves towards 60° latitude, where it remains until the beginning of the next cycle, whereupon it moves rapidly towards the poles, where it disappears after maximum. It is this polar zone which gives the corona the more even distribution of light when it is photographed during an eclipse at spot maximum.

Corona Indices: Since the green line is the most prominent of all coronal lines, its intensity variation is recorded by all observatories in distances of 5° around the solar limb. Occasionally, its apparent visibility "height" is also estimated. The same is done with the other lines. Unfortunately, the various observatories use different methods, as well as a different scale in their observations. Thus, there are occasionally even large differences between the observations made on the same day at different stations, (even when atmospheric conditions are compensated for). Dr. Behr of the Fraunhofer Institut found considerable discrepancies when he compared observations of five stations (29). Arosa estimates the intensity of the green line visually on a scale of 0-50 using a tangential slit for the spectroscope; Pic du Midi uses a radial slit and estimates the line intensity on the solar limb in millionths of the intensity in the centre of the solar disc; Climax uses a bent slit and estimates the intensity of the coronal lines on a scale from 0-40. All observatories have their observations published in the I.A.U.'s Quarterly Bulletin of Solar Activity. Climax and Sacramento Peak publish their observations in the "Ionospheric Data" of the Central Radio Propagation Laboratory, National Bureau of Standards.

The origin or cause of the corona is unknown. F. Hoyle's theory of accretion seems plausible, though we have no proof as yet besides theoretical considerations (12).

REFERENCES:

23) Waldmeier: Sonne und Erde (1946)

24) Waldmeier in Astron. Mitteilungen (Zurich) No: 160 (1949) (about the possibility of continuous corona observations)

25) Waldmeier in Astron. Mitteilungen No. 147 (1946) (about the rotation of the corona)

26) Waldmeier in Astron. Mitteilungen No. 151 (1947) (coronal streamings)

27) Waldmeier in Astron. Mitteilungen No. 157 (coronal zones and their motion)

28) Waldmeier in Astron. Mitteilungen No. 146 (1945) (about the yellow corona line)

Other papers dealing with the corona observation:

Waldmeier in Astron. Mitteilungen:
- No. 164 (1949) about the corona during the 11th solar cycle.
- No. 169 (1950) coronal structure in the vicinity of a large sunspot.
- No. 171 (1950) statistic of the green coronal line.
- No. 174 (1951) the form of the monochromatic corona.
- No. 178 (1952) variation of the corona temperature.

29) Menzel in "Our Sun" p. 202 (Dr. Roverts' observation of coronal streaming)

30) Behr in Zeitschrift fur Astophysic, Vol. 28, p. 296 (1951) (about the corona observation at Wendelstein, Kanzehohe and Zugspitze (1943-1950) and the differences in the corona indices)

31) Roberts in Astrophysical Journal, Vol. 115, No. 3 p. 488 (May 1952)
(about the yellow corona line)

32) Behr and Siedentopf in "Die Naturwissenschaften" No. 2, Vol. 39 (1952)
(an excellent summary of solar observation)

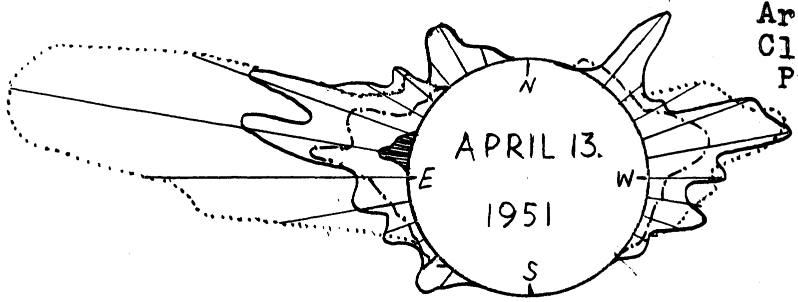
ERRATA: In a previous paper, Solar Division Bulletin No. 83, Feb. 1953, were a few errors:

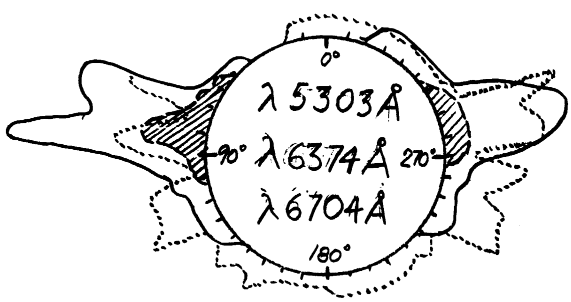
1) Page 3, point II should read as follows: The DEFINITIVE or Final Sunspot Numbers consist of unaltered Zurich Provisional Numbers of observations made under good conditions. These (incomplete) Definitive Numbers are used for the computation of yearly k factors of outside observers. Only then, when the k factors were determined from parallel observations are the missing days in the Zurich statistic filled as a mean of the contributing observers.

2) During the copying process a few mistakes entered my Graph A.
   a) the RF/Fraunhofer sunspot numbers-curve actually follows RZ closely during May 1947.
   b) the Zero base of the different Numbers is shifted by 20 points for better clarity. It is imperative to take this into consideration. No close reading-off of actual values is possible on the multigraphed sheets.

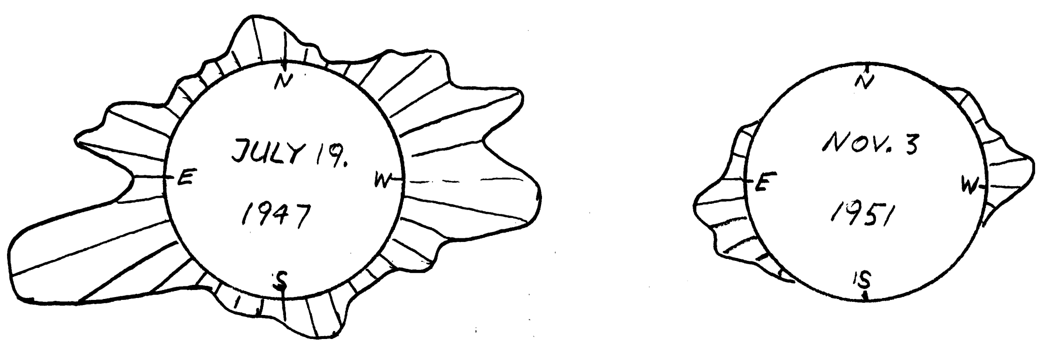
CORONA INDICES GRAPH 3.

Intensity Variations of the Green Coronal Line 5303 A as observed on April 13,1951, at:
Arosa 6h 30 U.T. ————
Climax 17H 42 U.T. —·—·—·
Pic du Midi 7h 50 U.T.·······
(see text for scales)
The rare Yellow cor. line as observed at Pic du Midi.





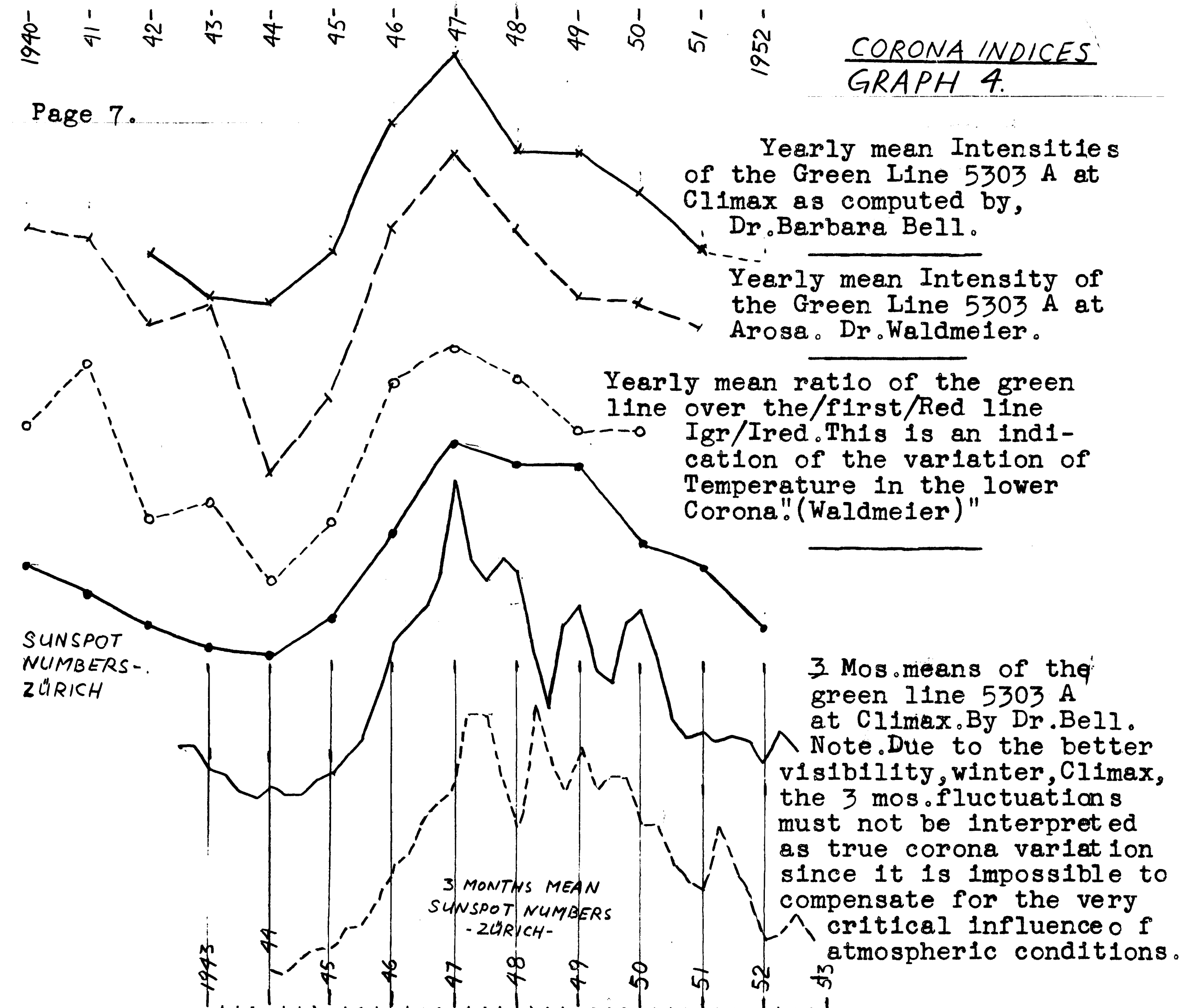
Intensity Variations of the Green 5303 —— the first red, 6374 ······· and the second red line - - - -as observed at Climax.



High and low coronal activity of the Green line 5303 A,
- CLIMAX -

H.Bondy.

CORONA INDICES
GRAPH 4.



Note: Iam greatly indebted to Dr. Barbara Bell for her permission to illustrate graphically her Climax data before publication. (H.B.)