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NATIONAL RESEARCH COUNCIL

CANADA

ELECTRICAL ENGINEERING
AND RADIO BRANCH

OTTAWA, 12th December, 1947

Mr. Grote Reber,
P. O. Box 4868,
Clevland Park Station,
WASHINGTON 8, D.C.

Dear Mr. Reber;

I have had another look for the Milky Way (Saggittarius) noise on 10.7 centimeters, and so far can't find any. The sensitivity of the set is such that a change in the equivalent temperature of the antenna radiation resistance of 10°C would have been noticed. In the future when we get a better set in operation, I will have another look for the noise.

The solar noise observations are still being made. It looks as though the activity on 10 centimeters is nearly over. This spring the amplitude variations of the 27-day component of noise were about two to three times the value for the quiet sun; while now the same variation is only about 25% of the quiet value. The curve looks very much like a damped oscillation of 27-day period.

I have enclosed a copy of the note which appeared in Terrestrial Magnetism, on sky noise. In looking over the records for the past year it will be impossible to assign the arbitrary character figures to the sky noise, since there were few storms. The storms that have appeared can, however, be definitely associated with significant changes in the magnetic records. On the other hand, many changes in the magnetic traces show no associated changes in the sky noise. This can be explained in part because the magnetic record shows the effect of currents not overhead, while the noise records are from a 6° cone in the direction of the zenith.

I hope your work is progressing satisfactorily.

Yours sincerely,

Arthur E. Covington

AEC:HP

A. E. Covington,
Microwave Section

cc. G. A. Miller

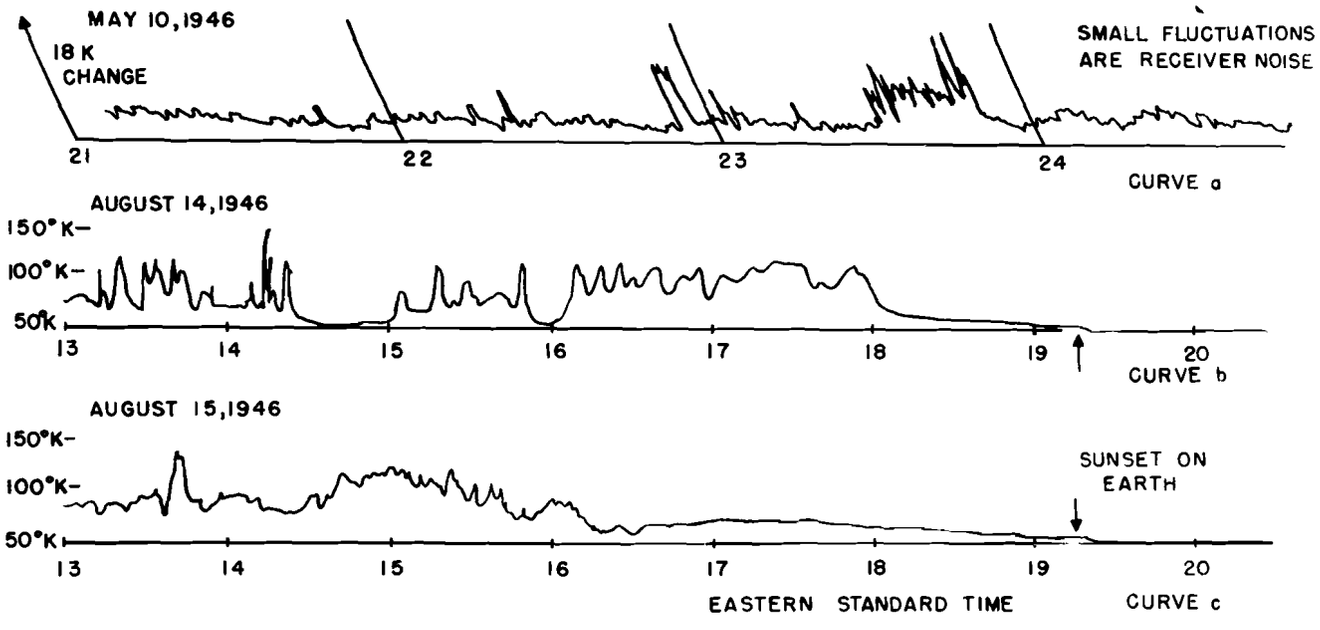
MAY 10,1946
18 K
CHANGE
SMALL FLUCTUATIONS
ARE RECEIVER NOISE
21
22
23
24
CURVE a
AUGUST 14,1946
150°K
100°K
50°K
13
14
15
16
17
18
19
20
CURVE b
AUGUST 15,1946
150°K
100°K
50°K
SUNSET ON
EARTH
13
14
15
16
17
18
19
20
EASTERN STANDARD TIME
CURVE c

FIG. 1

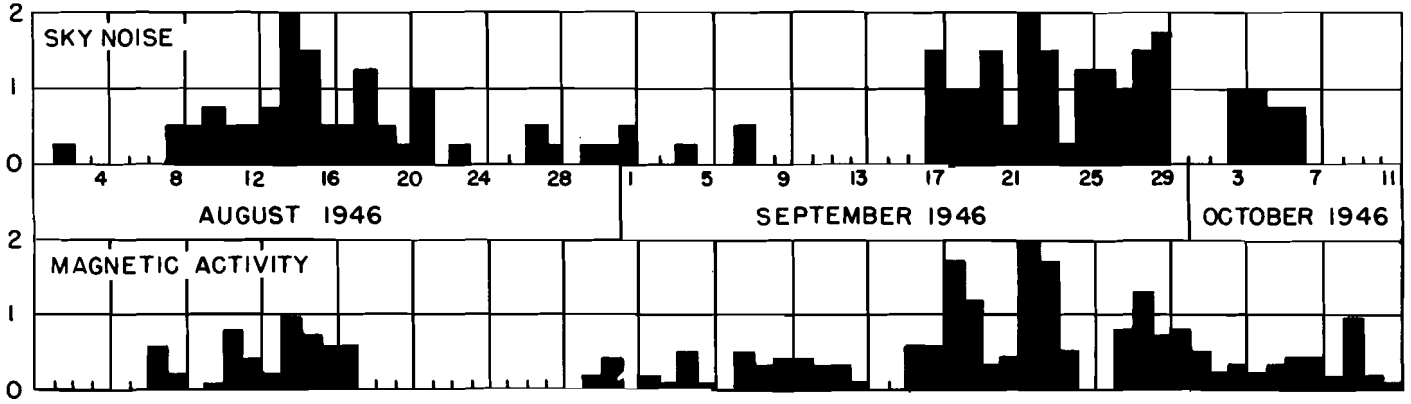
SKY NOISE
2
1
0
4
8
12
16
20
24
28
1
5
9
13
17
21
25
29
3
7
11
AUGUST 1946
SEPTEMBER 1946
OCTOBER 1946
MAGNETIC ACTIVITY
2
1
0

FIGURE 2

MICROWAVE SKY NOISE

A sensitive microwave receiver capable of measuring small differences of radiant energy in the 3000-megacycle band has been constructed after the manner of Dicke[1], and is used to measure the radio noise from the sky at Ottawa, Canada. A continuous record is obtained by means of a recording milliammeter. The receiver is calibrated by measuring the temperature of a resistance which has been substituted for the antenna; thus the equivalent temperature of the sky is used as a measure of the sky noise.

The records taken during the period April 30 to July 23, 1946, were interrupted to make improvements in the receiver, and by occasional set failure. During this period, an antenna with a cone of acceptance of 30° to the half-power points was used. After July 27th, a continuous record was taken using an antenna with an acceptance cone of 6°. In each case the antenna was pointed toward the zenith with the electric vector in the magnetic east-west direction. The narrow beam antenna is astronomically mounted so that solar noise observations can be taken; when this antenna points more than 15° away from the sun, no solar noise can be received, and the background noise is measured independently.

The first strong noise fluctuations were 20°K amplitude on a background of about 75°K, and consisted of two oscillatory bursts of energy, each lasting about eight minutes. These appeared on the afternoon of May 6th at 19:25 and 20:06 hours G.M.T. Near these times, the H and D traces of the magnetograms from Agincourt exhibited two sharp movements in opposite senses, appearing as a distorted U in the traces, and resulting in a shift in the general levels. Later, a sudden commencement storm appeared at 22:25 and reached a maximum of disturbance in the night. During the violent magnetic fluctuations, the sky temperature showed only a gradual decline from early

afternoon values to a constant night value. On the night of May 10th, a noise storm (Fig. 1, curve a) was accompanied by an auroral display, the noise increasing in intensity with the movement of the display from north to south. This marked the beginning of a magnetic and ionospheric storm, increasing in severity during the next four hours. The hourly ionospheric readings taken at Ottawa[2] show the presence of the abnormal E-layer and a spread F-layer at midnight, then complete absorption at the end of the four hours. During the violent magnetic fluctuations, the sky temperature again remained relatively constant. On the magnetically calm days preceding the storm period of May 6-11, there was little variation in sky temperature, and it was concluded there was no correlation with the quiet day solar magnetic variation.

Other attempts to obtain instantaneous correlations with magnetic storms reveal a few more cases. A more general, though less accurate correlation has been obtained by assigning arbitrary character figures to the daily noise fluctuations. These noise figures, together with the American full-day magnetic character figures[3] have been plotted in Fig. 2. During this period the magnetic and noise storms both reached a maximum severity on the same days, August 14 and September 22. The storm of August 14 was followed on the next day by a similar disturbance of reduced intensity, (Fig. 1, curves b and c). For these two days, a corresponding similarity in the daily magnetic storms was also noted. The equinoctial magnetic storm of September was accompanied by evening auroral displays and associated abnormal E-layer ionization. The noise records show a corresponding evening activity, as well as the mid-day storms. Although abnormal E-layer was reported during the meteor shower of October 9th, 1946, the noise records show no increase.

On May 6th, the decline of the sky temperature from an afternoon value to a night value was most pronounced twenty minutes after sunset on earth. This small drop of about 8°K has been noticed on a few other days, (Fig. 1, curves b and c). A corresponding increase of sky temperature some minutes before sunrise on earth has also been noted. This effect, apparently associated with sunrise and sunset in the upper atmosphere, is infrequent, and once occurred exactly at sunrise on earth instead of before.

Although the present data points to a strong relationship between microwave sky noise and geomagnetic activity, further work will be needed before any explanation can be attempted.

The writer sincerely appreciates the assistance and co-operation given by members of the Dominion Observatory, Ottawa.

A.E. Covington,
Electrical Engineering and Radio Branch,
National Research Council,
OTTAWA, Canada.

March 28th, 1947

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1 - R.H. Dicke, Rev. Sci. Inst., 17, 268 (1946)

2 - C.R.W.P.C. Ionospheric Reports, Ottawa, Can.

3 - W.E. Scott, Terr. Magn. Atmos. Elect. 51, 505 (1946)

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copy of letter to: Terrestrial Magnettron & Atmospheric Electricity.

Sept 1947
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