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PRELIMINARY MODELS OF THE CORE FIELD

by

J.L. LE MOUEL, A. GALDEANO and J. DUCRUIX

OBJECTIVE

Using the CHROFIN tapes containing MAGSAT data for the month of December we prepared two spherical harmonic models. One of these models have been specially designed to study the Bangui anomaly region. In this region we try to downward continue the data and to compare it with the ground level existing map.

BACKGROUND

These models are aimed at long wave length anomaly studies. They do not contain any ground level data and they are made out of a short sample of MAGSAT data (Dec. 2 to 22 1979), we decided to neglect the secular variation effect for such a short time interval. For details on the method we applied to the Bangui area data see our preceding progress report "Continuation of potential field data to a common altitude".

RECENT ACCOMPLISHMENTS

Spherical harmonic analysis

The two models calculated are called MAGP1 and MAGP2, they are both of order and degree 11 and dated 1979.85 . To compute the MAGP1 model we use only points with a latitude lower than 60° and with an external index lower or equal to 1 (for the meaning of this index see our progress report "Separation of internal and external fields : a new technique of data screening").After averaging and decimating the raw measurements we remain with 8902 values of X,Y,Z. One component is theoretically enough to compute a model but we use the three components with respective weight 1.8, 0.6, 0.8 in order to get similar r.m.s. deviations in X,Y and Z.

The MAGP2 model is designed specifically to represent the field in the central region of Africa. We use data points with a latitude lower than 50° but no selection as far as external field agitation is concerned. Inside the area defined by the longitudes 0-40° East and the latitude 25° South - 35° North the data density is roughly ten times greater than outside this area. We get a total of 8844 points and choose a component weighting of 1.8,0.8,0.6 for X,Y and Z respectively.

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Comparison of the two models

The two models are quite similar and this is not surprising. Differences up to 100 nT are found in the series of g°_{2p+1} terms. The origin of such discrepancies comes probably from the difference of processing with respect to the external field situation : MAGP2 data contain 65% of points with an index greater or equal to 2. It has to be remembered that most of subauroral transient events come from the ring current and are then axi-symmetric. Another possible cause could be the difference in the data point distributions, in particular in polar regions the difference between the fields computed by each model can reach 1000 nT. The values of the coefficients of both models are given in Table 1.

Study of the Bangui anomaly

For our study of the Bangui anomaly, we use 18 passes at an altitude of 350 to 400 km. Among these points we keep 158 spread as regularly as possible over a square zone centered at 20°East, 5°North with a side length of 24°. The average distance between two points is 200 km and we downward continue these data using 120 eigenvalues out of 158. We compute first X,Y and Z anomaly maps at ground level and then the total field anomaly map. The results have not been yet judged satisfactory. It seems that the data reduction and selection has to be very carefully performed to reduce the noise at the lowest level possible. It is well known that downward continuation leads to an exponential enhancement of the high frequencies and that the noise has the maximum of its energy spectrum in the high frequency domain.

FUTURE EMPHASIS

As soon as more MAGSAT data will be processed (this is a rather lengthy operation with our computer), we will prepare better models of the main field. A longer sample of data means that we will have to take the secular variation into account, but this will allow a better geographic distribution of data. We will also compute new models for regional studies : first the Bangui anomaly and then (this is a long term aim) the whole Western Europe.

TABLE 1

		MAGP1		MAGP2	
n	m	g_n^m	h_n^m	g_n^m	h_n^m
1	0	-29958.8		-29897.4	
1	1	-1993.2	5599.6	-1993.9	5589.0
2	0	-1996.8		-2001.4	
2	1	3040.2	-2112.6	3045.1	-2104.5
2	2	1668.7	-175.0	1664.8	-176.8
3	0	1310.3		1407.0	
3	1	-2177.5	-346.7	-2175.9	-350.6
3	2	1242.1	286.7	1248.1	288.8
3	3	838.8	-239.3	838.3	-235.7
4	0	939.1		932.2	
4	1	780.0	219.4	787.0	222.7
4	2	403.6	-251.1	402.0	-253.2
4	3	-421.2	48.8	-420.0	44.2
4	4	204.5	-293.1	206.6	-291.6
5	0	-183.9		-73.6	
5	1	358.7	48.2	362.0	44.5
5	2	258.0	152.5	259.5	154.8
5	3	-70.2	-155.7	-70.7	-152.4
5	4	-155.8	-80.5	-159.5	-82.4
5	5	-52.2	91.6	-51.2	90.3
6	0	49.9		44.9	
6	1	64.1	-12.5	72.5	-8.7
6	2	39.2	93.8	42.2	91.3
6	3	-193.1	67.5	-193.3	65.7
6	4	1.2	-43.8	4.5	-42.5
6	5	15.9	-4.4	13.7	-2.2
6	6	-107.5	14.2	-108.0	13.1
7	0	100.5		189.4	
7	1	-56.9	-81.7	-52.1	-85.5
7	2	1.3	-27.7	2.2	-26.1
7	3	19.7	-4.8	21.7	-5.8
7	4	-10.9	16.1	-12.8	16.4
7	5	-1.6	20.8	-0.5	17.9
7	6	9.6	-24.5	11.7	-22.7
7	7	0.0	-10.7	-1.4	-10.2
8	0	20.4		18.1	
8	1	6.0	8.8	12.8	10.9
8	2	-1.0	-17.8	2.0	-20.5
8	3	-9.6	3.0	-10.7	1.3
8	4	-6.7	-21.8	-6.5	-21.4
8	5	4.3	7.1	3.8	9.1
8	6	4.2	17.9	2.1	15.8
8	7	5.0	-12.0	7.0	-12.9
8	8	-1.0	-16.0	-0.6	-14.9

		MAGP1		MAGP2	
n	m	g_n^m	h_n^m	g_n^m	h_n^m
9	0	26.7		73.0	
9	1	12.0	-19.7	16.3	-22.6
9	2	1.1	14.4	1.5	16.2
9	3	-13.6	8.1	-11.2	6.7
9	4	9.6	-5.4	9.7	-4.7
9	5	-2.8	-5.6	-3.9	-6.2
9	6	-3.3	7.9	-1.4	9.2
9	7	8.1	8.7	6.1	9.8
9	8	2.3	-3.6	-1.9	-6.7
9	9	-6.2	2.3	-5.1	1.7
10	0	-2.1		-1.7	
10	1	-4.4	0.9	-0.9	2.9
10	2	0.2	1.2	3.2	-1.7
10	3	-4.2	1.6	-5.1	-0.6
10	4	-2.1	6.2	-2.8	7.1
10	5	4.2	-4.3	4.2	-4.3
10	6	3.9	-0.5	3.5	-0.6
10	7	-0.1	-0.3	0.8	-1.4
10	8	1.2	1.9	1.6	3.5
10	9	4.7	-0.7	2.8	-0.4
10	10	0.3	-5.3	0.3	-6.3
11	0	12.6		24.8	
11	1	0.2	3.6	2.2	1.2
11	2	-2.7	0.5	-1.3	2.1
11	3	1.7	-0.9	3.7	-3.8
11	4	0.0	-3.2	0.6	-3.0
11	5	-0.5	1.0	-1.8	1.0
11	6	-0.7	0.4	-0.3	0.2
11	7	1.9	-3.0	2.0	-2.6
11	8	1.6	0.8	1.6	-0.5
11	9	-2.0	-1.7	-0.9	-1.8
11	10	1.8	-2.6	2.1	-1.4
11	11	3.9	0.8	3.8	1.0