SUNSPOTS, OCTOBER 1947 TO JANUARY 1949

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For the past year and a half the author has been observing sunspots daily for the Solar Division of the American Association of Variable Star Observers. This paper summarizes my observations for the sixteen month period beginning with October of 1947 and ending with January of 1949.

The instrument used for this work is a five inch refractor, diaphragmed to four and a quarter inches because of the condition of the objective. It might be of historical interest to note that this telescope, which is now located on the top of the chemistry building at South Dakota State College, was purchased in 1893, and at the present time only one eyepiece remains, this giving a power of about 60. The projection method is used in observing sunspots, the sun's image being projected on a screen placed back of the eyepiece so that the resulting image is 10 inches in diameter. On the screen is a 10 inch circle, which is ruled off into one and a quarter inch squares, using two perpendicular diameters of the circle as the axes. Before the screen is used to record the position of the groups it is so orientated that a sunspot will trail along one diameter of the circle. This fixes the east-west directions of the image, and the positions of the groups may then be plotted on graph paper ruled in a similar manner. The actual positions of the sun's equator and central meridian are then determined from data given in the **American Ephemeris and Nautical Almanac.** The resulting data is later reduced for the regular sunspot reports which are forwarded through the Chairman of the Solar Division, Mr. Neal J. Heines, to the National Bureau of Standards at Washington, D. C. At the present time the data is also being used for the Gleissburg Foreshortening Project being conducted by Prof. Gleissburg in Istanbul, Turkey.

Figure 1 is a graph of the daily sunspot numbers of the author for the month of April 1948. Similar graphs have been made for the other months of the period covered by this

paper. This sunspot number, as set up by Wolf at Zurich a number of years ago, consists of the figure equaling the number of groups seen multiplied by 10 and added to the number of sunspots seen. If it is desired to reduce the observations of a group of observers to a common scale it is necessary to multiply their individual sunspot numbers by an observer's constant, which depends, among other things, on the size of the instrument used and the method of viewing the spots.

Seeing conditions have a marked effect on the daily sunspot number of any individual observer. On some days the image will be rock steady, and very minute features will be visible, resulting in a high sunspot number. On other occasions the image may be boiling to such an extent that only the larger spots may be seen and then not too distinctly. The standard procedure of the Solar Division is to divide the seeing into four classifications, these being poor (p), fair (f), good (g), and excellent (e). It is interesting to note that the degree of cloudiness does not necessarily determine the seeing conditions. For example, a perfectly clear day may rate only poor or fair, while on a day overcast with cirrus clouds the seeing may be good or excellent. As part of the survey of weather and seeing conditions being conducted by members of the Solar Division, I have compared my daily sunspot numbers and their corresponding seeing conditions with the average sunspot number of all the American observers, and I have found that on days of poor seeing I record on the average only 81.9% of the American Relative Sunspot Number, on days of fair seeing 91.1%, on good days 101.9%, and on days of excellent seeing my number is about 107.0% of the American Relative Sunspot Number.

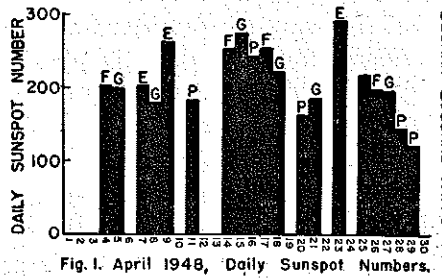

Fig. 1. April 1948, Daily Sunspot Numbers.

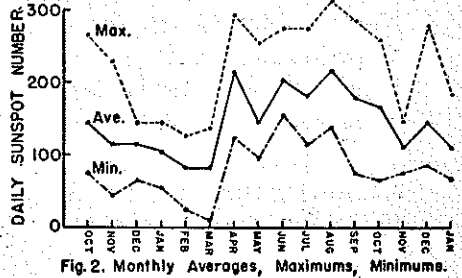

Fig. 2. Monthly Averages, Maximums, Minimums.

In examining graphs such as Fig. 1, it is well to keep the above facts in mind. In the majority of cases the small variations from day to day can be leveled off somewhat by taking into account the seeing conditions. Fig 1. is a good example of this fact. However any large changes in the sunspot number are due to an actual change on the sun and it is with these changes that we are concerned.

Fig. 2 indicates the trends of the current sunspot cycle for the period under consideration as indicated by the observations of the author. The solid black line shows the monthly averages of my sunspot numbers. The dotted line indicates the peak number reached in each month, while the broken line shows the minimum number recorded in each month.

Briefly, the trends of the present cycle from Oct. 1947 to Jan. 1949 were as follows:

October and November were somewhat erratic, but the trend was downward from the very active months of the preceeding summer months, when the maximum of the present cycle was reached. December of 1947 and January of 1948 were very stable, only a very few days in each of those months varying far from the average. February and March were more variable, but still the trend was downward. March was notable in one respect, for on the 22nd the lowest sunspot number since the passing of the maximum was recorded. At that time only one small spot was seen, thus giving a sunspot number of only 11. Several observers throughout the country reported a value of 0 on this day.

This inactivity was only the lull before the storm, however, for the activity during April surged to great heights, as shown by Figure 2. The American Relative Sunspot number for March was only 103.8, but the average for April jumped up to 222.5. The period of May through July continued at a high level, although there was considerable variation in the daily sunspot number. August saw three of the highest sunspot numbers recorded by this observer, these being over 300. By October the average sunspot number had declined somewhat and by November the average was down to about 120. December of 1948 and Janu-

ary of 1949 continued at about the same level although there was a temporary increase in the middle of December.

Many large groups were seen during the period under consideration, some reached such magnitudes that they were easily seen with the naked eye. Several cases of rapid development and disintegration of sunspot groups are on record. The best example of the former took place during the first week of September of 1948. On the third of September a single small spot was recorded to be preceding a complex group of 32 spots. These two groups were in the north solar hemisphere, and were at that time just on the western side of the central solar meridian. Twenty-eight hours later the single spot had developed into a group almost as complex as the following one. It now consisted of 26 spots in a bipolar arrangement, while the other group had 40 spots in it.

Not all groups were as active however. A goodly portion of the groups consisted of a single large spot enclosed in a circular penumbra, and would pass from one side of the visible hemisphere to the other without changing their physical appearance to any great extent.

Also apparent during the current cycle is a peruliar phenomena where zones of sunspot activity will be displaced by 180 degrees from inactive zones. At times this phenomena was very pronounced, and the author, together with Charles Lundquist, a recent graduate of South Dakota State College, started an investigation of longitudinal zones of sunspot development. However, because of insufficient data, no conclusive results were obtained.

It was noticed that most of the bright auroras seen during this period could be traced to solar activity.

The above remarks give some indication of the behavior of the present cycle which has been the most active since 1778, at which time the maximum was only slightly greater than the one just past.

At the present time solar observations are playing a large role in the field of radio wave propagation, as well as many allied fields, and it is the hope of the author that people will come to realize the importance of solar astronomy in the present scientific age.