FIFTH QUARTERLY REPORT

FOR

EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA

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During this quarterly period the following modeling and software development work has been done:

I. The cause of the apparent bulge in the power spectrum presented in the third quarterly report (Dipole Model #4 from Table I) was investigated via a simulation. The simulation consisted of generating synthetic data at exactly the same spatial locations as the MGST (6/80) data set used in the equivalent dipole source models, with the data consisting of measurements due to a crustal field plus a geocentric dipole only. The crustal field model used was the global POGO equivalent source model, which was expanded to degree and order 40 in spherical harmonics to analyze its spectral character, as well as to generate the synthetic data. Fits were then made to this data set with a single geocentric dipole and with a geocentric dipole plus dipoles of 32°×32° and 21°×21° density at the core/mantle boundary. The results for cases with and without noise are given in Table II, and the spectra of selected results are given in Figure 2. The results seem to indicate that the beginning of the bump in the spectrum of Dipole Model #4 in Figure 1 (Report #3) is due to crustal influence, while the departure of the spectrum from that of MGST (12/80-2) around expansion order 17 is due to the resolution limits of the dipole density (i.e., $\frac{360°}{21°} \cong 17$). This investigation is continuing.

II. A program error was detected in the option to simultaneously estimate observatory anomaly biases. The bug is being investigated.

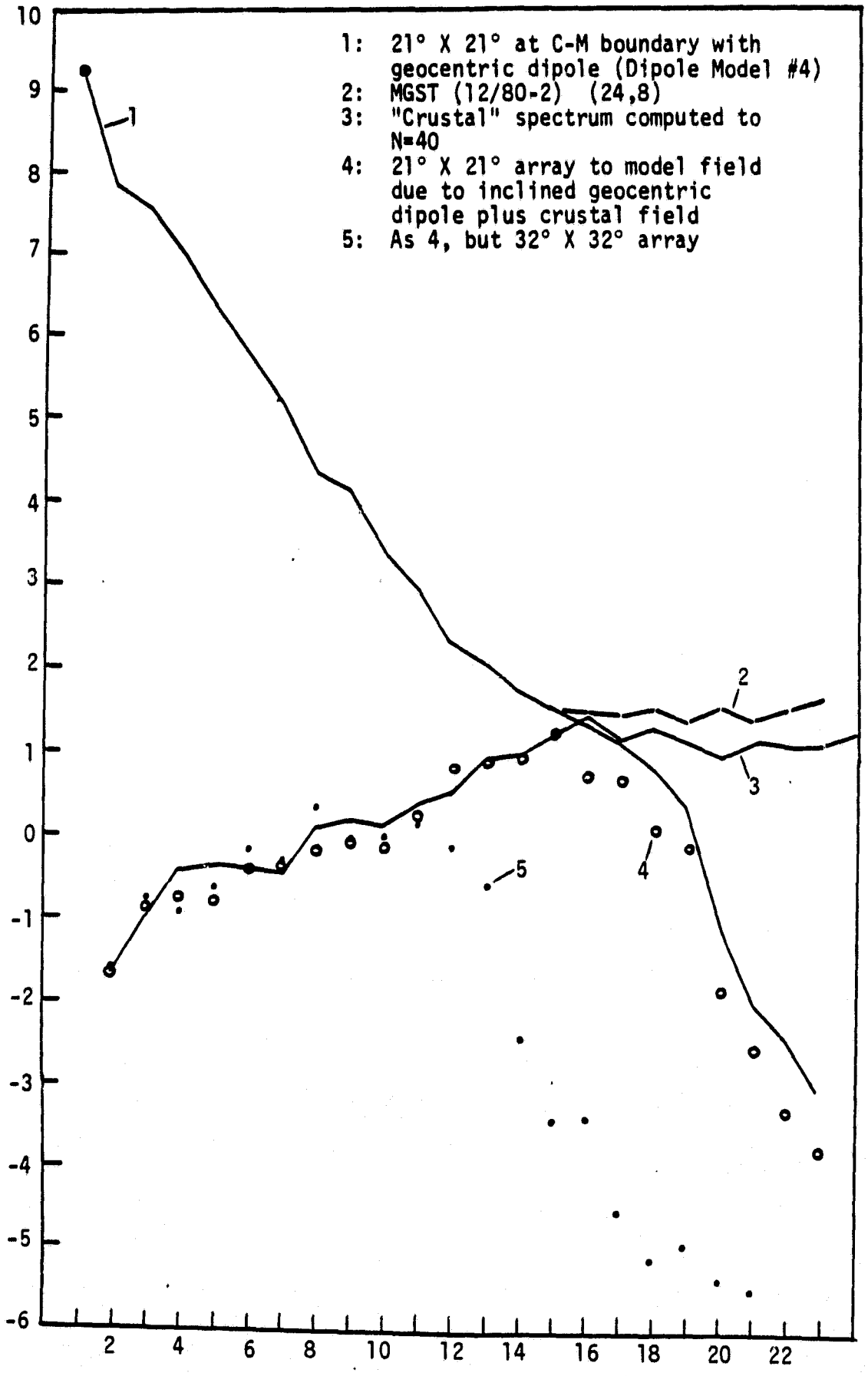
1: 21° X 21° at C-M boundary with geocentric dipole (Dipole Model #4)
2: MGST (12/80-2) (24,8)
3: "Crustal" spectrum computed to N=40
4: 21° X 21° array to model field due to inclined geocentric dipole plus crustal field
5: As 4, but 32° X 32° array
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
2
4
6
8
10
12
14
16
18
20
22

Table 2

Simulation with POGO Crustal Anomaly Field Model
Synthesized Data Set is the Vector Sum of a Centered Dipole and the Crustal Field

Model	Dipole Density at core/mantle Boundary	# dipoles	# degrees of freedom	Geocentric Dipole included	Noise	RMS to synthesized data
6	--	1	3	YES	NO	8γ
7	32°x32°	43	129	YES	NO	2γ
8	32°x32°	43	129	YES	6γ	6γ
9	21°x21°	93	279	YES	NO	1γ
10	21°x21°	93	279	YES	6γ	6γ