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A Preliminary, Full Spectrum, Magnetic Anomaly Grid of the United States with Improved Long Wavelengths for Studying Continental Dynamics: A Website for Distribution of Data

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U.S. Department of the Interior
U.S. Geological Survey

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A Preliminary, Full Spectrum, Magnetic Anomaly Grid of the United States with Improved Long Wavelengths for Studying Continental Dynamics: A Website for Distribution of Data

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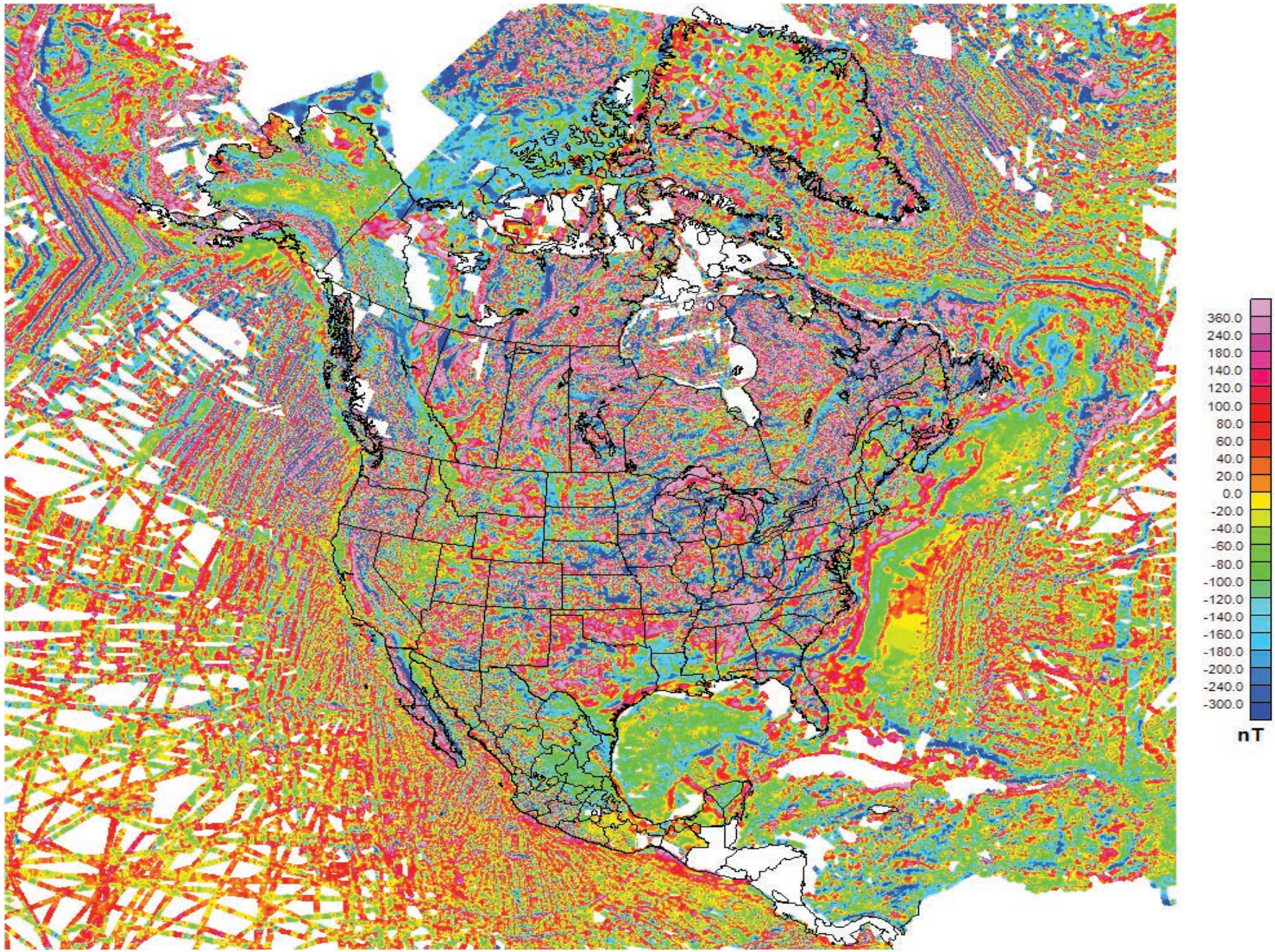
Abstract

Under an initiative started by Thomas G. Hildenbrand of the U.S. Geological Survey, we have improved the long-wavelength (50–2,500 km) content of the regional magnetic anomaly compilation for the conterminous United States by utilizing a nearly homogeneous set of National Uranium Resource Evaluation (NURE) magnetic surveys flown from 1975 to 1981. The surveys were flown in quadrangles of 2° of longitude by 1° of latitude with east-west flight lines spaced 4.8 to 9.6 km apart, north-south tie lines variably spaced, and a nominal terrain clearance of 122 m. Many of the surveys used base-station magnetometers to remove external field variations.

The NURE surveys were originally processed with International Geomagnetic Reference Field (IGRF)/Definitive Geomagnetic Reference Field (DGRF) core-field models, which left behind nonuniform residual trends in the data and discontinuities at survey boundaries. In this study, in place of the IGRF/DGRF models, we used a spatially and temporally continuous model of the magnetic field known as the Comprehensive Model (CM), which allowed us to avoid discontinuities at survey boundaries. The CM simultaneously models the core magnetic field and long-wavelength ionospheric and magnetospheric fields, along with their induced components in the earth. Because of the availability of base-stations for removing external fields, we removed only the core-derived geomagnetic field based on the present version of the model, CM4 (spherical harmonic degree 13) for our compilation.

The NURE data have short-wavelength (less than 30 km) noise due to cultural sources, base-station offsets, and residual external field effects. It is possible to reduce and even remove these defects by identifying and editing them and by applying leveling and micro-leveling. There are also many high-resolution, individual surveys over the U.S. which could be incorporated into the improved NURE database; however, this could take a few years. Therefore, we have created a preliminary, full spectrum, 1.25-km magnetic anomaly grid from a database by combining short-wavelength magnetic anomalies from the North American Magnetic Anomaly Map (NAMAM) and long-wavelength anomalies from NURE using a Gaussian filter centered at 50-km wavelength. We call this product the NURE-NAMAM2008 magnetic database and grid. NURE-NAMAM2008 is useful for analyzing geodynamic aspects of the crustal and mantle magnetic field that require precise long-wavelength information; for example, estimating Curie-temperature depths and constraining estimates of lithospheric temperatures. Preliminary studies show that the corrected long-wavelength components in NURE-NAMAM2008 lead to more realistic Curie depths for the average western U.S. crust. The grid and a format explanation file accompany this abstract. An image of the grid with North American boundaries is included with this report.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