NSTIF

E82-10138
CR-168523

INVESTIGATION NUMBER : M - 50

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PROGRESS REPORT OF April 1, 1981

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(E82-10138) CONTINUATION OF POTENTIAL FIELD DATA TO A COMMON ALTITUDE (Paris VI Univ.) 3 p HC A02/MF A01 CSCL 05B

N82-21665

Unclas
G3/43 00138

CONTINUATION OF POTENTIAL FIELD DATA TO A COMMON ALTITUDE

by

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OBJECTIVE

The distorsions introduced by the variation of distance between the sources and the measurement points can be important enough to create fake anomalies. The average amplitude of the anomalies at MAGSAT altitude is of the order of a few nT. Thus it is necessary to be careful in reducing MAGSAT data to a common elevation. The achievement of the corresponding anomaly map is of primary importance for the study of regional and long wave length anomalies.

BACKGROUND

From 1973 to 1976 continuation of potential fields has been one of the main concern of our team (our english written papers are given in the list of references).
Though the aim was the handling of aeromagnetic surveys data, the equations were given in various coordinate systems in particular in spherical coordinates. The corresponding algorithm had never been tested and we decided to begin with synthetic data to evaluate the pros and cons of our new method.

RECENT ACCOMPLISHMENTS

Our method consists in representing any harmonic function (in particular the anomaly as function of space coordinates) as a sum of elementary harmonic functions, the continuation being achieved by an inverse technique. We made our tests on a synthetic set of data having the same general characteristics as the Bangui anomaly. Let Ψ be the anomaly, function of geographic coordinates, to be continued. The various parameters of our problem are : λ a characterictic wave length of Ψ , H the distance of continuation, N the number of points on which Ψ is known, D a characteristic length of the domain on which Ψ is continued, P the typical distance between two measurement points and n the number of eigenvalues kept for the representation on the continued function. We reached the following conclusions :

1/ - the use of spherical coordinates implies that $H/P > 1.5$ but numerical stability problems seem to arise when this value is larger than 2.

2/ - the edge effect , although of limited extension with our method, implies that $N > (D + 4H)^2/p^2$.

3/ - to keep error propagation in reasonable bounds implies $N/2 < n < 2N/3$

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4/ - for a good representation of Ψ, we have to choose $P < \lambda/10$. The tests have shown that when these conditions are not fulfilled, the errors can rise up to 20 %, but even in that case the shape of the continued anomalies remains realistic.

FUTURE EMPHASIS

We intend to try various models of the main field (including the one we are preparing) in order to get the anomalies in the area we are interested (mainly the western Europe and the Bangui region). We will continue these anomalies to a common altitude and then compare the resulting maps to upward continued ground data.

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