

SUNSPOTS

AND

Their Effects

by HARLAN TRUE STETSON

*Research Associate at the Massachusetts
Institute of Technology*

Author of

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AND THE STARS"

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FOREWARNING

THE near approach of another sunspot maximum with the accompanying interest shown by the press and the general public gives the occasion for a book on sunspots. So much has been said about the possibilities of sunspots' affecting the earth and human affairs that a candid discussion of sunspots and their effects is due the general reader who would keep himself informed of trends in science. Sunspots have been blamed for calamities and misfortunes that run the gamut from Florida hurricanes to financial panics. Is there any basis whatever for such assumptions?

Since we are all more interested in ourselves than we are in things, the book has been written from the human point of view. While statements have been qualified, various possible hypotheses have been discussed which bear upon the question of solar disturbances and affairs on the earth.

Perhaps all too long has the reading public been dependent upon the technical material in textbooks on astronomy for a knowledge of sunspots. Such textbooks which must deal only with well-established facts cannot naturally try to discuss speculative questions.

This book therefore departs from the usual type of book on science in that it frankly presents questionable material as well as the results of more completely

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established facts from which the reader may draw his own conclusions with respect to inferences not yet fully established as well as to those which may be regarded as beyond debate.

As the book is intended to be distinctly popular, the more speculative material which intrigues the imagination has been presented in the earlier part, leaving the more well-established effects of sunspots upon the earth to the later chapters. The book undoubtedly raises more questions than it answers, and will, it is hoped, suggest attention to some of the less conventional aspects of the question concerning the influence of the sunspots on world events.

So many apparently serious articles have been written concerning sunspots and the business cycle that a chapter is devoted to the more plausible hypotheses that may be worth investigation. If the author appears noncommittal in his interpretation of some of the more startling presentations, it is because a scientist cannot by nature be otherwise. On the other hand, I have refrained from condemning interpretations where evidence is still scanty, for thus to condemn appears to me as unscientific as to make positive statements where complete evidence is wanting.

If the book falls into the hands of the overcredulous, perhaps a word of warning is necessary to curb hurried conclusions. One can only hope that none of the more speculative statements will be quoted except with qualifications which go therewith.

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In the closing chapter I have endeavored to differentiate clearly between the several effects well established and scientifically recognized from those which are more speculative and require much further investigation before definite conclusions can be drawn. Only by such differentiation can the whole subject be clarified, with the door still open for future progress.

A scientific reader will miss technical phraseology and numerous references quoting sources which obviously are out of place in so popular a presentation. If the reading of the book stimulates a consciousness of man's cosmic surroundings and opens certain questions for serious consideration, the answers to which are yet to come, the purpose of the book will in a measure be realized.

HARLAN TRUE STETSON.

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CHAPTER I

Ladies and Gentlemen—the Sun!

NOT since August, 1917, have such violent outbreaks been seen on the surface of the sun as have been reported this year. What influence sunspots can have on world affairs we are just beginning to find out. Many of the effects of which we are most confident are unfortunately so subtle that only scientific instruments reveal them. Yet it is a fact that there are unmistakable and often striking changes on the earth that do take place with the appearance of spots on the sun.

Take a good look at a chart representing the activity of the stock market from 1929 to date. Compare this with a similar one representing the activity of the sun as indicated by the appearance of sunspots during these same years. It will give you something to talk about when conversation lags or goes bromidic. Whether these two curves have anything to do with each other, frankly, I do not know, but here are the facts.

Sunspots were riding high in 1928 and 1929. In the autumn of 1929 there was an abrupt break in sunspot activity. The numbers of sunspots steadily fell off to near zero in 1932 and 1933. Then they began to rise.

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In 1937 they made new highs with breaks both spring and fall. One does not need to be reminded of Dow-Jones averages during the last decade to be persuaded of the similarity in the action of sunspots and Wall Street. If the last decade were the only record we had

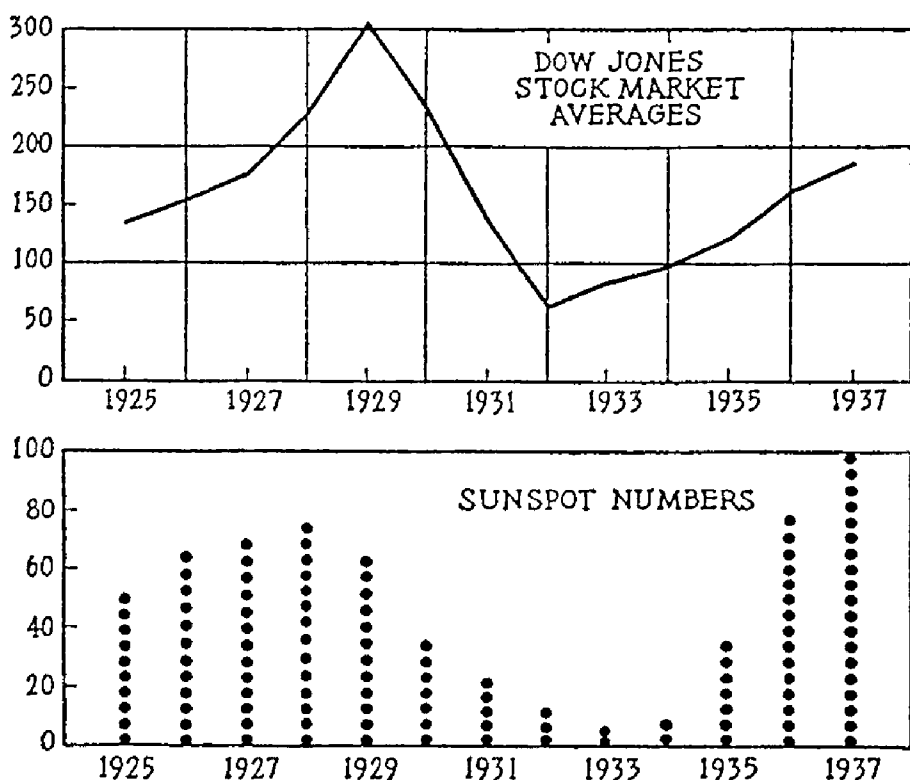


FIG. 1.—Does the stock market follow sunspots? (1937 estimated.)

of sunspot phenomena and market prices, we should certainly be enthusiastic about the relationship. Unfortunately, however, for our enthusiasm, previous decades did not show such a close correspondence. However, four out of the last five major depressions have followed in the wake of a sunspot maximum. Whether or not the similarity of these changes in the

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sun and economic affairs should be taken seriously, they do give us something to think about, and a surprising lot of thinking is being done in this direction at the moment.

One does not need to be an astronomer, an economist, or a statistician to realize the simple fact that life on the earth is very much dependent upon the quantity and quality of the sun's light and heat. If there were any drastic changes in the character of the sun's output, it certainly would not be long before we found its counterpart in general conditions on the earth. While astronomers who have measured quantitatively the amount of heat from the sun received by the earth find that it varies from day to day and year to year, it does not appear to them that this variation in solar radiation alone is enough to produce any drastic changes on the earth in recent times. There are, however, subtle changes taking place in the earth that follow so closely the changes on the sun as to be a matter of scientific record and defy contention.

It is only very recently that we have been able to discover that the electrical state of the earth's atmosphere is affected by changes in the sun which accompany the outbreak of sunspots. Did you know that long-distance communication by radio on certain wave lengths has been almost impossible for several minutes at a time during the last few years? This has occurred when certain outbreaks were observed on the sun. Radio engineers have sometimes been at their wits'

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end to find wave lengths or frequencies that would meet the commercial demand to transmit messages during such abnormal conditions.

Economists are too busy with world affairs and business statistics to delve into the technicalities of solar physics. Statisticians have too many worries of their own to give much thought to affairs off the earth. They are quite accustomed to blaming the ups and downs of the economic cycles on departures from the laws of supply and demand. Then, of course, there is always the possibility that some unanticipated turn in the affairs of Washington may be a bit disconcerting.

Back in the days of 1932 when traveling salesmen were scarce and one could unexpectedly find himself the sole occupant of a Pullman car for the price of a lower berth, I entered into conversation with a courageous traveler.

"What gets me," he said, "is that there are not brains enough in this country to solve this problem of booms and depressions. Why are we rushed to the limit trying to fill unsolicited orders one year, and then in a few years we can find no one to order anything, even at greatly reduced prices?"

"Has it ever occurred to you," I ventured, "that there are perhaps some fundamental cycles in Nature, the true character of which we do not understand, but which are the fundamental bases for changes in business, or psychology, or what have you, that results in

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booms and depressions? We have had them as far back as history.”

Now that we are well on our way toward what appears to be another great American boom we find the question still unanswered. Those who have survived what will probably go down in history as one of the greatest periods of economic depression have more than a passing interest in any serious considerations of events terrestrial or extraterrestrial that can possibly have any bearing on economic factors.

Sunspots come and go quite independently of the seasons. The sun seems to have epidemics of them. They last for four or five years and then subside and break out again. These little dark patches as seen on the surface of the sun with a telescope are indices of the kind of weather the sun is experiencing.

Ever since the invention of the telescope in the early part of the seventeenth century, traffic in sunspots has been watched continuously as they march across the solar disk, owing to the rotation of the sun which turns on its axis once in a little less than a month. While undoubtedly many astronomers must have noted that the intervals between times when sunspot traffic was most congested covered about a decade, credit for the discovery of the sunspot cycle seems to be attributed to S. H. Schwabe, who in 1843 published his findings.

Schwabe found from records of observations available to him that the interval between times of maximum traffic of these spots on the sun ranged between eleven

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and twelve years. Sunspots, however, are a bit irregular in their habits, so that sometimes as short a time as nine years has elapsed between their "rush hours," and sometimes seventeen years have elapsed between periods of maximum congestion. There are many speculations as to the possible effect of these cycles of the sun on affairs on the earth and human behavior.

One of the most persistent ideas in the minds of many people is that they influence weather on the earth. Various attempts have been made, as we shall see later, to connect these solar disturbances with the passing of storms across the United States and elsewhere. There are good reasons for believing that these solar disturbances very considerably affect the earth's atmosphere, but the connecting link is not a simple one.

It is only until comparatively recent years that astronomers had any idea as to what sunspots really were. Now they know they are terrific hurricanes raging in the sun's atmosphere. These hurricanes often extend over billions of square miles and would make the most violent and devastating of tropical disturbances that was ever recorded on earth appear a puny zephyr in comparison.

It does not seem unreasonable that weather on the sun should be accompanied by changes in weather on the earth as a whole. The problem of untangling such relationships as may exist is a complex one, but it may be one of the most important problems that science can solve.

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Just think of the boon it would be to business if we were really able to trace the sunspot period in the march of weather over the earth, even if we could do it only in a general way. There are so many businesses that are affected directly or indirectly by the weather that it would be one of the greatest assets to industry if science could ever solve this problem. Even the ability to predict severe or open winters in various regions of the globe would be worth millions of dollars to many communities.

Whatever the vagaries of the weather and however skeptical one may be as to sunspots' solving meteorological problems, even the most conservative scientist recognizes that the sun is after all the fundamental weather breeder. Certainly it is the principal factor in stirring up the convection currents in the earth's atmosphere that are the basis of all our weather changes.

We do know that the light and the heat of the sun undergo variations and that some of the changes appear to follow the outbreaks of sunspots. At least one prominent American scientist is convinced that by measuring variations in solar radiation, weather in certain localities can be predicted far in advance of what the official weather bureaus are doing at the present time.

Stormy weather may mean good business for dealers in umbrellas, storm boots, and raincoats, but it may ruin a bargain day for large department stores. A winter of heavy snows may skyrocket the ski business

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and railroad revenue in snow trains. Cold weather in the North may cause record business for winter resorts in Florida and southern California. If sunspots or changes in the sun which accompany such disturbances are a fundamental factor in predicting mild and frigid winters, then the more we can know about the sun and its behavior the sooner we may be able to solve these problems of world weather.

Recent droughts in the Midwest may have been partly caused by man's wanton disregard of the importance of virgin forests, but there have been droughts throughout history at more or less irregular intervals, many of which have shown a striking correspondence with the sunspot cycle. Billions may be spent for flood control, but a fraction of this amount spent in investigating relationships between the sun and the earth might give us information as to when and where the next period of floods is most likely to be severe. Just as the study of earthquakes has taught us to build resistant buildings in earthquake territory at ultimate enormous savings, so a knowledge that could anticipate extreme weather conditions may well be expected to result in social adjustments that will greatly diminish losses from such causes.

However fascinating may be the far-off worlds, and however intriguing remote galaxies may appear in our big telescopes, the sun is certainly the most important star to us as human beings living on this planet Earth. After all, the sun is a typical star. It is a million times

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bigger than the earth, and its trivial distance of 93,000,000 miles is rather meager where astronomical distances are concerned. We are able to live on this earth of ours because the earth's distance from the sun is such that we get just the right amount and quality of radiation from the sun to make life possible.

Have you ever thought how sensitive a creature man really is? He cannot stand for long very great changes in temperature. Life began where it was warm, presumably in the tropics, and where there was plenty of moisture. Man could not have wandered far from his original habitat had it not been for the discovery of fire. It was the discovery of fire that made it possible for him to maintain bodily comfort even during the rigorous winters of the temperate zones. The human machine is a complicated affair, and there are many other factors besides temperature for efficient running.

That changes in the sun may momentarily affect the balance of all these various factors influencing human temperament and behavior may be speculative but not at all impossible. On such a basis it will do us no harm to venture our imaginations. We may be surprised to find more basis for speculating in these directions than we have been accustomed to suppose. It may be a bit surprising to find in how many different ways changes in the sun are reflected in affairs on the earth.