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# A Global Digital Elevation Model - GTOPO30

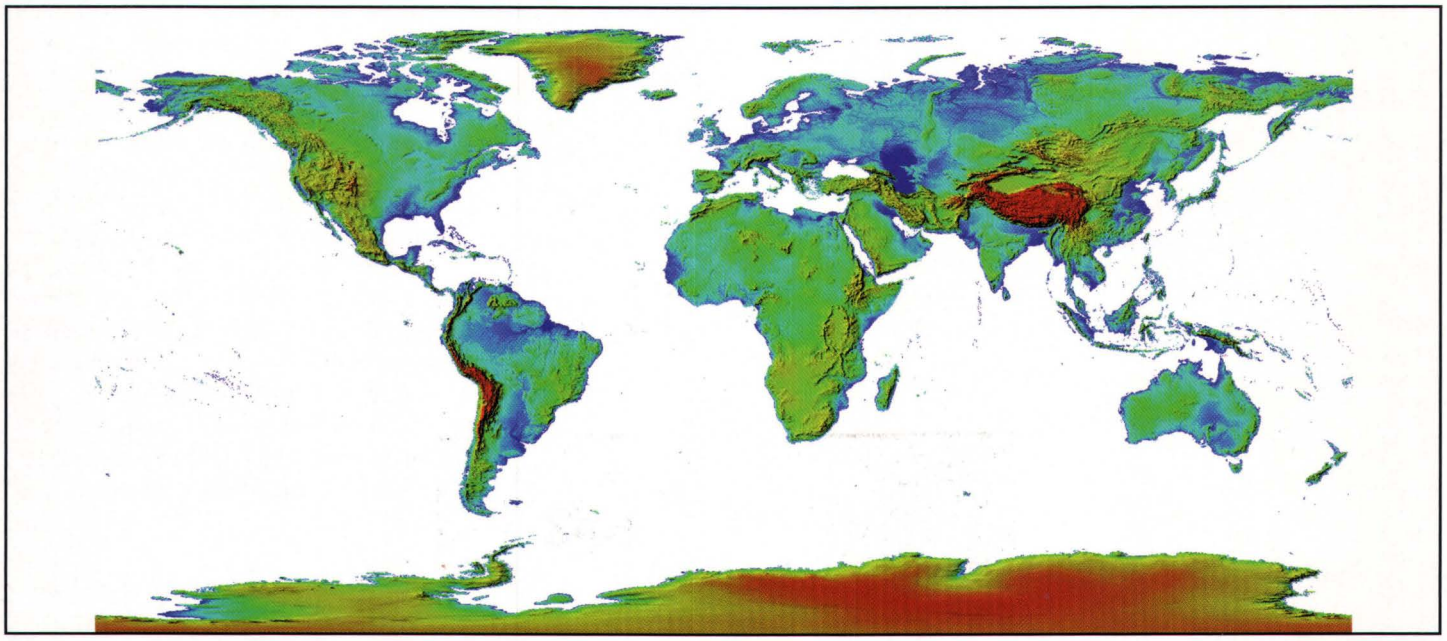

**Figure 1: GTOPO30 provides a new level of detail in global topographic data. Shown here is a color shaded relief rendition of the global coverage of GTOPO30. The color map varies from blue for elevations at or below sea level to reds at the highest elevations.**

GTOPO30, the U.S. Geological Survey's (USGS) digital elevation model (DEM) of the Earth, provides the first global coverage of moderate resolution elevation data. The original GTOP30 data set, which was developed over a 3-year period through a collaborative effort led by the USGS, was completed in 1996 at the USGS EROS Data Center in Sioux Falls, South Dakota. The collaboration involved contributions of staffing, funding, or source data from cooperators including the National Aeronautics and Space Administration (NASA), the United Nations Environment Programme Global Resource Information Database (UNEP/GRID), the U.S. Agency for International Development (USAID), the Instituto Nacional de Estadística Geografía e Informática (INEGI) of Mexico, the Geographical Survey Institute (GSI) of Japan, Manaaki Whenua Landcare Research of New Zealand, and the Scientific Committee on Antarctic Research (SCAR). In 1999, work was begun on an update to the GTOPO30 data set. Additional data sources are being incorporated into GTOPO30 with an enhanced and improved data set planned for release in 2000.

GTOPO30 was developed to meet the needs of the spatial data user community for regional- and continental-scale topographic data. Elevations in GTOPO30 are regularly spaced at 30 arc-seconds of latitude and longitude (approximately 1 kilometer), providing sufficient detail for many applications on a continental scale. Being a global data set, GTOPO30 covers the full extent of latitude and longitude on the globe, from 90° S to 90° N and 180° W to 180° E. For the entire GTOPO30 data set, this results in a "mesh" consisting of 21,600 rows by 43,200 columns. Each center location in the mesh has been assigned an elevation value representative of the topography within that 30-arc-second by 30-arc-second square. This results in a data set containing a total of 933,120,000 elevation values. Elevation values are reported in meters above mean

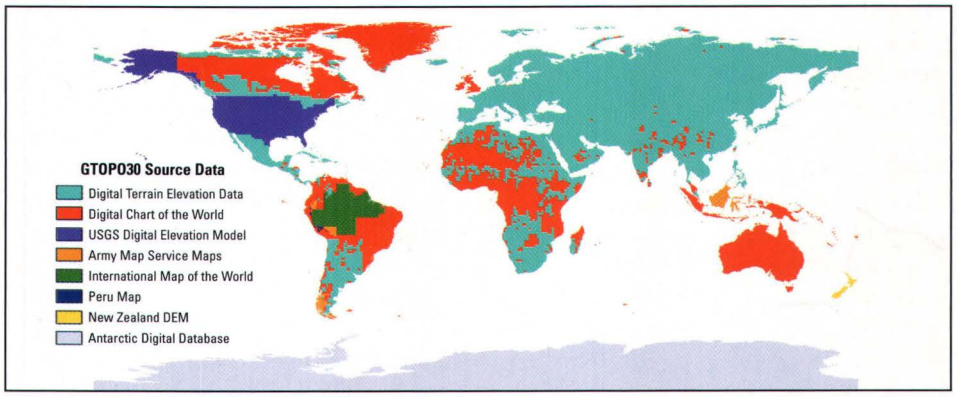


**Figure 2: Multiple sources of elevation data, both raster and vector, were used in the development of GTOPO30. Data were selected for inclusion in GTOPO30 only if they were free of copyright restrictions.**

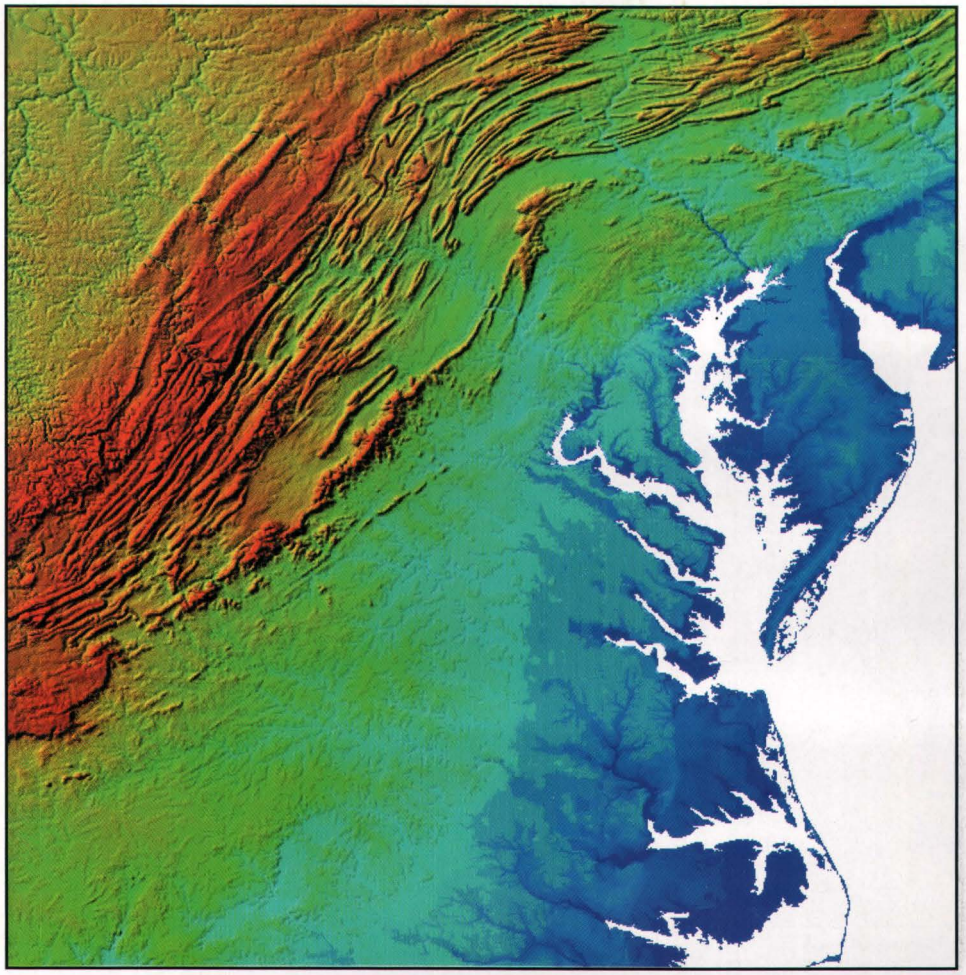

**Figure 3: Shown here is the detail provided by the GTOPO30 coverage of the Chesapeake Bay area. The color map varies from blue for elevations at or below sea level to reds at the highest elevations.**

sea level and are horizontally referenced to the World Geodetic System 1984 datum.

GTOPO30 was developed using multiple sources of elevation information (fig. 2). The majority of the elevation values for the globe (57 percent) were obtained by generalizing preexisting, higher resolution digital elevation data. Digital Terrain Elevation Data (DTED), a product of the National Imagery and Mapping Agency (NIMA), is a digital elevation data set with elevations spaced at 3-arc-second intervals (approximately 100 meters). This full-resolution data set served as the primary source and was aggregated to the 30 arc-second spacing of GTOPO30. Additional areas of the globe were covered with higher resolution data contributed by cooperators and aggregated to 30-arc-seconds for use in GTOPO30. The elevations for the remaining 43 percent of the globe were derived through computer techniques that transform vector contour and hydrographic data into digital elevation models. Existing 1:1,000,000-scale digital mapping of elevation contours, spot heights, drainage features, and coastlines extracted from the Digital Chart of the World (also a product of NIMA) was used as source data wherever possible. In areas of the globe with inadequate digital mapping, additional data layers were identified, contributed, and digitized by cooperators. After the 30 arc-second DEMs were created from the various data sources, the resulting DEMs were then merged in a way that minimized visual and numerical discontinuities.

Due to the variety of data sources used in the development of GTOPO30, the absolute vertical accuracy of the elevations in the data set varies according to the source data. Generally, the elevations derived from the aggregation of higher resolution DEMs have the best vertical accuracy. The accuracy of elevations derived from the interpolation of digitized contour data is controlled by the contour interval of the original topographic maps and the quality of the surface interpolation. The GTOPO30 documentation provides details about the stated accuracy of each source data set and how those numbers are used to estimate the accuracy of GTOPO30.

GTOPO30 is distributed under the auspices of the USGS EROS Data Center's Distributed Active Archive Center (DAAC), part of NASA's Earth Observing System Data and Information System. An underlying goal of the GTOPO30 development was to produce a global topographic data set that would be free of any use or redistribution restrictions, including licensing restrictions, royalties, or copyrights. Data were incorporated into the GTOPO30 DEM only if they could be made freely available through electronic distribution to the public. Because of this criterion, the resulting GTOPO30 DEM has been made available through ftp at no cost to the user community. The data can also be obtained on other media, such as magnetic tape or CD-ROM, for a nominal charge. For the January to September 1999 period, the EROS Data Center DAAC received requests from more than 4,600 data users and delivered more than 42 gigabytes of GTOPO30 data per month.

GTOPO30 provides a new level of detail in global topographic data. Previously, the best available global DEM had a horizontal grid spacing of 5 arc-minutes (approximately 10 kilometers), roughly 100 times coarser than the GTOPO30 data. The increased detail in GTOPO30 makes it particularly suitable for use in many regional and continental applications, such as extraction of drainage features and parameter estimation for hydrologic modeling, climate modeling, continental scale land cover mapping, line of sight and perspective view analysis, and geometric and atmospheric correction of medium- and coarse-resolution satellite image data.

## Information

For more information on the GTOPO30 product, visit the Web page at http://edcwww.cr.usgs.gov/landdaac/gtopo30/gtopo30.html.

For information on other USGS products and services, call 1-888-ASK-USGS, use the Ask-USGS fax-on-demand system, which is available 24 hours at 703-648-4888, or visit the general interest publications Web site on mapping, geography, and related topics at http://mapping.usgs.gov/www/products/mappubs.html.

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