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"A Study of Earth Radar Returns from Alouette Satellite"

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INTRODUCTION

The Center for Research, Inc., Engineering Science Division of the University of Kansas is studying the ground returns observed by the Alouette top-side sounder. The processing of new data from DRTE mentioned in the last report is complete and has yielded 32 data points in addition to the 48 data points from the original set of data.

In January Dr. H. Doemland visited DRTE in order to select data from the Alouette B. The selected data have not yet been received from DRTE.

DATA PROCESSING AND CURRENT ACTIVITY

Correction for the ionosphere absorption has been under study since last summer. The 9 mc "Quiet Day" data has been reduced and a "Quiet Day Curve" plotted. Briefly, the "Quiet Day Curve" was obtained by the following method. The radiometric data at 9 mc collected by Dr. James Warwick at the High Altitude Observatory, Boulder, Colorado, were used. During the quiet hours of 1:00 a.m. to 6:00 a.m. local time the ionosphere is assumed to be transparent to (in this case) 9 mc radiometric signals. Calibrated radiometric power for these times taken over a period of a year is plotted against sidereal time to obtain a scatter diagram. The curve through the uppermost limit of the scattered points is then the "Quiet Day Curve" and represents zero attenuation for incoming signals. From the continuous record of received radiometric power the power received at a particular minute in sidereal time on a particular day may be compared to the Quiet Day Curve at the same sidereal time to obtain the attenuation.

For our purposes we will assume the ionosphere is symmetrical about the earth's geomagnetic axis so that first order corrections may be made on the Alouette data points falling in latitudes corresponding to the latitude of Boulder, Colorado. This correction is underway and appears to amount to 1 - 2 db.

The double ground bounce experiment (ionosphere image radar) is also continuing. This experiment is designed to obtain information on the ground return from a fixed ground based station. Pulses at 5.3mc are directed vertically to the ionosphere and the first and second returns are to be studied. The first return will have suffered some ionospheric absorption in addition to path loss. Comparing this to the transmitted power, the ionospheric absorption may be obtained. The second bounce will in addition have suffered loss due to reflection at the ground. Thus comparing this to the first return should result in information on the ground reflection coefficient. These results are then to be compared to the Alouette data. In addition, this experiment will provide interesting and useful information on ground return under varying conditions of ground moisture, snow, foliage, etc. For this reason data is to be collected daily for at least a year (subject to continuance of the FCC license). Calibration of the transmitter and receiver is now proceeding. Initial experiments with the system have provided excellent first and second bounces.

PROPOSED RESEARCH

Plans are to continue analysis of data from Alouette I and II and correction of these data to account for ionospheric attenuation by means of the Quiet Day data.

We plan to continue the fixed frequency ionosphere double bounce experiment by analysis of variations in daily records of ground return. The return pulses are calibrated and should provide valuable data on the effect of seasonal changes in ground moisture and vegetation on the ground reflectivity in the 5 to 10 mc range. The acquisition of such data necessarily involves daily recording of data for a period of at least one year.