

Potential-Field Computer Programs, Databases, and Maps

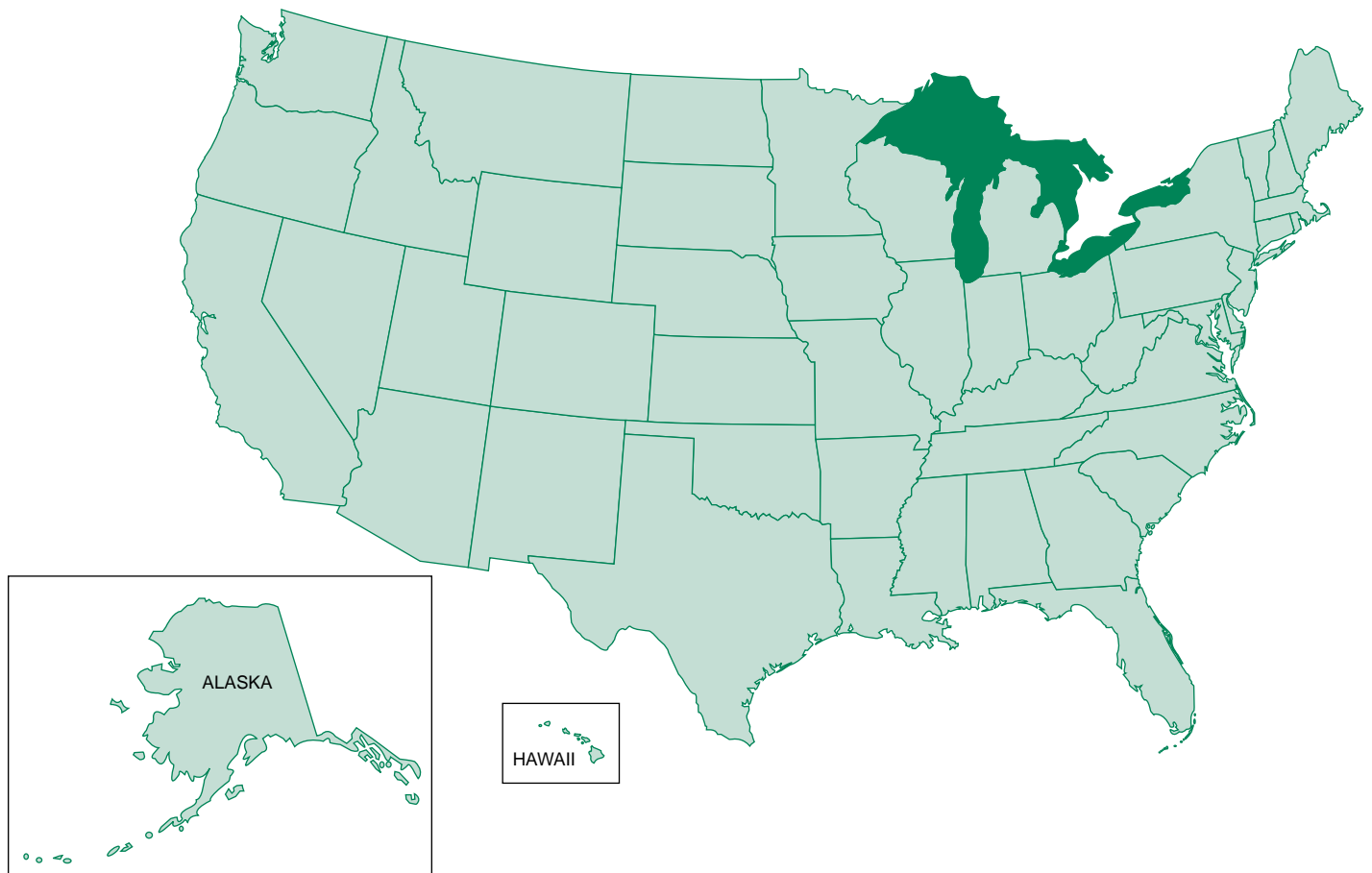
Introduction

Scientists of the U.S. Geological Survey (USGS) have written computer software to process and interpret geophysical data, including gravity and magnetic (potential field), radiometrics (gamma ray), electromagnetics, remote sensing, spectroscopy, borehole geophysics, and shallow seismic data. They also have compiled gravity, magnetics, and radiometric data for large areas of the United States.

U.S. Geological Survey Open-File Report 95-77 is a bibliography that lists many of these programs and databases. This fact sheet describes some of the most useful ones for potential-field data.

Potential-Field Databases

Publicly available gravity and magnetic data for the United States include Bouguer gravity station data (as point data or grids), aeromagnetic flight-line or gridded data, or both. A CD-ROM, USGS Digital Data Series DDS-9, contains gridded gravity, magnetic, and topographic data for the conterminous 48 States. Additional data sets, often gridded at a smaller interval, are available for many States or regions. Maps made from these gravity and magnetic data sets, and other related maps made by using techniques to enhance features of interest, are published for many States at the scale of the geologic





map. Open-File Reports 91–370 A–F list bibliographies and location maps of original aeromagnetic surveys covering the United States.

Potential-Field Programs

A separate fact sheet describes potential-field geophysical software for the PC (personal computer) that is available either as diskettes

(Open-File Report 92–18 A–G) or on CD-ROM (DDS–9)

Open-File Report 93–560 A–D consists of materials provided for a workshop on geophysical map interpretation using the PC, including programs to use with potential field, radiometric, and remote sensing data sets. Data collected in the Osgood Mountains, Nevada, to study the Getchell gold trend are used to demonstrate the programs and methods included in this report.

In addition to the packages of potential-field software in the three reports listed above, there are individual programs that prepare and interpret potential-field data. Some of these programs estimate depth to a geologic source by analyzing magnetic profiles. Other programs compute the magnetic field over a topographic surface or calculate corrections for the effect of terrain on magnetic anomalies.

Several interactive modeling programs calculate forward or inverse, 2- or simplified 3-dimensional geologic models using gravity or magnetic data or both. These programs help the geoscientist interpret data by constructing geological bodies that account for anomalies, calculating the expected field, and matching the results with the known field.

Magnetic values depend on aircraft altitude and whether the survey was flown at a constant barometric elevation (such as 9,000 ft) or at a constant terrain clearance (such as 1,000 ft above the ground, also called draped surveying). Neighboring surveys may have been flown at different specifications. In order to compare anomalies from different surveys, several programs provide methods to calculate potential-field data on different surfaces (higher/lower surfaces, or level/draped surfaces).

Deeply buried geologic sources causing potential-field anomalies have broad, low-amplitude anomalies, whereas shallow sources usually cause narrow, high-amplitude anomalies. This characteristic allows the geoscientist to analyze anomalies based on wavelength and amplitude. Some programs mathematically filter data to selectively remove anomalies caused by either deeper or shallower sources.

Gravity reduction programs calculate known factors that affect gravity meter readings, such as distance from the Earth's center, the effect of land above sea level, tidal attraction, and local terrain. Some programs calculate an isostatic correction based on topographic models of buried, low-density mountain roots below areas of high elevation.

The USGS REMAPP system is a series of programs to process satellite and aircraft imagery data acquired by government or commercial sources. Image processing programs developed for remote sensing data include various mathematical operations, image statistics, data enhancements, ratioing, and masking. Potential-field data can be treated as image data, and these REMAPP programs can display or enhance certain characteristics of potential-field anomalies that may be hard to see in a simple contour map.

Availability

The current release of potential-field software package for PC and several other programs, and the bibliography of programs and databases (U.S. Geological Survey Open-File Report 95–77) are available at:

<http://minerals.er.usgs.gov>

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