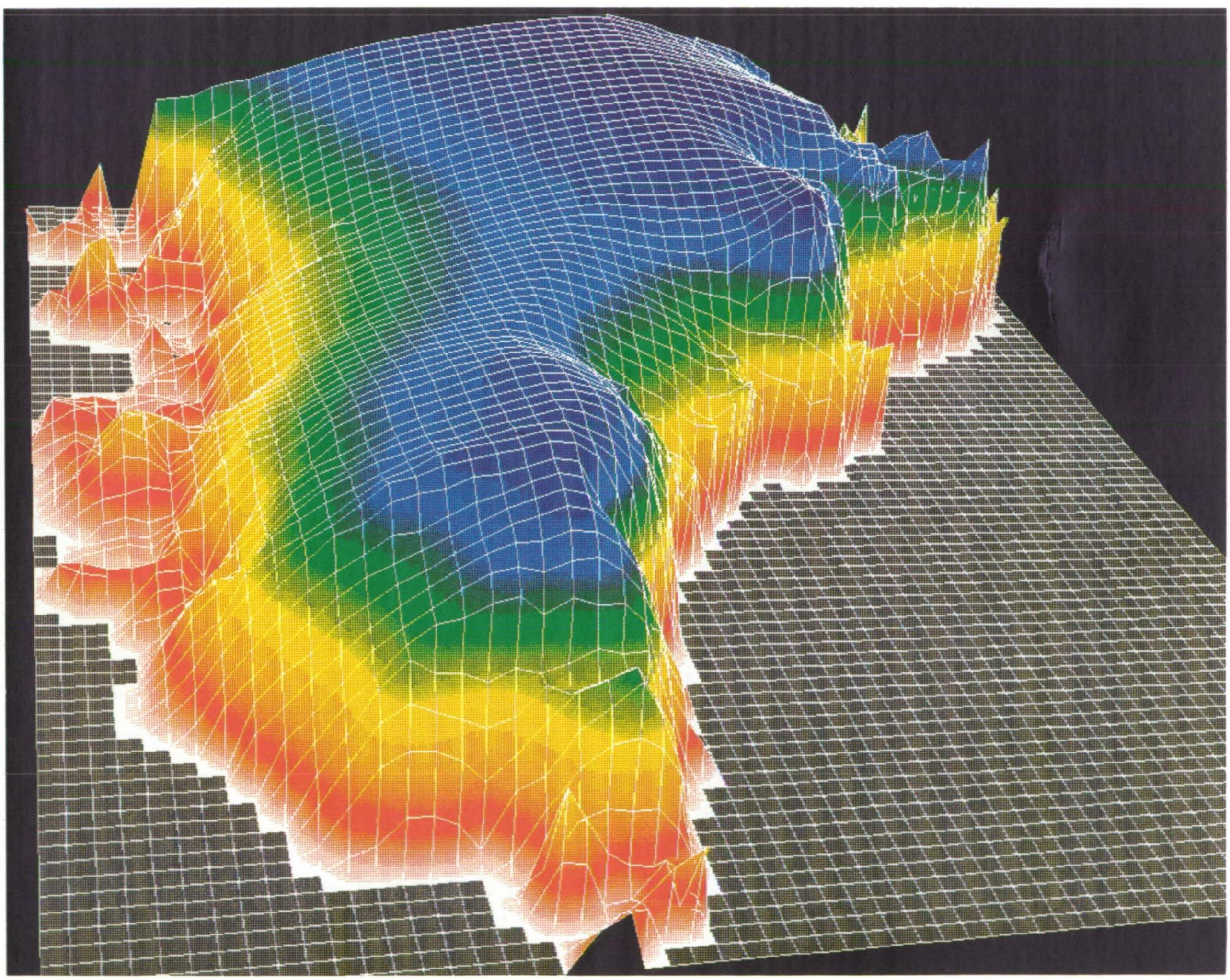
NASA SP-503

Surface Topography of the Greenland Ice Sheet from Satellite Radar Altimetry



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Cover:

Three-dimensional perspective of Greenland (south of 72° N). Bands change color every 500 meters of elevation. The elevations are derived from Seasat radar altimeter data. (Figure conceived and generated by Steve Fiegles, STX Corporation.)

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Surface Topography of the Greenland Ice Sheet from Satellite Radar Altimetry

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CONTENTS

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1
PREFACE

Surface elevation maps of the southern half of the Greenland subcontinent are produced from radar altimeter data acquired by the Seasat satellite. A summary of the processing procedure and examples of return waveform data are given. The elevation data are used to generate a regular grid which is then computer-contoured to provide an elevation contour map. Ancillary maps show the statistical quality of the elevation data and various characteristics of the surface. The elevation map is used to define ice flow directions and delineate the major drainage basins. Regional maps of the Jakobshavns Glacier drainage basin and the ice divide in the vicinity of Crete Station are presented. Altimeter-derived elevations are compared with elevations measured by both satellite geoceivers and optical surveying. The altimeter data indicate a surface 2 to 3 meters lower than data from the other survey methods. This difference is probably due to unresolved differences in gravity models used to derive orbital information.

2
INTRODUCTION

Today's ice sheets cover approximately 10 percent of the earth's land surface and contain about 75 percent of the world's fresh water (Paterson, 1980). However, on paleoclimatic time scales of tens of thousands of years, the earth's ice cover has undergone enormous variations. During glacial periods, much of North America and Europe were covered by thick ice sheets, whereas during the minima of the interglacial periods, the volume of the existing ice sheets was much less than today. It has been estimated that Antarctica was 50 percent more voluminous during the last glacial peak 18,000 years ago (Denton and Hughes, 1981) and that global ice volume during the Sangamon interglacial some 125,000 years before present was 10 percent less than present ice volume with a corresponding 6-meter rise in mean sea level (Shackleton and Opdyke, 1973).

It is not known whether the current ice sheets of Antarctica and Greenland are growing or shrinking. Interpretation of ice cores from ice sheets indicates that for the last 10,000 years the earth has been in a relatively warm period (Robin, 1983). From calculations of the temporal variation in solar insolation, which appears to be the principal forcing responsible for the glacial/interglacial cycle (Milankovitch, 1941; Imbrie and Imbrie, 1980), one might expect a protracted cooling trend leading toward the next glacial maximum. However, human activity may have altered this natural cycle. The increased combustion of fossil fuels has raised the amount of CO_2 in the atmosphere, and this, along with increased amounts of other similar trace gases, has increased the retention of heat by the atmosphere. This enhanced "greenhouse" effect is believed to portend a warming of the earth's atmosphere by an average of 3 degrees Celsius (Climate Research Board, 1979).

Changes in climate cause changes in ice sheets, but we do not have sufficient data at present to identify what climatically-induced changes are currently taking place within the ice sheets. While most mountain glaciers in temperate climates are experiencing retreat, there is no consensus as to the behavior of ice sheets in the polar regions (NRC Committee on Glaciology, 1985). The results of field measurements in localized regions of Antarctica, Greenland, and some smaller ice caps, range from high rates of thickening to high rates of thinning. These results illustrate the complexity of ice sheet behavior. Ice sheets are actually composed of a collection of individual drainage basins which at times behave synchronously but often demonstrate considerable independence. This independence underscores the requirement that ice sheets must be monitored in their entirety.

Ice sheets not only respond to climatic change, but through their interactions with the atmosphere and oceans, strongly affect global climate. Ice sheet behavior can impact the thermal and chemical structure of the ocean. In addition, the size and extent of the major ice sheets influence the circulation patterns in the atmosphere.

The most immediate response of ice sheet-climate interaction felt elsewhere in the world is a change in sea level; changes in ice volume translate directly into changes in sea level. The 6-meter increase in sea level during the last interglacial is believed to have been caused by the disappearance of the West Antarctic ice sheet (Mercer, 1972). If the entire Antarctic and Greenland ice sheets were to be discharged into the oceans, sea level would rise more than 70 meters. These concerns about ice sheet mass balance and dynamic behavior require a satellite-based monitoring program which spans the vastness of both the Antarctic and Greenland ice sheets. In particular, sequential measurements of ice elevation will provide a direct measurement of thickening or thinning rates and net changes in ice volume.

Surface elevation data are of central importance for studies of ice sheet dynamics. Because ice flows along the direction of maximum surface elevation gradient, i.e., downhill, an elevation map also provides flow direction. Elevation data can be used to delineate the individual drainage basins comprising the ice sheet. The driving stress causing ice motion is related to the product of the ice thickness and surface slope, so again, elevation data are crucial to understanding the ice motion. Finally, most of the perimeter of Antarctica consists of ice cliffs, either on land or at the edge of ice shelves. Elevation data can be interpreted to fix the position of the ice sheet edge and monitor it over time. For all these reasons, and more, surface elevation is the single most meaningful parameter to measure to monitor ice sheets.

Spaceborne altimetry fills the need to collect these valuable data on the continental scale. The feasibility of this technique was demonstrated by Brooks and others (1978) when surface elevations from the radar altimeter aboard the Geos-3 satellite compared favorably with surface-based elevations made by geoceivers. The Geos-3 satellite orbited the earth between 65° S and 65° N, so ice sheet coverage was limited to the southern third of Greenland. Since the time of Geos-3, other radar altimeters have flown in space on the Seasat and Geosat satellites. Both of these satellites covered more of the polar regions, up to ± 72°.

This report presents the data of surface topography of the Greenland ice sheet as derived from the radar altimeter on board the Seasat satellite. Seasat operated for only 100 days before a massive power failure occurred in October 1978. Nevertheless, a large data set of range measurements over the Greenland ice sheet was collected. Because the instrument was designed to measure the topography of the ocean surface and not the rougher ice sheet surface, the data required extensive reprocessing to derive useful surface elevations. Most of the procedures involved in this reprocessing have been described elsewhere (Martin and others, 1983; Brenner and others, 1983; and Zwally and others, 1983 and 1989a). This report briefly reviews these procedures to give the reader an appreciation for their effects on the elevation data.

Most results in this report appear in map form. The maps indicate data distribution and quality, and give examples of how these data can be used to conduct various scientific studies. This data set provides the detailed topography necessary to delineate the separate drainage basins of the ice sheet and serves as a baseline against which subsequent elevation surveys can be compared to discover regions of changing elevation. The data set of surface elevation and other derived parameters is available from the World Data Center-A for Glaciology in Boulder, Colorado and from the authors at NASA/Goddard Space Flight Center, Greenbelt, Maryland.

3
PRINCIPLES OF RADAR ALTIMETRY OVER ICE SHEETS

3.1 ALTIMETER OPERATION

Altimeters measure the range between the instrument and a reflecting surface by transmitting a signal pulse and timing the delay before the reflected pulse is received back at the altimeter. The Seasat altimeter recorded the reflected energy from each pulse for 187.5 nanoseconds. Individual returns were summed in two groups of 50 returns each to form what is referred to here as a "return waveform." The pulse repetition frequency was 1000 Hz; each return waveform averaged 0.1 second of return. With an effective satellite groundspeed of 6.62 kilometers per second, each return waveform averaged over a 662-meter-long segment of the groundtrack. The information contained within the return waveform was used to carry out a number of data processing operations on board the altimeter including setting the Automatic Gain Control (AGC), predicting the time of the next return pulse, and calculating the range to the surface (MacArthur, 1978). The return waveform, AGC, range, and other parameters including engineering data were telemetered to receiving ground stations and they form the altimeter data set.

The altimeter performed well over the ocean. The regular ocean return waveforms, shown in Figure 1a, permitted an accurate calculation of the range by computers on board the spacecraft. Over the ice sheet, however, the more rapid variation in surface range produced a wide variety of return waveforms (see Figure 1b). The major difficulty encountered by the altimeter for operation over the ice sheet was in keeping the midpoint of the leading edge of the return waveform in the center of the 187.5-nanosecond receiver window. This is important because the range calculated by the Seasat altimeter actually corresponds to the time at the center of the receiver window (or tracking point) rather than to any part of the return waveform itself. It is the function of an onboard tracking circuit to predict the appropriate delay between pulse transmission and the receiving window so that the midpoint of the leading edge of the return waveform coincides with the window center. When these two do not coincide, as is usually the case over the ice sheets, the altimeter range contains an error.

The choice of the midpoint of the leading edge as the appropriate range point over ice represents a compromise between various effects of the interaction of the radar beam with the ice surface. Physically, the midpoint range corresponds to the average range over that portion of the surface which is nearest to the altimeter and is simultaneously illuminated by the altimeter pulse. This is referred to as the "pulse-limited footprint" (PLF). Its size is directly related to the altimeter pulse length. For Seasat, pulse-compression techniques were employed to minimize pulse length and the PLF corresponded to a 1600-meter-diameter circle over a smooth horizontal surface. Alternatives to the midpoint range which have been used by other researchers are the point of first return, corresponding to the minimum range within the PLF; and the half-power range, corresponding to the average range over a region sometimes larger and sometimes smaller than the PLF. Each of these alternatives has disadvantages. The minimum range is very difficult to determine accurately for many return waveforms due to the slow initial rise time of many waveforms (a result of surface roughness on a spatial scale less than the PLF) combined with system noise in the intervals between waveforms. The half-power method is less reliable because power levels vary considerably due to both surface characteristics and variable truncation of waveforms caused by poor tracking. Subsequent to our choice of using midpoint ranging, Ridley and Partington (1988) showed that this method is insensitive to the effects of penetration and subsurface volume scattering.

3.2 RETRACKING

To determine the precise location of the midpoint of the leading edge and correct the indicated range for the distance between this point and the center of the timing window, the data over the ice sheet have been reprocessed. Our approach has been to fit each return waveform with a function which approximates the general shape of the return waveform. Figure 2 shows samples of return waveforms and the

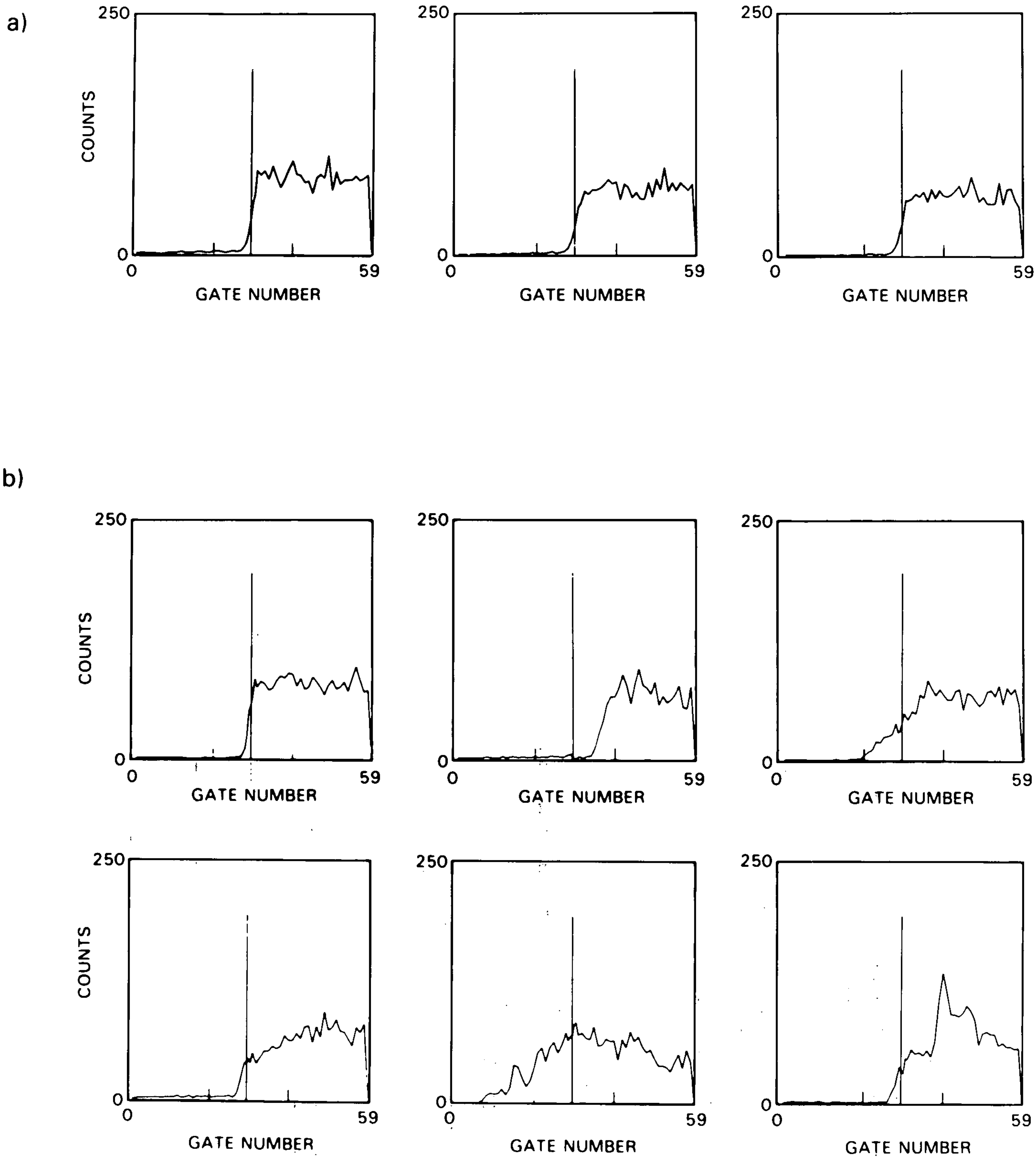

Figure 1. Sample return waveforms over (a) ocean (equatorial Atlantic), and (b) Greenland ice sheet. Horizontal axis corresponds to a 187.5-nanosecond time window which is sampled by 60 full gates and 3 overlapping half-gates. A full gate lasts 3.125 nanoseconds. Vertical axis corresponds to power received during each gated interval (adjusted by an Automatic Gain Control) and is measured in counts. Vertical line in center of each waveform is the tracking point corresponding to the altimeter-derived range to surface. Errors in the tracking of the ice sheet surface and variation of the ice sheet return waveform are evident.

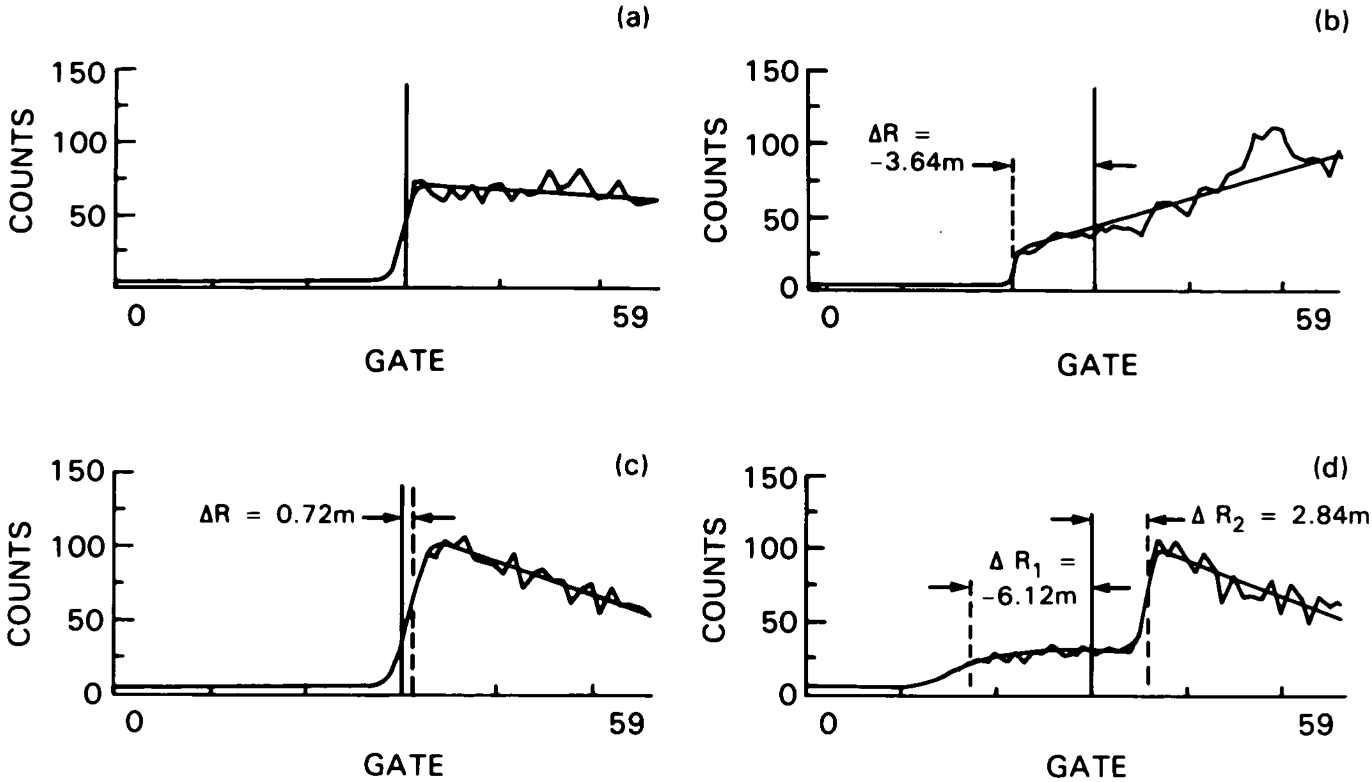

Figure 2. Sample return waveforms over ice sheet with retracking function superimposed. Retracking range correction is indicated by ΔR. Waveform (d) is fit by a double-return function (nine-parameter) as discussed in text.

fitted functions. In the fitting procedure, called "retracking," data on the leading edge of the return waveform data are weighted more heavily than data elsewhere in the waveform to ensure a close fit of the analytic function in this critical part of the return. The parameterization of the functions is such that the midpoint of the leading edge can be readily calculated and, from it, the range error. Martin and others (1983) and Zwally and others (1989a) discuss the details of the retracking procedure.

Most often, a five-parameter function adequately approximates the return waveform (Figure 2a-c), but many of the return waveforms appear to include a strong reflection from a second surface. For these "double waveforms," the five-parameter function cannot provide an acceptable fit and a modified nine-parameter function is used (see Figure 2d for an example). A decision algorithm determines whether a waveform is single or double (Zwally and others, 1989a).

3.3 LOSS OF TRACK

When the tracking circuit cannot predict the arrival time of the return energy well enough to include the leading edge of the return waveform in the receiver window, no range can be measured. This happens when the range is changing faster than the response time of the tracking circuit. The 187.5-nanosecond-long receiver window corresponds to a range length of only ± 14.1 meters centered about the tracking point. In these cases, the altimeter "loses track" and useful return waveforms are not collected until the altimeter reacquires the return signal. The response time of the tracking circuit is controlled by two parameters which could have been altered by commands from the ground, but this was never done during the shortened lifetime of the Seasat mission. Future altimeter designs will include appropriate modifications to permit more agile tracking over surfaces much rougher than the ocean.

3.4 SURFACE RECONSTRUCTION FROM ALTIMETER DATA

The range data are used to reconstruct the elevation profile of the reflecting surface. The surface reconstruction procedure was studied using a computer altimeter simulator which generated return waveforms using the Seasat algorithms for any specified surface. For simplicity, the initial study was carried out using a surface which varied in two dimensions (elevation and horizontal position beneath the satellite path) and was constant, normal to the satellite path. Figure 3 shows how both the character of the return waveforms and the tracking error vary over even a simple surface. The altimeter-indicated surface before retracking is very different from the true surface. Retracking improves the accuracy of the surface, but there are still significant differences. The agreement between the retracked and true surfaces is best at the topographic highs. The remainder of the retracked surface consists of a succession of hyperbolae, each with an apex coinciding with the true position and elevation of a surface high. The more distant tails of these hyperbolae often become the second return in a double waveform.

The retracked surface is biased toward the higher elevations in the true surface. Surface highs will be accurately measured only if the satellite passes directly over them. Surface troughs may be missed entirely if their curvatures exceed the curvature of the radar wavefront (1/800 km). Waveform number 18 in Figure 3 shows a case where the curvatures of the surface and wavefront nearly match, causing a focusing effect and a very strong first return.

The main characteristic of the altimeter which creates errors in the elevation using the retracked ranges is the fact that the altimeter attempts to track the range to the nearest surface, not necessarily the surface at nadir. Thus, in Figure 3, the altimeter begins ranging forward toward the elevation peaks before it is actually over them and continues to range to them for a time after it has passed them.

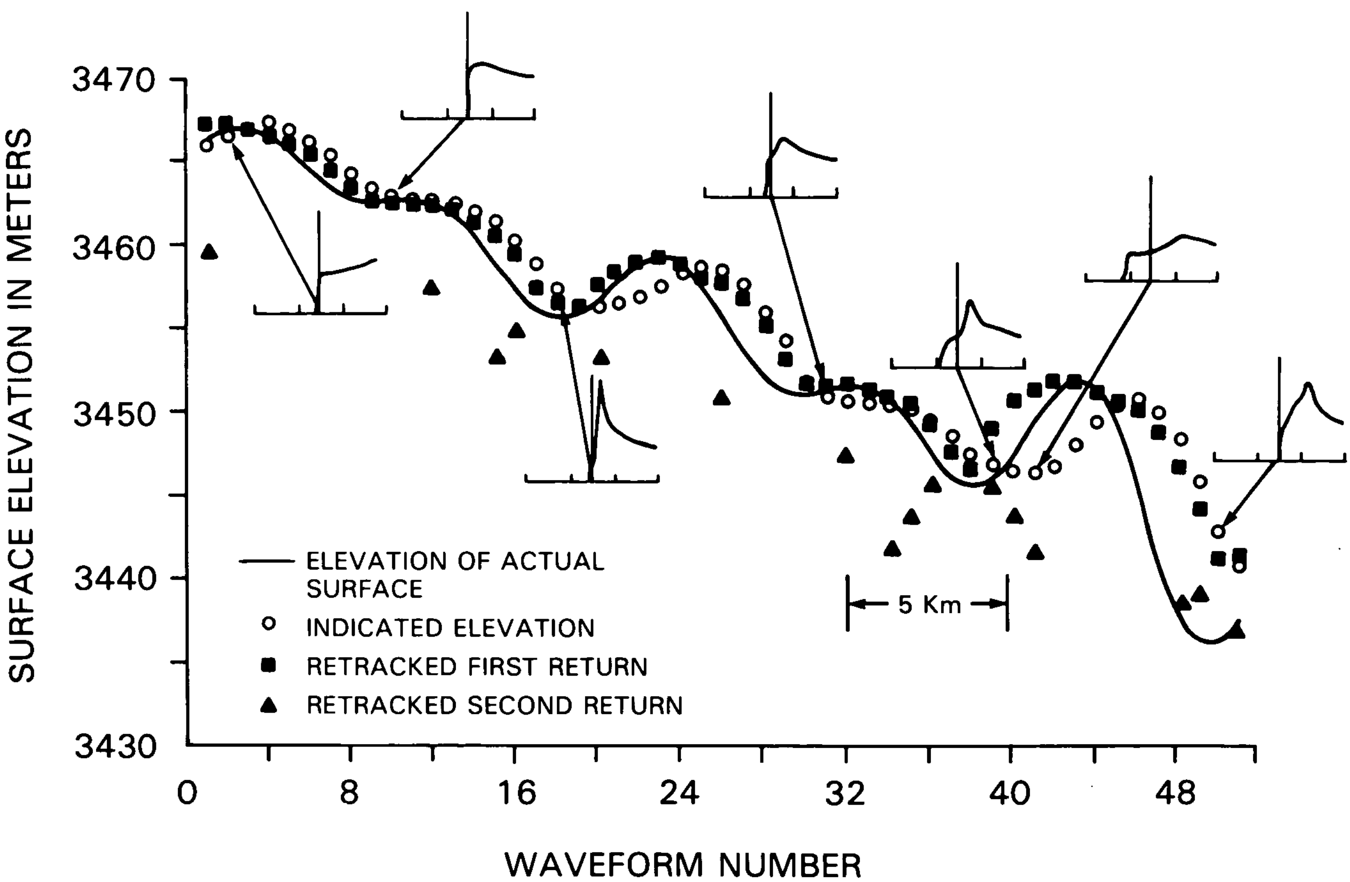

Figure 3. Surface reconstructed from return waveforms generated using numerical altimeter simulator. True (input) surface is indicated by solid line. Computer-derived return waveforms are shown at selected points along the profile. Open circles represent surface elevations derived from altimeter-measured ranges (these include the tracking errors evident on some of the sample return waveforms, for example, waveform 41). Solid squares represent surface profile after return waveforms have been retracked and retracking corrections have been applied. Solid triangles indicate elevation of second return when retracking algorithm indicated double return waveform.

Hyperbolic returns, such as appear in Figure 3, are characteristic of point sources in reflection geophysics. Data adjustment to account for this type of return is discussed in the next section.

In the three-dimensional case, the situation is even more complex because the closest surface may occur to the side of the groundtrack. This further hinders attempts to reconstruct the true surface. The behavior of the altimeter, however, remains the same. Gundestrup and others (1986) have demonstrated the tendency of the altimeter to track a series of local surface highs over a real ice sheet surface. They analyzed a portion of measured Seasat ranges in the vicinity of the Dye-3 station in south-central Greenland. By combining these data with surface topography measured by a ground-based optical survey and the known position of the satellite, they showed that the first returns came from the sides of undulations located 2 to 4 kilometers to the side of the groundtrack (Figure 4).

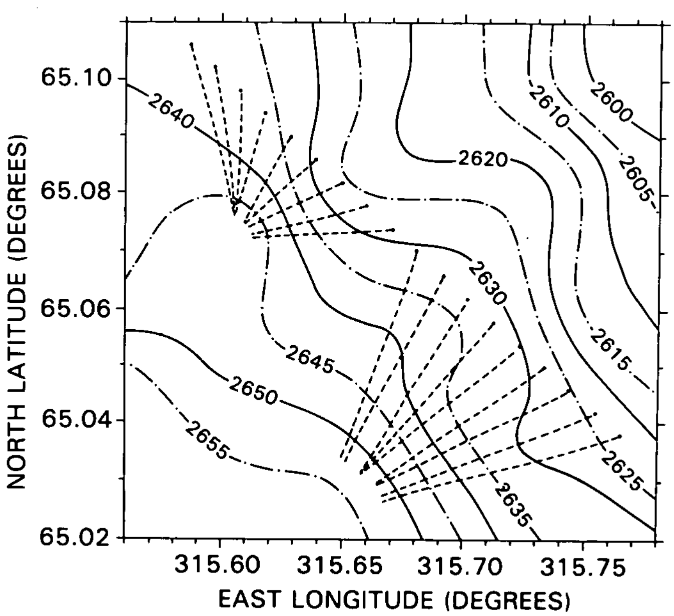

Figure 4. Surface projection of vectors from Seasat position to nearest surface point for orbit 1236 in the vicinity of Dye-3 station in southern Greenland. Surface elevation is derived from geoceiver and barometer measurements. Figure is modified from Gundestrup and others (1986).

3.5 SLOPE-INDUCED ERROR

To improve the accuracy of the reconstructed surface, the fact that the range is off-nadir must be taken into account. Because this error is caused by sloping surfaces, we have termed this effect "slope-induced" error. The correction can either adjust the measured range to the true nadir range (range adjustment), or the reflection point can be moved from nadir to the actual location (migration). Brenner and others (1983) studied these two methods for different scenarios and concluded that migration is preferable in the two-dimensional case, but for the more realistic three-dimensional case where data are densely spaced along groundtracks which themselves are widely spaced, range adjustment results in a closer approximation to the true surface.

The magnitude of the range adjustment can be derived from Figure 5. Brooks and others (1978) showed that if a flat surface of constant slope α is assumed, the range adjustment is

$$\Delta = H \times (1 - \cos\alpha) \qquad (1)$$

where H is the spacecraft altitude. For small slopes, Equation (1) can be approximated by

$$\Delta = \tfrac{1}{2} \times H \times \alpha^2. \qquad (1')$$

Figure 5 also shows that the true point of reflection is displaced upslope from nadir by the amount

$$\delta = H \times \cos\alpha \times \sin\alpha. \qquad (2)$$

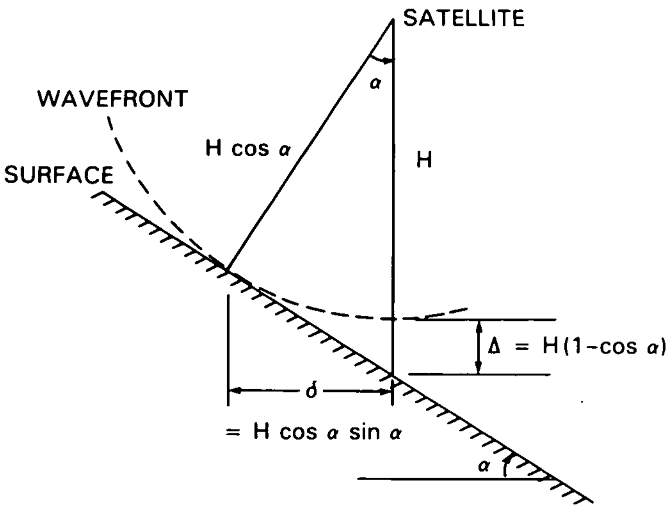

Figure 5. Schematic diagram of altimeter wavefront intersecting sloping surface. Satellite is at an altitude H and surface slope is α. This figure is used to derive the slope-induced errors in range (Δ) and migration (δ).

In the reconstruction procedure, the determination of α is problematic because the true slope is neither known nor constant. For undulated surfaces, it is difficult to know what averaging scale is appropriate for determining α in the above equations. Figure 6 shows how the slope-induced error varies for a simple undulated surface. The figure also shows how neither the use of the instantaneous slope nor the mean slope in Equation (1′) completely removes the slope-induced error.

Figure 6 does suggest that a combination of the instantaneous slope and an appropriate phase shift would optimize the error reduction; however, in practice this is not feasible because the surface is both unknown and comprised of undulations on many wavelength scales. This was borne out by the more realistic, three-dimensional analysis of Brenner and others (1983). They showed that for a typical ice sheet surface, a surface slope averaged over 2.6 kilometers (five data points) was slightly more effective than using a 7.9-kilometer average (13 data points). Further, they recommended that the estimation of the along-track component of α can be optimized if an iterative scheme is employed which converges toward the true surface by a succession of apparent surfaces. Correction for the cross-track component requires ancillary information.

As a general rule of thumb, rougher surfaces cannot be reconstructed as accurately as smoother surfaces. This is true for two reasons; first, the determination of α is more difficult in the rougher case, and second, the highs in the rough case are preferentially sampled while the troughs and steep sides are missed. These two effects are linked because the biasing of the sampling to the topographic highs and the possible omission of some of the lows will produce a smoother apparent surface.

The difficulties introduced to elevation measurement by the slope-induced error can be minimized in future designs by reducing the beamwidth. The Seasat altimeter had a 3-dB half-angle beamwidth of 0.8 degree. At 800 kilometers altitude, this defined a 22-kilometer-diameter spot on a horizontal surface. This is called the "beam-limited footprint." Narrower beams, available by either synthetic radar techniques or laser altimeters, would avoid the possibility of returns from points which are closer to the satellite but well away from nadir, by focusing most of the beam energy close to nadir.

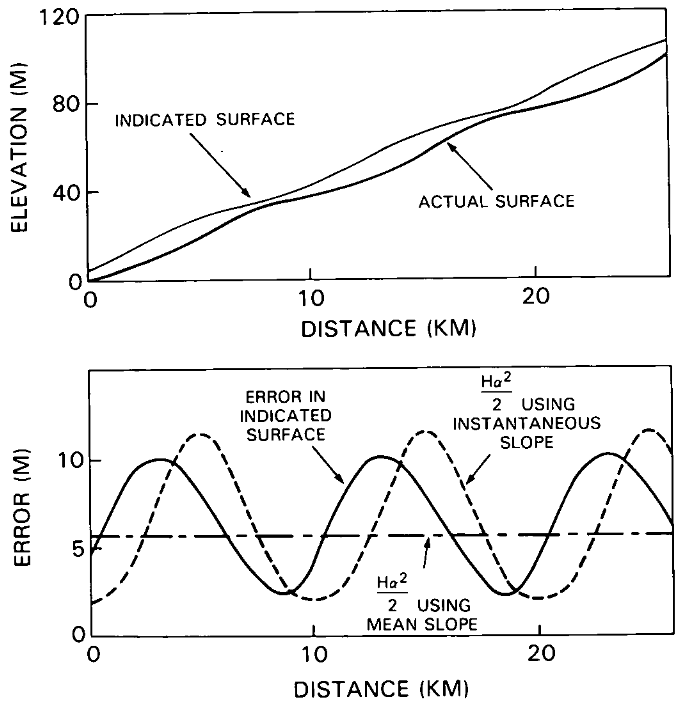

Figure 6. Difference between actual surface and surface indicated from altimeter-derived ranges. Actual surface has undulations of 5-meter peak-to-trough amplitude with 10-kilometer wavelength superimposed on a mean slope of 0.22 degree. Indicated surface is constructed by using range to closest surface at each point as nadir range. Lower plot shows error between indicated and actual surfaces (solid line), calculation of error from Equation 1′ using the true instantaneous slope (dashed line), and error from Equation 1′ using the mean slope (short dash-long dash line). (Figure taken from Brenner and others, 1983.)

4
PROCESSING OF SEASAT DATA

4.1 DATA DISTRIBUTION

During the 100-day life of Seasat, about 256,000 individual return waveforms were collected over the subcontinent of Greenland. Many of these were unusable for range measurement due to the absence of a distinct leading edge. After editing the data set to remove unusable data and retracking to correct the range measurement, about 100,000 useful data points remained.

Map 1 gives the geographic distribution of these usable data. The vast majority of these data are over the Greenland ice sheet. The 662-meter spacing between individual data points is so small that the groundtracks of separate satellite passes are easily identified when tracking of the surface was maintained.

The gaps in the groundtracks illustrate how frequently the altimeter lost track. Most of these gaps occur around the perimeter of the ice sheet. Near the ice sheet margin, the ice is thinner and the surface is rougher, so maintaining track is expected to be difficult. Tracking is even worse throughout the rugged coastal mountains.

Most of the data are spread throughout the central portions of the ice sheet. This is where the ice is thickest and the surface is smoothest. However, there are still a number of gaps, even in this area. Although the large-scale surface slope is small, the amplitude and wavelength of undulations are large enough to prevent continuous tracking of the surface with the tracking parameters used for Seasat. A frequent loss of track occurred when the main ice divide was crossed because the surface slope changed quickly. The gaps occur on the west side of the divide because Seasat traveled westward. The higher concentration of data near the northern limit of coverage at 72° N is a result of the increased density of groundtracks at higher latitudes due to orbit inclination.

4.2 MISCELLANEOUS RANGE CORRECTIONS

Various additional corrections to the range data must be applied to account for propagation of the radar beam through the ionosphere and troposphere, variation of the earth's solid tide, and offset of the altimeter antenna from the spacecraft's center of gravity. The atmospheric corrections are based on a standard atmospheric model and shorten the range; the tropospheric correction is the largest of these—about 1.5 meters. The solid tide correction is both time- and space-dependent. Theoretically, it could have been as large as 0.4 meter, but for this data set, it never exceeded 0.11 meter. The center-of-gravity correction is also time-dependent and well-known from mission logs. All of these corrections are discussed in more detail in Zwally and others (1989a).

4.3 ORBIT ADJUSTMENT

Conversion of range data to surface elevations demands that the position of the altimeter in space be known precisely. Errors in position, particularly radial position, transform directly into errors in surface elevation. The magnitude of this error can be quantified by comparing the apparent surface elevation at locations where two satellite passes cross each other. Map 1 shows that there are a large number of such "crossover" points, especially toward the ice-sheet center and near the northern limit of data. Using the NASA/GSFC PGS-S4 orbit data and the retracked range data corrected for atmospheric and solid tide effects, the elevation differences for all 1235 crossovers have a mean error of 0.33 meter with an RMS residual of 1.15 meters.

These errors were reduced by adjusting the surface elevations over the oceans for each altimeter pass which crossed Greenland to an existing mean ocean surface, derived from Seasat and Geos-3 data (Marsh, personal communication). A first- or-second-order polynomial was used, depending on the availability of data and their proximity to Greenland. The preferred case used only data immediately east and west of Greenland, however, in some instances, ocean data as distant as the Pacific and Indian oceans were used. Prior to this adjustment, the ocean elevations were reduced to a mean sea reference by correcting them for tidal variations (Zwally and others, 1989a). Over central Greenland, the resulting radial orbit corrections averaged 0.21

meter with a standard deviation of 0.60 meter (see Figure 7). With the orbital adjustments applied, the distribution of crossover errors was reduced to a mean of just 0.07 meter with an RMS residual of 0.99 meter (see Figure 8). Details of this adjustment procedure can be found in Zwally and others (1989a).

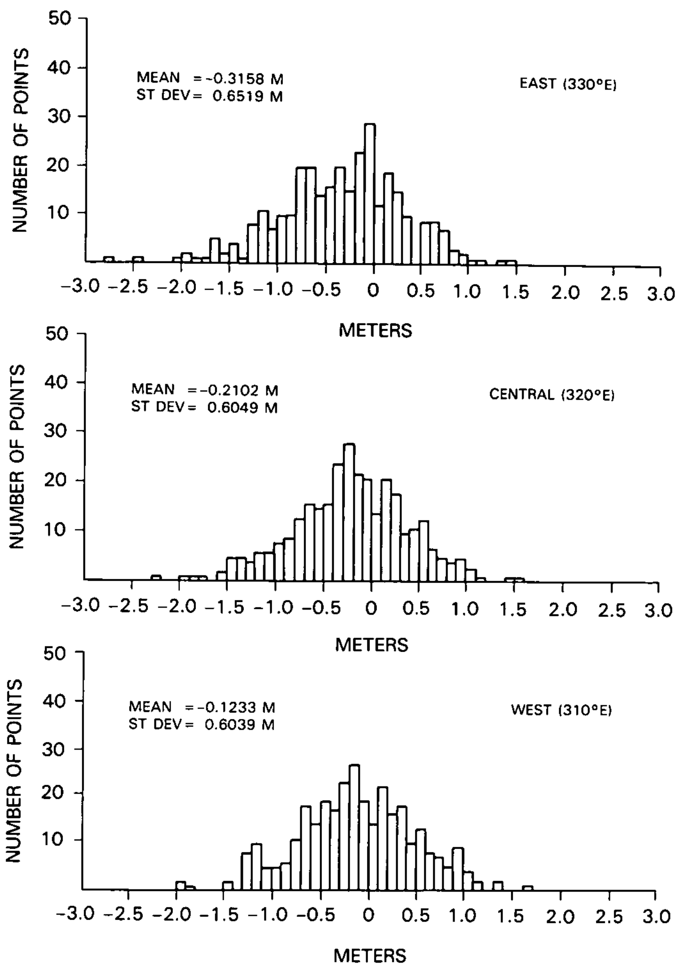

Figure 7. Orbit adjustments over Greenland. Histograms of adjustments are shown for three longitudes: 330°E, 320°E, and 310°E.

4.4 SLOPE CORRECTIONS

A correction for the slope-induced error was also applied. The cause of this error was discussed in Section 3.5. Figure 9 presents the histogram of surface slopes as well as histograms of the along-track and cross-track slope components. The calculation of the along-track slope applied an iterative technique which began with the apparent surface indicated by the range data and converged to a more accurate representation of the along-track surface. After the final iteration, the total range correction for any data point was converted to an "effective" along-track slope using Equation (1′). Zwally and others (1989a) describe the details of this procedure.

The cross-track slope was calculated using an elevation model of Greenland derived from an earlier version of the grid elevations discussed in Section 5 which follows. A limit at 0.8 degree was set for both the along-track and cross-track slope components. This represents the limiting slope for which the first return would occur at the outer edge of the beam-limited footprint. The larger average slope for the along-track component as shown in Figure 9 is due to a combination of more detailed information which can resolve steeper small-scale slopes in this direction and the orientation of the groundtracks which were preferentially directed down the fall line of the ice sheet.

Once the along-track and cross-track components of the slope were obtained, the range corrections were calculated from Equation (1′) using the value of total slope. The histogram of range corrections for slope-induced errors is shown in Figure 10.

4.5 REFERENCE TO MEAN SEA LEVEL

Satellite orbits are referenced to a particular ellipsoid. The reference for the Seasat PGS-S4 orbit data is the IUGG-77 ellipsoid (a = 6,378,137 meters; f = 1/298.257). Therefore, the elevations derived from the Seasat altimeter range data are referenced to this surface. To convert these elevations to elevations above mean sea level, a correction for the height of the mean sea surface (or geoid) above this ellipsoid must be applied. We used the GEM10-B model which specifies the height of mean sea level above the IUGG-77 ellipsoid at the nodes of a 1-degree latitude by 1-degree longitude grid. Map 2 shows the contours of this geoid model in the region of Seasat coverage over Greenland. Geoid corrections were not applied to each data point, but rather, geoid corrections were made to the elevation values of the grid described in the next section.

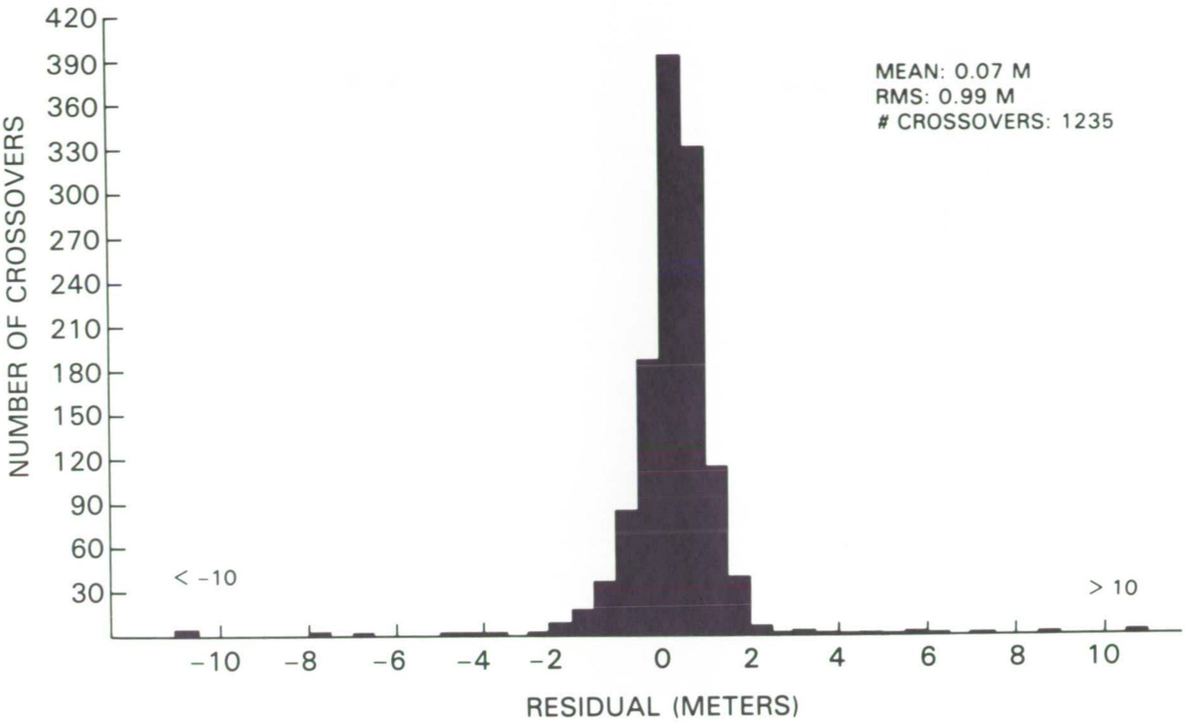

Figure 8. Histogram of crossover errors for adjusted Seasat orbits.

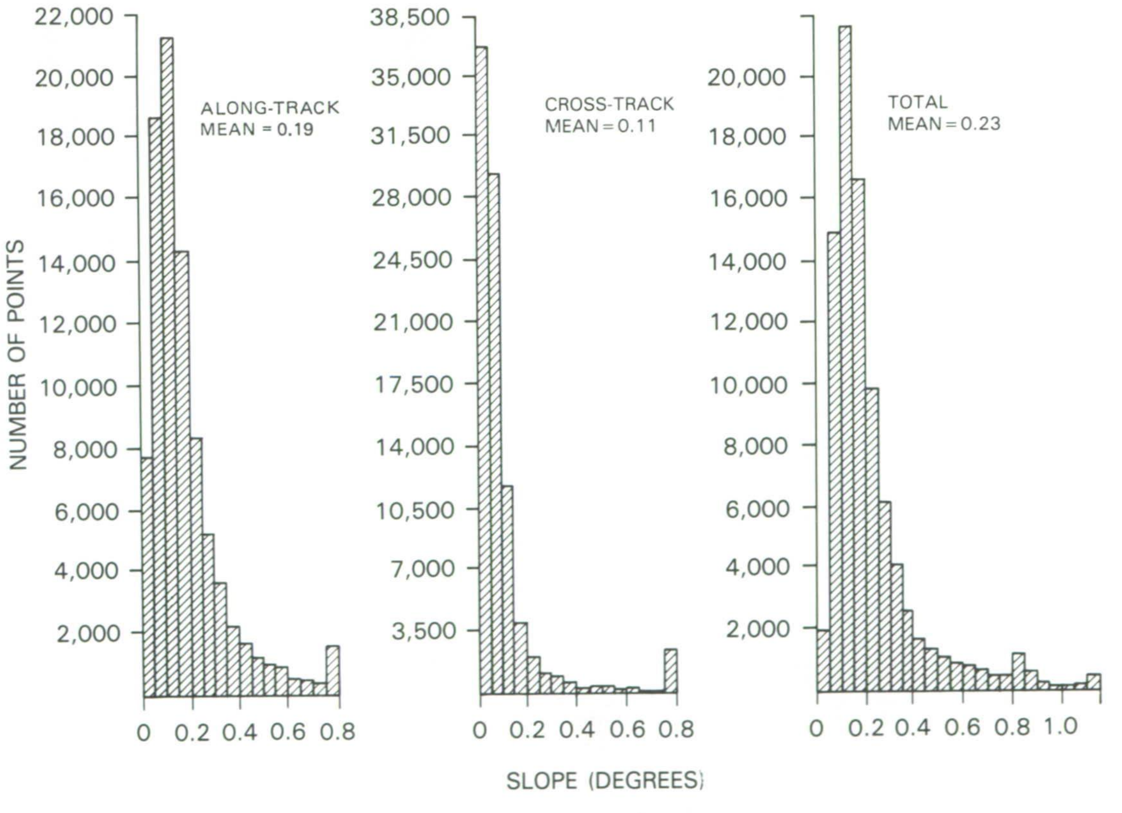

Figure 9. Histograms of along-track, cross-track, and total surface slopes. Along-track and cross-track components greater than 0.8 degree were set to 0.8 degree (the 3-dB angle of the altimeter antenna).

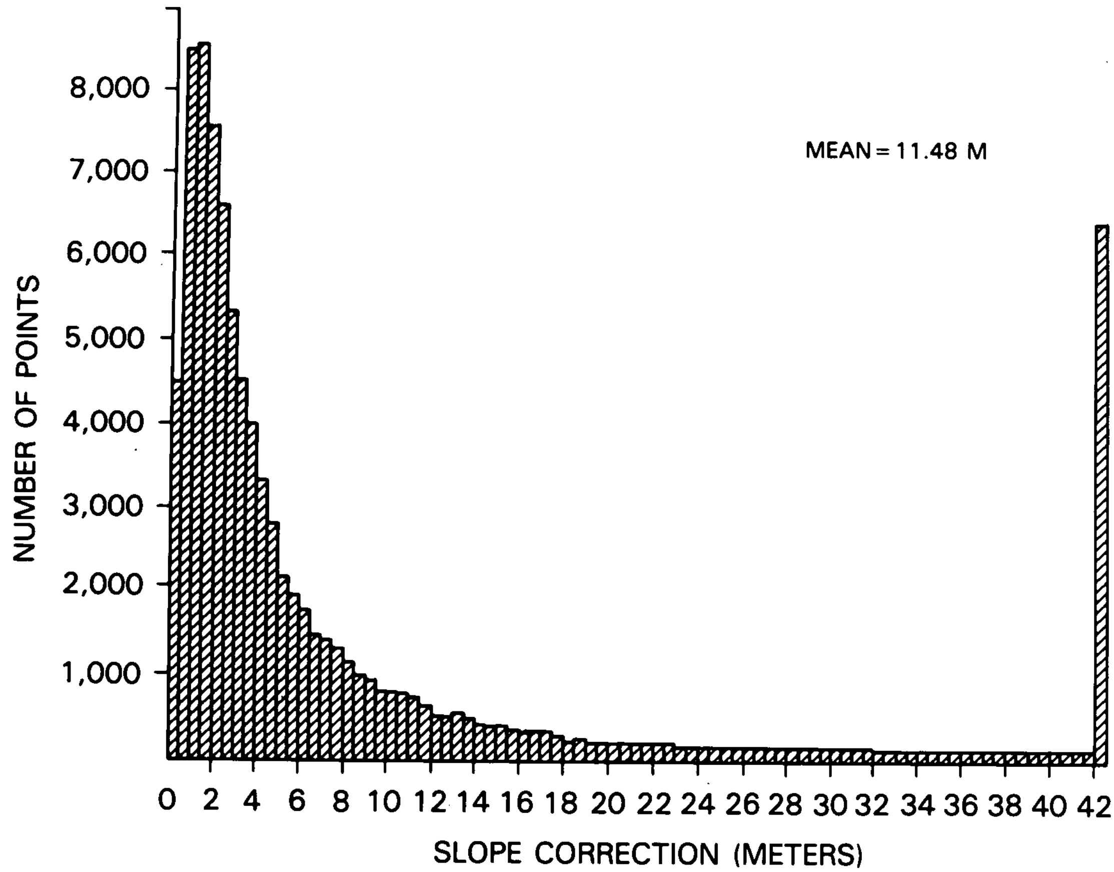

Figure 10. Histogram of corrections for slope-induced error applied to elevation data.

5
INTERPOLATION OF DATA TO GRID

The contouring package used to produce the maps in this folio requires that data values be specified on a regular grid. The technique is general and can be applied to data of any type: elevation, geoid, slope correction, etc. We chose a polar stereographic grid with a spacing between gridpoints of 20 kilometers at 90° N. Map 3 shows the grid pattern superimposed on the Greenland map.

The interpolation procedure used to determine the data values at the gridpoints involved fitting a six-parameter, biquadratic function to data in the vicinity of each gridpoint and evaluating the function's value at the gridpoint position. Initially, all data within a specified distance from the gridpoint were used and these data were weighted inversely by the square of their distances from the gridpoint. A singular-value-decomposition (SVD) method was used to solve for the coefficients of the function and to evaluate the goodness of the fit. If this method indicated a poor fit due to sparsity of data, poor data distribution, or large errors, then additional data further from the gridpoint were included by increasing the size of the fitting region. Again, if no acceptable fit was found, the size of the region was increased still further, up to some specified maximum. If a fit was not acceptable over this largest region, then a three-parameter, bilinear function was used, beginning with the smallest fitting region. The details of this gridding process are described in Zwally and others (1989a).

This grid interpolation technique is general and can be applied to any data set. The maps presented in this report were all contoured from grids generated by this interpolation method unless otherwise noted. For the maps which follow in Section 6, the radius of the fitting region varied from 10 kilometers to 67 kilometers.

6
GREENLAND MAPS

6.1 SURFACE ELEVATION

Map 4 presents the surface elevation contours of the Greenland ice sheet as measured by the Seasat radar altimeter. A standard contouring routine was used to produce this 100-meter contour plot. Figure 11 presents the same data in a three-dimensional perspective where 500-meter bands of elevation are assigned different colors. The data set used to create both maps is the elevation data interpolated to a 20-kilometer regular grid (see Map 3). These grid elevations are listed in Table 1 along with the geographic location, slope and geoid corrections, and a standard deviation of the grid elevation. The standard deviation was calculated from the SVD method assuming a ± 1-meter standard deviation for each data point used in the interpolation procedure. The elevations are referenced to mean sea level by subtracting the GEM 10-B geoid heights from the elevations above the IUGG-77 ellipsoid at each gridpoint (see Section 4.5).

The general shape of the ice sheet was known from earlier work (for example, Bader, 1961), but the elevations were tied to only a few elevations surveyed by different field teams. The elevation map from altimetry data shows these same features (a near-parabolic cross section with shallow slopes in the center and increasing surface slopes toward the margins) but also presents details of the surface topography never shown before, and notably, represents data obtained with a single instrument.

Map 4 and Figure 11 both show the shape of the ice sheet as asymmetric with the major ice divide displaced east of center. From 72° N to 69° N the ice divide strikes nearly due south, but then turns to the SSW where it passes through a saddle, turns south again, and rises to a dome which dominates the southern portion of the ice sheet. Beginning at a maximum elevation just under 3200 m.a.s.l. at 72° N, the elevation of the ice divide falls to about 2400 m.a.s.l. at the saddle minimum, and rises again to reach almost 2850 m.a.s.l. at the summit of the southern dome. A smaller ice dome lies near the margin of the ice sheet directly south of the major ice divide. The pattern of drainage on the eastern side of the ice sheet consists of a network of small drainage basins, sometimes almost entirely disconnected from the main ice sheet. This is, at least in part, a result of the more rugged mountains in the eastern half of Greenland. By contrast, the drainage to the west of the ice divide is more uniform; individual drainage basins are ill-defined until the margin is nearly reached.

The accuracy of the surface elevation map is not uniform. Map 1 showed the variability in data coverage across the ice sheet due to tracking and retracking difficulties. This variability affects the ability to accurately determine the true surface elevation at any gridpoint (Section 5). The contours of Map 4 are dashed where the calculated error exceeds ± 10 meters. Map 5 presents a statistical summary of the gridding process used to produce the grid elevations. The numerical value at each gridpoint indicates the magnitude of the standard deviation of the gridpoint elevation value. Numerical values start at 1, increase to 9 followed by 0, and continue with the letters A through E. The physical size of the number indicates the size of the fitting region required to arrive at an acceptable fit.

The physical size of the numbers and letters on the ice sheet is small, indicating an ability to obtain a good fit from a biquadratic function without relying on data far from the particular gridpoint. The fitting region is smallest over those areas best covered with groundtracks (Map 1). The poorest quality grid values (represented by large letters) occur in the coastal mountains where data are most sparse.

The numeric sizes of the numbers and letters in Map 5 indicate the ability of the biquadratic function to represent the surface. Where the surface is rough, the number is expected to be larger. Map 5 shows that, in general, the margins are the roughest regions and the ice divides are the smoothest regions as predicted by classical glacier theory. Quantitative comparisons of this parameter between different areas can be misleading, however, because the size of the fitting region varies over the ice sheet. Nevertheless, it is clear from Map 5 that the smoothest regions occur on the ice divides

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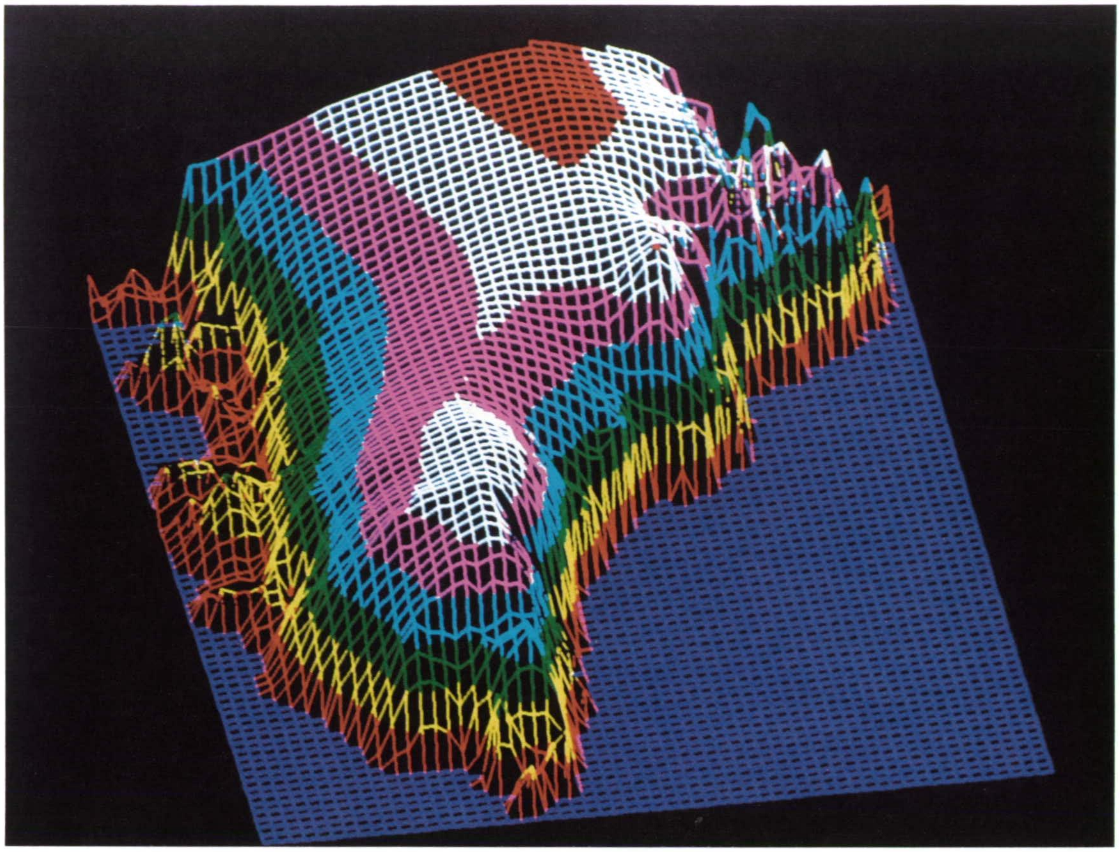

Figure 11. Three-dimensional perspective of Greenland (south of 72° N) from grid elevations. Bands change color every 500 meters of elevation. View is from SSW.

and domes. Over the remainder of the ice sheet, this parameter is quite variable, suggesting that a rough surface is prevalent over much of the ice sheet and is often mixed with regions of smoother surface. This roughness is important when considering the accuracy of repeat altimetry missions to detect regions of changing elevation.

6.2 DRAINAGE BASINS

The increased detail in the contours of surface elevation permit the identification and delineation of individual drainage basins of the Greenland ice sheet. This ability is useful for glaciological studies which seek to isolate the dynamics of a particular basin for detailed study and for hydrological studies of the hydro-potential of distinct basins discharging ice at particular points of the margin.

The discrimination of separate drainage basins is most apparent when a map of flow direction is produced from grid elevations. Because ice flows downhill in the direction of maximum surface slope, the conversion from elevation to the direction and magnitude of maximum surface slope, and therefore, flow direction, is straightforward. Map 6 plots the azimuth of the maximum surface slope at each gridpoint. This direction is determined at each gridpoint from the gridpoint-centered slopes taken in the two orthogonal grid directions.

Map 7 gives our interpretation of the drainage pattern of the Greenland ice sheet derived from large-scale (40 km) surface slopes (i.e., Map 6). Regions of major convergence or divergence near the coast were identified and boundaries between these regions were traced upstream. This map improves upon an earlier version drawn only from surface elevation contours (Bindschadler, 1984). The strong convergence into narrow outlet glaciers east of the major ice divide is striking. In contrast, the convergence west of the divide is much milder. The accuracy of the basin boundaries is limited by the elevation accuracy near the ice sheet margin. Small errors in the orientation of a drainage basin boundary near the ice sheet margin can be amplified upstream, causing large errors in the total areal extent of the basin. In an assessment of the equilibrium conditions of the Jakobshavns Glacier, Bindschadler (1984) used altimeter-derived contours to estimate the drainage basin boundaries and estimated the uncertainty of the basin area to be ± 20 percent.

6.3 SLOPE CORRECTIONS

Because the correction for the slope-induced error (Section 3.5) was a major correction to the elevation data, a map (Map 8) showing the spatial distribution of slope corrections made over Greenland was generated. The same 20-kilometer grid and contouring package were used to produce Map 8 as were used in the elevation map, but a modified grid interpolation scheme was employed. The modification was necessary due to the large spatial variability of surface slope. Proportionally, spatial variation is more rapid for surface slope than for surface elevation, and slope correction varies as the square of surface slope (see Equation 1′). Thus, attempts to fit a biquadratic surface to the slope correction data produced a distribution of grid values which exhibited large local variability. To reduce this variability, the grid values of slope correction were calculated as the average of at least ten data values in the fitting region around the gridpoint. These grid values of slope correction are included in Table 1.

Map 8 shows the expected pattern of smaller slopes in the central ice sheet while the largest slopes are confined to the marginal regions of the ice sheet and to the mountains. Equation (1') can be used to convert the slope correction to slope: a correction of 10 meters corresponds to a slope of 0.005 radians (about 0.3 degree).

There is a difference between the slopes represented by Map 8 and the slopes derived from the grid elevations. The latter set represent an average over two grid spacings, or 40 kilometers, and are more of a regional slope suitable for calculation of driving stress (Drewry, 1983). The slopes represented in Map 8 are essentially an expression of intermediate-scale slopes which occur within the beam-limited footprint (22-kilometer diameter) and affect the displacement of the first return from nadir. The considerable structure in the contours of Map 8 demonstrates that although the general shape of the ice sheet is smooth, the surface contains undulations everywhere on an intermediate scale which have a significant effect on altimeter performance.

6.4 AUTOMATIC GAIN CONTROL

The Automatic Gain Control (AGC) of the altimeter adjusts the receiver gain to maintain a preferred recorded signal strength as the return signal strength varies. Its value can be used as a measure of the return signal strength. Large AGC values correspond to strong return signals. The strength of the return signal will vary with both the geometric shape and reflecting character of the ice sheet surface. Map 9 shows the distribution of AGC over Greenland.

As with the slope correction, the spatial variability of AGC is quite high and the grid values were calculated from an average of AGC within a fitting region local to each gridpoint. The textural homogeneity of an ice-sheet surface on the scale of many kilometers suggests that some of the variability in AGC is caused by surface topography. Figure 3 shows how geometric focusing and defocusing of the beam energy on the scale of the beam-limited footprint are possible.

The broader trend of higher values of AGC in the interior and lower values nearer the margin is probably due to a combination of two effects. The larger surface slopes nearer the margin will tend to reduce the intensity of the return signal relative to the flatter central ice sheet because more of the return will be coming from the edge of the antenna beam. In addition, the Seasat data were collected in late summer when the margins were experiencing surface melting. The presence of free water in the surface snow would reduce the amount of energy returned. In this report we do not attempt to discriminate between these two effects or quantify their relative contributions.

7
REGIONAL STUDIES

7.1 GEO-REFERENCED DATA BASE

The examples in Section 6 illustrate how the full data set can be used to produce large-scale maps of different altimeter parameters. There is, however, another set of studies on a regional or local scale which is also important. Considerable effort has been directed toward the organization of these data into a data base which makes such local studies more feasible. The data in this data base are geo-referenced; that is, organized by geographical position to facilitate the access of regional data from a much larger data base. This data base is now archived at both the World Data Center for Glaciology-A in Boulder, Colorado; and at NASA/Goddard Space Flight Center in Greenbelt, Maryland. The altimeter data are stored both as individual elevation measurements and as grid values (see Section 5). These data are available in tape format and are accompanied by a User's Guide (Zwally and others, 1989b) to facilitate the use of these data.

Map 10 shows the geographical scheme used to organize the individual data values. The data are arranged into 4300 storage bins to ease the selection of subsets of data for limited regions. The size of each storage bin decreases with latitude to keep the number of data in any bin from becoming very large. The number of data within any bin ranges from zero to 475. The information on each data point in any bin consists of: location, surface elevation, Seasat orbit number, orbit adjustment, standard deviation of the orbit adjustment, slope correction, and standard deviation of the slope correction.

The grid elevations are also archived. For each gridpoint, there is information on geographic position, surface elevation (including standard deviation), size of the fitting region, and the coefficients of the biquadratic (or bilinear) surface derived for the calculation of the grid value.

As examples of how the data base can be used to produce maps of specific regions, two regions of particular interest are shown: the drainage basin of Jakobshavns Glacier and the ice divide in the vicinity of Crete Station.

7.2 JAKOBSHAVNS GLACIER DRAINAGE BASIN

Jakobshavns Glacier, an outlet glacier in West Greenland, is one of the Greenland outlet glaciers for which discharge rates have been calculated (Carbonnell and Bauer, 1968; Lingle and others, 1981). Integration of the snow accumulation over the catchment basin of this glacier results in the balance flux which, when compared to the measured outflow, provides a measure of the average thickening or thinning within the basin. Altimeter-derived elevations were used to produce a contour map of the area containing the drainage basin. This map was then used to define the boundaries of the drainage basin of Jakobshavns Glacier and calculate the balance flux expected throughout the basin (Bindschadler, 1984).

The data base described in Section 7.1 was used to select the relevant data (46,480 individual data points in 1168 bins). A grid 0.1 degree in latitude by 0.2 degree in longitude was generated and grid elevations were calculated in a manner equivalent to the full Greenland case. The data were corrected for slope-induced errors and referenced to mean sea level by subtracting the geoid. Map 11 shows the distribution of groundtracks, Map 12 is the 50-meter contour map generated from the grid elevations, and Map 13 shows the statistics of the gridding process (size of fitting region and standard deviation of the gridded elevations). The contour lines of Map 12 are dashed where the standard deviation of the gridded elevations exceeds ± 10 meters.

Jakobshavns Glacier terminates at 69.1° N, 310° E. On Landsat imagery, the glacier can be identified as extending 100 kilometers inland (Williams, 1986). Map 12 does suggest a zone of moderate convergence upstream of the Jakobshavns Glacier terminus. Map 11 shows that data in this region are sparse and Map 8 indicates the large slope-induced errors. It is important to note these facts when interpreting the details of contours near the margin and the values of those contours. Nevertheless, the altimeter data are the only information used to derive the contour plot and they do indicate the proper location of the outlet glacier.

7.3 CRETE STATION REGION

A second regional map was made of the area around Crete Station (71.12° N, 322.68° E). This site, near both the ice divide and the maximum latitude of Seasat coverage, occurs at a location where the density of data is particularly high. Map 14 shows the distribution of usable data in this region. These data are contained in 371 bins of the geo-referenced data base.

Using a polar stereographic grid with a 5-kilometer grid spacing, the grid elevations were calculated and then contoured at 2-meter intervals to create the plot shown in Map 15, while Map 16 shows the pattern of statistics of the gridding process. The elevation contour lines are dashed in the areas where the standard deviations of the grid elevations exceed $\pm$ 10 meters. Figure 12 is a three-dimensional perspective of the region using colored bands for every 50 meters of elevation. With such a small contouring interval, the undulations in the surface are revealed, especially in the contour plot.

The ice divide is easily identifiable as a fairly sharp ridge 72° N to 71.2° N which broadens to the south and by 70° N is hardly distinguishable. The existence of the saddle along the ice divide at 70° N is not certain because it occurs at the southern limit of the mapped region where artificial features may arise from edge effects of the contouring process.

The surface slope on the eastern side of the ice divide is larger than that on the western side, but the undulations on either side appear approximately equal in amplitude and wavelength. Variations of the surface slope over these undulations are of the order of 10^{-3}. These undulations would be imperceptible to the field observer's eye without the aid of stake lines or leveling traverses. Extensive radar soundings over the northern half of the mapped region have confirmed that this area is underlain by a rough bed (Hodge, personal communication). A preliminary map of the subglacial relief indicates a positive correlation between the surface and bedrock roughnesses. The scale of undulations is also of the same order as slope variations discernible from Landsat imagery (Swithinbank and others, 1988), and Landsat MSS imagery of this area at low sun angle shows some evidence for the existence of undulations.

Figure 12. Three-dimensional perspective of region near Crete Station. Area shown in figure corresponds to Map 16. Bands change color every 50 meters of elevation. View is from SSE.

8
COMPARISON OF SATELLITE ALTIMETER ELEVATIONS TO OTHER ELEVATION MEASUREMENTS

8.1 GEOCEIVER-DERIVED ELEVATIONS: GENERAL

The initial demonstration that satellite altimetry data are useful for ice sheet elevation measurements was made by Brooks and others (1978) when they confirmed that elevations derived from the radar altimeter on Geos-3 were in rough agreement with elevations determined by satellite positioning receiver (geoceiver) on the ice sheet surface (Mock, 1976). Without sufficient data density, however, interpolation of the altimeter data to the precise geoceiver position was not possible. The distribution of Seasat data is more dense and does permit this interpolation.

From 1972 to 1975, eight geoceiver elevations south of 72° N were measured and published by Mock (1976, Table 1). All sites were located near the central ridge of the ice sheet (see Map 17). The published elevations are not corrected for the height of the electrical center of the geoceiver antenna above the surface and are referenced to the NWL-9D ellipsoid ($a = 6,378,145$ m, $f = 1/298.25$). A correction is made to transform Mock's data to the IUGG-77 ellipsoid ($a = 6,378,137$ m, $f = 1/298.257$), used as the reference for Seasat elevations. This transformation also requires information on the relative positions of the ellipsoid centers and semimajor axes. We assumed that they coincided. In addition, it is assumed that the height of the electrical center of the antenna above the surface was 1 meter in all cases. Mock provides no data on this height at different sites, but for the type of antenna used, our assumption is valid to ± 0.5 meter. A Seasat elevation at each geoceiver position is calculated from the four nearest grid elevations: the gridding surfaces for each of the four gridpoints are evaluated at the geoceiver position and a weighted average is calculated, based on the inverse of the distance between each gridpoint and the geoceiver position.

Table 2 compares the geoceiver elevations to the Seasat elevations. The mean difference (Seasat-Mock) is −5.71 meters with a standard deviation of ± 7.64 meters. The derived accuracy of the Seasat measurement is roughly ± 2 meters over the central region (see Figure 8). The accuracy of the geoceiver measurement varies from site to site, depending primarily on the number of satellite passes obtained. Mock's estimates of the elevation error at each site range from 1.5 to 5 meters. With only eight comparisons at six sites, a zero mean cannot be expected, but a difference of zero meters is within one standard deviation of the calculated mean. From work done in Antarctica using similar geoceivers, Bindschadler and others (1987) report that multiple-pass elevations obtained 1 year apart differed by a mean of 3.6 meters. Thus, the size of the standard deviation is reasonable.

8.2 GEOCEIVER-DERIVED ELEVATIONS: SOUTHERN GREENLAND

A second set of geoceiver measurements was obtained by glaciologists of the Ohio State University during the summers of 1980 and 1981 (Drew, 1983). Their measurements were concentrated in three clusters in southern Greenland (see Map 17). Table 3 summarizes the comparison between their 22 geoceiver sites and corresponding Seasat elevations calculated from grid elevations as described in Section 5. The OSU measurements were referenced to the WGS-66 ellipsoid ($a = 6,378,145$ meters, $f = 1/298.25$) and are transformed in Table 3 to the IUGG-77 ellipsoid.

The mean difference (Seasat-OSU) in Table 3 is −0.87 ± 12.59 meters. With this larger sample size, the mean has decreased to less than one meter. The errors quoted for the geoceiver elevations were generally less than one meter due to the large number of passes collected at each site (Drew, 1983). In contrast to the reduced mean difference, the standard deviation has increased. The western cluster (sites beginning with WC) occur in a region where derived errors of the gridded altimeter elevations exceed ± 10 meters. However, there is a large difference seen in at least one site in each OSU cluster (WC, CC, and EC). Sites located in deep surface troughs "hidden" from the altimeter by higher surrounding topography seem unlikely in the CC and EC clusters because the sense of the difference is that the altimeter surface is lower than the geoceiver surface. There seems to be no systematic explanation for the large standard deviation.

8.3 GEOCEIVER-DERIVED ELEVATIONS: CRETE STATION REGION

A third set of geoceiver-derived elevations was collected by Danish field parties in the region around Crete Station (71.1° N, 322.7° E) in 1984 and 1985. It is expected that the Seasat elevations in this region are particularly good because it is near the center of the ice sheet and near the latitude where the density of coverage is at a maximum. Gundestrup (personal communication, 1986) has made data available to us for the seven geoceiver sites (labeled A, B, D, E, F, G, and H). These locations, along with Crete Station (occupied with a geoceiver in 1972 by Mock), are included in Map 16. The Danish geoceiver elevations are referenced to the WGS-72 ellipsoid (a = 6,378,135 m, f = 1/298.26) and are transformed to the IUGG-77 ellipsoid and adjusted for antenna height for the comparison with Seasat elevations in Table 4. The Seasat elevations are calculated from the grid elevations as described earlier but employing the finer resolution, 5-kilometer grid used to generate Map 16. The elevations for the sites in Table 4 do not agree with the elevations on Map 16 because the map is referenced to mean sea level and the Table 4 elevations are referenced to the IUGG-77 or WGS-72 ellipsoid. The difference is the geoid.

Table 4 indicates the mean elevation difference (Seasat-Danish) is -3.94 ± 2.15 meters. The size of the mean is intermediate between the two previous comparisons in Sections 8.1 and 8.2. The sample size is small, nevertheless, the standard deviation is small. A mean difference of zero is no longer within one standard deviation of the calculated mean. This suggests that there may be a bias between the Seasat-derived and geoceiver-derived surfaces (with the Seasat surface being slightly lower), but from the three comparisons with geoceiver data, it is not possible to draw definite conclusions. This point is discussed in more detail in Section 8.5.

8.4 OPTICALLY-SURVEYED ELEVATIONS: EGIG LINE

Another data set with which comparisons can be made is a line of surface markers known as the EGIG line (Malzer, 1964) (see Map 17). This line was surveyed in 1959 and again in 1968 (Seckel, 1977). The important difference between these data and the other data sets is that this line was optically surveyed and tied to sea level at the western coast of Greenland. Thus, the elevations are directly referenced to mean sea level. To compare them to satellite elevations, a geoid model must be applied. Using the GEM10-B geoid model which is specified on a 1-degree by 1-degree grid, the Seasat elevations (calculated at the EGIG stake location using the weighted averaging technique described earlier) were adjusted to a mean sea level reference.

Table 5 shows the comparison of these two elevation sets. The mean difference (Seasat-EGIG) is -0.53 ± 11.13 meters. Figure 13 plots the comparison with distance along the EGIG line. A systematic trend in the difference is clear, with a larger absolute difference occurring nearer to the ice sheet margin. The larger differences are believed to be caused by a combination of the larger slope-induced error (see Map 8) and the rougher surface. These differences are also responsible for the large standard deviations nearer to the margin.

A second comparison using the EGIG data is possible when considering those data which lie in the Crete region discussed in Sections 7.3 and 8.3. Map 16 includes the locations of the EGIG stakes. Table 6 repeats the EGIG elevations and compares them with Seasat elevations calculated at the EGIG stake locations employing the higher-resolution grid used to generate the 2-meter contour elevation map (Map 16), and adjusting them to a mean sea level reference using the GEM10-B geoid. The Seasat elevations are seen to agree well with their respective locations on the 2-meter contour map. This serves as a consistency check on the weighted-average method used to derive the Seasat elevations for Tables 2 through 6. The mean difference (Seasat-EGIG) is -2.60 ± 2.76 meters. This is similar to the difference calculated in this region between the Danish geoceivers and Seasat (see Table 4).

The individual stake differences are included in Figure 13. The differences in the Crete region are very similar to the differences in Table 5. This similarity confirms that the surface definition is not strongly dependent on grid size. The small differences between the results of Tables 5 and 6 are probably due to the ability of the smaller grid to better represent the details of the surface.

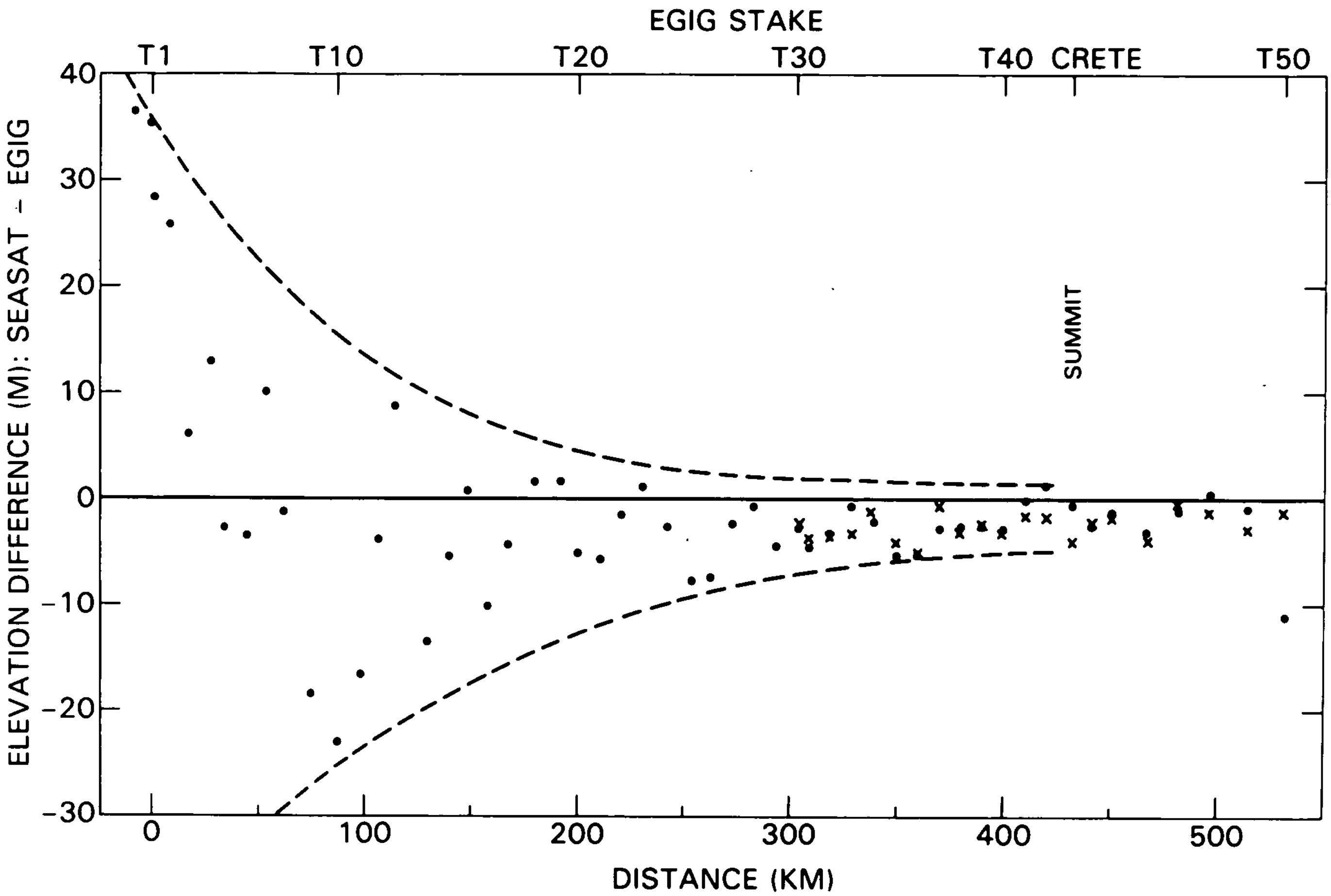

Figure 13. Elevation differences between Seasat and EGIG survey. Solid circles are differences using Seasat elevations from 20-kilometer grid (Table 5). X's are differences using Seasat elevations from 5-kilometer grid in region around Crete Station (Table 6).

8.5 POSSIBLE BIAS IN SEASAT-DERIVED ELEVATIONS

In each of the five comparisons made here between Seasat elevations and elevations derived by either geoceiver or optical surveying, Seasat elevations were lower. Figure 14 summarizes these comparisons. The standard deviations are smallest for the two comparisons made for the region around Crete Station. For these two, a zero bias does not fall within one standard deviation of the mean difference. On the other hand, for the other three comparisons, zero bias is included, and for two of these, the mean itself is within 1 meter of zero. Figure 14 suggests that Seasat elevations may be lower by anywhere from 2 to 3 meters on average than those derived by either geoceiver or optical survey.

One possibility for the differences between the Seasat elevations and the geoceiver elevations is differences in the orbital calculations used by Seasat and by the geoceiver satellites. Such differences could arise from different gravity models being used in the generation of the respective orbit ephemerides. However, this would not explain the differences with the optical survey data.

Another possibility is penetration of the radar pulse into the ice sheet surface which alters the shape of the leading edge of the return waveform. Significant penetration could lead to a volume scattering component which, when the return waveform is retracked, could cause a range error. Ridley and Partington (1988) have shown that this error can overestimate the range (and underestimate the elevation) by as much as 3.3 meters. The error, however, is dependent on the retracking method; Ridley and Partington further state that the Martin and others (1983) method used to retrack the Seasat data is more accurate than other methods they tested (see Section 3.2). Nevertheless, it is useful to keep the effect of penetration in mind. The largest biases in Figure 14 are for those comparison sets which occur on the highest elevations of the ice sheet where penetration is more likely. Unfortunately, a sufficient amount of control data are not available to make possible any comprehensive study of regional or temporal trends in the differences. Nevertheless, the possible existence of differences must not be ignored when combining data sets of elevation collected by different sources.

Neither can the possibility be excluded that these differences represent real elevation change. Again, the data are too sparse in time, location, and number to reject or confirm this possibility at this time. These comparisons of data sets underscore the need for reliable reference levels. Without them, detection of changes in ice sheet elevation will not be possible.

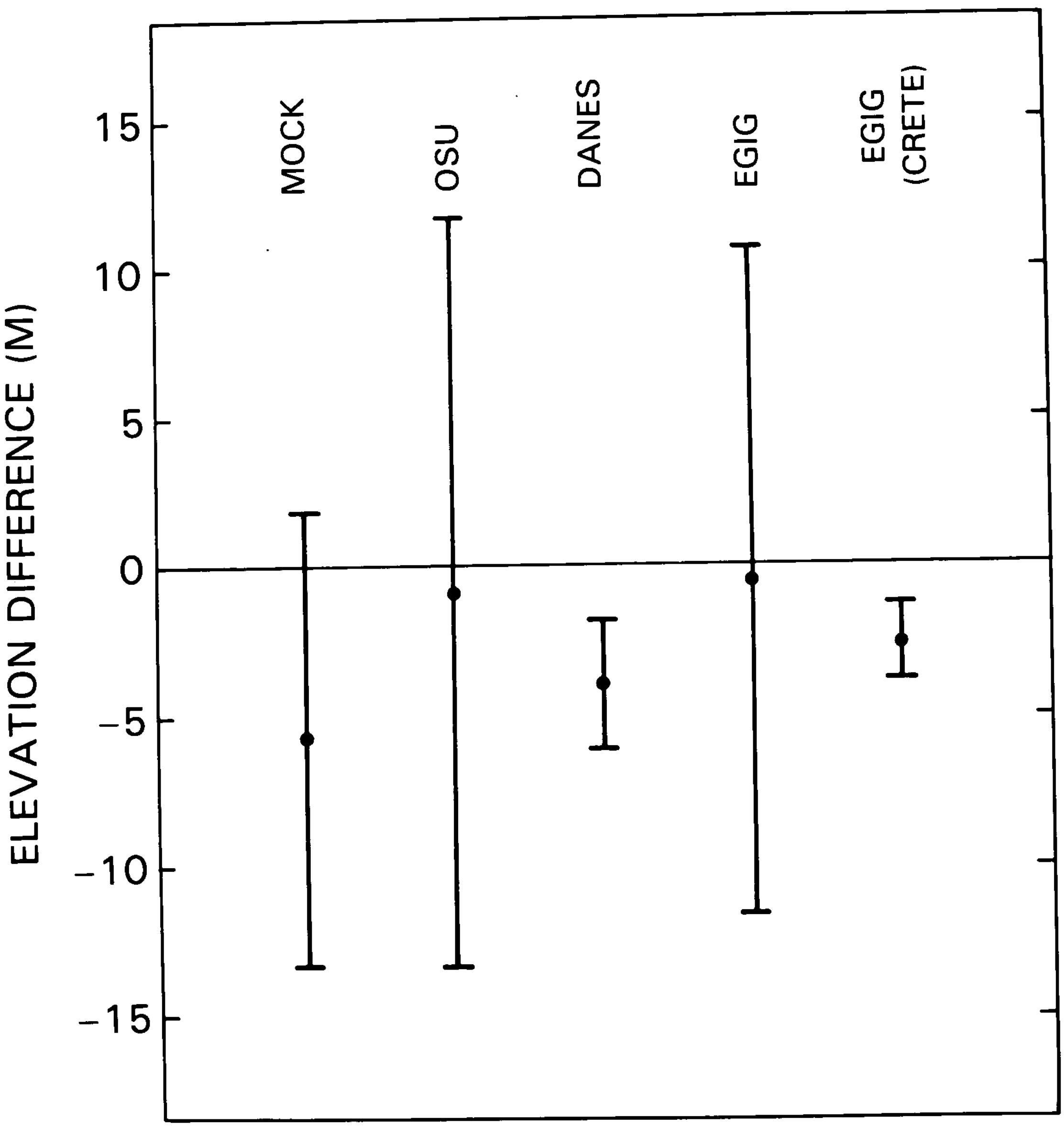

Figure 14. Mean elevation difference for five comparison sets appearing in Tables 2 through 6. Length of bar corresponds to one standard deviation.

9
FUTURE WORK

Nearly all of the work discussed in the preceding sections has been based on the analysis of a single parameter from the altimeter data—the midpoint of the leading edge. We have interpreted this parameter to be the best representative measure of the average range to the near-surface. Other measures of range were discussed in Section 3.1. Some useful analysis by Partington and others (1987) has been completed with this approach in mapping crevasse fields and grounding lines in Antarctica.

The wide variety of waveforms shown earlier in Figure 3 indicates that the details of individual waveforms contain information on the geometric character of the surface. The slope and height of the leading edge, the slope of the trailing edge and the separation of double waveforms are all important data which deserve attention. The development of methods to extract this information will rely on model simulations to demonstrate the uniqueness of inverse techniques. Section 6.4 briefly discussed the AGC parameter, but much more interpretation of the variation in this parameter is possible.

Most waveform details are a result of the wide-angle beam of the altimeter. While the illumination of a large surface area enables the collection of information about that area, the interpretation of this information may prove difficult. The effect of slope-induced errors also limits the accuracy of the primary measurement, the elevation, for the wide-angle altimeter. Thus, it is our feeling that future altimeters would be more useful to the glaciological community if the footprint of the altimeter was substantially reduced. For radar systems, this can be done using synthetic aperture techniques. An alternative is the use of a laser whose narrow beam also avoids the need for a large antenna. Both techniques are presently being studied and it is hoped that future spacecraft will include such instruments.

10
SUMMARY

Altimetry from space provides the synoptic coverage and the data density to map the entirety of the polar ice sheets accurately enough to detect changes in their elevations. In this report, the data from the radar altimeter on board the Seasat satellite were analyzed to determine a number of fundamental glaciological characteristics such as shape, flow direction, and drainage basin boundaries. These data serve as a baseline data set from which the mass balance of the ice sheets will be measurable directly. Used in this and other ways, these data, and the continued monitoring of the polar ice sheets from space, will enable scientists to assess the current role of the ice sheets in their effect on the global climate.

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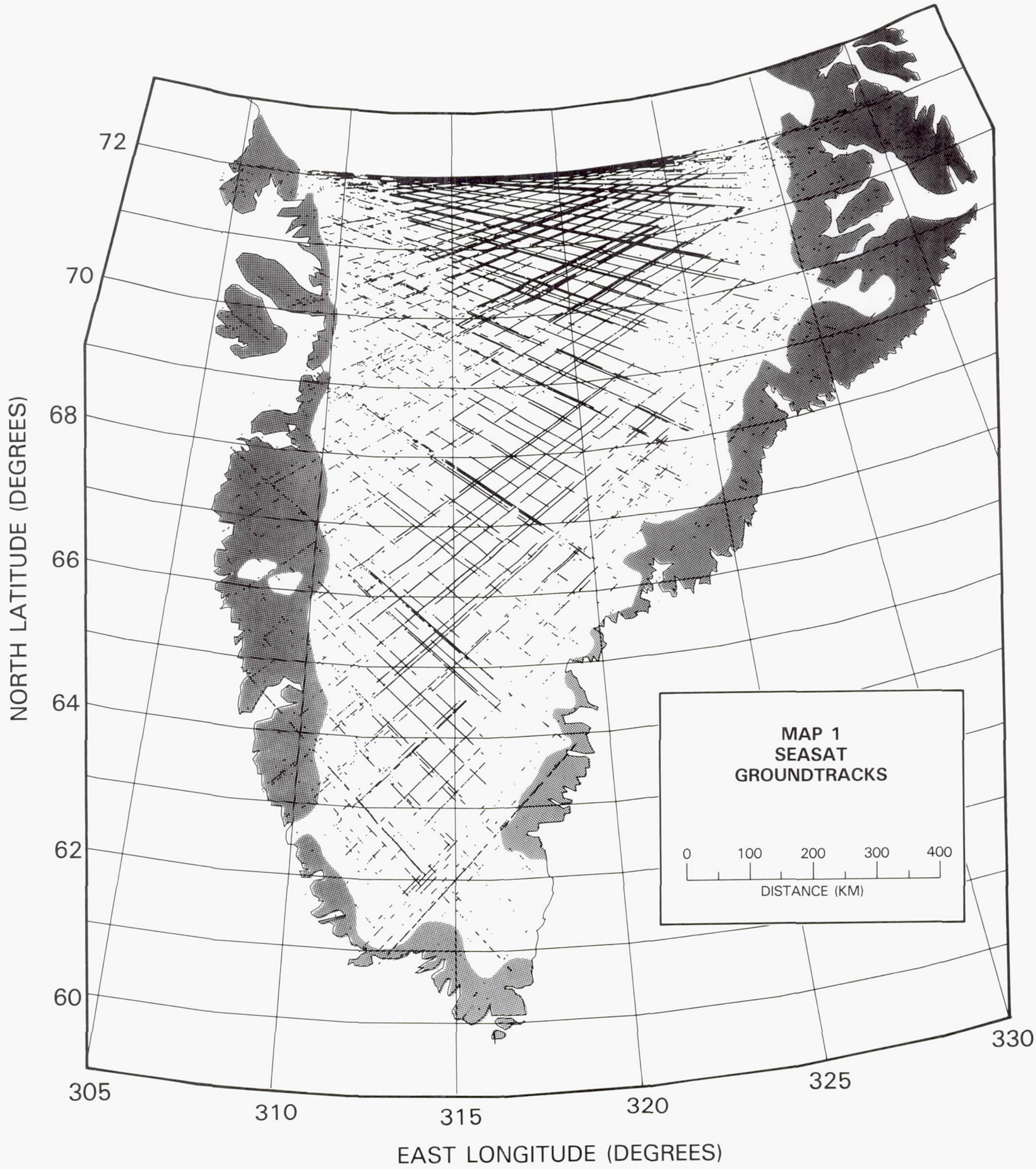
APPENDIX A
MAPS



Map 1. Locations of useable Seasat range measurements. Continous data points are spaced 662 meters apart. In the rougher margins of Greenland, data are sparse. Shading in this and subsequent maps represents the portions of Greenland not covered by ice sheet. Projection of this and subsequent maps is polar stereographic.

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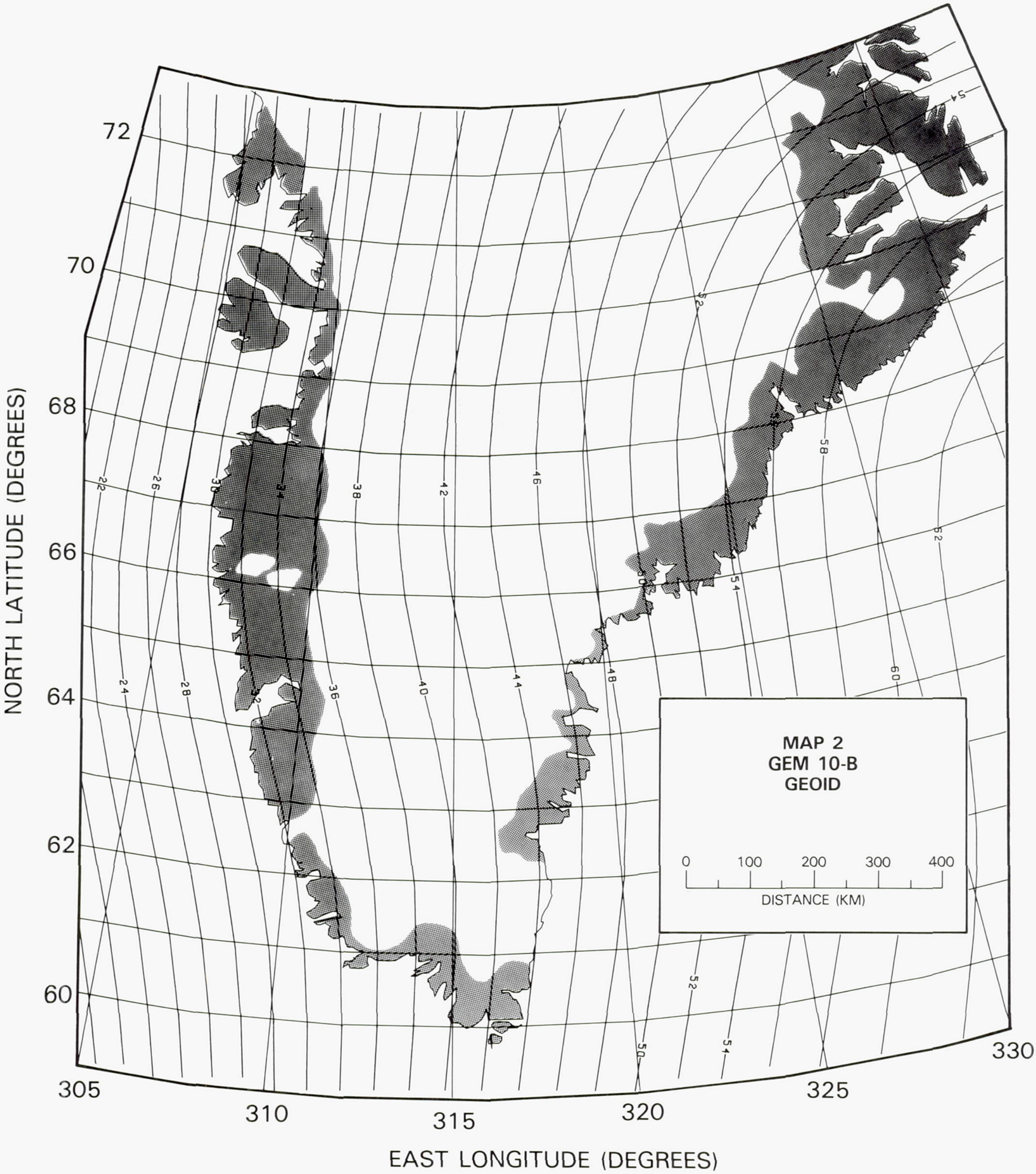
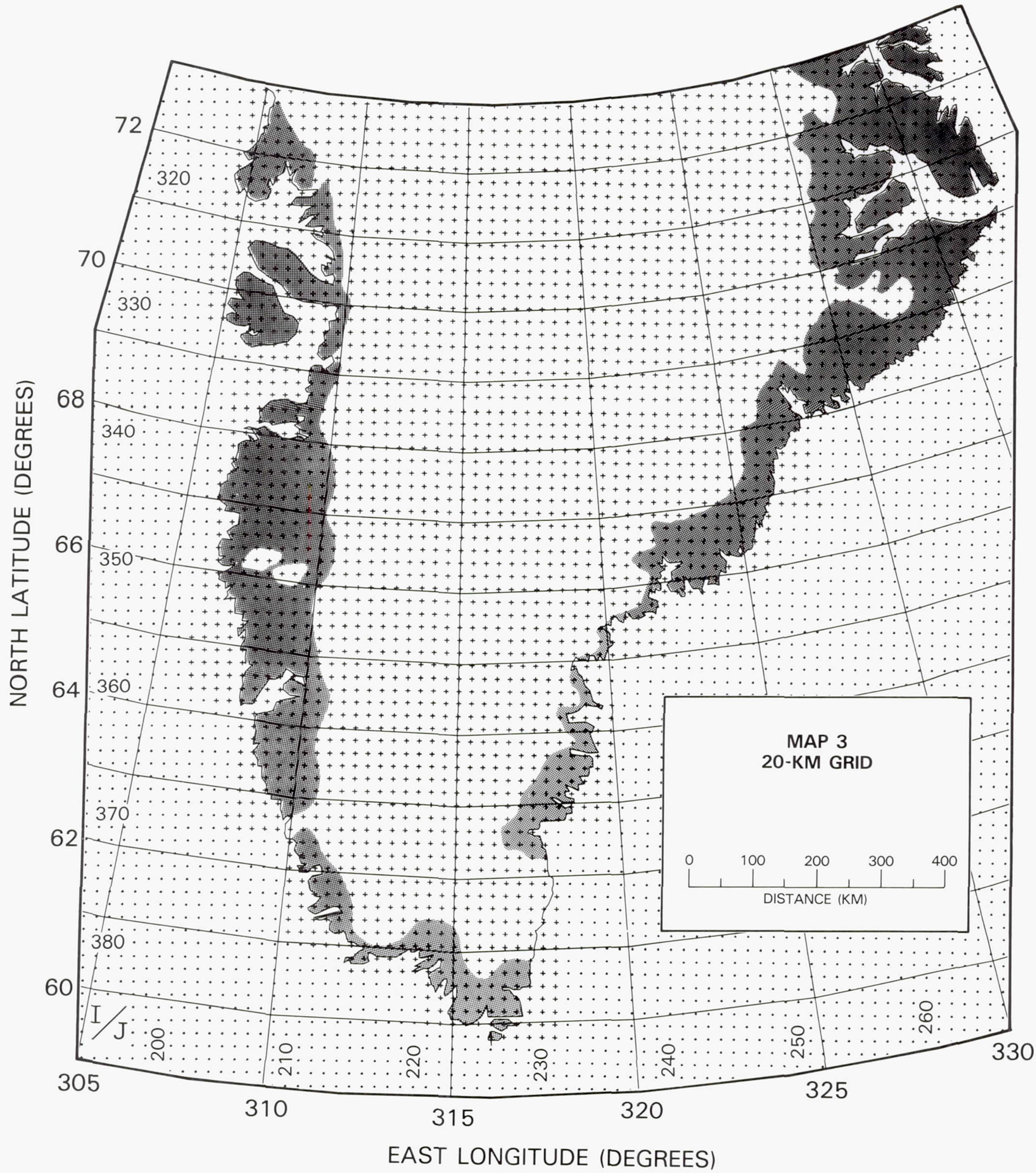
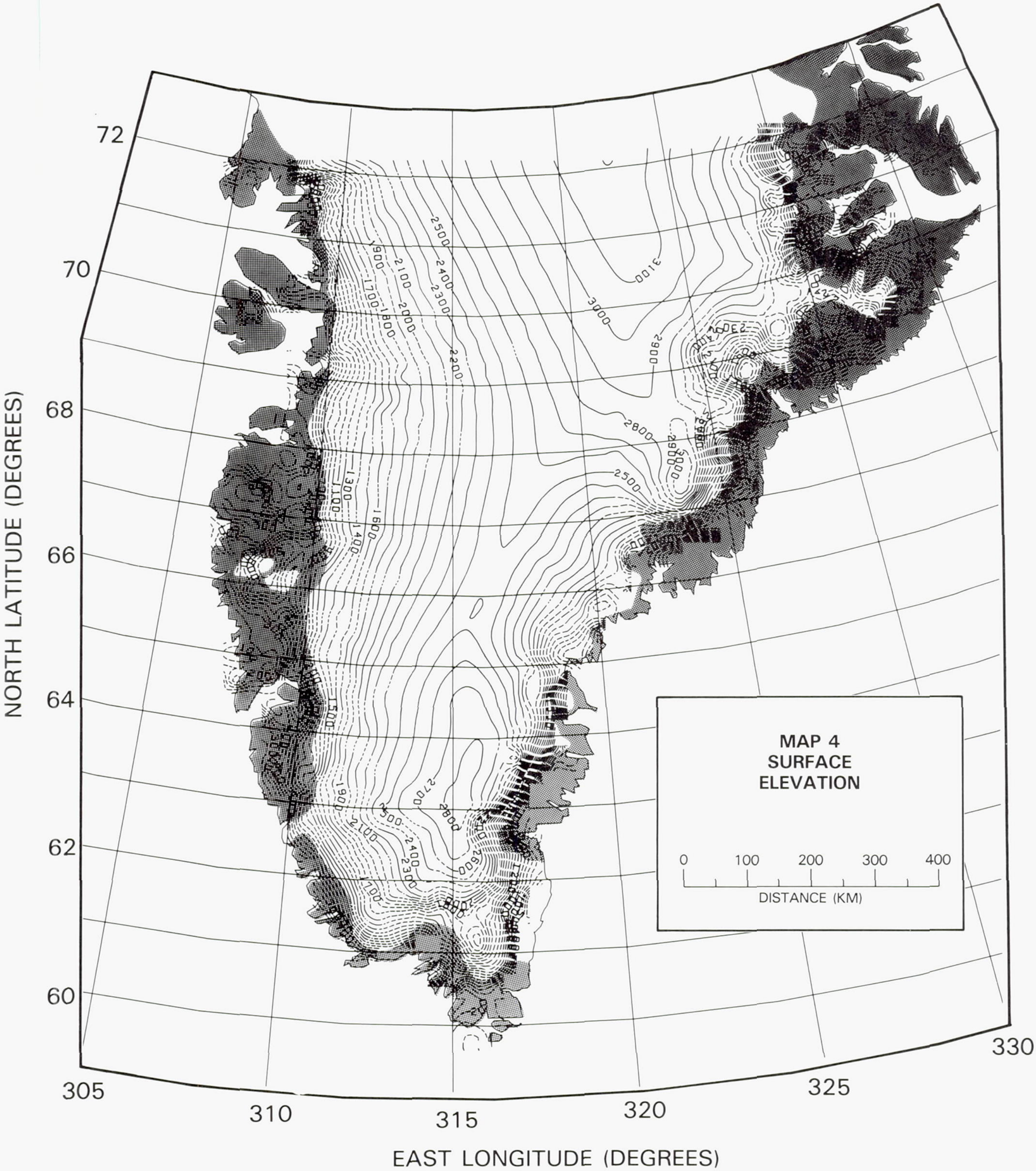


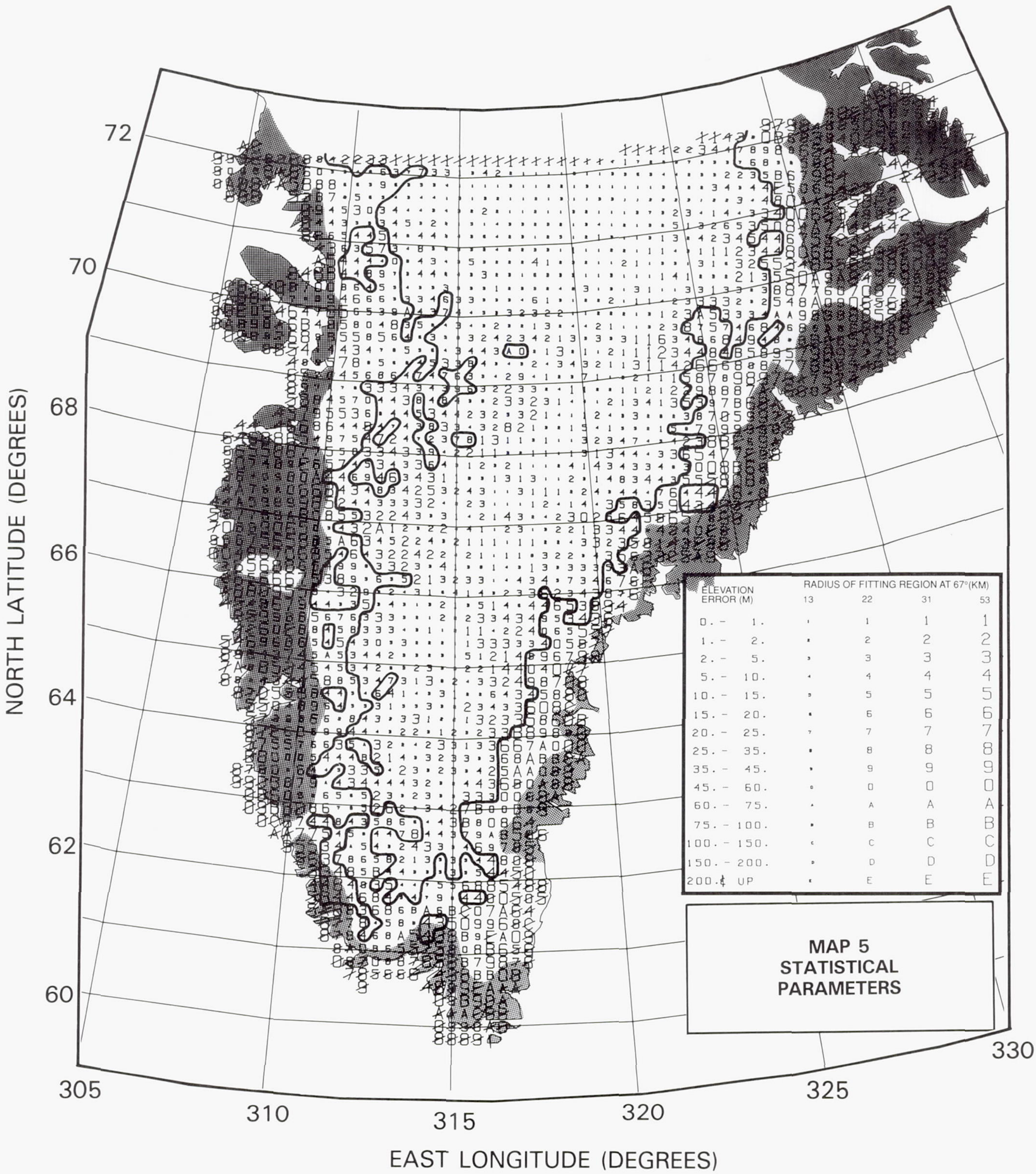
Map 2. Contours of the GEM 10-B geoid in the Greenland region. Values are referenced to the IUGG-77 ellipsoid. Contour interval is 2 meters.



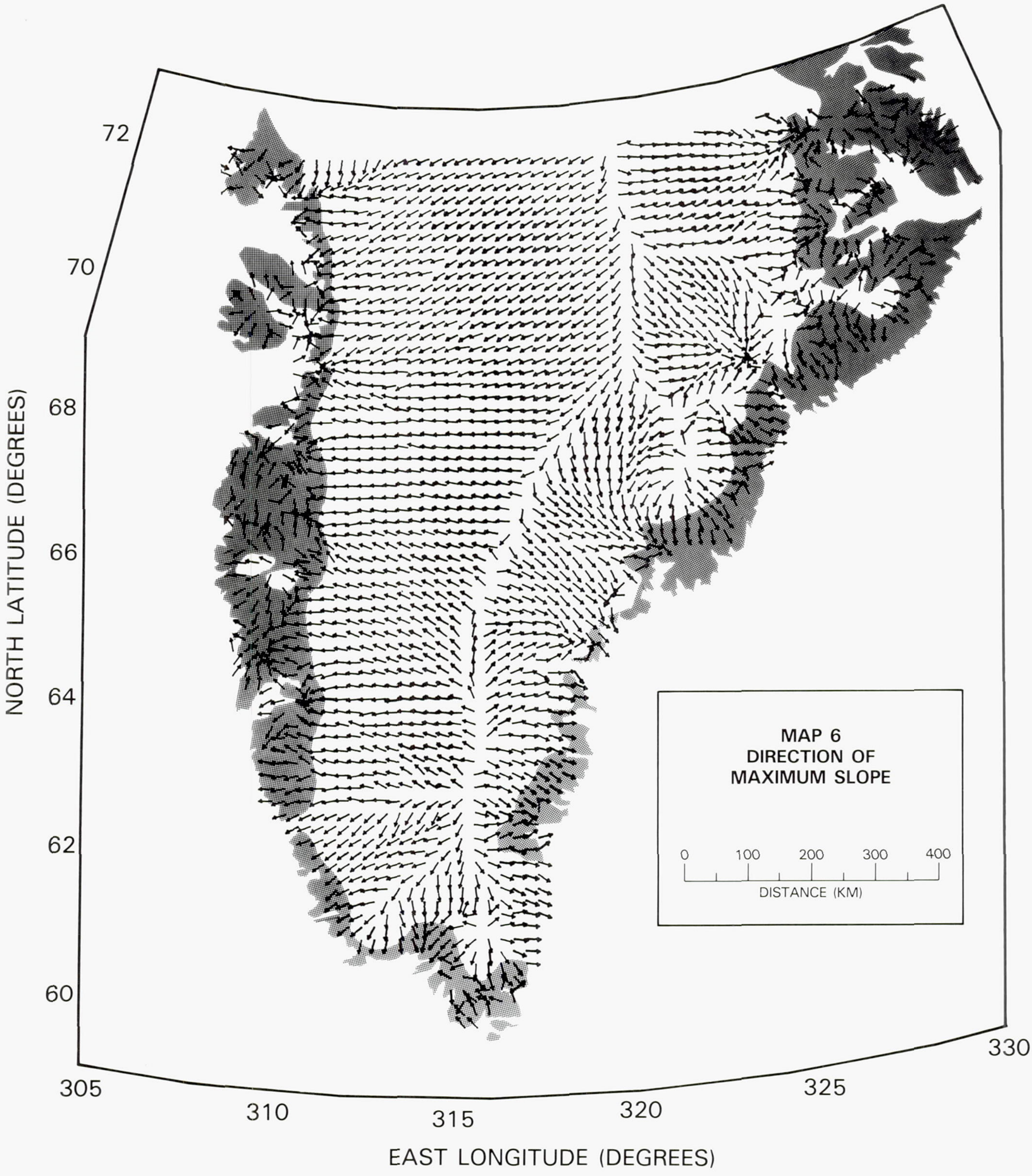
Map 3. Regular grid superimposed on Greenland region. Spacing of gridpoints is 20 kilometers at 90° N. Rectangular axes provide unique coordinates (I, J) for each gridpoint (see Table 1). I- and J-axes are oriented roughly north-south and east-west, respectively.



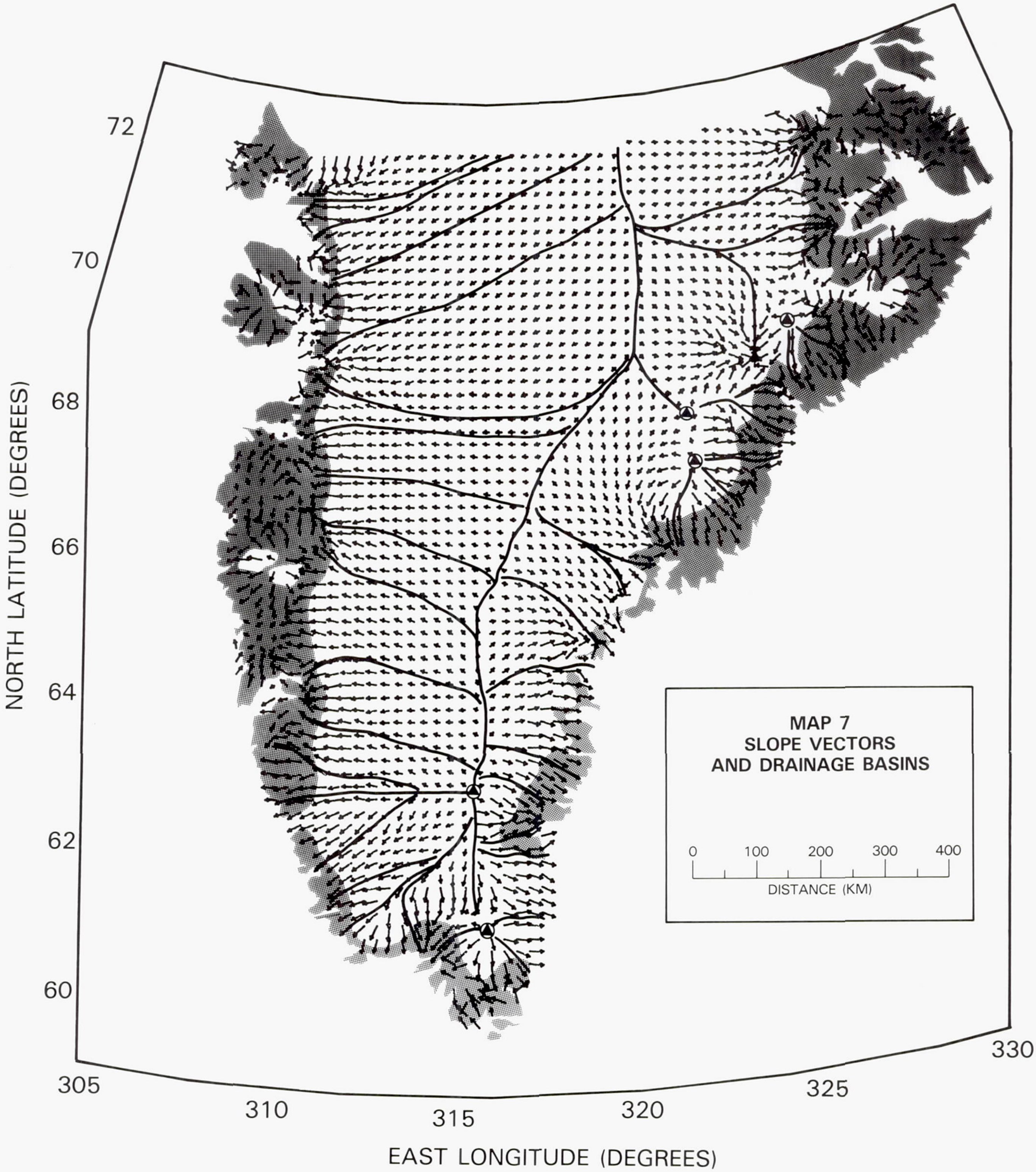
Map 4. Surface elevation contours of Greenland relative to mean sea level (as defined by the GEM 10-B geoid). Contour interval is 100 meters. Contour lines are dashed in areas where grid-elevation error (one standard deviation) exceeds ± 10 meters (see Map 5). Shaded areas are not covered by ice sheet. Some areas near the coast are not contoured due to sparsity of data.



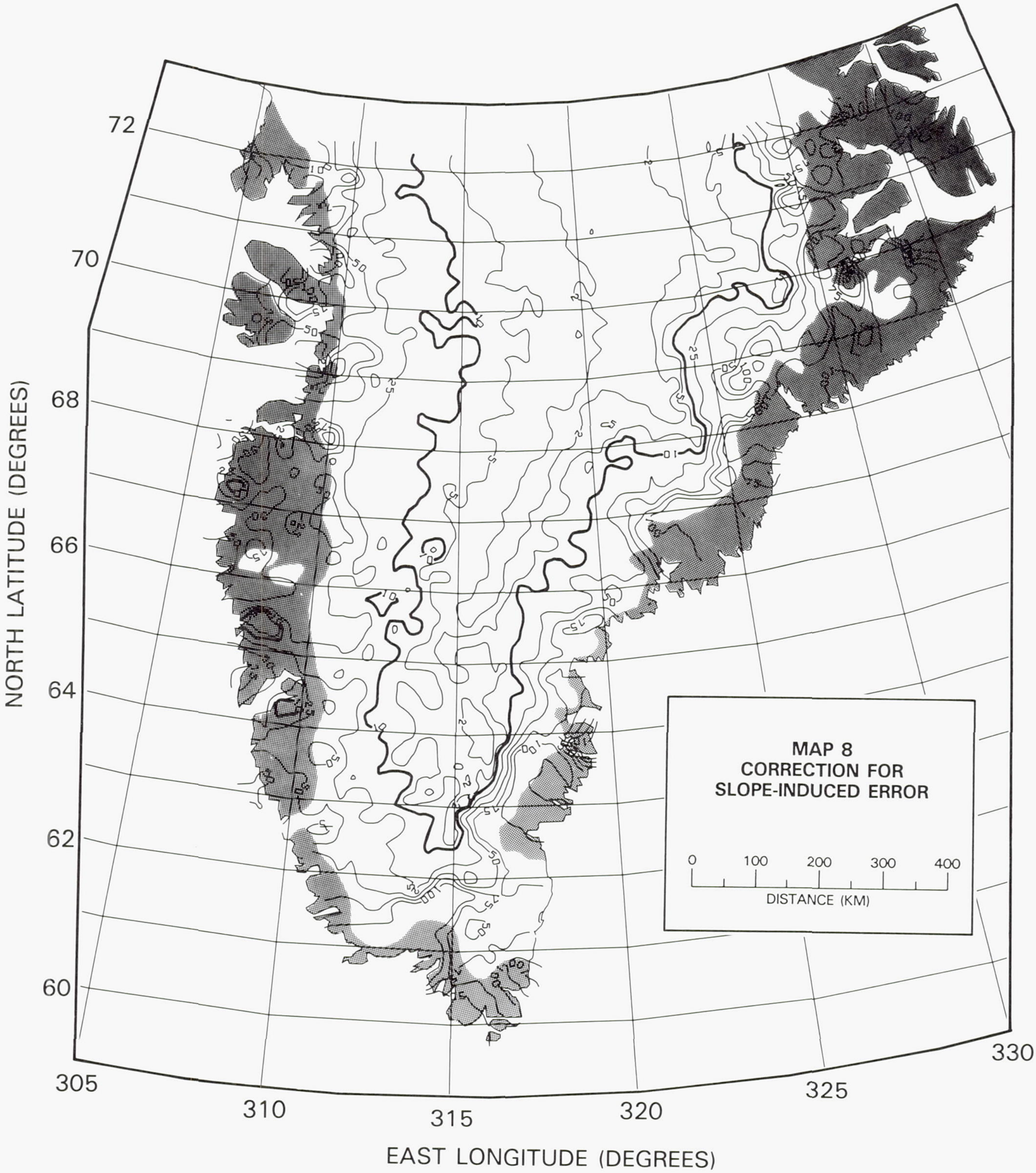
Map 5. Statistical parameters of grid-elevation values. Physical size of number or letter indicates the size of fitting region used for interpolation at each gridpoint while numerical value or alphabetic order indicates the error (one standard deviation) for each grid elevation. Inset table gives the respective values of fitting region and elevation error for a particular number or letter. Radius of fitting region varies with latitude by a scaling factor equal to the cosine of the latitude. A slash through a number or letter indicates that a bilinear fit was used rather than a biquadratic fit as described in the text. Single contour is drawn at elevation error of ± 10 meters.



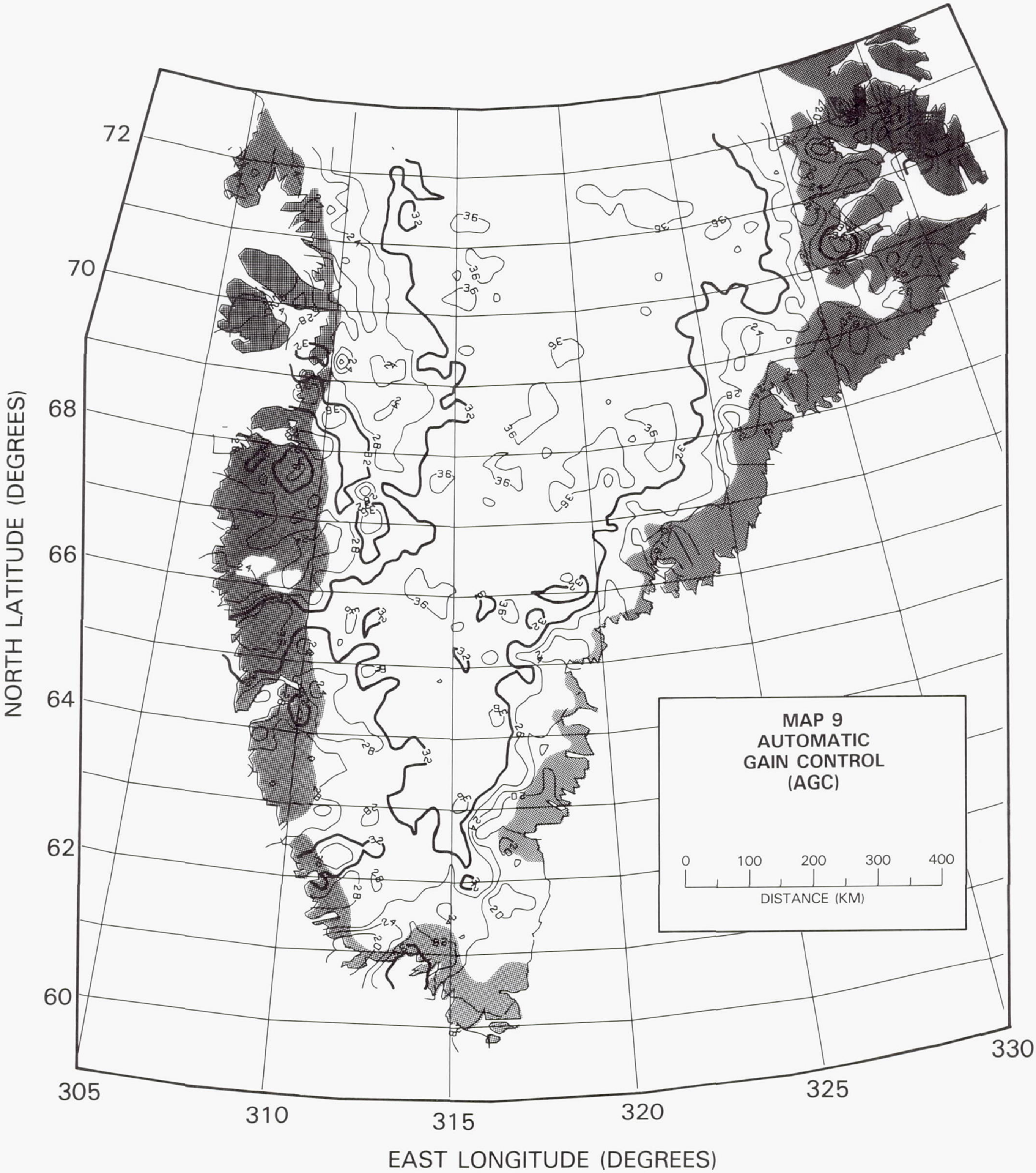
Map 6. Azimuth of maximum slope at each gridpoint derived as centered-difference slope using grid-elevation data set. Slopes correspond to a 40-kilometer average and indicate direction of ice flow.



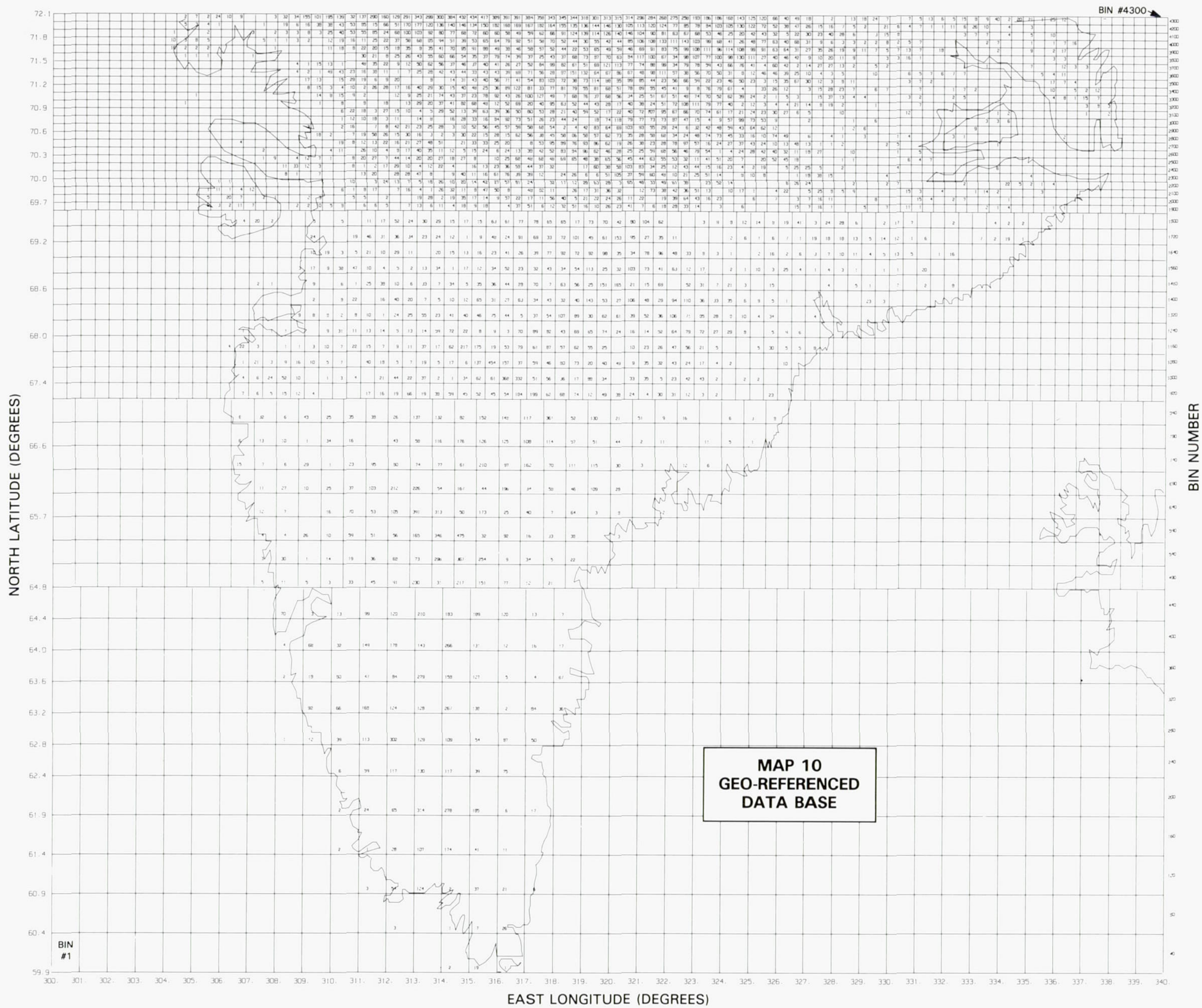
Map 7. Drainage basins interpreted from slope-azimuth map (Map 6). Length of each vector in this map is scaled to magnitude of surface slope.



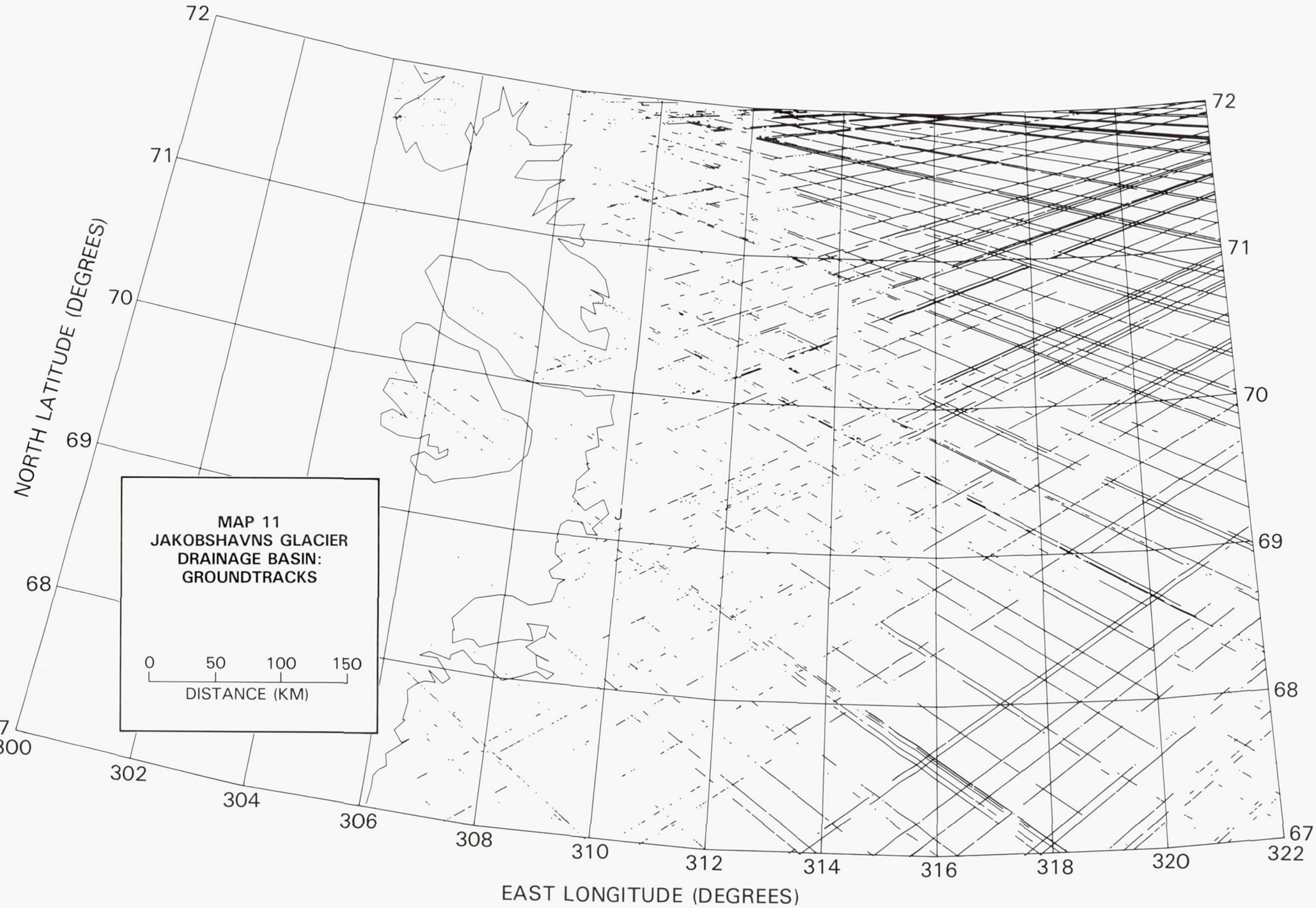
Map 8. Contours of elevation correction for slope-induced error. Contour values are 2, 5, 10 (bold), 25, 50, 75, and 100 meters. Elevation correction values at each data point are calculated from Equation (1′) and then gridded as described in the text.



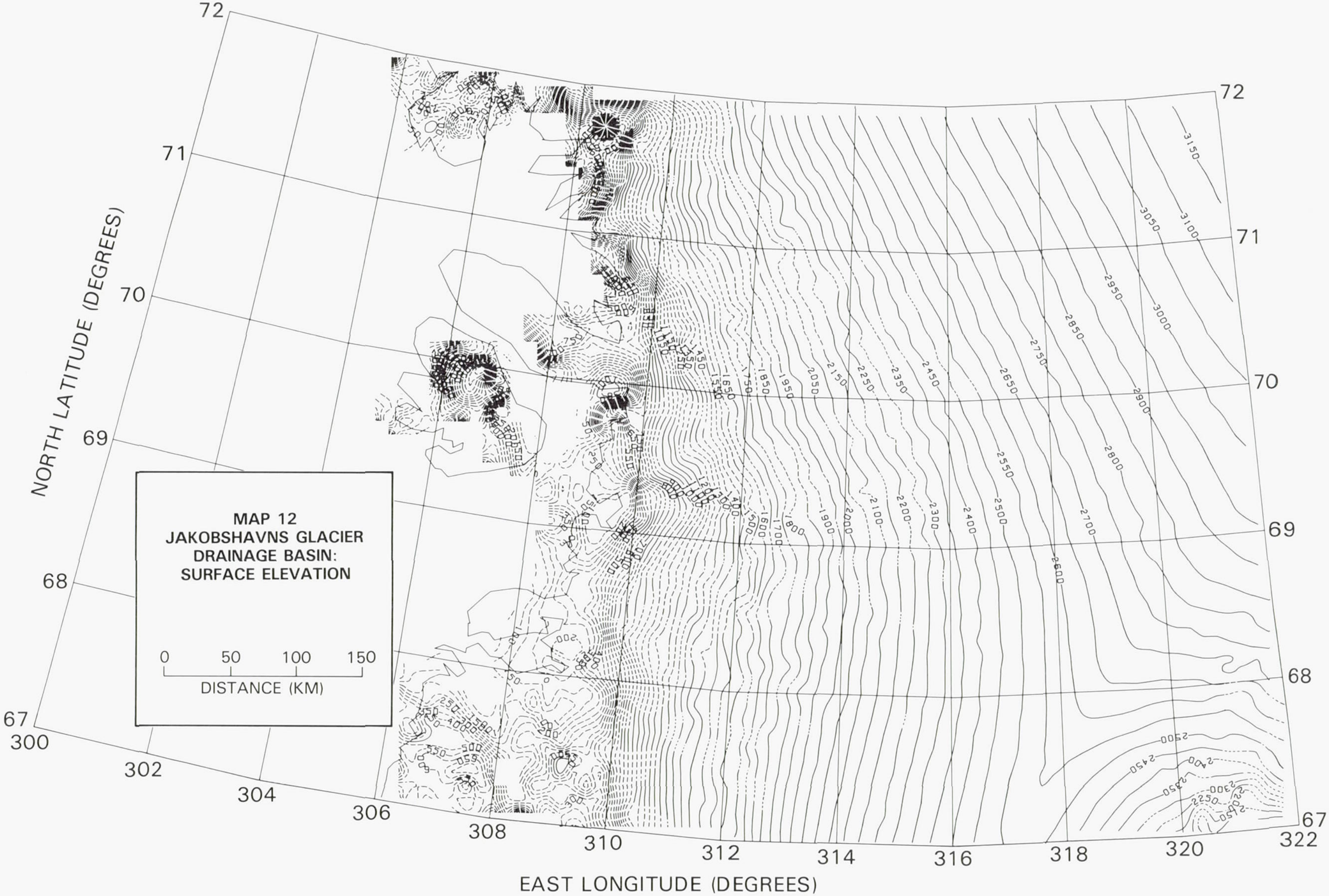
Map 9. Contours of Automatic Gain Control (AGC). Contour interval is 4 with bold line corresponding to a value of 32. Gridding procedure is similar to that used for slope-induced range corrections.



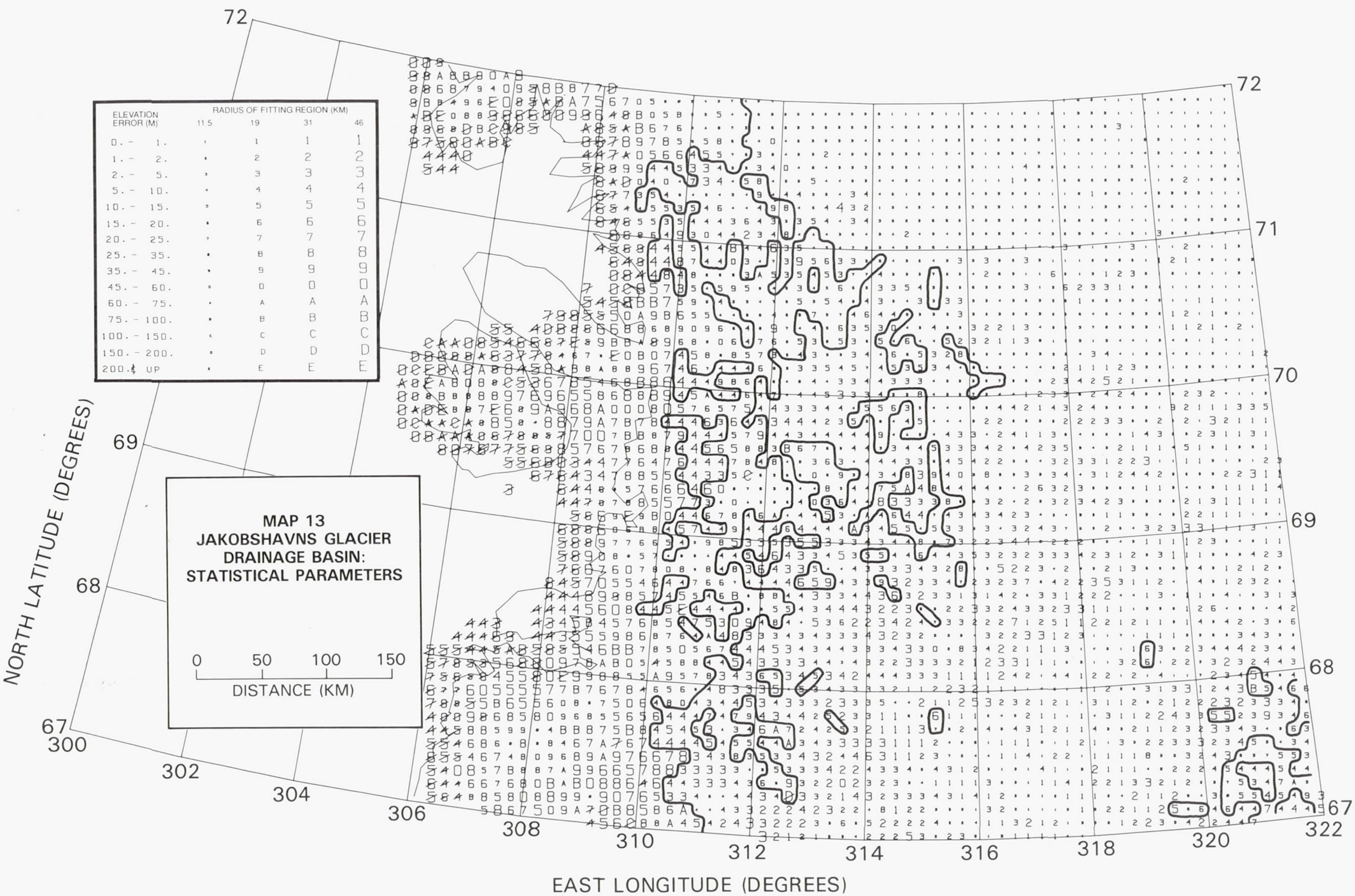
Map. 10. Geographic distribution of bins comprising the geo-referenced data base. Numbers within boxes indicate number of individual data points in that bin. Bins with no number written inside the box contain no data. Numbers on the right border indicate the bin number of the rightmost bin in that row. Projection of this map is Mercator, not polar stereographic.



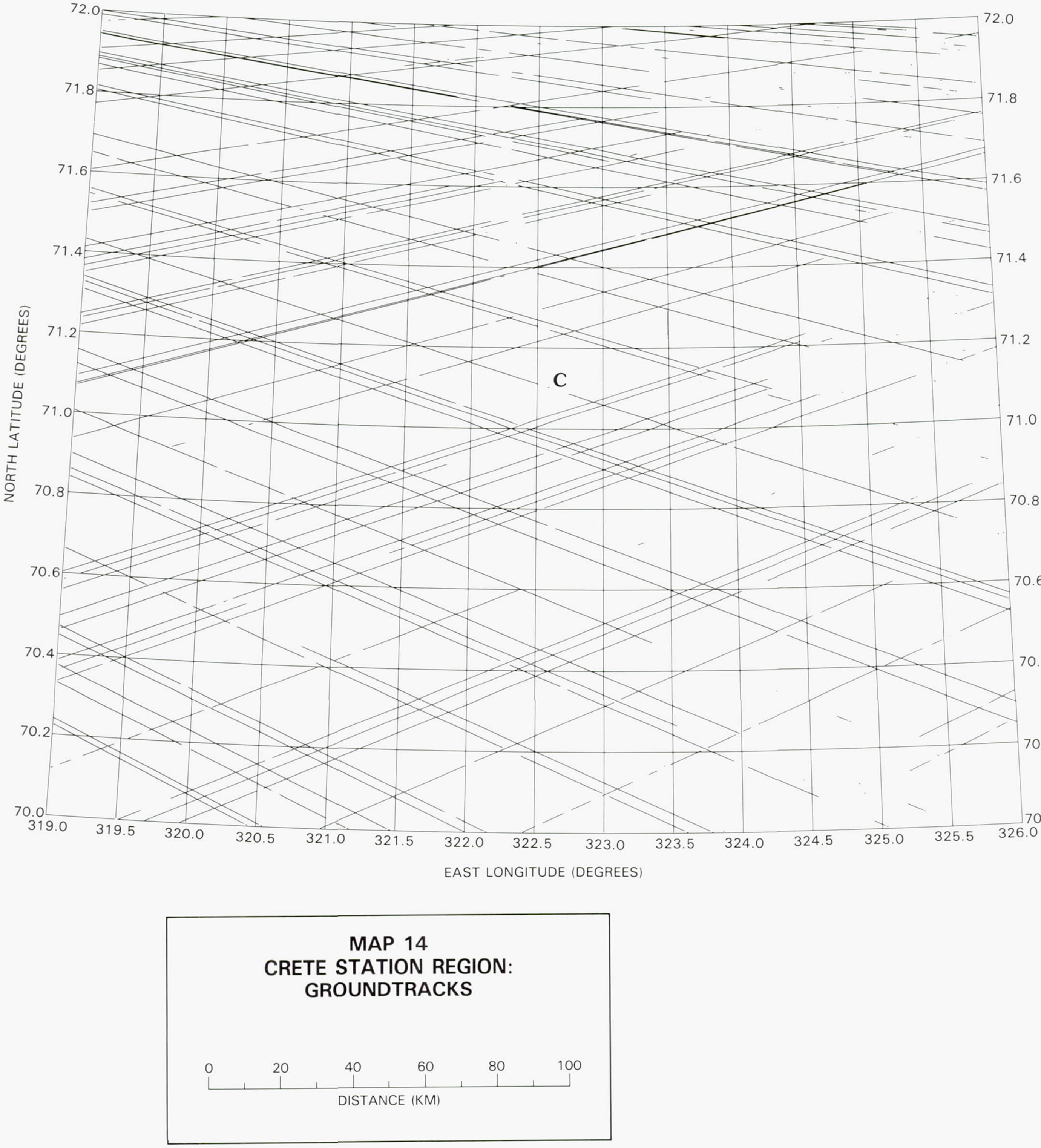
Map 11. Seasat altimeter data in the Jakobshavns Glacier region. Contiguous data spaced at intervals of 662 meters are connected by solid lines. Line breaks represent losses of track where no useful elevation data were collected. 'J' indicates the position of the lower reach of Jakobshavns Glacier.



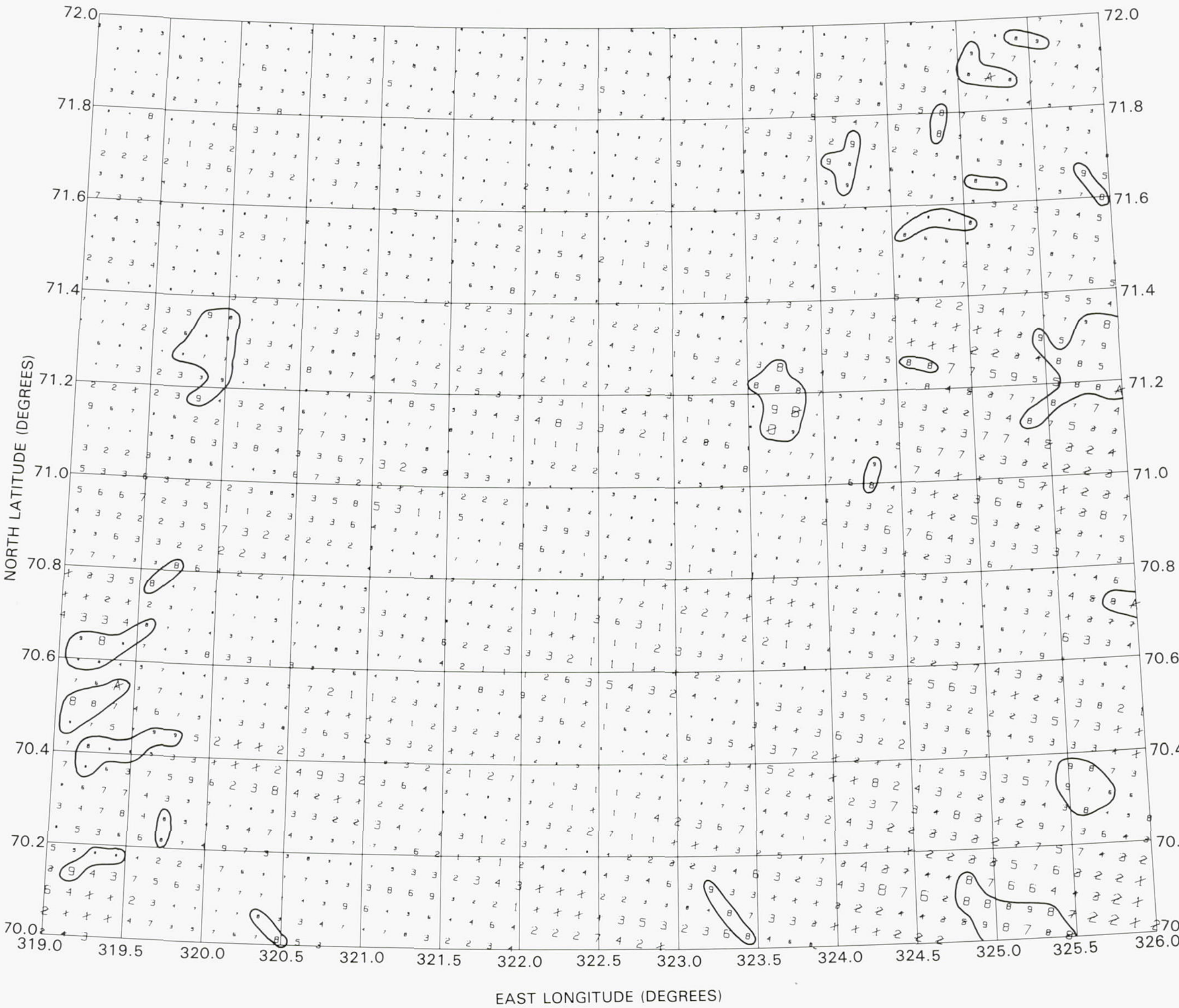
Map 12. Surface elevation contours of Jakobshavns Glacier region. Contour interval is 50 meters and elevations are referenced to mean sea level (as defined by the GEM10-B geoid). Contour lines are dashed in areas where error of grid elevations exceeds ±10 meters (see Map 13).



Map 13. Statistical parameters of grid elevations calculated in Jakobshavns Glacier region (Map 12). Physical size of number or letter at each gridpoint indicates size of gridding region at that gridpoint. Numerical size or alphabetical order indicates magnitude of elevation error (one standard deviation) at each gridpoint. Inset table provides key to sizes of fitting regions and magnitudes of elevation errors. Solid line encloses extended areas where derived elevation error exceeds ± 10 meters.



Map 14. Seasat altimeter data used in region around Crete Station. Contiguous data spaced at intervals of 662 meters are connected by solid lines. Line breaks represent losses of track where no useful elevation data were collected. 'C' indicates position of Crete Station.



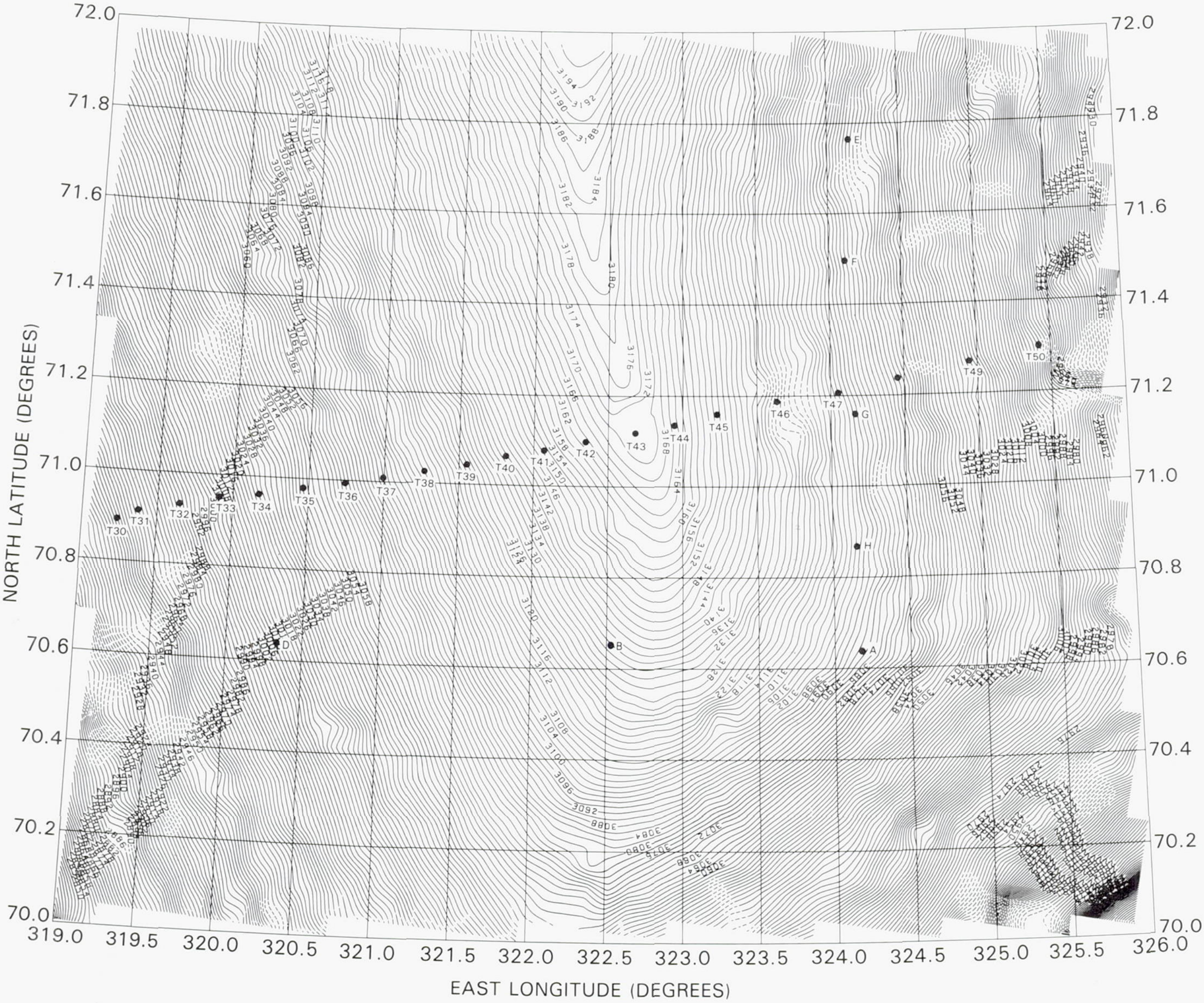
MAP 15
CRETE STATION REGION: STATISTICAL PARAMETERS

0 20 40 60 80 100

DISTANCE (KM)

ELEVATION ERROR (M)	RADIUS OF FITTING REGION (KM) 2.7	5.5	11	18	29
0.00 - 0.10	·	1	1	1	1
0.10 - 0.20	·	2	2	2	2
0.20 - 0.40	·	3	3	3	3
0.40 - 0.60	·	4	4	4	4
0.60 - 0.80	·	5	5	5	5
0.80 - 1.00	·	6	6	6	6
1.00 - 2.00	·	7	7	7	7
2.00 - 4.00	·	8	8	8	8
4.00 - 8.00	·	9	9	9	9
8.00 - 12.00	·	0	0	0	0
12.00 - 20.00	·	A	A	A	A
20.00&Up	·	B	B	B	B

Map 15. Statistical parameters of grid elevations in region around Crete Station (Map 16). Physical size of number or letter at each gridpoint indicates size of gridding region at that gridpoint. Numerical size or alphabetical order indicates magnitude of elevation error (one standard deviation) at each gridpoint. Inset table provides key to sizes of fitting regions and magnitudes of elevation errors. Solid line encloses extended areas where derived elevation error exceeds ± 2 meters.

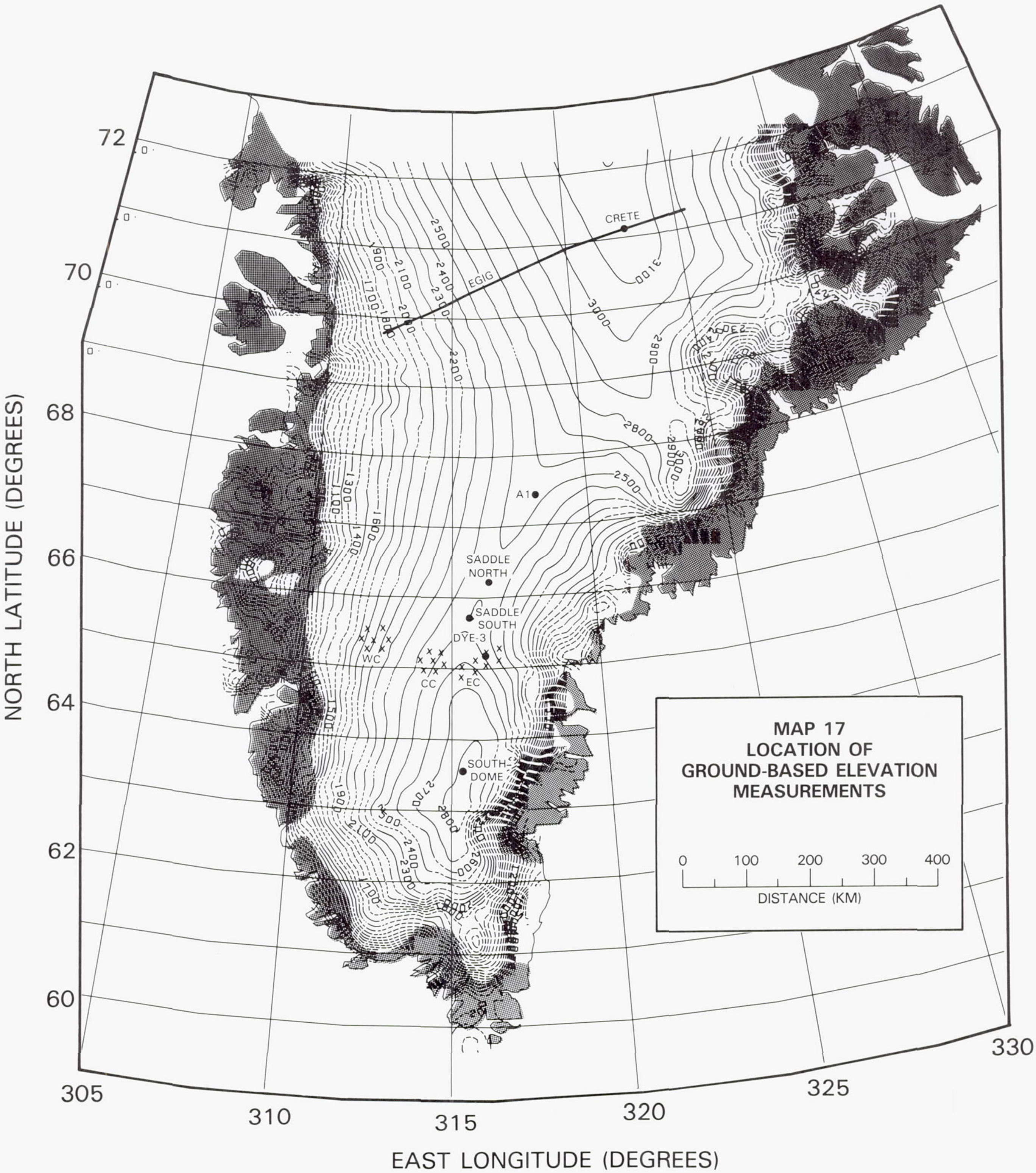


MAP 16
CRETE STATION REGION:
SURFACE ELEVATION

0 20 40 60 80 100

DISTANCE (KM)

Map 16. Surface elevation of Crete Station region. Contour interval is 2 meters and elevations are referenced to mean sea level. Contour lines are dashed in areas where error of grid elevation exceeds ± 2 meters. Solid circles show positions of Danish geoceivers and EGIG surface markers (see Tables 4 and 6).



Map 17. Locations of geoceiver sites occupied by Mock (solid circles) and OSU (X). Heavy solid line indicates position of EGIG line.

APPENDIX B
TABLES

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Table 1

Gridpoint values of location (I, J; see Map 3), latitude, longitude, slope-corrected surface elevation, elevation error (one standard deviation), GEM 10-B geoid, and total slope correction (see Equation 1′).

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
318	204	71.9148	303.6899	267.57	38.68	26.03	–35.74
319	204	71.7348	303.8047	49.88	40.26	26.12	–33.81
330	204	69.7566	304.9309	242.77	50.51	27.56	–169.22
331	204	69.5770	305.0222	20.55	90.32	27.75	41.65
345	204	67.0690	306.1479	266.55	6.54	30.02	29.96
346	204	66.8904	306.2187	214.18	12.96	30.09	36.78
347	204	66.7119	306.2883	49.37	22.99	30.13	–23.78
348	204	66.5335	306.3572	128.49	43.18	30.17	0.96
349	204	66.3551	306.4246	29.97	46.98	30.20	–2.44
318	205	71.9499	304.2710	9.59	44.76	26.92	–65.67
319	205	71.7695	304.3801	268.98	48.48	27.00	266.99
320	205	71.5891	304.4873	91.44	75.60	27.09	–37.18
321	205	71.4088	304.5923	–5.17	15.94	27.18	–127.75
329	205	69.9676	305.3623	–4.99	69.61	28.25	–94.40
330	205	69.7876	305.4507	–49.65	177.67	28.44	–183.27
331	205	69.6078	305.5376	268.63	73.65	28.63	–90.69
332	205	69.4279	305.6228	152.27	58.58	28.81	37.22
340	205	67.9915	306.2537	24.50	16.10	30.23	–73.44
341	205	67.8123	306.3267	145.16	17.48	30.35	–46.58
342	205	67.6331	306.3984	367.77	35.43	30.47	–36.32
343	205	67.4541	306.4690	290.70	4.36	30.58	18.85
344	205	67.2751	306.5386	580.85	8.78	30.70	6.86
345	205	67.0961	306.6069	412.68	8.49	30.81	–33.26
346	205	66.9173	306.6743	333.36	15.44	30.89	10.81
347	205	66.7385	306.7405	186.22	61.74	30.93	–63.53
348	205	66.5599	306.8057	339.11	88.04	30.96	22.74
349	205	66.3813	306.8699	188.01	60.58	30.99	–27.53
350	205	66.2028	306.9329	–90.52	22.23	31.02	–114.87
351	205	66.0244	306.9951	193.47	4.19	31.05	–14.78
352	205	65.8461	307.0564	166.30	61.33	30.99	–18.34
353	205	65.6678	307.1167	121.36	7.64	30.93	–15.93
356	205	65.1337	307.2925	222.15	13.49	30.73	106.62
357	205	64.9559	307.3491	93.19	26.52	30.65	–0.63
358	205	64.7781	307.4053	258.85	24.91	30.51	–63.31
359	205	64.6005	307.4604	409.41	28.82	30.37	336.78
317	206	72.1639	304.7488	–12.22	61.09	27.74	–47.57
318	206	71.9831	304.8542	109.80	37.54	27.79	–81.37
319	206	71.8024	304.9578	446.57	59.73	27.88	–29.23
320	206	71.6217	305.0593	175.39	179.35	27.97	–44.83
321	205	71.4410	305.1587	106.20	44.52	28.06	–145.27
329	206	69.9973	305.8884	405.67	179.27	29.13	–82.19
330	206	69.8171	305.9722	619.41	588.99	29.31	–61.32
331	206	69.6369	306.0544	344.60	93.47	29.49	–107.19
339	206	68.1979	306.6624	–51.31	8.17	30.88	–77.06
340	206	68.0184	306.7327	31.28	9.90	31.04	–63.86
341	206	67.8389	306.8018	153.95	20.21	31.16	–45.96
342	206	67.6595	306.8699	311.00	58.54	31.28	–22.70
343	206	67.4802	306.9365	536.19	18.25	31.39	–22.51
344	206	67.3010	307.0024	603.03	38.02	31.50	–5.47
345	206	67.1218	307.0671	562.94	63.26	31.60	15.65
346	206	66.9428	307.1309	417.89	31.56	31.68	–68.30
347	206	66.7638	307.1934	50.85	29.20	31.70	–139.13
348	206	66.5849	307.2551	460.47	16.99	31.72	–90.64
349	206	66.4061	307.3159	441.08	7.57	31.74	–70.89
350	206	66.2274	307.3757	339.13	17.41	31.76	–68.70
351	206	66.0488	307.4346	475.67	17.85	31.78	–72.07
352	206	65.8703	307.4924	346.88	76.39	31.74	–37.87

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Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
353	206	65.6918	307.5496	258.74	12.49	31.67	–24.12
354	206	65.5135	307.6060	109.19	73.33	31.60	–12.50
355	206	65.3353	307.6614	125.08	5.83	31.53	–12.32
356	206	65.1572	307.7158	141.08	7.79	31.46	–23.81
357	206	64.9791	307.7695	11.38	38.40	31.38	–10.26
358	206	64.8012	307.8228	200.68	84.96	31.24	–19.14
359	206	64.6234	307.8748	57.86	90.36	31.10	–196.42
360	206	64.4456	307.9263	550.20	25.21	30.97	583.04
317	207	72.1957	305.3401	613.20	105.68	28.60	1613.20
318	207	72.0146	305.4397	511.97	782.14	28.64	–157.92
319	207	71.8335	305.5376	156.48	27.63	28.73	–88.07
320	207	71.6525	305.6333	320.26	80.02	28.82	40.22
321	207	71.4715	305.7273	206.91	82.44	28.92	–211.22
328	207	70.2060	306.3357	278.92	11.17	29.83	–88.66
329	207	70.0254	306.4163	994.11	25.15	29.98	–69.76
330	207	69.8449	306.4954	1055.74	56.09	30.15	–79.64
331	207	69.6645	306.5730	577.75	48.61	30.33	–90.64
332	207	69.4841	306.6492	–126.61	59.20	30.51	873.39
339	207	68.2235	307.1465	11.98	9.46	31.68	–34.83
340	207	68.0437	307.2129	–52.76	17.77	31.84	–105.25
341	207	67.8640	307.2781	–6.79	17.38	31.96	–64.35
342	207	67.6844	307.3423	180.47	45.00	32.06	–67.12
343	207	67.5049	307.4053	426.08	10.16	32.16	–59.64
344	207	67.3254	307.4673	670.87	22.88	21.26	–54.42
345	207	67.1461	307.5283	578.86	12.79	32.36	–31.58
346	207	66.9668	307.5884	430.07	33.35	32.44	–97.56
347	207	66.7876	307.6475	277.24	80.82	32.46	–18.10
348	207	66.6085	307.7056	332.84	22.50	32.47	–52.68
349	207	66.4295	307.7629	585.82	34.45	32.49	–116.02
350	207	66.2506	308.8193	777.41	14.14	32.50	–61.64
351	207	66.0718	307.8748	603.38	10.54	32.51	–85.22
352	207	65.8931	307.9294	796.71	29.54	32.48	163.81
353	207	65.7145	307.9834	472.91	21.90	32.41	371.00
354	207	65.5360	308.0364	262.31	14.94	32.33	76.69
355	207	65.3576	308.0886	191.55	6.76	32.25	–93.18
356	207	65.1793	308.1401	191.54	18.20	32.17	–19.74
357	207	65.0010	308.1909	52.17	18.34	32.10	–13.30
358	207	64.8229	308.2407	174.22	26.13	31.95	16.03
359	207	64.6449	308.2900	286.00	88.71	31.81	–84.16
360	207	64.4671	308.3386	573.07	24.38	31.67	196.51
362	207	64.1116	308.4336	80.92	11.87	31.38	0.49
363	207	63.9340	308.4800	207.44	31.23	31.23	132.30
364	207	63.7566	308.5259	–11.53	13.60	31.06	–19.79
365	207	63.5792	308.5710	–4.59	76.86	30.89	–33.32
366	207	63.4020	308.6157	–107.12	24.22	30.72	–59.68
367	207	63.2249	308.6597	–104.74	43.47	30.55	–87.69
318	208	72.0441	306.0273	378.54	31.53	29.49	–30.05
319	208	71.8627	306.1191	268.32	29.82	29.57	–45.60
320	208	71.6814	306.2092	118.21	20.37	29.66	–45.65
328	208	70.2326	306.8699	459.41	6.41	30.67	–78.66
329	208	70.0518	306.9456	579.48	12.04	30.82	–84.70
330	208	69.8711	307.0198	925.79	35.50	30.99	–100.44
331	208	69.6904	307.0928	468.50	30.57	31.16	109.48
332	208	69.5098	307.1643	205.32	53.06	31.34	–56.52
340	208	68.0675	307.6941	75.85	47.93	32.61	–35.24
341	208	67.8876	307.7554	–5.03	11.90	32.73	–30.36
342	208	67.7078	307.8157	40.85	10.86	32.83	–53.09

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM 10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
343	208	67.5281	307.8748	172.84	61.82	32.92	–61.39
344	208	67.3484	307.9331	745.19	17.61	33.02	–74.96
345	208	67.1689	307.9905	536.76	57.94	33.11	–9.21
346	208	66.9894	308.0469	607.28	18.03	33.19	66.25
347	208	66.8100	308.1025	203.73	40.76	33.20	–90.47
348	208	66.6307	308.1570	274.65	15.36	33.21	–49.28
349	208	66.4516	308.2109	864.65	16.87	33.21	–93.60
350	208	66.2725	308.2639	1066.34	19.12	33.22	–40.52
351	208	66.0935	308.3159	974.85	15.86	33.22	–226.22
352	208	65.9146	308.3674	821.93	232.17	33.18	–14.11
353	208	65.7358	308.4180	447.48	86.19	33.10	108.71
354	208	65.5571	308.4678	299.38	44.66	33.02	–14.47
355	208	65.3785	308.5168	239.65	15.77	32.94	–19.58
356	208	65.2000	308.5652	240.09	46.51	32.86	–21.48
357	208	65.0217	308.6128	193.46	7.97	32.78	–60.56
358	208	64.8434	308.6597	99.24	28.19	32.65	–2.92
359	208	64.6652	308.7058	293.54	13.02	32.50	25.87
360	208	64.4872	308.7515	500.38	116.32	32.36	–44.65
361	208	64.3092	308.7964	472.54	15.84	32.22	–82.65
362	208	64.1314	308.8408	69.06	21.11	32.08	–396.28
363	208	63.9537	308.8843	286.25	20.29	31.93	109.38
364	208	63.7761	308.9275	136.17	22.24	31.76	–29.09
365	208	63.5986	308.9700	186.29	26.57	31.59	19.46
366	208	63.4212	309.0117	198.78	19.86	31.43	–392.02
367	208	63.2439	309.0530	175.13	163.62	31.26	–51.08
368	208	63.0668	309.0937	60.61	91.26	31.09	–94.72
369	208	62.8898	309.1338	–75.14	41.07	30.93	–105.08
319	209	71.8902	306.7026	214.49	60.50	30.39	–41.10
320	209	71.7085	306.7871	240.20	61.24	30.49	74.90
328	209	70.2576	307.4053	334.26	48.71	31.49	–88.28
329	209	70.0766	307.4761	362.09	22.38	31.64	–145.38
330	209	69.8956	307.5457	480.43	10.14	31.80	–42.64
331	209	69.7146	307.6138	–12.80	239.17	31.97	–72.38
332	209	69.5338	307.6809	77.68	24.25	32.14	–259.28
333	209	69.3530	307.7466	101.87	85.21	32.31	24.71
338	209	68.4503	308.0588	69.91	7.15	33.09	–53.67
339	209	68.2701	308.1182	110.72	5.38	33.23	–36.22
340	209	68.0899	308.1765	165.29	31.53	33.38	–8.60
341	209	67.9097	308.2336	152.74	29.64	33.49	–4.65
342	209	67.7297	308.2900	211.94	27.84	33.58	–1.32
343	209	67.5498	308.3455	322.53	34.64	33.66	–11.99
344	209	67.3699	308.3999	214.20	92.82	33.74	–19.97
345	209	67.1902	308.4536	304.48	69.93	33.83	–27.41
346	209	67.0105	308.5063	618.97	28.31	33.91	233.31
347	209	66.8310	308.5583	305.65	56.32	33.91	–9.29
348	209	66.6515	308.6094	599.91	16.76	33.92	–77.59
349	209	66.4722	308.6597	946.27	28.02	33.92	–74.63
350	209	66.2929	308.7092	1029.86	37.86	33.91	–21.37
351	209	66.1138	308.7581	870.45	15.81	33.91	23.62
352	209	65.9347	308.8059	843.12	37.90	33.88	–7.62
353	209	65.7557	308.8533	591.65	17.91	33.80	187.95
354	209	65.5769	308.8999	476.55	39.46	33.72	–73.03
355	209	65.3981	308.9458	284.40	45.06	33.63	–87.97
356	209	65.2195	308.9910	243.77	15.08	33.55	–2.60
357	209	65.0410	309.0354	173.52	4.63	33.46	–13.98
358	209	64.8625	309.0793	120.14	14.37	33.33	3.60
359	209	64.6842	309.1226	366.99	4.58	33.18	217.92

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
360	209	64.5060	309.1650	513.17	12.70	33.04	–55.64
361	209	64.3279	309.2070	662.92	75.80	32.89	–41.34
362	209	64.1500	309.2485	532.23	15.12	32.75	–28.30
363	209	63.9721	309.2893	317.06	552.86	32.60	2.16
364	209	63.7943	309.3296	313.38	11.88	32.43	–41.55
365	209	63.6167	309.3691	363.44	46.28	32.27	–31.20
366	209	63.4392	309.4082	596.89	90.03	32.10	–9.24
367	209	63.2618	309.4470	387.62	95.01	31.94	–54.75
368	209	63.0845	309.4849	268.76	19.52	31.77	340.03
369	209	62.9074	309.5225	–117.20	95.50	31.61	–94.03
370	209	62.7303	309.5596	–10.91	113.07	31.47	–74.44
371	209	62.5534	309.5962	–92.54	60.98	31.32	–70.23
318	210	72.0977	307.2078	815.21	17.29	31.12	–165.04
319	210	71.9157	307.2881	532.95	19.91	31.19	–48.06
320	210	71.7338	307.3665	270.91	14.17	31.29	335.22
321	210	71.5520	307.4436	–4.56	11.59	31.39	995.44
327	210	70.4623	307.8748	981.79	31.92	32.15	525.72
328	210	70.2809	307.9421	802.26	88.22	32.30	1.13
329	210	70.0996	308.0081	465.61	23.63	32.45	–151.54
330	210	69.9184	308.0728	96.01	33.26	32.60	18.69
331	210	69.7373	308.1362	–125.36	18.04	32.76	–88.84
332	210	69.5562	308.1985	–31.97	15.74	32.93	–51.85
333	210	69.3752	308.2598	208.81	10.38	33.09	–4.24
334	210	69.1943	308.3201	166.73	8.52	33.25	–16.61
335	210	69.0135	308.3792	429.88	18.49	33.41	17.35
336	210	68.8327	308.4373	178.87	26.47	33.55	–29.81
337	210	68.6521	308.4941	152.02	13.14	33.70	–46.62
338	210	68.4715	308.5503	220.88	4.67	33.84	–20.08
339	210	68.2910	308.6055	231.40	17.50	33.97	2.26
340	210	68.1107	308.6597	218.48	18.81	34.11	–4.22
341	210	67.9304	308.7129	84.90	32.71	34.23	–64.70
342	210	67.7502	308.7654	55.67	47.84	34.31	–1.77
343	210	67.5700	308.8169	334.95	33.03	34.39	–27.46
344	210	67.3900	308.8677	420.79	54.69	34.46	26.92
345	210	67.2101	308.9175	343.88	40.08	34.54	47.03
346	210	67.0303	308.9666	231.91	67.89	34.62	–17.46
347	210	66.8505	309.0149	319.30	19.08	34.63	–10.81
348	210	66.6709	309.0625	767.50	14.73	34.62	–52.65
349	210	66.4914	309.1091	870.08	51.60	34.61	–29.46
350	210	66.3120	309.1553	670.68	41.51	34.60	14.93
351	210	66.1326	309.2007	557.15	18.34	34.59	0.42
352	210	65.9534	309.2454	589.02	13.95	34.56	–21.38
353	210	65.7743	309.2893	548.63	23.03	34.47	22.04
354	210	65.5953	309.3325	272.11	91.85	34.38	–162.68
355	210	65.4164	309.3752	531.57	159.57	34.29	–28.59
356	210	65.2376	309.4172	400.81	92.38	34.20	–73.43
357	210	65.0590	309.4587	417.85	20.98	34.11	–41.80
358	210	64.8804	309.4995	775.97	3.77	33.98	532.43
359	210	64.7019	309.5396	758.62	12.80	33.84	274.69
361	210	64.3454	309.6184	442.48	24.73	33.55	14.41
362	210	64.1673	309.6567	527.65	31.08	33.40	2.49
363	210	63.9892	309.6948	499.16	20.69	33.26	–29.30
364	210	63.8114	309.7322	569.52	14.44	33.10	–47.08
365	210	63.6336	309.7690	691.66	68.81	32.93	–71.36
366	210	63.4559	309.8054	684.40	94.02	32.77	–84.64
367	210	63.2784	309.8413	802.87	27.20	32.61	39.63
368	210	63.1010	309.8767	575.72	54.42	32.45	–82.08

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
369	210	62.9237	309.9116	504.39	92.41	32.30	–79.48
370	210	62.7466	309.9460	452.36	17.91	32.15	–52.42
371	210	62.5695	309.9800	506.64	64.89	32.01	–34.31
372	210	62.3926	310.0134	323.84	44.50	31.87	–26.42
318	211	72.1217	307.8005	1281.55	31.15	31.91	–310.82
319	211	71.9394	307.8748	1281.69	17.37	31.98	–113.45
320	211	71.7573	307.9475	513.77	27.58	32.09	–50.76
321	211	71.5752	308.0188	464.26	3.53	32.19	–119.17
322	211	71.3932	308.0886	567.58	38.72	32.30	553.68
323	211	71.2112	308.1570	162.51	18.00	32.40	–125.75
324	211	71.0293	308.2241	427.03	25.63	32.50	–130.79
327	211	70.4841	308.4180	545.69	8.66	32.93	–29.11
328	211	70.3025	308.4800	731.72	22.96	33.08	–5.08
329	211	70.1210	308.5410	507.07	60.46	33.22	–103.65
330	211	69.9396	308.6008	295.76	24.23	33.37	46.25
331	211	69.7582	308.6597	40.00	82.23	33.53	–59.16
332	211	69.5770	308.7173	68.76	30.20	33.69	–57.56
333	211	69.3958	308.7742	174.05	6.90	33.85	–5.07
334	211	69.2147	308.8296	166.87	32.10	34.01	–6.24
335	211	69.0337	308.8843	255.99	11.89	34.17	9.45
336	211	68.8527	308.9380	308.37	73.13	34.31	–36.46
337	211	68.6719	308.9910	348.40	33.91	34.45	–26.48
338	211	68.4911	309.0427	304.13	23.55	34.58	–28.17
339	211	68.3105	309.0937	235.79	33.76	34.71	–48.81
340	211	68.1299	309.1438	169.15	14.66	34.84	–73.94
341	211	67.9495	309.1931	164.83	23.38	34.95	–42.51
342	211	67.7691	309.2417	162.92	72.46	35.02	–41.25
343	211	67.5888	309.2893	438.93	46.54	35.09	–17.46
344	211	67.4086	309.3362	500.19	17.32	35.16	42.77
345	211	67.2285	309.3823	301.55	40.62	35.23	36.14
346	211	67.0486	309.4277	125.97	51.96	35.29	–23.54
347	211	66.8687	309.4724	223.45	10.24	35.30	–70.83
348	211	66.6889	309.5164	655.21	26.73	35.29	–61.67
349	211	66.5092	309.5596	696.80	19.99	35.27	–20.69
350	211	66.3296	309.6021	625.81	15.28	35.26	10.77
351	211	66.1502	309.6440	800.87	23.92	35.25	–36.59
352	211	65.9708	309.6853	793.25	11.50	35.22	–39.47
353	211	65.7915	309.7261	808.26	44.95	35.13	–45.03
354	211	65.6124	309.7661	713.13	28.44	35.04	–138.46
355	211	65.4334	309.8054	758.91	26.57	34.94	–72.99
356	211	65.2544	309.8442	829.01	28.36	34.85	–67.13
357	211	65.0756	309.8826	952.72	11.52	34.76	–42.66
358	211	64.8969	309.9202	1006.09	5.91	34.64	–6.90
359	211	64.7183	309.9575	636.64	11.43	34.49	–84.97
360	211	64.5399	309.9941	272.51	30.63	34.35	–55.73
361	211	64.3615	310.0300	157.91	30.94	34.20	–49.29
362	211	64.1833	310.0657	303.54	26.24	34.05	–53.20
363	211	64.0051	310.1008	703.56	54.64	33.91	–86.22
364	211	63.8271	310.1353	964.72	24.82	33.75	–16.09
365	211	63.6492	310.1694	943.11	45.42	33.59	–20.82
366	211	63.4715	310.2031	1165.68	22.89	33.43	–19.35
367	211	63.2938	310.2363	1115.72	21.32	33.27	–39.55
368	211	63.1163	310.2690	889.72	31.95	33.11	–146.57
369	211	62.9389	310.3013	1006.68	176.37	32.96	–3.51
370	211	62.7616	310.3330	1064.37	20.34	32.82	25.17
371	211	62.5845	310.3645	854.67	20.55	32.68	–54.01
372	211	62.4075	310.3955	652.63	11.62	32.54	–38.85

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
373	211	62.2306	310.4260	403.18	12.18	32.40	–65.78
318	212	72.1437	308.3950	1815.52	32.84	32.68	–246.54
319	212	71.9613	308.4631	1508.24	75.13	32.75	48.59
320	212	71.7789	308.5300	670.95	33.51	32.86	–73.12
321	212	71.5966	308.5955	734.30	25.35	32.96	–22.54
322	212	71.4143	308.6597	592.84	43.71	33.07	–87.59
323	212	71.2322	308.7227	688.67	8.99	33.18	–108.85
324	212	71.0501	308.7842	925.59	17.95	33.28	–112.92
325	212	70.8680	308.8447	561.14	7.63	33.42	–104.56
326	212	70.6861	308.9041	177.17	65.06	33.56	3.65
327	212	70.5042	308.9622	495.91	29.93	33.71	–1.52
328	212	70.3224	309.0193	694.04	48.85	33.85	13.76
329	212	70.1407	309.0752	384.43	77.22	34.00	–117.02
330	212	69.9591	309.1304	–51.96	21.89	34.14	–62.30
331	212	69.7776	309.1843	206.27	35.99	34.30	–65.09
332	212	69.5961	309.2373	–19.85	36.76	34.45	–142.86
333	212	69.4147	309.2893	324.14	96.94	34.60	–10.52
334	212	69.2334	309.3403	108.25	38.60	34.75	–17.21
335	212	69.0523	309.3906	100.75	30.32	34.91	–5.86
336	212	68.8712	309.4399	207.61	26.66	35.04	–89.84
337	212	68.6901	309.4883	391.72	25.06	35.17	–51.55
338	212	68.5092	309.5361	388.33	36.63	35.29	–47.68
339	212	68.3284	309.5828	414.78	25.63	35.42	–43.64
340	212	68.1477	309.6289	388.92	24.80	35.54	–135.37
341	212	67.9670	309.6741	235.65	25.72	35.65	166.34
342	212	67.7865	309.7187	271.36	17.55	35.72	–36.84
343	212	67.6061	309.7625	445.82	97.88	35.78	–43.88
344	212	67.4258	309.8054	411.23	17.13	35.84	–80.97
345	212	67.2455	309.8479	378.95	19.41	35.90	–29.70
346	212	67.0654	309.8894	425.39	58.48	35.96	–43.46
347	212	66.8853	309.9304	332.64	46.40	35.98	–64.08
348	212	66.7054	309.9707	676.24	88.10	35.96	–22.50
349	212	66.5256	310.0105	766.06	29.16	35.94	–7.94
350	212	66.3459	310.0496	1032.37	13.64	35.92	–17.83
351	212	66.1663	310.0881	1077.75	15.01	35.90	–39.73
352	212	65.9868	310.1260	1090.77	5.25	35.87	–42.77
353	212	65.8074	310.1633	1106.37	5.54	35.77	–36.54
354	212	65.6281	310.2000	1123.21	12.25	35.67	–37.26
355	212	65.4490	310.2363	1109.78	32.46	35.58	–47.89
356	212	65.2699	310.2720	1236.19	15.80	35.48	0.21
357	212	65.0910	310.3071	1286.35	11.63	35.38	–43.26
358	212	64.9121	310.3416	1248.76	13.02	35.26	–43.46
359	212	64.7334	310.3757	1091.49	12.42	35.12	–17.07
360	212	64.5548	310.4094	1033.50	27.02	34.97	153.90
361	212	64.3764	310.4424	675.90	37.62	34.82	16.28
362	212	64.1980	310.4751	873.37	19.52	34.68	–32.78
363	212	64.0198	310.5073	1129.04	18.57	34.53	–79.23
364	212	63.8416	310.5391	1155.78	17.41	34.38	–69.66
365	212	63.6637	310.5703	1103.30	28.16	34.22	–73.62
366	212	63.4858	310.6011	1165.58	8.00	34.06	–104.40
367	212	63.3080	310.6316	1410.86	39.51	33.91	–32.27
368	212	63.1304	310.6616	1451.58	39.22	33.75	–55.97
369	212	62.9529	310.6912	1364.94	28.17	33.61	–30.60
370	212	62.7755	310.7205	1247.79	9.75	33.47	–48.21
371	212	62.5983	310.7493	1084.61	22.84	33.34	–95.16
372	212	62.4211	310.7776	859.45	13.72	33.21	–88.28
373	212	62.2441	310.8057	657.17	15.81	33.08	–88.31

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
374	212	62.0673	310.8333	531.78	3.26	32.95	–82.39
375	212	61.8905	310.8606	370.28	6.42	32.85	–81.66
376	212	61.7139	310.8877	211.33	13.08	32.77	–82.28
377	212	62.5374	310.9143	24.07	11.49	32.68	–83.35
318	213	72.1639	308.9910	1915.13	7.67	33.44	–98.24
319	213	71.9812	309.0530	1674.19	34.05	33.51	–109.11
320	213	71.7986	309.1138	1019.08	38.35	33.62	–102.38
321	213	71.6161	309.1736	1272.83	20.25	33.72	0.83
322	213	71.4337	309.2319	1177.39	6.11	33.83	–73.10
323	213	71.2513	309.2893	1283.76	10.13	33.94	–87.95
324	213	71.0690	309.3455	1255.29	21.66	34.05	–71.77
325	213	70.8868	309.4006	1073.91	5.93	34.18	–56.48
326	213	70.7046	309.4546	706.61	15.17	34.32	–83.22
327	213	70.5226	309.5076	522.63	92.54	34.46	–105.75
328	213	70.3406	309.5596	669.58	53.49	34.60	–88.82
329	213	70.1587	309.6106	505.76	42.69	34.74	–10.52
330	213	69.9769	309.6606	268.68	29.39	34.88	–60.06
331	213	69.7952	309.7097	576.35	26.03	35.04	–47.35
332	213	69.6136	309.7581	551.95	118.57	35.19	–66.71
333	213	69.4321	309.8054	497.58	13.25	35.34	–25.23
334	213	69.2506	309.8521	122.39	14.73	35.48	–54.08
335	213	69.0692	309.8977	315.93	59.27	35.63	9.00
336	213	68.8880	309.9426	568.65	49.82	35.76	–68.96
337	213	68.7068	309.9868	714.36	9.63	35.89	–48.15
338	213	68.5258	310.0300	803.09	12.83	36.00	–49.31
339	213	68.3448	310.0728	872.75	20.95	36.12	–37.32
340	213	68.1639	310.1147	787.32	40.62	36.24	–117.87
341	213	67.9831	310.1558	708.52	14.08	36.34	–82.85
342	213	67.8024	310.1963	777.09	12.21	36.40	–65.16
343	213	67.6219	310.2363	829.80	9.14	36.45	–68.42
344	213	67.4414	310.2754	829.59	32.48	36.51	–69.61
345	213	67.2610	310.3140	855.51	11.69	36.56	–51.20
346	213	67.0807	310.3518	933.80	26.47	36.61	–60.03
347	213	66.9006	310.3892	795.73	22.29	36.62	–71.10
348	213	66.7205	310.4260	787.51	10.93	36.60	–52.18
349	213	66.5406	310.4622	910.94	16.46	36.57	–19.49
350	213	66.3607	310.4978	1127.25	6.85	36.55	–58.60
351	213	66.1810	310.5327	1273.65	4.15	36.52	–22.70
352	213	66.0014	310.5671	1309.43	11.30	36.49	–21.10
353	213	65.8219	310.6011	1322.37	8.97	36.39	–20.69
354	213	65.6425	310.6345	1358.48	17.44	36.29	–13.74
355	213	65.4632	310.6675	1381.25	9.40	36.20	–30.60
356	213	65.2840	310.7000	1448.96	11.65	36.10	–15.76
357	213	65.1050	310.7319	1494.90	60.13	36.00	–27.97
358	213	64.9261	310.7634	1464.47	9.68	35.88	–12.19
359	213	64.7472	310.7944	1399.60	32.18	35.73	–57.72
360	213	64.5685	310.8252	1330.44	7.15	35.59	–81.43
361	213	64.3900	310.8552	1304.86	16.76	35.45	–97.95
362	213	64.2115	310.8850	1406.24	18.28	35.30	–60.18
363	213	64.0331	310.9143	1430.52	42.84	35.16	–41.23
364	213	63.8549	310.9431	1445.54	19.60	35.01	–62.11
365	213	63.6768	310.9717	1500.35	10.75	34.85	–69.19
366	213	63.4988	310.9998	1587.57	13.83	34.70	–68.88
367	213	63.3210	311.0273	1707.85	54.54	34.55	–21.34
368	213	63.1432	311.0547	1659.93	20.80	34.40	–49.62
369	213	62.9657	311.0815	1642.73	16.43	34.25	–49.92
370	213	62.7882	311.1082	1579.91	9.20	34.12	–80.36

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
371	213	62.6108	311.1345	1387.03	13.23	34.00	–88.74
372	213	62.4336	311.1604	1223.66	3.47	33.87	–68.75
373	213	62.2565	311.1858	994.08	3.46	33.75	–69.94
374	213	62.0796	311.2109	851.52	4.45	33.62	–86.33
375	213	61.9027	311.2358	650.96	8.77	33.52	–95.17
376	213	61.7260	311.2603	461.69	4.46	33.45	–86.27
377	213	61.5495	311.2847	272.59	67.27	33.37	–80.02
378	213	61.3730	311.3086	19.46	59.34	33.30	–83.78
318	214	72.1822	309.5879	2090.99	1.82	34.17	–59.13
319	214	71.9993	309.6440	1784.32	5.76	34.25	–95.64
320	214	71.8165	309.6990	1442.11	19.61	34.36	–132.37
321	214	71.6338	309.7527	1603.18	68.14	34.47	–9.28
322	214	71.4512	309.8054	1492.05	19.31	34.58	–81.94
323	214	71.2686	309.8572	1536.32	5.67	34.69	–46.91
324	214	71.0862	309.9077	1436.45	16.08	34.80	–75.80
325	214	70.9037	309.9575	1393.61	17.50	34.92	–39.16
326	214	70.7214	310.0061	1218.65	6.07	35.06	–64.72
327	214	70.5392	310.0540	1054.75	8.35	35.20	–76.11
328	214	70.3571	310.1008	1022.66	37.27	35.34	–68.34
329	214	70.1750	310.1467	929.05	8.91	35.48	–80.42
330	214	69.9931	310.1919	863.06	10.96	35.62	–51.45
331	214	69.8112	310.2363	917.22	17.45	35.76	–54.03
332	214	69.6294	310.2798	993.44	12.49	35.91	–55.38
333	214	69.4477	310.3225	942.70	8.45	36.05	–54.18
334	214	69.2661	310.3645	597.49	20.80	36.19	–80.35
335	214	69.0846	310.4055	681.17	11.27	36.33	–21.09
336	214	68.9032	310.4460	850.79	24.57	36.46	–95.36
337	214	68.7219	310.4858	988.26	11.57	36.57	–43.49
338	214	68.5407	310.5249	973.23	20.92	36.69	–42.31
339	214	68.3596	310.5635	1034.83	9.40	36.80	–47.55
340	214	68.1786	310.6011	1086.45	47.36	36.91	–32.32
341	214	67.9977	310.6382	1047.42	11.06	37.01	–44.70
342	214	67.8169	310.6748	1076.59	25.63	37.06	–58.13
343	214	67.6362	310.7107	1101.68	5.48	37.11	–42.75
344	214	67.4556	310.7461	1152.62	9.32	37.16	–23.14
345	214	67.2751	310.7808	1136.28	2.75	37.21	–38.60
346	214	67.0947	310.8149	1139.46	14.41	37.25	–35.80
347	214	66.9144	310.8486	1132.47	14.83	37.26	–36.45
348	214	66.7342	310.8816	1074.25	67.54	37.23	–35.15
349	214	66.5542	310.9143	1183.09	8.49	37.20	–56.28
350	214	66.3742	310.9463	1322.34	48.47	37.17	–34.81
351	214	66.1944	310.9778	1390.82	30.22	37.14	–10.79
352	214	66.0146	311.0090	1436.48	4.25	37.11	–9.15
353	214	65.8350	311.0396	1446.09	13.03	37.01	–8.75
354	214	65.6555	311.0698	1520.40	23.87	36.91	–19.22
355	214	65.4761	311.0994	1512.91	16.18	36.81	–31.43
356	214	65.2968	311.1287	1569.00	13.19	36.70	–18.91
357	214	65.1177	311.1575	1563.61	11.37	36.60	–49.03
358	214	64.9386	311.1858	1629.44	14.84	36.48	–22.25
359	214	64.7597	311.2139	1646.51	21.49	36.34	–26.58
360	214	64.5809	311.2412	1660.59	6.15	36.19	–27.71
361	214	64.4022	311.2686	1627.93	6.80	36.05	–49.02
362	214	64.2237	311.2952	1655.93	73.90	35.90	–36.51
363	214	64.0452	311.3215	1731.25	41.51	35.76	–26.35
364	214	63.8669	311.3477	1787.45	3.90	35.61	–20.95
365	214	63.6887	311.3733	1776.28	11.57	35.46	–50.08
366	214	63.5107	311.3987	1834.98	19.91	35.31	–31.54

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
367	214	63.3327	311.4236	1884.44	6.67	35.17	–17.92
368	214	63.1549	311.4482	1845.19	14.88	35.02	–18.67
369	214	62.9772	311.4724	1903.12	25.04	34.87	–8.68
370	214	62.7997	311.4963	1838.24	26.26	34.75	–44.77
371	214	62.6222	311.5200	1635.40	16.51	34.63	–54.38
372	214	62.4449	311.5432	1477.84	9.33	34.52	–57.28
373	214	62.2677	311.5662	1339.85	20.98	34.40	–104.11
374	214	62.0907	311.5889	1111.71	6.03	34.28	–78.98
375	214	61.9138	311.6113	958.73	28.89	34.19	–83.84
376	214	61.7370	311.6333	790.07	5.50	34.12	–77.68
377	214	61.5603	311.6553	672.21	28.46	34.05	–77.90
378	214	61.3838	311.6768	390.75	22.62	33.98	–80.77
379	214	61.2075	311.6980	316.89	20.24	33.92	1316.89
380	214	61.0312	311.7190	255.89	27.00	33.85	1255.89
318	215	72.1986	310.1863	2167.46	2.05	34.90	–39.80
319	215	72.0155	310.2363	1934.87	13.27	34.98	–56.46
320	215	71.8326	310.2852	1697.62	18.80	35.08	–96.24
321	215	71.6497	310.3330	1739.97	3.98	35.19	–53.56
322	215	71.4669	310.3799	1754.73	3.15	35.30	–48.61
323	215	71.2841	310.4260	1767.34	18.29	35.41	–34.22
324	215	71.1015	310.4709	1678.23	9.84	35.52	–34.42
325	215	70.9190	310.5154	1613.59	5.27	35.65	–47.80
326	215	70.7365	310.5586	1532.78	7.98	35.78	–35.20
327	215	70.5541	310.6011	1419.92	7.73	35.92	–43.22
328	215	70.3718	310.6428	1295.89	19.87	36.06	–87.37
329	215	70.1896	310.6838	1254.58	40.82	36.20	–83.84
330	215	70.0075	310.7241	1176.47	35.53	36.33	–73.77
331	215	69.8255	310.7634	1166.97	48.54	36.47	–49.87
332	215	69.6436	310.8022	1248.95	18.75	36.61	–13.45
333	215	69.4618	310.8403	1043.67	6.15	36.75	–82.13
334	215	69.2800	310.8777	909.07	33.51	36.89	–93.36
335	215	69.0984	310.9143	961.37	13.15	37.03	–59.48
336	215	68.9169	310.9502	1086.16	44.85	37.15	–51.57
337	215	68.7354	310.9856	1145.87	22.64	37.26	–37.95
338	215	68.5541	311.0205	1181.99	4.13	37.37	–32.32
339	215	68.3729	311.0547	1240.67	16.82	37.47	–17.60
340	215	68.1917	311.0884	1233.47	13.91	37.57	–21.89
341	215	68.0107	311.1213	1277.88	55.32	37.67	–32.72
342	215	67.8298	311.1538	1282.42	9.46	37.72	–21.89
343	215	67.6490	311.1858	1313.62	19.12	37.76	–11.97
344	215	67.4682	311.2173	1352.42	3.50	37.80	–7.40
345	215	67.2876	311.2480	1341.86	7.55	37.84	–11.67
346	215	67.1071	311.2786	1337.14	35.92	37.87	–22.30
347	215	66.9268	311.3086	1315.65	4.06	37.88	–28.80
348	215	66.7465	311.3379	1286.34	15.51	37.85	–56.68
349	215	66.5663	311.3669	1377.13	10.96	37.81	–43.56
350	215	66.3862	311.3955	1451.34	40.22	37.77	–23.80
351	215	66.2063	311.4236	1507.79	28.56	37.74	–18.83
352	215	66.0265	311.4512	1564.38	2.01	37.70	–25.29
353	215	65.8468	311.4785	1585.44	7.42	37.60	–23.18
354	215	65.6672	311.5051	1600.94	18.49	37.50	–26.53
355	215	65.4877	311.5317	1635.69	75.47	37.40	–37.17
356	215	65.3083	311.5576	1750.57	9.68	37.29	–25.68
357	215	65.1290	311.5833	1799.61	8.33	37.19	–25.74
358	215	64.9499	311.6086	1823.30	4.72	37.07	–25.16
359	215	64.7709	311.6333	1814.45	12.02	36.93	–34.13
360	215	64.5920	311.6580	1880.90	14.54	36.79	–37.28

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
361	215	64.4132	311.6821	1868.44	15.52	36.64	–57.33
362	215	64.2346	311.7058	1867.62	27.98	36.50	–22.96
363	215	64.0561	311.7295	1930.87	8.60	36.36	–22.57
364	215	63.8777	311.7524	1971.37	11.51	36.21	–10.23
365	215	63.6994	311.7754	1994.24	11.73	36.07	–21.93
366	215	63.5212	311.7979	2051.68	5.45	35.92	–14.48
367	215	63.3432	311.8201	2043.32	4.74	35.78	–10.19
368	215	63.1653	311.8420	2009.14	27.92	35.64	–19.64
369	215	62.9875	311.8635	2055.74	43.18	35.50	–23.19
370	215	62.8099	311.8848	2077.17	7.75	35.38	–26.36
371	215	62.6324	311.9058	1842.31	12.13	35.27	–53.73
372	215	62.4550	311.9265	1660.95	81.88	35.16	–40.08
373	215	62.2778	311.9470	1591.95	27.69	35.05	–39.07
374	215	62.1006	311.9673	1414.53	26.27	34.94	–61.10
375	215	61.9237	311.9871	1278.17	7.82	34.85	–64.73
376	215	61.7468	312.0068	1142.17	9.70	34.79	–63.13
377	215	61.5701	312.0261	1056.92	32.05	34.73	–70.00
378	215	61.3935	312.0454	885.24	20.15	34.67	–102.65
379	215	61.2171	312.0642	518.22	27.50	34.61	–91.47
380	215	61.0408	312.0828	262.69	63.07	34.55	213.17
381	215	60.8646	312.1013	230.08	37.96	34.52	1230.08
318	216	72.2130	310.7856	2250.80	3.47	35.60	–25.81
319	216	72.0298	310.8293	2075.27	27.64	35.69	–33.77
320	216	71.8467	310.8723	1959.68	13.12	35.79	–47.72
321	216	71.6637	310.9143	1951.45	27.97	35.91	–42.63
322	216	71.4807	310.9553	1922.27	56.48	36.02	–40.88
323	216	71.2979	310.9956	1903.39	34.59	36.13	–24.89
324	216	71.1151	311.0352	1862.94	6.85	36.24	–28.72
325	216	70.9324	311.0740	1789.00	16.22	36.36	–19.80
326	216	70.7498	311.1121	1708.19	5.45	36.50	–32.75
327	216	70.5673	311.1492	1636.64	21.09	36.63	–37.44
328	216	70.3849	311.1858	1605.48	6.40	36.77	–31.71
329	216	70.2025	311.2217	1542.54	17.92	36.90	–34.03
330	216	70.0203	311.2568	1455.48	20.80	37.04	–75.79
331	216	69.8382	311.2915	1447.46	41.53	37.17	–53.29
332	216	69.6561	311.3254	1412.27	29.20	37.31	–55.22
333	216	69.4742	311.3586	1291.76	12.65	37.44	–51.98
334	216	69.2923	311.3914	1199.00	26.58	37.57	–77.04
335	216	69.1106	311.4236	1200.87	18.37	37.70	–32.28
336	216	68.9289	311.4551	1264.71	4.91	37.82	–18.40
337	216	68.7474	311.4861	1290.94	79.35	37.92	–47.62
338	216	68.5659	311.5166	1356.18	16.27	38.02	–36.91
339	216	68.3846	311.5466	1362.14	99.94	38.12	–17.95
340	216	68.2034	311.5759	1411.90	8.50	38.21	–11.76
341	216	68.0222	311.6050	1423.71	6.10	38.31	–20.91
342	216	67.8412	311.6333	1439.54	11.76	38.35	–11.11
343	216	67.6603	311.6614	1446.24	36.68	38.39	–26.24
344	216	67.4794	311.6890	1475.69	5.69	38.42	–19.44
345	216	67.2988	311.7161	1460.25	7.15	38.45	–11.50
346	216	67.1181	311.7427	1477.00	3.79	38.49	–12.70
347	216	66.9377	311.7688	1485.58	2.19	38.49	–15.69
348	216	66.7573	311.7947	1512.61	2.36	38.45	–13.86
349	216	66.5770	311.8201	1567.16	7.39	38.41	–11.68
350	216	66.3969	311.8450	1634.70	31.88	38.37	–31.17
351	216	66.2168	311.8696	1691.10	10.17	38.33	9.01
352	216	66.0369	311.8938	1722.32	32.35	38.29	–20.32
353	216	65.8571	311.9177	1765.63	14.52	38.19	–14.09

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
354	216	65.6774	311.9412	1791.86	3.71	38.09	–25.76
355	216	65.4979	311.9644	1839.85	7.64	37.98	–17.57
356	216	65.3184	311.9871	1897.78	3.16	37.88	–14.76
357	216	65.1391	312.0095	1962.00	9.04	37.77	–11.96
358	216	64.9599	312.0317	2016.71	7.05	37.66	–15.06
359	216	64.7808	312.0535	2040.17	4.55	37.51	–12.32
360	216	64.6018	312.0750	2071.52	10.57	37.37	–30.52
361	216	64.4230	312.0959	2098.03	17.64	37.23	–31.71
362	216	64.2442	312.1169	2085.33	5.14	37.09	8.01
363	216	64.0656	312.1375	2032.41	5.35	36.95	–28.79
364	216	63.8872	312.1577	2078.18	66.17	36.80	–9.21
365	216	63.7088	312.1777	2124.06	6.02	36.66	–34.57
366	216	63.5306	312.1975	2185.62	2.45	36.52	–23.22
367	216	63.3525	312.2168	2179.15	6.06	36.38	–11.13
368	216	63.1745	312.2361	2205.76	10.97	36.25	–15.24
369	216	62.9967	312.2549	2258.94	19.69	36.11	–29.71
370	216	62.8190	312.2737	2216.49	7.01	36.00	–14.38
371	216	62.6414	312.2920	2010.84	38.83	35.89	–79.25
372	216	62.4639	312.3101	1923.15	12.41	35.79	–30.24
373	216	62.2866	312.3281	1773.78	24.91	35.68	–49.21
374	216	62.1095	312.3457	1686.21	12.74	35.58	–28.31
375	216	61.9324	312.3630	1656.53	39.05	35.49	–24.31
376	216	61.7555	312.3804	1495.47	16.31	35.44	–32.92
377	216	61.5787	312.3972	1487.86	5.29	35.39	–57.82
378	216	61.4021	312.4141	1298.01	28.30	35.33	–84.55
379	216	61.2256	312.4307	968.42	13.14	35.28	–97.60
380	216	61.0492	312.4470	519.14	73.17	35.23	–119.76
381	216	60.8729	312.4631	15.23	22.92	35.21	47.94
318	217	72.2256	311.3860	2346.38	2.68	36.29	1.73
319	217	72.0422	311.4236	2210.48	38.05	36.38	–31.17
320	217	71.8590	311.4602	2169.76	38.56	36.48	–24.91
321	217	71.6758	311.4963	2142.69	10.17	36.60	–14.01
322	217	71.4927	311.5317	2110.44	4.41	36.71	–15.27
323	217	71.3097	311.5662	2039.47	5.34	36.82	–23.86
324	217	71.1268	311.6001	1978.59	15.17	36.94	–17.50
325	217	70.9440	311.6333	1894.36	18.90	37.06	–29.91
326	217	70.7613	311.6660	1879.52	13.45	37.19	–17.87
327	217	70.5787	311.6980	1816.96	29.74	37.32	–34.22
328	217	70.3961	311.7295	1805.49	12.10	37.46	–14.66
329	217	70.2137	311.7603	1741.84	16.93	37.59	–17.51
330	217	70.0314	311.7903	1688.01	6.08	37.73	–29.55
331	217	69.8491	311.8201	1657.76	7.80	37.86	–27.53
332	217	69.6670	311.8491	1627.79	12.09	37.99	–17.48
333	217	69.4849	311.8777	1547.03	34.62	38.12	–52.69
334	217	69.3030	311.9058	1417.88	22.57	38.24	–42.10
335	217	69.1211	311.9333	1425.06	32.61	38.37	–33.03
336	217	68.9394	311.9604	1415.61	4.51	38.49	–24.16
337	217	68.7577	311.9871	1432.70	8.32	38.58	–19.23
338	217	68.5762	312.0132	1535.07	41.78	38.67	–25.14
339	217	68.3947	312.0391	1545.94	6.82	38.76	–14.28
340	217	68.2134	312.0642	1541.71	24.56	38.85	–12.44
341	217	68.0322	312.0891	1526.98	4.97	38.94	–15.63
342	217	67.8511	312.1135	1570.23	8.77	38.98	–10.96
343	217	67.6701	312.1375	1583.46	9.41	39.01	–12.64
344	217	67.4892	312.1611	1580.40	25.70	39.03	–15.14
345	217	67.3084	312.1843	1574.34	5.11	39.06	–20.33
346	217	67.1277	312.2073	1593.57	1.47	39.09	–10.13

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
347	217	66.9471	312.2297	1612.77	58.60	39.09	–14.82
348	217	66.7667	312.2517	1689.23	8.09	39.05	–8.30
349	217	66.5863	312.2737	1739.91	2.56	39.00	–12.13
350	217	66.4061	312.2949	1797.48	3.92	38.95	–18.52
351	217	66.2260	312.3162	1829.96	13.54	38.91	–17.12
352	217	66.0460	312.3369	1870.10	6.42	38.86	–3.97
353	217	65.8661	312.3574	1900.31	4.70	38.77	–18.07
354	217	65.6864	312.3774	1947.38	4.01	38.66	–12.74
355	217	65.5067	312.3972	1987.29	3.09	38.55	–14.03
356	217	65.3272	312.4167	2032.94	56.61	38.44	–8.29
357	217	65.1478	312.4360	2093.53	8.13	38.33	–19.96
358	217	64.9685	312.4551	2154.61	2.22	38.22	–8.38
359	217	64.7893	312.4739	2191.36	14.81	38.08	–10.71
360	217	64.6103	312.4922	2230.72	36.95	37.94	–8.02
361	217	64.4314	312.5103	2230.13	4.69	37.80	–5.87
362	217	64.2526	312.5283	2206.75	3.01	37.66	–6.68
363	217	64.0739	312.5459	2196.31	6.35	37.52	–9.85
364	217	63.8954	312.5632	2212.35	2.96	37.38	–13.29
365	217	63.7170	312.5803	2274.33	2.71	37.25	–17.56
366	217	63.5387	312.5972	2320.76	15.77	37.11	–10.73
367	217	63.3605	312.6140	2321.18	10.29	36.98	–12.40
368	217	63.1825	312.6304	2381.15	2.05	36.84	–20.30
369	217	63.0046	312.6465	2468.03	2.39	36.71	–0.46
370	217	62.8268	312.6626	2389.57	13.20	36.61	–15.83
371	217	62.6492	312.6785	2192.50	13.18	36.51	–37.12
372	217	62.4717	312.6938	2031.97	9.41	36.41	–38.60
373	217	62.2943	312.7092	1955.75	12.99	36.31	–52.76
374	217	62.1171	312.7244	1895.29	169.12	36.22	–36.58
375	217	61.9400	312.7393	1796.54	12.64	36.14	–18.91
376	217	61.7630	312.7542	1704.23	25.47	36.09	–43.12
377	217	61.5862	312.7688	1637.16	21.16	36.04	–65.88
378	217	61.4095	312.7832	1447.00	13.18	36.00	–105.25
379	217	61.2329	312.7974	1122.91	29.82	35.95	–136.35
380	217	61.0565	312.8113	585.56	97.44	35.91	–162.05
381	217	60.8802	312.8252	105.57	47.46	35.90	–132.76
318	218	72.2362	311.9871	2373.92	0.80	36.97	–15.60
319	218	72.0527	312.0183	2335.12	7.50	37.06	–12.82
320	218	71.8694	312.0491	2276.62	15.56	37.17	–15.32
321	218	71.6861	312.0791	2255.99	8.53	37.28	–16.45
322	218	71.5029	312.1086	2217.04	10.15	37.39	–11.68
323	218	71.3198	312.1375	2140.76	20.73	37.51	–17.91
324	218	71.1368	312.1658	2103.30	6.73	37.62	–13.73
325	218	70.9539	312.1936	2051.47	4.56	37.74	–14.19
326	218	70.7711	312.2207	2020.04	41.35	37.87	–17.97
327	218	70.5883	312.2473	1932.06	52.97	38.01	–27.91
328	218	70.4057	312.2737	1906.85	15.58	38.14	–38.14
329	218	70.2232	312.2993	1870.41	7.17	38.27	–20.41
330	218	70.0407	312.3245	1838.84	34.37	38.40	–12.87
331	218	69.8584	312.3491	1817.61	2.43	38.52	–14.52
332	218	69.6762	312.3735	1758.35	18.71	38.65	–14.51
333	218	69.4940	312.3972	1691.48	28.04	38.77	–21.54
334	218	69.3120	312.4207	1608.28	31.59	38.90	–41.63
335	218	69.1301	312.4438	1600.70	15.26	39.02	–24.11
336	218	68.9482	312.4663	1609.34	4.97	39.13	–8.41
337	218	68.7665	312.4885	1563.61	9.53	39.22	–23.53
338	218	68.5849	312.5103	1681.86	13.12	39.30	–9.13
339	218	68.4034	312.5317	1657.94	22.62	39.39	–15.77

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
340	218	68.2219	312.5527	1673.23	2.58	39.47	–12.68
341	218	68.0406	312.5735	1670.55	6.55	39.55	–13.46
342	218	67.8595	312.5940	1679.49	8.50	39.59	–18.88
343	218	67.6784	312.6140	1712.23	16.44	39.61	–9.93
344	218	67.4974	312.6335	1722.39	4.99	39.63	–18.76
345	218	67.3165	312.6531	1734.56	5.47	39.65	–15.88
346	218	67.1358	312.6721	1750.00	2.13	39.67	–15.52
347	218	66.9551	312.6909	1751.65	1.81	39.68	–12.45
348	218	66.7746	312.7092	1790.69	8.68	39.63	–17.33
349	218	66.5942	312.7275	1858.56	2.03	39.58	–10.62
350	218	66.4139	312.7454	1912.05	3.30	39.53	–7.43
351	218	66.2337	312.7629	1946.70	12.05	39.47	–10.95
352	218	66.0537	312.7803	1982.01	2.68	39.42	–14.86
353	218	65.8737	312.7974	2020.78	4.39	39.33	–7.86
354	218	65.6939	312.8140	2061.88	5.92	39.22	–20.43
355	218	65.5142	312.8306	2116.21	5.04	39.11	–8.09
356	218	65.3346	312.8469	2180.76	10.92	39.00	–1.68
357	218	65.1551	312.8630	2205.26	2.40	38.90	–14.37
358	218	64.9758	312.8787	2263.08	41.32	38.78	–6.70
359	218	64.7966	312.8943	2293.21	22.85	38.64	–5.09
360	218	64.6175	312.9097	2323.53	6.87	38.51	–5.55
361	218	64.4385	312.9248	2329.95	1.45	38.37	–4.70
362	218	64.2597	312.9397	2313.54	6.73	38.23	–7.99
363	218	64.0809	312.9546	2322.76	8.59	38.09	–9.02
364	218	63.9023	312.9690	2350.78	1.47	37.96	–8.61
365	218	63.7239	312.9832	2385.65	1.02	37.83	–8.12
366	218	63.5455	312.9973	2415.63	16.28	37.70	–9.58
367	218	63.3673	313.0112	2442.97	9.92	37.57	–20.00
368	218	63.1893	313.0249	2473.66	4.18	37.44	–29.18
369	218	63.0113	313.0386	2529.90	16.26	37.31	–12.93
370	218	62.8335	313.0518	2469.80	32.32	37.22	–37.14
371	218	62.6558	313.0649	2276.45	12.30	37.12	–33.01
372	218	62.4782	313.0779	2182.29	6.19	37.03	–12.76
373	218	62.3008	313.0908	2093.38	43.59	36.94	–40.50
374	218	62.1235	313.1033	2067.89	7.41	36.85	–28.52
375	218	61.9464	313.1157	2020.94	12.79	36.77	–26.37
376	218	61.7694	313.1282	1972.76	14.42	36.73	–42.17
377	218	61.5925	313.1404	1616.34	30.78	36.70	–83.92
378	218	61.4157	313.1523	1375.04	12.96	36.66	–96.15
379	218	61.2391	313.1641	1097.02	29.79	36.62	–126.44
380	218	61.0627	313.1758	624.53	33.25	36.58	–144.84
381	218	60.8863	313.1873	–17.15	34.90	36.57	–158.16
318	219	72.2449	312.5889	2464.68	0.34	37.62	–7.66
319	219	72.0613	312.6140	2429.56	23.23	37.72	–12.30
320	219	71.8779	312.6384	2392.28	4.39	37.83	–10.60
321	219	71.6945	312.6626	2352.07	4.28	37.94	–13.60
322	219	71.5112	312.6860	2297.97	8.41	38.06	–21.77
323	219	71.3280	312.7092	2235.74	18.85	38.18	–15.82
324	219	71.1449	312.7319	2199.30	35.71	38.29	–3.72
325	219	70.9619	312.7542	2172.46	8.70	38.41	–8.45
326	219	70.7791	312.7759	2119.35	30.35	38.54	–9.50
327	219	70.5962	312.7974	2087.29	5.48	38.67	–9.67
328	219	70.4135	312.8181	2049.42	9.36	38.80	16.83
329	219	70.2309	312.8389	2011.85	4.28	38.93	–6.76
330	219	70.0484	312.8589	1963.31	31.24	39.06	–10.38
331	219	69.8660	312.8787	1926.15	6.79	39.18	–16.64
332	219	69.6837	312.8982	1859.66	13.73	39.30	–30.88

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
333	219	69.5015	312.9172	1815.30	10.38	39.42	−20.53
334	219	69.3194	312.9360	1740.22	72.64	39.54	−12.05
335	219	69.1374	312.9546	1818.31	6.86	39.66	−13.63
336	219	68.9555	312.9727	1733.97	5.53	39.77	−19.29
337	219	68.7737	312.9902	1737.44	4.67	39.85	−11.25
338	219	68.5920	313.0078	1781.18	6.47	39.93	22.84
339	219	68.4104	313.0249	1774.28	6.03	40.01	−10.50
340	219	68.2289	313.0417	1749.82	6.90	40.09	−11.95
341	219	68.0475	313.0583	1785.77	5.54	40.16	−14.38
342	219	67.8663	313.0747	1796.65	4.43	40.20	−13.23
343	219	67.6852	313.0908	1818.08	2.94	40.21	−9.31
344	219	67.5041	313.1064	1842.48	13.80	40.23	−13.64
345	219	67.3232	313.1221	1863.46	4.38	40.24	−14.08
346	219	67.1424	313.1372	1882.71	5.87	40.25	−10.40
347	219	66.9617	313.1523	1890.89	2.21	40.25	−8.90
348	219	66.7811	313.1670	1916.04	2.33	40.20	−10.10
349	219	66.6006	313.1816	1961.98	1.57	40.14	−7.54
350	219	66.4203	313.1958	2011.54	3.06	40.09	−5.98
351	219	66.2401	313.2100	2020.98	21.35	40.03	−35.75
352	219	66.0600	313.2239	2075.10	15.22	39.98	−11.15
353	219	65.8799	313.2375	2127.23	6.60	39.89	−9.13
354	219	65.7001	313.2510	2176.47	5.81	39.78	−11.01
355	219	65.5203	313.2642	2214.04	8.78	39.67	−9.95
356	219	65.3407	313.2771	2268.58	2.11	39.56	−3.28
357	219	65.1612	313.2900	2303.80	6.62	39.45	−4.43
358	219	64.9818	313.3027	2345.14	5.67	39.33	−3.05
359	219	64.8025	313.3152	2369.71	5.28	39.20	−4.55
360	219	64.6234	313.3274	2393.75	1.02	39.06	−5.43
361	219	64.4444	313.3396	2406.39	17.62	38.92	−4.04
362	219	64.2655	313.3516	2415.81	4.39	38.79	−5.76
363	219	64.0867	313.3633	2418.27	2.17	38.65	−8.17
364	219	63.9081	313.3750	2444.63	2.71	38.52	−4.19
365	219	63.7295	313.3862	2466.20	7.51	38.40	−3.54
366	219	63.5511	313.3977	2505.55	1.59	38.27	−10.92
367	219	63.3729	313.4087	2557.58	6.37	38.15	−14.15
368	219	63.1948	313.4197	2620.78	9.26	38.02	−6.49
369	219	63.0168	313.4304	2625.07	1.92	37.90	−7.28
370	219	62.8389	313.4412	2520.96	17.07	37.81	−37.04
371	219	62.6612	313.4517	2363.57	21.50	37.72	−26.11
372	219	62.4836	313.4622	2296.48	4.06	37.64	−4.26
373	219	62.3061	313.4724	2265.52	2.32	37.55	−10.30
374	219	62.1288	313.4824	2232.58	8.38	37.47	−8.20
375	219	61.9516	313.4924	2175.43	10.72	37.40	−32.53
376	219	61.7746	313.5022	2016.56	46.18	37.37	−76.82
377	219	61.5976	313.5120	1613.79	21.83	37.34	−163.08
378	219	61.4209	313.5215	1284.85	34.76	37.31	−98.91
379	219	61.2442	313.5310	956.92	34.44	37.28	−77.74
380	219	61.0677	313.5405	446.52	15.14	37.25	−131.95
318	220	72.2516	313.1912	2544.85	0.36	38.26	−7.58
319	220	72.0680	313.2100	2519.86	20.26	38.36	−9.79
320	220	71.8845	313.2285	2490.37	16.40	38.48	−6.09
321	220	71.7010	313.2466	2445.32	8.50	38.59	−10.31
322	220	71.5177	313.2642	2396.74	8.67	38.71	−11.80
323	220	71.3345	313.2815	2344.83	8.72	38.83	−13.34
324	220	71.1513	313.2986	2292.48	5.28	38.95	−11.07
325	220	70.9682	313.3152	2253.22	26.91	39.07	−11.74
326	220	70.7853	313.3315	2209.57	9.53	39.20	−7.59

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
327	220	70.6024	313.3477	2181.95	12.77	39.32	–9.06
328	220	70.4196	313.3633	2153.73	3.92	39.45	–8.49
329	220	70.2370	313.3787	2101.31	5.81	39.58	–14.88
330	220	70.0544	313.3938	2071.53	5.44	39.71	–10.34
331	220	69.8719	313.4087	2042.61	10.23	39.83	–7.96
332	220	69.6895	313.4233	1987.32	16.40	39.94	3.78
333	220	69.5073	313.4377	1944.26	13.78	40.06	–22.17
334	220	69.3251	313.4517	1888.85	7.43	40.17	–14.22
335	220	69.1431	313.4656	1847.77	23.71	40.29	–15.73
336	220	68.9611	313.4790	1835.58	3.31	40.39	–18.88
337	220	68.7793	313.4924	1856.95	25.32	40.47	–12.43
338	220	68.5975	313.5056	1831.23	11.21	40.54	–32.83
339	220	68.4159	313.5183	1878.93	3.55	40.61	0.72
340	220	68.2343	313.5310	1866.20	26.65	40.68	–7.30
341	220	68.0529	313.5435	1903.50	3.41	40.76	–13.20
342	220	67.8716	313.5557	1917.75	6.92	40.78	–7.27
343	220	67.6904	313.5679	1932.77	5.05	40.79	–9.52
344	220	67.5094	313.5796	1957.10	2.24	40.80	–6.60
345	220	67.3284	313.5913	1971.43	2.84	40.81	–8.81
346	220	67.1475	313.6028	1986.35	2.69	40.82	–7.55
347	220	66.9668	313.6140	2006.26	4.24	40.82	–7.83
348	220	66.7862	313.6250	2028.16	1.60	40.76	–14.29
349	220	66.6057	313.6360	2060.79	6.34	40.70	–6.11
350	220	66.4253	313.6467	2103.14	2.17	40.64	–7.68
351	220	66.2450	313.6572	2136.86	3.10	40.59	–6.75
352	220	66.0648	313.6677	2175.90	5.58	40.53	–10.37
353	220	65.8848	313.6780	2216.30	2.18	40.43	–9.71
354	220	65.7049	313.6880	2261.88	2.25	40.32	–6.18
355	220	65.5251	313.6980	2302.60	4.20	40.21	–8.42
356	220	65.3454	313.7078	2346.85	3.24	40.10	–8.67
357	220	65.1658	313.7173	2382.55	3.26	39.99	–1.55
358	220	64.9864	313.7268	2398.23	1.68	39.88	–6.08
359	220	64.8071	313.7361	2441.42	1.77	39.74	–7.34
360	220	64.6279	313.7454	2471.78	8.79	39.61	–4.05
361	220	64.4489	313.7544	2479.32	16.66	39.48	–5.82
362	220	64.2700	313.7634	2495.89	2.52	39.34	–4.62
363	220	64.0912	313.7722	2505.85	1.66	39.21	–5.46
364	220	63.9125	313.7810	2516.15	8.39	39.08	–3.99
365	220	63.7339	313.7896	2542.55	6.07	38.96	–11.14
366	220	63.5555	313.7981	2567.58	4.47	38.84	–5.64
367	220	63.3772	313.8064	2615.77	1.94	38.72	–6.04
368	220	63.1991	313.8147	2681.43	2.57	38.60	–3.61
369	220	63.0210	313.8228	2684.71	2.94	38.48	–4.49
370	220	62.8432	313.8308	2625.07	19.92	38.40	1.95
371	220	62.6654	313.8386	2502.10	33.54	38.32	–24.44
372	220	62.4878	313.8464	2429.47	8.41	38.25	–9.96
373	220	62.3103	313.8540	2400.48	2.31	38.17	–10.40
374	220	62.1329	313.8618	2383.61	5.50	38.09	–16.34
375	220	61.9557	313.8691	2323.03	8.50	38.03	–25.14
376	220	61.7786	313.8765	2138.17	9.61	38.00	–60.48
377	220	61.6017	313.8838	1571.25	90.41	37.98	–90.16
378	220	61.4249	313.8911	1262.75	121.60	37.96	–124.70
379	220	61.2482	313.8982	812.95	12.04	37.93	–95.09
380	220	61.0717	313.9053	135.06	12.99	37.91	–443.25
318	221	72.2565	313.7939	2625.24	0.27	38.89	–8.81
319	221	72.0728	313.8064	2600.66	5.51	39.00	–6.54
320	221	71.8892	313.8186	2566.20	4.43	39.11	–5.62

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
321	221	71.7057	313.8308	2528.66	11.80	39.23	–5.36
322	221	71.5223	313.8425	2479.85	4.26	39.35	–9.85
323	221	71.3390	313.8540	2437.55	1.96	39.47	–6.11
324	221	71.1558	313.8655	2390.23	11.09	39.59	–12.29
325	221	70.9727	313.8765	2358.35	3.41	39.71	–7.60
326	221	70.7897	313.8875	2303.23	4.81	39.84	–20.22
327	221	70.6068	313.8982	2288.55	6.54	39.97	–13.82
328	221	70.4240	313.9087	2260.39	16.40	40.10	–5.98
329	221	70.2413	313.9189	2199.64	9.17	40.22	–14.02
330	221	70.0586	313.9290	2133.88	5.11	40.35	–18.33
331	221	69.8761	313.9390	2133.47	28.45	40.47	–8.67
332	221	69.6937	313.9487	2074.76	4.16	40.58	–11.04
333	221	69.5114	313.9583	2049.57	20.21	40.69	–13.04
334	221	69.3292	313.9675	1997.43	15.59	40.80	–12.65
335	221	69.1471	313.9768	1982.47	8.83	40.91	–10.14
336	221	68.9651	313.9858	1964.34	5.40	41.01	–6.40
337	221	68.7832	313.9949	1952.42	22.61	41.08	–25.72
338	221	68.6015	314.0034	1940.51	3.58	41.15	–21.23
339	221	68.4198	314.0122	1950.16	26.51	41.21	–13.80
340	221	68.2382	314.0205	1969.93	2.33	41.28	–10.39
341	221	68.0568	314.0288	1983.81	47.21	41.35	–1.02
342	221	67.8754	314.0371	2009.92	16.22	41.37	1.05
343	221	67.6942	314.0449	2024.19	4.70	41.37	–6.56
344	221	67.5131	314.0530	2040.76	12.49	41.38	–5.86
345	221	67.3321	314.0608	2064.64	1.83	41.38	–6.07
346	221	67.1512	314.0684	2085.37	5.97	41.39	–6.44
347	221	66.9704	314.0759	2097.86	1.74	41.38	–8.47
348	221	66.7898	314.0833	2121.92	7.30	41.32	–4.50
349	221	66.6092	314.0906	2150.35	6.60	41.26	–10.73
350	221	66.4288	314.0977	2173.81	3.67	41.19	–16.73
351	221	66.2485	314.1047	2217.92	1.26	41.13	–5.08
352	221	66.0683	314.1116	2252.21	1.10	41.07	–4.61
353	221	65.8883	314.1184	2295.66	4.46	40.98	–2.75
354	221	65.7083	314.1252	2336.10	1.78	40.87	–3.93
355	221	65.5285	314.1318	2367.11	1.01	40.75	–5.71
356	221	65.3488	314.1384	2413.01	2.33	40.64	–3.85
357	221	65.1692	314.1448	2446.08	1.76	40.53	–5.55
358	221	64.9897	314.1511	2472.32	2.39	40.42	–4.76
359	221	64.8104	314.1575	2515.72	4.35	40.29	–4.37
360	221	64.6312	314.1636	2536.54	4.67	40.15	–12.35
361	221	64.4521	314.1697	2565.30	3.87	40.02	–6.83
362	221	64.2732	314.1755	2574.39	0.83	39.89	–4.24
363	221	64.0943	314.1814	2582.11	5.40	39.76	–3.40
364	221	63.9156	314.1873	2599.82	1.91	39.64	–6.77
365	221	63.7371	314.1929	2622.87	3.76	39.52	–5.94
366	221	63.5586	314.1985	2645.29	4.08	39.41	–4.53
367	221	63.3803	314.2041	2682.48	1.96	39.29	–3.65
368	221	63.2021	314.2097	2732.91	5.11	39.18	–0.10
369	221	63.0241	314.2151	2729.33	2.45	39.07	–5.15
370	221	62.8462	314.2205	2663.74	11.20	38.99	–17.10
371	221	62.6684	314.2256	2576.93	5.87	38.92	–10.01
372	221	62.4908	314.2310	2561.86	2.43	38.85	–8.56
373	221	62.3132	314.2361	2527.27	2.57	38.77	–8.15
374	221	62.1358	314.2410	2477.87	5.28	38.70	–17.26
375	221	61.9586	314.2461	2373.47	23.16	38.65	–31.00
376	221	61.7815	314.2510	2206.05	26.34	38.63	–69.11
377	221	61.6045	314.2559	1684.24	68.59	38.61	–150.57

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
378	221	61.4277	314.2605	1299.19	9.98	38.60	–91.48
379	221	61.2510	314.2654	935.37	8.01	38.58	–88.65
380	221	61.0745	314.2700	–136.96	22.67	38.57	–461.75
381	221	60.8980	314.2747	536.48	19.35	38.58	–62.40
383	221	60.5456	314.2837	145.76	7.22	38.64	–75.17
318	222	72.2594	314.3967	2691.40	0.22	39.50	–4.40
319	222	72.0757	314.4031	2668.24	3.25	39.61	–5.10
320	222	71.8921	314.4092	2637.73	4.50	39.73	–5.99
321	222	71.7085	314.4153	2600.61	1.48	39.85	–6.16
322	222	71.5251	314.4211	2560.61	3.47	39.98	–5.81
323	222	71.3418	314.4270	2519.66	2.74	40.10	–5.12
324	222	71.1585	314.4326	2485.68	8.04	40.22	–5.84
325	222	70.9754	314.4382	2438.09	49.47	40.34	–14.81
326	222	70.7924	314.4436	2398.62	7.94	40.47	–26.35
327	222	70.6094	314.4490	2385.17	18.39	40.60	–9.62
328	222	70.4266	314.4541	2326.43	4.76	40.72	–16.69
329	222	70.2438	314.4595	2294.54	22.14	40.85	–11.98
330	222	70.0612	314.4644	2252.85	20.48	40.97	–4.67
331	222	69.8787	314.4695	2226.46	10.79	41.09	–8.54
332	222	69.6962	314.4744	2171.63	11.01	41.19	–0.08
333	222	69.5139	314.4790	2120.05	6.87	41.30	3.75
334	222	69.3317	314.4836	2082.33	4.64	41.41	–16.89
335	222	69.1496	314.4883	2063.15	21.53	41.51	3.97
336	222	68.9675	314.4929	2056.10	7.36	41.61	–10.37
337	222	68.7856	314.4973	2061.93	13.60	41.67	–9.86
338	222	68.6038	314.5017	2056.23	6.12	41.74	–2.37
339	222	68.4221	314.5059	2057.36	3.18	41.80	–12.52
340	222	68.2406	314.5103	2066.99	3.00	41.86	–9.21
341	222	68.0591	314.5144	2066.50	6.14	41.92	–11.22
342	222	67.8777	314.5183	2089.42	8.22	41.94	–6.53
343	222	67.6965	314.5225	2108.24	0.55	41.94	–7.29
344	222	67.5153	314.5264	2131.99	2.72	41.94	–3.87
345	222	67.3343	314.5303	2145.10	8.36	41.94	–4.48
346	222	67.1534	314.5342	2160.31	3.35	41.94	–6.66
347	222	66.9726	314.5378	2183.63	1.67	41.93	–7.00
348	222	66.7919	314.5415	2207.16	4.32	41.86	–8.87
349	222	66.6114	314.5452	2229.75	3.62	41.80	–7.69
350	222	66.4309	314.5488	2258.88	6.82	41.73	–3.52
351	222	66.2506	314.5522	2284.06	3.12	41.67	–4.54
352	222	66.0704	314.5557	2315.28	14.27	41.60	–3.45
353	222	65.8903	314.5591	2355.24	1.70	41.51	–3.91
354	222	65.7104	314.5625	2389.67	2.25	41.40	–5.11
355	222	65.5305	314.5659	2426.77	1.79	41.29	–4.10
356	222	65.3508	314.5691	2468.80	1.72	41.17	–4.13
357	222	65.1712	314.5723	2503.50	3.18	41.06	–6.17
358	222	64.9917	314.5754	2549.88	3.28	40.95	–5.79
359	222	64.8124	314.5786	2588.52	22.28	40.82	–3.25
360	222	64.6332	314.5818	2622.84	3.68	40.69	–4.51
361	222	64.4541	314.5847	2640.64	2.95	40.56	–6.16
362	222	64.2751	314.5876	2646.95	1.98	40.44	–4.31
363	222	64.0963	314.5906	2648.27	1.02	40.31	–4.35
364	222	63.9175	314.5935	2665.10	4.84	40.19	–3.96
365	222	63.7390	314.5964	2688.50	1.78	40.08	–3.18
366	222	63.5605	314.5991	2706.27	1.45	39.97	–5.17
367	222	63.3822	314.6021	2753.06	4.10	39.86	–1.85
368	222	63.2040	314.6047	2769.70	2.96	39.75	–9.33
369	222	63.0259	314.6074	2780.61	4.69	39.64	–4.89

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
370	222	62.8480	314.6101	2737.97	6.11	39.57	10.05
371	222	62.6702	314.6128	2700.19	10.53	39.51	–2.31
372	222	62.4925	314.6152	2655.39	6.78	39.44	–8.22
373	222	62.3150	314.6179	2616.18	14.48	39.38	–9.59
374	222	62.1376	314.6204	2485.62	13.62	39.31	–40.09
375	222	61.9604	314.6230	2336.20	13.70	39.26	–61.06
376	222	61.7832	314.6255	2015.28	43.30	39.25	–110.07
377	222	61.6063	314.6279	1557.04	17.86	39.24	–181.35
378	222	61.4294	314.6301	1446.70	5.64	39.23	–121.31
379	222	61.2527	314.6326	1332.64	7.99	39.23	60.66
380	222	61.0761	314.6350	1096.51	14.43	39.22	–93.76
381	222	60.8997	314.6372	722.24	11.01	39.23	9.68
382	222	60.7234	314.6396	242.72	7.01	39.27	13.73
383	222	60.5473	314.6418	1055.10	30.03	39.31	480.49
384	222	60.3713	314.6440	–60.02	46.00	39.34	–359.17
385	222	60.1954	314.6462	–45.46	67.17	39.38	954.54
386	222	60.0197	314.6484	60.17	58.46	39.42	198.91
387	222	59.8441	314.6506	365.77	29.42	39.47	1365.77
318	223	72.2603	315.0000	2749.73	0.11	40.11	–3.25
319	223	72.0766	315.0000	2726.08	0.93	40.22	–3.78
320	223	71.8930	315.0000	2697.90	0.72	40.34	–5.22
321	223	71.7095	315.0000	2666.09	3.05	40.47	–7.03
322	223	71.5260	315.0000	2632.97	4.77	40.59	–6.35
323	223	71.3427	315.0000	2592.82	2.29	40.72	–6.20
324	223	71.1595	315.0000	2559.16	6.20	40.84	–8.26
325	223	70.9763	315.0000	2524.91	8.15	40.97	–10.41
326	223	70.7933	315.0000	2483.84	3.65	41.09	–9.77
327	223	70.6103	315.0000	2449.39	11.28	41.22	–7.10
328	223	70.4275	315.0000	2418.38	12.04	41.34	–6.02
329	223	70.2447	315.0000	2360.91	7.34	41.47	–9.90
330	223	70.0621	315.0000	2335.90	8.99	41.59	–16.90
331	223	69.8795	315.0000	2295.15	6.49	41.70	–11.99
332	223	69.6971	315.0000	2271.75	33.72	41.81	–5.99
333	223	69.5147	315.0000	2191.50	7.09	41.91	–39.85
334	223	69.3325	315.0000	2193.59	4.22	42.01	–9.27
335	223	69.1504	315.0000	2165.88	19.53	42.12	–5.39
336	223	68.9683	315.0000	2141.47	50.09	42.21	–12.91
337	223	68.7864	315.0000	2142.05	5.03	42.27	–8.85
338	223	68.6046	315.0000	2127.12	9.08	42.33	–10.53
339	223	68.4229	315.0000	2140.12	2.45	42.38	–6.26
340	223	68.2413	315.0000	2148.40	15.56	42.44	–3.47
341	223	68.0598	315.0000	2159.84	1.36	42.50	–7.42
342	223	67.8785	315.0000	2171.74	4.36	42.51	–6.32
343	223	67.6972	315.0000	2191.91	1.01	42.51	–5.72
344	223	67.5161	315.0000	2204.23	1.52	42.50	–5.73
345	223	67.3351	315.0000	2226.13	3.45	42.50	–7.74
346	223	67.1541	315.0000	2243.15	0.97	42.49	–3.94
347	223	66.9733	315.0000	2260.52	3.84	42.48	–9.50
348	223	66.7927	315.0000	2287.01	1.78	42.41	–3.05
349	223	66.6121	315.0000	2305.95	11.98	42.34	–1.82
350	223	66.4317	315.0000	2322.33	0.78	42.27	–5.61
351	223	66.2513	315.0000	2352.84	2.27	42.20	–3.19
352	223	66.0711	315.0000	2380.95	7.06	42.14	–5.69
353	223	65.8910	315.0000	2415.46	0.69	42.04	–3.52
354	223	65.7111	315.0000	2447.08	1.91	41.93	–3.17
355	223	65.5312	315.0000	2482.54	2.43	41.82	–2.52
356	223	65.3515	315.0000	2513.02	1.69	41.70	–5.96

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
357	223	65.1719	315.0000	2555.52	1.05	41.59	−4.75
358	223	64.9924	315.0000	2598.44	4.53	41.48	−4.34
359	223	64.8130	315.0000	2642.94	1.71	41.35	−6.08
360	223	64.6338	315.0000	2694.14	0.61	41.23	−4.02
361	223	64.4547	315.0000	2715.35	3.03	41.10	−2.57
362	223	64.2757	315.0000	2713.03	2.04	40.98	−5.69
363	223	64.0969	315.0000	2717.53	2.01	40.85	−3.19
364	223	63.9182	315.0000	2736.10	3.04	40.74	−2.30
365	223	63.7396	315.0000	2755.20	3.57	40.63	−4.55
366	223	63.5611	315.0000	2768.60	5.04	40.53	−2.32
367	223	63.3828	315.0000	2798.31	2.94	40.42	−1.16
368	223	63.2046	315.0000	2848.39	3.28	40.32	−8.05
369	223	63.0265	315.0000	2844.47	1.62	40.22	−6.35
370	223	62.8486	315.0000	2802.92	4.68	40.15	−1.54
371	223	62.6708	315.0000	2780.08	2.86	40.09	−3.27
372	223	62.4931	315.0000	2738.67	4.82	40.04	−6.12
373	223	62.3156	315.0000	2706.01	5.25	39.98	−14.78
374	223	62.1382	315.0000	2573.17	6.53	39.92	−33.75
375	223	61.9609	315.0000	2363.44	22.21	39.88	−100.06
376	223	61.7838	315.0000	2188.62	93.97	39.88	−71.29
377	223	61.6068	315.0000	1773.96	82.47	39.87	−29.38
378	223	61.4300	315.0000	1624.77	18.73	39.87	212.47
379	223	61.2533	315.0000	1554.59	28.96	39.87	185.43
380	223	61.0767	315.0000	1223.80	42.83	39.87	−101.35
381	223	60.9003	315.0000	1022.79	95.78	39.89	134.88
382	223	60.7240	315.0000	729.74	39.28	39.94	278.74
383	223	60.5478	315.0000	737.31	44.88	39.98	702.56
384	223	60.3718	315.0000	68.59	36.57	40.02	1068.59
385	223	60.1960	315.0000	71.59	61.00	40.06	1071.59
386	223	60.0203	315.0000	254.56	44.39	40.11	64.00
387	223	59.8447	315.0000	315.51	29.94	40.17	−5.72
318	224	72.2594	315.6030	2800.42	0.07	40.69	−3.18
319	224	72.0757	315.5967	2781.90	4.22	40.81	−2.74
320	224	71.8921	315.5906	2759.63	1.00	40.93	−3.29
321	224	71.7085	315.5845	2733.10	1.01	41.06	−4.40
322	224	71.5251	315.5786	2699.28	2.35	41.19	−6.17
323	224	71.3418	315.5728	2665.67	6.18	41.32	−3.26
324	224	71.1585	315.5671	2630.23	5.88	41.45	−10.97
325	224	70.9754	315.5615	2593.04	3.14	41.57	−6.61
326	224	70.7924	315.5562	2559.84	8.91	41.70	−6.79
327	224	70.6094	315.5508	2519.68	3.07	41.82	−11.03
328	224	70.4266	315.5457	2488.93	5.88	41.95	−5.31
329	224	70.2438	315.5403	2453.81	2.92	42.07	−7.54
330	224	70.0612	315.5354	2401.50	7.39	42.20	−5.57
331	224	69.8787	315.5303	2385.30	3.62	42.30	−4.99
332	224	69.6962	315.5254	2340.78	3.53	42.40	−7.97
333	224	69.5139	315.5208	2300.09	10.08	42.50	−18.50
334	224	69.3317	315.5161	2289.65	76.29	42.60	−7.49
335	224	69.1496	315.5115	2243.46	4.94	42.71	−25.89
336	224	68.9675	315.5068	2218.71	17.28	42.80	−4.55
337	224	68.7856	315.5024	2232.06	5.31	42.85	−4.90
338	224	68.6038	315.4980	2231.27	1.43	42.90	−7.31
339	224	68.4221	315.4939	2228.57	10.12	42.95	−9.75
340	224	68.2406	315.4895	2239.60	7.44	43.01	−5.43
341	224	68.0591	315.4854	2238.00	1.57	43.06	−6.55
342	224	67.8777	315.4814	2249.78	0.85	43.07	−6.86
343	224	67.6965	315.4773	2267.40	96.24	43.06	−3.24

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
344	224	67.5153	315.4734	2292.07	8.25	43.05	–3.69
345	224	67.3343	315.4695	2300.41	1.81	43.04	–3.47
346	224	67.1534	315.4656	2315.88	6.83	43.03	–4.36
347	224	66.9726	315.4619	2333.48	13.82	43.01	–3.14
348	224	66.7919	315.4583	2348.76	0.89	42.94	–3.01
349	224	66.6114	315.4546	2362.92	2.31	42.87	–5.46
350	224	66.4309	315.4509	2384.45	1.73	42.80	–2.85
351	224	66.2506	315.4475	2411.70	3.98	42.73	–2.29
352	224	66.0704	315.4441	2436.10	0.87	42.66	–2.46
353	224	65.8903	315.4407	2472.39	3.64	42.57	–1.62
354	224	65.7104	315.4373	2494.64	1.74	42.45	–1.76
355	224	65.5305	315.4338	2500.50	0.66	42.34	–2.73
356	224	65.3508	315.4307	2530.23	0.67	42.23	–5.40
357	224	65.1712	315.4275	2583.15	11.15	42.12	–2.73
358	224	64.9917	315.4243	2627.82	1.33	42.01	–4.02
359	224	64.8124	315.4211	2677.35	5.87	41.88	–4.16
360	224	64.6332	315.4180	2728.31	1.46	41.76	–2.68
361	224	64.4541	315.4150	2755.03	1.22	41.64	–0.90
362	224	64.2751	315.4121	2767.48	1.16	41.51	–1.15
363	224	64.0963	315.4092	2775.35	3.38	41.39	–1.10
364	224	63.9175	315.4062	2790.36	1.39	41.28	–2.22
365	224	63.7390	315.4033	2815.70	4.34	41.18	–1.40
366	224	63.5605	315.4006	2830.98	3.18	41.08	–1.42
367	224	63.3822	315.3977	2824.14	10.05	40.98	–0.52
368	224	63.2040	315.3950	2832.00	4.12	40.89	–13.79
369	224	63.0259	315.3923	2824.58	20.49	40.79	–10.95
370	224	62.8480	315.3896	2770.98	81.36	40.73	–25.53
371	224	62.6702	315.3870	2727.92	23.91	40.68	–1.50
372	224	62.4925	315.3845	2733.13	17.64	40.63	–8.09
373	224	62.3150	315.3818	2658.90	17.37	40.58	–18.25
374	224	62.1376	315.3794	2572.74	16.25	40.53	–15.83
375	224	61.9604	315.3767	2423.27	16.65	40.49	–50.27
376	224	61.7832	315.3743	2196.54	15.13	40.49	–47.04
377	224	61.6063	315.3718	1914.97	93.06	40.50	49.86
378	224	61.4294	315.3696	1717.23	52.15	40.50	–56.01
379	224	61.2527	315.3672	1790.84	84.13	40.51	–60.61
380	224	61.0761	315.3647	1593.89	49.87	40.51	–102.44
381	224	60.8997	315.3625	1370.40	97.77	40.54	–154.92
382	224	60.7234	315.3601	818.94	34.53	40.59	–65.50
383	224	60.5473	315.3579	263.42	41.30	40.64	–56.32
384	224	60.3713	315.3557	104.38	97.26	40.69	–17.64
385	224	60.1954	315.3535	207.78	64.67	40.74	–14.65
386	224	60.0197	315.3513	326.70	43.29	40.78	–86.17
387	224	59.8441	315.3491	406.04	31.12	40.85	29.97
318	225	72.2565	316.2058	2851.35	0.08	41.26	–2.92
319	225	72.0728	316.1934	2834.33	7.31	41.39	–2.58
320	225	71.8892	316.1812	2816.15	1.20	41.52	–3.20
321	225	71.7057	316.1689	2786.02	4.91	41.65	–4.28
322	225	71.5223	316.1572	2757.27	1.44	41.78	–3.23
323	225	71.3390	316.1458	2719.44	1.09	41.91	–4.09
324	225	71.1558	316.1343	2687.33	22.63	42.04	–5.97
325	225	70.9727	316.1233	2654.85	3.06	42.18	–2.85
326	225	70.7897	316.1123	2618.97	8.84	42.30	–10.41
327	225	70.6068	316.1016	2592.91	2.40	42.42	–6.56
328	225	70.4240	316.0911	2566.12	3.00	42.55	–4.88
329	225	70.2413	316.0808	2529.76	4.50	42.67	–13.55
330	225	70.0586	316.0708	2495.59	13.47	42.80	–3.06

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
331	225	69.8761	316.0608	2453.46	5.04	42.90	−7.08
332	225	69.6937	316.0510	2413.18	3.02	43.00	−8.00
333	225	69.5114	316.0415	2391.29	6.01	43.10	−6.99
334	225	69.3292	316.0322	2365.50	7.56	43.20	−4.89
335	225	69.1471	316.0229	2364.27	4.11	43.29	−4.39
336	225	68.9651	316.0139	2329.79	5.14	43.38	−6.11
337	225	68.7832	316.0049	2328.36	24.31	43.43	−4.66
338	225	68.6015	315.9963	2312.37	5.93	43.48	−10.27
339	225	68.4198	315.9875	2316.49	2.94	43.53	−3.57
340	225	68.2382	315.9792	2314.91	1.07	43.57	−3.89
341	225	68.0568	315.9709	2313.81	1.03	43.62	−8.25
342	225	67.8754	315.9626	2330.93	1.85	43.63	−1.97
343	225	67.6942	315.9548	2338.35	3.33	43.62	−3.98
344	225	67.5131	315.9468	2353.22	4.14	43.60	−4.28
345	225	67.3321	315.9390	2368.86	2.69	43.59	−2.48
346	225	67.1512	315.9314	2385.03	2.29	43.57	−2.84
347	225	66.9704	315.9238	2396.91	0.72	43.55	−3.17
348	225	66.7898	315.9165	2407.14	0.62	43.48	−2.19
349	225	66.6092	315.9092	2422.06	0.80	43.41	−3.23
350	225	66.4288	315.9021	2444.06	32.54	43.33	−1.87
351	225	66.2485	315.8950	2466.00	2.36	43.26	−3.68
352	225	66.0683	315.8882	2490.17	5.33	43.19	−1.12
353	225	65.8883	315.8813	2504.23	9.09	43.09	−0.07
354	225	65.7083	315.8745	2493.67	4.23	42.98	−1.48
355	225	65.5285	315.8679	2476.70	1.24	42.87	−4.19
356	225	65.3488	315.8613	2496.62	2.58	42.75	−6.46
357	225	65.1692	315.8550	2534.51	1.11	42.64	−4.99
358	225	64.9897	315.8486	2595.95	2.01	42.53	−3.38
359	225	64.8104	315.8423	2647.11	1.68	42.41	−4.25
360	225	64.6312	315.8362	2706.87	2.22	42.29	−4.56
361	225	64.4521	315.8301	2735.72	2.58	42.17	−6.22
362	225	64.2732	315.8242	2766.82	3.49	42.05	−1.90
363	225	64.0943	315.8184	2788.26	1.89	41.93	−1.04
364	225	63.9156	315.8125	2806.58	4.16	41.82	−2.59
365	225	63.7371	315.8069	2811.01	13.10	41.73	−2.50
366	225	63.5586	315.8013	2799.25	6.34	41.64	−2.65
367	225	63.3803	315.7957	2751.71	4.95	41.54	−5.64
368	225	63.2021	315.7900	2724.48	7.42	41.45	−22.48
369	225	63.0241	315.7847	2711.32	85.31	41.36	−23.58
370	225	62.8462	315.7793	2271.25	71.66	41.30	−106.28
371	225	62.6684	315.7742	2261.48	48.58	41.26	−42.98
372	225	62.4908	315.7688	2532.81	21.29	41.22	−35.64
373	225	62.3132	315.7637	2566.53	7.65	41.17	−15.01
374	225	62.1358	315.7588	2437.76	16.37	41.13	−34.10
375	225	61.9586	315.7537	2325.32	35.56	41.10	−60.25
376	225	61.7815	315.7488	1995.03	9.45	41.11	−92.13
377	225	61.6045	315.7439	1663.00	50.33	41.12	−27.18
378	225	61.4277	315.7393	1741.38	39.49	41.13	−61.54
379	225	61.2510	315.7344	1913.62	55.05	41.14	−43.70
380	225	61.0745	315.7297	1867.20	65.43	41.15	−22.66
381	225	60.8980	315.7251	1399.24	25.25	41.19	−97.25
382	225	60.7218	315.7205	882.08	90.23	41.24	−212.24
383	225	60.5456	315.7161	497.78	309.86	41.30	−107.04
384	225	60.3697	315.7117	169.42	51.41	41.35	−15.86
385	225	60.1938	315.7073	204.72	142.23	41.41	15.88
386	225	60.0181	315.7029	281.35	52.86	41.46	−50.68
387	225	59.8425	315.6985	397.73	37.41	41.53	−87.57

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
318	226	72.2516	316.8086	2899.41	0.08	41.82	−2.45
319	226	72.0680	316.7898	2883.30	1.16	41.95	−2.87
320	226	71.8845	316.7712	2861.74	1.11	42.09	−3.34
321	226	71.7010	316.7532	2840.11	0.85	42.23	−2.14
322	226	71.5177	316.7356	2808.87	1.26	42.36	−2.66
323	226	71.3345	316.7183	2780.09	7.80	42.49	−4.57
324	226	71.1513	316.7012	2749.08	4.16	42.63	−4.39
325	226	70.9682	316.6846	2719.79	6.27	42.76	−3.11
326	226	70.7853	316.6682	2690.76	3.17	42.89	−5.40
327	226	70.6024	316.6521	2660.52	2.30	43.01	−4.88
328	226	70.4196	316.6365	2634.28	0.74	43.14	−5.25
329	226	70.2370	316.6211	2590.52	4.92	43.26	−5.63
330	226	70.0544	316.6060	2551.48	4.16	43.39	−8.03
331	226	69.8719	316.5911	2532.76	1.60	43.49	−3.77
332	226	69.6895	316.5764	2499.46	6.33	43.58	−4.29
333	226	69.5073	316.5620	2472.62	2.79	43.68	−6.57
334	226	69.3251	316.5481	2432.63	4.72	43.77	−15.50
335	226	69.1431	316.5342	2422.74	6.30	43.87	−3.97
336	226	68.9611	316.5208	2401.09	1.89	43.95	−10.09
337	226	68.7793	316.5073	2391.76	1.95	44.00	−7.16
338	226	68.5975	316.4941	2393.98	1.83	44.04	−7.55
339	226	68.4159	316.4814	2389.58	1.69	44.09	−1.89
340	226	68.2343	316.4687	2385.55	4.89	44.13	−6.04
341	226	68.0529	316.4563	2389.50	0.48	44.18	−5.28
342	226	67.8716	316.4441	2396.37	4.20	44.18	−1.78
343	226	67.6904	316.4319	2407.84	0.83	44.16	−4.40
344	226	67.5094	316.4202	2421.44	1.15	44.14	−4.72
345	226	67.3284	316.4084	2434.43	1.20	44.13	−3.29
346	226	67.1475	316.3970	2448.67	0.52	44.11	−2.24
347	226	66.9668	316.3857	2454.54	1.55	44.08	−1.53
348	226	66.7862	316.3748	2464.50	0.67	44.01	−1.58
349	226	66.6057	316.3638	2473.86	1.12	43.93	−1.26
350	226	66.4253	316.3530	2476.32	0.75	43.86	−0.75
351	226	66.2450	316.3425	2490.37	1.21	43.78	−0.80
352	226	66.0648	316.3320	2481.05	3.61	43.71	−3.12
353	226	65.8848	316.3218	2469.78	1.05	43.61	−2.65
354	226	65.7049	316.3118	2434.49	4.00	43.50	21.93
355	226	65.5251	316.3018	2402.70	7.06	43.39	−3.41
356	226	65.3454	316.2920	2408.44	3.23	43.28	−9.15
357	226	65.1658	316.2825	2455.76	1.51	43.16	−9.61
358	226	64.9864	316.2729	2515.55	1.46	43.05	−6.17
359	226	64.8071	316.2637	2579.65	2.92	42.94	−4.97
360	226	64.6279	316.2544	2624.95	14.04	42.82	−6.24
361	226	64.4489	316.2454	2653.16	12.77	42.70	−5.50
362	226	64.2700	316.2363	2693.16	2.65	42.59	−4.23
363	226	64.0912	316.2275	2737.56	2.16	42.47	−2.96
364	226	63.9125	316.2187	2760.67	2.55	42.37	−3.12
365	226	63.7339	316.2102	2741.94	3.49	42.28	−2.23
366	226	63.5555	316.2017	2710.24	1.57	42.19	−8.88
367	226	63.3772	316.1934	2636.39	2.34	42.10	−16.75
368	226	63.1991	316.1851	2559.87	3.64	42.01	−48.81
369	226	63.0210	316.1770	2365.15	54.76	41.92	−85.99
370	226	62.8432	316.1689	1789.68	76.46	41.88	−242.29
371	226	62.6654	316.1611	1938.10	84.56	41.84	−74.06
372	226	62.4878	316.1533	2046.08	54.67	41.81	−102.87
373	226	62.3103	316.1458	2248.60	6.96	41.77	−29.00
374	226	62.1329	316.1379	2196.16	6.91	41.73	−28.60

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
375	226	61.9557	316.1306	2045.46	25.87	41.71	–9.62
376	226	61.7786	316.1233	1673.12	58.50	41.72	–69.69
377	226	61.6017	316.1160	1608.50	20.33	41.74	–38.00
378	226	61.4249	316.1086	1441.22	37.19	41.76	–54.36
379	226	61.2482	316.1016	1529.25	333.94	41.78	–33.62
380	226	61.0717	316.0945	1461.73	90.20	41.80	2.06
381	226	60.8952	316.0876	1280.34	45.86	41.84	–63.39
382	226	60.7190	316.0808	951.46	82.04	41.90	–58.83
383	226	60.5429	316.0740	377.14	68.87	41.96	124.65
384	226	60.3669	316.0674	280.74	161.08	42.02	–41.71
385	226	60.1911	316.0608	254.48	86.05	42.08	–43.53
386	226	60.0154	316.0542	230.95	71.15	42.14	–122.08
318	227	72.2449	317.4109	2943.13	0.06	42.37	–2.26
319	227	72.0613	317.3857	2927.82	0.84	42.51	–2.17
320	227	71.8779	317.3613	2910.50	2.79	42.65	–2.05
321	227	71.6945	317.3372	2884.82	1.14	42.79	–2.54
322	227	71.5112	317.3137	2858.66	0.80	42.93	–3.34
323	227	71.3280	317.2905	2831.55	4.80	43.07	–2.66
324	227	71.1449	317.2678	2800.85	1.89	43.21	–4.61
325	227	70.9619	317.2456	2774.95	1.92	43.34	–5.36
326	227	70.7791	317.2239	2744.90	1.99	43.47	–8.35
327	227	70.5962	317.2024	2720.51	4.31	43.59	–4.86
328	227	70.4135	317.1816	2688.41	1.92	43.72	–2.81
329	227	70.2309	317.1609	2660.34	3.15	43.84	–5.05
330	227	70.0484	317.1409	2627.96	4.71	43.97	–5.16
331	227	69.8660	317.1211	2597.72	5.19	44.07	–3.92
332	227	69.6837	317.1016	2566.42	2.05	44.17	–5.60
333	227	69.5015	317.0825	2538.22	68.24	44.26	–6.95
334	227	69.3194	317.0637	2515.29	7.93	44.35	–5.06
335	227	69.1374	317.0452	2498.25	1.69	44.44	–5.16
336	227	68.9555	317.0271	2485.32	1.29	44.53	–3.33
337	227	68.7737	317.0095	2465.74	1.97	44.57	–4.15
338	227	68.5920	316.9919	2461.82	4.98	44.61	–2.58
339	227	68.4104	316.9749	2458.80	39.04	44.65	–3.95
340	227	68.2289	316.9580	2452.90	0.77	44.69	–4.07
341	227	68.0475	316.9414	2456.14	4.13	44.73	–3.39
342	227	67.8663	316.9250	2462.18	2.79	44.73	–2.28
343	227	67.6852	316.9089	2469.00	3.00	44.71	–2.41
344	227	67.5041	316.8933	2481.31	1.01	44.69	–3.91
345	227	67.3232	316.8777	2492.94	0.63	44.67	–2.19
346	227	67.1424	316.8625	2500.18	4.86	44.65	–1.41
347	227	66.9617	316.8474	2512.43	1.31	44.61	–2.42
348	227	66.7811	316.8328	2506.02	1.20	44.54	–1.07
349	227	66.6006	316.8181	2490.09	0.38	44.46	–0.23
350	227	66.4203	316.8040	2455.96	4.84	44.38	–3.00
351	227	66.2401	316.7898	2441.22	6.01	44.31	–2.30
352	227	66.0600	316.7759	2409.21	1.53	44.23	–7.22
353	227	65.8799	316.7622	2375.45	8.08	44.13	–0.42
354	227	65.7001	316.7488	2322.96	6.01	44.02	–5.29
355	227	65.5203	316.7356	2308.13	2.26	43.91	–10.54
356	227	65.3407	316.7227	2308.65	2.25	43.80	–9.87
357	227	65.1612	316.7097	2339.84	1.40	43.69	–8.02
358	227	64.9818	316.6970	2419.31	7.94	43.58	–13.80
359	227	64.8025	316.6846	2474.83	1.86	43.46	–9.68
360	227	64.6234	316.6724	2529.69	8.51	43.35	–6.86
361	227	64.4444	316.6602	2548.59	3.78	43.24	–14.92
362	227	64.2655	316.6482	2590.00	2.71	43.12	–6.90

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
363	227	64.0867	316.6365	2643.96	3.10	43.01	–10.48
364	227	63.9081	316.6248	2640.11	19.19	42.91	–5.60
365	227	63.7295	316.6135	2627.20	15.52	42.83	–15.09
366	227	63.5511	316.6021	2523.94	14.41	42.74	–33.30
367	227	63.3729	316.5911	2406.87	23.61	42.66	–63.29
368	227	63.1948	316.5801	2258.12	47.80	42.58	–44.22
369	227	63.0168	316.5693	1703.96	52.60	42.49	25.82
370	227	62.8389	316.5586	1258.86	58.37	42.46	–166.87
371	227	62.6612	316.5481	1408.87	31.83	42.42	–103.20
372	227	62.4836	316.5376	1620.54	21.74	42.39	18.78
373	227	62.3061	316.5273	1717.84	32.24	42.36	–111.45
374	227	62.1288	316.5173	1634.95	6.02	42.33	–56.63
375	227	61.9516	316.5073	1636.33	13.65	42.31	–90.28
376	227	61.7746	316.4976	1362.89	77.83	42.34	–39.51
377	227	61.5976	316.4878	1032.14	63.51	42.36	–70.68
378	227	61.4209	316.4783	1185.92	26.39	42.39	–41.81
379	227	61.2442	316.4687	1156.50	60.69	42.41	–102.57
380	227	61.0677	316.4592	1078.19	19.17	42.43	–32.09
381	227	60.8913	316.4502	978.76	43.98	42.48	2.93
382	227	60.7151	316.4409	607.64	144.40	42.55	–89.09
383	227	60.5390	316.4319	121.37	72.90	42.61	–163.67
384	227	60.3631	316.4231	315.03	61.77	42.68	–179.62
385	227	60.1873	316.4143	369.24	79.73	42.74	–123.38
386	227	60.0116	316.4055	202.56	45.48	42.80	–115.99
318	228	72.2362	318.0127	2984.19	0.15	42.91	–2.13
319	228	72.0527	317.9814	2971.72	0.38	43.06	–1.95
320	228	71.8694	317.9507	2954.68	0.74	43.20	–1.88
321	228	71.6861	317.9207	2930.15	1.25	43.35	–3.27
322	228	71.5029	317.8911	2907.81	1.25	43.49	–2.24
323	228	71.3198	317.8623	2878.98	3.22	43.63	–4.28
324	228	71.1368	317.8340	2853.76	2.85	43.77	–2.96
325	228	70.9539	317.8062	2829.53	1.78	43.91	–3.92
326	228	70.7711	317.7791	2803.04	3.37	44.04	–4.38
327	228	70.5883	317.7524	2782.41	1.15	44.17	–2.94
328	228	70.4057	317.7261	2748.52	5.12	44.29	–4.14
329	228	70.2232	317.7004	2724.48	3.87	44.42	–3.37
330	228	70.0407	317.6753	2694.59	1.73	44.55	–5.29
331	228	69.8584	317.6506	2661.19	2.75	44.64	–3.09
332	228	69.6762	317.6262	2627.88	4.14	44.74	–7.69
333	228	69.4940	317.6025	2607.99	48.06	44.83	–1.86
334	228	69.3120	317.5791	2585.05	4.26	44.92	–3.91
335	228	69.1301	317.5559	2557.39	40.06	45.01	–6.56
336	228	68.9482	317.5334	2546.29	4.13	45.09	–5.23
337	228	68.7665	317.5112	2531.73	2.17	45.13	–3.95
338	228	68.5849	317.4895	2521.09	3.98	45.17	–2.46
339	228	68.4034	317.4680	2518.96	1.21	45.20	–3.09
340	228	68.2219	317.4470	2514.42	0.62	45.24	–3.29
341	228	68.0406	317.4263	2514.90	1.79	45.28	–3.06
342	228	67.8595	317.4058	2517.77	0.60	45.27	–2.77
343	228	67.6784	317.3857	2521.67	1.23	45.25	–1.84
344	228	67.4974	317.3662	2527.96	2.67	45.23	–2.13
345	228	67.3165	317.3467	2535.57	1.48	45.20	–0.69
346	228	67.1358	317.3276	2532.85	4.58	45.18	–2.08
347	228	66.9551	317.3088	2515.79	2.18	45.14	–0.97
348	228	66.7746	317.2905	2483.45	0.94	45.07	–2.55
349	228	66.5942	317.2722	2443.06	1.40	44.99	–3.04
350	228	66.4139	317.2544	2399.69	4.82	44.91	–3.96

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
351	228	66.2337	317.2368	2351.33	11.63	44.83	–6.90
352	228	66.0537	317.2195	2306.72	5.47	44.75	–11.99
353	228	65.8737	317.2024	2273.79	39.33	44.65	–7.55
354	228	65.6939	317.1858	2224.82	3.08	44.54	–11.16
355	228	65.5142	317.1692	2166.03	2.00	44.43	–16.31
356	228	65.3346	317.1528	2159.19	4.96	44.32	–5.07
357	228	65.1551	317.1367	2199.65	6.77	44.21	–1.96
358	228	64.9758	317.1211	2305.61	7.45	44.10	–14.05
359	228	64.7966	317.1055	2355.60	12.92	43.99	–16.12
360	228	64.6175	317.0901	2353.51	4.29	43.88	–11.83
361	228	64.4385	317.0750	2386.64	9.62	43.77	–20.12
362	228	64.2597	317.0601	2375.40	5.30	43.66	–7.63
363	228	64.0809	317.0452	2448.92	82.13	43.55	–2.73
364	228	63.9023	317.0308	2402.64	17.93	43.45	–11.75
365	228	63.7239	317.0166	2706.91	29.19	43.38	–154.09
366	228	63.5455	317.0024	2277.87	61.25	43.30	–109.91
367	228	63.3673	316.9885	1995.94	99.86	43.22	–96.84
368	228	63.1893	316.9749	1479.09	48.51	43.14	–64.77
369	228	63.0113	316.9612	925.09	83.87	43.06	–136.52
370	228	62.8335	316.9480	617.34	21.30	43.03	–100.35
371	228	62.6558	316.9348	514.04	13.90	43.01	–609.44
372	228	62.4782	316.9219	1188.87	34.01	42.98	50.30
373	228	62.3008	316.9089	1243.11	91.81	42.95	–95.88
374	228	62.1235	316.8965	1152.55	12.94	42.93	–58.41
375	228	61.9464	316.8840	1043.34	7.07	42.92	–63.77
376	228	61.7694	316.8716	851.67	21.66	42.95	–53.06
377	228	61.5925	316.8594	677.19	29.23	42.98	–537.93
378	228	61.4157	316.8474	367.79	25.82	43.01	–48.40
379	228	61.2391	316.8357	352.25	49.77	43.04	–41.07
380	228	61.0627	316.8240	324.72	13.95	43.07	–21.40
381	228	60.8863	316.8125	276.10	29.20	43.12	19.43
382	228	60.7101	316.8010	251.93	84.74	43.19	–63.54
383	228	60.5341	316.7898	–78.04	69.50	43.26	–128.72
318	229	72.2256	318.6138	3024.75	0.12	43.43	–2.03
319	229	72.0422	318.5762	3012.84	0.39	43.59	–1.46
320	229	71.8590	318.5396	2994.61	1.43	43.74	–3.28
321	229	71.6758	318.5034	2977.72	0.88	43.89	–1.90
322	229	71.4927	318.4680	2951.98	2.08	44.04	–2.39
323	229	71.3097	318.4336	2928.81	2.26	44.18	–4.00
324	229	71.1268	318.3997	2899.90	1.35	44.33	–4.94
325	229	70.9440	318.3665	2880.33	2.48	44.47	–2.02
326	229	70.7613	318.3337	2854.36	4.11	44.60	–2.39
327	229	70.5787	318.3018	2835.11	14.33	44.73	–1.50
328	229	70.3961	318.2703	2804.99	2.59	44.86	–4.31
329	229	70.2137	318.2395	2774.44	22.59	44.99	–7.33
330	229	70.0314	318.2095	2747.24	5.53	45.12	–6.22
331	229	69.8491	318.1797	2714.83	1.30	45.21	–4.67
332	229	69.6670	318.1506	2700.16	4.01	45.30	–2.91
333	229	69.4849	318.1221	2668.22	3.12	45.40	–5.27
334	229	69.3030	318.0940	2646.50	1.47	45.49	–4.35
335	229	69.1211	318.0664	2631.30	8.93	45.58	–2.85
336	229	68.9394	318.0393	2609.45	6.86	45.65	–4.57
337	229	68.7577	318.0127	2591.52	1.50	45.69	–3.91
338	229	68.5762	317.9866	2581.18	1.46	45.72	–3.45
339	229	68.3947	317.9607	2576.87	1.03	45.76	–2.75
340	229	68.2134	317.9355	2574.29	3.34	45.79	–0.89
341	229	68.0322	317.9106	2569.07	0.58	45.83	–2.38

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
342	229	67.8511	317.8862	2565.78	1.35	45.82	−1.35
343	229	67.6701	317.8623	2565.59	1.72	45.79	−0.92
344	229	67.4892	317.8386	2549.20	1.74	45.76	−0.58
345	229	67.3084	317.8154	2528.26	0.37	45.74	−2.30
346	229	67.1277	317.7925	2502.47	1.77	45.71	−3.33
347	229	66.9471	317.7700	2468.73	2.09	45.67	−3.80
348	229	66.7667	317.7480	2432.42	1.47	45.59	−3.36
349	229	66.5863	317.7261	2378.04	35.35	45.51	−2.48
350	229	66.4061	317.7048	2330.06	1.12	45.43	−6.17
351	229	66.2260	317.6836	2275.11	4.81	45.35	−11.79
352	229	66.0460	317.6628	2228.04	3.57	45.28	−8.34
353	229	65.8661	317.6423	2158.05	11.01	45.17	−11.31
354	229	65.6864	317.6223	2085.75	8.11	45.06	−19.54
355	229	65.5067	317.6025	2013.42	7.09	44.95	−27.15
356	229	65.3272	317.5830	1992.65	9.50	44.84	−19.81
357	229	65.1478	317.5637	2054.12	72.92	44.73	−32.46
358	229	64.9685	317.5447	2192.87	44.89	44.63	−32.08
359	229	64.7893	317.5259	2054.62	40.89	44.52	−46.73
360	229	64.6103	317.5076	2024.67	7.94	44.41	−36.39
361	229	64.4314	317.4895	2141.29	16.55	44.30	−38.39
362	229	64.2526	317.4714	2225.00	15.81	44.19	−8.55
363	229	64.0739	317.4539	2225.63	28.24	44.09	−6.63
364	229	63.8954	317.4365	2063.55	24.55	44.00	−19.69
365	229	63.7170	317.4194	1932.70	61.18	43.93	−136.74
366	229	63.5387	317.4026	1490.76	62.26	43.85	−84.34
367	229	63.3605	317.3857	847.25	53.70	43.78	37.72
368	229	63.1825	317.3694	477.31	29.32	43.70	−12.75
369	229	63.0046	317.3533	484.81	56.72	43.63	−175.39
370	229	62.8268	317.3372	646.67	12.62	43.61	746.04
371	229	62.6492	317.3213	728.86	27.96	43.59	−204.60
372	229	62.4717	317.3059	686.72	11.93	43.57	826.95
373	229	62.2943	317.2905	887.08	32.05	43.55	99.24
374	229	62.1171	317.2754	750.53	168.84	43.53	−92.49
375	229	61.9400	317.2605	674.12	27.68	43.53	−249.37
376	229	61.7630	317.2456	246.92	58.09	43.56	−172.64
377	229	61.5862	317.2310	203.85	11.30	43.60	−49.06
378	229	61.4095	317.2166	442.39	146.54	43.63	−75.35
318	230	72.2130	319.2141	3062.65	0.12	43.95	−1.37
319	230	72.0298	319.1704	3049.54	0.82	44.11	−1.97
320	230	71.8467	319.1274	3035.39	1.96	44.27	−1.32
321	230	71.6637	319.0854	3014.42	0.34	44.42	−1.43
322	230	71.4807	319.0444	2994.65	0.92	44.58	−2.40
323	230	71.2979	319.0042	2970.78	4.68	44.73	−2.70
324	230	71.1151	318.9646	2950.16	1.64	44.89	−1.77
325	230	70.9324	318.9258	2924.43	2.65	45.03	−6.14
326	230	70.7498	318.8877	2908.90	0.64	45.16	−0.81
327	230	70.5673	318.8506	2877.96	1.75	45.29	−2.57
328	230	70.3849	318.8140	2858.12	2.46	45.42	−3.68
329	230	70.2025	318.7781	2830.45	0.88	45.55	−3.43
330	230	70.0203	318.7429	2806.98	1.67	45.68	−2.17
331	230	69.8382	318.7083	2781.63	7.10	45.78	−2.72
332	230	69.6561	318.6743	2753.84	2.14	45.87	−2.74
333	230	69.4742	318.6411	2726.47	0.95	45.96	−3.74
334	230	69.2923	318.6084	2709.37	8.64	46.05	−3.97
335	230	69.1106	318.5762	2689.30	1.07	46.14	−2.98
336	230	68.9289	318.5447	2673.14	5.57	46.21	−1.46
337	230	68.7474	318.5137	2647.19	3.22	46.24	−2.82

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
338	230	68.5659	318.4832	2637.81	1.02	46.27	–1.10
339	230	68.3846	318.4531	2628.44	3.96	46.31	–1.56
340	230	68.2034	318.4238	2622.73	0.92	46.34	–2.23
341	230	68.0222	318.3948	2613.78	0.99	46.38	–0.96
342	230	67.8412	318.3665	2598.14	0.94	46.36	–0.46
343	230	67.6603	318.3384	2563.28	0.67	46.33	–2.40
344	230	67.4794	318.3108	2524.45	0.57	46.30	–2.32
345	230	67.2988	318.2837	2485.03	2.50	46.27	–4.28
346	230	67.1181	318.2571	2451.17	5.84	46.25	–3.54
347	230	66.9377	318.2310	2413.46	2.84	46.20	–5.64
348	230	66.7573	318.2051	2376.19	2.18	46.12	–4.86
349	230	66.5770	318.1797	2324.46	4.50	46.04	–4.20
350	230	66.3969	318.1548	2228.73	3.62	45.96	–21.01
351	230	66.2168	318.1301	2186.53	5.29	45.88	–9.21
352	230	66.0369	318.1060	2109.49	16.74	45.80	–12.91
353	230	65.8571	318.0820	2035.68	8.07	45.69	–5.01
354	230	65.6774	318.0586	1940.68	39.29	45.59	–13.00
355	230	65.4979	318.0354	1771.89	54.49	45.48	–5.42
356	230	65.3184	318.0127	1688.02	10.21	45.37	–34.99
357	230	65.1391	317.9902	1634.72	62.99	45.26	–210.68
358	230	64.9599	317.9680	1909.22	18.36	45.15	9.90
359	230	64.7808	317.9463	1978.47	64.05	45.05	57.41
360	230	64.6018	317.9248	1948.70	13.17	44.94	–63.62
361	230	64.4230	317.9038	1829.19	58.39	44.84	–141.06
362	230	64.2442	317.8828	1856.19	68.44	44.73	13.68
363	230	64.0656	317.8623	1740.83	55.22	44.63	–24.62
364	230	63.8872	317.8420	1553.30	64.80	44.55	–153.61
365	230	63.7088	317.8220	1134.92	86.86	44.48	–97.60
366	230	63.5306	317.8022	740.79	57.78	44.41	–63.53
367	230	63.3525	317.7830	394.34	92.61	44.34	234.84
368	230	63.1745	317.7637	–50.65	62.38	44.27	–49.15
371	230	62.6414	317.7078	590.15	18.27	44.17	–226.97
375	230	61.9324	317.6367	354.90	27.95	44.13	10.88
376	230	61.7555	317.6194	–97.01	13.15	44.17	–32.77
318	231	72.1986	319.8135	3100.73	0.11	44.45	–1.20
319	231	72.0155	319.7634	3085.40	0.61	44.62	–1.35
320	231	71.8326	319.7146	3070.18	1.75	44.79	–1.59
321	231	71.6497	319.6667	3051.81	2.33	44.95	–0.93
322	231	71.4669	319.6199	3031.98	0.67	45.11	–1.84
323	231	71.2841	319.5737	3011.11	1.09	45.27	–2.00
324	231	71.1015	319.5288	2991.39	13.76	45.43	–1.36
325	231	70.9190	319.4844	2970.10	0.71	45.57	–1.61
326	231	70.7365	319.4412	2954.37	1.29	45.71	–2.70
327	231	70.5541	319.3987	2928.19	4.29	45.84	–3.83
328	231	70.3718	319.3569	2903.42	5.98	45.98	–2.79
329	231	70.1896	319.3159	2881.93	2.64	46.11	–1.55
330	231	70.0075	319.2756	2855.71	1.53	46.24	–4.44
331	231	69.8255	319.2363	2830.32	1.76	46.33	–0.14
332	231	69.6436	319.1975	2808.18	1.13	46.42	–2.69
333	231	69.4618	319.1594	2778.67	3.16	46.52	–3.22
334	231	69.2800	319.1221	2760.73	3.51	46.61	–1.89
335	231	69.0984	319.0854	2739.73	2.96	46.70	–4.11
336	231	68.9169	319.0496	2724.00	6.49	46.76	–2.45
337	231	68.7354	319.0142	2702.66	1.22	46.79	–3.17
338	231	68.5541	318.9792	2687.80	3.44	46.83	–1.63
339	231	68.3729	318.9451	2674.56	2.71	46.86	–2.65
340	231	68.1917	318.9114	2661.96	1.03	46.89	–0.99

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
341	231	68.0107	318.8784	2639.99	0.71	46.92	−2.03
342	231	67.8298	318.8459	2599.05	1.51	46.90	−1.04
343	231	67.6490	318.8140	2539.70	1.37	46.87	−6.59
344	231	67.4682	318.7825	2482.52	1.24	46.84	−5.66
345	231	67.2876	318.7517	2434.92	3.57	46.81	−2.76
346	231	67.1071	318.7212	2390.21	1.10	46.78	−1.24
347	231	66.9268	318.6912	2342.23	3.18	46.73	−8.34
348	231	66.7465	318.6619	2305.54	3.57	46.65	−8.78
349	231	66.5663	318.6328	2259.05	2.59	46.57	−1.84
350	231	66.3862	318.6042	2179.70	6.76	46.49	−13.12
351	231	66.2063	318.5762	2066.50	13.02	46.41	−25.86
352	231	66.0265	318.5486	2003.05	1.81	46.32	−19.45
353	231	65.8468	318.5212	1927.11	18.95	46.22	−10.95
354	231	65.6672	318.4946	1783.59	29.82	46.11	−14.61
355	231	65.4877	318.4680	1568.32	47.30	46.00	−63.99
356	231	65.3083	318.4421	1365.68	48.04	45.90	−58.99
357	231	65.1290	318.4165	1264.63	15.41	45.79	−121.03
358	231	64.9499	318.3911	1458.27	49.36	45.68	−61.20
359	231	64.7709	318.3665	1493.24	21.20	45.58	−72.22
360	231	64.5920	318.3418	1047.55	28.30	45.48	−284.42
361	231	64.4132	318.3176	1249.13	31.98	45.38	−90.90
362	231	64.2346	318.2939	1167.88	43.52	45.27	196.13
363	231	64.0561	318.2703	1043.58	67.37	45.17	88.63
364	231	63.8777	318.2473	903.12	55.12	45.10	−77.72
365	231	63.6994	318.2244	497.95	99.23	45.03	−160.62
366	231	63.5212	318.2019	276.60	80.24	44.97	−122.85
318	232	72.1822	320.4119	3132.24	0.11	44.95	−1.48
319	232	71.9993	320.3557	3119.91	2.82	45.13	−1.18
320	232	71.8165	320.3008	3102.89	0.54	45.30	−1.35
321	232	71.6338	320.2471	3088.21	1.10	45.47	−1.07
322	232	71.4512	320.1943	3069.94	2.23	45.63	−1.23
323	232	71.2686	320.1426	3049.95	0.74	45.80	−1.26
324	232	71.0862	320.0920	3028.03	0.91	45.96	−1.97
325	232	70.9037	320.0422	3011.15	0.43	46.11	−1.26
326	232	70.7214	319.9937	2991.58	1.77	46.25	−2.49
327	232	70.5392	319.9458	2972.26	4.13	46.39	−1.46
328	232	70.3571	319.8989	2950.05	2.32	46.53	−0.97
329	232	70.1750	319.8530	2925.07	1.29	46.66	−1.68
330	232	69.9931	319.8079	2902.09	1.55	46.80	−2.99
331	232	69.8112	319.7634	2880.18	6.11	46.89	−1.86
332	232	69.6294	319.7200	2856.67	3.93	46.98	−1.42
333	232	69.4477	319.6772	2830.08	0.98	47.07	−2.21
334	232	69.2661	319.6353	2812.82	4.49	47.16	−2.97
335	232	69.0846	319.5942	2791.39	4.96	47.25	−4.63
336	232	68.9032	319.5537	2774.35	0.78	47.31	−2.24
337	232	68.7219	319.5139	2755.90	2.70	47.34	−1.69
338	232	68.5407	319.4749	2731.17	1.37	47.37	−2.43
339	232	68.3596	319.4363	2710.86	0.45	47.41	−0.97
340	232	68.1786	319.3987	2679.76	1.08	47.44	−2.78
341	232	67.9977	319.3616	2635.30	1.16	47.47	−2.91
342	232	67.8169	319.3250	2581.08	5.21	47.44	−5.39
343	232	67.6362	319.2891	2508.92	1.54	47.41	−8.54
344	232	67.4556	319.2537	2438.19	3.89	47.38	−7.45
345	232	67.2751	319.2190	2377.40	1.13	47.35	−6.51
346	232	67.0947	319.1848	2316.11	2.11	47.31	−6.24
347	232	66.9144	319.1511	2264.67	1.93	47.26	−7.25
348	232	66.7342	319.1182	2215.53	5.67	47.18	−13.38

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
349	232	66.5542	319.0854	2184.28	2.10	47.10	–6.02
350	232	66.3742	319.0535	2119.29	2.91	47.01	–9.74
351	232	66.1944	319.0220	2000.13	25.95	46.93	–29.21
352	232	66.0146	318.9907	1892.40	9.49	46.85	–23.24
353	232	65.8350	318.9602	1806.48	13.72	46.75	–11.99
354	232	65.6555	318.9299	1625.23	5.14	46.64	–53.77
355	232	65.4761	318.9004	1507.59	11.26	46.53	–85.49
356	232	65.2968	318.8711	1224.57	40.73	46.42	–13.36
357	232	65.1177	318.8423	1051.54	24.87	46.32	–62.73
358	232	64.9386	318.8140	1349.04	21.21	46.21	–59.03
359	232	64.7597	318.7859	687.59	46.97	46.12	–70.09
360	232	64.5809	318.7585	580.83	27.28	46.02	–45.99
361	232	64.4022	318.7312	476.51	128.07	45.92	–0.95
362	232	64.2237	318.7046	213.85	155.53	45.82	–67.49
364	232	63.8669	318.6521	188.00	57.35	45.65	194.43
365	232	63.6887	318.6265	480.33	136.31	45.59	101.16
366	232	63.5107	318.6011	258.68	36.52	45.53	51.97
318	233	72.1639	321.0088	3162.39	0.24	45.44	–1.00
319	233	71.9812	320.9468	3149.29	0.74	45.63	–0.90
320	233	71.7986	320.8860	3134.22	4.20	45.80	–1.29
321	233	71.6161	320.8262	3120.42	0.80	45.98	–1.24
322	233	71.4337	320.7678	3101.26	2.01	46.15	–1.50
323	233	71.2513	320.7104	3081.79	3.20	46.32	–1.80
324	233	71.0690	320.6543	3065.49	1.74	46.49	–1.97
325	233	70.8868	320.5991	3048.53	0.49	46.64	–0.88
326	233	70.7046	320.5452	3029.90	1.09	46.79	–1.86
327	233	70.5226	320.4922	3008.89	0.97	46.93	–2.16
328	233	70.3406	320.4402	2985.83	3.96	47.07	–2.54
329	233	70.1587	320.3892	2965.21	1.76	47.21	–0.99
330	233	69.9769	320.3391	2945.84	1.43	47.34	–1.21
331	233	69.7952	320.2900	2922.57	9.89	47.43	–3.29
332	233	69.6136	320.2417	2898.10	3.19	47.53	–2.02
333	233	69.4321	320.1943	2876.59	0.68	47.62	–2.31
334	233	69.2506	320.1477	2854.91	2.82	47.71	–1.85
335	233	69.0692	320.1021	2831.79	18.58	47.81	–1.91
336	233	68.8880	320.0571	2823.46	0.85	47.86	–0.91
337	233	68.7068	320.0129	2796.81	2.72	47.89	–1.26
338	233	68.5258	319.9697	2766.58	0.70	47.92	–3.02
339	233	68.3448	319.9270	2726.00	14.26	47.95	–2.90
340	233	68.1639	319.8850	2678.54	3.48	47.98	–2.94
341	233	67.9831	319.8440	2624.79	6.84	48.01	–4.21
342	233	67.8024	319.8035	2550.87	1.38	47.98	–9.89
343	233	67.6219	319.7634	2489.05	4.92	47.95	–9.00
344	233	67.4414	319.7244	2396.89	2.07	47.91	–9.33
345	233	67.2610	319.6858	2331.98	5.99	47.88	–10.07
346	233	67.0807	319.6479	2252.13	59.88	47.85	–9.38
347	233	66.9006	319.6106	2178.25	0.99	47.79	–9.28
348	233	66.7205	319.5737	2120.43	2.56	47.71	–15.94
349	233	66.5406	319.5376	2088.37	6.02	47.63	–10.12
350	233	66.3607	319.5020	2018.15	4.13	47.55	–18.42
351	233	66.1810	319.4670	1907.20	4.34	47.46	–28.08
352	233	66.0014	319.4326	1767.46	20.61	47.38	–29.83
353	233	65.8219	319.3987	1627.13	7.17	47.28	–30.98
354	233	65.6425	319.3652	1504.04	7.26	47.17	–67.93
355	233	65.4632	319.3323	1295.30	14.12	47.06	–55.57
356	233	65.2840	319.2998	1095.05	77.94	46.96	–38.14
357	233	65.1050	319.2678	1040.58	40.17	46.85	–22.22

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
358	233	64.9261	319.2363	1199.90	22.85	46.75	−35.06
359	233	64.7472	319.2053	−12.94	26.27	46.65	24.38
360	233	64.5685	319.1746	64.76	57.53	46.56	9.70
364	233	63.8549	319.0566	−79.51	59.63	46.20	920.49
365	233	63.6768	319.0281	373.56	67.41	46.15	437.30
318	234	72.1437	321.6047	3187.05	0.24	45.91	−0.51
319	234	71.9613	321.5366	3175.50	0.90	46.11	−0.93
320	234	71.7789	321.4697	3161.50	0.41	46.29	−0.75
321	234	71.5966	321.4043	3149.85	0.51	46.48	−0.98
322	234	71.4143	321.3401	3135.20	0.71	46.66	−1.57
323	234	71.2322	321.2771	3121.49	2.59	46.84	−1.25
324	234	71.0501	321.2156	3101.28	0.74	47.02	−1.36
325	234	70.8680	321.1550	3082.71	0.83	47.17	−1.36
326	234	70.6861	321.0957	3064.24	1.16	47.32	−1.58
327	234	70.5042	321.0376	3045.30	0.55	47.47	−2.05
328	234	70.3224	320.9805	3029.04	0.82	47.61	−0.64
329	234	70.1407	320.9246	3003.92	1.29	47.75	−1.42
330	234	69.9591	320.8694	2979.42	1.84	47.89	−1.81
331	234	69.7776	320.8154	2956.73	2.02	47.98	−2.49
332	234	69.5961	320.7625	2935.81	2.24	48.07	−1.24
333	234	69.4147	320.7104	2915.74	1.76	48.17	−3.32
334	234	69.2334	320.6594	2896.83	0.79	48.26	−1.44
335	234	69.0523	320.6091	2874.98	0.64	48.36	−0.81
336	234	68.8712	320.5598	2858.02	1.58	48.41	−1.43
337	234	68.6901	320.5115	2826.80	1.54	48.44	−1.28
338	234	68.5092	320.4636	2785.02	2.35	48.47	−1.16
339	234	68.3284	320.4170	2733.62	5.46	48.50	−7.93
340	234	68.1477	320.3708	2681.72	2.01	48.53	−3.51
341	234	67.9670	320.3257	2621.29	1.08	48.55	−4.53
342	234	67.7865	320.2810	2542.89	10.38	48.52	−9.80
343	234	67.6061	320.2373	2468.38	2.07	48.49	−6.08
344	234	67.4258	320.1943	2338.99	6.17	48.45	−11.90
345	234	67.2455	320.1519	2286.85	13.77	48.42	−11.21
346	234	67.0654	320.1104	2183.70	2.84	48.39	−14.48
347	234	66.8853	320.0693	2091.01	3.41	48.32	−7.74
348	234	66.7054	320.0291	2012.90	4.65	48.24	−11.31
349	234	66.5256	319.9893	1972.25	9.15	48.16	−18.49
350	234	66.3459	319.9502	1941.73	4.42	48.08	−10.09
351	234	66.1663	319.9116	1817.36	5.44	48.00	−26.77
352	234	65.9868	319.8738	1620.45	2.76	47.91	−56.81
353	234	65.8074	319.8364	1307.07	31.82	47.81	−171.96
354	234	65.6281	319.7998	1326.85	3.35	47.70	146.83
355	234	65.4490	319.7634	979.42	12.33	47.60	78.83
356	234	65.2699	319.7278	890.57	22.60	47.49	145.31
357	234	65.0910	319.6926	612.49	27.22	47.39	−28.53
318	235	72.1217	322.1992	3201.25	0.81	46.38	−0.62
319	235	71.9394	322.1250	3194.98	2.29	46.59	−0.23
320	235	71.7573	322.0522	3182.50	0.52	46.78	−0.22
321	235	71.5752	321.9810	3172.95	2.46	46.98	−0.55
322	235	71.3932	321.9111	3161.80	0.45	47.16	−0.96
323	235	71.2112	321.8428	3148.76	0.99	47.35	−0.88
324	235	71.0293	321.7756	3131.38	3.77	47.53	−0.89
325	235	70.8475	321.7097	3114.15	1.13	47.69	−1.14
326	235	70.6658	321.6453	3095.55	0.77	47.84	−1.37
327	235	70.4841	321.5818	3075.55	2.68	47.99	−1.86
328	235	70.3025	321.5198	3056.72	3.38	48.14	−1.12
329	235	70.1210	321.4587	3034.27	1.12	48.29	−1.42

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
330	235	69.9396	321.3989	3012.71	1.93	48.42	–1.22
331	235	69.7582	321.3401	2989.37	1.11	48.52	–3.39
332	235	69.5770	321.2825	2971.64	4.07	48.62	–1.66
333	235	69.3958	321.2256	2951.89	1.55	48.71	–1.04
334	235	69.2147	321.1702	2934.58	0.68	48.81	–0.82
335	235	69.0337	321.1155	2912.02	0.80	48.91	0.07
336	235	68.8527	321.0618	2883.23	1.79	48.95	–1.81
337	235	68.6719	321.0088	2845.21	1.20	48.98	–2.49
338	235	68.4911	320.9570	2802.76	7.19	49.02	–2.44
339	235	68.3105	320.9060	2745.99	1.31	49.05	–6.13
340	235	68.1299	320.8560	2697.33	2.85	49.08	–4.21
341	235	67.9495	320.8066	2612.29	3.75	49.09	–19.77
342	235	67.7691	320.7581	2541.72	3.42	49.06	–8.06
343	235	67.5888	320.7104	2465.05	7.45	49.03	–17.47
344	235	67.4086	320.6636	2370.57	10.28	48.99	–13.38
345	235	67.2285	320.6174	2245.61	6.57	48.96	–20.63
346	235	67.0486	320.5720	2102.37	17.49	48.93	–30.67
347	235	66.8687	320.5273	1994.18	4.64	48.86	–17.99
348	235	66.6889	320.4834	1873.24	1.97	48.78	–18.88
349	235	66.5092	320.4402	1818.52	4.77	48.70	–13.32
350	235	66.3296	320.3977	1800.20	10.28	48.62	–22.40
351	235	66.1502	320.3557	1686.94	15.94	48.53	–57.33
352	235	65.9708	320.3145	1434.94	25.48	48.45	–176.97
353	235	65.7915	320.2737	1260.51	35.50	48.34	66.12
354	235	65.6124	320.2336	1348.19	18.75	48.24	607.91
355	235	65.4334	320.1943	640.67	20.60	48.14	137.47
317	236	72.2797	322.8738	3187.56	0.50	46.63	–0.72
318	236	72.0977	322.7920	3193.15	0.76	46.85	–0.66
319	236	71.9157	322.7117	3182.90	0.87	47.06	–0.73
320	236	71.7338	322.6333	3176.91	0.37	47.26	–0.57
321	236	71.5520	322.5562	3177.75	0.46	47.46	–0.58
322	236	71.3702	322.4807	3178.59	0.31	47.66	–0.15
323	236	71.1885	322.4067	3170.29	1.50	47.85	–0.56
324	236	71.0069	322.3342	3154.78	0.81	48.04	–0.49
325	236	70.8253	322.2632	3139.44	1.43	48.21	–0.92
326	236	70.6438	322.1934	3121.32	1.06	48.36	–0.82
327	236	70.4623	322.1250	3102.63	1.06	48.52	–0.64
328	236	70.2809	322.0576	3080.68	0.99	48.68	–0.44
329	236	70.0996	321.9917	3060.27	0.59	48.83	–0.41
330	236	69.9184	321.9270	3038.24	1.69	48.96	–0.93
331	236	69.7373	321.8635	3019.52	0.55	49.06	–0.35
332	236	69.5562	321.8013	2998.08	3.84	49.16	–0.94
333	236	69.3752	321.7400	2980.57	0.39	49.26	–0.12
334	236	69.1943	321.6797	2963.32	0.23	49.36	–0.89
335	236	69.0135	321.6206	2934.79	2.99	49.45	–1.25
336	236	68.8327	321.5625	2903.46	0.69	49.49	–1.85
337	236	68.6521	321.5056	2864.13	1.36	49.53	–2.49
338	236	68.4715	321.4495	2787.31	4.14	49.56	–2.46
339	236	68.2910	321.3943	2767.99	4.92	49.59	–2.20
340	236	68.1107	321.3401	2700.59	9.08	49.63	–17.07
341	236	67.9304	321.2869	2590.13	15.56	49.63	–56.36
342	236	67.7502	321.2344	2545.03	5.00	49.60	–8.58
343	236	67.5700	321.1829	2465.31	25.76	49.57	–16.10
344	236	67.3900	321.1321	2351.21	7.93	49.54	–9.93
345	236	67.2101	321.0823	2244.17	14.07	49.50	–26.40
346	236	67.0303	321.0332	2061.69	24.57	49.47	–51.28
347	236	66.8505	320.9849	1912.07	6.54	49.40	–33.65

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
348	236	66.6709	320.9373	1737.77	3.18	49.32	–9.80
349	236	66.4914	320.8906	1626.59	12.01	49.24	–11.19
350	236	66.3120	320.8445	1691.13	2.89	49.15	–6.55
351	236	66.1326	320.7991	1655.19	20.76	49.07	–1.28
352	236	65.9534	320.7544	1576.01	22.30	48.99	7.65
353	236	65.7743	320.7104	1447.70	9.48	48.88	624.56
317	237	72.2536	323.4709	3155.94	0.29	47.07	–1.16
318	237	72.0719	323.3831	3148.46	22.10	47.30	–2.70
319	237	71.8902	323.2971	3147.97	18.29	47.52	–0.59
320	237	71.7085	323.2126	3147.13	0.94	47.73	–1.39
321	237	71.5270	323.1299	3149.16	0.51	47.94	–1.43
322	237	71.3454	323.0488	3157.04	1.53	48.15	–0.72
323	237	71.1640	322.9695	3163.06	0.26	48.35	–0.54
324	237	70.9826	322.8916	3165.83	0.46	48.55	–0.17
325	237	70.8013	322.8152	3154.67	0.48	48.71	–0.13
326	237	70.6200	322.7402	3136.55	0.23	48.88	–0.41
327	237	70.4388	322.6667	3115.80	1.24	49.04	–0.53
328	237	70.2576	322.5945	3088.21	4.52	49.20	–1.20
329	237	70.0766	322.5237	3062.25	0.92	49.36	–0.53
330	237	69.8956	322.4541	3036.77	1.48	49.49	–1.76
331	237	69.7146	322.3860	3015.70	1.08	49.59	–1.59
332	237	69.5338	322.3188	2998.30	0.38	49.70	–1.09
333	237	69.3530	322.2532	2984.46	0.61	49.80	–0.74
334	237	69.1723	322.1885	2969.19	1.93	49.90	–0.84
335	237	68.9917	322.1250	2946.92	1.53	50.00	–1.09
336	237	68.8112	322.0625	2917.25	0.64	50.04	–1.69
337	237	68.6307	322.0012	2879.52	2.39	50.07	–1.69
338	237	68.4503	321.9409	2829.98	3.78	50.11	–3.99
339	237	68.2701	321.8816	2795.11	14.45	50.14	–2.87
340	237	68.0899	321.8232	2735.03	17.32	50.17	–3.86
341	237	67.9097	321.7661	2661.40	13.29	50.17	–9.77
342	237	67.7297	321.7097	2586.81	4.56	50.14	–21.17
343	237	67.5498	321.6543	2512.84	5.01	50.11	–7.90
344	237	67.3699	321.5999	2441.62	8.75	50.08	–8.64
345	237	67.1902	321.5461	2224.39	39.83	50.05	–75.44
346	237	67.0105	321.4934	2025.87	5.37	50.02	–83.29
347	237	66.8310	321.4414	1808.02	5.61	49.94	–68.04
348	237	66.6515	321.3904	1556.69	11.85	49.86	–34.77
349	237	66.4722	321.3401	1122.36	16.20	49.78	172.88
350	237	66.2929	321.2905	1257.85	69.95	49.70	–203.35
351	237	66.1138	321.2417	1763.70	15.76	49.62	104.91
352	237	65.9347	321.1938	1133.96	93.74	49.53	–425.82
317	238	72.2256	324.0664	3119.89	0.55	47.51	–0.59
318	238	72.0441	323.9724	3114.64	1.20	47.76	–3.53
319	238	71.8627	323.8806	3107.05	3.04	47.98	–1.96
320	238	71.6814	323.7905	3108.43	0.99	48.20	–2.88
321	238	71.5001	323.7021	3117.30	0.94	48.42	–1.21
322	238	71.3189	323.6155	3124.43	23.06	48.63	–1.61
323	238	71.1377	323.5308	3135.34	15.82	48.84	–0.75
324	238	70.9566	323.4475	3140.31	2.77	49.04	–0.79
325	238	70.7755	323.3657	3137.73	0.15	49.22	–0.60
326	238	70.5945	323.2856	3124.67	0.48	49.39	–0.88
327	238	70.4135	323.2070	3100.44	0.92	49.56	–1.73
328	238	70.2326	323.1299	3072.73	0.45	49.72	–1.98
329	238	70.0518	323.0542	3040.41	0.96	49.89	–1.67
330	238	69.8711	322.9800	3012.79	1.94	50.02	–1.94
331	238	69.6904	322.9070	2985.01	3.76	50.12	–2.43

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
332	238	69.5098	322.8354	2962.91	0.42	50.23	–2.77
333	238	69.3292	322.7651	2954.66	0.25	50.34	–2.57
334	238	69.1487	322.6960	2940.13	0.73	50.44	–1.99
335	238	68.9683	322.6279	2930.11	1.55	50.54	–1.19
336	238	68.7880	322.5613	2919.96	1.69	50.57	–0.72
337	238	68.6078	322.4958	2887.91	4.99	50.61	–4.18
338	238	68.4276	322.4314	2851.17	1.52	50.65	–1.10
339	238	68.2475	322.3679	2808.01	2.30	50.69	–3.96
340	238	68.0675	322.3057	2781.79	9.93	50.72	4.67
341	238	67.8876	322.2444	2704.49	6.96	50.72	–0.89
342	238	67.7078	322.1841	2667.41	5.85	50.69	–11.11
343	238	67.5281	322.1250	2588.86	10.38	50.66	–31.26
344	238	67.3484	322.0667	2542.43	12.53	50.63	–31.07
345	238	67.1689	322.0093	2386.96	6.63	50.59	–50.45
346	238	66.9894	321.9529	1970.04	14.72	50.56	–83.53
347	238	66.8100	321.8972	1718.57	53.60	50.48	–97.27
348	238	66.6307	321.8428	1361.06	19.14	50.40	–215.85
349	238	66.4516	321.7888	1196.44	46.74	50.32	–75.95
350	238	66.2725	321.7358	1158.88	102.07	50.24	–191.47
317	239	72.1957	324.6597	3059.93	0.45	47.94	–5.48
318	239	72.0146	324.5601	3061.60	1.71	48.20	–3.12
319	239	71.8335	324.4622	3061.60	10.99	48.43	–2.39
320	239	71.6525	324.3665	3070.91	2.35	48.66	–1.84
321	239	71.4715	324.2725	3079.15	2.72	48.89	–1.09
322	239	71.2905	324.1804	3089.33	2.34	49.11	–1.63
323	239	71.1096	324.0901	3101.47	1.41	49.33	–1.34
324	239	70.9288	324.0017	3110.50	1.06	49.54	–1.01
325	239	70.7480	323.9148	3110.41	0.30	49.72	–0.56
326	239	70.5673	323.8296	3100.13	4.47	49.89	–1.38
327	239	70.3866	323.7461	3074.80	0.61	50.07	–1.31
328	239	70.2060	323.6641	3043.95	1.15	50.24	–1.72
329	239	70.0254	323.5835	3015.04	5.57	50.41	–3.46
330	239	69.8449	323.5044	2979.18	0.37	50.54	–2.96
331	239	69.6645	323.4268	2942.50	1.70	50.65	–5.01
332	239	69.4841	323.3506	2907.32	15.25	50.76	–4.73
333	239	69.3038	323.2759	2887.26	1.05	50.87	–3.01
334	239	69.1236	323.2021	2886.14	0.35	50.98	–3.93
335	239	68.9434	323.1299	2883.40	0.96	51.07	–1.91
336	239	68.7633	323.0591	2884.52	0.75	51.11	–1.66
337	239	68.5833	322.9893	2889.45	0.72	51.16	–1.07
338	239	68.4034	322.9207	2876.75	50.92	51.19	–0.71
339	239	68.2235	322.8533	2847.04	0.85	51.23	–3.68
340	239	68.0437	322.7869	2807.19	20.79	51.27	–5.24
341	239	67.8640	322.7217	2775.78	6.78	51.26	–7.91
342	239	67.6844	322.6575	2755.44	9.59	51.23	–8.05
343	239	67.5049	322.5945	2767.29	2.74	51.20	–10.94
344	239	67.3254	322.5325	2668.15	23.67	51.17	–38.83
345	239	67.1461	322.4714	2597.98	11.53	51.14	–34.58
346	239	66.9668	322.4114	2143.84	82.47	51.10	–156.32
347	239	66.7876	322.3523	1703.54	8.78	51.03	–131.75
348	239	66.6085	322.2942	1286.21	1.34	50.95	–92.98
349	239	66.4295	322.2368	985.45	69.93	50.87	–106.29
317	240	72.1639	325.2510	3008.19	1.19	48.37	–4.53
318	240	71.9831	325.1455	3002.86	2.79	48.63	–4.28
319	240	71.8024	325.0420	3012.98	6.34	48.88	–0.41
320	240	71.6217	324.9404	3020.48	0.83	49.12	–2.12
321	240	71.4410	324.8411	3032.68	2.18	49.35	–1.92

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
322	240	71.2604	324.7434	3048.38	1.28	49.58	–2.52
323	240	71.0798	324.6479	3065.83	10.79	49.81	–0.63
324	240	70.8993	324.5542	3076.54	2.96	50.02	–1.14
325	240	70.7188	324.4622	3079.51	7.44	50.21	–0.97
326	240	70.5383	324.3721	3063.81	2.04	50.39	–2.25
327	240	70.3579	324.2834	3040.69	5.24	50.58	0.12
328	240	70.1776	324.1965	3021.40	0.98	50.76	–1.40
329	240	69.9973	324.1113	2984.02	1.45	50.94	–3.15
330	240	69.8171	324.0276	2946.83	1.07	51.06	–3.04
331	240	69.6369	323.9453	2886.33	2.07	51.18	–10.47
332	240	69.4568	323.8645	2831.72	4.36	51.29	–5.78
333	240	69.2768	323.7852	2805.49	3.67	51.41	1.06
334	240	69.0968	323.7073	2803.71	9.82	51.52	–8.08
335	240	68.9169	323.6306	2816.18	0.73	51.60	–8.80
336	240	68.7370	323.5554	2828.22	1.11	51.65	–6.31
337	240	68.5573	323.4814	2841.84	2.71	51.69	–4.34
338	240	68.3776	323.4087	2887.23	1.61	51.74	–0.95
339	240	68.1979	323.3374	2896.22	9.12	51.78	–4.25
340	240	68.0184	323.2671	2880.48	8.62	51.82	–4.71
341	240	67.8389	323.1980	2859.92	4.58	51.80	–10.33
342	240	67.6595	323.1299	2881.11	54.76	51.77	–6.42
343	240	67.4802	323.0632	2931.99	4.73	51.75	–9.66
344	240	67.3010	322.9973	2893.42	18.89	51.72	–38.13
345	240	67.1218	322.9326	2700.40	28.29	51.69	–158.84
346	240	66.9428	322.8689	2275.16	16.80	51.65	–177.61
347	240	66.7638	322.8064	1545.06	3.94	51.57	–247.96
348	240	66.5849	322.7446	1223.25	12.51	51.49	–54.69
349	240	66.4061	322.6838	663.36	137.53	51.42	–305.17
317	241	72.1303	325.8401	2951.37	1.17	48.79	–3.87
318	241	71.9499	325.7288	2950.90	23.12	49.06	–5.70
319	241	71.7695	325.6196	2955.51	2.04	49.31	–4.37
320	241	71.5891	325.5125	2968.40	1.64	49.56	–3.46
321	241	71.4088	325.4075	2982.90	4.07	49.81	–3.59
322	241	71.2285	325.3047	3003.04	3.50	50.05	–4.27
323	241	71.0482	325.2039	3019.95	1.22	50.29	–2.43
324	241	70.8680	325.1050	3032.44	1.96	50.50	–2.80
325	241	70.6879	325.0078	3042.01	5.81	50.70	–1.51
326	241	70.5077	324.9126	3023.10	0.61	50.89	–4.02
327	241	70.3276	324.8191	2993.02	0.91	51.08	–3.70
328	241	70.1476	324.7275	2968.69	2.65	51.27	–3.34
329	241	69.9676	324.6375	2937.85	2.09	51.44	–3.14
330	241	69.7876	324.5491	2908.66	3.94	51.57	–3.59
331	241	69.6078	324.4622	2816.87	30.94	51.69	–12.57
332	241	69.4279	324.3770	2726.54	6.64	51.82	–24.89
333	241	69.2482	324.2932	2690.89	8.28	51.94	–14.22
334	241	69.0684	324.2109	2712.93	1.15	52.06	–22.66
335	241	68.8888	324.1301	2725.42	13.36	52.14	–32.00
336	241	68.7092	324.0505	2740.81	4.36	52.19	–16.97
337	241	68.5297	323.9724	2783.38	11.51	52.23	–6.64
338	241	68.3502	323.8958	2879.62	2.59	52.28	–2.23
339	241	68.1709	323.8203	2916.57	10.54	52.32	–1.48
340	241	67.9915	323.7461	2926.05	2.23	52.37	–4.11
341	241	67.8123	323.6731	3016.90	16.73	52.34	7.95
342	241	67.6331	323.6013	3015.66	4.87	52.32	32.70
343	241	67.4541	323.5308	3051.09	30.43	52.29	–36.34
344	241	67.2751	323.4612	3048.29	8.20	52.27	–63.14
345	241	67.0961	323.3928	2766.03	6.37	52.24	–132.31

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
346	241	66.9173	323.3254	2291.89	11.54	52.19	–235.58
347	241	66.7385	323.2593	1604.22	9.72	52.12	–178.18
348	241	66.5599	323.1941	1088.62	5.99	52.04	–70.83
349	241	66.3813	323.1299	501.54	14.71	51.97	445.98
316	242	72.2749	326.5466	2891.24	0.55	48.91	–3.28
317	242	72.0948	326.4270	2886.27	3.54	49.20	–4.76
318	242	71.9148	326.3098	2893.36	2.73	49.48	–3.53
319	242	71.7348	326.1951	2889.17	5.53	49.74	–5.26
320	242	71.5548	326.0825	2904.79	1.77	50.01	–4.14
321	242	71.3748	325.9722	2922.34	1.91	50.26	–4.92
322	242	71.1949	325.8640	2965.15	6.55	50.51	10.98
323	242	71.0149	325.7578	2973.08	2.78	50.76	–3.76
324	242	70.8351	325.6538	2988.30	8.21	50.97	–4.16
325	242	70.6552	235.5518	3000.16	1.23	51.18	–2.47
326	242	70.4754	325.4514	2986.18	3.41	51.38	–1.29
327	242	70.2956	325.3533	2950.13	2.47	51.58	–5.36
328	242	70.1159	325.2566	2910.46	3.56	51.77	–4.56
329	242	69.9362	325.1619	2862.53	3.31	51.95	–10.44
330	242	69.7566	325.0688	2791.64	32.29	52.08	–12.04
331	242	69.5770	324.9775	2703.80	22.31	52.21	–23.79
332	242	69.3974	324.8879	2579.93	19.91	52.34	–25.25
333	242	69.2179	324.7998	2390.23	8.44	52.47	–49.54
334	242	69.0385	324.7131	2439.96	16.46	52.59	–41.36
335	242	68.8591	324.6279	2579.28	34.84	52.66	–40.32
336	242	68.6798	324.5444	2583.53	57.85	52.72	–38.16
337	242	68.5006	324.4622	2716.55	4.95	52.77	–34.15
338	242	68.3214	324.3813	2815.79	27.73	52.82	–7.42
339	242	68.1423	324.3020	2809.22	20.30	52.87	–18.37
340	242	67.9632	324.2239	2819.31	2.13	52.90	–29.52
341	242	67.7842	324.1470	2892.81	14.93	52.88	–29.44
342	242	67.6053	324.0713	2963.78	59.18	52.86	–8.39
343	242	67.4265	323.9971	2885.03	10.25	52.84	–52.65
344	242	67.2477	323.9238	2780.27	9.70	52.82	–60.60
345	242	67.0690	323.8518	2292.76	3.37	52.79	–105.17
346	242	66.8904	323.7810	2114.89	22.96	52.74	–184.37
347	242	66.7119	323.7114	1380.97	53.73	52.67	–137.55
348	242	66.5335	323.6426	503.73	246.04	52.59	62.54
349	242	66.3551	323.5752	–148.15	66.85	52.52	851.85
316	243	72.2372	327.1367	2839.60	0.75	49.31	–4.14
317	243	72.0575	327.0115	2830.97	3.27	49.61	–4.81
318	243	71.8779	326.8884	2819.61	3.33	49.89	–6.28
319	243	71.6982	326.7681	2817.62	6.09	50.17	–7.99
320	243	71.5186	326.6501	2835.97	2.79	50.44	–4.87
321	243	71.3390	326.5344	2862.79	3.22	50.70	–5.17
322	243	71.1595	326.4211	2890.64	0.93	50.97	–5.69
323	243	70.9799	326.3098	2912.12	1.10	51.22	–3.42
324	243	70.8004	326.2007	2935.41	2.32	51.44	–3.20
325	243	70.6209	326.0935	2960.79	0.56	51.66	–1.92
326	243	70.4414	325.9885	2948.67	0.32	51.87	–1.96
327	243	70.2619	325.8855	2901.70	2.12	52.07	–7.41
328	243	70.0826	325.7842	2846.85	0.56	52.28	–5.60
329	243	69.9032	325.6848	2779.05	3.29	52.45	1.80
330	243	69.7239	325.5872	2698.73	10.78	52.59	–24.82
331	243	69.5446	325.4915	2570.53	12.84	52.72	–28.20
332	243	69.3653	325.3972	2398.64	17.08	52.86	–66.02
333	243	69.1862	325.3047	2103.89	25.73	52.99	–65.36
334	243	69.0070	325.2139	2172.81	19.36	53.13	–37.94

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
335	243	68.8279	325.1245	2257.46	23.52	53.19	–44.29
336	243	68.6489	325.0369	2445.24	33.33	53.25	–65.42
337	243	68.4700	324.9504	2687.59	38.21	53.30	–36.73
338	243	68.2910	324.8657	2621.93	20.66	53.36	–54.90
339	243	68.1122	324.7822	2399.18	37.99	53.41	–53.16
340	243	67.9334	324.7002	2372.29	30.94	53.44	–149.99
341	243	67.7547	324.6196	2451.05	9.36	53.42	–153.72
342	243	67.5760	324.5403	2552.79	55.29	53.40	–104.59
343	243	67.3975	324.4622	2389.08	14.24	53.38	–124.40
344	243	67.2189	324.3855	2145.90	10.66	53.36	–236.71
345	243	67.0405	324.3098	1975.44	7.84	53.34	–123.71
346	243	66.8621	324.2354	1669.67	49.68	53.28	–203.62
347	243	66.6839	324.1621	1359.21	306.23	53.21	–50.70
348	243	66.5056	324.0901	325.02	40.29	53.14	94.61
316	244	72.1976	327.7241	2811.26	5.94	49.69	7.16
317	244	72.0184	327.5933	2765.53	7.11	50.01	–9.25
318	244	71.8392	327.4648	2729.91	6.46	50.30	–14.92
319	244	71.6599	327.3389	2735.75	1.94	50.59	–8.21
320	244	71.4807	327.2156	2760.17	15.87	50.87	–12.06
321	244	71.3015	327.0947	2791.82	3.98	51.15	–3.28
322	244	71.1223	326.9761	2824.44	5.33	51.42	–5.04
323	244	70.9431	326.8596	2853.03	11.08	51.68	–4.58
324	244	70.7640	326.7456	2872.31	4.51	51.90	–6.43
325	244	70.5848	326.6335	2910.57	0.55	52.12	–3.37
326	244	70.4057	326.5237	2907.03	15.65	52.34	–0.91
327	244	70.2266	326.4158	2858.45	2.19	52.56	–7.98
328	244	70.0476	326.3098	2790.24	3.96	52.77	–8.18
329	244	69.8685	326.2058	2706.42	7.05	52.94	–10.55
330	244	69.6895	326.1038	2547.11	5.03	53.09	–30.55
331	244	69.5106	326.0034	2315.40	20.06	53.24	–38.51
332	244	69.3317	325.9048	2267.12	27.94	53.38	–42.73
333	244	69.1528	325.8081	2093.98	14.93	53.52	–56.48
334	244	68.9740	325.7129	2043.24	19.05	53.64	–19.36
335	244	68.7952	325.6196	1897.12	33.93	53.71	–150.17
336	244	68.6165	325.5276	2322.63	32.18	53.77	–97.20
337	244	68.4378	325.4373	2649.46	21.53	53.83	–74.01
338	244	68.2592	325.3486	2492.46	58.24	53.89	–69.24
339	244	68.0806	325.2612	2299.59	41.02	53.95	–163.43
340	244	67.9021	325.1753	1938.19	89.66	53.97	–123.40
341	244	67.7237	325.0908	1742.75	21.62	53.96	–93.18
342	244	67.5453	325.0078	2168.22	33.99	53.95	–83.04
343	244	67.3670	324.9260	1957.35	25.00	53.93	–157.15
344	244	67.1887	324.8457	1806.20	22.95	53.91	–76.43
345	244	67.0105	324.7666	1560.87	37.80	53.89	35.94
346	244	66.8324	324.6887	1365.32	42.96	53.83	–223.26
347	244	66.6544	324.6121	1386.70	33.56	53.76	619.94
348	244	66.4764	324.5366	233.63	80.79	53.69	1233.63
316	245	72.1562	328.3091	2662.60	3.24	50.08	–61.03
317	245	71.9774	328.1724	2618.77	23.99	50.40	–16.88
318	245	71.7986	328.0386	2585.47	40.95	50.70	–22.47
319	245	71.6198	327.9072	2637.24	2.00	51.00	–11.91
320	245	71.4410	327.7786	2674.96	7.04	51.29	–6.88
321	245	71.2622	327.6523	2715.73	2.32	51.58	–8.83
322	245	71.0834	327.5286	2741.19	5.49	51.86	–6.21
323	245	70.9046	327.4072	2767.60	11.29	52.12	–3.43
324	245	70.7259	327.2881	2811.51	8.51	52.36	–8.45
325	245	70.5471	327.1714	2845.46	2.10	52.59	–3.90

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
326	245	70.3684	327.0566	2861.22	2.99	52.82	–3.01
327	245	70.1896	326.9441	2821.55	1.72	53.05	–6.69
328	245	70.0109	326.8335	2748.41	4.63	53.27	–10.84
329	245	69.8323	326.7251	2645.14	1.82	53.43	–16.43
330	245	69.6536	326.6184	2492.27	4.56	53.58	–42.44
331	245	69.4750	326.5137	2341.71	7.16	53.74	–39.81
332	245	69.2964	326.4109	2058.64	8.53	53.89	–67.64
333	245	69.1179	326.3098	1846.83	84.24	54.03	–65.50
334	245	68.9394	326.2104	1643.70	36.17	54.15	94.18
335	245	68.7609	326.1130	1587.85	49.64	54.23	–52.70
336	245	68.5825	326.0171	2151.81	25.56	54.30	–55.29
337	245	68.4041	325.9226	2499.76	81.76	54.36	–33.06
338	245	68.2258	325.8301	2434.08	23.51	54.43	–13.16
339	245	68.0475	325.7388	2365.89	50.70	54.49	–148.56
340	245	67.8693	325.6492	1428.65	355.60	54.50	–104.87
341	245	67.6912	325.5608	1227.72	23.13	54.49	–73.21
342	245	67.5131	325.4741	1639.23	90.49	54.48	–52.25
343	245	67.3351	325.3887	1523.45	52.71	54.47	–65.63
344	245	67.1571	325.3047	1003.43	30.92	54.46	–342.12
345	245	66.9792	325.2222	1298.28	4.30	54.44	148.86
346	245	66.8013	325.1406	1486.63	38.15	54.37	2486.63
316	246	72.1130	328.8911	2582.10	11.35	50.46	–60.88
317	246	71.9347	328.7490	2485.08	30.28	50.78	–23.17
318	246	71.7563	328.6096	2436.21	15.10	51.10	–26.21
319	246	71.5780	328.4731	2525.34	11.55	51.40	–23.68
320	246	71.3996	328.3391	2575.25	8.73	51.71	–11.65
321	246	71.2212	328.2078	2647.65	7.52	52.01	–3.21
322	246	71.0428	328.0791	2672.24	3.50	52.30	–5.16
323	246	70.8645	327.9526	2684.88	8.35	52.56	–4.21
324	246	70.6861	327.8286	2735.14	11.84	52.81	–10.40
325	246	70.5077	327.7070	2772.77	4.67	53.05	–6.64
326	246	70.3294	327.5876	2810.62	1.24	53.28	–2.92
327	246	70.1510	327.4705	2787.84	1.34	53.52	–3.98
328	246	69.9727	327.3552	2735.40	1.95	53.74	–5.98
329	246	69.7944	327.2422	2634.98	5.45	53.91	–18.40
330	246	69.6161	327.1311	2515.24	4.66	54.07	–17.92
331	246	69.4378	327.0222	2324.85	17.52	54.24	–47.41
332	246	69.2596	326.9150	1977.64	48.97	54.39	–59.13
333	246	69.0814	326.8098	1589.22	12.87	54.55	116.58
334	246	68.9032	326.7063	1266.68	50.90	54.66	–14.60
335	246	68.7251	326.6047	1218.43	33.06	54.74	19.05
336	246	68.5470	326.5046	1921.78	23.72	54.81	116.51
337	246	68.3690	326.4065	2091.44	22.54	54.88	–61.78
338	246	68.1910	326.3098	1916.50	35.28	54.96	–56.72
339	246	68.0130	326.2148	1702.62	46.05	55.02	–94.75
340	246	67.8351	326.1213	860.86	16.28	55.03	–165.14
341	246	67.6573	326.0293	835.66	408.04	55.03	–76.72
342	246	67.4794	325.9390	838.51	16.39	55.02	–40.29
343	246	67.3017	325.8501	891.39	73.95	55.01	–45.57
344	246	67.1240	325.7625	1026.00	91.06	55.00	–94.81
345	246	66.9464	325.6763	1152.00	21.78	54.98	–181.97
315	247	72.2458	329.6208	2256.07	35.17	50.48	–195.03
316	247	72.0680	329.4702	2440.63	45.87	50.82	71.48
317	247	71.8902	329.3225	2066.18	35.20	51.16	278.80
318	247	71.7123	329.1780	2171.28	26.51	51.49	–103.31
319	247	71.5344	329.0361	2364.98	11.49	51.81	–4.13
320	247	71.3564	328.8970	2494.50	9.11	52.12	–2.55

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
321	247	71.1785	328.7607	2555.60	9.69	52.43	–3.47
322	247	71.0005	328.6270	2582.10	3.66	52.73	–6.22
323	247	70.8226	328.4956	2587.25	11.46	52.99	–9.75
324	247	70.6446	328.3667	2641.97	8.69	53.25	–19.42
325	247	70.4667	328.2405	2686.39	5.10	53.50	–16.99
326	247	70.2887	328.1162	2773.11	10.76	53.75	41.41
327	247	70.1107	327.9944	2723.54	3.17	54.00	–3.19
328	247	69.9328	327.8750	2685.24	2.33	54.21	–10.89
329	247	69.7549	327.7573	2620.99	1.97	54.38	–9.56
330	247	69.5770	327.6421	2532.39	5.06	54.56	–18.25
331	247	69.3991	327.5286	2336.50	30.91	54.72	–72.66
332	247	69.2212	327.4172	2042.88	8.74	54.89	–69.20
333	247	69.0434	327.3079	1908.32	29.52	55.05	–47.35
334	247	68.8656	327.2004	1462.02	29.79	55.16	91.60
335	247	68.6878	327.0947	1540.78	40.76	55.25	–308.71
336	247	68.5100	326.9907	1515.62	62.93	55.33	123.10
337	247	68.3323	326.8884	1212.97	78.16	55.41	159.81
338	247	68.1546	326.7881	1164.04	44.73	55.48	–104.62
339	247	67.9770	326.6892	760.36	35.46	55.55	–148.74
340	247	67.7994	326.5920	719.16	39.61	55.55	–113.46
341	247	67.6219	326.4963	455.25	44.56	55.55	–52.39
342	247	67.4444	326.4023	911.74	43.56	55.55	–24.82
343	247	67.2669	326.3098	447.06	75.96	55.55	–177.93
344	247	67.0896	326.2187	1165.46	48.96	55.54	–49.76
345	247	66.9122	326.1292	1340.58	45.04	55.51	2340.58
315	248	72.1986	330.2024	1859.12	22.17	50.83	202.17
316	248	72.0212	330.0464	1623.12	93.82	51.19	28.15
317	248	71.8439	329.8933	1512.66	36.17	51.53	–263.12
318	248	71.6665	329.7434	1640.87	45.31	51.87	–16.77
319	248	71.4890	329.5964	1995.87	97.03	52.19	–78.78
320	248	71.3116	329.4524	2445.32	840.16	52.52	–0.61
321	248	71.1341	329.3110	2139.77	29.21	52.84	–6.97
322	248	70.9566	329.1721	2419.13	16.16	53.14	45.02
323	248	70.7791	329.0361	2167.07	45.17	53.42	–103.65
324	248	70.6015	328.9026	2431.02	7.86	53.68	–29.26
325	248	70.4240	328.7715	2490.39	9.82	53.94	–79.77
326	248	70.2464	328.6428	2560.40	10.68	54.20	–31.22
327	248	70.0689	328.5164	2492.11	11.91	54.45	–20.08
328	248	69.8913	328.3923	2513.40	45.91	54.67	–22.84
329	248	69.7138	328.2705	2531.51	10.48	54.85	–7.20
330	248	69.5363	328.1509	2469.47	60.68	55.03	–23.87
331	248	69.3588	328.0332	2609.71	9.62	55.21	–25.43
332	248	69.1813	327.9177	2502.07	98.45	55.39	–94.21
333	248	69.0038	327.8042	2155.59	35.71	55.56	–43.37
334	248	68.8263	327.6926	1938.54	23.57	55.65	–83.39
335	248	68.6489	327.5828	1674.45	22.60	55.74	–120.28
337	248	68.2941	327.3689	570.49	61.20	55.92	–89.93
338	248	68.1168	327.2646	480.19	23.12	56.00	–59.77
339	248	67.9395	327.1621	388.27	56.03	56.06	–137.12
341	248	67.5851	326.9619	–14.98	32.78	56.08	21.62
315	249	72.1495	330.7805	1171.24	41.98	51.18	–456.92
316	249	71.9727	330.6194	1211.40	19.88	51.55	371.67
317	249	71.7958	330.4612	1079.92	33.04	51.90	–217.73
318	249	71.6189	330.3059	1285.71	30.71	52.24	–62.85
319	249	71.4420	330.1541	1508.43	18.22	52.58	–163.97
320	249	71.2650	330.0049	2286.71	11.56	52.92	–82.78
321	249	71.0880	329.8584	2161.82	52.42	53.25	–68.59

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
322	249	70.9109	329.7148	1995.35	46.12	53.55	–25.70
323	249	70.7338	329.5740	2128.15	29.30	53.83	–28.25
324	249	70.5567	329.4358	2300.69	19.45	54.11	48.60
325	249	70.3796	329.3000	2110.34	32.17	54.38	–62.15
326	249	70.2025	329.1670	2309.39	10.00	54.65	–55.98
327	249	70.0254	239.0361	2246.47	12.23	54.91	–36.70
328	249	69.8483	328.9077	2444.80	26.46	55.12	–31.32
329	249	69.6711	328.7815	2414.89	14.85	55.31	–19.07
330	249	69.4940	328.6575	2489.77	70.28	55.50	–109.32
331	249	69.3169	328.5356	2641.28	27.28	55.69	–20.02
332	249	69.1398	328.4160	2505.75	98.50	55.87	–86.34
333	249	68.9627	328.2983	2163.99	13.14	56.03	–132.74
334	249	68.7856	328.1829	1988.78	20.86	56.14	–114.29
335	249	68.6086	328.0691	1280.28	35.20	56.24	–133.49
336	249	68.4315	327.9575	900.60	17.52	56.34	–136.24
339	249	67.9006	327.6333	–93.25	13.47	56.56	–99.54
315	250	72.0986	331.3557	1551.09	30.17	51.52	481.84
316	250	71.9224	331.1892	800.68	16.87	51.89	205.30
317	250	71.7460	331.0256	1028.62	31.06	52.26	250.26
318	250	71.5696	330.8655	1382.47	15.81	52.61	–105.50
319	250	71.3932	330.7085	1615.95	23.76	52.96	–101.99
320	250	71.2167	330.5544	1115.65	53.13	53.30	15.89
321	250	71.0401	330.4033	1182.90	61.16	53.64	–450.83
322	250	70.8636	330.2549	1560.73	49.55	53.95	–36.12
323	250	70.6870	330.1094	1514.02	10.07	54.24	–31.77
324	250	70.5103	329.9666	1334.33	23.61	54.53	–59.72
325	250	70.3337	329.8264	1462.51	46.29	54.81	–35.70
326	250	70.1570	329.6887	1590.15	9.11	55.09	–69.26
327	250	69.9803	329.5535	2032.33	45.27	55.35	–78.03
328	250	69.8036	329.4207	2443.22	20.76	55.56	–85.04
329	250	69.6269	329.2903	2393.10	30.75	55.76	3.90
330	250	69.4502	329.1621	2108.38	37.32	55.97	175.13
331	250	69.2735	329.0361	2218.99	28.14	56.16	3.78
332	250	69.0968	328.9124	2379.69	155.94	56.35	–66.17
333	250	68.9201	328.7908	2219.68	21.04	56.50	–208.89
334	250	68.7434	328.6711	1747.23	46.06	56.61	365.42
335	250	68.5667	328.5537	1308.50	70.81	56.72	20.55
336	250	68.3901	328.4380	500.19	53.86	56.82	–364.20
315	251	72.0461	331.9275	718.34	29.97	51.86	–122.29
316	251	71.8703	331.7556	916.18	10.27	52.23	738.46
317	251	71.6945	331.5872	1092.22	14.72	52.60	983.08
318	251	71.5186	331.4221	1073.39	15.74	52.97	407.58
319	251	71.3427	331.2600	1327.07	50.59	53.33	–161.20
320	251	71.1667	331.1011	1060.38	18.52	53.69	71.69
321	251	70.9907	330.9453	1163.75	61.75	54.04	–41.13
322	251	70.8146	330.7922	1161.70	18.51	54.34	–64.87
323	251	70.6385	330.6421	825.59	61.09	54.64	–134.14
324	251	70.4623	330.4946	883.89	16.54	54.94	–77.56
325	251	70.2861	330.3501	1336.91	18.37	55.23	–42.99
326	251	70.1099	330.2080	1837.05	30.93	55.52	–86.59
327	251	69.9337	330.0684	2313.89	72.11	55.78	–83.80
328	251	69.7574	329.9314	2298.17	21.44	56.00	–0.90
329	251	69.5811	329.7966	2219.23	69.02	56.21	–52.69
330	251	69.4048	329.6643	1803.95	27.19	56.41	–88.94
331	251	69.2285	329.5344	1596.08	19.84	56.62	–12.32
332	251	69.0523	329.4065	1820.39	61.67	56.82	167.96
333	251	68.8760	329.2810	1734.07	39.39	56.96	330.71

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
334	251	68.6997	329.1575	1064.50	93.72	57.08	60.69
335	251	68.5234	329.0361	637.04	24.32	57.20	–210.93
336	251	68.3471	328.9167	9.63	57.57	57.31	–272.30
314	252	72.1668	332.6760	1041.71	40.82	51.78	67.78
315	252	71.9917	332.4956	765.68	80.11	52.18	–47.64
316	252	71.8165	332.3188	1631.11	39.09	52.57	391.96
317	252	71.6413	332.1455	1891.59	5.91	52.95	1854.55
318	252	71.4659	331.9753	1302.85	54.47	53.33	204.56
319	252	71.2905	331.8086	1328.58	29.79	53.69	13.17
320	252	71.1151	331.6450	896.33	12.29	54.05	–85.97
321	252	70.9395	331.4844	1074.40	22.48	54.40	–237.50
322	252	70.7640	331.3267	1059.00	11.01	54.72	–55.37
323	252	70.5883	331.1721	530.33	24.02	55.03	–175.38
324	252	70.4127	331.0203	440.99	14.36	55.34	–86.61
325	252	70.2370	330.8711	590.53	31.46	55.64	–75.51
326	252	70.0612	330.7246	2001.92	13.56	55.94	–77.16
327	252	69.8854	330.5808	2382.83	48.11	56.19	–73.81
328	252	69.7096	330.4395	2489.17	24.31	56.42	–64.94
329	252	69.5338	330.3008	2271.21	58.59	56.64	–55.59
330	252	69.3579	330.1643	2087.45	44.32	56.86	–76.34
331	252	69.1821	330.0303	1645.19	65.21	57.08	25.85
332	252	69.0062	329.8987	1425.29	49.40	57.28	–97.85
333	252	68.8303	329.7690	1007.39	25.31	57.42	–100.22
334	252	68.6545	329.6418	904.06	37.06	57.54	–123.78
335	252	68.4786	329.5166	511.38	41.35	57.66	–72.11
336	252	68.3027	329.3936	99.12	21.95	57.78	–38.66
314	253	72.1102	333.2458	–98.24	53.90	52.09	–496.62
315	253	71.9356	333.0603	1351.22	83.66	52.50	–315.46
316	253	71.7610	332.8787	1267.69	5.39	52.89	–618.04
319	253	71.2367	332.3540	1345.06	8.81	54.04	370.64
320	253	71.0618	332.1855	951.07	6.98	54.42	–16.01
321	253	70.8868	332.0205	974.91	1.09	54.77	–31.42
322	253	70.7117	331.8584	990.79	3.25	55.09	–46.49
323	253	70.5366	331.6992	784.39	9.68	55.41	–72.08
324	253	70.3614	331.5430	467.05	1.71	55.73	–40.47
326	253	70.0109	331.2388	1778.40	18.24	56.35	63.54
327	253	69.8356	331.0906	2408.93	72.01	56.60	–6.67
328	253	69.6603	330.9453	2416.65	84.12	56.84	21.49
329	253	69.4849	330.8025	2158.10	35.55	57.06	–73.06
330	253	69.3095	330.6619	2180.93	82.96	57.29	–147.06
331	253	69.1341	330.5239	1735.26	89.95	57.51	–170.71
332	253	68.9587	330.3884	1676.70	95.42	57.71	281.97
333	253	68.7832	330.2549	1134.01	43.39	57.85	–122.34
334	253	68.6078	330.1238	749.81	15.89	57.99	–103.78
335	253	68.4323	329.9949	436.39	20.55	58.13	9.42
336	253	68.2569	329.8682	3.65	21.86	58.25	119.34
314	254	72.0518	333.8118	68.53	986.91	52.40	27.72
315	254	71.8779	333.6216	1612.06	13.92	52.81	415.90
316	254	71.7039	333.4348	1241.11	50.19	53.21	–279.73
317	254	71.5297	333.2517	803.69	72.82	53.61	311.45
320	254	71.0069	332.7231	876.35	1.19	54.77	–10.69
321	254	70.8324	332.5535	902.32	13.27	55.11	–24.15
322	254	70.6579	332.3870	1058.74	9.93	55.45	–56.25
323	254	70.4832	332.2234	607.14	5.10	55.78	–61.77
324	254	70.3086	332.0627	401.44	2.15	56.11	–143.34
325	254	70.1339	331.9050	436.07	31.03	56.44	196.75
326	254	69.9591	331.7502	1154.26	94.57	56.73	26.57

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
327	254	69.7843	331.5979	2030.57	78.45	56.98	254.84
328	254	69.6094	331.4485	2526.06	34.48	57.23	209.81
329	254	69.4345	331.3015	2349.64	48.70	57.47	–118.24
330	254	69.2596	331.1572	2172.33	30.51	57.71	–128.98
331	254	69.0846	331.0154	1542.25	19.18	57.95	–153.44
332	254	68.9097	330.8757	1241.00	14.07	58.14	142.32
333	254	68.7346	330.7388	991.51	22.81	58.28	–103.32
334	254	68.5596	330.6038	651.80	10.32	58.43	–56.08
335	254	68.3846	330.4712	320.97	6.29	58.57	25.60
313	255	72.1649	334.5730	1595.24	107.00	52.26	80.03
314	255	71.9917	334.3740	987.42	57.36	52.69	675.68
315	255	71.8184	334.1790	805.16	59.36	53.11	–31.45
316	255	71.6450	333.9875	812.41	47.42	53.52	–130.75
317	255	71.4715	333.7998	691.95	20.73	53.93	479.23
320	255	70.9503	333.2573	570.55	14.69	55.11	–37.90
321	255	70.7764	333.0833	879.28	88.62	55.46	246.17
322	255	70.6024	332.9124	696.41	49.96	55.81	–38.28
323	255	70.4283	332.7446	287.70	17.69	56.14	–68.85
324	255	70.2542	332.5798	945.24	9.00	56.48	324.81
325	255	70.0800	332.4180	550.43	15.12	56.81	1550.43
326	255	69.9057	332.2588	1333.84	10.77	57.10	883.21
327	255	69.7314	332.1025	1701.47	8.32	57.37	–147.76
328	255	69.5570	331.9492	1988.86	56.37	57.63	–97.54
329	255	69.3826	331.7983	2367.60	17.08	57.88	–435.12
330	255	69.2082	331.6499	2519.57	34.71	58.12	–38.71
331	255	69.0337	331.5042	1593.62	27.05	58.36	–1.91
332	255	68.8591	331.3608	1187.04	71.40	58.54	–17.68
333	255	68.6846	331.2200	951.51	20.32	58.70	–67.04
334	255	68.5100	331.0815	563.92	6.62	58.86	–33.23
312	256	72.2749	335.3440	984.63	69.75	52.10	–248.91
313	256	72.1025	335.1362	1226.63	115.66	52.55	–148.79
314	256	71.9299	334.9324	1052.09	59.46	52.98	–80.90
315	256	71.7573	334.7327	726.43	40.10	53.40	–108.76
316	256	71.5845	334.5366	561.86	13.45	53.82	–99.75
317	256	71.4116	334.3442	610.77	7.36	54.23	185.65
320	256	70.8921	333.7886	372.54	40.06	55.43	63.34
321	256	70.7188	333.6101	164.83	622.61	55.79	26.35
322	256	70.5453	333.4348	271.69	50.20	56.14	–151.92
323	256	70.3718	333.2627	679.93	8.96	56.49	–70.47
325	256	70.0246	332.9277	986.32	3.55	57.18	498.35
326	256	69.8508	322.6546	1283.79	4.09	57.46	152.13
327	256	69.6770	332.6045	1676.27	12.50	57.73	–109.60
328	256	69.5031	332.4470	2096.75	34.42	58.00	–18.43
329	256	69.3292	332.2922	2277.98	12.13	58.26	–77.27
330	256	69.1552	332.1401	2696.35	11.81	58.52	–113.48
331	256	68.9812	331.9907	1873.23	26.62	58.77	–380.01
332	256	68.8072	331.8437	925.50	24.15	58.94	–210.27
333	256	68.6331	331.6992	572.56	24.25	59.10	–94.05
334	256	68.4590	331.5569	290.58	43.02	59.26	–56.62
312	257	72.2101	335.9080	89.70	29.84	52.38	104.66
313	257	72.0384	335.6953	583.09	69.85	52.82	–28.86
314	257	71.8665	335.4868	854.80	95.38	53.25	216.12
315	257	71.6945	335.2825	753.26	45.35	53.68	201.13
316	257	71.5223	335.0818	399.31	10.68	54.11	283.50
317	257	71.3500	334.8850	599.62	36.79	54.53	–109.20
318	257	71.1776	334.6919	189.91	8.99	54.95	–92.04
320	257	70.8324	334.3162	328.28	11.40	55.74	–139.68

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
321	257	70.6596	334.1335	114.08	31.36	56.11	–182.92
322	257	70.4867	333.9541	373.42	12.30	56.47	–82.63
323	257	70.3138	333.7778	423.00	9.75	56.83	–44.66
325	357	69.9676	333.4348	976.71	14.11	57.52	–37.20
326	257	69.7944	333.2678	1321.00	27.50	57.81	–160.89
327	257	69.6211	333.1038	1775.00	14.87	58.09	–120.64
328	257	69.4477	332.9424	2073.24	20.02	58.37	–66.59
329	257	69.2743	332.7837	2137.44	19.51	58.64	–96.27
330	257	69.1008	332.6279	1865.23	13.60	58.90	–135.93
331	257	68.9273	332.4746	1679.97	30.80	59.13	–29.68
332	257	68.7538	332.3240	797.26	181.15	59.31	–102.23
333	257	68.5801	332.1758	358.85	38.93	59.49	–94.59
313	258	71.9727	336.2505	–60.91	44.68	53.09	–119.09
314	258	71.8015	336.0374	87.88	23.34	53.53	3.72
315	258	71.6301	335.8284	108.68	45.73	53.96	–146.46
316	258	71.4586	335.6233	244.17	14.15	54.39	–23.59
317	258	71.2869	335.4221	248.86	9.73	54.82	–99.75
318	258	71.1151	335.2249	55.07	6.06	55.24	24.29
319	258	70.9431	335.0310	158.21	1.56	55.66	–49.88
322	258	70.4266	334.4702	699.93	1.45	56.78	–121.39
324	258	70.0817	334.1128	829.97	23.70	57.52	–97.32
325	258	69.9091	333.9390	824.14	3.19	57.85	–47.95
326	258	69.7364	333.7678	1191.95	27.57	58.14	–73.81
327	258	69.5637	333.5999	1340.48	42.56	58.43	–62.05
328	258	69.3908	333.4348	1455.15	50.15	58.71	–120.83
329	258	69.2179	333.2725	1047.90	81.97	59.00	–555.34
330	258	69.0450	333.1130	1056.77	31.46	59.28	–123.56
331	258	68.8720	332.9561	130.41	29.82	59.49	–98.60
314	259	71.7348	336.5837	129.85	20.99	53.78	–49.26
315	259	71.5641	336.3706	296.91	12.56	54.22	–60.49
316	259	71.3932	336.1611	386.30	25.14	54.66	–88.70
317	259	71.2221	335.9556	156.41	55.20	55.10	–40.96
318	259	71.0510	335.7539	47.00	24.29	55.53	–23.78
319	259	70.8796	335.5559	–113.31	9.28	55.93	36.65
323	259	70.1931	334.7988	1161.46	10.09	57.46	–191.83
324	259	70.0211	334.6177	1025.64	10.78	57.83	–112.96
325	259	69.8491	334.4399	1007.54	12.78	58.15	–24.64
326	259	69.6770	334.2651	981.23	45.94	58.46	–6.42
327	259	69.5048	334.0933	1114.08	75.32	58.76	–147.86
328	259	69.3325	333.9246	746.97	45.44	59.06	–1.57
329	259	69.1601	333.7585	833.30	26.01	59.34	–1181.29
315	260	71.4964	336.9087	4.84	44.94	54.48	–108.37
316	260	71.3262	336.6951	270.42	33.21	54.92	–142.17
317	260	71.1558	336.4854	312.89	99.96	55.36	–18.79
318	260	70.9853	336.2795	488.89	66.61	55.80	412.58
319	260	70.8146	336.0774	35.20	5.52	56.20	–50.58
324	260	69.9591	335.1196	1155.44	6.15	58.13	–112.21
325	260	69.7876	334.9380	1017.19	2.80	58.45	–82.48
326	260	69.6161	334.7593	661.35	82.52	58.76	–146.46
327	260	69.4444	334.5840	443.15	45.74	59.06	–156.87
328	260	69.2727	334.4114	1064.48	12.22	59.37	550.54
329	260	69.1008	334.2417	184.19	9.91	59.67	–32.76
315	261	71.4272	337.4426	91.65	25.24	54.72	–72.92
316	261	71.2577	337.2249	88.45	37.99	55.17	–6.44
317	261	71.0880	337.0112	224.67	51.03	55.62	–17.87
318	261	70.9181	336.8013	247.90	17.23	56.04	–131.85
319	261	70.7480	336.5952	114.37	4.30	56.45	–81.09

Table 1 (Continued)

I	J	NORTH LATITUDE	EAST LONGITUDE	ELEVATION (M)	SIGMA (M)	GEM10-B GEOID (M)	DELTA SLOPE CORRECTION (M)
324	261	69.8956	335.6182	654.07	13.42	58.39	1654.07
325	261	69.7247	335.4326	781.47	2.69	58.72	–95.89
326	261	69.5537	335.2505	269.46	13.41	59.04	–179.94
327	261	69.3826	335.0713	164.00	18.24	59.37	–357.47
328	261	69.2114	334.8953	–28.75	55.93	59.68	971.25
315	262	71.3564	337.9727	325.29	35.66	54.96	14.35
316	262	71.1876	337.7510	491.90	95.32	55.41	201.57
317	262	71.0185	337.5332	169.46	74.70	55.86	–130.98
318	262	70.8493	337.3193	321.36	26.71	56.28	184.30
319	262	70.6799	337.1094	198.89	3.56	56.69	–71.37
316	263	71.1160	338.2727	430.56	24.90	55.63	–1.54
317	263	70.9476	338.0513	542.83	36.94	56.08	49.05
318	263	70.7791	337.8335	376.06	17.04	56.50	111.81

Table 2

Comparisons of surface elevations measured by Seasat and geoceiver at sites occupied by Mock (1976).

GEOCEIVER SITE (DATE)	LATITUDE (deg)	LONGITUDE (deg)	SEASAT ELEVATION* (m)	GEOCEIVER ELEVATION+ (m) published	GEOCEIVER ELEVATION* (m) corrected #	DIFFERENCE (m) (SEASAT-GEOCEIVER)
CRETE (1972)	71.1204	322.6837	3222.64	3214.14	3220.67	1.97
DYE-3 (1972)	65.1874	316.1695	2515.00	2517.38	2523.95	–8.95
DYE-3 (1973)	65.1831	316.1740	2515.31	2525.18	2531.74	–16.43
DYE-3 (1975)	65.1860	316.1744	2514.42	2523.75	2530.31	–15.89
SOUTH DOME (1975)	63.5459	315.4010	2871.12	2861.43	2868.01	3.11
SADDLE SOUTH (1975)	65.6703	315.6851	2539.02	2536.71	2543.37	–4.25
SADDLE NORTH (1975)	66.1921	316.3378	2534.78	2534.14	2540.70	–5.92
A1 (1975)	67.4551	318.0195	2583.16	2575.94	2582.49	0.67
						mean = -5.71 ± 7.64

* referred to IUGG-77 ellipsoid

\+ referred to NWL-9D ellipsoid

\# corrections included:
1) height of electrical center of antenna above surface (subtract an estimated height of 1.0 meter)
2) transformation to IUGG-77 ellipsoid from NWL-9D ellipsoid (add from 7.53 to 7.58 meters)

Table 3

Comparison of surface elevations measured by Seasat and geoceiver at sites occupied by Ohio State University (OSU) (Drew,1983).

GEOCEIVER SITE (DATE)	LATITUDE (deg)	LONGITUDE (deg)	SEASAT ELEVATION* (m)	GEOCEIVER ELEVATION+ (m) published	GEOCEIVER ELEVATION* (m) corrected #	DIFFERENCE (m) (SEASAT-GEOCEIVER)
WC1001	65.3876	312.3270	2026.35	2022.08	2029.64	–3.29
WC1002	65.3867	312.7621	2175.14	2163.52	2171.08	4.06
WC1003	65.2370	312.5398	2130.08	2126.08	2133.64	–3.56
WC1004	65.2423	312.1291	2007.93	1988.80	1996.36	11.57
WC1005	65.3904	311.8903	1889.90	1860.16	1867.72	22.18
WC1006	65.5468	312.1045	1915.80	1904.54	1912.10	3.70
WC1007	65.5399	312.5373	2063.12	2025.62	2033.18	29.94
CC2001	65.1082	314.3132	2523.53	2518.72	2526.28	–2.75
CC2002	65.0672	314.7129	2589.50	2586.13	2593.70	–4.20
CC2003	64.9328	314.4033	2573.53	2566.12	2573.69	–0.16
CC2004	64.9815	313.9736	2472.55	2485.04	2492.61	–20.06
CC2005	65.1491	313.8966	2447.06	2441.96	2449.52	–2.46
CC2006	65.2929	314.1659	2466.94	2456.72	2464.28	2.66
CC2007	65.2468	314.5911	2531.24	2529.63	2537.20	–5.96
EC3001	65.2589	316.5328	2416.67	2414.35	2421.91	–5.24
EC3002	65.1062	316.5344	2453.02	2474.59	2482.16	–29.14
EC3003	65.2015	316.1597	2513.14	2522.35	2529.91	–16.77
EC3004	65.0255	316.1519	2568.41	2555.62	2563.19	5.22
EC3005	65.1187	315.8020	2601.00	2590.89	2598.46	2.54
EC3006	64.9265	315.8201	2660.22	2648.16	2655.72	4.50
EC3007	65.0141	315.3566	2665.08	2665.58	2673.15	–8.07
EC3008	64.8498	315.3467	2704.43	2700.68	2708.25	–3.82
						mean = –0.87 ± 12.39

* referred to IUGG-77 ellipsoid

\+ referred to WGS-66 ellipsoid

\# correction transforms reference ellipsoid from WGS-66 to IUGG-77 (add from 7.56 to 7.57 meters)

Table 4

Comparison of surface elevations near Crete Station measured by Seasat and geoceiver at sites occupied by Danes (Gundestrup, personal communication).

GEOCEIVER SITE (DATE)	LATITUDE (deg)	LONGITUDE (deg)	SEASAT ELEVATION* (m)	GEOCEIVER ELEVATION+ (m) published	GEOCEIVER ELEVATION* (m) corrected #	DIFFERENCE (m) (SEASAT-GEOCEIVER)
A	70.6349	324.1800	3140.78	3145.28	3142.48	−1.70
B	70.6508	322.5212	3183.70	3190.80	3188.00	−4.30
D	70.6398	320.3822	3059.21	3068.12	3065.32	−6.11
E	71.7593	324.1495	3127.80	3137.54	3134.74	−6.94
F	71.4920	324.1188	3137.25	3143.40	3140.60	−3.35
G	71.1550	324.1623	3146.65	3150.48	3147.68	−1.03
H	70.8651	324.1619	3151.12	3158.10	3155.30	−4.18
						mean = −3.94 ±2.15

* referred to IUGG-77 ellipsoid and calculated from 5-kilometer grid of region around Crete Station (Map 14)

\+ referred to WGS-72 ellipsoid

\# corrections include: 1) height of antenna above surface (subtract an estimated height of 1.0 meter)
2) transformation to IUGG-77 ellipsoid from WGS-72 ellipsoid (subtract 1.80 meter)

C.2

Table 5

Comparison of surface elevations by Seasat and optical survey along EGIG line.

EGIG SITE	LATITUDE (deg)	LONGITUDE (deg)	SEASAT ELEVATION* (m)	GEM-10B GEOID (m)	EGIG ELEVATION+ (m)	DIFFERENCE (m) (SEASAT-EGIG)
T301	69.7274	311.7027	1612.78	37.76	1576.27	36.51
TA	69.7380	311.9276	1687.50	38.05	1652.11	35.39
T 1	69.7405	311.9435	1693.36	38.07	1665.10	28.26
T 2	69.7597	312.1411	1755.13	38.31	1729.20	25.93
T 3	69.7880	312.3502	1808.40	38.56	1802.40	6.00
T 4	69.8237	312.5676	1860.00	38.82	1847.09	12.92
T 5	69.8526	312.7438	1898.68	39.02	1901.54	–2.86
T 6	69.8982	312.9878	1960.86	39.30	1964.55	–3.96
T 7	69.9434	313.1932	2018.40	39.53	2008.42	9.98
T 8	69.9718	313.3881	2058.30	39.75	2059.56	–1.26
T 9	70.0216	313.6884	2093.12	40.08	2111.61	–18.49
T 10	70.0662	313.9920	2151.94	40.42	2174.95	–23.01
T 11	70.1093	314.2419	2223.11	40.68	2239.78	–16.67
T 11A	70.1406	314.4325	2267.28	40.88	2271.25	–3.97
T 12	70.1768	314.6508	2314.74	41.11	2306.01	8.73
T 13	70.2366	315.0109	2360.96	41.49	2374.66	–13.70
T 14	70.2748	315.2383	2415.34	41.71	2420.75	–5.41
TA 15	70.3059	315.4167	2449.98	41.89	2449.14	0.84
T 16	70.3409	315.6588	2483.17	42.13	2493.30	–10.13
T 17	70.3770	315.8879	2527.95	42.36	2532.25	–4.30
T 18	70.4312	316.1979	2582.06	42.66	2580.60	1.46
T 19	70.4742	316.4592	2623.07	42.90	2621.52	1.55
T 20	70.5088	316.6990	2657.56	43.13	2662.58	–5.02
T 21	70.5460	316.9677	2689.60	43.39	2695.48	–5.88
T 22	70.5871	317.1988	2719.58	43.60	2721.23	–1.65
T 23	70.6277	317.4427	2754.57	43.81	2753.53	1.04
T 24	70.6668	317.7201	2788.67	44.07	2791.58	–2.91
T 25	70.7051	317.9944	2816.18	44.31	2823.94	–7.76
T 26	70.7398	318.2192	2840.14	44.51	2847.45	–7.31
T 27	70.7766	318.4672	2868.72	44.72	2871.20	–2.48
T 28	70.8144	318.7124	2896.98	44.93	2897.87	–0.89
T 29	70.8526	318.9943	2925.01	45.17	2929.41	–4.40
T 30	70.8859	319.2268	2946.09	45.36	2948.86	–2.77

(con't)

Table 5 (continued)

EGIG SITE	LATITUDE (deg)	LONGITUDE (deg)	SEASAT ELEVATION* (m)	GEM-10B GEOID (m)	EGIG ELEVATION+ (m)	DIFFERENCE (m) (SEASAT-EGIG)
T 31	70.9095	319.3665	2960.15	45.47	2964.71	–4.56
T 32	70.9269	319.6371	2982.81	45.71	2986.28	–3.47
T 33	70.9447	319.9090	3005.18	45.95	3005.70	–0.51
T 34	70.9598	320.1785	3025.64	46.18	3027.71	–2.07
T 35	70.9761	320.4551	3045.38	46.42	3050.95	–5.57
T 36	70.9936	320.7209	3064.10	46.64	3069.30	–5.20
T 37	71.0074	320.9960	3083.49	46.88	3086.37	–2.88
T 38	71.0243	321.2734	3102.31	47.10	3105.17	–2.86
T 39	71.0423	321.5402	3118.64	47.31	3121.04	–2.40
T 40	71.0606	321.8047	3136.96	47.52	3139.96	–3.00
T 41	71.0783	322.0765	3152.83	47.73	3152.89	–0.06
T 42	71.0959	322.3465	3165.93	47.93	3164.68	1.25
T 43#	71.1198	322.6804	3174.48	48.18	3175.12	–0.64
T 44	71.1388	322.9501	3164.27	48.37	3166.90	–2.63
T 45	71.1566	323.2233	3151.36	48.57	3152.89	–1.53
T 46	71.1826	323.6338	3127.22	48.86	3130.28	–3.06
T 47	71.2092	324.0452	3101.61	49.14	3102.63	–1.02
T 48	71.2373	324.4543	3075.03	49.40	3074.92	0.11
T 49	71.2685	324.9335	3035.20	49.71	3036.27	–0.97
T 50	71.2988	325.4109	2980.05	50.00	2991.11	–11.06
						mean = –0.53 ±11.13

* referred to mean sea level using GEM-10B geoid

\+ referred to mean sea level, 1959 survey

\# Crete Station

Table 6

Comparison of surface elevations measured by Seasat and optical survey along EGIG line for region around Crete Station.

EGIG SITE	LATITUDE (deg)	LONGITUDE (deg)	SEASAT ELEVATION* (m)	GEM-10B GEOID (m)	EGIG ELEVATION+ (m)	DIFFERENCE (m) (SEASAT-EGIG)
T 30	70.8859	319.2268	2946.21	45.36	2948.86	−2.65
T 31	70.9095	319.3665	2960.81	45.47	2964.71	−3.90
T 32	70.9296	319.6371	2982.82	45.71	2986.28	−3.46
T 33	70.9447	319.9090	3002.51	45.95	3005.70	−3.19
T 34	70.9598	320.1785	3026.32	46.18	3027.71	−1.39
T 35	70.9761	320.4551	3046.90	46.42	3050.95	−4.05
T 36	70.9936	320.7209	3064.17	46.64	3069.30	−5.13
T 37	71.0074	320.9960	3085.61	46.88	3086.37	−0.76
T 38	71.0243	321.2734	3101.99	47.10	3105.17	−3.18
T 39	71.0423	321.5402	3118.68	47.31	3121.04	−2.36
T 40	71.0606	321.8047	3136.75	47.52	3139.96	−3.21
T 41	71.0783	322.0765	3151.09	47.73	3152.89	−1.80
T 42	71.0959	322.3465	3162.91	47.93	3164.68	−1.77
T 43#	71.1198	322.6804	3171.02	48.18	3175.12	−4.10
T 44	71.1388	322.9501	3164.61	48.37	3166.90	−2.30
T 45	71.1566	323.2233	3151.36	48.57	3152.89	−1.53
T 46	71.1826	323.6338	3126.35	48.86	3130.28	−3.93
T 47	71.2092	324.0452	3102.13	49.14	3102.63	−0.50
T 48	71.2373	324.4543	3073.70	49.40	3074.92	−1.22
T 49	71.2685	324.9335	3033.32	49.71	3036.27	−2.95
T 50	71.2988	325.4109	2989.92	50.00	2991.11	−1.19
						mean = 2.60 ± 1.26

* referred to mean sea level using GEM-10B geoid

\+ referred to mean sea level, 1959 survey

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