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MAGSAT PROGRAM

Progress Report No. 7

Investigation Number M-41



THE REDUCTION, VERIFICATION AND INTERPRETATION
OF MAGSAT MAGNETIC DATA OVER CANADA

R.L. Coles, Principal Investigator
Co-investigators: G.V. Haines
G. Jansen van Beek
J.K. Walker
L.R. Newitt

Earth Physics Branch
Energy, Mines and Resources Canada
1 Observatory Crescent
Ottawa, Ontario, Canada
K1A 0Y3



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INTRODUCTION

This investigation deals primarily with the magnetic field originating in the solid earth, as measured by Magsat. Techniques described in earlier reports and in publications noted in those reports have enabled preliminary magnetic anomaly maps and maps of the main field and its vector components to be produced for high northern latitudes.

TECHNIQUES AND RESULTS

A major problem in producing accurate maps of the magnetic field using the Magsat data is in reducing the measurements to a common altitude, or alternatively developing a functional representation over a range of altitudes. Consideration is being given to representing the magnetic field in the area 40°N to 83°N by means of functions in spherical coordinates. The usual spherical harmonic formulae, suitable for the whole earth, are numerically untenable for a portion of the earth's surface since the least-squares matrix becomes almost singular. A solution to Laplace's Equation for the magnetic potential over a restricted area has been found, and programming and testing are currently being carried out.

Although refinements to the magnetic anomaly maps are anticipated, based on the application of the method noted above, magnetic anomaly modelling is proceeding. A major effort to date has been to adapt the program SPHERE, from Purdue University, to function correctly on our Cyber computer. This is now operational, for deriving gravity and magnetic models in a spherical coordinate system.

Modelling has indicated a highly magnetic crust in northern Quebec, correlating with a region containing near-surface rocks of high metamorphic grade. The preliminary anomaly map also suggests that this region may extend under the northeastern part of Hudson Bay; this suggestion is supported by recent shipborne magnetic data from the area.

The preliminary scalar anomaly map has been provided in a digital form to the Magsat Investigator Team at NRC Ottawa, for use in their studies of ionospheric and magnetospheric current systems. The crustal anomalies, it has been realized, can produce a significant "noise" component in their modelling procedures under some conditions of the external magnetic field. This is an interesting application of the crustal map, and serves to emphasize the level of interaction between the various facets of geomagnetism.

PUBLICATIONS

There have been no publications during this reporting period.

CONCLUSIONS

No new conclusions can be drawn at this stage. However, it is hoped that during the next reporting period the techniques noted earlier will have been implemented and that modelling will have progressed to an advanced stage.