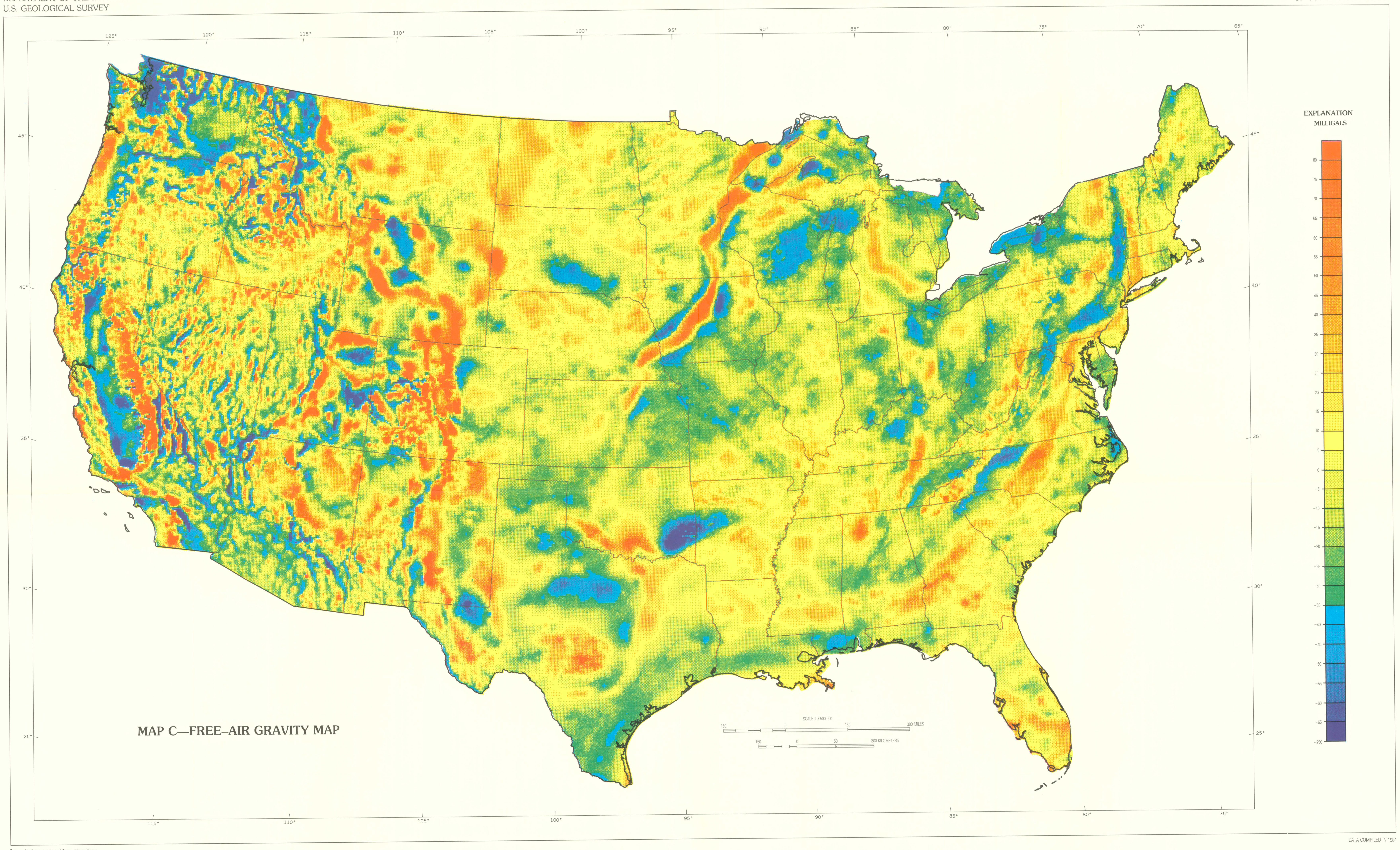
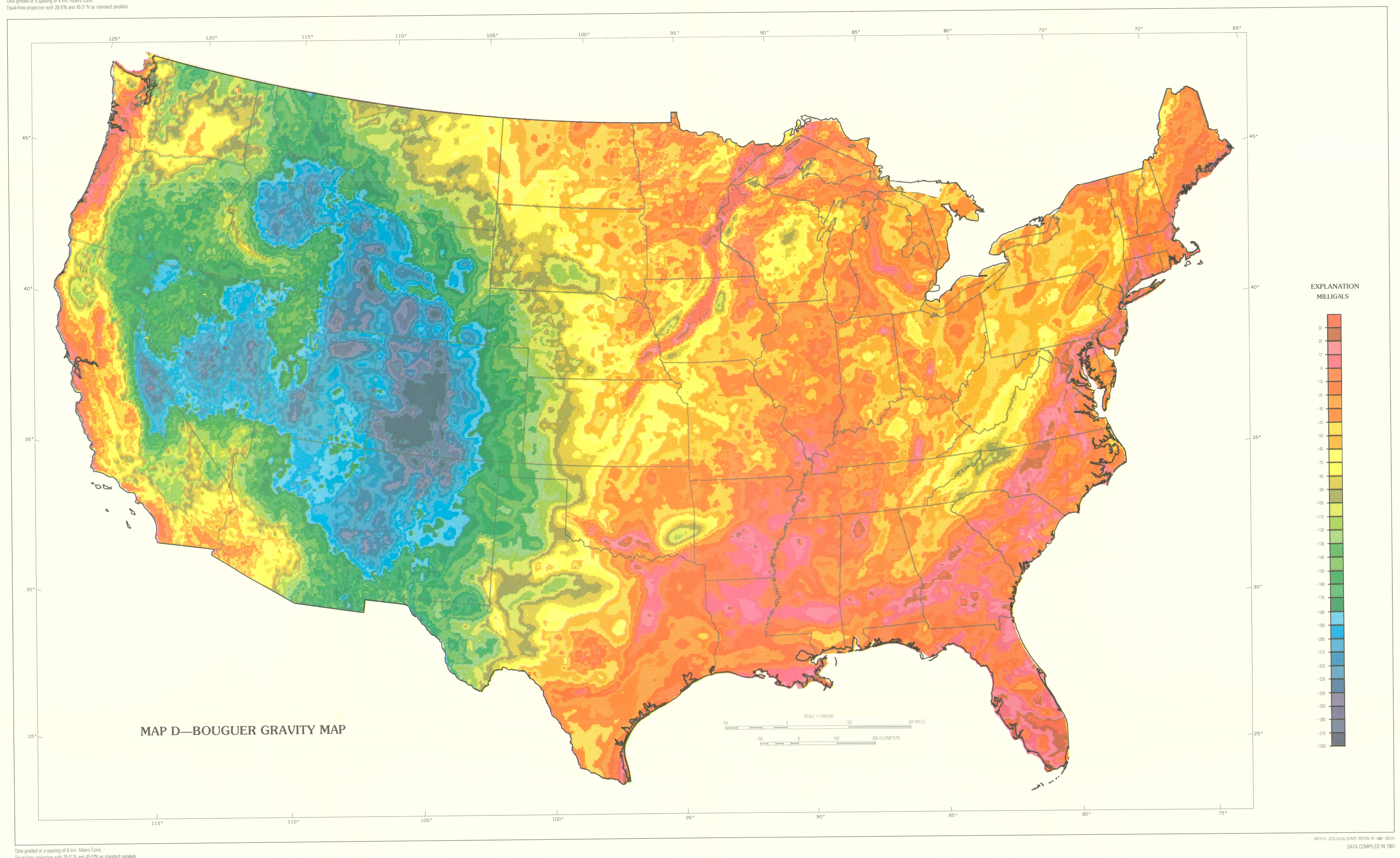


MAP C—FREE–AIR GRAVITY MAP

Data gridded at a spacing of 6 km. Albers Conic
Equal-Area projection with 29.5° N and 45.5° N as standard parallels



MAP D—BOUGUER GRAVITY MAP

Data gridded at a spacing of 6 km. Albers Conic
Equal-Area projection with 29.5° N and 45.5°N as standard parallels

Text continued from sheet 1 of 2

DESCRIPTION OF THE MAPS

These maps were plotted from the data grids on an Applicon* inkjet color plotter.

STATION LOCATION MAP

The station location map (A) shows the distribution of the 221,215 gravity observations in the screened data set that was used to produce the gravity maps of this report and the maps by Hildenbrand and others (1982). Moire patterns appearing in certain areas of dense coverage are probably caused by the interference of the 4x4–km screening cell size with the color-plotter pixel size.

Most of the gravity observations come from the gravity data file, which is maintained by the U.S. National Oceanic and Atmospheric Administration (NOAA) Data Center. (NOAA; National Geophysical and Solar-Terrestrial Data Center; Boulder, CO 80302.) Additional gravity data in the Great Lakes area were provided by the Canadian Gravity Data Center (Energy, Mines and Resources Canada; Earth Physics Branch, Gravity and Geodynamics Division; 1 Observatory Crescent; Ottawa, Canada, K1A 0Y3).

Editing of these data sets has shown that, except for a small number of clearly erroneous values, most duplicate land stations have observed gravity values which agree to better than 2 mGal.

TERRAIN MAP

The terrain map (B) is a differently colored version of the gridded data set described by Godson (1981). The map was prepared from a 6x6-km grid derived from 3-minute averaged elevation data.

The terrain data were originally obtained from the U.S. National Geodetic Survey, which in turn received it from the Electromagnetic Compatability Analysis Center, an agency of the U.S. Department of Defense. The data were extensively edited and reformated to produce average elevations for the entire country at 30-second, 1-minute, and 3-minute latitude and longitude intervals. This data set is also available through the NOAA Data Center.

FREE-AIR GRAVITY MAP

The free-air gravity map (C) is based on a 6x6-km grid of data values. No correction has been applied for the indirect effect. The free-air gravity anomaly can be thought of as a measure of the attraction of the anomalous masses that lie approximately under a gravity observation. These masses include both the mass of topographic features and the masses of geologic bodies. Free-air maps can be quite variable ("noisy") at short wavelengths, because two nearby observations, one on a hill and the other in a valley, may have rather different free-air gravity values simply because the higher observation records the extra mass of the hill. For this reason, free-air maps are usually not a useful way to display gravity data in small areas with substantial topographic relief if the intent is to highlight anomalies caused by bodies of geologic interest. Insofar as the principle of isostasy holds (see below), free-air values averaged over large enough windows ought to approach 0 mGal, although long-wavelength anomalies produced by sources in the mantle or the core will remain. McGinnis and others (1979) have performed this averaging for the free-air gravity field of the conterminous United States using several different window sizes.

BOUGUER GRAVITY MAP

The Bouguer gravity map (D) is derived from a 6x6-km grid of data values. Again no correction has been applied for the indirect effect.

The Bouguer reduction is applied to remove the effects of nearby topography, and yet one of the most prominent features of this Bouguer gravity map is the inverse correlation of the long-wavelength Bouguer gravity field with the topography. That is, broad regions of low Bouguer values coincide with broad regions of elevated topography.

The explanation is to be found in the principle of isostasy, which was proposed by Bouguer, Airy, and Pratt in the 18th and 19th centuries (see Dutton, 1889; Daly, 1940; Woollard, 1966). The principle states that the load of topographic features on the crust is supported by deficiencies of mass at depth, just as if the crust were floating in a denser substratum. The gravitational attraction of these low-density compensating masses remains, even after the attraction of topography down to sea level has been removed by the Bouguer reduction. Thus in the Bouguer gravity field the existence of long-wavelength anomalies which inversely correlate with topography supplies compelling evidence for isostasy, even though it is difficult to infer the exact depth and shape of these compensating masses from their gravitational effects alone (McNutt, 1980).

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* Use of commerical trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

DIGITAL COLORED BOUGUER GRAVITY, FREE-AIR GRAVITY, STATION LOCATION, AND TERRAIN MAPS FOR THE CONTERMINOUS UNITED STATES

By
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1987