September 3rd, 1953
Wailuku, Maui
Territory of Hawaii
U. S. A.

Dr. J. C. W. Scott,
Radio Physics Laboratory
Defence Research Board
Shirely's Bay
Ottawa, Canada

Dear Dr. Scott:

It has been suggested by Art Covington that I write to you upon the subject of spread F. This phenomenon seems to be associated with the fluctuations of cosmic static which I am studying out here. About one day a week I get down into the valley and usually spend an afternoon at the Kibei ionosphere station. Their data goes back to March 1944. All of this I've inspected and about half I've analysed for spread F.

As the study is essentially statistical, it seemed that at least 100 observations should be available for analysis in any given category. Thus the year was divided into three seasons, Summer; May, June, July, August; Equinoxes: March, April, Sept., October; Winter: Nov., Dec., Jan., Feb. in consecutive order joining two calendar years. The spread F was divided into four categories, Absent: the cusp of F trace was clear and sharp, Faint: a slight forking of end of trace or a slight broadening but not sufficient to affect the accuracy of reading of f_oF_2, Moderate: trace multivalued or sufficiently broad so that exact reading of f_oF_2 in doubt, f_oF_2 given in parenthesis, Strong: trace so broad and thick that no value of f_oF_2 can be secured or estimated within several megacycles, short disturbance the value of f_oF_2 secured by interpolation and given in brackets, long disturbance of over two hours the letter F is entered.

These divisions are more or less subjective as the phenomenon is progressive. In boarderline cases one operator might enter a guesstimate of (f_oF_2) while another operator might take one look and enter an F. Altho there is some doubt between adjacent classifications there would be no doubt between alternate classifications, say Faint and Strong or Absent and Moderate. While something less than quantitative the above classification seems to portray what is happening in the ionosphere and not what is happening in theequipment. Over the years there have been several changes in apparatus

and many changes in operators. No abrupt changes in the amount of spread F could be detected at these times. Conversely, sporadic E showed great changes whenever the apparatus was changed.

Each hour of the day and each season of the year was then analyzed for the percent time the various categories of spread F were present. In general it has been found that spread F has a single peak about 2am in summer. It has two peaks, one about midnight and one before dawn in winter. The equinoxes are a combination of summer and winter, giving a rather flat characteristic. At solar activity maximum there is much more spread F in summer than in winter. At solar activity minimum there is a bit more spread F in winter than summer and markedly less during the equinoxes. Over the 11 year solar activity cycle the winter characteristic goes thru one cycle, while the summer characteristic goes thru two cycles. Moderate spread F varies from being present 2% of time in winter at solar activity maximum to 40% of time in winter at solar activity minimum. The other seasons and years falling between these limits. The above is a general picture. When all the results are in, some of the details may change. I will see that you get a copy of the end product.

From Covington's letter I gather that some study has been made of the Winnipeg data. If convenient I would like to know how the data was grouped in time and how the amount of spread F was divided; also when the most and least spread F was present and about what percent of time. It is my belief that spread F varies widely from place to place and time to time. Also I have a hunch that it is least somewhere between 30° and 50°N around 90°W. If such a place can be found, that place will be a good place to do radio astronomy. I hope the above gives some idea of my present thinking. Your comments and suggestions will be greatly appreciated by me.

The fotos of Covington's apparatus and curves of results arrived today. I am much impressed not only with the apparatus but also the skill with which it is being used. However, the snow is one thing I don't envy. Please tell him thanks very much. I also read with interest his recent article in the Jal. R.A.S. of Canada about the three intense solar noise bursts and am looking forward to the article about results with 150' antenna.

Sincerely yours,

Grote Reber

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