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Technical Report WK/91/2

Regional Geophysics Series

Regional infill gravity survey in north-east Antrim, Northern Ireland

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Cover illustration

250 m pixel DTM of the survey area, viewed from the north-east

Bibliographic reference

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Keyworth, Nottingham British Geological Survey 1991

SUMMARY

An infill regional gravity survey was carried out in August - September 1990 over an upland region in north-east Antrim, Northern Ireland. The purpose of the survey was to define the nature of a north-south striking gravity anomaly which is located on the south-east margin of the Highland Border Ridge.

A total of 107 gravity stations were collected both along roads and over the hills. The revised Bouguer anomaly map shows that the gravity gradient over the anomaly is broad, with a small low developed in the north-east. A simple two-and-a-half dimensional gravity model demonstrates that the gradient is due to a low angled contact between denser Dalradian rocks to the north-west and Permo-Trias sediments to the south-east.

CONTENTS

1. INTRODUCTION

This report describes an infill regional gravity survey carried out over an upland area in the north-east of Northern Ireland during August and September 1990. The area of the survey is bounded approximately by the villages of Cushendall, Carnlough and Broughshane and is shown in figure 1. This upland region is described as one of the last untracked areas of Northern Ireland and as such is only accessable by foot.

The regional gravity survey of Northern Ireland carried out in 1959 and 1960 (Bullerwell, 1961) concentrated data collection along roads and tracks where known heights were available from Ordnance Survey benchmarks and spot heights. Untracked areas were therefore not covered by the survey although eight data points, whose heights were estimated from the nearest topographic contours, were collected in the area of this report. Figure 2 is a colour contour Bouguer anomaly map of the regional gravity data with the data points indicated by a cross. It can be seen that there is a large north-south striking gravity gradient across the region. To the north-west are high values over the Highland Border Ridge and to the south-east are low values over Permo-Trias sediments. The form of the gravity gradient is not well controlled due to the lack of data over it. This region is of interest because it marks a boundary between older Dalradian rocks to the north and younger Permo-Trias to the south. It has been proposed by Busby, 1990, that this gravity gradient may be associated with other west-east striking gravity and magnetic lineations to the west and may mark the line of the Highland Boundary Fault extension into Northern Ireland. The infill gravity survey was therefore undertaken in order to better define the form of the gravity gradient.

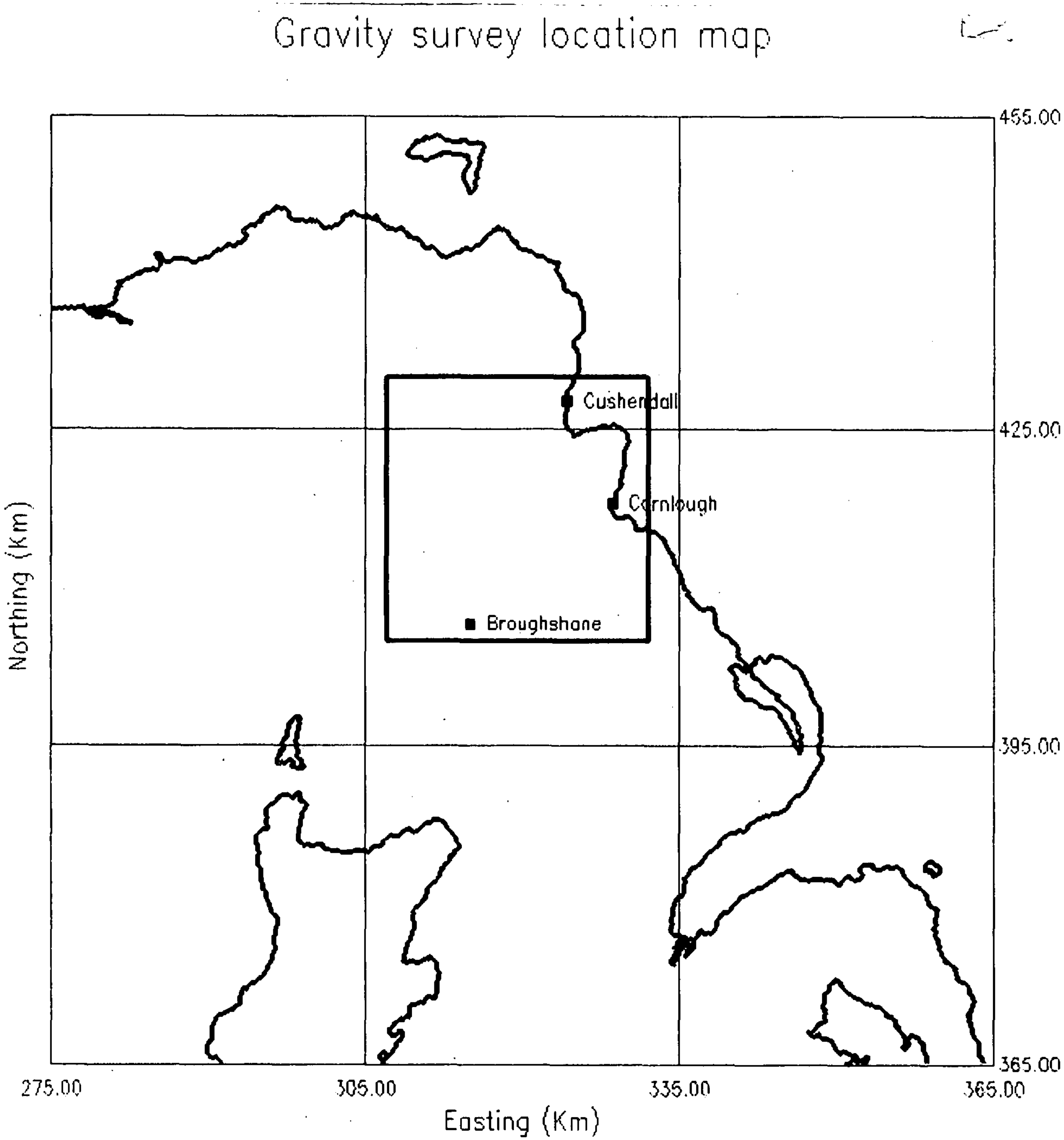


Figure 1. Location map for the infill gravity survey. The survey area is shown by the marked rectangle.

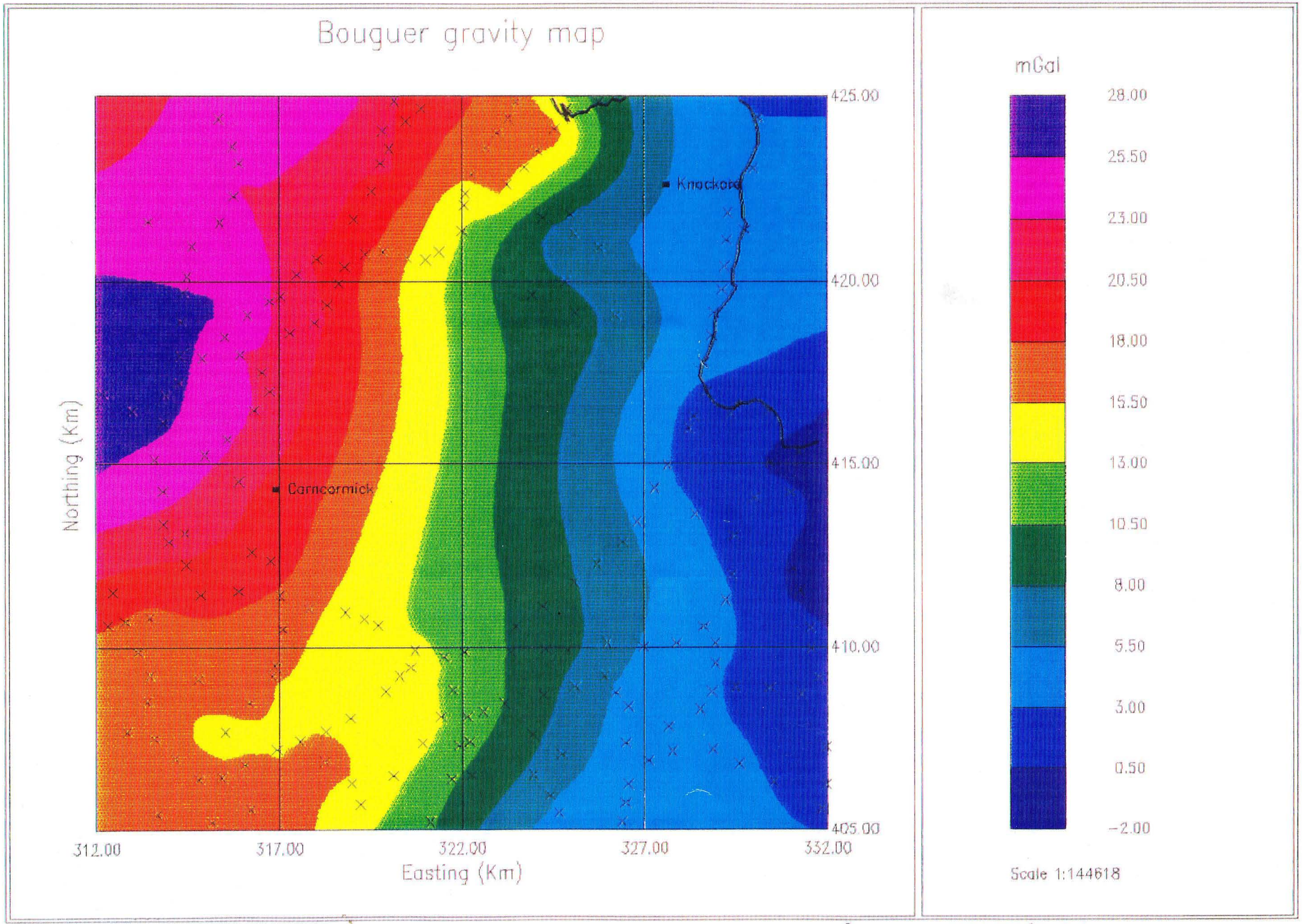


Figure 2. Bouguer gravity anomaly map, reduced at a density of 2.7 Mg/m^3, of the 1959/1960 data.

2. FIELD SURVEY PROCEDURES

When a gravity value is measured there are a number of factors which influence the magnitude of the value. One of these is the density of the underlying geology, but, since the force due to gravity follows an inverse square law with distance, the main factor is the height above sea level of the gravity station. This is taken into account in the processing of the data when they are reduced to sea level, but it is therefore necessary to know the height of the gravity station. For regional gravity surveys the heights need to be known to an accuracy of one metre. Due to the lack of bench marks and spot heights in the region of the survey the necessary heights were obtained by topographic surveying.

Topographic surveying procedure

The aim of the gravity survey was to obtain infill data to a station density of approximately one per square kilometre. This therefore required topographic surveying over long distances. This was accomplished by using an electronic theodolite coupled to a an infra-red electronic distance measuring (EDM) device. The required distance was obtained by bouncing the infra-red beam off a reflective target back to the EDM. The vertical angle from the theodolite to the target was read from the theodolite which then gave a direct read-out of horizontal distance to the target and height difference between the target and theodolite. The heights of the target and theodolite were then measured to give the height difference at ground level.

The equipment used was a WILD T1000 electronic theodolite and a WILD DI3000 Distomat EDM which can measure distances of up to six kilometres. In order to obtain the co-ordinates of the gravity stations two surveying procedures were used. The first was traversing which involves starting from a known point and a known bearing and measuring the horizontal clockwise angle between the bearing and a new point and the horizontal distance to the new point. This fixes the new points position to which the theodolite is then moved. The horizontal clockwise angle from the theodolites previous position to the next new point and the horizontal distance to the next new point are then measured which fixes this point. This procedure is repeated along the length of the traverse which ideally terminates on a known point which then provides an estimate of the error. For this survey three personnel were used, one leading and holding the reflective target, the second operating the theodolite and EDM and the third marking the previous positions of the theodolite with a ranging rod. Surveyed positions to which it was required to return were marked with a wooden stake, intermediate points were temporarily marked with a bamboo cane. Whenever possible Ordnance Survey trig points were used as the known points, two, Carncormick and Knockore, are within the bounds of the survey (see figure 2).

With a network of wooden stakes in-place extra points were surveyed-in with the second procedure, radiation. This involves setting up the theodolite and EDM over a wooden stake, whose co-ordinates and height are now known, and measuring the horizontal clockwise angle between a known bearing and the extra point and the horizontal distance to the extra point. The height difference was read directly from the electronic theodolite. The known bearings were taken to trig points, other wooden stakes or identifyable man made structures shown on the 1:10,000 map sheets. Since the co-ordinates and height of each extra point are a one-off measurement it is not possible to assess the error.

Gravity surveying procedure

The gravity measurements were taken with Lacoste and Romberg gravity meter G280. This is a relative instrument which measures the difference in gravity between points and not the absolute value of gravity. It is therefore necessary to establish a base within the area whose absolute value of gravity is known at which the gravity meter is read at the beginning and end of each day. This base was established in a car park at

Cushendall. It's absolute value of gravity was measured by linking it to two established bases on the shores of Lough Neagh. (A link involves reading the gravity meter at the unknown base, then at the established base and then at the unknown base. The two readings at the same base give a measure of the instrumental drift for which the readings can then be corrected.) The Lough Neagh bases were Antrim Marine and Toome (New) which are reported in Tully, 1983. Two links were made to the bases which resulted in an absolute value of gravity for the Cushendall base of;

$$G = 981\ 525.01 \pm 0.01 \text{ mGal}$$

On gravity surveying days base readings were taken at the beginning and end of each day at the Cushendall base in order to give a measure of the instrumental drift. Due to the inaccessability of the upland areas it was impractical to return to the base during the day. Gravity measurements were taken at the wooden stakes established by the traversing topographic surveying and at the extra points which were surveyed in by the radiation method at the same time as the gravity measurement. Topographic surveying was impossible on days with low cloud and so some infill gravity stations were established on the roads.

3. DATA PROCESSING

The survey was undertaken over a four week period, but a considerable amount of time was lost to the weather during the first two weeks. As a result a total of 107 gravity stations were measured, 69 on the hills and 38 on the roads.

Topographic surveying data processing

When surveying over long distances a number of corrections have to be applied to the distance data before the calculation of heights and co-ordinates. These are an atmospheric correction for the refraction of the infra-red beam; a correction to reduce the measured distances to those that would have been made at sea level and a map projection scale factor correction to allow for the change in the scale factor from it's value of 1.0 at the central meridian. (Note that the Irish grid is a Transverse Mercator projection on the Airy spheroid.) Values were calculated for each of these corrections and then combined into a single parts per million error which was entered into the electronic theodolite. The theodolite corrected measured distances before displaying the result on the control panel.

Due to the inaccessability of the area only three points whose co-ordinates and heights were known were included in the survey. From these the maximum error in the co-ordinates was found to be three metres, but since this is within the desired accuracy of ten metres no attempt has been made to distribute this error. The error in the heights has been distributed linearly resulting in the desired accuracy of one metre.

Gravity data processing

The gravity data were reduced to Bouguer anomaly values using conventional procedures (see for example Telford et al., 1976). The parameters used in the reduction were a free air gradient of 0.3086 mGal/m, a Bouguer constant of 0.041929 mGal/m and normal gravity calculated from GRS67. The reduction density was 2.7 Mg/m^3. Due to the steep terrain the gravitational effect of the topography is likely to be quite large for some stations. Some considerable effort was therefore expended in performing terrain corrections, a description of which is given below.

Rollin, 1990, has produced a computer program for performing terrain corrections from a digital terrain model. The gravitational effect of adjacent terrain is calculated as conical octants centred on the gravity station, near terrain as vertical prisms and far terrain using a vertical line mass algorithm. For the zone beyond 20 Km from the gravity station earth curvature is allowed for by using a dipping line mass algorithm.

Two digital terrain models (DTM's) were produced of the topography. The first consisted of average height estimates in 250 sq. m units of the Irish grid. The estimates for on-shore areas were made from the 1:10,000 map sheets and marine areas from the Admiralty charts. The area covered was between eastings 309 Km to 335 Km and northings 403 Km to 428 Km. This resulted in a total of 10,400 height estimates. The 250 sq. m DTM is shown in figure 3. The second DTM consisted of height estimates on a 1 Km grid which covered the area between eastings 272 Km to 368 Km and northings 367 Km to 468 Km. This grid of 9,696 points was produced from 6,097 height estimates. These were obtained from the land and marine gravity data, the 250 sq. m DTM (averaged to 1 sq. Km), spot heights from the 1:50,000 map sheets and the Admiralty charts. This DTM is shown in figure 4.

The inner zone terrain corrections out to 3 Km from each gravity station were made with the 250 sq. m DTM, except for 7 road stations which fell outside of the DTM. Their inner zone terrain corrections were done out to Hammer zone G (1.53 Km from the gravity station) with the chart method of Turnbull, 1984. The outer zone terrain corrections for all of the stations were carried out to Hammer zone N (32.667 Km from the gravity station) using the 1 Km grid DTM. With the DTM's established the terrain corrections for the 1959/1960 data within a rectangle defined by eastings 312 Km to 332 Km and northings 406 Km to 425 Km have been recalculated. The result of subtracting the original from the new terrain correction for each station is shown in table 1. It can be seen that most of the original terrain corrections are less than the new, but not by very large values. This is probably because the outer zone terrain corrections were not done to the original data. However there are a few terrain corrections which are markedly different and in which the original correction is greater than the new. These occurr mainly in Glenariff and

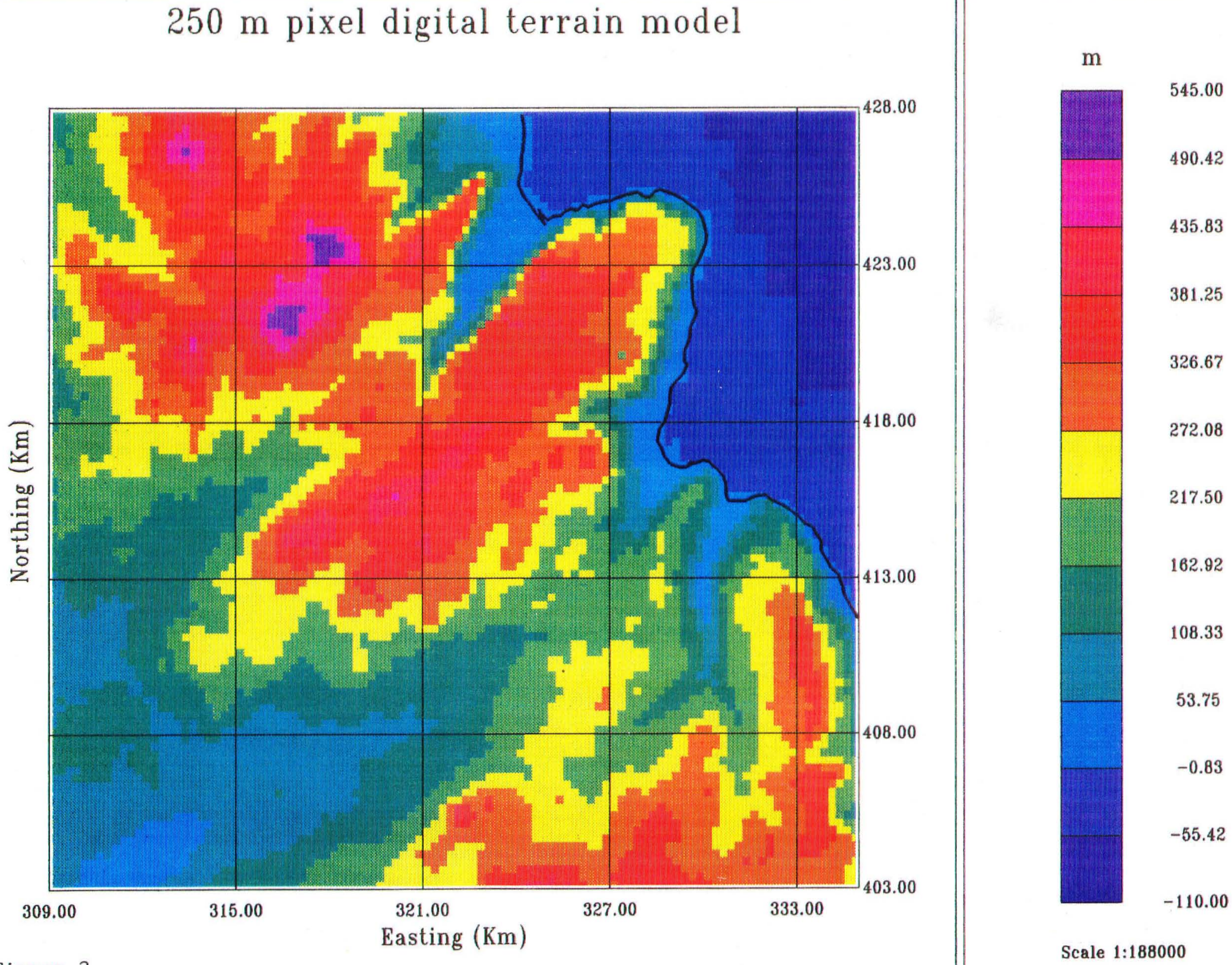
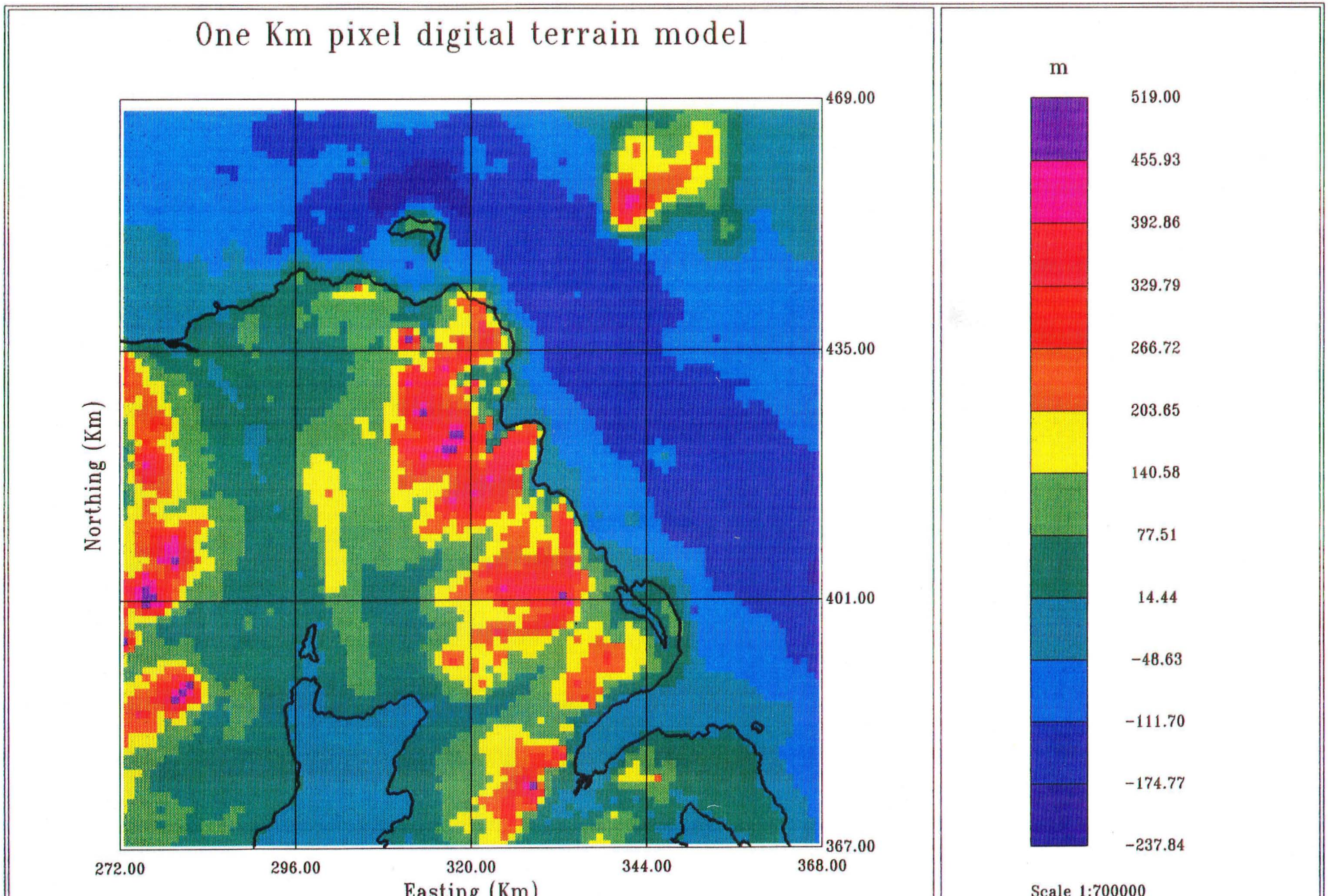

250 m pixel digital terrain model
Northing (Km)
Easting (Km)
309.00
315.00
321.00
327.00
333.00
428.00
423.00
418.00
413.00
408.00
403.00
m
545.00
490.42
435.83
381.25
326.67
272.08
217.50
162.92
108.33
53.75
-0.83
-55.42
-110.00
Scale 1:188000

Figure 3.



One Km pixel digital terrain model
469.00
435.00
401.00
367.00
Northing (Km)
272.00
296.00
320.00
344.00
368.00
Easting (Km)
m
519.00
455.93
392.86
329.79
266.72
203.65
140.58
77.51
14.44
-48.63
-111.70
-174.77
-237.84
Scale 1:700000

Figure 4.

Table 1. Listing of the terrain corrections (TC) for the gravity stations within the rectangle eastings 312 Km to 332 Km and northings 406 Km to 425 Km. Original TC is from the 1959/1960 survey, New TC has been calculated from the digital terrain models and Org.-new is the result of subtracting the two TC's.

Station No.	Co-ordinates (km) Easting	Northing	Original TC	New TC	Org.-new TC
U1 19A08	315.35	424.38	0.19	0.43	-0.24
U1 19A09	315.74	423.65	0.32	0.52	-0.20
U1 19A10	315.90	423.18	0.37	0.56	-0.19
U1 19A11	315.77	422.28	0.49	0.94	-0.45
U1 19B01	319.53	422.42	0.55	0.66	-0.11
U1 19B02	319.83	424.07	1.11	1.23	-0.12
U1 19B03	320.15	424.87	1.06	1.54	-0.48
U1 19B08	320.03	423.59	1.17	1.06	0.11
U1 19B09	320.47	424.33	1.47	1.86	-0.39
U1 19B10	320.90	424.68	1.63	2.00	-0.37
U1 19B19	319.78	423.20	1.60	0.80	0.80
U1 20A01	324.89	424.69	3.78	1.81	1.97
U1 20A02	329.98	423.06	2.59	2.32	0.27
U1 20A03	330.10	424.43	2.95	2.19	0.76
U1 20A07	325.74	424.85	3.68	2.74	0.94
U1 20A15	324.06	423.55	7.68	3.65	4.03
U1 20A16	323.23	422.62	7.68	4.16	3.52
U1 20A17	323.71	423.09	7.61	4.12	3.49
U1 20A18	324.53	424.12	7.72	2.75	4.97
U1 20A21	323.47	424.85	4.28	2.82	1.46
U1 20A22	323.27	424.42	4.76	2.76	2.00
U1 20A23	322.96	424.03	5.92	3.34	2.58
U1 20A24	322.65	423.60	4.76	3.33	1.43
U1 20A25	322.26	422.89	4.64	3.82	0.82
U1 20A26	322.10	422.36	4.58	4.48	0.10
U1 20A29	329.47	422.62	3.49	2.67	0.82
U1 23B12	312.16	416.95	0.16	0.34	-0.18
U1 24A01	312.98	416.46	0.44	0.34	0.10
U1 24A02	313.88	416.90	0.31	0.64	-0.33
U1 24A03	313.84	416.15	0.60	0.35	0.25
U1 24A04	314.24	417.25	0.29	0.58	-0.29
U1 24A05	314.28	417.98	0.49	0.62	-0.13
U1 24A06	314.33	418.90	0.70	0.75	-0.05
U1 24A07	314.38	419.70	0.45	0.75	-0.30
U1 24A08	314.64	420.95	0.47	0.67	-0.20
U1 24A09	313.43	421.59	0.27	0.59	-0.32
U1 24A10	315.40	421.58	1.11	0.94	0.17
U1 24A11	314.49	420.13	0.48	0.73	-0.25
U1 24A12	314.92	417.90	0.27	0.42	-0.15
U1 24A13	315.53	418.49	0.15	0.41	-0.26
U1 24A14	316.14	419.09	0.25	0.64	-0.39
U1 24A15	316.76	419.47	0.46	0.89	-0.43
U1 24A16	315.94	418.01	0.18	0.48	-0.30
U1 24A17	316.52	417.53	0.34	0.52	-0.18
U1 24A18	316.76	417.01	0.45	0.59	-0.14
U1 24A19	316.33	416.48	0.56	0.63	-0.07

Station No.	Co-ordinates (km) Easting	Northing	Original TC	New TC	Org.-new TC
U1 24B01	321.39	420.79	1.72	1.91	-0.19
U1 24B02	321.01	420.58	0.53	1.23	-0.70
U1 24B03	320.50	420.63	0.35	0.93	-0.58
U1 24B04	319.85	420.79	0.22	0.64	-0.42
U1 24B05	319.36	420.73	0.13	0.62	-0.49
U1 24B06	318.80	420.40	0.12	0.56	-0.44
U1 24B07	318.63	419.94	0.10	0.42	-0.32
U1 24B08	318.04	420.60	0.28	0.84	-0.56
U1 24B09	318.31	419.35	0.11	0.39	-0.28
U1 24B10	317.97	418.87	0.38	0.45	-0.07
U1 24B11	317.31	418.60	0.62	0.62	0.00
U1 24B12	319.05	421.66	0.27	0.74	-0.47
U1 24B13	317.05	419.60	0.38	0.91	-0.53
U1 24B14	317.48	420.19	0.40	1.02	-0.62
U1 25A01	328.68	417.00	1.72	1.02	0.70
U1 25A02	330.40	416.45	2.74	1.38	1.36
U1 25A03	329.35	416.39	2.08	1.75	0.33
U1 25A04	328.61	417.78	1.74	1.07	0.67
U1 25A05	328.83	418.52	1.67	1.08	0.59
U1 25A06	329.75	421.40	1.89	1.24	0.65
U1 25A07	329.29	421.84	2.00	2.07	-0.07
U1 25A08	329.26	421.13	1.73	1.80	-0.07
U1 25A09	329.20	420.41	1.59	1.34	0.25
U1 25A10	329.13	419.77	1.56	1.17	0.39
U1 25A11	328.90	419.14	1.61	1.11	0.50
U1 25A12	328.36	416.32	1.76	1.20	0.56
U1 25A13	322.06	422.04	3.92	4.40	-0.48
U1 25A14	322.01	421.36	3.27	3.72	-0.45
U1 25A16	324.96	421.80	1.66	1.04	0.62
U1 25A21	325.11	419.15	0.97	0.58	0.39
U1 25A22	326.19	419.09	0.74	1.65	-0.91
U1 27B22	312.31	410.60	0.24	0.24	0.00
U1 28A01	313.13	409.88	0.33	0.35	-0.02
U1 28A02	312.78	410.71	0.33	0.30	0.03
U1 28A03	312.46	411.50	0.31	0.27	0.04
U1 28A04	313.99	412.89	0.27	0.42	-0.15
U1 28A05	313.84	413.36	0.29	0.35	-0.06
U1 28A06	313.82	414.27	0.38	0.39	-0.01
U1 28A07	313.60	415.13	0.24	0.26	-0.02
U1 28A08	314.97	415.26	0.43	0.50	-0.07
U1 28A09	315.89	414.53	0.50	1.25	-0.75
U1 28A10	315.60	415.68	0.63	0.69	-0.06
U1 28A11	314.43	413.13	0.27	0.53	-0.26
U1 28A12	313.47	410.82	0.22	0.53	-0.31
U1 28A13	314.86	411.43	0.27	0.33	-0.06
U1 28A14	314.48	412.25	0.23	0.48	-0.25
U1 28A15	315.89	411.53	0.17	0.30	-0.13
U1 28A16	317.02	411.42	0.22	0.43	-0.21
U1 28A17	316.25	412.61	0.27	0.53	-0.26
U1 28A18	316.78	412.38	0.25	0.53	-0.28
U1 28A19	317.10	410.51	0.29	0.40	-0.11
U1 28A20	316.89	409.52	0.21	0.36	-0.15
U1 28B01	317.80	411.06	0.33	0.35	-0.02

Station No.	Co-ordinates (km) Easting	Northing	Original TC	New TC	Org.-new TC
U1 28B02	318.81	410.97	0.29	0.34	-0.05
U1 28B03	319.32	410.78	0.36	0.39	-0.03
U1 28B04	319.70	410.62	0.42	0.42	0.00
U1 28B05	320.72	409.93	0.53	0.42	0.11
U1 28B06	320.59	409.47	0.53	0.36	0.17
U1 28B07	321.52	409.75	0.37	0.29	0.08
U1 28B08	322.05	409.88	0.44	0.34	0.10
U1 29A01	323.34	409.89	0.20	0.27	-0.07
U1 29A02	324.29	409.96	0.07	0.22	-0.15
U1 29A03	324.89	409.92	0.14	0.20	-0.06
U1 29A04	325.98	410.14	0.09	0.16	-0.07
U1 29A05	326.97	410.02	0.08	0.22	-0.14
U1 29A06	323.47	410.56	0.27	0.34	-0.07
U1 29A07	324.21	411.12	0.23	0.32	-0.09
U1 29A08	325.08	411.78	0.20	0.30	-0.10
U1 29A09	325.68	412.28	0.11	0.22	-0.11
U1 29A10	326.40	412.89	0.03	0.22	-0.19
U1 29A11	326.81	413.43	0.09	0.29	-0.20
U1 29B01	327.89	410.13	0.31	0.29	0.02
U1 29B02	328.61	410.57	0.06	0.26	-0.20
U1 29B03	328.95	410.13	0.16	0.35	-0.19
U1 29B04	329.21	411.28	0.41	0.45	-0.04
U1 29B05	329.40	411.99	0.55	0.80	-0.25
U1 29B06	329.44	413.06	0.87	1.27	-0.40
U1 29B07	330.02	414.10	1.10	1.22	-0.12
U1 29B08	330.42	415.07	1.31	1.30	0.01
U1 29B09	328.38	413.64	0.27	0.51	-0.24
U1 29B10	327.64	414.98	0.77	0.98	-0.21
U1 29B11	328.22	415.98	1.73	1.32	0.41
U1 29B12	327.27	414.36	0.40	0.90	-0.50
U1 29B13	331.21	415.34	0.99	1.15	-0.16
U1 29B14	331.00	414.24	0.85	1.15	-0.30
U1 29B15	331.06	412.17	0.32	1.14	-0.82
U1 29B16	331.25	411.56	0.09	0.89	-0.80
U1 29B17	331.52	410.55	0.32	0.57	-0.25
U1 29B18	331.57	409.99	0.23	0.50	-0.27
U1 33A06	315.42	406.44	0.23	0.21	0.02
U1 33A07	316.93	407.21	0.22	0.28	-0.06
U1 33A08	316.07	406.81	0.24	0.27	-0.03
U1 33A09	315.53	407.69	0.28	0.29	-0.01
U1 33A10	316.19	408.50	0.29	0.32	-0.03
U1 33A11	316.80	409.24	0.17	0.31	-0.14
U1 33A15	314.15	406.97	0.20	0.21	-0.01
U1 33A16	313.58	407.54	0.20	0.17	0.03
U1 33A17	313.40	408.53	0.18	0.20	-0.02
U1 33A18	313.45	409.24	0.20	0.25	-0.05
U1 33A19	314.79	409.14	0.27	0.41	-0.14
U1 33A20	312.84	407.71	0.13	0.13	0.00
U1 33A23	314.80	406.39	0.31	0.24	0.07
U1 33B01	317.58	407.44	0.53	0.29	0.24
U1 33B02	318.28	407.72	0.51	0.31	0.20
U1 33B03	318.95	408.09	0.46	0.34	0.12
U1 33B04	319.91	408.82	0.36	0.30	0.06

Station No.	Co-ordinates (km) Easting	Northing	Original TC	New TC	Org.-new TC
U1 33B05	320.29	409.24	0.36	0.32	0.04
U1 33B06	321.42	408.13	0.27	0.35	-0.08
U1 33B07	321.76	408.84	0.29	0.34	-0.05
U1 33B08	322.15	408.12	0.22	0.28	-0.06
U1 33B09	321.93	407.32	0.29	0.41	-0.12
U1 33B10	320.91	407.38	0.36	0.38	-0.02
U1 33B11	321.71	406.38	0.27	0.62	-0.35
U1 33B12	320.12	406.50	0.30	0.32	-0.02
U1 33B18	318.98	406.29	0.37	0.28	0.09
U1 33B19	318.24	406.89	0.44	0.24	0.20
U1 34A01	326.56	408.40	0.07	0.29	-0.22
U1 34A02	326.21	408.77	0.07	0.26	-0.19
U1 34A03	325.89	409.22	0.04	0.23	-0.19
U1 34A04	325.09	408.95	0.04	0.18	-0.14
U1 34A05	324.24	408.70	0.13	0.20	-0.07
U1 34A06	323.17	408.48	0.23	0.25	-0.02
U1 34A07	322.57	408.25	0.31	0.28	0.03
U1 34A08	322.22	407.43	0.37	0.37	0.00
U1 34A09	323.95	407.62	0.08	0.34	-0.26
U1 34A10	324.74	407.08	0.07	0.28	-0.21
U1 34A11	326.49	407.38	0.08	0.28	-0.20
U1 34A12	322.25	406.50	0.27	0.67	-0.40
U1 34A13	323.97	406.51	0.10	0.43	-0.33
U1 34A20	326.55	406.24	0.14	0.30	-0.16
U1 34B01	327.11	406.90	0.19	0.32	-0.13
U1 34B02	327.76	407.17	0.18	0.37	-0.19
U1 34B03	327.67	407.84	0.26	0.29	-0.03
U1 34B05	330.53	406.33	0.18	0.60	-0.42
U1 34B06	329.59	406.82	0.44	0.52	-0.08
U1 34B07	328.87	407.22	0.09	0.44	-0.35
U1 34B08	328.52	408.31	0.21	0.36	-0.15
U1 34B09	328.85	408.79	0.31	0.51	-0.20
U1 34B10	328.94	409.57	0.26	0.37	-0.11
U1 34B11	329.49	408.93	0.25	0.45	-0.20
U1 34B12	330.41	408.90	0.11	0.64	-0.53
U1 34B13	331.28	408.74	0.24	0.55	-0.31
U1 34B14	331.78	409.19	0.15	0.68	-0.53
U1 34B15	331.97	406.24	0.14	0.48	-0.34
U1 35A01	331.97	407.29	0.83	0.39	0.44

a plot of them superimposed on the topography is shown in figure 5. There is clearly a strong correlation with topography which implies that the original terrain correction is in error although the 250 sq. m DTM is still a crude representation of the near terrain of these Glenariff stations. With the new terrain corrections the correlation with topography is removed and therefore this is the correction which has been used for these data.

4. PRESENTATION AND INTERPRETATION

Of the eight data points taken over the upland region in the 1959/1960 survey it was found that five of these stations did not fit the new data. This is due to errors in the heights of these points and they have therefore been removed.

Bouguer anomaly map

A revised Bouguer anomaly map, reduced with a density of 2.7 Mg/m^3, has been produced for the area and is shown as map 1. The data used for the map are the new 1990 data, 1959/1960 data within the rectangle eastings 312 Km to 332 Km and northings 406 Km to 425 Km with terrain corrections calculated from the digital terrain models and 1959/1960 data with the original terrain corrections. The station positions of the 1959/1960 data are indicated by diagonal crosses and the 1990 data by upright crosses. It can be seen that the form of the gravity gradient has not changed. In particular its strike direction is still north-south and the magnitude of the gradient is the same. There have been a few small changes in the anomalies and a low is developed in the region of the Knockore trig point.

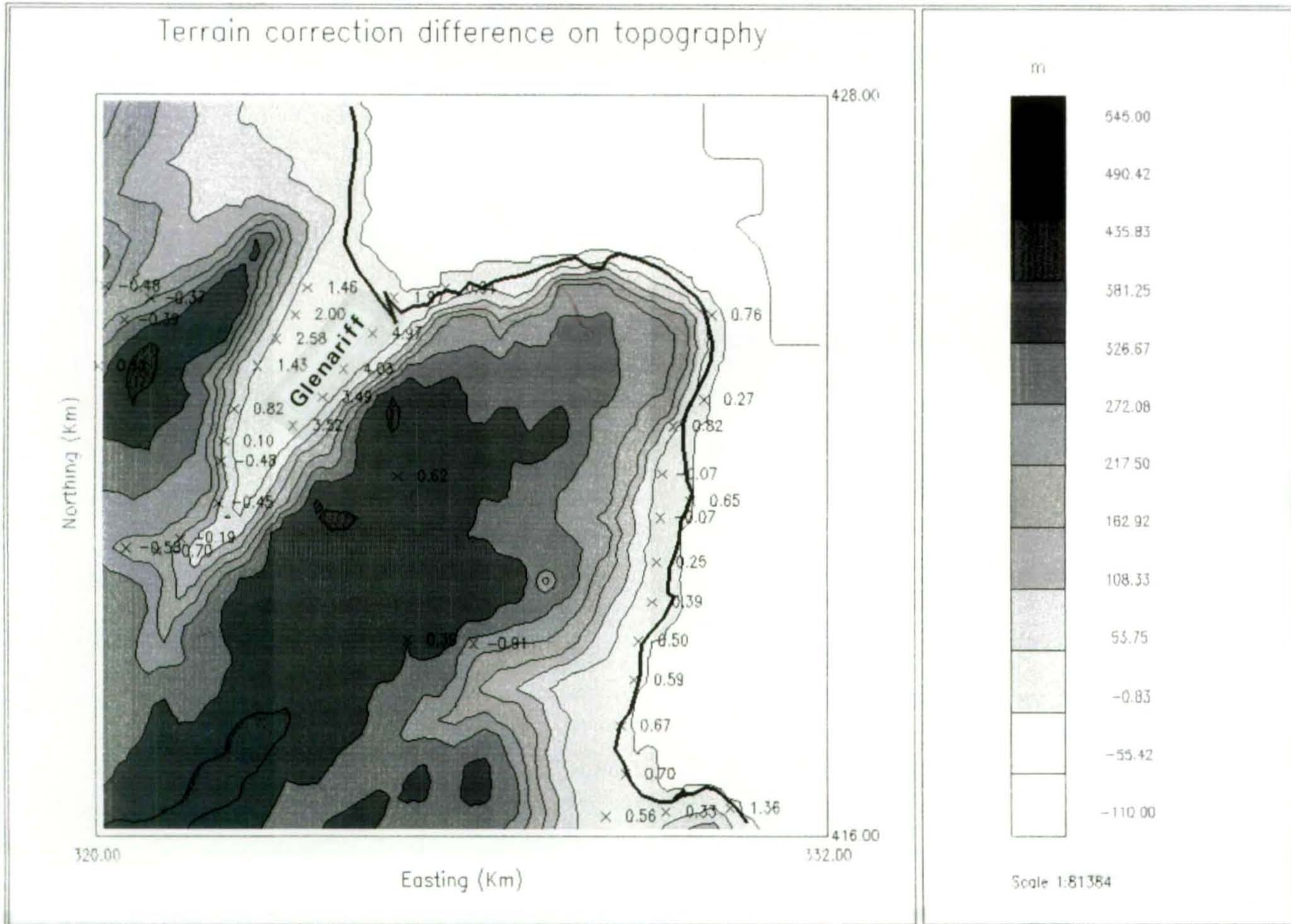


Figure 5. Terrain correction difference (original-new) superimposed on the topography.

Databanking

The 1990 data have been added to the Northern Ireland gravity databank which is maintained by Regional Geophysics. The terrain corrections for the 1959/1960 data which have been recalculated using the digital terrain models have replaced the old terrain corrections and the five stations found to be in error have been removed.

Interpretation

The Cushendall fault is seen in outcrop to the north of Cushendall in the Lower Old Red Sandstone. It's strike is correlated with the strike of the gravity anomaly. The gravity anomaly may represent it's continuation under the Antrim Lavas. The broad nature of the gravity anomaly indicates that the contact between the Dalradian and Permo-Trias is not high angled. This is in contrast to the contact between the northern edge of the Highland Border Ridge and the Rathlin Trough which is steep. A two and half dimensional gravity model over the anomaly is shown in figure 6. The gravity profile is taken from west to east along northing 415 Km, starting from easting 300 Km and finishing on easting 340 Km. This is a simple model in which an arbitrary constant regional of 16 mGal has been removed from the observed profile. The regional represents deeper high density crustal elements. In the model polygon 1 is Dalradian (density 2.8 Mg/m^3), polygons 2, 4 and 6 are Permo-Trias (density 2.5 Mg/m^3), polygon 3 is Palaeozoic sediments (density 2.6 Mg/m^3) and polygon 5 is Antrim Lava (density 2.7 Mg/m^3). Due to the arbitrary nature of the regional the depths to the base of the polygons cannot be taken as significant. However the model does demonstrate the non-vertical nature of the Dalradian and Permo-Trias contact beneath the Antrim Lavas.

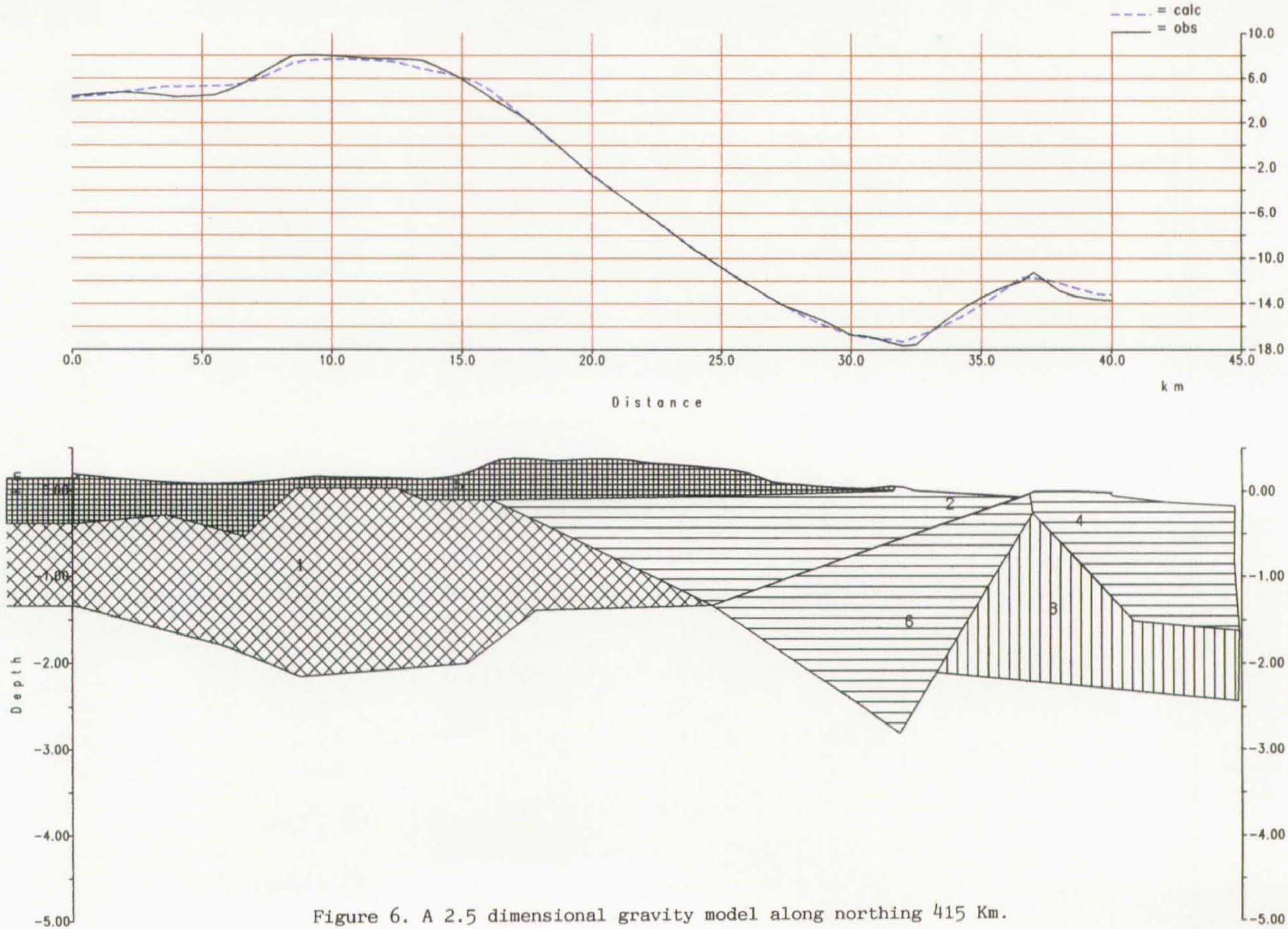


Figure 6. A 2.5 dimensional gravity model along northing 415 Km.

5. CONCLUSIONS

The 1990 regional gravity survey has filled a gap in the regional coverage over an upland area near Cushendall. It has proved the broad nature of the north-south striking gravity gradient. Some errors were found in the existing regional data and in the terrain corrections applied to the existing data. The new data and the corrected data have been added to the Northern Ireland gravity databank. These data show that the contact between the Dalradian and the Permo-Trias is not high angled as might be expected from a Caledonian strike slip fault.

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North-east Antrim Bouguer gravity