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Improved Definition of Crustal Anomalies for Magsat Data
Quarterly Report No. 3

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The following is a description of the progress made in external field modeling and programming efforts during the third quarter of this project:

1) Definition of the nature of external fields: past observatory data have been examined and analyzed in an effort to more precisely define the nature of certain external field phenomena. In particular, we have been interested in the relationship of measured external field activity to periods of solar maxima and minima. Towards this end observatory data have been obtained for the winter and summer of 1958, a time of solar maxima, and the winter and summer of 1964, a solar minimum. Several varieties of statistical analyses were performed on these data, and computer-generated histograms produced showing sunspot activity and Kp and Dst indices. These investigations revealed that the number of intervals during which external field activity was expected to be quiet did not vary substantially during times of solar minimum and maximum; i.e., the number of quiet intervals appeared to be relatively constant. This result has a practical significance: despite the fact that Magsat was initially aloft during a period of maximum solar activity, it should nevertheless be possible to obtain valid baseline corrections for observatory data collected at that time. A further result of these studies indicated that the largest disturbances in the external field occur during the declining phases of the solar cycle.

2) Baseline Corrections. Observatory data have been obtained for the period from October 1979 to April 1980. It has been necessary to reformat - and in some cases reconstruct - much of this data to render it more compatable with existing methods of baseline analysis. Once this has been done, the observatory data is plotted and scanned to select the five most quiet days during a given one month period. A regression line is then fit to this quiet five day period. The results of this analysis allow the computation of a zero-level baseline for each observatory on a monthly basis. Establishment of these baselines is essential in defining the Sq and Dst corrections. This work will be continuing in the future as more observatory data is received.

3) A subroutine has been developed, based on previously existing programs, to evaluate the Sq field as a function of position and time. This subroutine, similar to that of the FIELDG subroutine for main field representation, performs a spherical harmonic expansion form a set of coefficients of degree and

order four. Each set of coefficients is considered to be a valid representation of the Sq field for a period of only a few days. Using coefficient sets generated during earlier phases of this study, several global contour charts of the Sq field were produced for different time periods. These charts illustrate the strong latitude dependence of the Sq field. The field is usually close to zero near the magnetic equator but can be as large as 40 gammas at latitudes near 60° during periods of the solar maximum.

4) Magsat Data. During the latter part of this quarter we have received 16 tapes of Magsat data covering the period from mid-November to late January. This data is presently undergoing processing and tests are underway to apply the external field corrections that have been developed thus far.

5) As of this report, approximately 8 hours of computer time have been used in the IBM 360/91.