A
APPENDIX DESCRIPTION OF THE CEUS SSC PROJECT DATABASE

The purpose of compiling the CEUS SSC Project database was to organize and store those data and resources that had been carefully and thoroughly collected and described for the TI Team's use in characterizing potential seismic sources in the CEUS. An important goal for the development of this database was to document sources and dates for all information that was initially assessed for the CEUS SSC Project, specifying exactly what data and resources were considered, and provide for pertinent future data sets to be incorporated as they were generated for the project.

Development of the project database began at the inception of the project to provide TI Team members with a common set of data, maps, and figures for characterization of potential seismic sources. The database was continually updated during the course of the project through the addition of new references and data collected by TI Team members and project subcontractors, including information presented in project workshops and provided through PPRP review documentation.

This appendix presents the contents of the project database, as well as information on the workflow, development roles, database design considerations, data assessment tasks, and management of the database. Based on the CEUS Project Plan, the project database included, but was not limited to, the following general types of data:

- Magnetic anomaly
- Gravity anomaly
- Crystalline basement geology
- Tectonic features and tectonic/crustal domains
- Tectonic stress field
- Thickness of sediments
- Crustal thickness
- V_P at top of crystalline basement
- Seismic reflection data at Charleston, South Carolina
- Earthquake catalog
- Quaternary faulting and potential Quaternary features

- Mesozoic rift basins
- Paleoliquefaction sites
- Topography and bathymetry
- Liquefaction dates from published literature for the Wabash, New Madrid, and Charleston seismic zones
- Index map showing locations of published crustal scale seismic profiles and geologic cross sections

A table describing digital data layers included in the project database is presented at the end of this appendix (Table A-1), along with metadata summary sheets for each of the CEUS-scale data layers (Sheets A-1 through A-31).

A.1 Data Sources

The compilation and documentation of spatial geologic, seismic and geophysical data for the CEUS SSC Project required significant and continual effort to ensure that the geographic information system (GIS) data provided accurate and up-to-date information for use in seismic source characterization. Digital data were compiled from sources in the public domain, professional literature, private domain data developed as part of nuclear licensing activities, and available data in the academic sector. The database is designed to be available to the public for further use in seismic source zone characterization and assessment.

Digital data collection efforts focused on the CEUS SSC study area (Figure A-65, Sheet A-23). Digital and nondigital data were collected from a wide range of sources. For example, some data sets pertain to the conterminous United States (e.g., magnetic or gravity data), while others pertain to only a localized study area (e.g., paleoliquefaction studies). Digital data were not typically limited to the CEUS SSC study area extent unless it was necessary to reduce the file size of large data sets. In general, only selected features deemed to be the most pertinent were digitized from nondigital data.

Several new data layers were compiled specifically in support of this project and are included in the project database. These new data layers include the following information sets:

- Earthquake catalog (see Appendix B)
- Magnetic anomaly data
- Gravity anomaly data
- Paleoliquefaction features (see Appendix E)
- Mesozoic rift basins within the ECC-AM
- Maximum horizontal compressive stress data

A.2 Project Database Design and Management

The project database was compiled with input from the TI team, project subcontractors, and PPRP members. The GIS software used in the development of the database was Environmental Systems Research Institute's (ESRI) ArcGIS versions 9.3 and 9.3.1. The project database was compiled, maintained, and made available to team members on a server in the Fugro William Lettis & Associates (FWLA) Walnut Creek, California, office. Table A-1 presents the contents of the project database organized by the CEUS SSC study area, seismotectonic zone, and RLME zone. Subfolders organize data within these folders according to their similar subject matter or data theme.

The file-naming convention used in the project database allows for the quick identification of data type, geographic coverage, and author. For example, in the file name:

ROI_FeatureType_AuthorDate_Rev#.<file type suffix>

where *ROI* is the region of interest or source zone (e.g., CEUS, AHEX); *FeatureType* is the type of feature represented (e.g., GRAV for gravity; PL for paleoliquefaction features); *AuthorDate* is the author or organization and the year of publication; and *Rev#* is the revision number.

All project data began at revision 0 (R0) at the completion of this project and will be updated with consecutive revision numbers as the data are updated. Updated data will be made available via the project website as discussed in Section A.6. Providing a full file name reference allows data to be identified if removed from the organization of the project database.

During the course of the project, data were made available to TI Team members via a file transfer protocol (FTP) server established for the project in the FWLA Walnut Creek office. TI Team members were provided individual passwords to access the secured server. Updates to the project FTP server were provided by the project Database Manager.

A.3 Workflow and Data Assessment

Data were compiled by a staff of several geologists and analysts for CEUS-scale data. Processed and documented data were forwarded to the project Database Manager for inclusion in the database. Data were received in digital and nondigital forms. Digital data were in a GIS format compatible with ESRI's ArcGIS software, ASCII-delimited text files; databases, spreadsheets, or CAD layers. Nondigital data included hard copy drawings, maps, or other documents, including scans of hard-copy documents. The workflow and processes for compiling and documenting digital and nondigital data are outlined in the following sections.

A.3.1 Workflow

Project GIS data were collected by several TI Team members and the PPRP during the course of the project. Once received by the project Database Manager, data were reviewed prior to incorporation into the project database. Versions of data layers were indicated to show when updates were completed. Project data were stored on a replicated, secure server. All data were backed up on a weekly basis to provide an off-site archive of project data.

A.3.2 Digital Data

Digital data published by the USGS and other sources comprise a significant portion of the project database. Digital data were collected in various ESRI GIS-compatible formats for vector and raster data (shapefile, coverage, GRID, ArcInfo Interchange, and personal and file geodatabase formats) or in ASCII-delimited text formats. All data received were reviewed to assess, at a minimum, the following factors:

- Completeness of the data
- Accompanying metadata, including completeness of documentation, source information, compilation scale
- Defined coordinate system
- Topological integrity

Compiled data were not altered beyond any routine conversion or coordinate transformation required for uploading to the project database. Example conversions include converting data from a different GIS or CAD format, projecting data from the source coordinate system into the project coordinate system, transforming the horizontal and vertical datum, and converting from ASCII-delimited text format to the project data format.

Occasionally, data were incorporated into the project database without alteration or renaming from the source data. For example, data that comprise the GIS layers of the Geologic Map of North America (Figure A-5) retain their original file names as provided on the USGS's website (http://pubs.usgs.gov/ds/424/), although they have been converted from the ESRI file geodatabase format to the ESRI shapefile format. Metadata accompanying the data in the project database contain information informing the user of what data are contained in each layer.

A.3.3 Nondigital Data

Some geologic or geophysical data requested for use in the CEUS SSC Project were provided in a nondigital format, including hard copy documents such as maps and figures in reports or research papers. GIS data created from these nondigital data formats underwent a review process to ensure data quality. The assessment was performed in the following review stages:

1. Review by the originating GIS analyst
2. Review by the geologist or analyst requesting the data
3. Review by the project Database Manager prior to submission to the project database

The review of GIS data layers that were produced from nondigital data involved the following steps:

- Visual inspection by comparison to source hardcopy documents
- Check of coordinate reference system
- Completion of metadata
- Development of database attributes for each layer, as appropriate
- Check for complete topology (spatial adjacency), as appropriate

For both digital and nondigital sources of data, scale is a significant consideration in the use of the project database. The consideration of the scale of data allows for the assessment of positional accuracy. Each data layer in the database contains in the accompanying metadata a notation about the scale at which the data were referenced or collected. For example, for vector data, a line that was digitized at a scale of 1:100,000 will have a greater positional accuracy than the same line digitized at a scale of 1:1,000,000. The scale of source information varies significantly in the project database. Whenever data are digitized based from hard-copy maps, error can be introduced. Although a GIS allows the display of data at any scale specified by the user, the accuracy of the same data will not change. Therefore, using digital data at a larger scale than that of the original source will not produce a more accurate map. When the layers in the project database are used, the source scale must be considered. In the course of developing this database, data were digitized at scales the same as, or larger than, that of the source to limit the error introduced through the digitization process.

A.4 Use of Project Database in Model Development

The project database (Table A-1) comprises many different types of data that were useful to the TI Team and PPRP members for understanding seismic, geologic, and geophysical conditions and for development of the seismic source model. The database includes geologic, geophysical, geodetic, seismic, tectonic, geomorphic, and earthquake information.

The project database was made available to TI and PPRP team members during the course of the project. During project working meetings, elements of the database were projected on a screen to facilitate discussions. TI Team GIS analysts were available to display elements of the project database at the request of TI Team members. For example, using a GIS, various types of requested data layers were shown for a particular area to identify geologic relationships. Team member inputs were gathered in real time during these discussions through the drawing of features into the GIS display. These features could then be incorporated into the seismic model immediately afterward.

A.5 Metadata

Metadata were compiled for each GIS data layer. All source reference documents used in preparing the data layer were noted to allow contributing data layers to be cited in future applications of the data. Additional primary documentation includes scale of the sources used, the scale at which the data were digitized and appropriate scales of use, coordinate reference system, and attribute library and domains. Metadata conform, wherever possible, to the Content Standard for Digital Geospatial Metadata established by the

Federal Geographic Data Committee (FGDC). This metadata standard is currently used by federal agencies for documenting geospatial data.

Included in this appendix are metadata summary sheets that present information for each data layer that covers the CEUS study area or similar regional coverage (Sheets A-1 through A-31). These one- and two-page sheets serve as quick references that summarize the data, the source of the data, the original publisher, the source and converted data formats, and disclaimers or noted constraints on the use of the data. Accompanying each summary sheet is a figure depicting the data in the CEUS SSC study area, often with topography and state boundaries provided for reference. More local data derived from detailed studies have also been included in the database. These local data sets typically include features digitized from a figure in a publication or other published map. However, metadata summary sheets have not been developed for these large-scale data layers. All data layers and their accompanying metadata summary sheets (as appropriate) are listed in Table A-1.

A.6 Database Delivery Format

The project database includes both vector and raster data formats. Vector data formats represent features as points, lines, or polygons. Each type of vector class is suited for different types of features (i.e., points for spot features such as measurement locations, lines for features such as topographic contours, and polygons for area features such as mapped geologic units). A raster data format represents surfaces where each regularly spaced interval contains a discrete value. A digital elevation model (DEM) is an example of raster data.

The project database contains vectors and rasters depending on the type of data compiled. A goal of the project database was to make the data accessible to a large audience with minimal effort. The ESRI shapefile data format was selected for vector features because of the ubiquitous use of ESRI's ArcGIS software and the large number of other GIS software in use that can import this format. Raster data were compiled in a GeoTIFF format for similar reasons.

All data in the project database are provided in geographic (latitude/longitude) decimal degree coordinates using the North American Datum of 1983 (NAD83). This coordinate system can be read by nearly all GIS software packages and reprojected as necessary into other coordinate systems. As noted in Section A.3.2, data compiled from existing sources were provided in various coordinate systems. These data were reprojected as necessary to geographic coordinates on NAD83.

The database will be available on the CEUS SSC Project website (www.ceus-ssc.com) and will include the earthquake catalog plus all magnetic, gravity, and stress data compiled for the project. The CEUS SSC report, including all appendices, will also be provided on the website. All data are provided in a format that will allow other investigators to use the outputs of the CEUS SSC Project model for subsequent seismic hazard assessments. A more complete description of the CEUS SSC website is provided in Section 9.3.3 of the report.

Table A -1
CEUS SSC GIS Database

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
CEUS Study Area			
Base Data	General Bathymetric Chart of the Oceans (GEBCO) 30 arc-second topography and bathymetry for the CEUS CEUS_elev_GEBCO_R0.tif	General Bathymetric Chart of the Oceans (GEBCO), International Hydrographic Organization (IHO), Intergovernmental Oceanographic Commission (IOC), 2009, GEBCO_08 Grid, version 20091120, http://www.gebco.net.	Sheet A-1 Figure A-1
	Disclaimer: Data from the GEBCO's gridded data sets are not to be used for navigation or for any other purpose relating to safety at sea. The IHO, IOC, NERC, and BODC are not able to warrant the accuracy of the data and accept no responsibility whatsoever for determining the fitness of the data for their intended use or for any consequential loss, damage or expense arising from such use. Users should be aware that most areas of the world's oceans have not been fully surveyed and that the GEBCO bathymetry is an interpretation based on random tracklines of data from many sources. The quality and coverage of data from these sources is highly variable. Information on accessing the latest versions of GEBCO's data sets can be found on GEBCO's website: www.gebco.net.		
Earthquake Catalog	CEUS SSC Earthquake Catalog Compilation. Refer to Appendix B for detailed description. CEUS_EQ_Catalog_R0.shp	This study.	Sheet A-2 Figure A-2
Geology	Bedrock Geology and Extended Crust after Kanter (1994) CEUS_bedrock_geol_Kanter1994_R0.shp CEUS_ext_areas_Kanter1994_R0.shp	Kanter, L.R., 1994, Tectonic Interpretation of Stable Continental Crust: The Earthquakes of Stable Continental Regions, Volume I: Assessment of Large Earthquake Potential—Final Report TR-102261-V1, prepared for Electric Power Research Institute.	Sheet A-3 Figure A-3

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Geology	Crustal Provinces after Rohs and Van Schmus (2007) CEUS_pc_RohsVS2007_R0.shp	Rohs, C.R., and Van Schmus, V.R., 2007, Isotopic connections between basement rocks exposed in the St. Francois Mountains and the Arbuckle Mountains, southern mid-continent North America: International Journal of Earth Sciences, v. 96, pp. 599-611.	Sheet A-4 Figure A-4
Geology	Database of the Geologic Map of North America—Adapted from the Map by J.C. Reed, Jr. and Others (2005) Various shapefiles exported from source USGS geodatabase	Garrity, C.P., and Soller, D.R., 2009, Database of the Geologic Map of North America—Adapted from the Map by J.C. Reed, Jr. and Others (2005): U.S. Geological Survey Data Series 424, http://pubs.usgs.gov/ds/424/.	Sheet A-5 Figure A-5
Geology	Compilation of Geologic Cross Section Locations compiled from various DNAG plates, AAPG geologic highway maps and Texas Bureau of Economic Geology maps. CEUS_geologic_cross_sec_loc_R0.shp	See metadata for complete citation list.	Sheet A-6 Figure A-6
Geology	Precambrian Crustal Boundary by Van Schmus et al. (1996) CEUS_crustal_boundary_VanSchmus1996_R0.shp	Van Schmus, W.R., Bickford, M.E., and Turek, A., 1996, Proterozoic geology of the east-central mid-continent basement: in van der Pluijm, B.A., and Catacosinos, P.A. (editors), Basement and Basins of Eastern North America, Geological Society of America Special Paper 308, pp. 7-32.	Sheet A-7 Figure A-7

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Geology	Precambrian Geology and Features after Reed (1993) CEUS_pc_AnomaliesDikes_Reed1993_R0.shp CEUS_pc_FaultsContacts_Reed1993_R0.shp CEUS_pc_Geol_Reed1993_R0.shp	Reed, J.C., Jr., 1993, Map of the Precambrian rocks of the conterminous United States and some adjacent parts of Canada:, in Reed, J.C., Jr., Bickford, M.E., Houston, R.S., Link, P.K., Rankin, D.W., Sims, P.K., and Van Schmus, W.R., (editors), Precambrian: Conterminous U.S., Geological Society of America, The Geology of North America, v. C-2, plate 1, scale 1:5,000,000.	Sheet A-8 Figures A-8a and A-8b
Geology	Precambrian Provinces after Van Schmus (2007) CEUS_pc_basement_VanSchmus2007_R0.shp	Van Schmus, W.R., Schneider, D.A., Holm, D.K., Dodson, S., and Nelson, B.K., 2007, New insights in the southern margin of the Archean-Proterozoic boundary in the north-central United States based on U-Pb, Sm-Nd, and Ar-Ar geochronology: Precambrian Research, v. 157, pp. 80-105.	Sheet A-9 Figure A-9
Geology	Precambrian Units after Whitmeyer and Karlstrom (2007) CEUS_pc_Whitmeyer2007_R0.shp	Whitmeyer, S.J., and Karlstrom, K.E., 2007, Tectonic model for the Proterozoic growth of North America: Geosphere,,v. 3, no. 4, pp. 220-259.	Sheet A-10 Figure A-10
Geology	Surficial Materials in the Conterminous United States Contacts.shp, State_lines.shp, Surficial_materials.shp	Soller, D.R., Reheis, M.C., Garrity, C.P., and Van Sistine, D.R., 2009, Map Database for Surficial Materials in the Conterminous United States: U.S. Geological Survey Data Series 425, scale 1:5,000,000, http://pubs.usgs.gov/ds/425/.	Sheet A-11 Figure A-11

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Geology	USGS Crustal Database—Seismic Properties of North America and the Surrounding Ocean Basins CEUS_crustal_db_USGS_R0.shp	Seismic Properties of North America and the Surrounding Ocean Basins: http://earthquake.usgs.gov/research/structure/crust/nam.php, accessed April 24, 2008.	Sheet A-12 Figures A-12 and A-13
Geology	Sediment Thickness for North America and Neighboring Regions CEUS_sed_thickness_USGS_R0.tif	Mooney, W.D., 2011, personal communication: presented at CEUS SSC Project Workshop #1, July 22, 2008, Palo Alto, Calif.	Sheet A-13 Figure A-14
Geology	USGS Physiographic Divisions of the Conterminous United States CEUS_physio_USGS_R0.shp	Fenneman, N.M., and Johnson, D.W., 1946, Physiographic Divisions of the United States, U.S. Geological Survey Water Resources Maps and GIS Data, Washington, D.C., http://water.usgs.gov/GIS/dsdl/physio.gz.	Sheet A-14 Figure A-15
Gravity	CEUS SSC Gravity Compilation 2010 CEUS_GRAV_<varies>_CEUSSSC_R0.tif	Keller, G.R., 2010, personal communication.	Sheet A-15 Figures A-16 through A-37
Heat Flow	SMU Geothermal Laboratory Regional Heat Flow Database CEUS_Regional_HeatFlow_SMU_R0.shp	Blackwell, D. and Richards, M., eds., 2008, SMU Geothermal Laboratory Regional Heat Flow Database, Southern Methodist University, http://smu.edu/geothermal, accessed April 9.	Sheet A-16 Figure A-38

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Magnetic	Full-Spectrum Magnetic Anomaly Database for the Central and Eastern United States CEUS_MAG_<varies>_CEUSSSC_R0.tif	Ravat, D., Finn, C., Hill, P., Kucks, R., Phillips, J., Blakely, R., Bouligand, C., Sabaka, T., Elshayat, A., Aref, A., and Elawadi, E., 2009, 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: U.S. Geological Survey, Open-File Report 2009-1258, 2 pp. Ravat, D., 2009, personal communication.	Sheet A-17 Figures A-39 through A-46
Paleoliquefaction	CEUS SSC Paleoliquefaction Database CEUS_PL_DB_CEUSSSC_R0.shp	See Appendix E for complete citation list.	Sheet A-18 Figure A-47
Seismic Imagery	CEUS Compilation of Seismic Refraction/Reflection Lines, various authors. CEUS_SL_compilation_R0.shp	See metadata for complete citation list.	Sheet A-19 Figure A-48
Seismic Source Characterization	USGS National Seismic Hazard Maps Seismic Zones—2008 CEUS_NSHM_2008_po_R0.shp CEUS_NSHM_2008_pl_R0.shp Earthquake hazard probability grids	Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Y., Boyd, O.S., Perkins, D.M., Luco, N., Field, E.H., Wills, C.J., and Rukstales, K.S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 pp.	Sheet A-20 Figures A-49 through A-61

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Strain (GPS)	Calais—Deformation of the North American Plate Interior Using GPS Station Data CEUS_GPS_NA_ITRF2000_Calais_R0.shp	Calais, E., Han, J.Y., DeMets, C., and Nocquet, J.M., 2006, Deformation of the North American Plate interior from a decade of continuous GPS measurements: Journal of Geophysical Research, v. 111, B06402, doi:10.1029/2005JB004253.	Sheet A-21 Figure A-62
Stress	World Stress Map of 2008 Updated by Owen Hurd, Stanford University CEUS_WSM_Hurd2010_R0.shp	Heidbach, O., Tingay, M., Barth, A., Reinecker, J., Kurfess, D., and Müller, B., 2008, The World Stress Map database release 2008, doi:10.1594/GFZ.WSM.Rel2008. Hurd, O., 2010, personal communication.	Sheet A-22 Figure A-63
Study Area	CEUS SSC Study Area Boundary CEUS_boundary_R0.shp	CEUS SSC Project	Sheet A-23 Figure A-64
Tectonic Features	Faults and seismic areas associated with Quaternary seismicity, USGS Quaternary Fault and Fold Database CEUS_Q_faults_USGS_pl_R0.shp CEUS_Q_faults_USGS_po_R0.shp	Quaternary Fault and Fold Database for the United States, 2006, U.S. Geological Survey (and supporting agency if appropriate): http://earthquakes.usgs.gov/regional/qfaults/, accessed June 9, 2008.	Sheet A-24 Figure A-65
	Disclaimer: The USGS Quaternary Fault and Fold Database is continually updated. Access the website for the latest information.		

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Tectonic Features	Data for Quaternary Faults, Liquefaction Features, and Possible Tectonic Features in the CEUS CEUS_Q_features_USGS_(pt/pl/po)_R0.shp	Crone, A.J., and Wheeler, R.L., 2000, Data for Quaternary Faults, Liquefaction Features, and Possible Tectonic Features in the Central and Eastern United States, East of the Rocky Mountain Front: U.S. Geological Survey Open-File Report 00-0260, 342 pp. USGS Quaternary Fault and Fold Database, available online at http://earthquake.usgs.gov/hazards/qfaults/. Wheeler, R.L., 2005, Known or Suggested Quaternary Tectonic Faulting, Central and Eastern United States—New Updated Assessments for 2005: U.S. Geological Survey Open-File Report 2005 1336, 40 pp.	Sheet A-25 Figure A-66
Tectonic Features	Mesozoic Rift Basins after Benson (1992) CEUS_basins_Benson1992_R0.shp	Benson, R.N., 1992, Map of Exposed and Buried Early Mesozoic Rift Basins/Synrift Rocks of the U.S. Middle Atlantic Continental Margin: Delaware Geological Survey Miscellaneous Map Series No. 5.	Sheet A-26 Figure A-67
Tectonic Features	Mesozoic Rift Basins after Dennis et al. (2004) CEUS_basins_Dennis_etal_2004_R0.shp	Dennis, A.J., Shervais, J.W., Mauldin, J., Maher, H.D., Jr., and Wright, J.E., 2004, Petrology and geochemistry of Neoproterozoic volcanic arc terranes beneath the Atlantic Coastal Plain, Savannah River site, South Carolina: Geological Society of America Bulletin, v. 116, pp. 572-593.	Sheet A-27 Figure A-68

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Tectonic Features	Mesozoic Rift Basins after Schlische (1993) CEUS_basins_Schlische1993_R0.shp	Schlische, R.W., 1993, Anatomy and evolution of the Triassic-Jurassic continental rift system, eastern North America: Tectonics, v. 12, pp. 1026-1042.	Sheet A-28 Figure A-69
Tectonic Features	Mesozoic rift basins after Withjack et al. (1998) CEUS_basins_Withjack1998F2_R0.shp CEUS_basins_Withjack1998F7_R0.shp	Withjack, M.O., Schlische, R.W., and Olsen, P.E., 1998, Diachronous rifting, drifting, and inversion on the passive margin of central eastern North America: An analog for other passive margins: AAPG Bulletin, v. 82, pp. 817-835.	Sheet A-29 Figure A-70
Extended Continental Crust—Gulf Coast Zone			
Liquefaction	Craton margin paleoseismicity, paleoliquefaction areas after Cox (2009) ALM_Liq_Cox2009_R0.shp	Cox, R., 2009, Some Mississippi Valley Holocene Faulting and Liquefaction Beyond the New Madrid Seismic Zone: presentation given at CEUS SSC Project Workshop #2, February 18-20, Palo Alto, Calif.	
Liquefaction	Sand blow fields from aerial photo survey after Cox (2009) ALM_Liq_sandblowfields_Cox2009_R0.shp	Cox, R., 2009, Some Mississippi Valley Holocene Faulting and Liquefaction Beyond the New Madrid Seismic Zone: presentation given at CEUS SSC Project Workshop #2, February 18-20, Palo Alto, Calif.	
Tectonic Features	Transforms and spreading ridges as shown in Thomas (2009) ALM_F_Thomas2009_R0.shp	Thomas, W.A., 2009, Ouachita Sub-Detachment Structures: presentation given at CEUS SSC Project Workshop #2, February 18-20, Palo Alto, Calif.	

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Midcontinent Zone			
Tectonic Features	Polyline features from Fig. 1 of Niemi et al. (2004) MidC_Niemi_etal_2004_R0.shp	Niemi, T.M., Ferris, A.N., and Abers, G.A., 2004, Investigation of microearthquakes, macroseismic data, and liquefaction associated with the 1867 Wamego earthquake in eastern Kansas: Bulletin of the Seismological Society of America, v. 94, no. 6, pp. 2317-2329.	
New Madrid Zone			
Liquefaction	Liquefaction areas in New Madrid with possible magnitude ellipses RR_liq_field_(900/1450/1811)_Tuttle2002_R0.shp	Tuttle, M.P., Schweig, E.S., Sims, J.D., Lafferty, R.H., Wolf, L.W., and Haynes, M.L., 2002, The earthquake potential of the New Madrid seismic zone: Bulletin of the Seismological Society of America, v. 92, no. 6, pp. 2080-2089.	
Liquefaction	Tuttle et al. (2005) liquefaction > 1% sand blows RR_liq_sand_blows_Tuttle2005_R0.shp	Tuttle, M.P., Schweig, E., III, Campbell, J., Thomas, P.M., Sims, J.D., and Lafferty, R.H., III, 2005, Evidence for New Madrid earthquakes in A.D. 300 and 2350 B.C.: Seismological Research Letters, v. 76, no. 4, pp. 489-501.	
Tectonic Features	Fault lines from Fig. 3 of Csontos and Van Arsdale (2008) RR_F_Csontos_VanArsdale2008_R0.shp	Csontos, R., and Van Arsdale, R., 2008, New Madrid seismic zone fault geometry: Geosphere, v. 4, no. 5, pp. 802-813.	
Tectonic Features	Plio-Pleistocene uplifts from Fig. 4 of Csontos and Van Arsdale (2008) RR_uplifts_Csontos_VanArsdale2008_R0.shp	Csontos, R., and Van Arsdale, R., 2008, New Madrid seismic zone fault geometry: Geosphere, v. 4, no. 5, pp. 802-813.	

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Tectonic Features	Seismotectonic Maps in the Vicinity of New Madrid, Missouri Database Various USGS OFR 95-0574 shapefiles	Rhea, S., 1995, Seismotectonic Maps in the Vicinity of New Madrid, Missouri Database: U.S. Geological Survey Open-File Report 95–0574, 10 pp.	
Charleston RLME			
Geology	Approximation of the Fall Line after Hibbard (2006) CHAR_FallLine_Hibbard_etal_2006_R0.shp	Hibbard, J.P., van Staal, C.R., Rankin, D.W., and Williams, H., 2006, Lithotectonic Map of the Appalachian Orogen, Canada—United States of America: Geological Society of Canada, map 2096A, 1:1,500,000 scale.	
Liquefaction	Extent of quadrangles where river banks were investigated for liquefaction features CHAR_Liq_InvestigatedQuadrangles_Gelinas_etal_1998_R0.shp	Gelinas, R., Cato, K., Amick, D., and Kemppinen, H., 1998, Paleoseismic Studies in the Southeastern United States and New England: U.S. Nuclear Regulatory Commission Report, NUREG/CR-6274.	
Liquefaction	Representation of northern and southern limits of historically documented small liquefaction features caused by the 1886 earthquake CHAR_Liq_LimitsofLiquefaction_Obermeier1996_R0.shp	Obermeier, S.F., 1996, Using liquefaction-induced features for paleoseismic analysis: in McCalpin, J.P. (editor), Paleoseismology, Academic Press, ch. 7, pp. 331-396.	
Magnetic	Approximation of the magnetic field gradient CHAR_MagneticFieldGradient_Chapman_Beale2010_R0.shp	Chapman, M.C., and Beale, J.N., 2010, On the geologic structure at the epicenter of the 1886 Charleston, South Carolina, Earthquake: Bulletin of the Seismological Society of America, v. 100, no. 3, pp. 1010-1030.	

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Seismic Imagery	Representation of fault locations from seismic reflection data near Charleston, SC after Chapman and Beale (2008) CHAR_F_SeismicReflectionPoints_Chapman_ Beale2008_R0.shp	Chapman, M.C., and Beale, J.N., 2008, Mesozoic and Cenozoic faulting imaged at the epicenter of the 1886 Charleston, South Carolina, earthquake: Bulletin of the Seismological Society of America, v. 98, no. 5, pp. 2533-2542.	
Seismic Imagery	Representation of seismic profile stations after Chapman and Beale (2010) CHAR_F_FaultPoints_Chapman_Beale2010_R0.shp	Chapman, M.C., and Beale, J.N., 2010, On the geologic structure at the epicenter of the 1886 Charleston, South Carolina, earthquake: Bulletin of the Seismological Society of America, v. 100, no. 3, pp. 1010-1030.	
Seismicity	1886 Charleston Earthquake Epicentral Region—Obermeier (1996) CHAR_EQ_1886EpicentralRegion_Obermeier1996_ R0.shp	Obermeier, S.F., 1996, Using liquefaction-induced features for paleoseismic analysis: in McCalpin, J.P. (editor), Paleoseismology, Academic Press, ch. 7, pp. 331-396.	
Seismicity	1913 Charleston Earthquake Epicentral Region CHAR_EQ_1913UnionCoEqRegion_Gelinas_etal_1998_ R0.shp	Gelinas, R., Cato, K., Amick, D., and Kemppinen, H., 1998, Paleoseismic Studies in the Southeastern United States and New England: U.S. Nuclear Regulatory Commission Report, NUREG/CR-6274.	
Seismicity	Bowman seismic zone after Smith and Talwani (1985) CHAR_EQ_BowmanSZ_Smith_Talwani1985_R0.shp	Smith, W.A., and Talwani, P., 1985, Preliminary interpretation of a detailed gravity survey in the Bowman and Charleston, S.C. seismogenic zones: Geological Society of America Southeastern Section, Abstracts with Programs, v. 17, no. 2, p. 137.	

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Seismicity	Earthquake epicenters for Charleston, SC 1974-2002, South Carolina Seismic Network CHAR_EQ_CharlestonEarthquakes1974-2002_SCSN2001_R0.shp	South Carolina Seismic Network (SCSN), Website, List of Earthquakes in Charleston Between 1974 and 2002, http://scsn.seis.sc.edu, accessed September 13, 2005.	
Seismicity	Calculated Energy Center for August 31, 1886 Charleston Earthquake CHAR_EQ_CharlestonOffshoreFeature_Bakun_Hopper2004_R0.shp	Bakun, W.H., and Hopper, M.G., 2004b, Magnitudes and locations of the 1811-1812 New Madrid, Missouri, and the 1886 Charleston, South Carolina, earthquakes: Bulletin of the Seismological Society of America, v. 94, no. 1, pp. 64-75.	
Seismicity	Middleton Place Seismic Zone after Madabhushi and Talwani (1993) CHAR_EQ_MiddletonPlaceSZ_Madabhushi_Talwani1993_R0.shp	Madabhushi, S., and Talwani, P., 1993, Fault plane solutions and relocations of recent earthquakes in Middleton Place-Summerville seismic zone near Charleston, South Carolina: Bulletin of the Seismological Society of America, v. 83, no. 5, pp. 1442-1466.	
Seismicity	Isoseismals (intensity ranges) of the 1886 Charleston earthquake after Bollinger (1977) CHAR_Isoseismal_Bollinger1977_R0.shp	Bollinger, G.A., 1977, Reinterpretation of the Intensity Data for the 1886 Charleston, South Carolina, Earthquake, in Studies Related to the Charleston, South Carolina, Earthquake of 1886—A Preliminary Report: U.S. Geological Survey Professional Paper 1028, pp. 17-32.	
Tectonic Features	Segments of the East Coast Fault System after Marple and Talwani (2000) CHAR_F_EastcoastFaultSystem_Marple_Talwani2000_R0.shp	Marple, R.T., and Talwani P., 2000, Evidence for a buried fault system in the Coastal Plain of the Carolinas and Virginia: Implications for neotectonics in the southeastern United States: GSA Bulletin, v. 112, no. 2, pp. 200-220.	

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Tectonic Features	Representation of six faults in the Charleston area after Talwani and Dura-Gomez (2009) CHAR_F_CharlestonFaults_Talwani_DuraGomez2009_R0.shp	Talwani, P., and Dura-Gomez, I., 2009, Finding faults in the Charleston area, South Carolina: 2. Complementary data: Seismological Research Letters, v. 80, no. 5, pp. 901-919.	
Tectonic Features	Representation of three faults in the Charleston area after Talwani and Katuna (2004) CHAR_F_CharlestonFaults_Talwani_Katuna2004_R0.shp	Talwani, P., and Katuna M., 2004, Macroseismic Effects of the 1886 Charleston Earthquake: Carolina Geological Society Field Trip Guidebook, 43 pp.	
Tectonic Features	Representation of faults in the Charleston area after Weems and Lewis (2002) CHAR_F_CharlestonFaults_Weems_Lewis2002_R0.shp	Weems, R.E., and Lewis, W.C., 2002, Structural and tectonic setting of the Charleston, South Carolina, region: Evidence from the Tertiary stratigraphic record: Geological Society of America Bulletin, v. 114, no. 1, pp. 24-42.	
Tectonic Features	Representation of the postulated generalized spatial extent of the Dorchester fault after Bartholomew and Rich (2007) CHAR_F_Dorchesterfault_Bartholomew_Rich2007_R0.shp	Bartholomew, M.J., and Rich, F.J., 2007, The walls of colonial Fort Dorchester: A record of structures caused by the August 31, 1886 Charleston, South Carolina, earthquake and its subsequent earthquake history: Southeastern Geology, v. 44, no. 4, pp. 147-169.	
Tectonic Features	Representation of faults offshore and onshore of Charleston, SC after Behrendt and Yuan (1987) CHAR_F_Offshorefaults_Behrendt_Yuan1987_R0.shp	Behrendt, J.C., and Yuan, A., 1987, The Helena Banks strike-slip (?) fault zone in the Charleston, South Carolina, earthquake area: results from a marine, high-resolution, multichannel, seismic-reflection survey: Geological Society of America Bulletin, v. 98, no. 5, pp. 591-601.	

Data Theme	GIS Layer/File Name	Citation	Summary Sheet and Figures
Tectonic Features	Charleston area zone of river anomalies after Marple and Talwani (2000) CHAR_ZoneofRiverAnomaly_Marple_Talwani2000_R0 .shp	Marple, R.T., and Talwani, P., 2000, Evidence for a buried fault system in the Coastal Plain of the Carolinas and Virginia—Implications for neotectonics in the southeastern United States: Geological Society of America Bulletin, v. 112, no. 2, pp. 200-220.	
CEUS SSC Model Results			
RLME Zones	CEUS SSC Repeated Large-Magnitude Earthquake (RLME) zones CEUS_RLME_CEUSSSC_pl_R0.shp CEUS_RLME_CEUSSSC_po_R0.shp	CEUS SSC Project.	Sheet A-30 Figure A-71
Seismotectonic Zones	CEUS SSC Mesozoic and Non-Mesozoic Zones and Seismotectonic Zones CEUS_STZones_CEUSSSC_R0.shp	CEUS SSC Project.	Sheet A-31 Figures A-72 through A-77

Sheet A-1—CEUS SSC Project GIS Data Summary

General Bathymetric Chart of the Oceans (GEBCO)

CEUS_elev_GEBCO_R0.tif

Data Description: Data representing land elevation and ocean bathymetry. This layer was created from data provided by the British Oceanographic Data Centre (BODC) General Bathymetric Chart of the Oceans (GEBCO) 30-arc-second GEBCO_08 data set. This layer is continually updated by BODC.

Source (Internet URL, CD/DVD-ROM): http://www.gebco.net.

Author/Publisher/Year: The GEBCO Digital Atlas is published and maintained by the British Oceanographic Data Centre (BODC) of the Natural Environmental Research Council (NERC) on behalf of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, acting through the Joint IOC/IHO Guiding Committee for GEBCO. The contents of this data layer were published in November 2009, version 20091120.

Data Summary: Digital data in ESRI ASCII Grid format was exported into ERDAS Imagine .img raster format using ArcGIS 9.3.1. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: Data from the GEBCO's gridded data sets are not to be used for navigation or for any other purpose relating to safety at sea. The IHO, IOC, NERC, and BODC are not able to warrant the accuracy of the data and accept no responsibility whatsoever for determining the fitness of the data for their intended use or for any consequential loss, damage, or expense arising from such use. Users should be aware that most areas of the world's oceans have not been fully surveyed and that the GEBCO bathymetry is an interpretation based on random tracklines of data from many sources. The quality and coverage of data from these sources are highly variable.

Information on accessing the latest versions of the GEBCO data sets can be found on the GEBCO website: http://www.gebco.net.

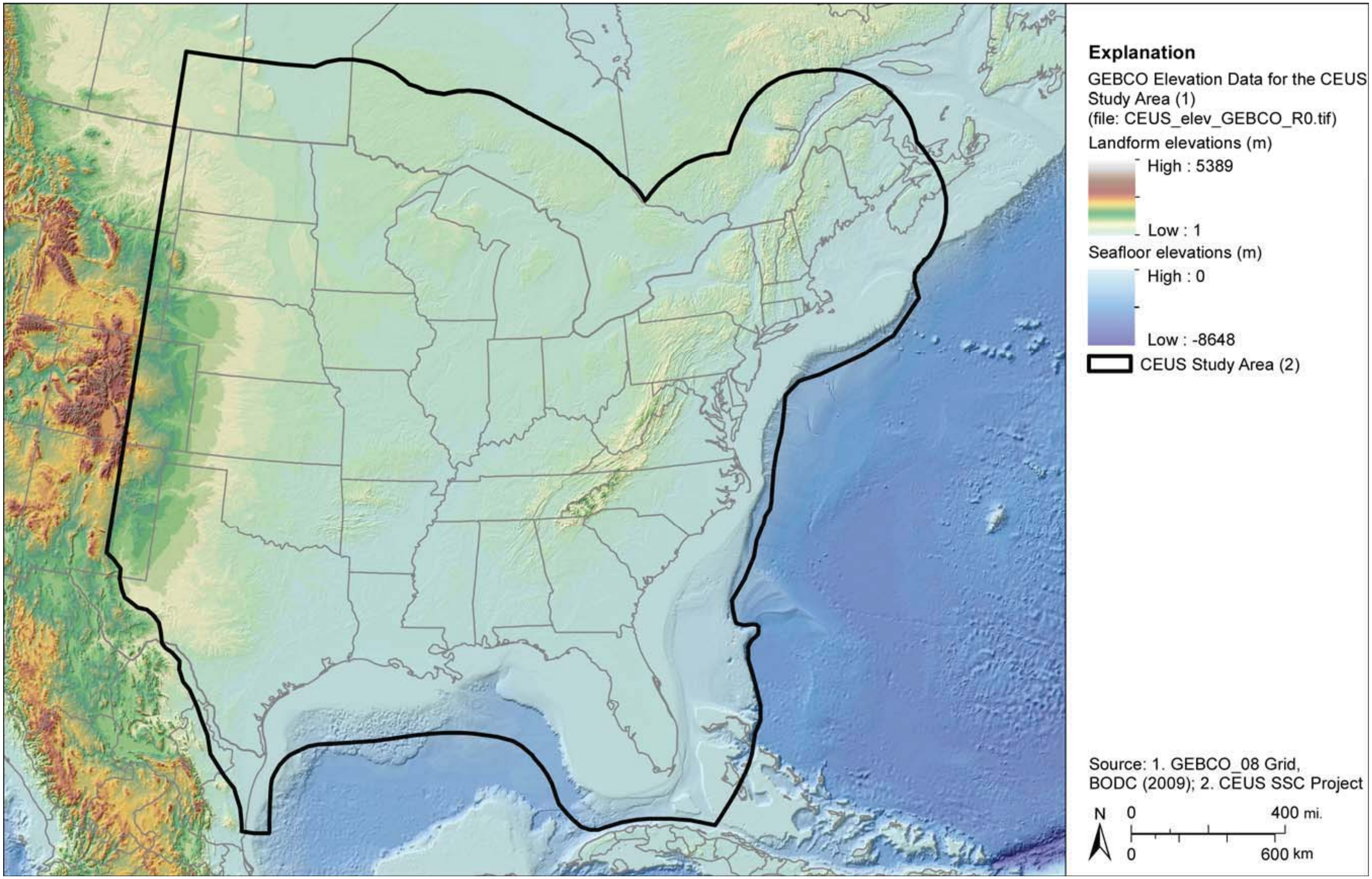

Figure A-1
GEBCO elevation data for the CEUS study area (BODC, 2009).

Sheet A-2—CEUS SSC Project GIS Data Summary

CEUS SSC Earthquake Catalog Compilation

CEUS_EQ_Catalog_R0.shp

Data Description: This map layer contains the earthquake catalog for the CEUS SSC Project. Source catalogs were merged to derive a preliminary catalog with duplicates and alternative estimates of location, magnitude, seismic moment, macroseismic intensity, and felt area. Relationships between the size measures presented in the source data were used to develop a common moment magnitude (**M**). The **M**-based catalog was then processed to identify and remove aftershocks using the methodology developed in EPRI-SOG (1988), thereby producing a catalog of independent earthquake events.

Source (Internet URL, CD/DVD-ROM): Records were obtained from several sources: USGS, GSC, NCEER, EPRI-SOG, ANSS, CERI, SUSN, SLU, Lamont-Doherty, Weston Observatory, NEDB, ISC, Jeff Munsey, Ann Metzger, Margaret Hopper, Sykes et al. (2008), and the Ohio Seismic Network.

Author/Publisher/Year: Several sources were compiled for this study. See accompanying metadata for complete reference list.

Data Summary: ESRI point shapefile with moment magnitude (**M**)

Disclaimer or Constraints on Use: No constraints have been identified.

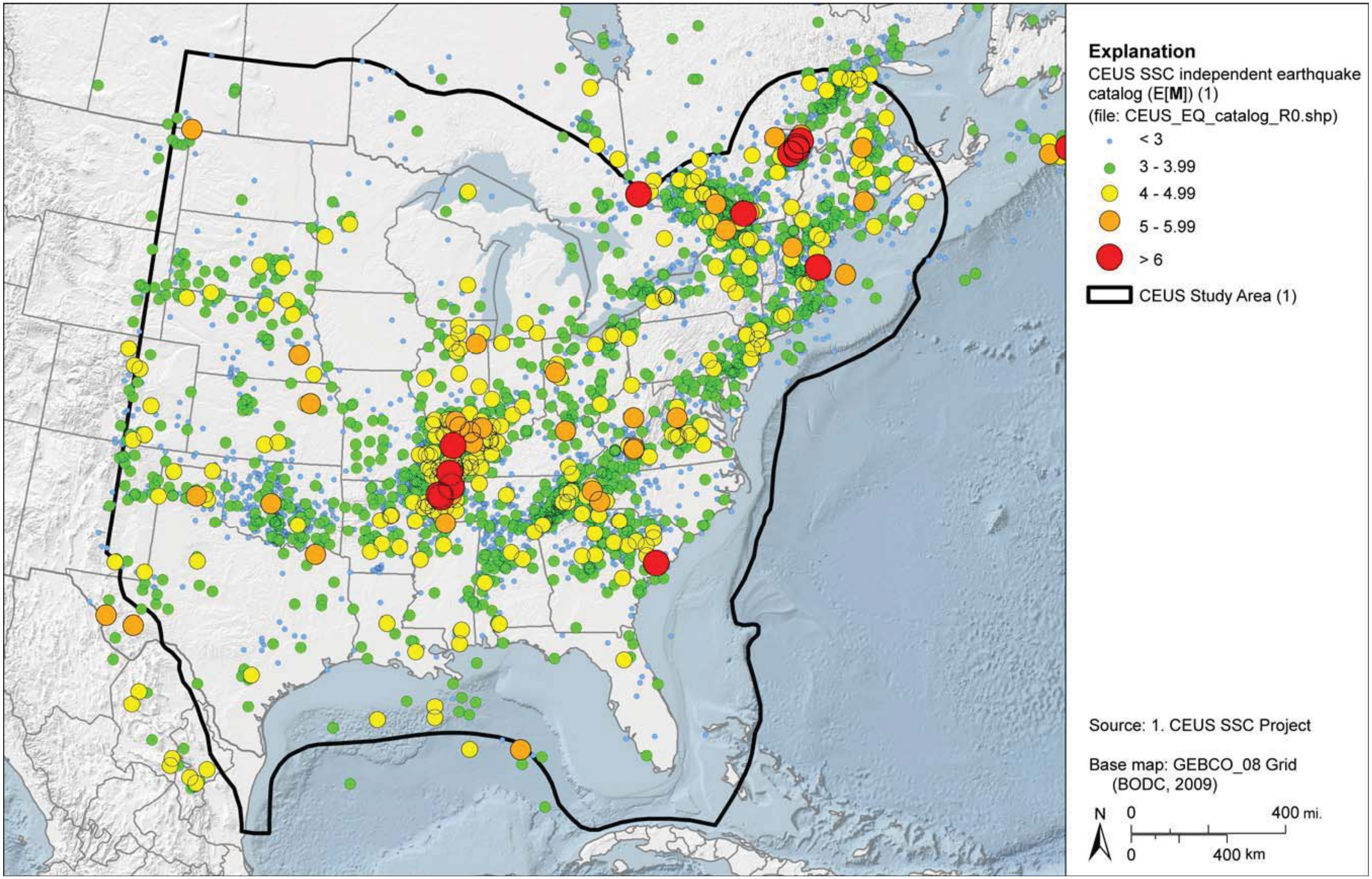

Figure A-2
CEUS SSC independent earthquake catalog

Sheet A-3—CEUS SSC Project GIS Data Summary

Bedrock Geology and Extended Crust after Kanter (1994)

CEUS_bedrock_geol_Kanter1994_R0.shp
CEUS_ext_areas_Kanter1994_R0.shp

Data Description: The data includes polygons representing the age and exposure of bedrock geology and the presence of extended crust in the CEUS as mapped by Kanter (1994). The bedrock geology data covers the CEUS, and the extended crust covers the Atlantic coastal region.

Source (Internet URL, CD/DVD-ROM): Digitized from figure in published report.

Author/Publisher/Year: Kanter, L.R., 1994, Tectonic Interpretation of Stable Continental Crust: *The Earthquakes of Stable Continental Regions, Volume I: Assessment of Large Earthquake Potential—Final Report TR-102261-V1*, prepared for Electric Power Research Institute.

Data Summary: Two ESRI polygon shapefiles have been developed and are intended to be used together; one data set containing the bedrock geology and the other showing areas of extended crust.

Disclaimer or Constraints on Use: No constraints have been identified.

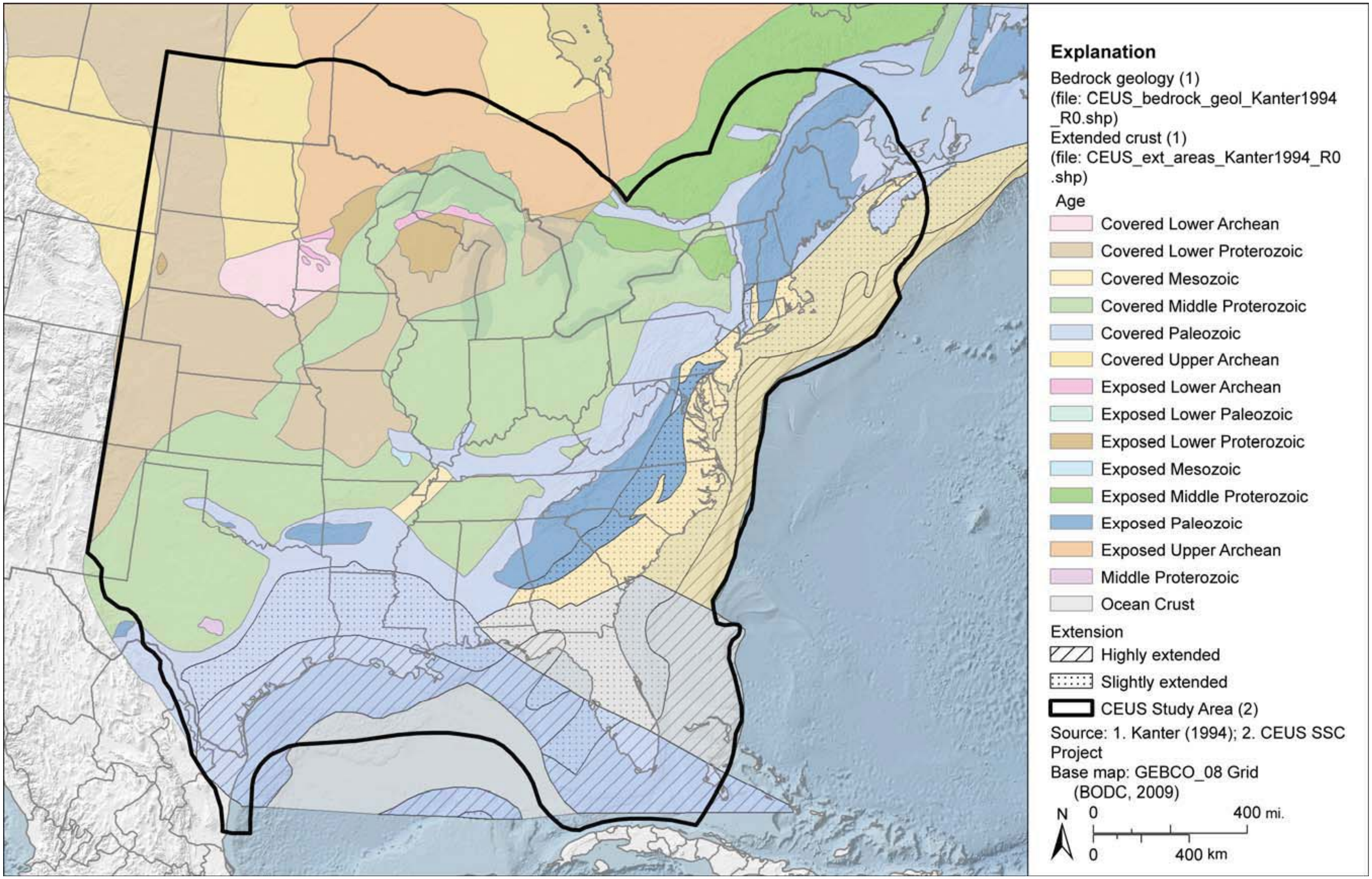

Figure A-3
Bedrock geology and extended crust after Kanter (1994)

Sheet A-4—CEUS SSC Project GIS Data Summary

Crustal Provinces after Rohs and Van Schmus (2007)

CEUS_pc_RohsVS2007_R0.shp

Data Description: Representation of crustal provinces, by age of crystallization, in the U.S.

Source (Internet URL, CD/DVD-ROM): Digitized after Rohs and Van Schmus (2007), Fig. 1, at a scale of 1:33,000,000 or larger.

Author/Publisher/Year: Rohs, C.R., and Van Schmus, V.R., 2007, Isotopic connections between basement rocks exposed in the St. Francois Mountains and the Arbuckle Mountains, southern midcontinent North America: *International Journal of Earth Sciences,* v. 96, pp. 599-611.

Data Summary: ESRI polygon shapefile representing crustal provinces. Each polygon is attributed according to the information presented in the source figure in Rohs and Van Schmus, 2007. Areas of empty polygon attributes represent areas of the conterminous U.S. that are not attributed in the source figure.

Disclaimer or Constraints on Use: No constraints have been identified.

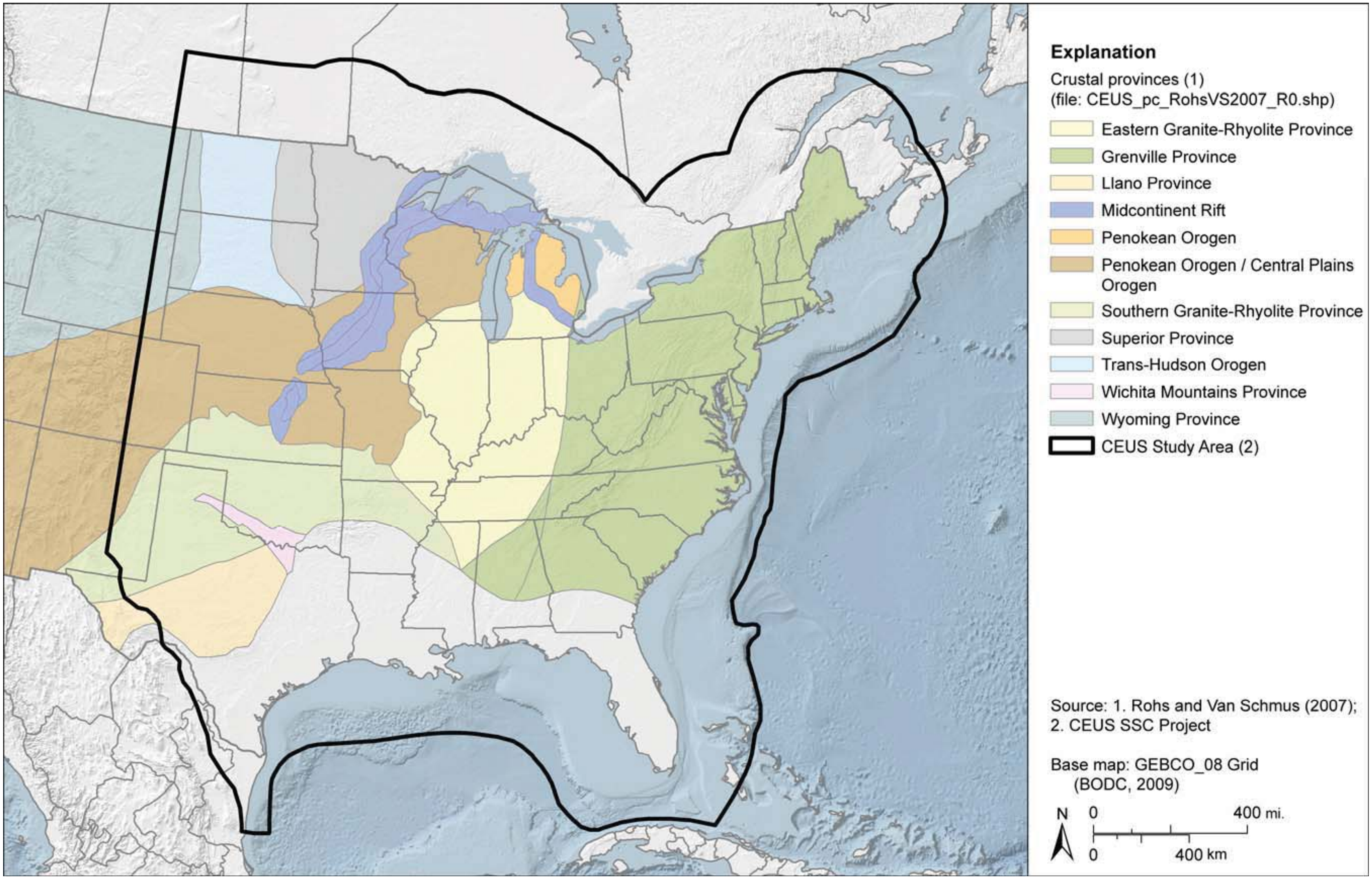

Figure A-4
Crustal provinces after Rohs and Van Schmus (2007)

Sheet A-5—CEUS SSC Project GIS Data Summary

Database of the Geologic Map of North America—Adapted from by J.C. Reed, Jr. et al. (2005)

GIS Layer Contents

Base map features	Bathymetry.shp Cities.shp Drainage.shp GMNA_bound.shp Open_water.shp Political_boundaries.shp
Geologic unit features	Faults.shp Geologic_contacts.shp Geologic_overprints.shp Geologic_units.shp
Miscellaneous geologic features	Calderas.shp Diapiric_structure_trends.shp Diapiric_structures.shp Diapirs.shp Dikes_and_sills.shp Glaciation_extent.shp Impact_structures_greater_than_10KM.shp Impact_structures_less_than_10KM.shp Small_bodies_of_unusual_igneous_rocks.shp Volcanoes.shp
Special submarine features	Gas_fluid_seeps.shp Gas_oil_seeps.shp Hydrothermal_vents.shp Maganiferous_deposits.shp Phosphate_nodules_or_pavement.shp Polymetallic_sulfide_deposits.shp Rock_in_seafloor_sample.shp

Data Description: Database of the Geologic Map of North America. The data depicts the surface and submarine geology of North America and portions in the Atlantic and Pacific oceans at 1:5,000,000 scale. Digitized from Reed et al. (1993). GIS layers listed above are organized into subfolders (left column) and contain the ESRI shapefiles in the right column. A separate folder named Layer_files contains the ESRI layer symbology developed by the authors for the shapefiles listed above.

Source (Internet URL, CD/DVD-ROM): http://pubs.usgs.gov/ds/424/.

Author/Publisher/Year: Garrity, C.P., and Soller, D.R., 2009, *Database of the Geologic Map of North America; Adapted from the Map by J.C. Reed, Jr., and Others (2005)*: U.S. Geological Survey Data Series 424 (CD-ROM); http://pubs.usgs.gov/ds/424/.

Data Summary: The USGS source data has been converted to ESRI shapefile format from the ESRI file geodatabase format. ESRI map symbology layers accompany the data with standardized geologic map symbology and color palette. Layers have been converted from a custom transverse Mercator projection to geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: Data are not intended to be used at a scale larger than 1:5,000,000.

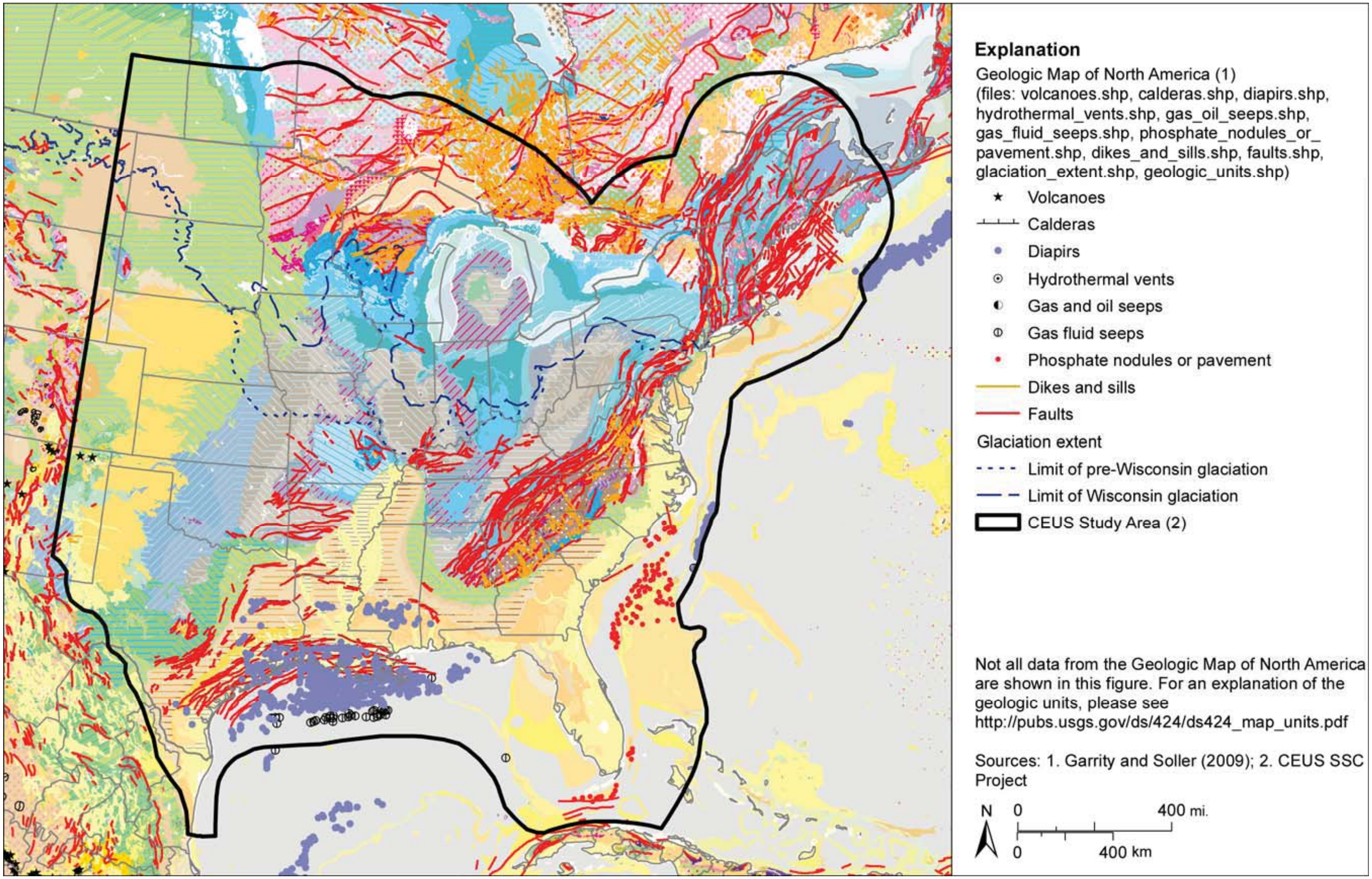

Figure A-5
Geologic map of North America

Sheet A-6—CEUS SSC Project GIS Data Summary

Compilation of Geologic Cross Sections

CEUS_geologic_cross_sec_loc_R0.shp

Data Description: Locations of published geologic cross sections across the CEUS. Several sources were used in compiling this data set. These lines depict the digitized locations of the geologic cross sections across the CEUS. Data set attribute table contains the sources for each geologic cross section profile location and the cross section identifiers for each cross section. Images of the cross sections are not included in the data set.

Source (Internet URL, CD/DVD-ROM): Digitized cross section locations from various publications including AAPG geologic highway maps, DNAG plates, and Texas Bureau of Economic Geology maps.

Author/Publisher/Year: See metadata for complete reference list.

Data Summary: The source references were georeferenced and digitized at a scale equal to or larger than the published scale of the source. ESRI line shapefiles depict the locations of the geologic cross sections.

Disclaimer or Constraints on Use: No constraints have been identified.

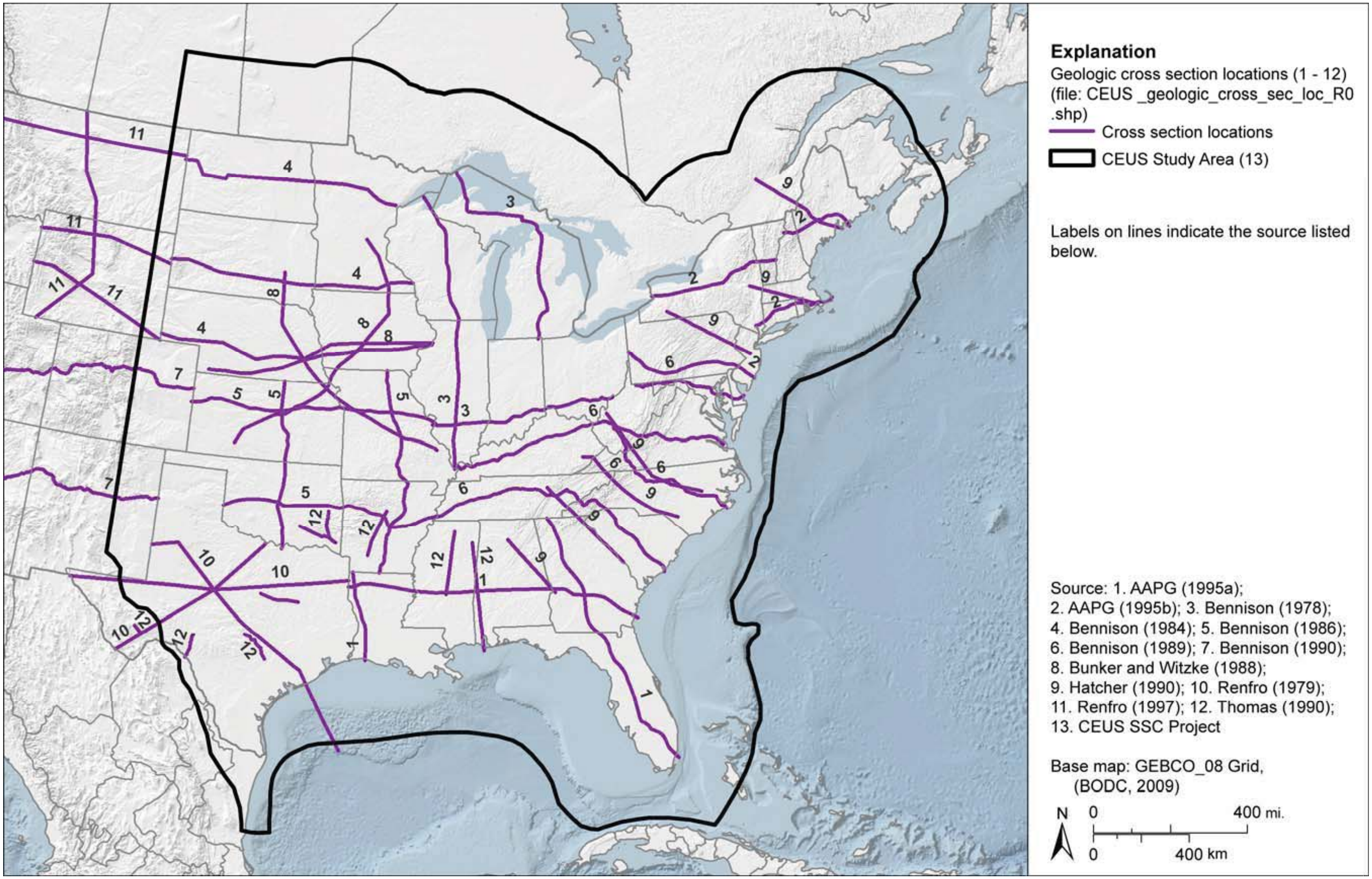

Figure A-6
Locations of geologic cross sections in the CEUS

Sheet A-7—CEUS SSC Project GIS Data Summary

Precambrian Crustal Boundary by Van Schmus et al. (1996)

CEUS_crustal_boundary_VanSchmus1996_R0.shp

Data Description: Data set representing the inferred eastern limit of pre-1,600 million-year-old continental crust. Extends from southeastern Oklahoma to southwestern Ontario.

Source (Internet URL, CD/DVD-ROM): Digitized after Fig. 2 in Van Schmus et al. (1996).

Author/Publisher/Year: Van Schmus, W.R., Bickford, M.E., Turek, A., 1996, Proterozoic geology of the east-central mid-continent basement: in van der Pluijm, B.A., and Catacosinos, P.A. (editors), Basement and Basins of Eastern North America: Boulder, Colorado, *Geological Society of America Special Paper 308*, pp. 7-32.

Data Summary: This layer was digitized at a scale of 1:1,650,000 from authors' source figure (Fig. 2) with a published scale of approximately 1:14,085,000. Data are presented as an ESRI line shapefile.

Disclaimer or Constraints on Use: No constraints have been identified.

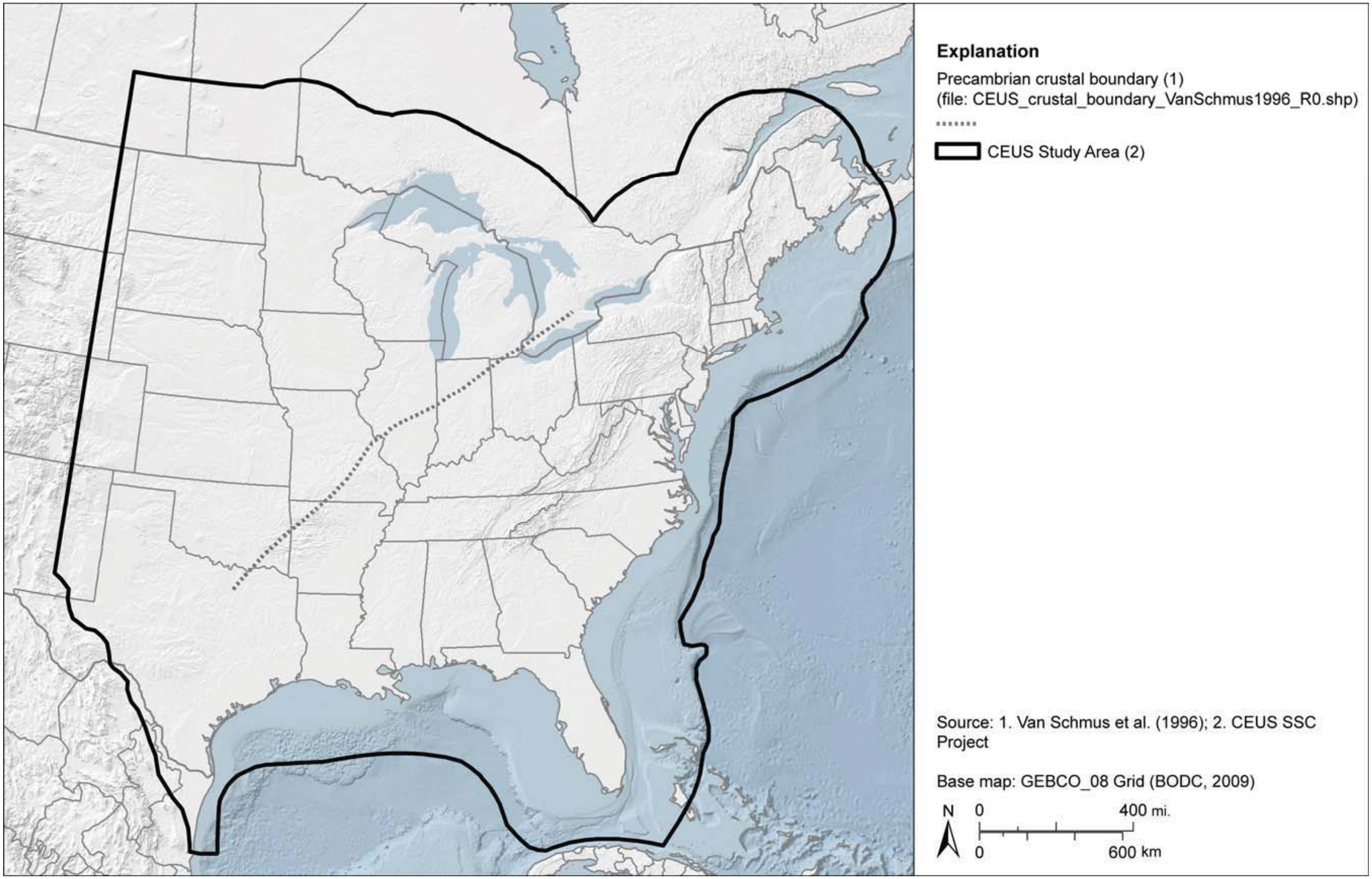

Figure A-7
Precambrian crustal boundary after Van Schmus et al. (1996)

Sheet A-8—CEUS SSC Project GIS Data Summary

Precambrian Geology and Features after Reed (1993)

CEUS_pc_AnomaliesDikes_Reed1993_R0.shp
CEUS_pc_FaultsContacts_Reed1993_R0.shp
CEUS_pc_Geol_Reed1993_R0.shp

Data Description: Data set created from Reed et al. (1993): Map of the Precambrian rocks of the Conterminous United States and Some Adjacent Parts of Canada. Faults, dikes, anomalies and geologic units are presented in separate shapefiles.

Source (Internet URL, CD/DVD-ROM): Digitized from published map.

Author/Publisher/Year: Reed, J.C., Jr., 1993, Map of the Precambrian rocks of the conterminous United States and some adjacent parts of Canada: in Reed, J.C., Jr., et al. (editors), *Precambrian: Conterminous U.S.*: Boulder, Colorado, Geological Society of America, Geology of North America, v. C-2, plate 1.

Data Summary: This data set was created by digitizing contacts, faults and other features to create lines representing faults, dikes, and other linear features, and polygons representing Precambrian geologic units. Faults and other features were attributed according to the information presented in the published map. Digitized at a scale of 1:5,000,000.

Disclaimer or Constraints on Use: No constraints have been identified.

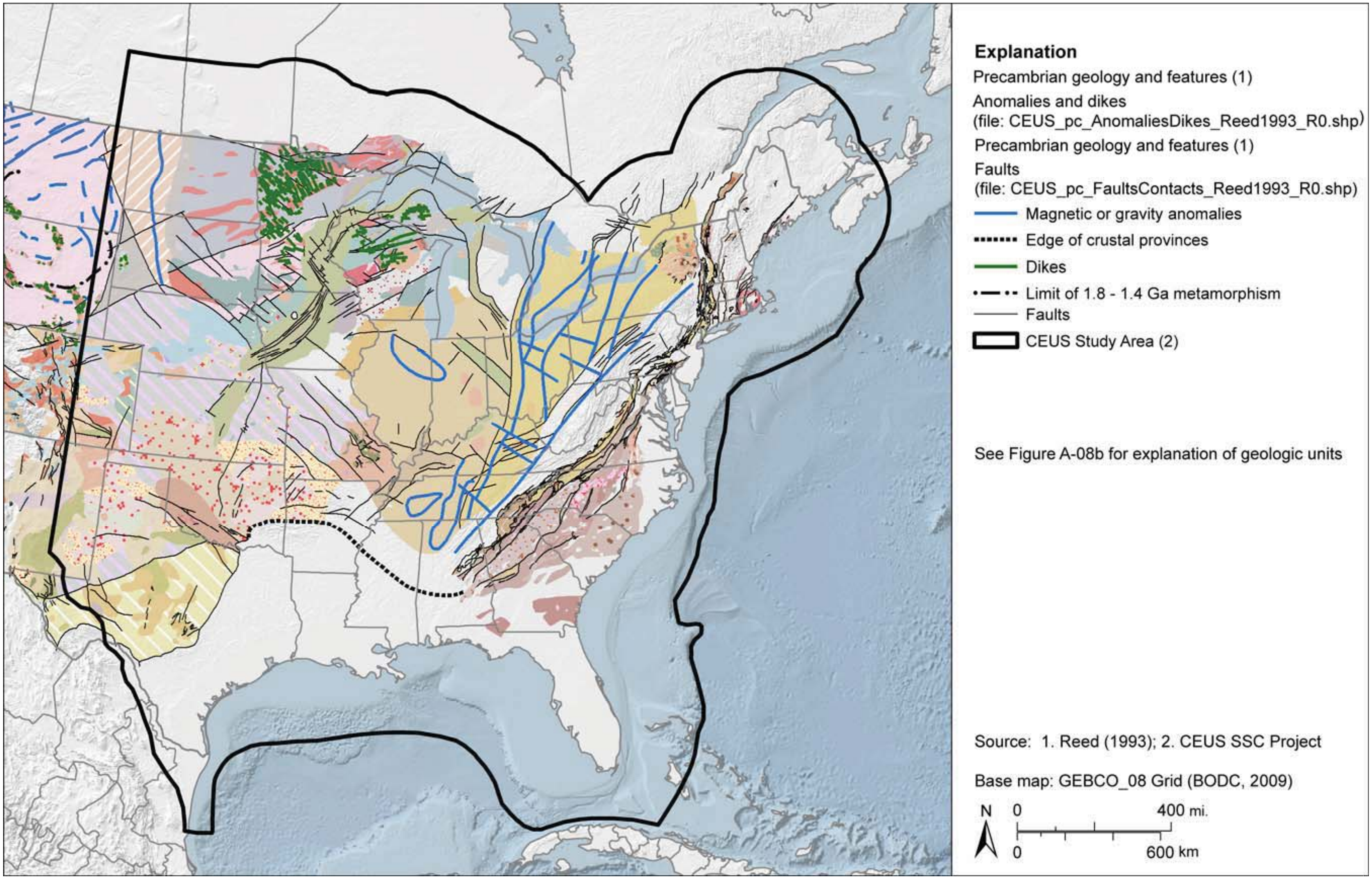

Figure A-8a
Precambrian geology and features after Reed (1993)

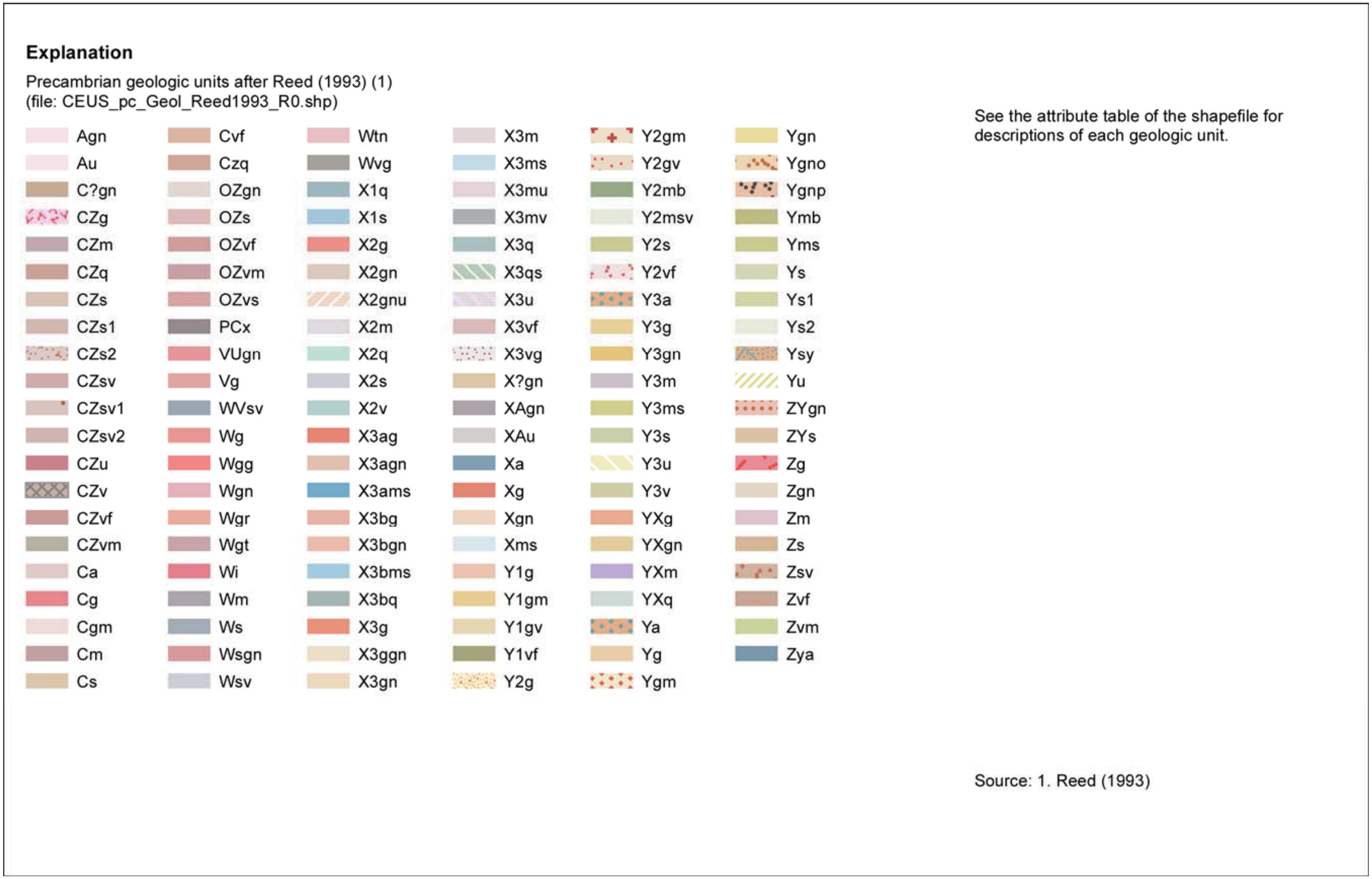

Figure A-8b
Explanation of Precambrian geology and features after Reed (1993)

Sheet A-9—CEUS SSC Project GIS Data Summary

Precambrian Provinces after Van Schmus et al. (2007)

CEUS_pc_basement_VanSchmus2007_R0.shp

Data Description: Data set represents Precambrian basement provinces as mapped by Van Schmus et al. (2007). Data extent covers a rectangular area from northwest North Dakota to northwest South Carolina.

Source (Internet URL, CD/DVD-ROM): Digitized from source figure in Van Schmus et al. (2007).

Author/Publisher/Year: Van Schmus, W.R. Schneider, D.A., Holm, D.K., Dodson, S., and Nelson, B.K., 2007, New insights in the southern margin of the Archean-Proterozoic boundary in the north-central United States based on U-Pb, Sm-Nd, and Ar-Ar geochronology: *Precambrian Research* v. 157, pp. 80-105.

Data Summary: ESRI polygon shapefile attributed according to Precambrian basement geology. Digitized at 1:13,500,000. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

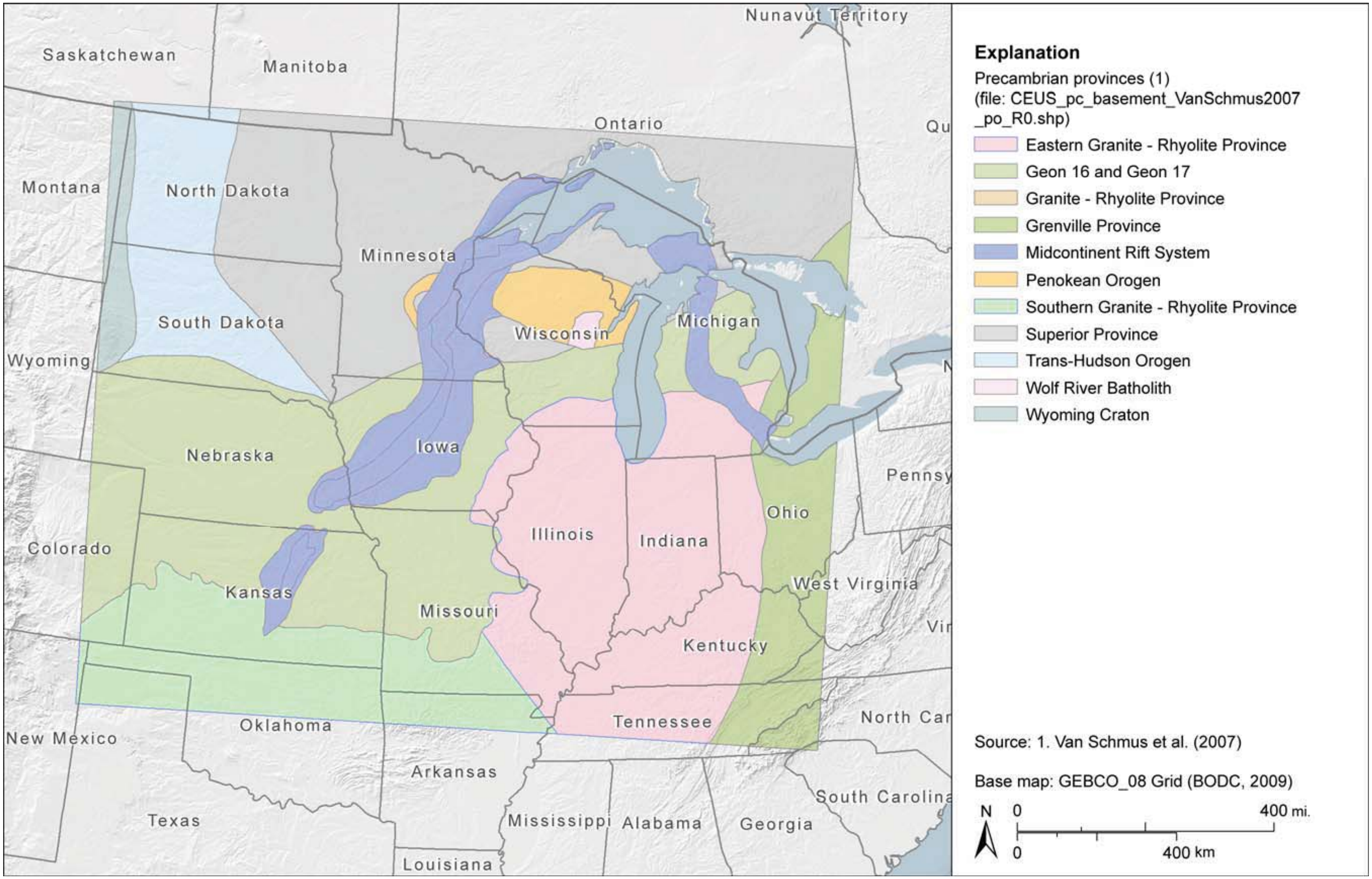

Figure A-9
Precambrian provinces after Van Schmus et al. (2007)

Sheet A-10—CEUS SSC Project GIS Data Summary

Precambrian Units after Whitmeyer and Karlstrom (2007)

CEUS_pc_Whitmeyer2007_R0.shp

Data Description: Data set represents a model for the tectonic growth of North America. Mapped units represent the ages of tectonic, accretionary, and depositional features.

Source (Internet URL, CD/DVD-ROM): Raster digital file provided by Steven Whitmeyer, 2008, personal communication.

Author/Publisher/Year: Whitmeyer, S.J., and Karlstrom, K.E., 2007, Tectonic model for the Proterozoic growth of North America: *Geosphere*, v. 3; no. 4, pp. 220-259.

Data Summary: ESRI polygon shapefile attributed as presented in the source figure. Digitized at 1:1,000,000. Data is presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

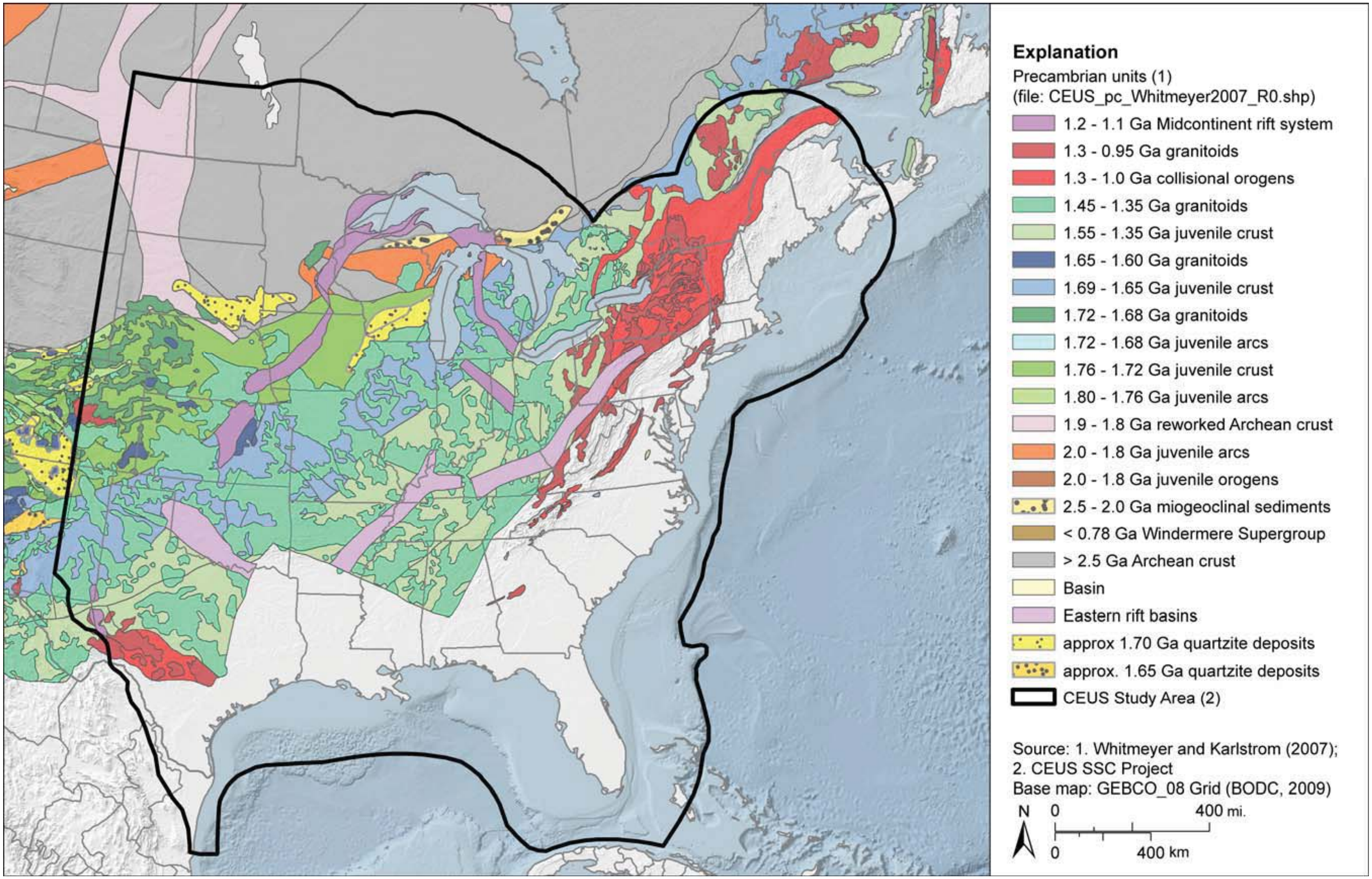

Figure A-10
Precambrian units after Whitmeyer and Karlstrom (2007)

Sheet A-11—CEUS SSC Project GIS Data Summary

Surficial Materials in the Conterminous United States

Surficial_materials.shp, Contacts,shp, State_lines.shp

Data Description: These shapefiles represent the distribution of surficial materials in the conterminous U.S. The GIS database includes surficial materials (geologic units), contacts and state boundaries. Shapefiles were downloaded directly from the website below. A map by Soller and Reheis (2004; scale of 1:5,000,000; http://pubs.usgs.gov/of/2003/of03-275/) was originally published in PDF format. The included data is the GIS database that was used to prepare the above publication.

Source (Internet URL, CD/DVD-ROM): http://pubs.usgs.gov/ds/425/.

Author/Publisher/Year: Soller, D.R., Reheis, M.C., Garrity, C.P., and Van Sistine, D.R., 2009*, Map Database for Surficial Materials in the Conterminous United States*: U.S. Geological Survey, Data Series 425, scale 1:5,000,000; http://pubs.usgs.gov/ds/425/.

Data Summary: These layers were exported to ESRI shapefile format from the ESRI file geodatabase format provided by the USGS. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: The USGS compiled this from state-scale source maps. This results in some data discrepancies at state boundaries therefore limiting its usefulness.

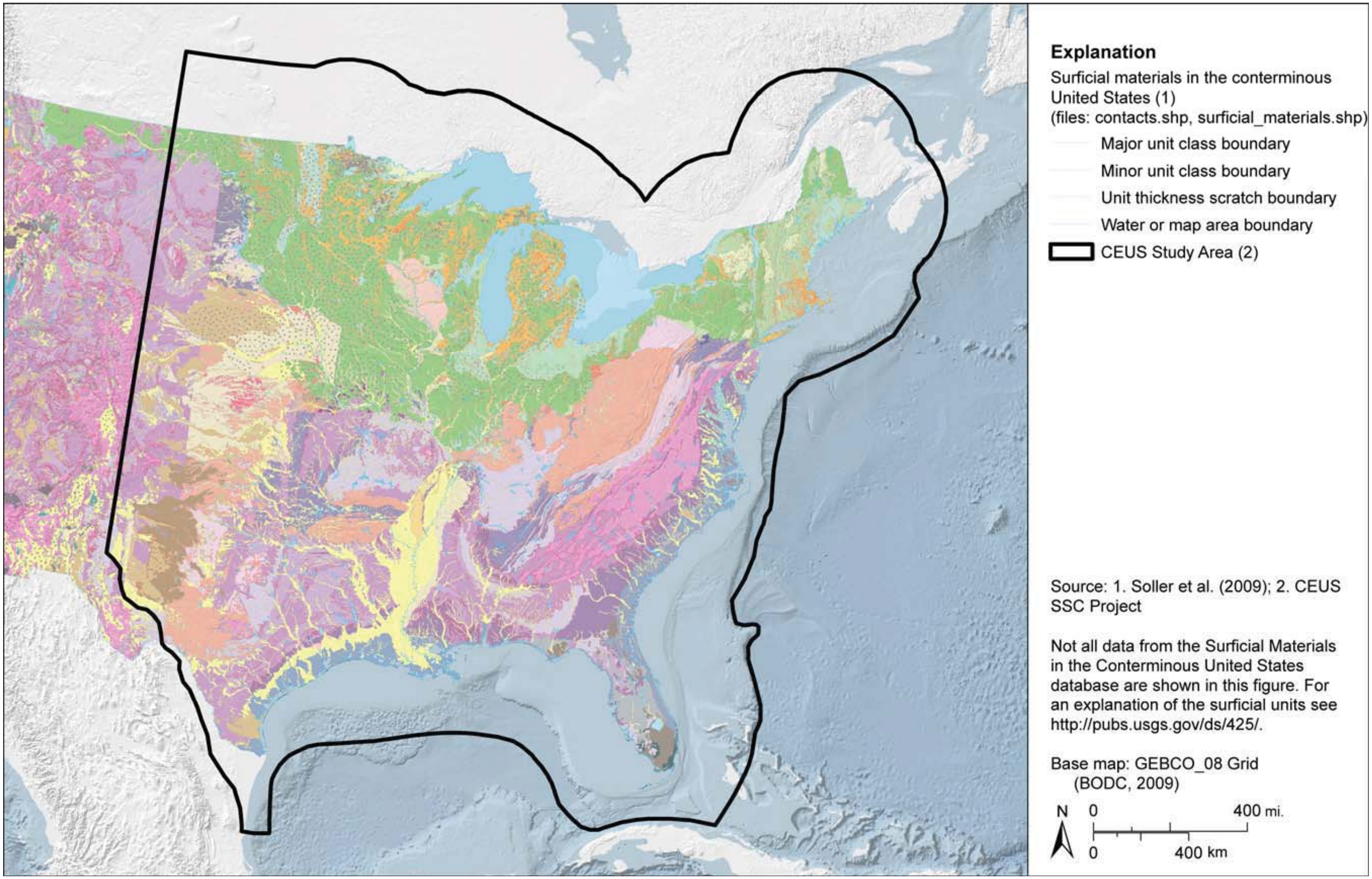

Figure A-11
Surficial materials in the conterminous United States after Soller et al. (2009)

Sheet A-12—CEUS SSC Project GIS Data Summary

USGS Crustal Database—Seismic Properties of North America and the Surrounding Ocean Basins

CEUS_crustal_db_USGS_R0.shp

Data Description: Data set of the USGS global structure database developed by Walter Mooney. Attributes include basement thickness, sediment thickness, heat flow values, V_p, and V_s. Sediment thickness, contained in the attribute "sed_thick", was derived from the subtraction of basement thickness from thickness with sediment ("thickw_sed"). Values for V_p are extracted from the source data set for the first basement depth layer (below the sediment layers, if present). Values for V_s are not complete; only 150 of the 5,237 data points have values for V_s greater than zero. Values of V_s equal to "0.00" indicate no data entry. Values for heat flow are not complete in this version of the database provided by the USGS. Units of heat flow are milliwatts per square meter.

We expect continued updates of the database by the USGS. Check the website below for the most current version.

Source (Internet URL, CD/DVD-ROM): http://earthquake.usgs.gov/research/structure/crust/nam.php.

Author/Publisher/Year: USGS Crustal Database—Seismic properties of North America and the surrounding ocean basins. Data accessed April 24, 2008, from the above website.

Data Summary: ESRI point shapefile developed from ASCII-formatted data available at the above website. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints identified other that the limited V_s values and heat flow values noted above.

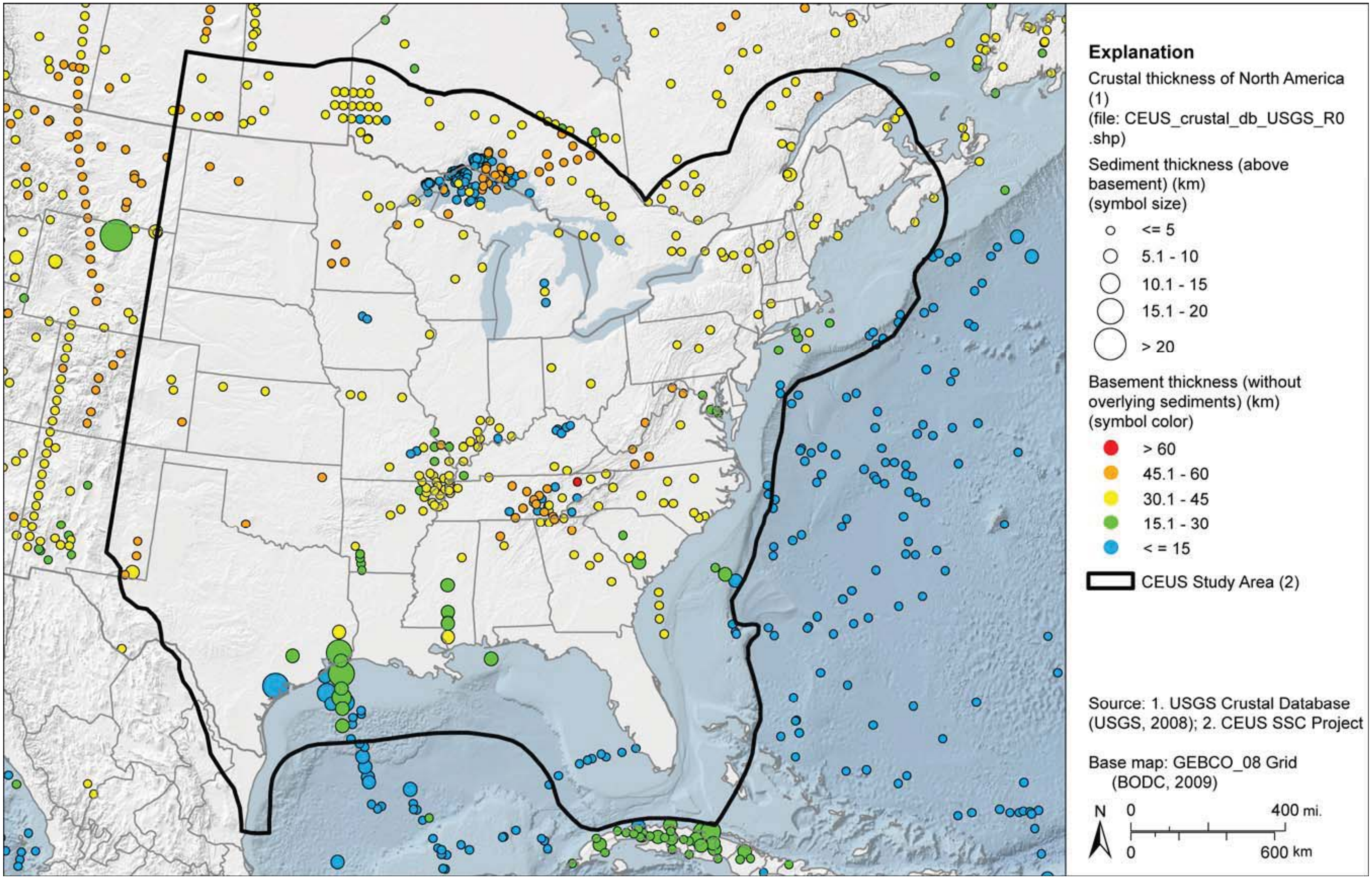

Figure A-12
Basement and sediment thickness in the USGS Crustal Database for North America. Symbol size represents overlying sediment thickness (km); symbol color represents basement thickness (km).

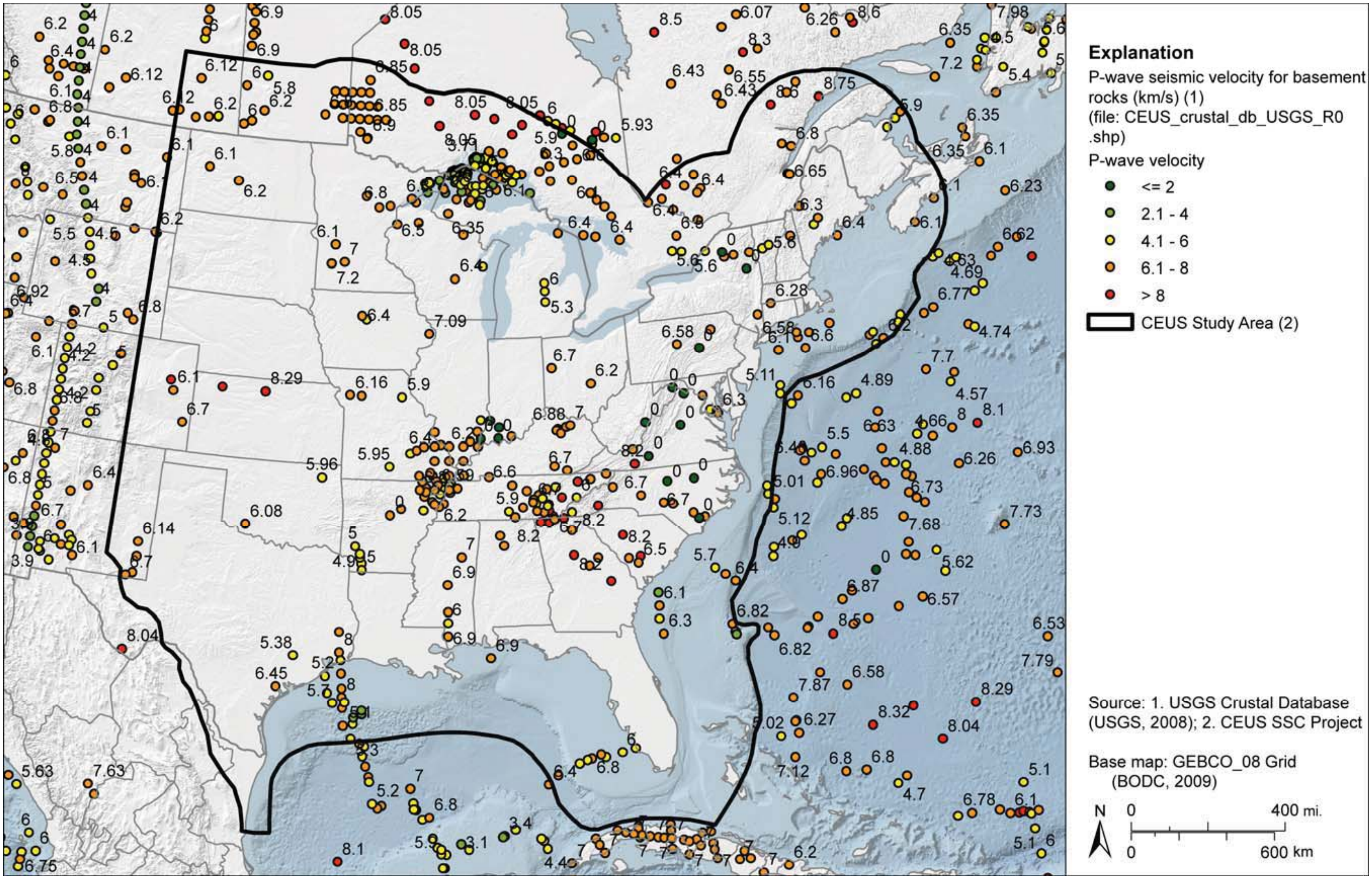

Figure A-13
Top of basement P-wave seismic velocity in the USGS Crustal Database for North America

Sheet A-13—CEUS SSC Project GIS Data Summary

Sediment Thickness for North America and Neighboring Regions

CEUS_sed_thickness_USGS_R0.tif

Data Description: Surface depicting sediment thickness provided by W. Mooney. These are the digital data presented during Workshop #1 on July 22, 2008. These data were subsequently displayed in the article referenced below.

Source (Internet URL, CD/DVD-ROM): Figure of the sediment thickness data provided during a presentation by W. Mooney during Workshop #1, July 22, 2008. Digital data provided by W. Mooney on September 29, 2011.

Author/Publisher/Year: Mooney, W.D., 2011, personal communication. Data was presented as a figure in:

Mooney, W.D. and Kaban, M.K., 2010, The North American upper mantle: Density, composition, and evolution: *Journal of Geophysical Research*, v. 115.

Data Summary: Values in the GeoTIFF represent sediment thickness in km. Data are spaced at 30 arc-seconds (0.08333 degrees). Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: The author’s citation should be referenced in all subsequent uses of this data.

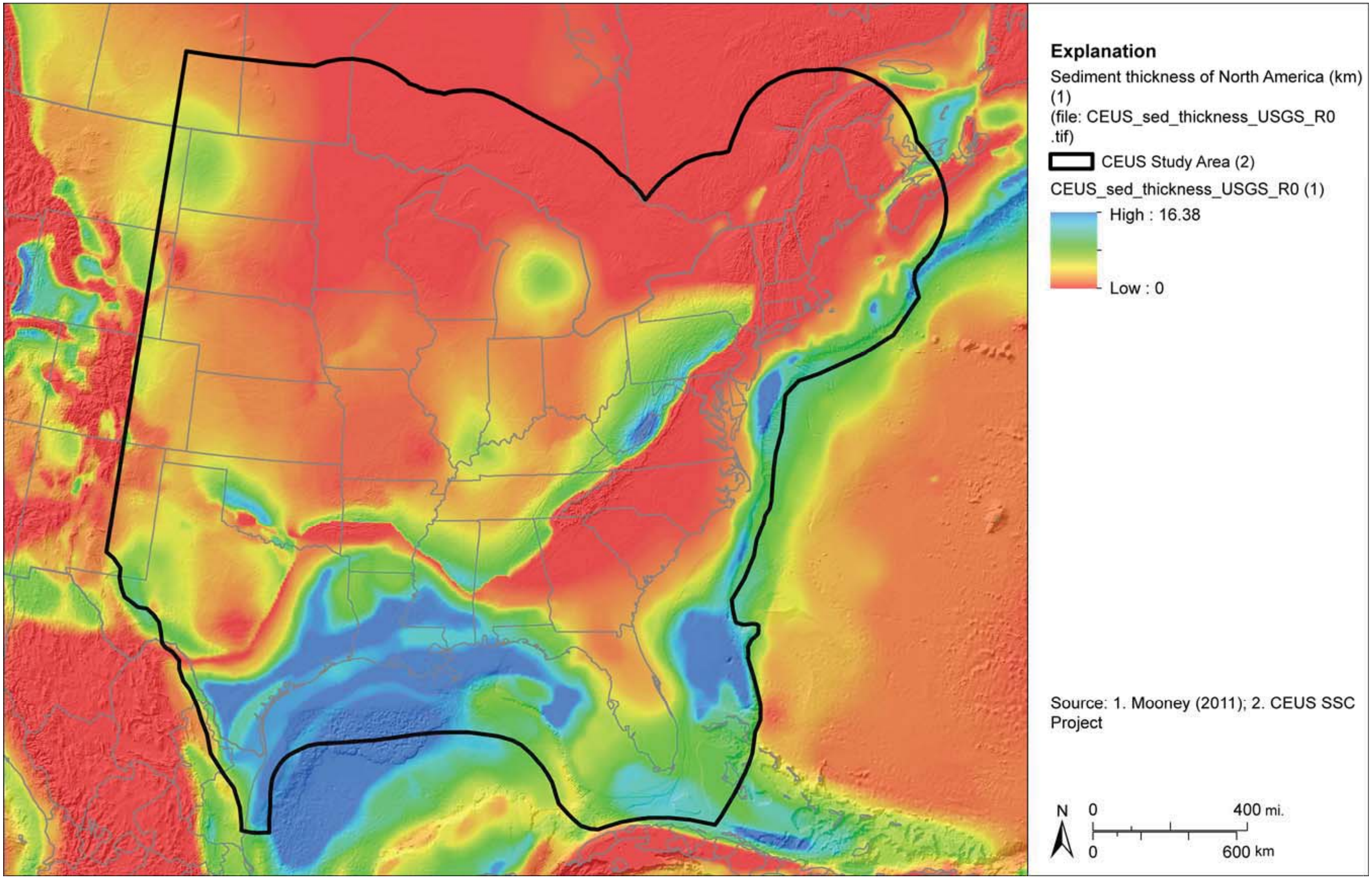

Figure A-14
Sediment thickness for North America and neighboring regions

Sheet A-14—CEUS SSC Project GIS Data Summary

USGS Physiographic Divisions of the Conterminous United States

CEUS_physio_USGS_R0.shp

Data Description: This data set is a polygon representation of Fenneman and Johnson's "Physiographic Divisions of the United States." This map divides the U.S. into eight major divisions, 25 provinces, and 86 sections representing distinctive areas having common topography, rock types and structure, and geologic and geomorphic history.

Source (Internet URL, CD/DVD-ROM): USGS (2002): http://water.usgs.gov/GIS/dsdl/physio.gz.

Author/Publisher/Year: Fenneman, N.M., and Johnson, D.W., 1946, *Physiographic Divisions of the United States*, U.S. Geological Survey (USGS), Washington, D.C., http://water.usgs.gov/GIS/dsdl/physio.gz.

Data Summary: The source map was compiled as a GIS data set by the USGS and made available online at the website listed above. Features were digitized from a mylar base and presented in a polyconic projection. The scale of the data is 1:7,000,000. The data layer is an ESRI polygon shapefile. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: These data are most appropriate for small-scale (regional) analysis rather than for assessment for specific locations.

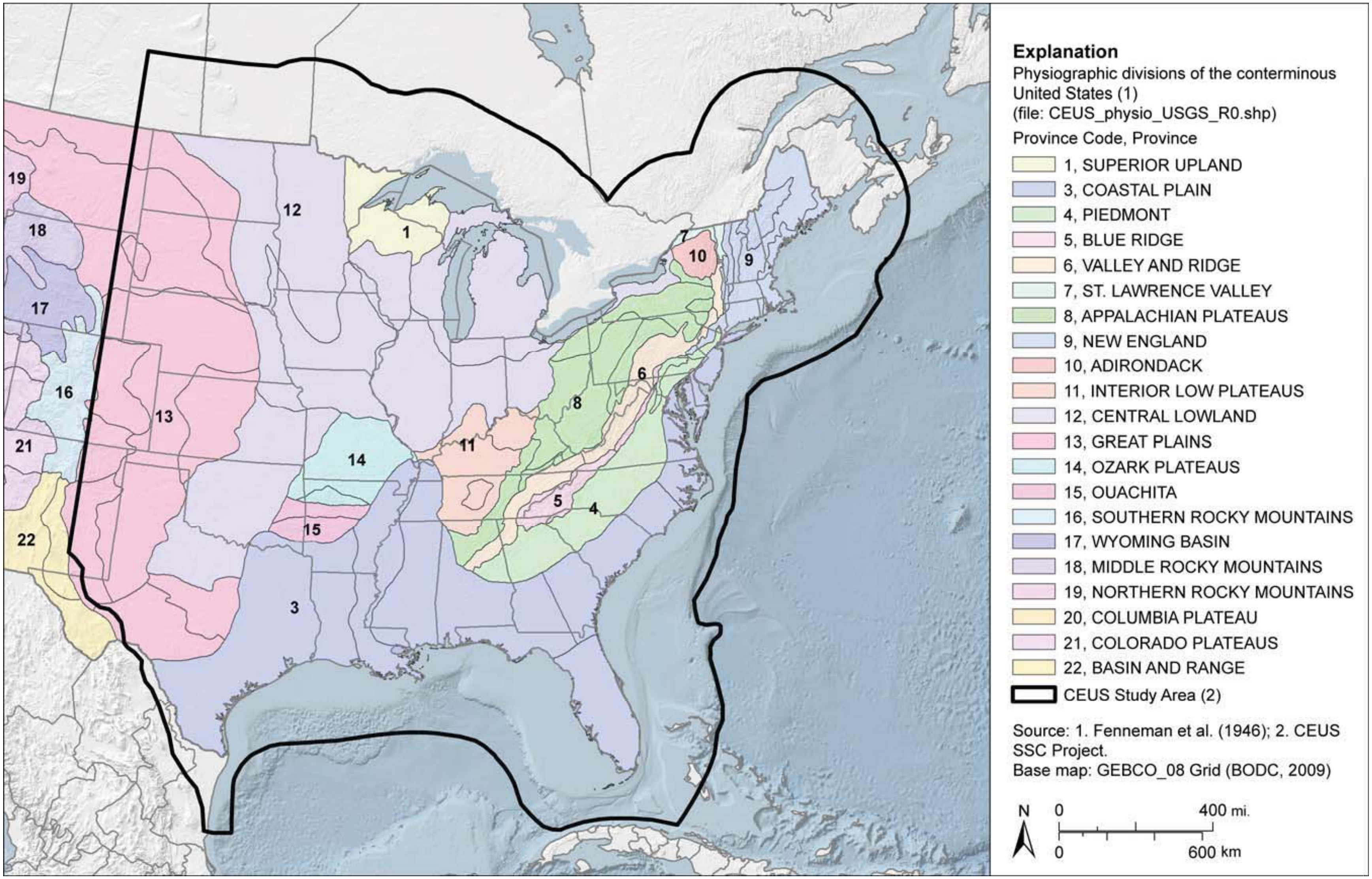

Figure A-15
Physiographic divisions of the conterminous United States after Fenneman and Johnson (1946)

Sheet A-15—CEUS SSC Project GIS Data Summary

CEUS SSC Gravity Anomaly Database Grids

CEUS_GRAV_<varies>_CEUSSSC_R0.tif

Data Description: These data sets present gravity anomaly data compiled from several public-domain and unpublished sources for use in the CEUS SSC Project. Bouguer, free-air, isostatic, and various derivatives of these data sets are provided. Data are presented in milligals (mGal) or mGal per kilometer (mGal/km) as noted below.

File Name	*Data Description*
CEUS_GRAV_Freeair_CEUSSSC_R0.TIF	Free-air anomaly (mGal)
CEUS_GRAV_Bouguer_CEUSSSC_R0.TIF	Complete Bouguer anomaly with free-air anomaly in marine areas (mGal)
CEUS_GRAV_RI_CEUSSSC_R0.TIF	Residual isostatic anomaly (mGal)
CEUS_GRAV_Isostatic_CEUSSSC_R0.TIF	Regional isostatic anomaly (mGal)
CEUS_GRAV_RI_1VD_CEUSSSC_R0.TIF	First vertical derivative of residual isostatic anomaly (mGal/km)
CEUS_GRAV_Bouguer_1VD_CEUSSSC_R0.TIF	First vertical derivative of Bouguer with free-air anomaly in marine areas (mGal/km)
CEUS_GRAV_Bouguer_LP_240km_CEUSSSC_R0.TIF	Complete Bouguer anomaly (with marine free-air) low pass filtered at 240 km (mGal)
CEUS_GRAV_Bouguer_HP_240km_CEUSSSC_R0.TIF	Complete Bouguer anomaly (with marine free-air) high pass filtered at 240 km (mGal)
CEUS_GRAV_Bouguer_HP_120km_CEUSSSC_R0.TIF	Complete Bouguer anomaly (with marine free-air) high pass filtered at 120 km (mGal)
CEUS_GRAV_Bouguer_UC_40km_CEUSSSC_R0.TIF	Bouguer anomaly with marine free-air anomaly upward continued to 40 km (mGal)
CEUS_GRAV_Bouguer-Bouguer_UC_40km_CEUSSSC_R0.TIF	Bouguer anomaly with marine free-air minus the Bouguer anomaly with marine free-air anomaly upward continued to 40 km (mGal)
CEUS_GRAV_Bouguer_UC_100km_CEUSSSC_R0.TIF	Bouguer anomaly with marine free-air anomaly upward continued to 100 km (mGal)
CEUS_GRAV_Bouguer-Bouguer_UC_100km_CEUSSSC_R0.TIF	Bouguer anomaly with marine free-air minus the Bouguer anomaly with marine free-air anomaly upward continued to

	100 km (mGal)
CEUS_GRAV_RI_HD_CEUSSSC_R0.TIF	Horizontal derivative of residual isostatic anomaly (mGal/km)
CEUS_GRAV_RI_HD_1VD_CEUSSSC_R0.TIF	Horizontal derivative of first vertical derivative of residual isostatic anomaly (mGal/km)

Shaded relief versions of the above shapefiles are presented where possible. The shaded relief of the gravity anomalies are provided in two versions. Those named with "315hs" in the file name present a shaded relief with a sun orientation of 315 degrees (45 degrees west of north) and a sun angle of 30 degrees above the horizon, while those with "180hs" in the file name present a shaded relief with a sun orientation of 180 degrees (south) and a sun angle of 30 degrees above the horizon.

Source (Internet URL, CD/DVD-ROM): Keller, G.R., 2010, personal communication.

Author/Publisher/Year: CEUS SSC Project.

Data Summary: Data provided at a grid resolution of 0.033 decimal degrees and converted to TIFF format. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

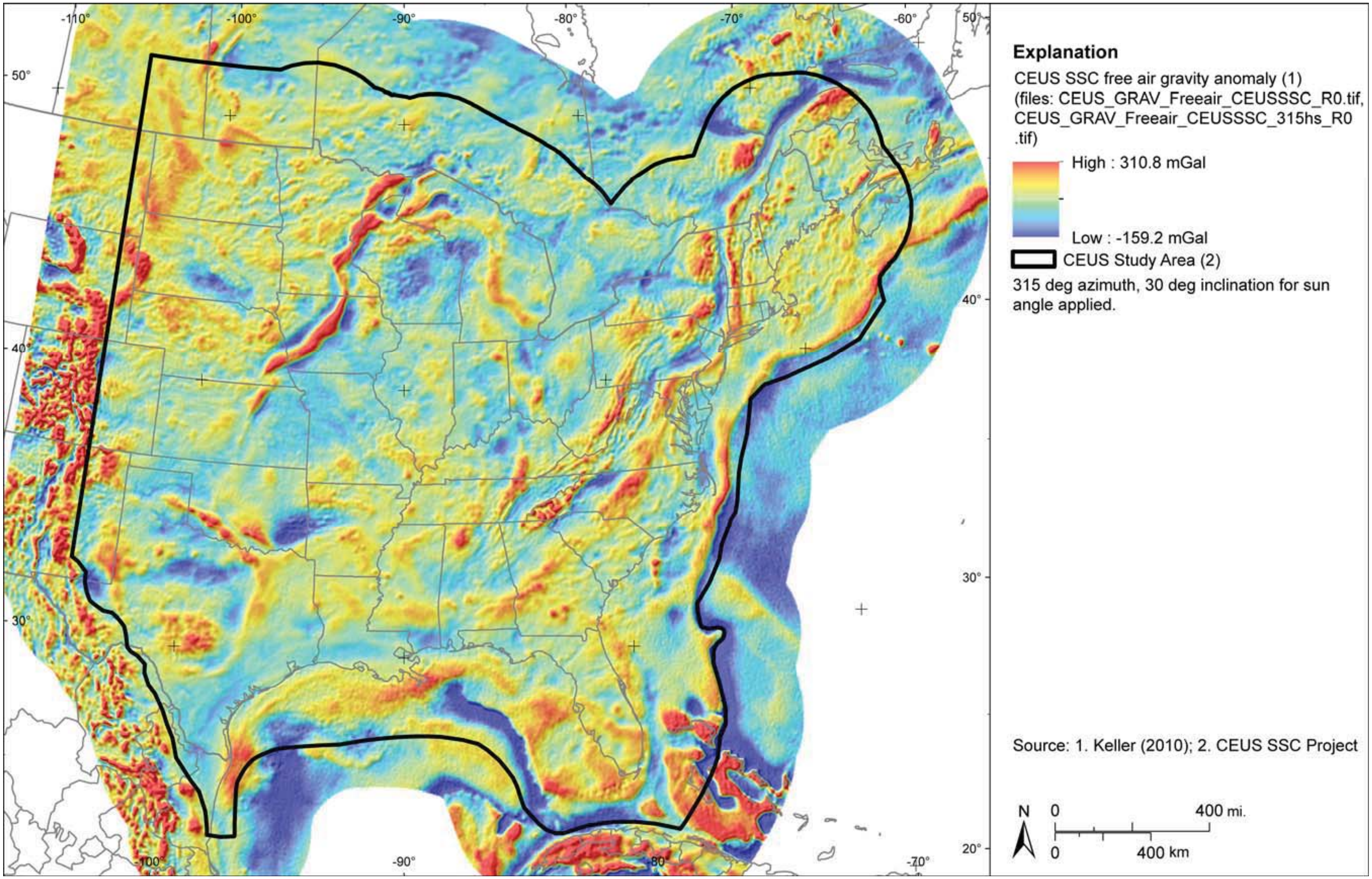

Figure A-16
CEUS SSC free-air gravity anomaly grid. Shaded relief with 315-degree azimuth and 30-degree inclination applied.

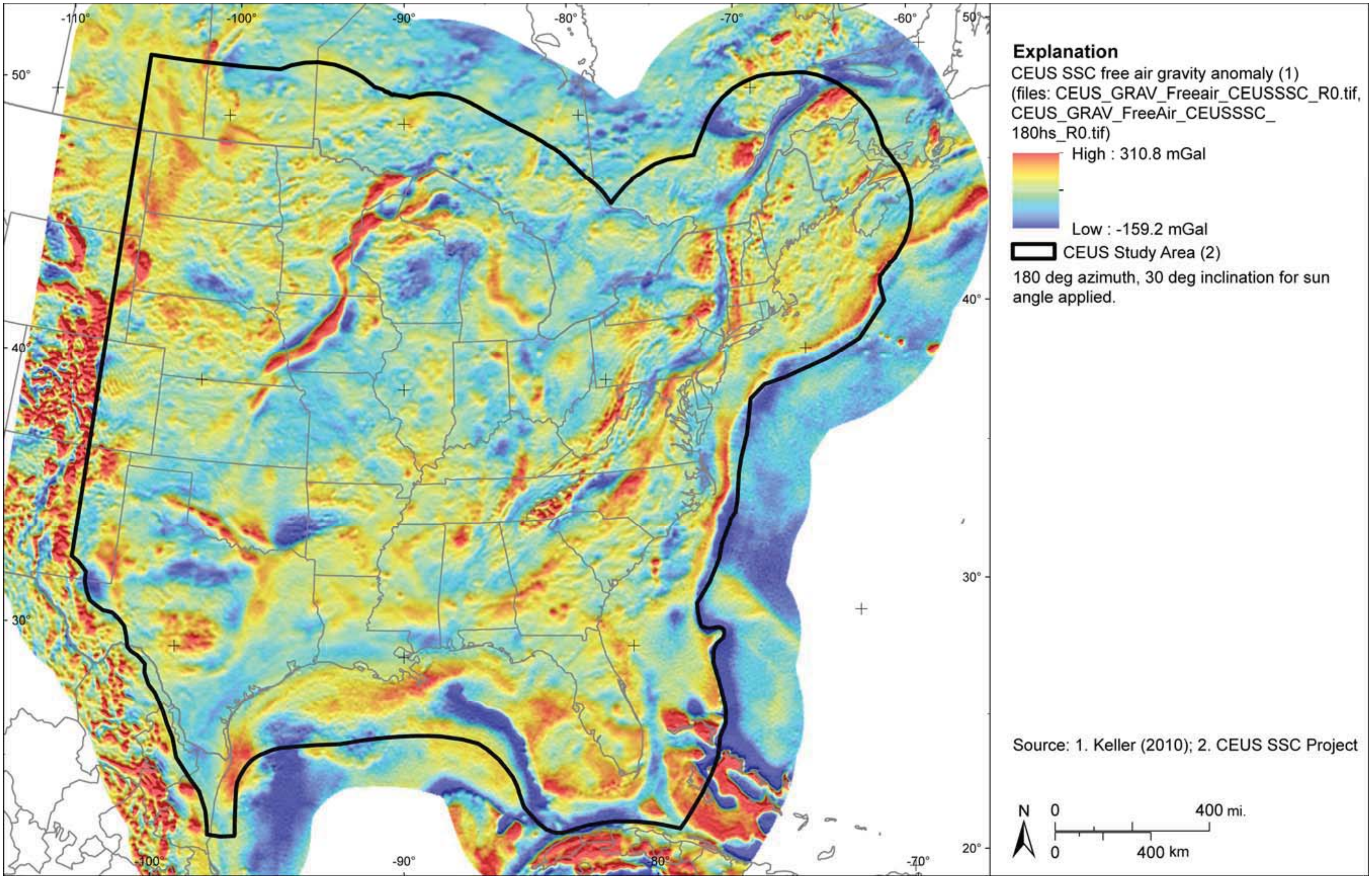

Figure A-17
CEUS SSC free-air gravity anomaly grid. Shaded relief with 180-degree azimuth and 30-degree inclination applied.

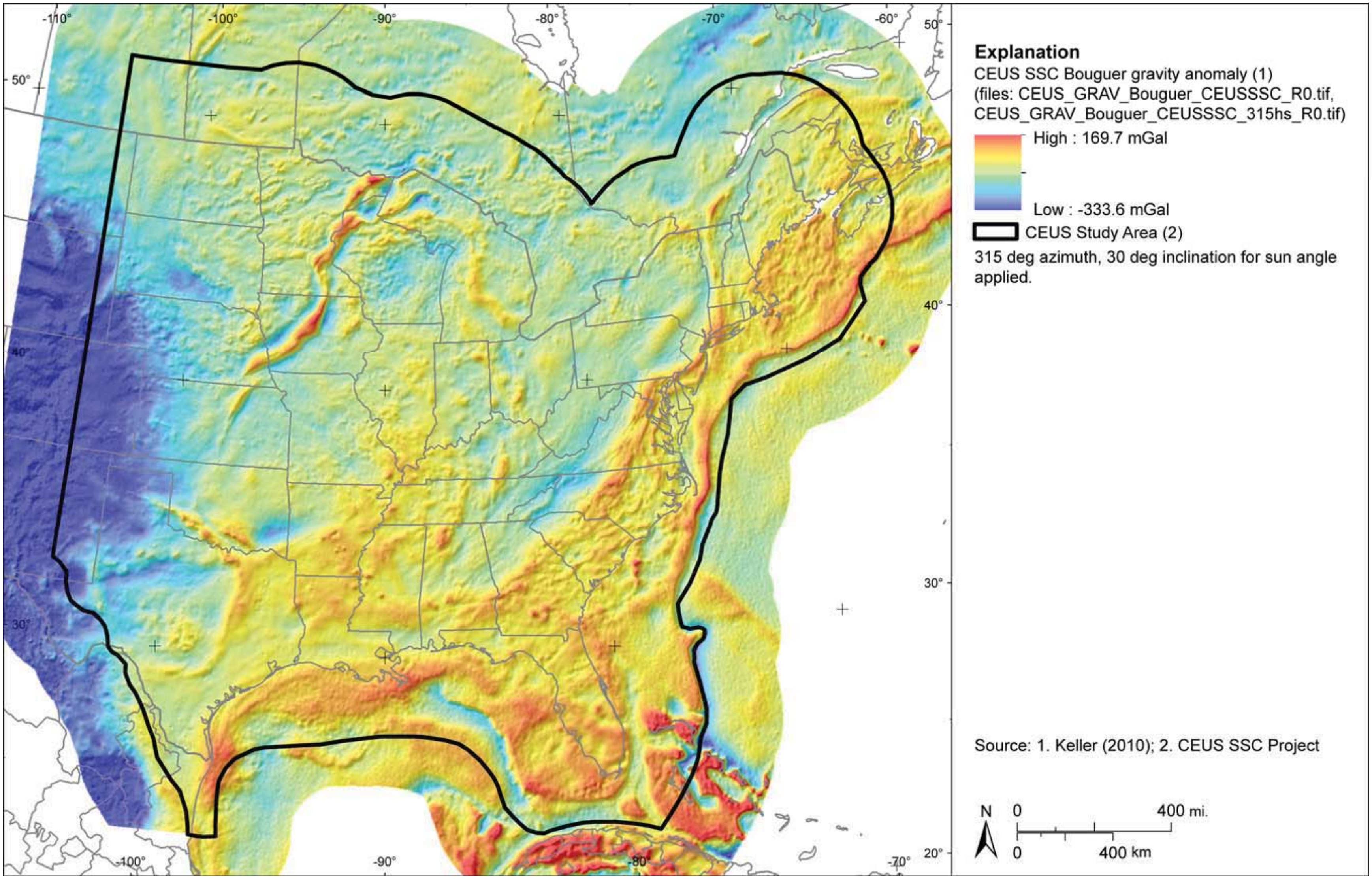

Figure A-18
CEUS SSC complete Bouguer gravity anomaly grid with free-air gravity anomaly in marine areas. Shaded relief with 315-degree azimuth and 30-degree inclination applied.

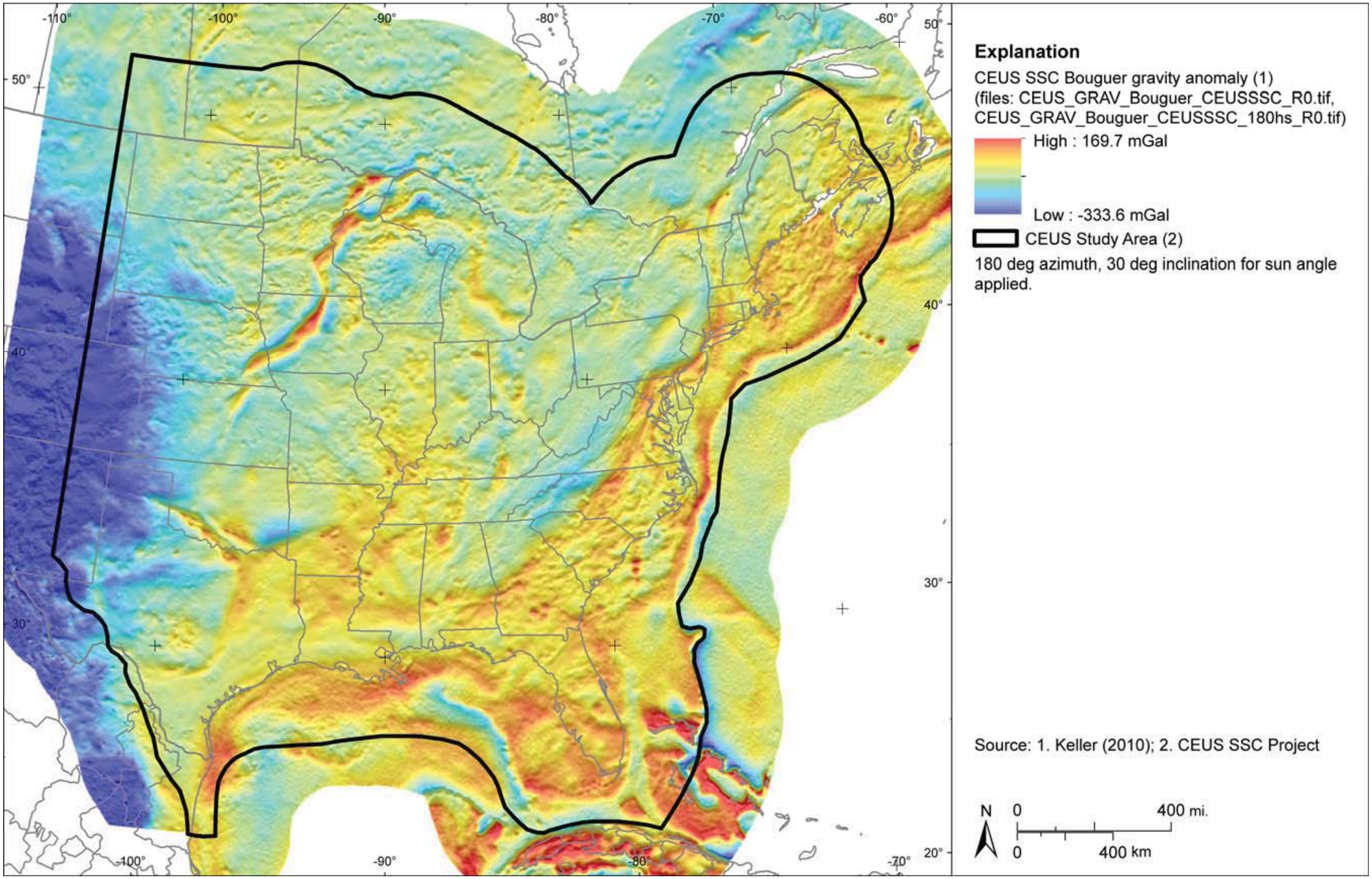

Figure A-19
CEUS SSC complete Bouguer gravity anomaly grid with free-air gravity anomaly in marine areas. Shaded relief with 180-degree azimuth and 30-degree inclination applied.

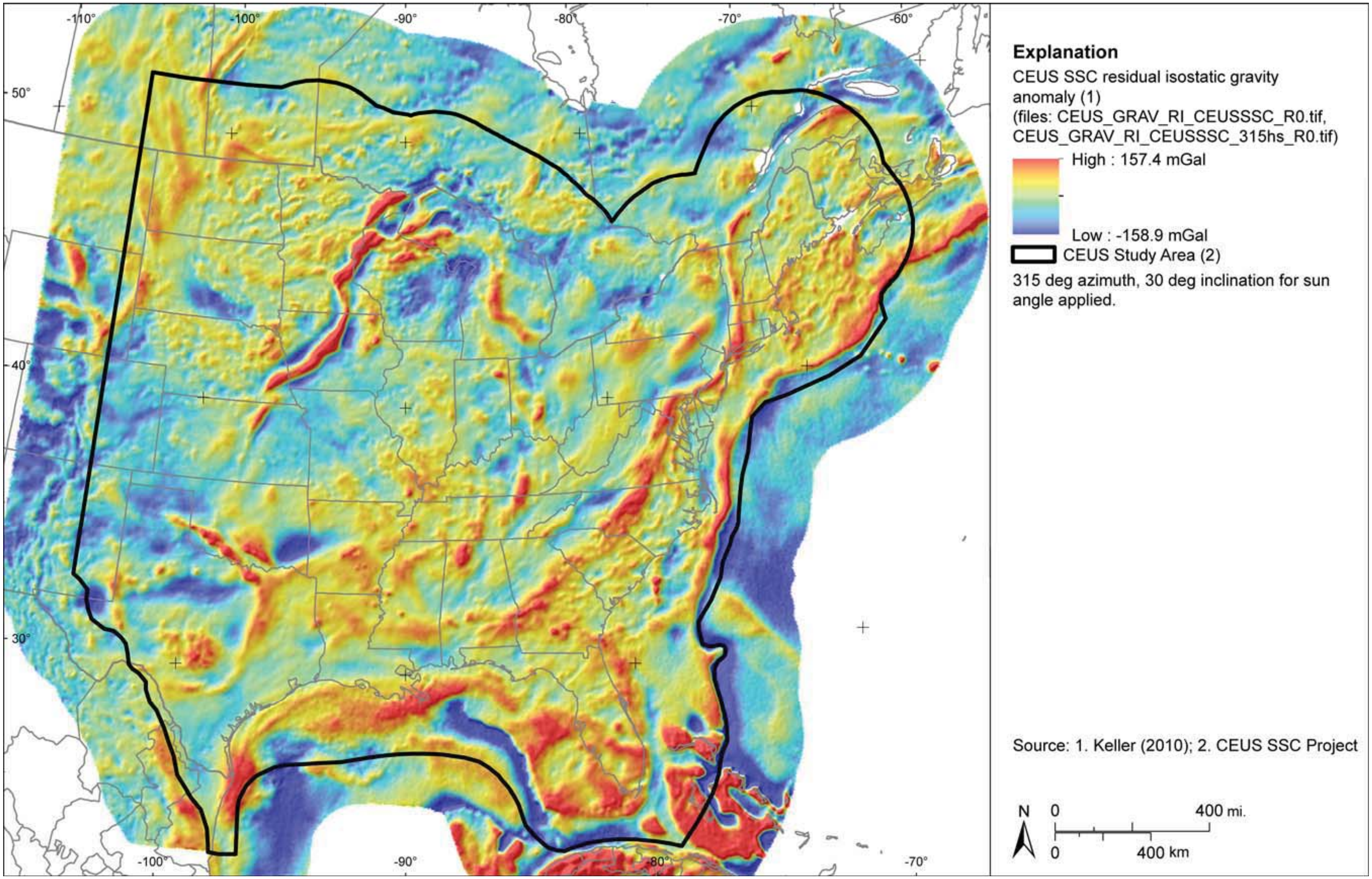

Figure A-20
CEUS SSC residual isostatic gravity anomaly grid. Shaded relief with 315-degree azimuth and 30-degree inclination applied.

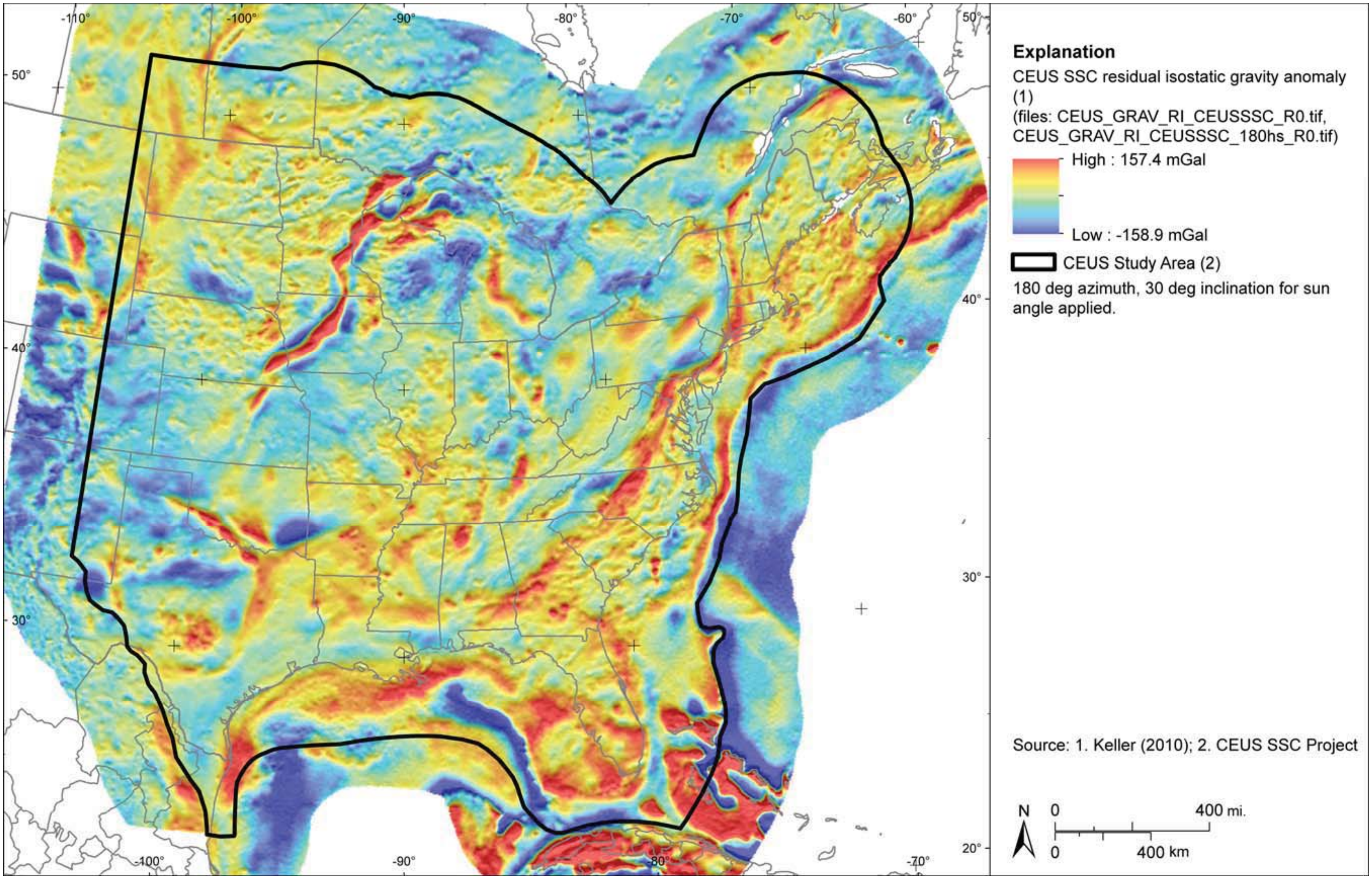

Figure A-21
CEUS SSC residual isostatic gravity anomaly grid Shaded relief with 180-degree azimuth and 30-degree inclination applied.

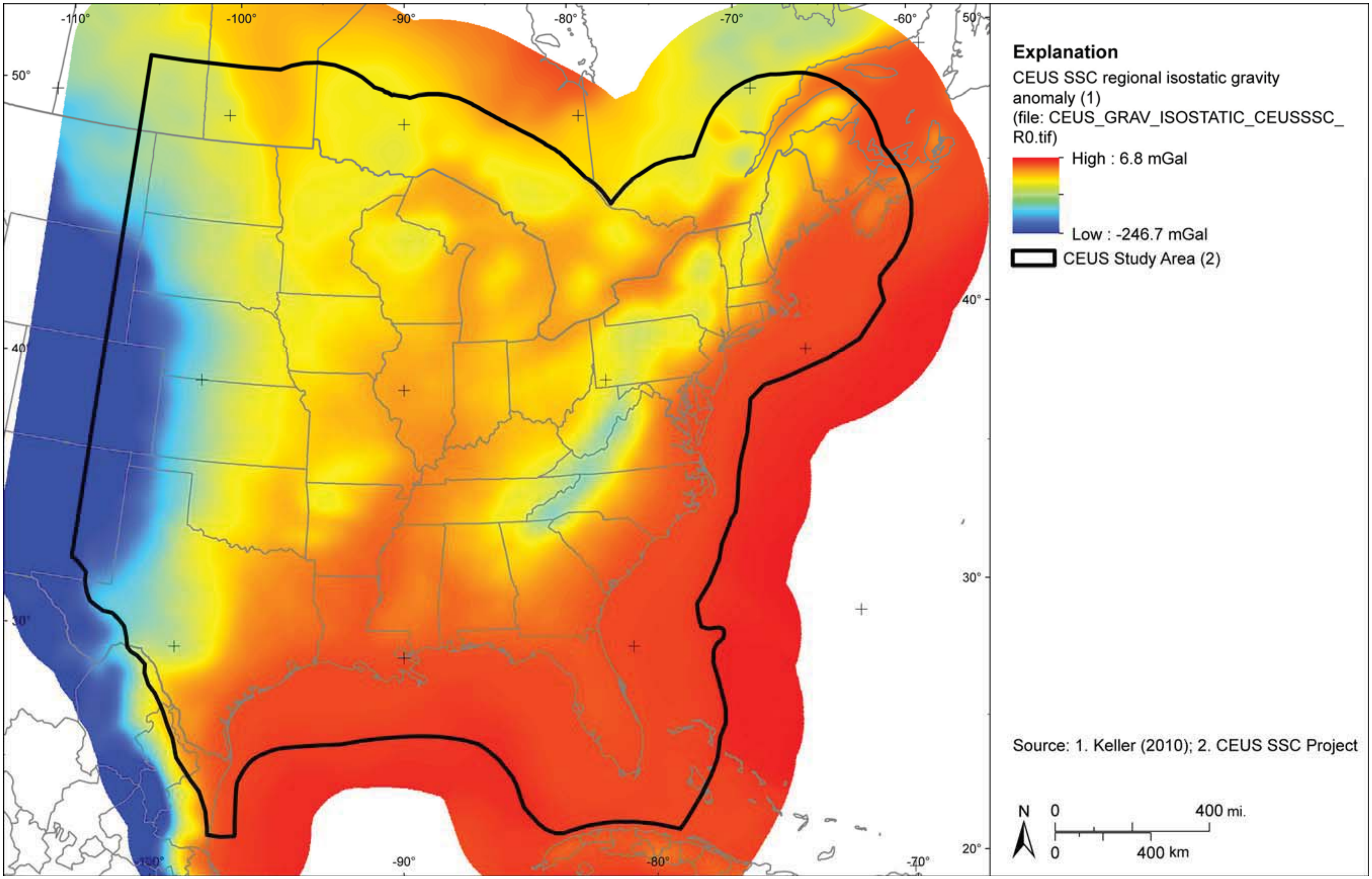

Figure A-22
CEUS SSC regional isostatic gravity anomaly grid

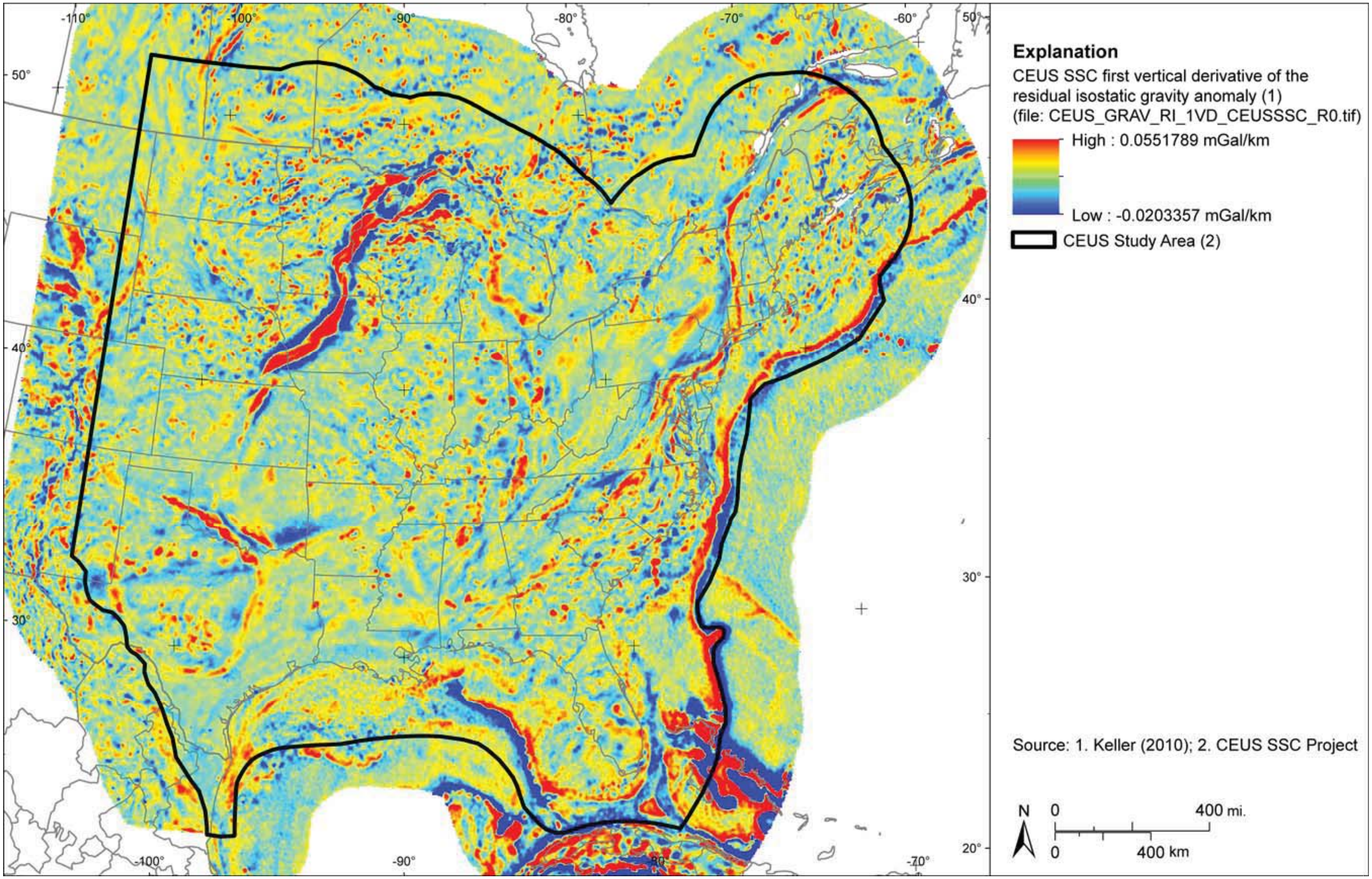

Figure A-23
CEUS SSC first vertical derivative of residual isostatic gravity anomaly grid.

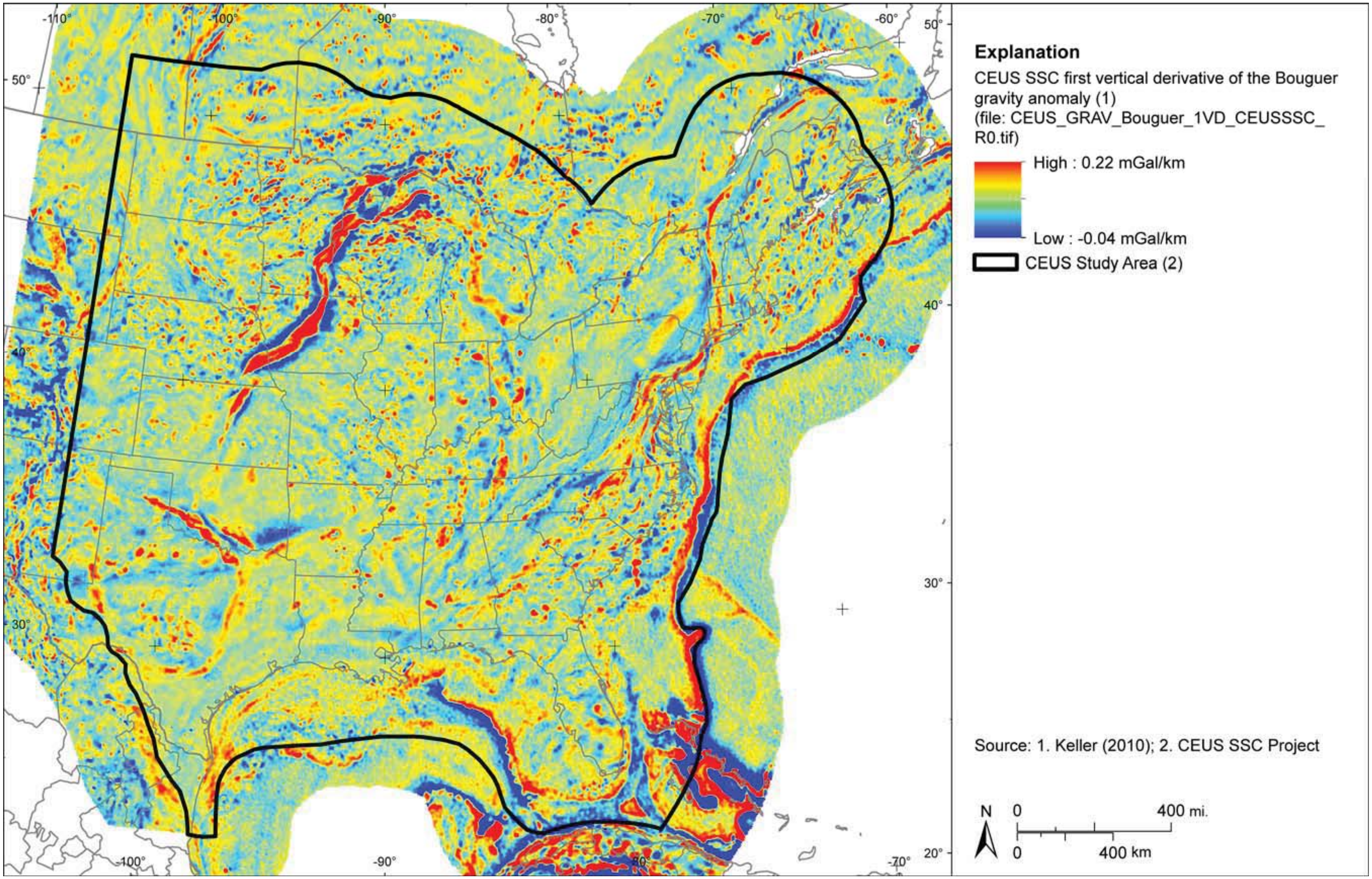

Figure A-24
CEUS SSC first vertical derivative of Bouguer gravity anomaly grid with free-air anomaly in marine areas

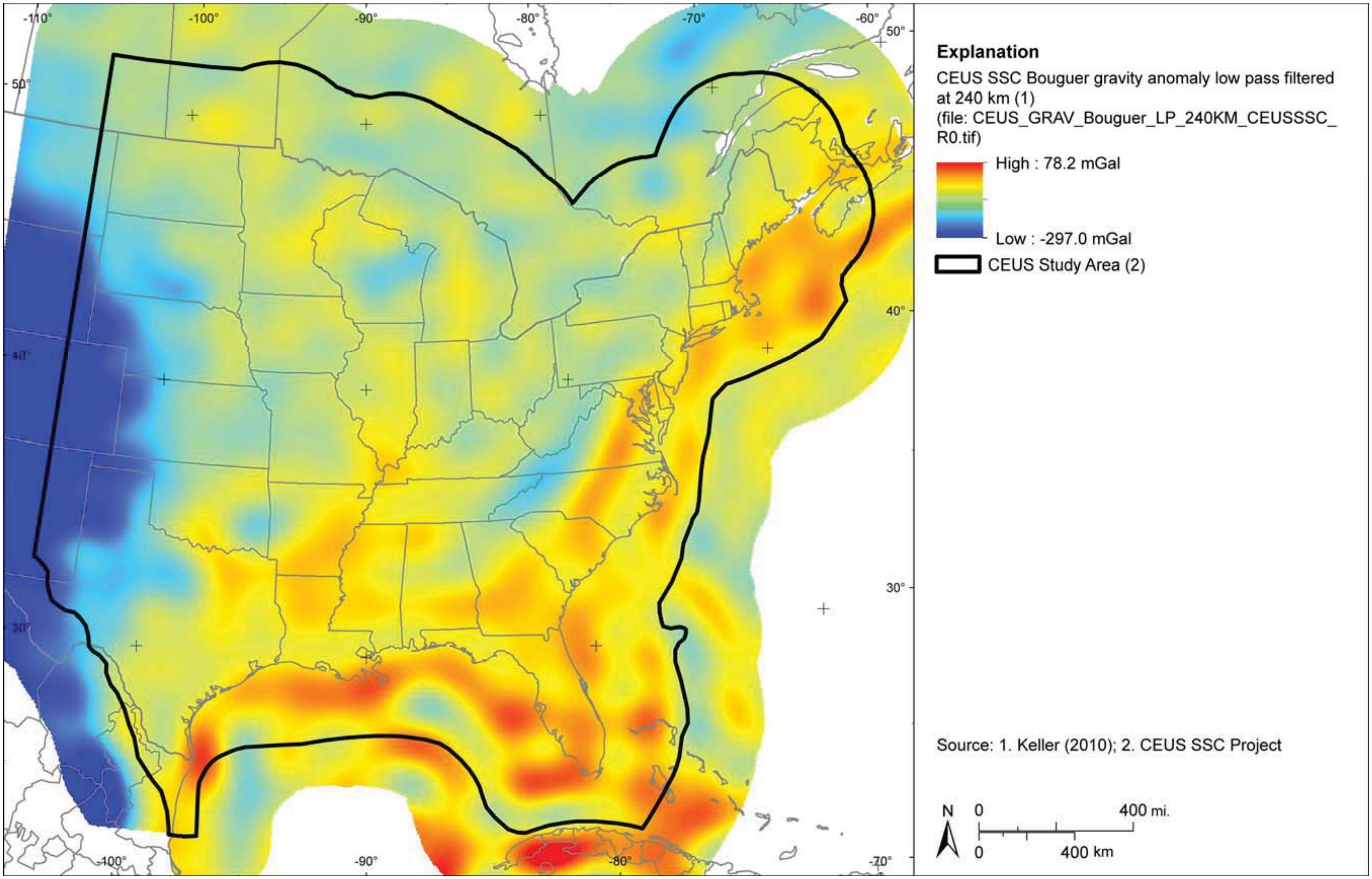

Figure A-25
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid low pass filtered at 240 km

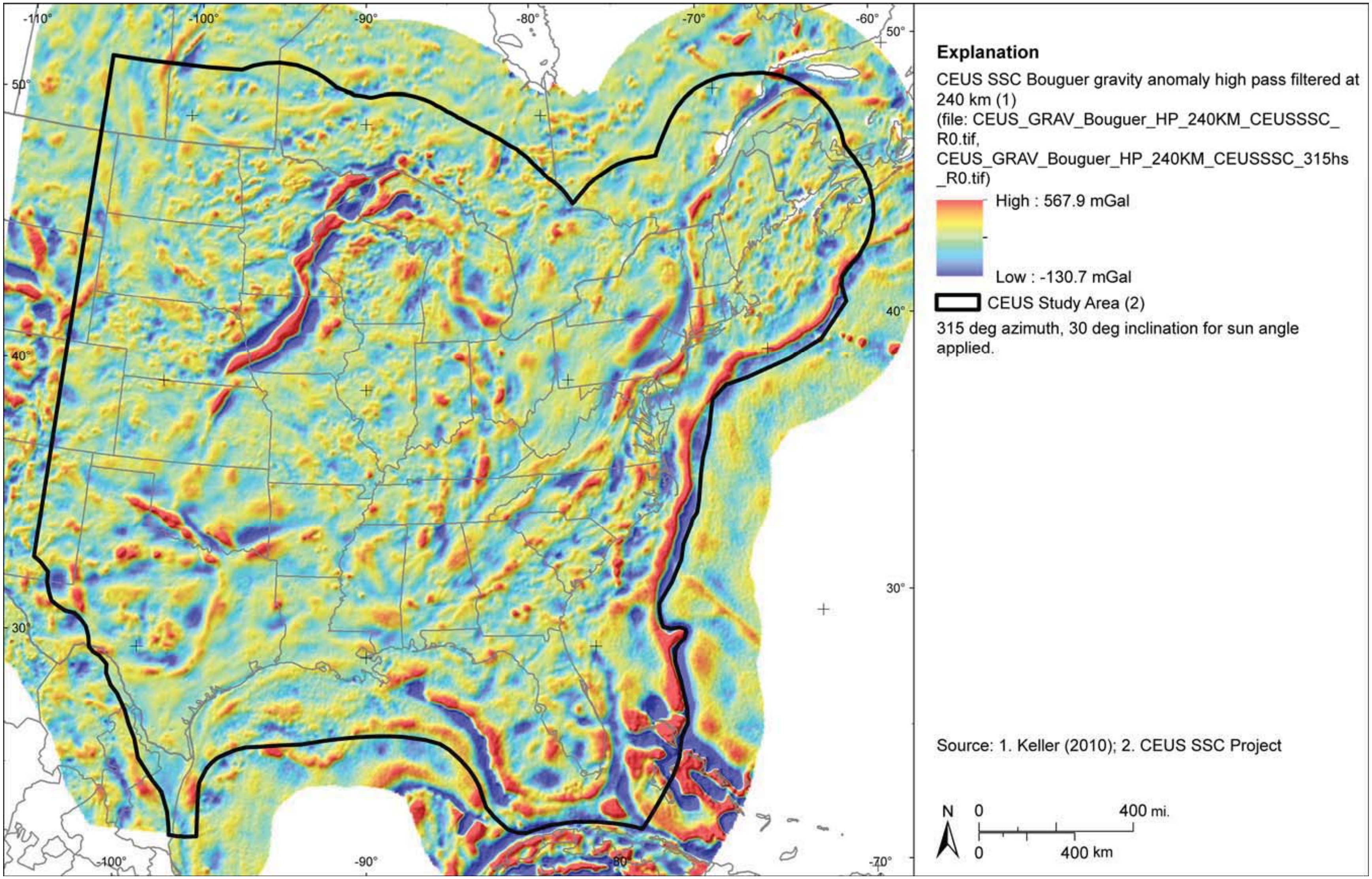

Figure A-26
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid high pass filtered at 240 km. Shaded relief with 315-degree azimuth and 30-degree inclination applied.

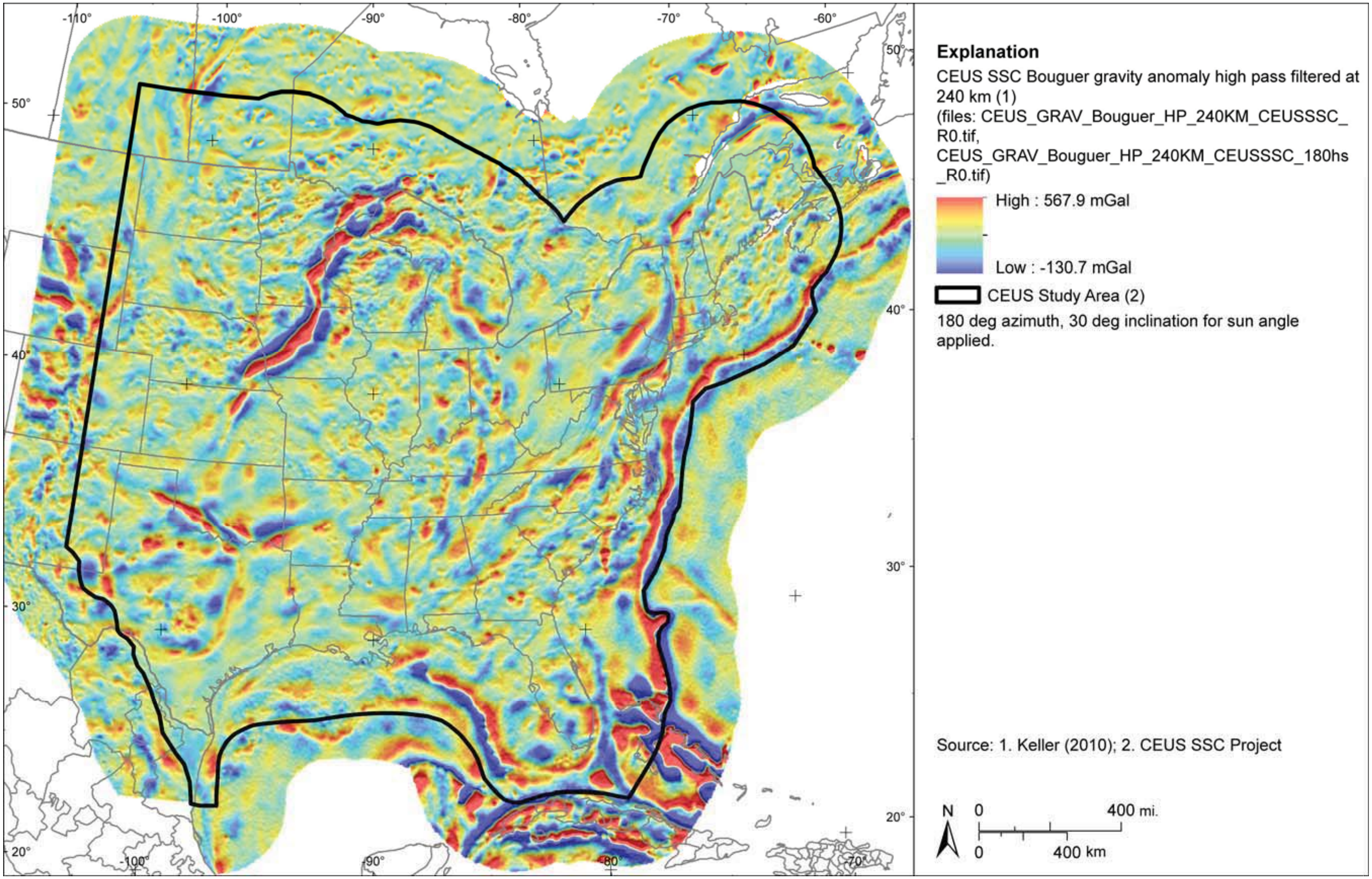

Figure A-27
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid high pass filtered at 240 km. Shaded relief with 180-degree azimuth and 30-degree inclination applied.

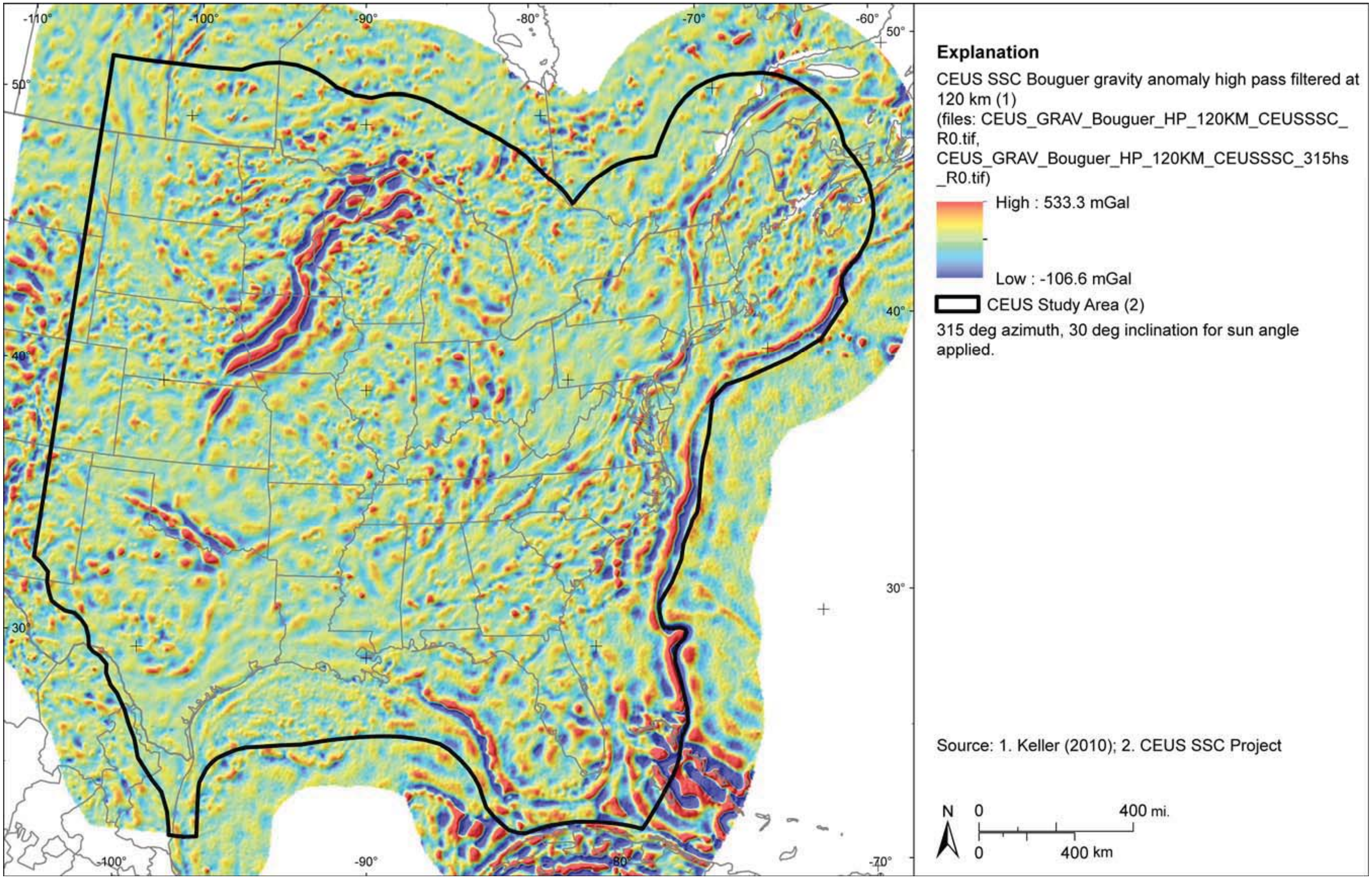

Figure A-28
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid high pass filtered at 120 km. Shaded relief with 315-degree azimuth and 30-degree inclination applied.

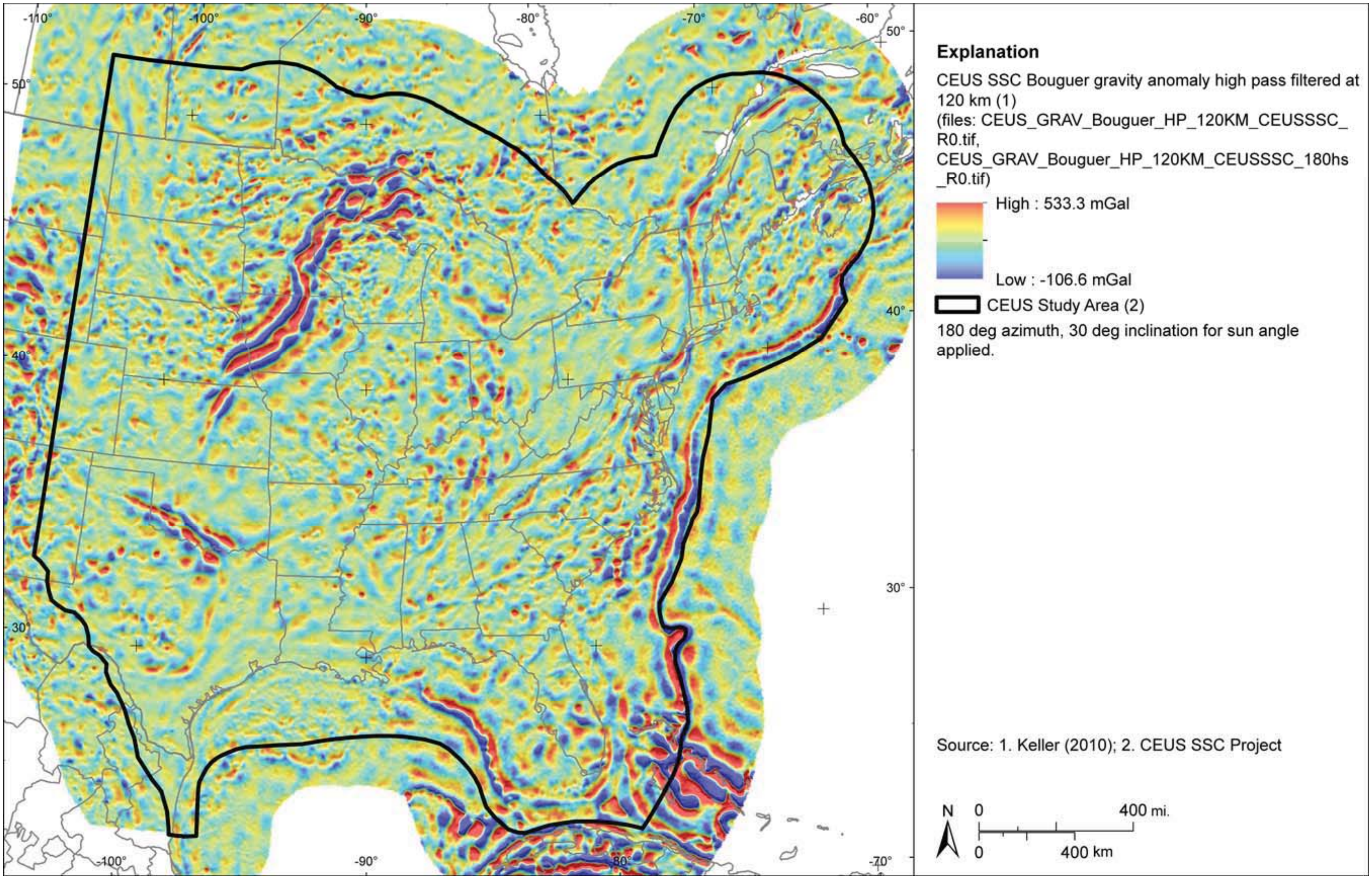

Figure A-29
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid high pass filtered at 120 km. Shaded relief with 180-degree azimuth and 30-degree inclination applied.

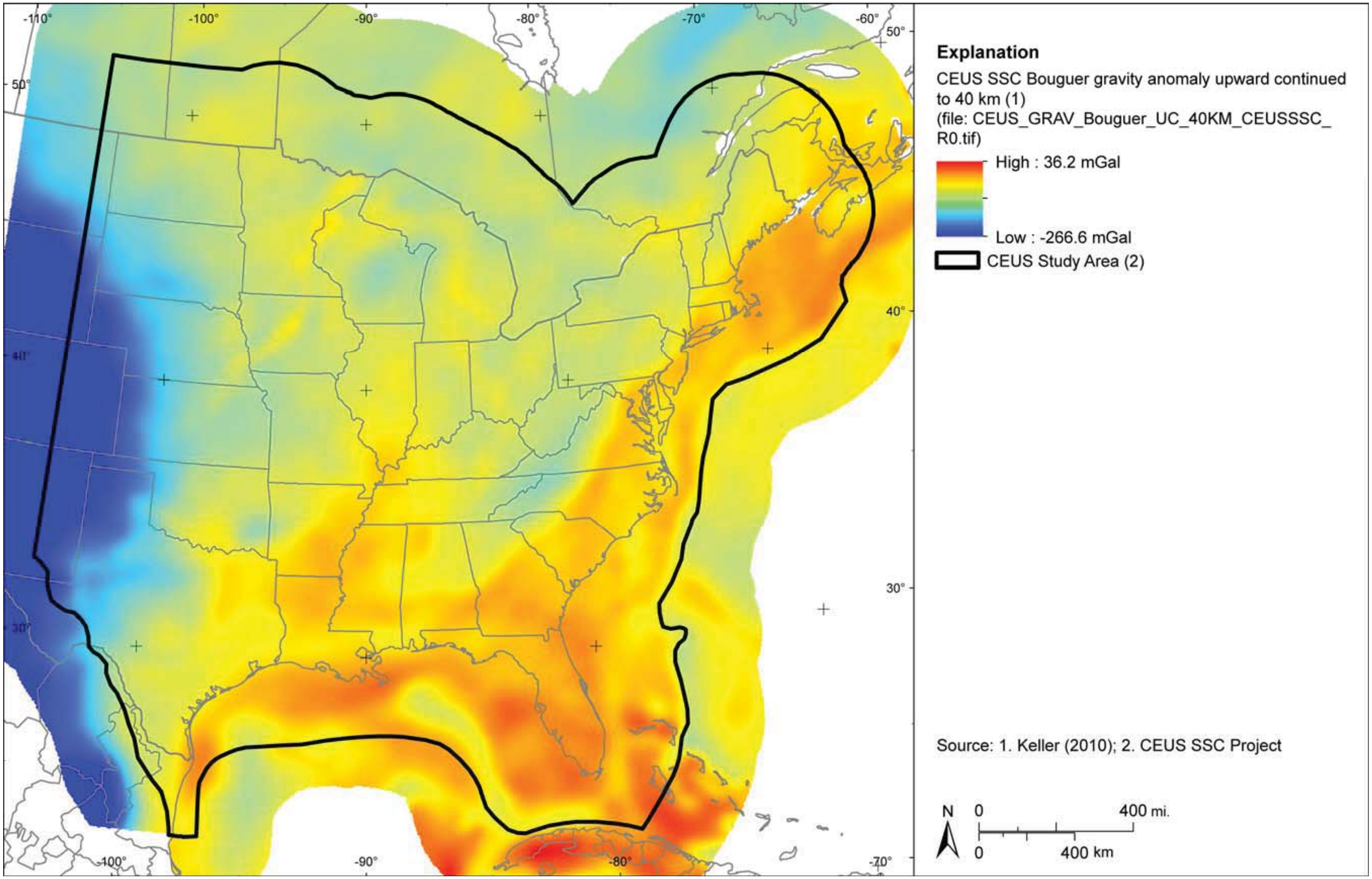

Figure A-30
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid upward continued to 40 km

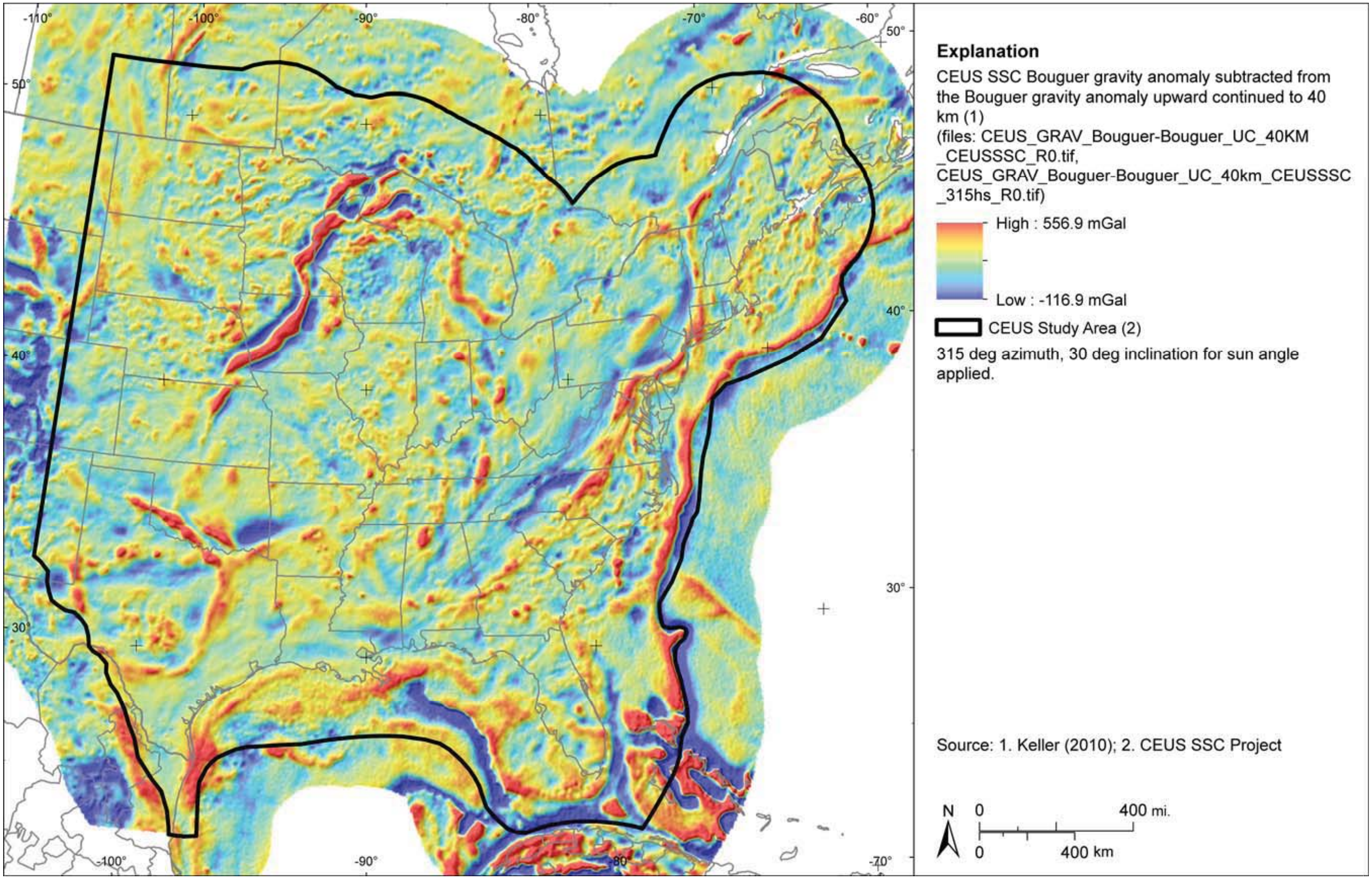

Figure A-31
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid minus the complete Bouguer (with marine free-air) gravity anomaly upward continued to 40 km. Shaded relief with 315-degree azimuth and 30-degree inclination applied.

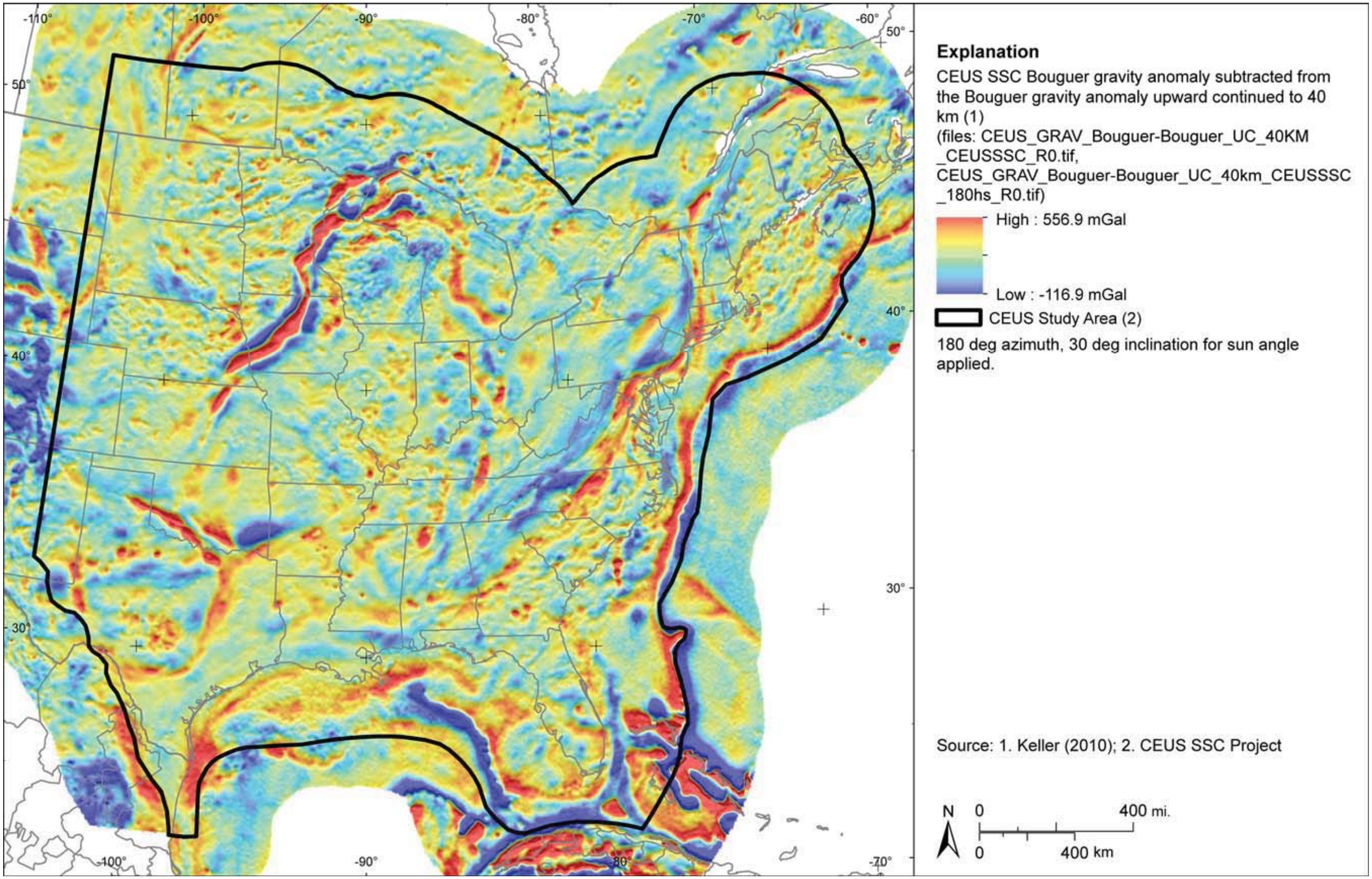

Figure A-32
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid minus the complete Bouguer (with marine free-air) gravity anomaly upward continued to 40 km. Shaded relief with 180-degree azimuth and 30-degree inclination applied.

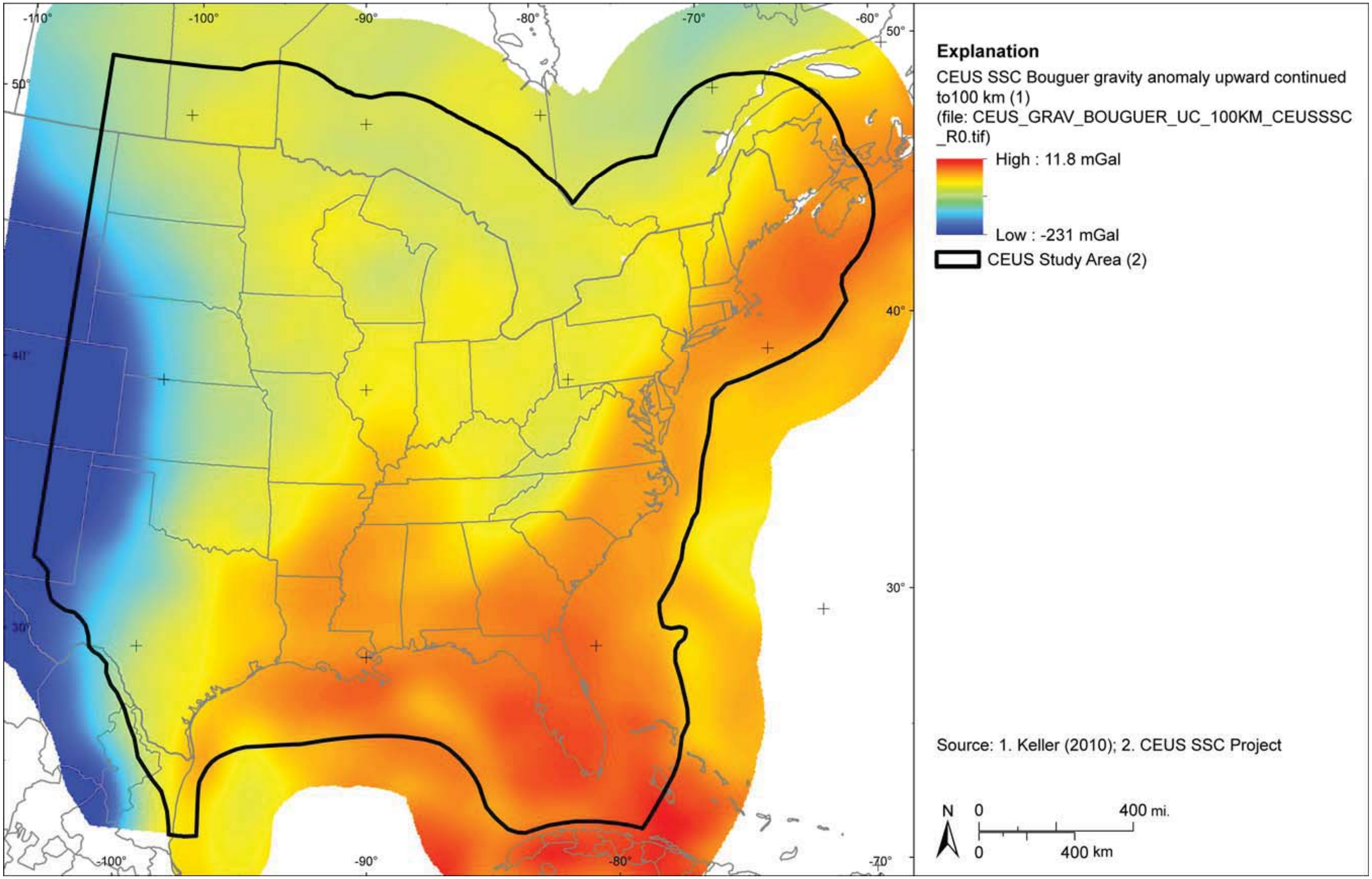

Figure A-33
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid upward continued to 100 km

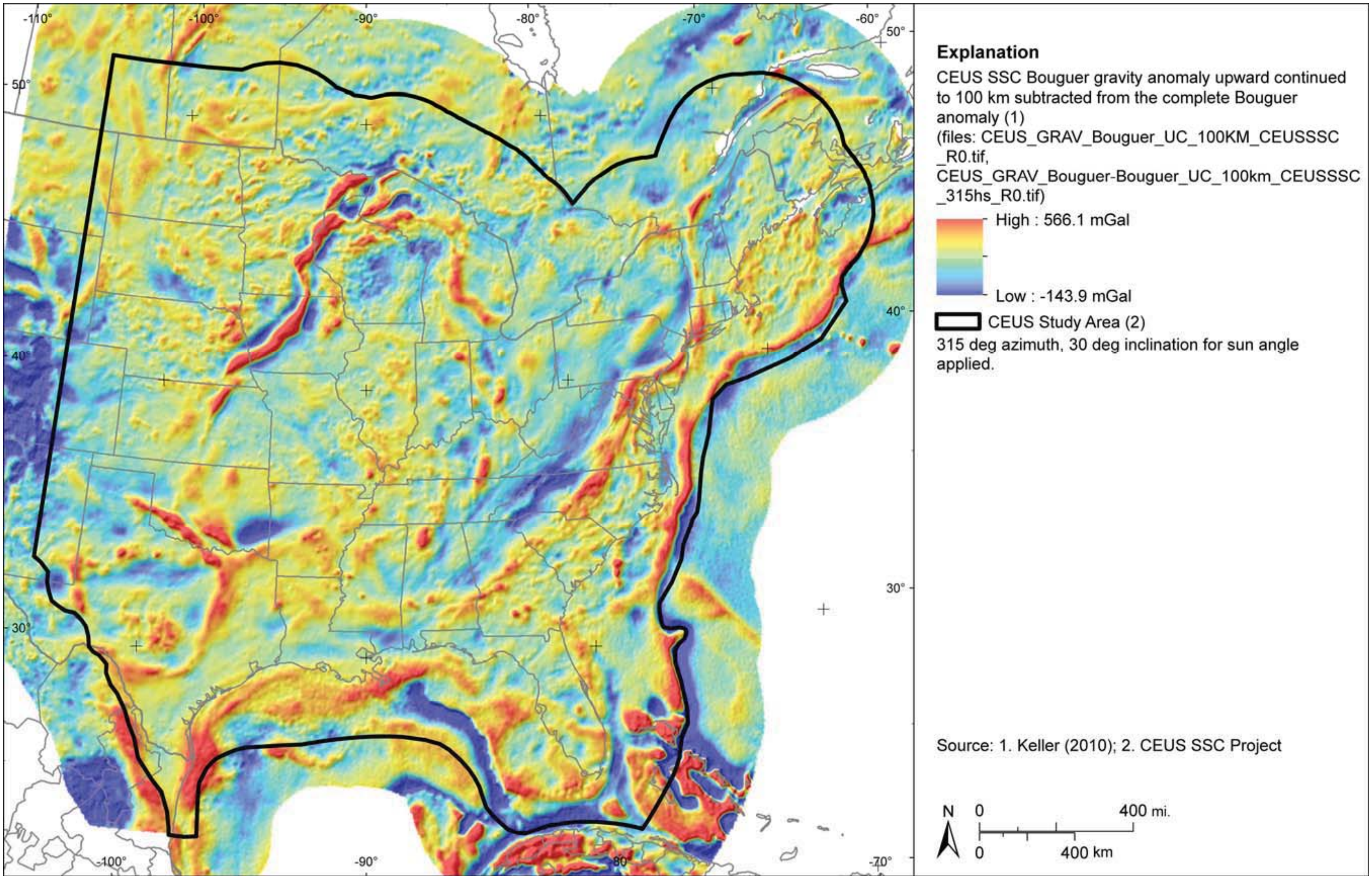

Figure A-34
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid minus the complete Bouguer (with marine free-air) gravity anomaly anomaly upward continued to 100 km. Shaded relief with 315-degree azimuth and 30-degree inclination applied.

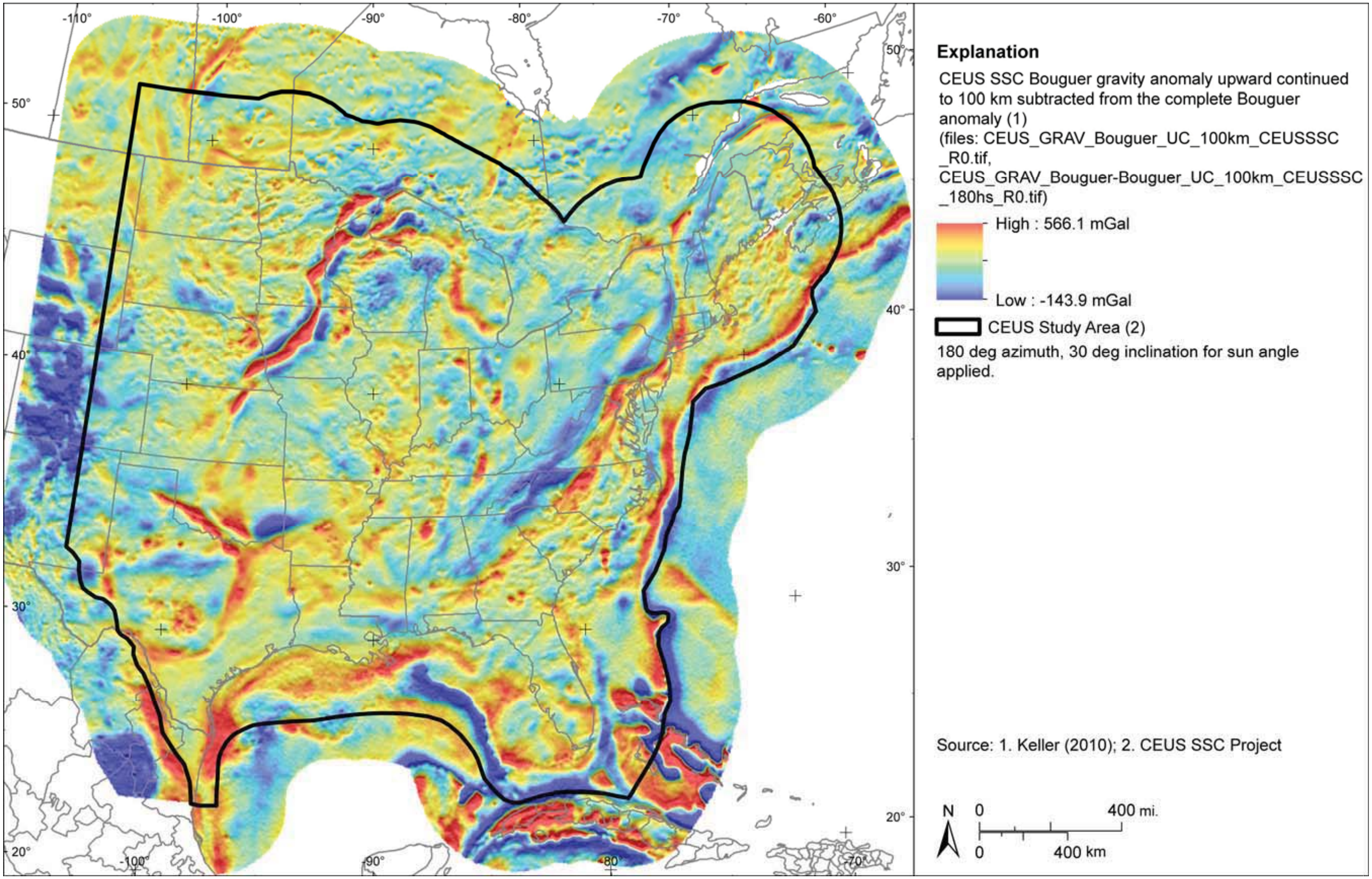

Figure A-35
CEUS SSC complete Bouguer (with marine free-air) gravity anomaly grid minus the complete Bouguer (with marine free-air) gravity anomaly upward continued to 100 km. Shaded relief with 180-degree azimuth and 30-degree inclination applied.

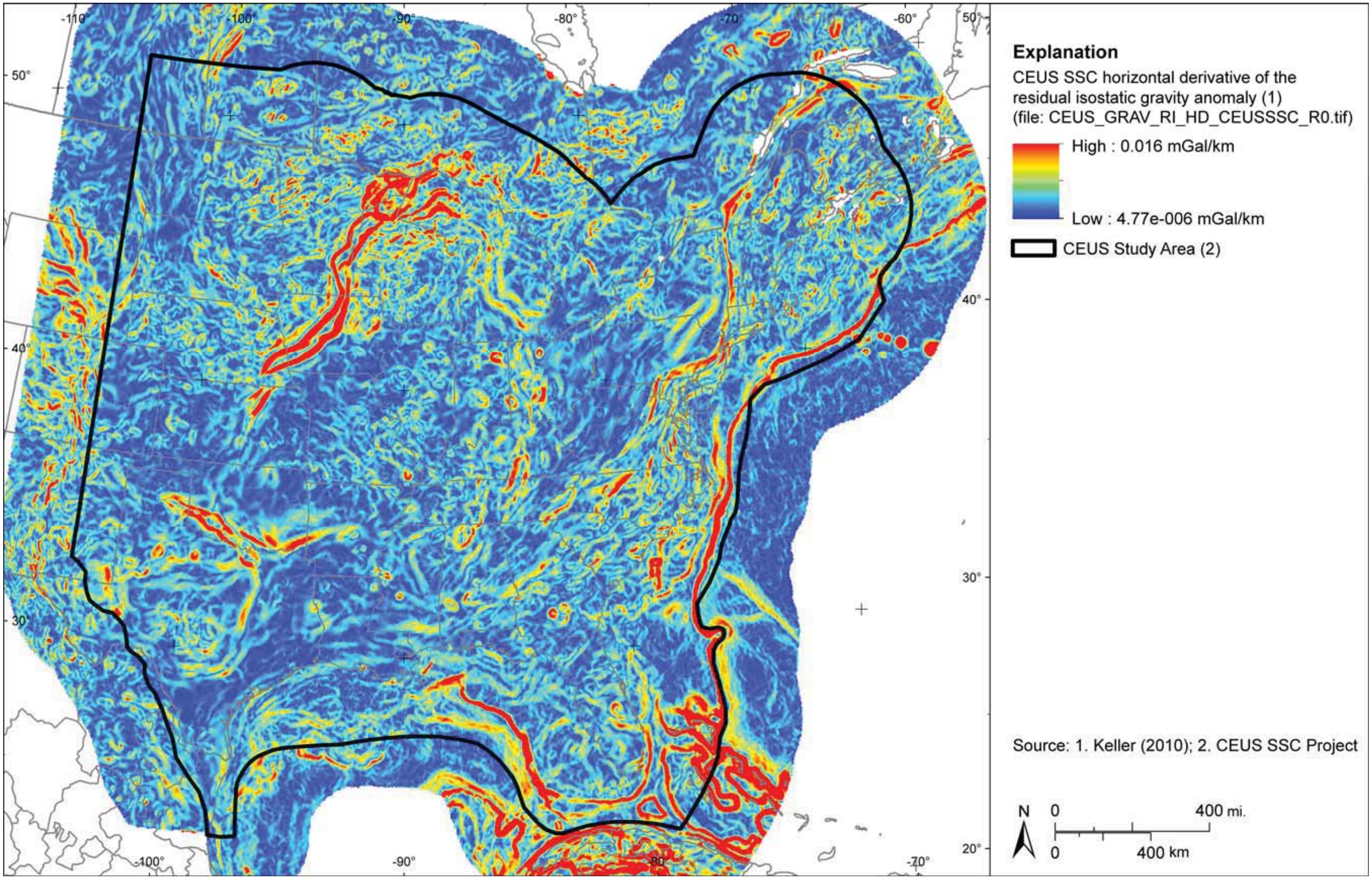

Figure A-36
CEUS SSC horizontal derivative of residual isostatic gravity anomaly grid

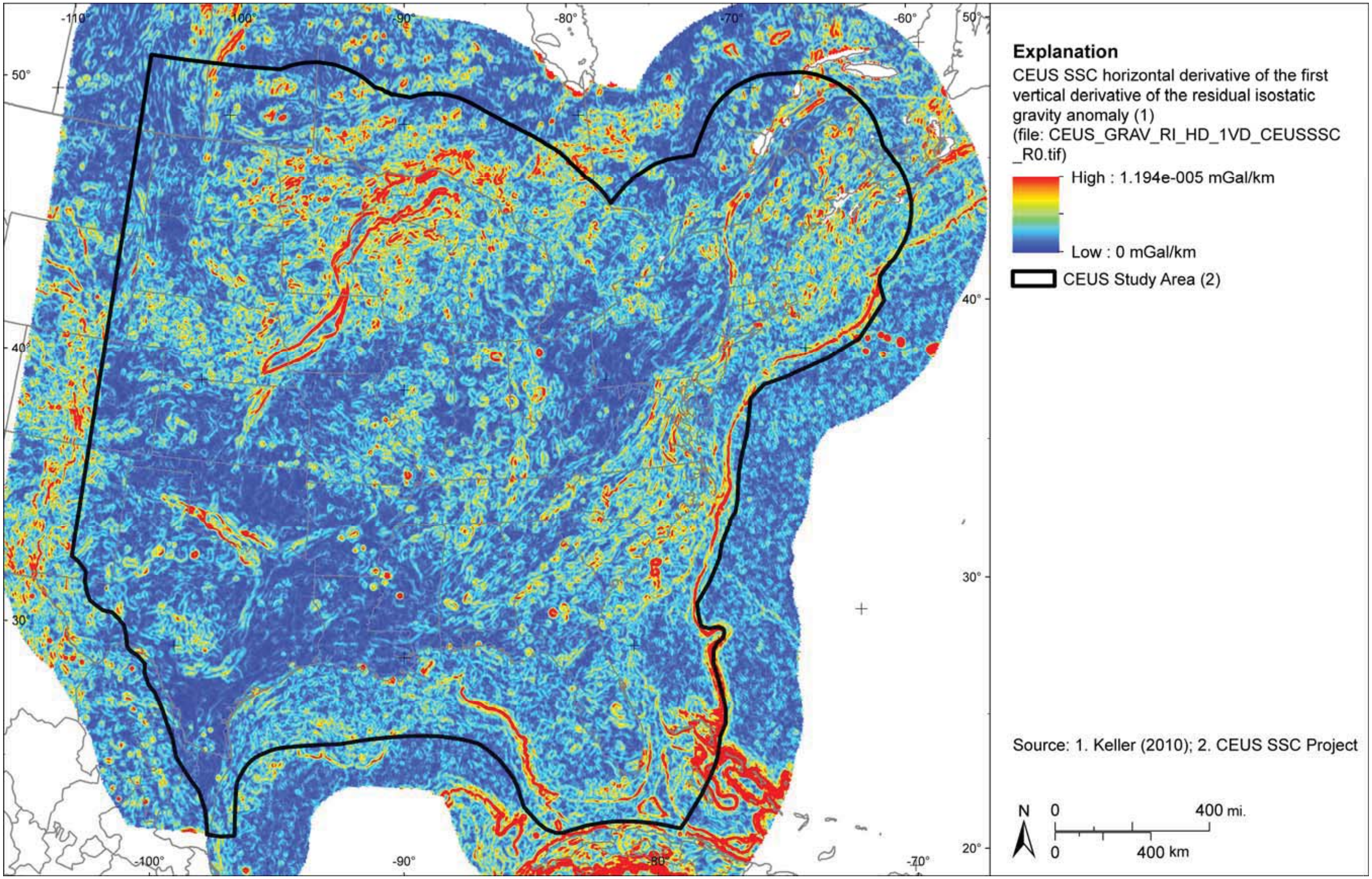

Figure A-37
CEUS SSC horizontal derivative of first vertical derivative of residual isostatic gravity anomaly grid

Sheet A-16—CEUS SSC Project GIS Data Summary

SMU Geothermal Laboratory Regional Heat Flow Database

CEUS_Regional_HeatFlow_SMU_R0.shp

Data Description: Geothermal heat flow data provided by the Southern Methodist University Geothermal Laboratory. These data contain regional or background wells for determining heat flow in the United States. Temperature gradients and conductivity were used to generate heat flow measurements. Some heat flow values from wells that are close together were averaged. Data include minimum and maximum temperatures, bottom-hole temperatures, gradients, thermal conductivity, heat flow, porosity, dates of drilling and logging measurements, water table depths, lithology and references.

Source (Internet URL, CD/DVD-ROM): Data were downloaded from http://smu.edu/geothermal/ on April 9, 2008.

Author/Publisher/Year: Blackwell, D. and Richards, M. (editors), 2008, *SMU Geothermal Laboratory Regional Heat Flow Database:* Southern Methodist University, http://smu.edu/geothermal, accessed April 9, 2008.

Data Summary: Digital data in ASCII format (comma-separated values) were imported into Microsoft Access. Numeric database attributes with no data values were replaced with "-9999" to represent null values. These data were subsequently converted to ESRI ArcGIS shapefile format using the latitude and longitude values. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified. Access the most recent version of the SMU Regional Heat Flow Database at the SMU Geothermal Laboratory website.

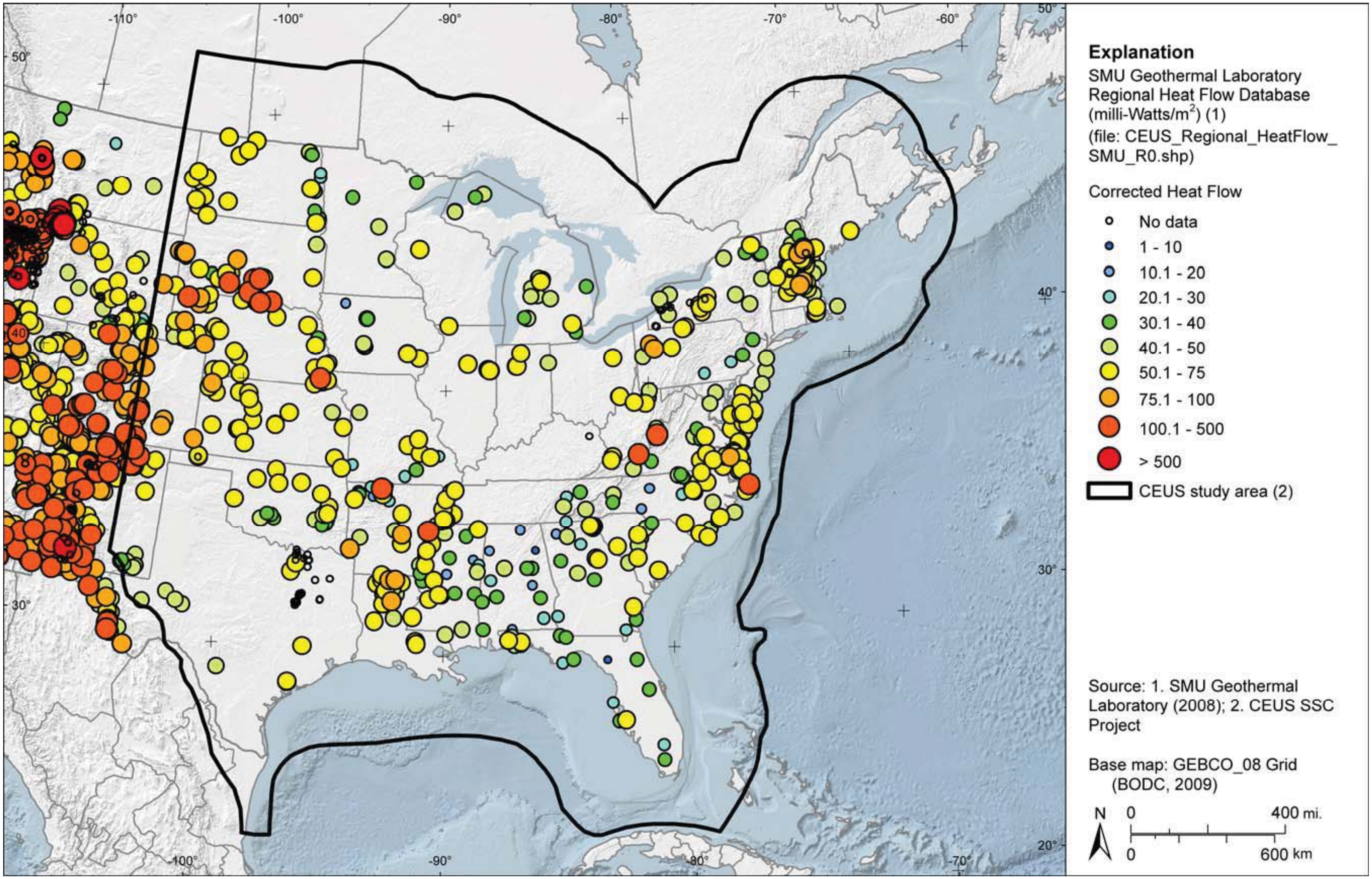

Figure A-38
Corrected heat flow values from the SMU Geothermal Laboratory Regional Heat Flow Database (2008)

Sheet A-17—CEUS SSC Project GIS Data Summary

Full-Spectrum Magnetic Anomaly Database for the Central and Eastern United States

CEUS_MAG_<varies>_CEUSSSC_R0.tif

Data Description: Data representing magnetic anomaly data in the CEUS. Data layers include:

CEUS_MAG_TMAG_CEUSSSC_R0.tif	Total intensity magnetic anomaly (nT)
CEUS_MAG_DRTP_CEUSSSC_R0.tif	Differentially reduced to pole magnetic anomaly data (nT)
CEUS_MAG_DEG_DRTP_TDR_CEUSSSC_R0.tif	Tilt derivative of differentially reduced to pole magnetic anomaly (geometric degrees)
CEUS_MAG_DRTP_HD_TDR_CEUSSSC_R0.tif	Horizontal derivative of tilt derivative (radians) of differentially reduced to pole magnetic anomaly
CEUS_MAG_DRTP_TDR_CEUSSSC_R0.tif	Tilt derivative of differentially reduced to pole magnetic anomaly (radians)
CEUS_MAG_TMAG_AAS_CEUSSSC_R0.tif	Amplitude of analytic signal (nT/m)

Source (Internet URL, CD/DVD-ROM): DVD-ROM provided by D. Ravat, University of Kentucky.

Author/Publisher/Year:

CEUS_MAG_TMAG_CEUSSSC_R0.tif	Ravat, D., Finn, C., Hill, P., Kucks, R., Phillips, J., Blakely, R., Bouligand, C., Sabaka, T., Elshayat, A., Aref, A., and Elawadi, E., 2009, *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:* U.S. Geological Survey, Open-File Report 2009-1258, 2 pp.
CEUS_MAG_DRTP_CEUSSSC_R0.tif CEUS_MAG_DEG_DRTP_TDR_CEUSSSC_R0.tif CEUS_MAG_DRTP_HD_TDR_CEUSSSC_R0.tif CEUS_MAG_DRTP_TDR_CEUSSSC_R0.tif	Ravat, D., 2009, personal communication.

CEUS_MAG_TMAG_AAS_CEUSSSC_R0.tif	

Data Summary: Digital data in ASCII format was imported into ESRI ArcGIS file geodatabase raster format and exported to TIFF raster format. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

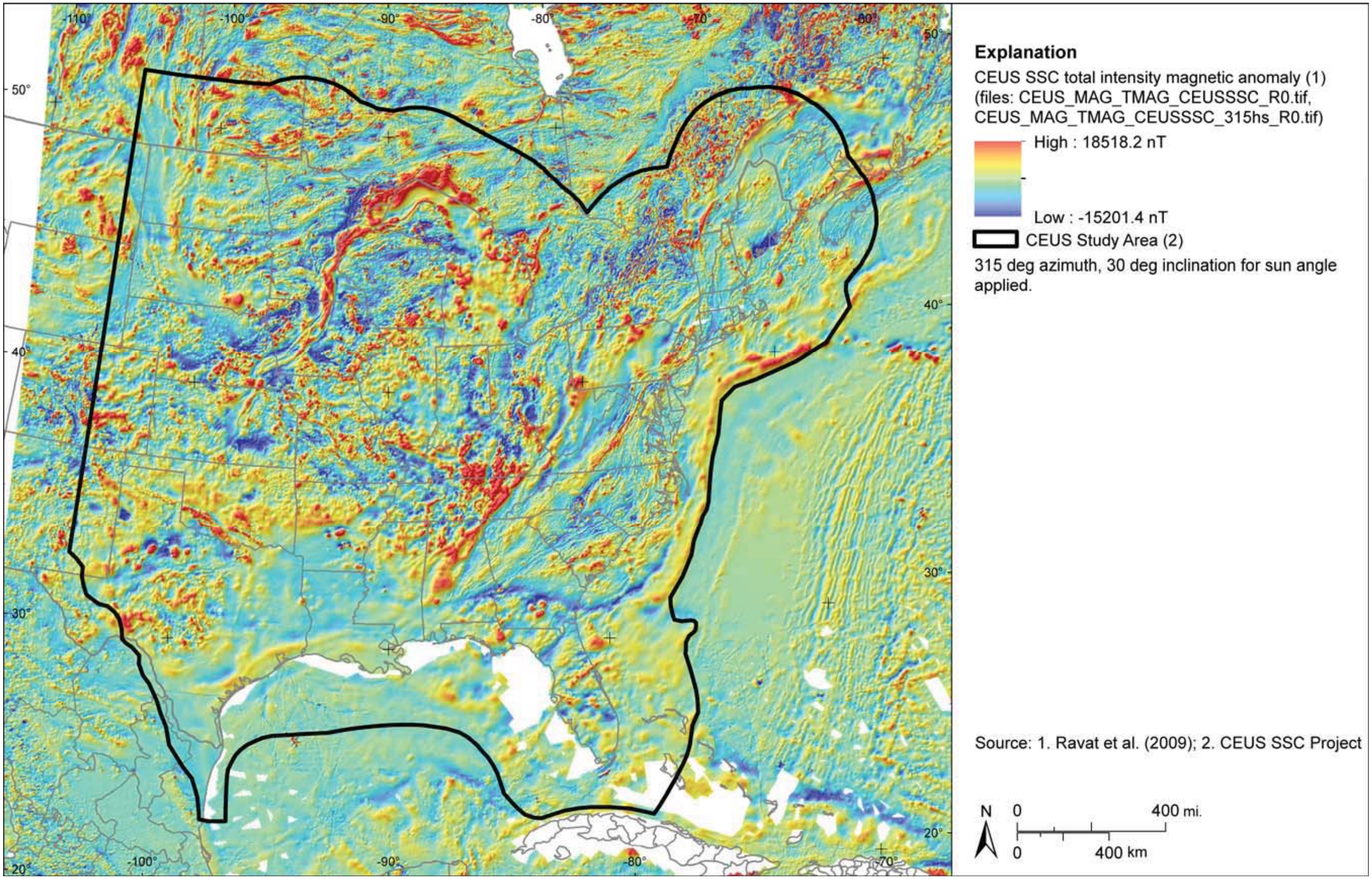

Figure A-39
CEUS SSC total intensity magnetic anomaly grid (Ravat et al., 2009). Shaded relief with 315-degree azimuth and 30-degree inclination applied.

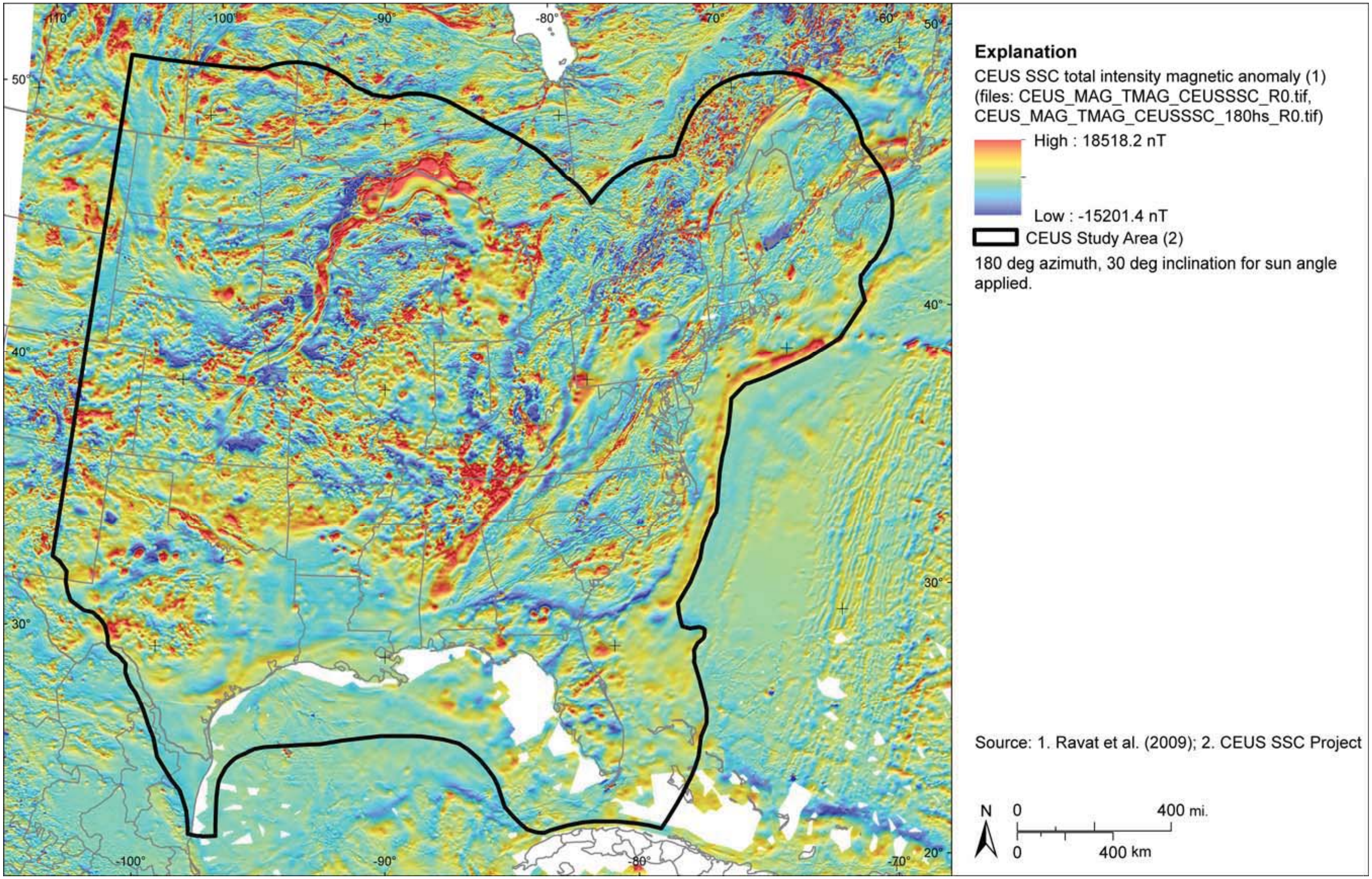

Figure A-40
CEUS SSC total intensity magnetic anomaly grid (Ravat et al., 2009). Shaded relief with 180-degree azimuth and 30-degree inclination applied.

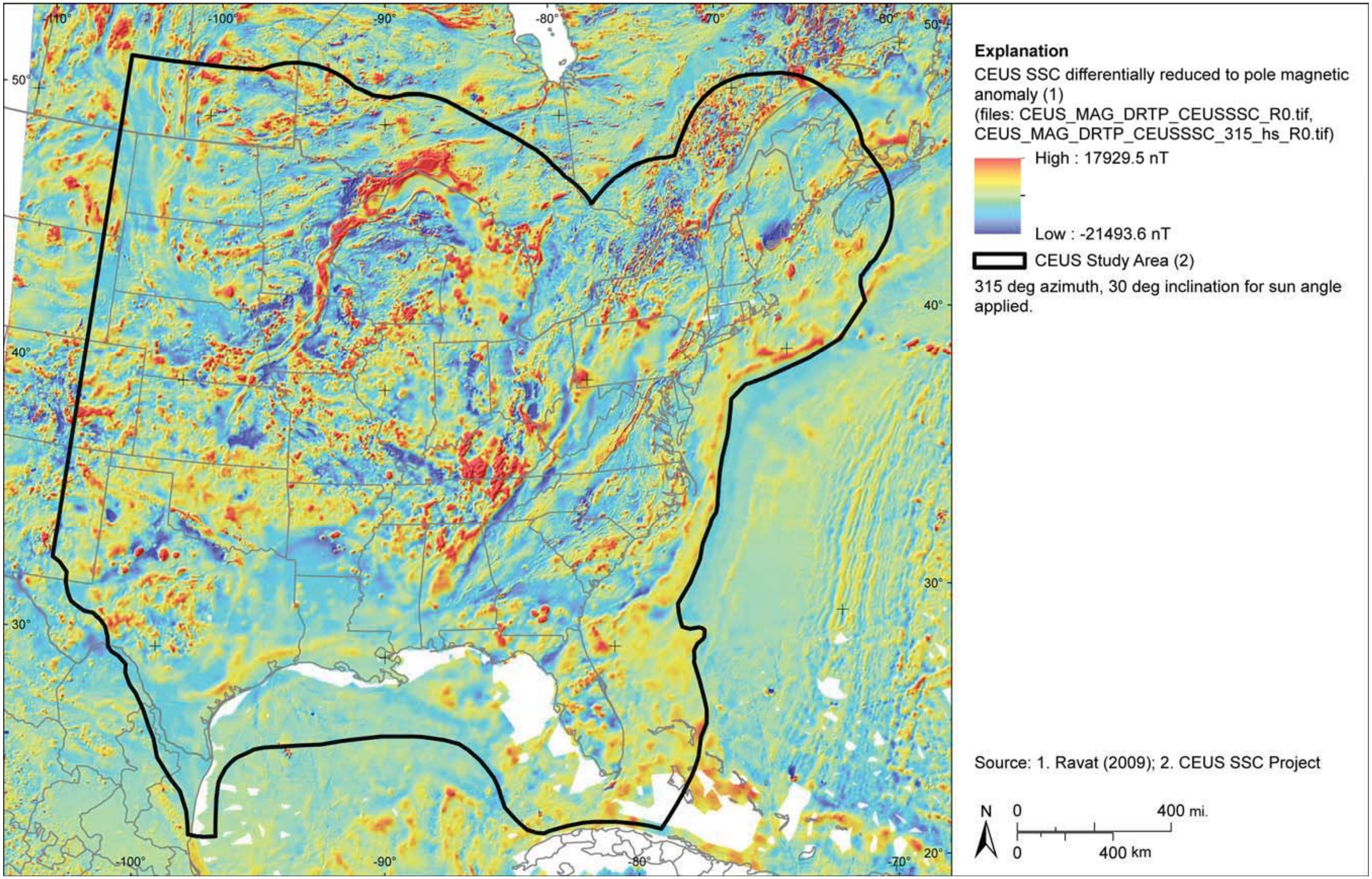

Figure A-41
CEUS SSC differentially reduced to pole magnetic anomaly grid (Ravat, 2009). Shaded relief with 315-degree azimuth and 30-degree inclination applied.

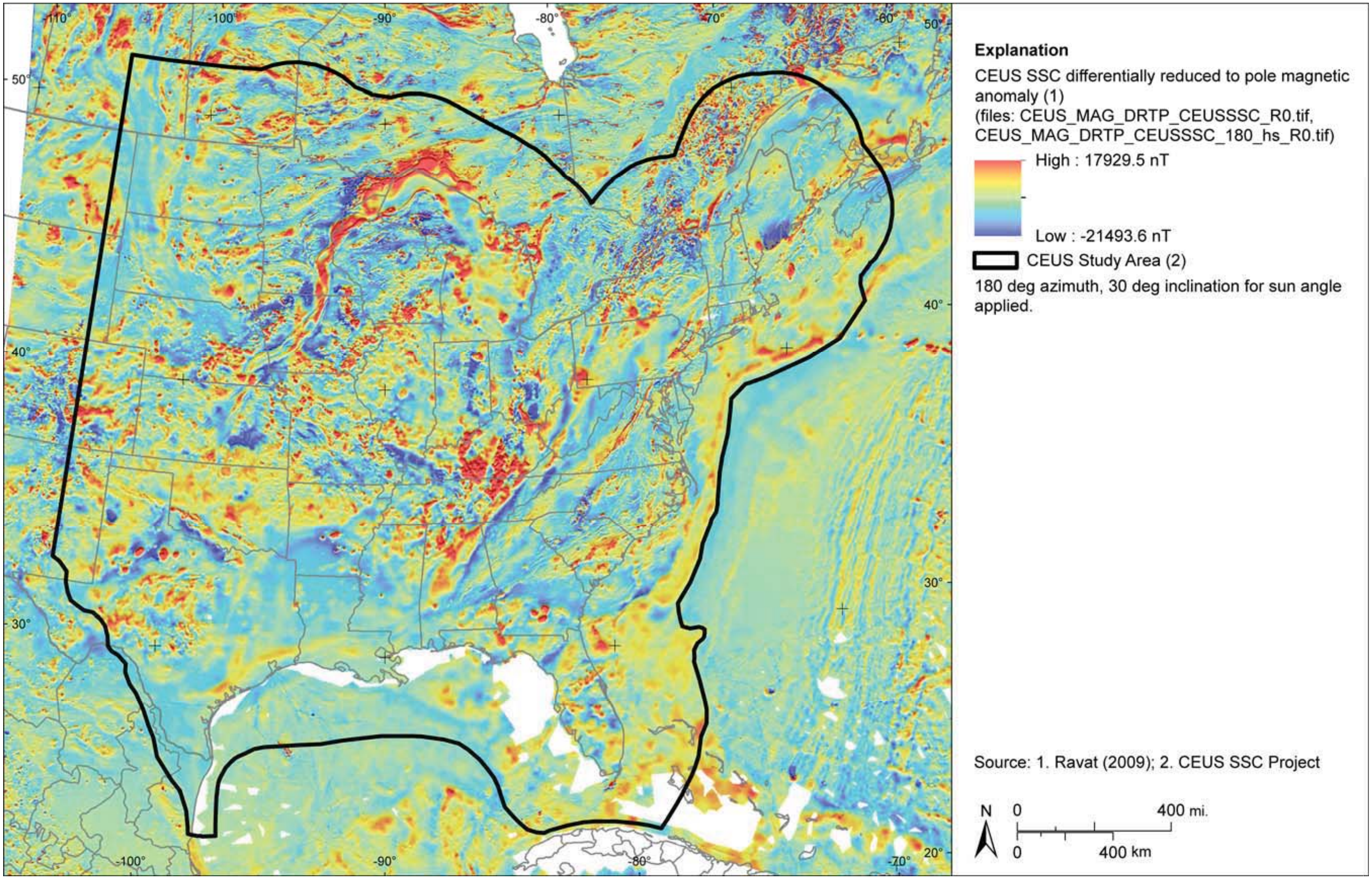

Figure A-42
CEUS SSC differentially reduced to pole magnetic anomaly grid (Ravat, 2009). Shaded relief with 180-degree azimuth and 30-degree inclination applied.

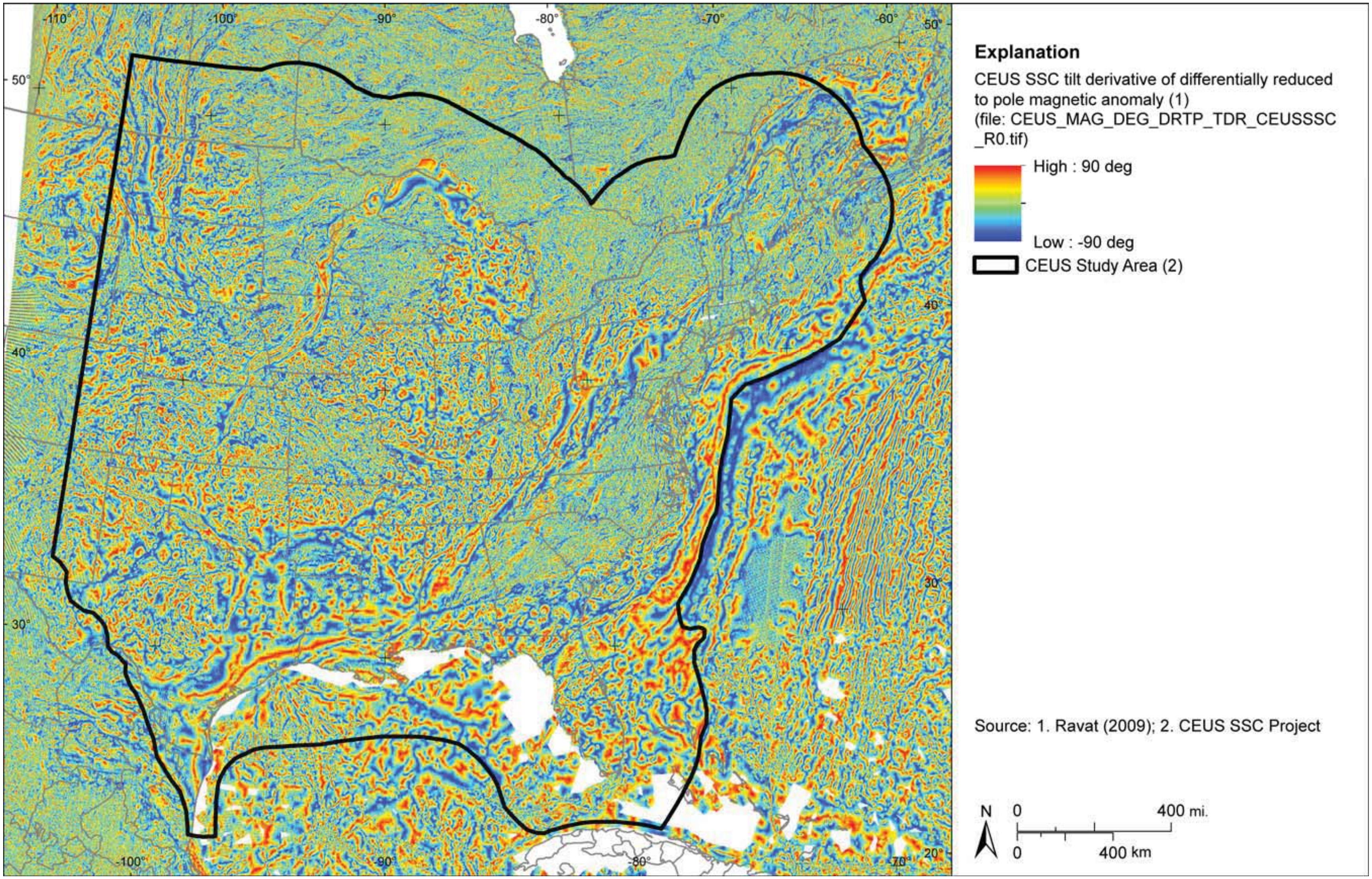

Figure A-43
CEUS SSC tilt derivative of differentially reduced to pole magnetic anomaly grid (degrees) (Ravat, 2009)

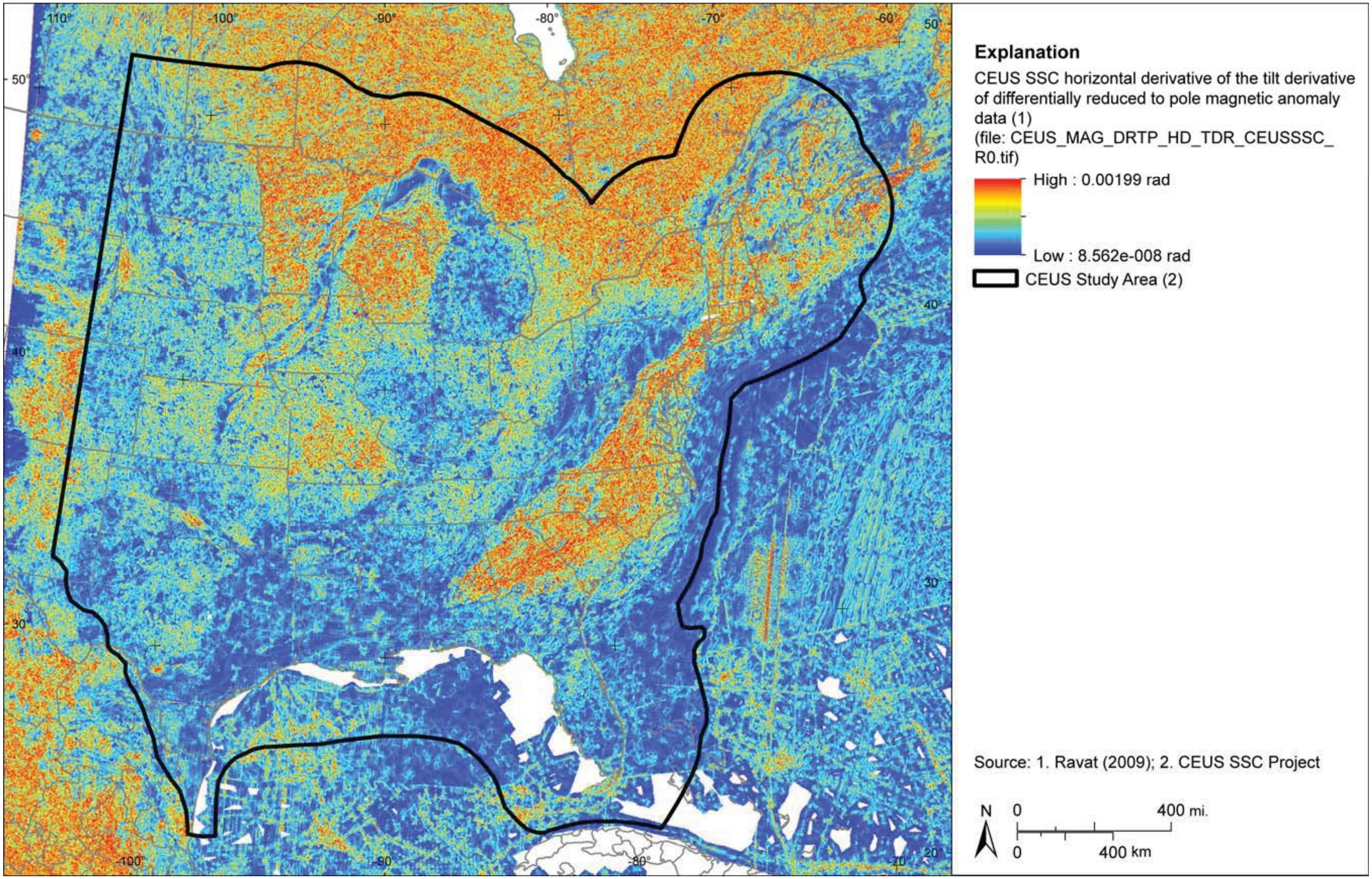

Figure A-44
CEUS SSC horizontal derivative of tilt derivative of differentially reduced to pole magnetic anomaly grid (radians) (Ravat, 2009)

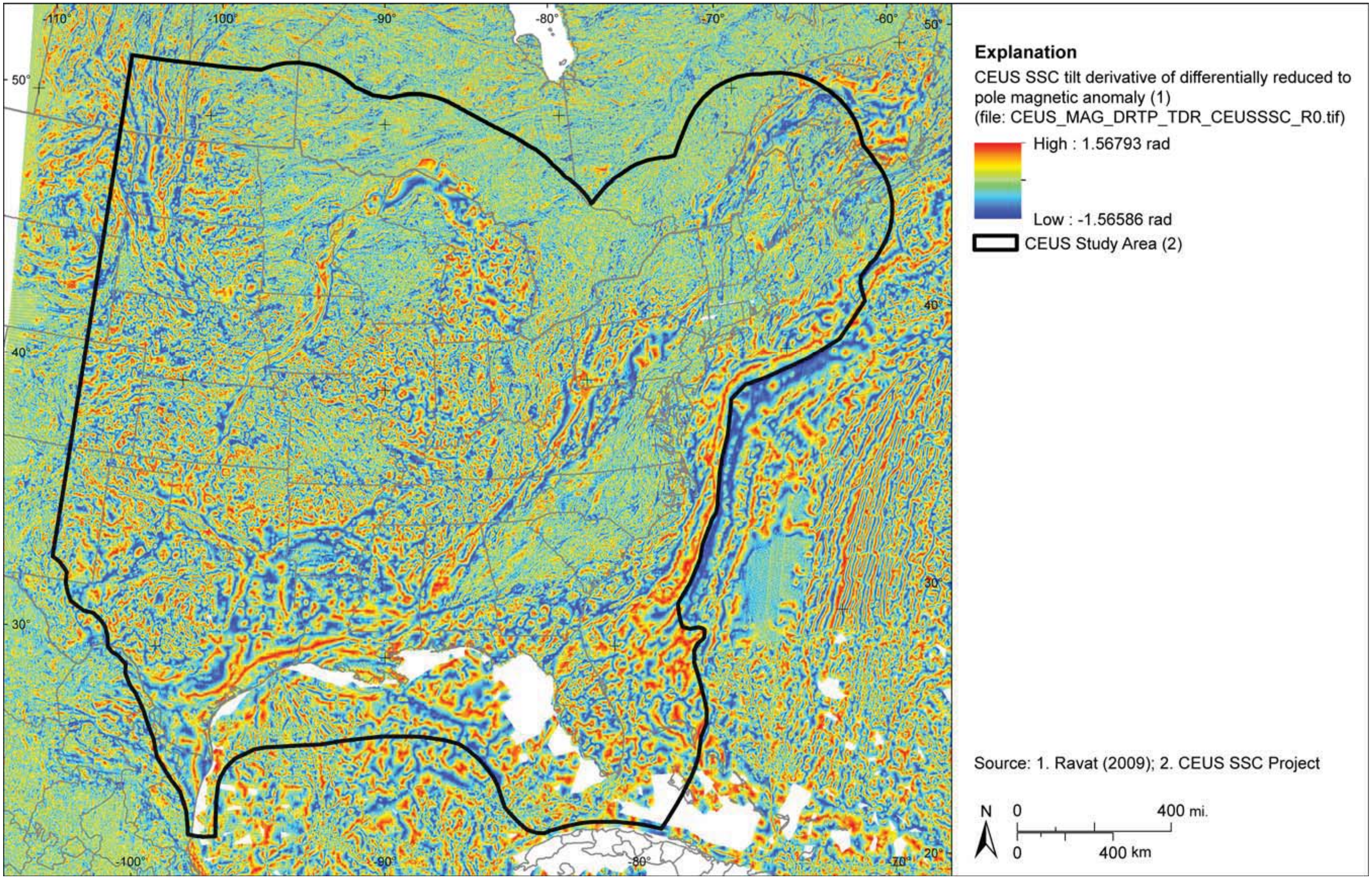

Figure A-45
CEUS SSC tilt derivative of differentially reduced to pole magnetic anomaly grid (Ravat, 2009)

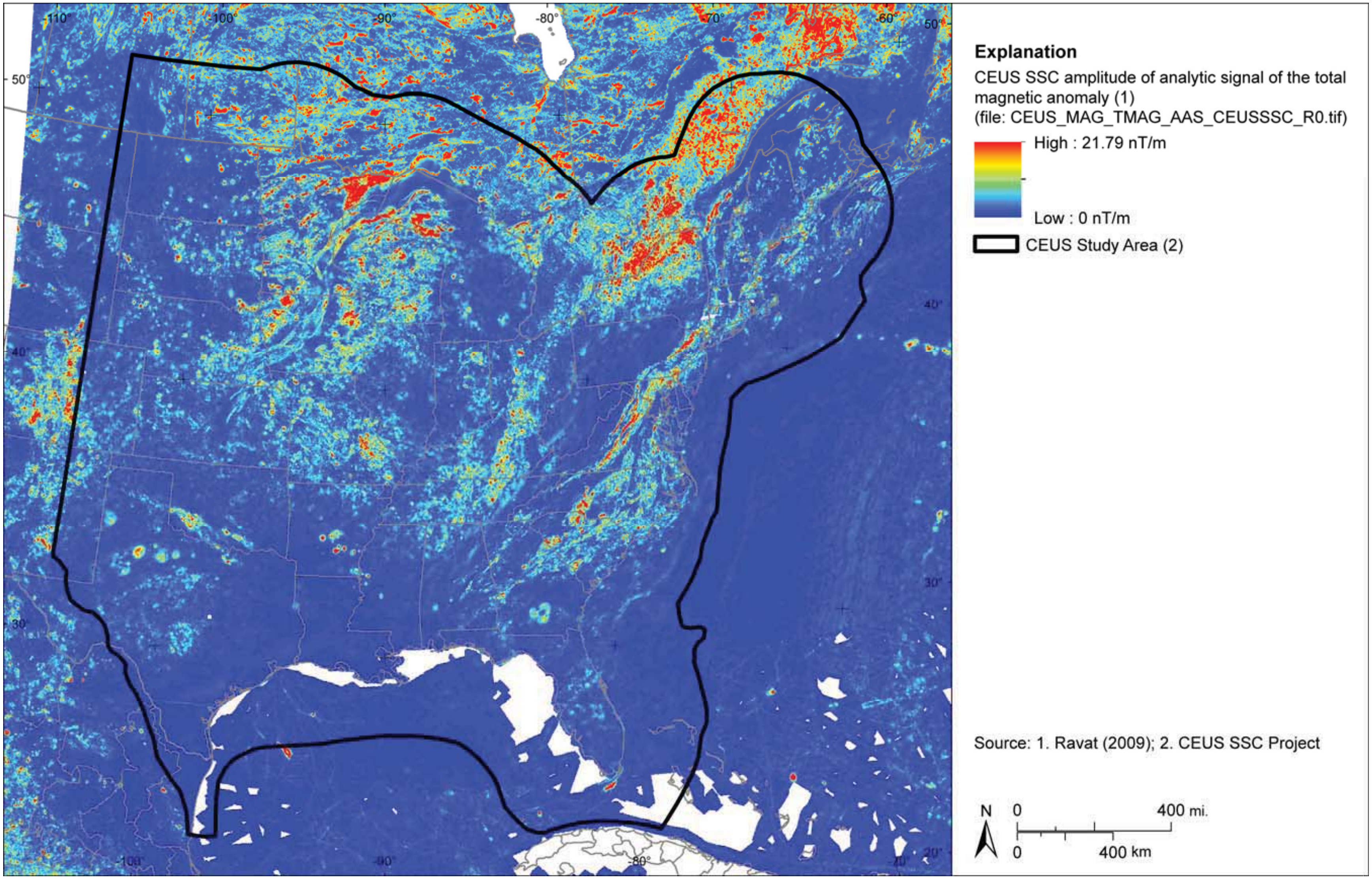

Figure A-46
CEUS SSC amplitude of analytic signal magnetic anomaly grid (Ravat, 2009)

Sheet A-18—CEUS SSC Project GIS Data Summary

CEUS SSC Paleoliquefaction Database

CEUS_PL_DB_CEUSSSC_R0.shp

Data Description: Data representing paleoliquefaction information for large regional data sets in the CEUS. This data layer was compiled to aid in the development of the CEUS seismic source model. Regional data from published and unpublished sources were combined to help constrain magnitudes, locations, and recurrence rates of magnitude earthquakes, for use in the characterization of seismic source zones for the CEUS SSC Project.

Features in the data layer are assigned the location of their respective source regions (KEY attribute) as well as a site name, unique identifier, latitude and longitude, observation type, feature type, age estimates, and other geotechnical, stratigraphic, and chronologic information. Appendix E describes the attributes in the database in detail.

Source (Internet URL, CD/DVD-ROM): Developed as part of the CEUS SSC Project.

Author/Publisher/Year: CEUS SSC Project. Appendix E includes a complete list of the references and data sources cited in the database.

Data Summary: Digital data in Microsoft Excel format were converted into an ESRI point shapefile format. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

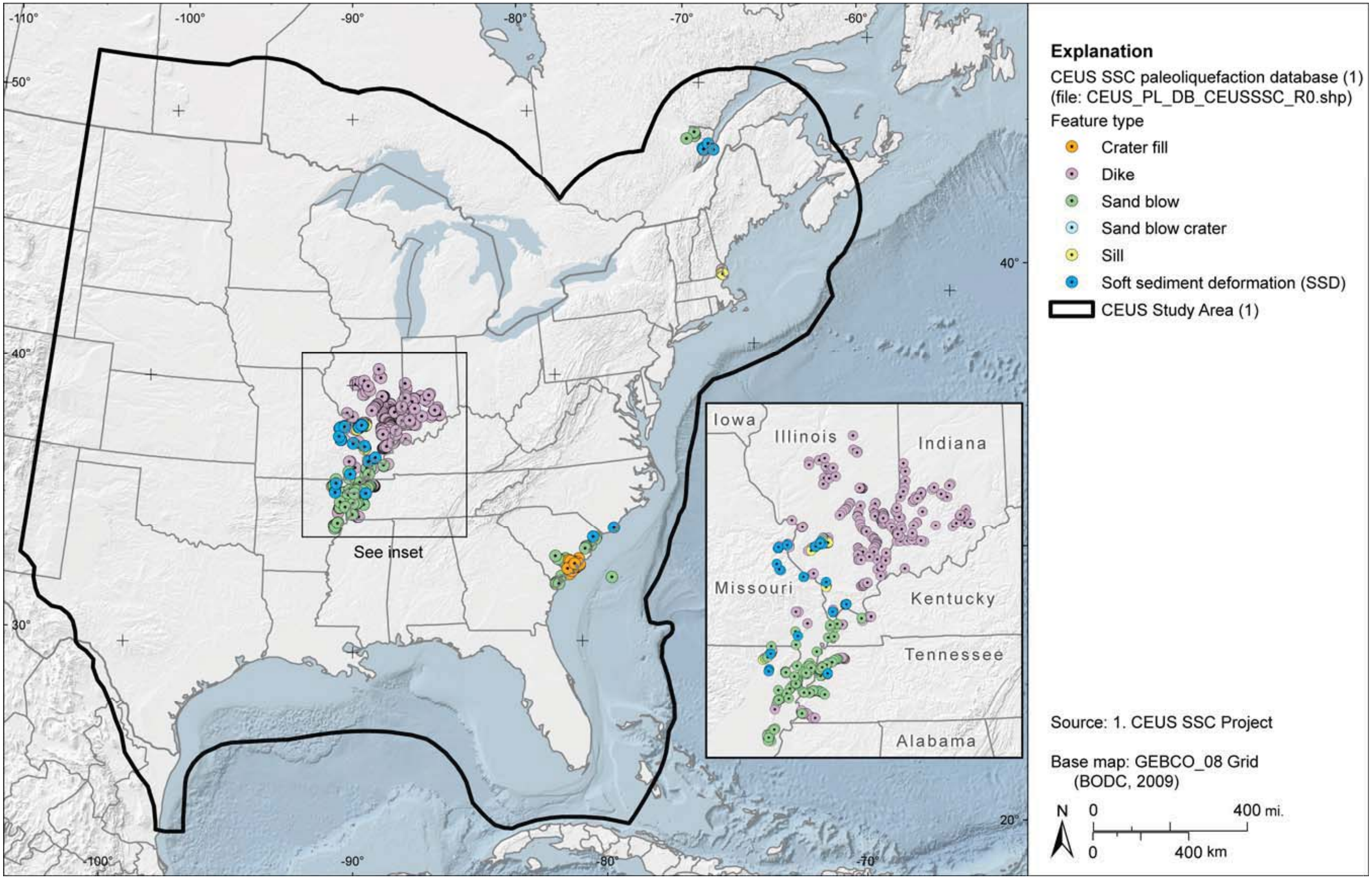

Figure A-47
CEUS SSC paleoliquefaction database

Sheet A-19—CEUS SSC Project GIS Data Summary

CEUS Compilation of Seismic Refraction/Reflection Lines, various authors

CEUS_SL_compilation_R0.shp

Data Description: A compilation of the locations of published seismic reflection or seismic refraction profiles in the literature. Attributes include the source of the publication and the type of profile, whether reflection or refraction. Attributes also include a cross-reference to the complete citation in the metadata.

Source (Internet URL, CD/DVD-ROM): Sources include profile lines digitized with reference to figures in publications and online databases. See the accompanying metadata for complete citation list.

Author/Publisher/Year: Layer compiled from profile locations depicted in several publications. See the layer's metadata for complete citation reference.

Data Summary: ESRI line shapefile compilation from figures provided at varying reference scales. Attributes include references to sources that are described in more detail in the accompanying metadata.

Disclaimer or Constraints on Use: No constraints have been identified.

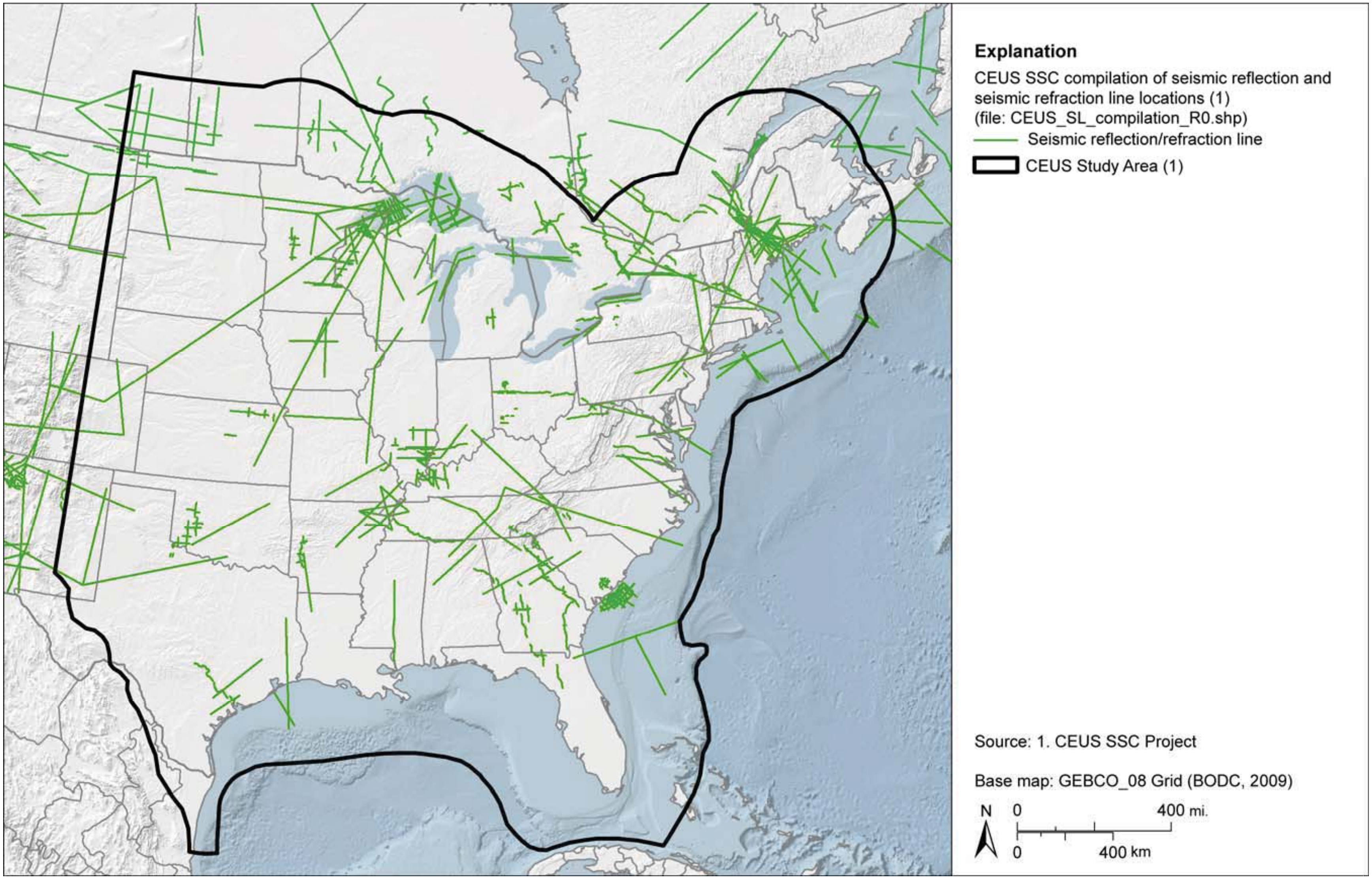

Figure A-48
CEUS SSC compilation of seismic reflection and seismic refraction lines

Sheet A-20—CEUS SSC Project GIS Data Summary

USGS National Seismic Hazard Maps Seismic Zones—2008

CEUS_NSHM_2008_po_R0.shp
CEUS_NSHM_2008_pl_R0.shp

eh1hz10pc50.tif	Earthquake hazard: 1 hz 10% in 50 years
eh1hz2pc50.tif	Earthquake hazard: 1 hz 2% in 50 years
eh1hz5pc50.tif	Earthquake hazard: 1 hz 5% in 50 years
eh3hz10pc50.tif	Earthquake hazard: 3 hz 10% in 50 years
eh3hz2pc50.tif	Earthquake hazard: 3 hz 2% in 50 years
eh3hz5pc50.tif	Earthquake hazard: 3 hz 5% in 50 years
eh5hz10pc50.tif	Earthquake hazard: 5 hz 10% in 50 years
eh5hz2pc50.tif	Earthquake hazard: 5 hz 2% in 50 years
eh5hz5pc50.tif	Earthquake hazard: 5 hz 5% in 50 years
ehpga10pc50.tif	Earthquake hazard: PGA 10% in 50 years
ehpga2pc50.tif	Earthquake hazard: PGA 2% in 50 years
ehpga5pc50.tif	Earthquake hazard: PGA 5% in 50 years

Data Description: Uniform background zones, special zones, finite fault sources and hazard probability layers for the CEUS. These zones were defined for U.S. Geological Survey Open-File Report 2008-1128, *Documentation for the 2008 Update of the United States National Seismic Hazard Maps*. The TIFF-format surfaces present ground motions for various probability levels.

Source (Internet URL, CD/DVD-ROM): ASCII text files provided by Charles Mueller, personal communication, May 2009.

Author/Publisher/Year: Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Y., Boyd, O.S., Perkins, D.M., Luco, N., Field, E.H., Wills, C.J., and Rukstales, K.S., 2008, *Documentation for the 2008 Update of the United States National Seismic Hazard Maps*: U.S. Geological Survey Open-File Report 2008-1128, 61 pp.

Data Summary: Data layers were compiled from source ASCII text files of latitude and longitude to define polygon and polyline boundaries. Text files that represent each uniform background zone were merged to create a single polygon GIS layer. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

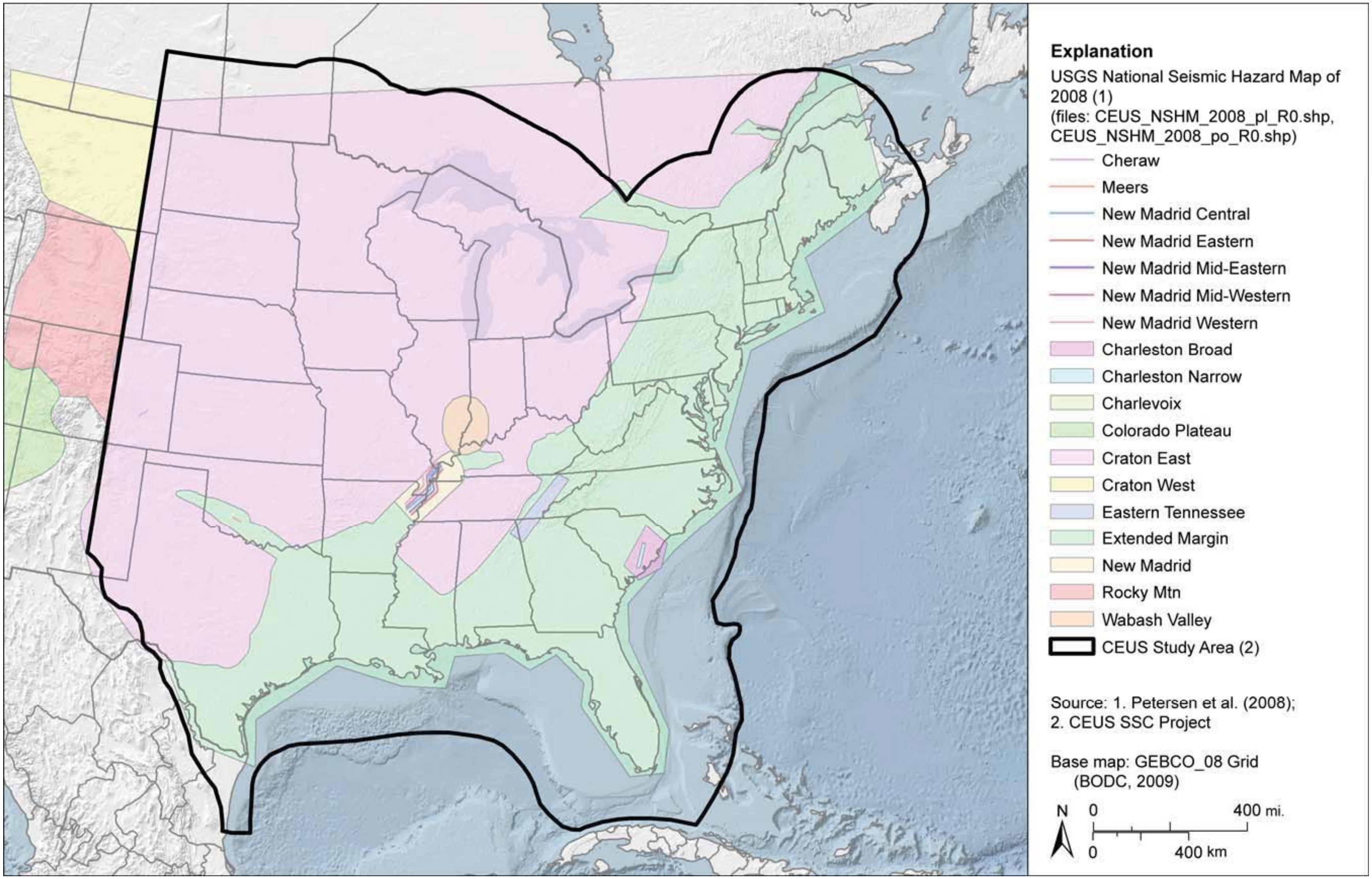

Figure A-49
USGS National Seismic Hazard Maps (Petersen et al., 2008)

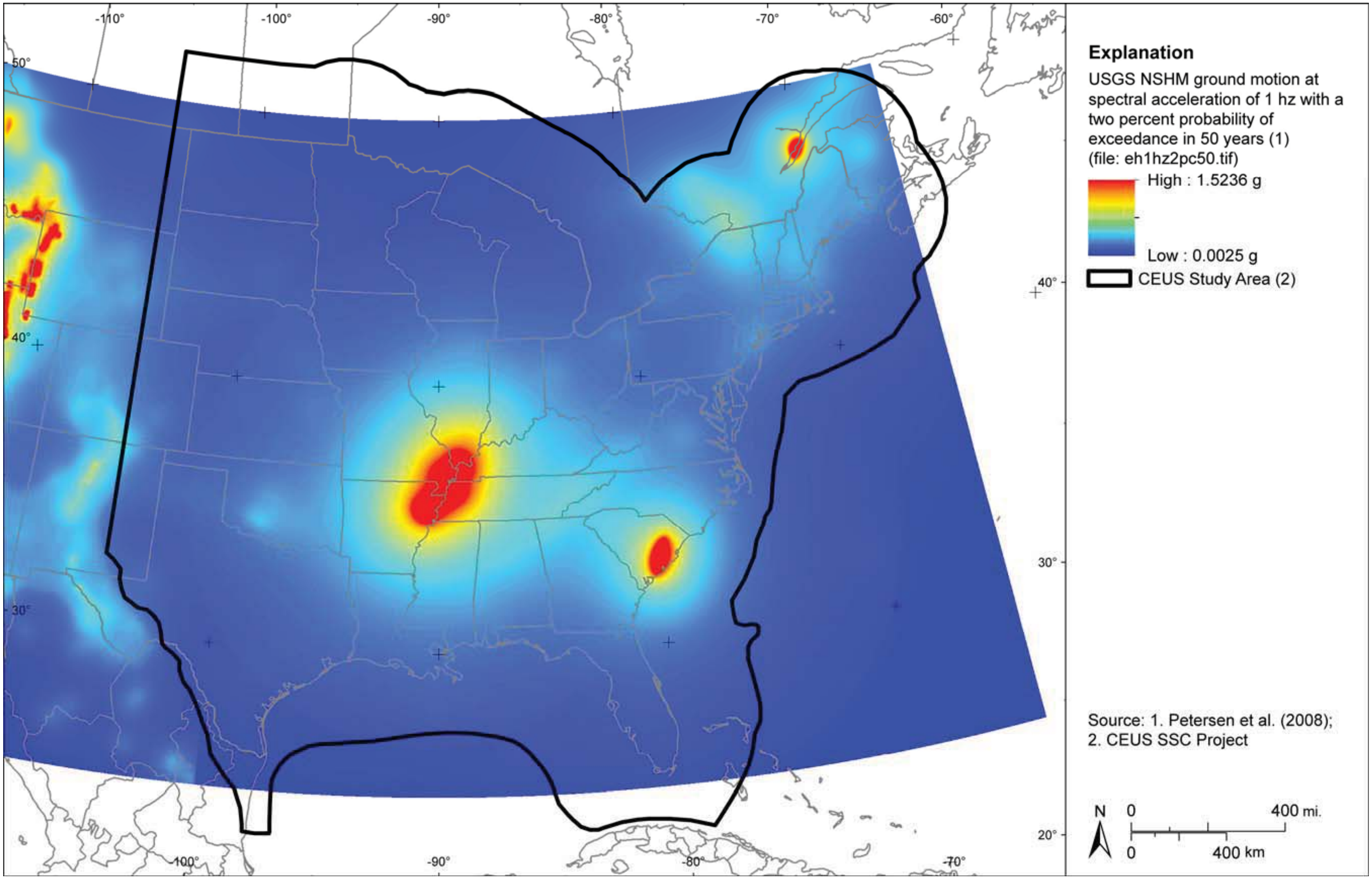

Figure A-50
USGS NSHM ground motion hazard at spectral acceleration of 1 hz with 2% probability of exceedance in 50 years (Petersen et al., 2008)

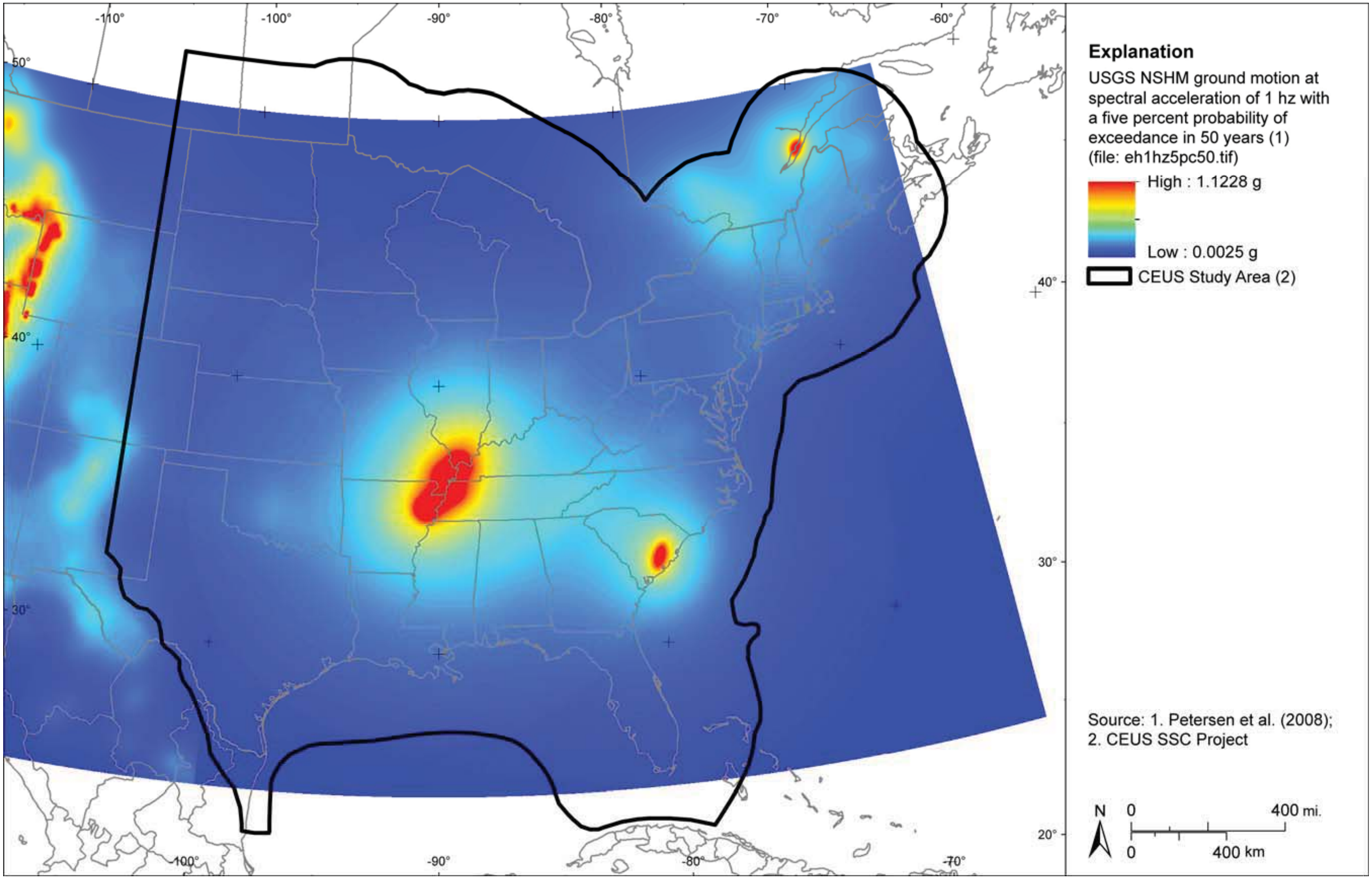

Figure A-51
USGS NSHM ground motion hazard at spectral acceleration of 1 hz with 5% probability of exceedance in 50 years (Petersen et al., 2008)

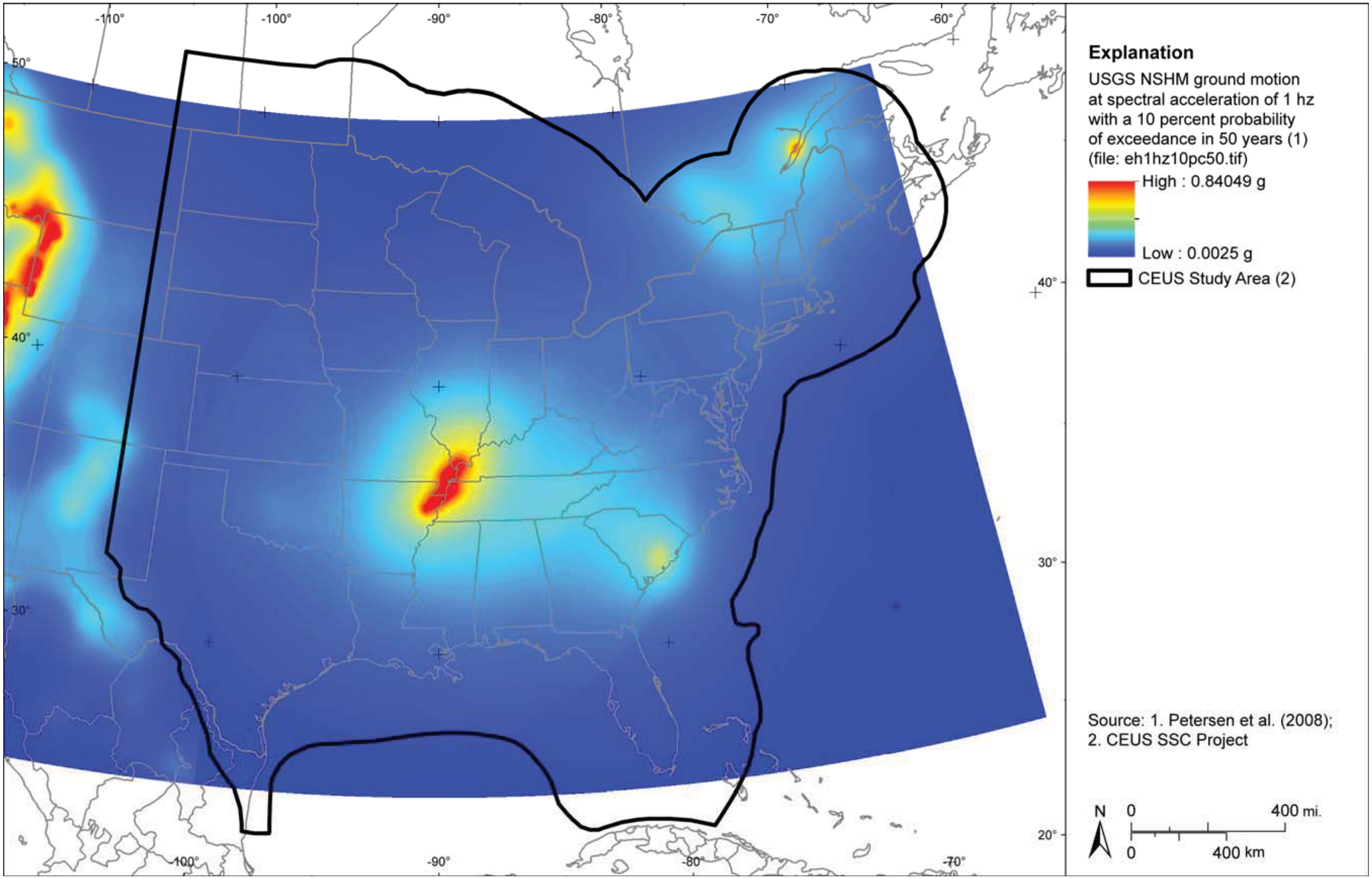

Figure A-52
USGS NSHM ground motion hazard at spectral acceleration of 1 hz with 10% probability of exceedance in 50 years (Petersen et al., 2008)

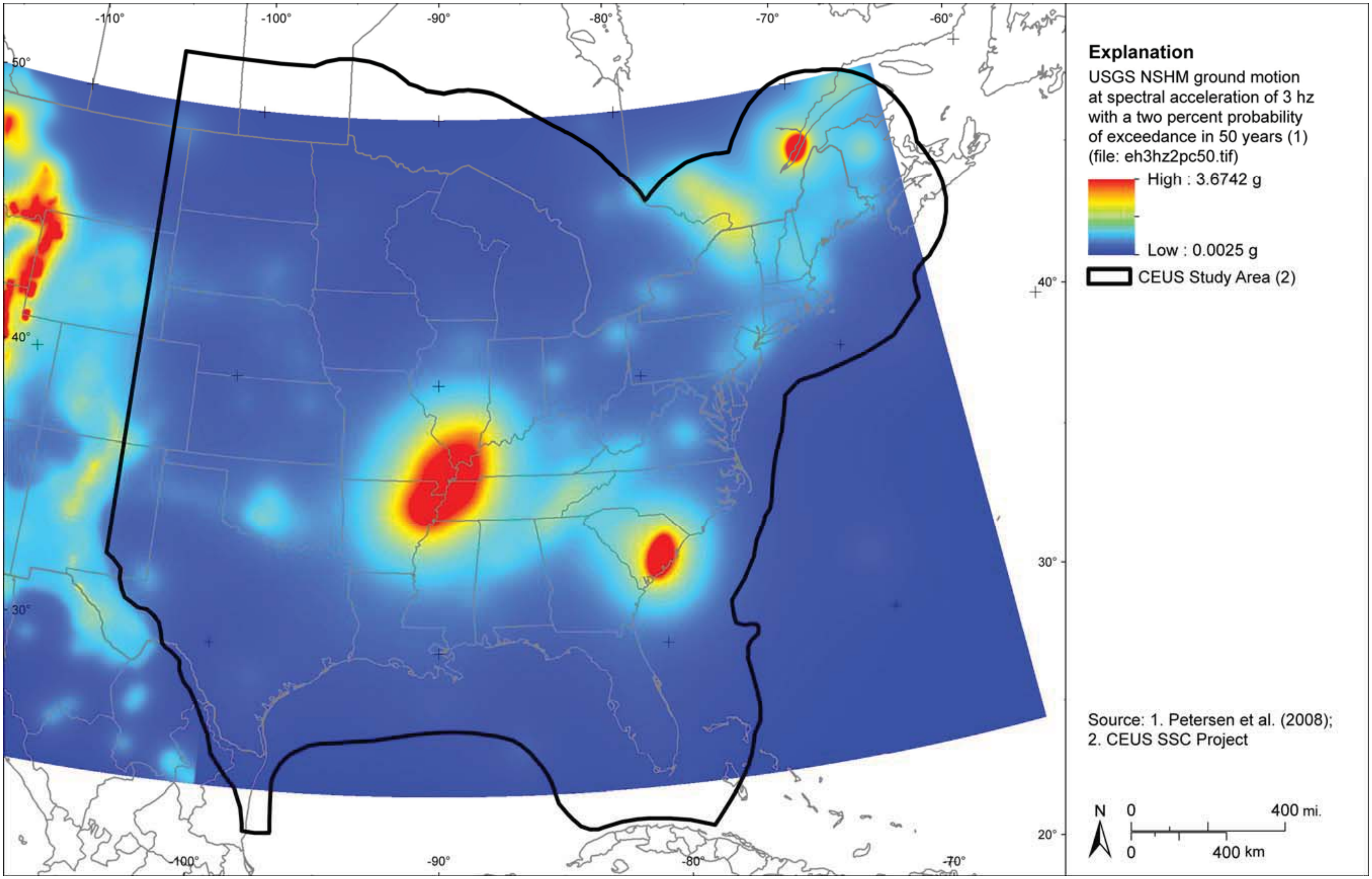

Figure A-53
USGS NSHM ground motion hazard at spectral acceleration of 3 hz with 2% probability of exceedance in 50 years (Petersen et al., 2008)

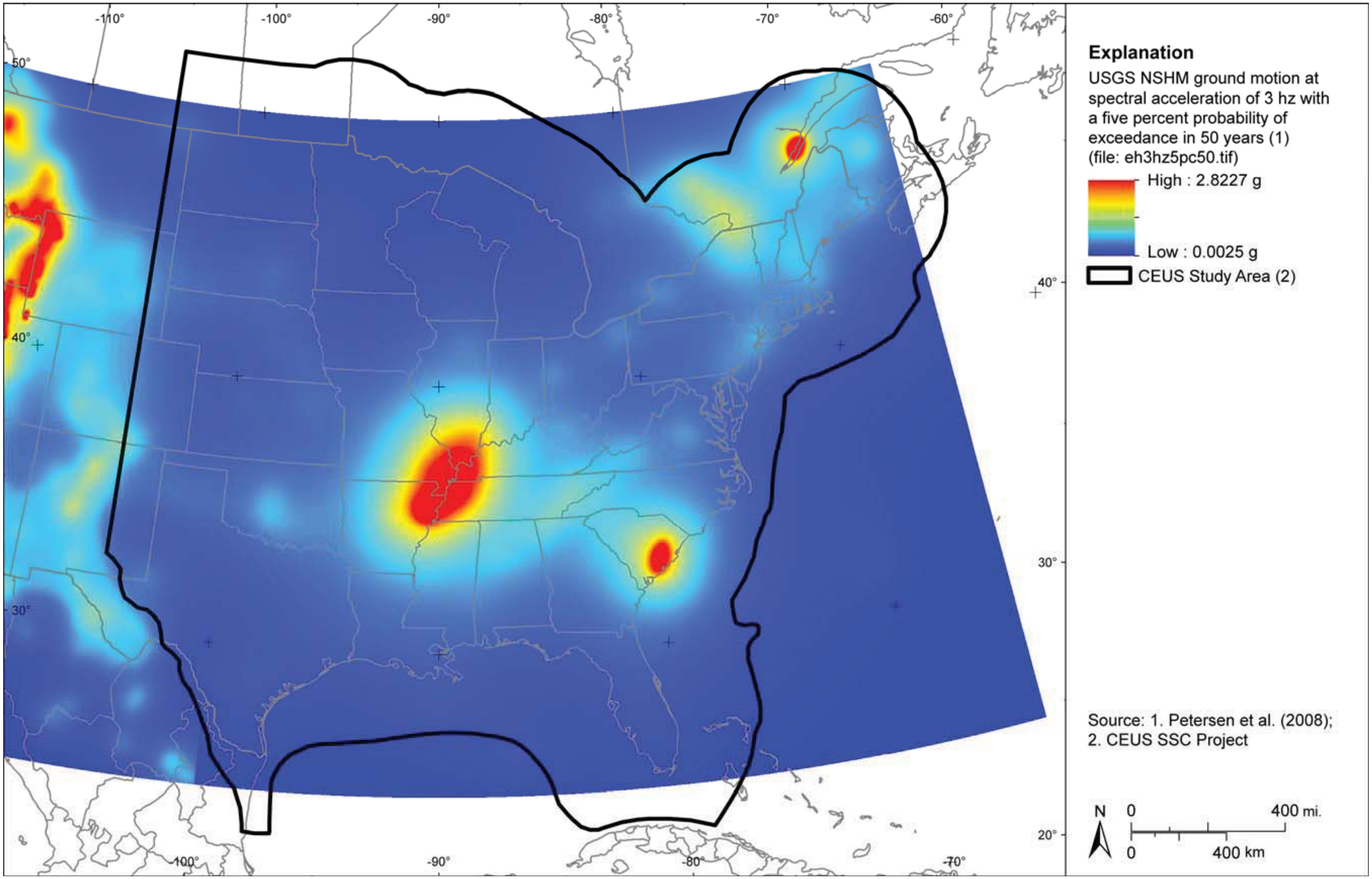

Figure A-54
USGS NSHM ground motion hazard at spectral acceleration of 3 hz with 5% probability of exceedance in 50 years (Petersen et al., 2008)

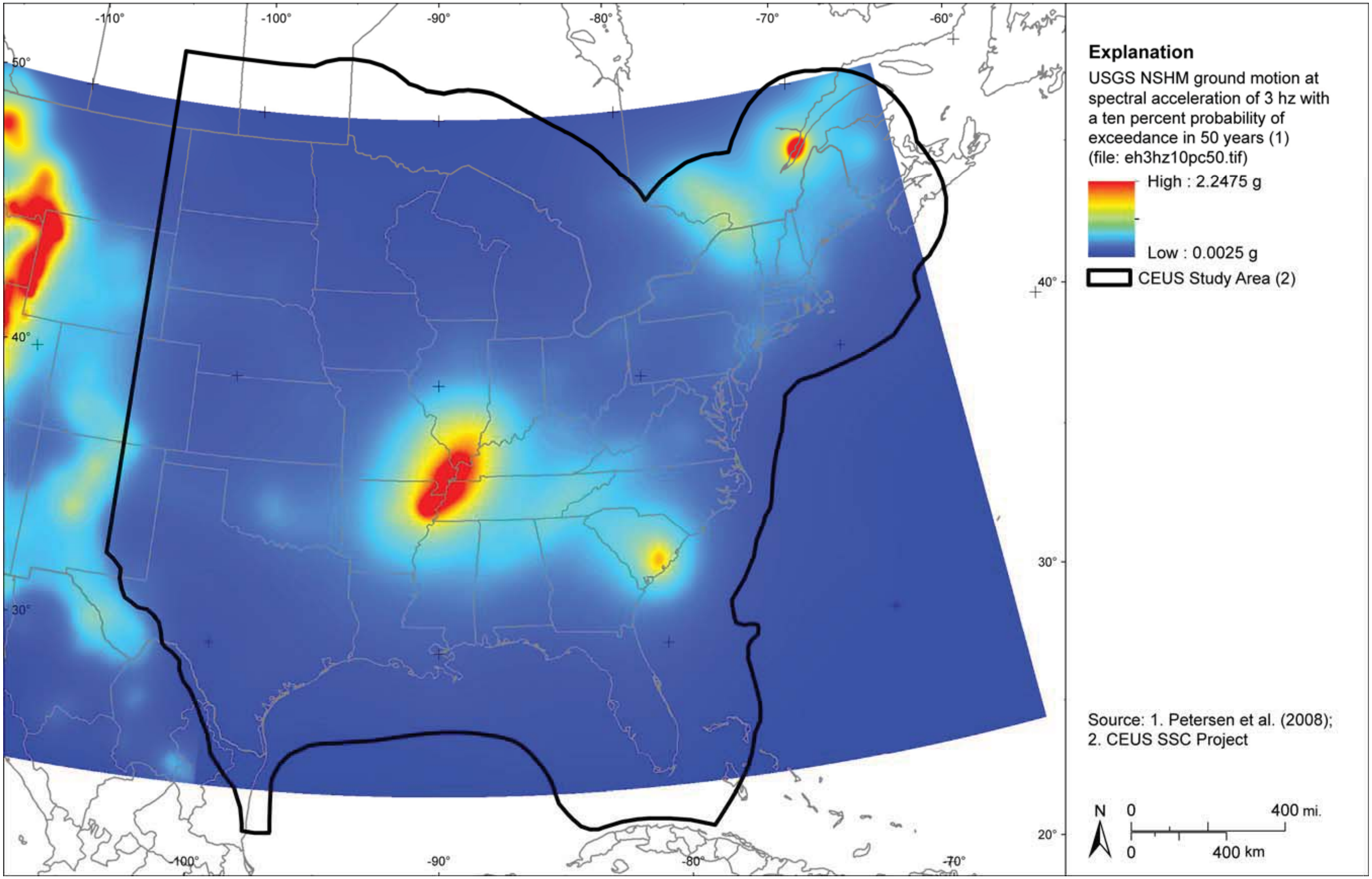

Figure A-55
USGS NSHM ground motion hazard at spectral acceleration of 3 hz with 10% probability of exceedance in 50 years (Petersen et al., 2008)

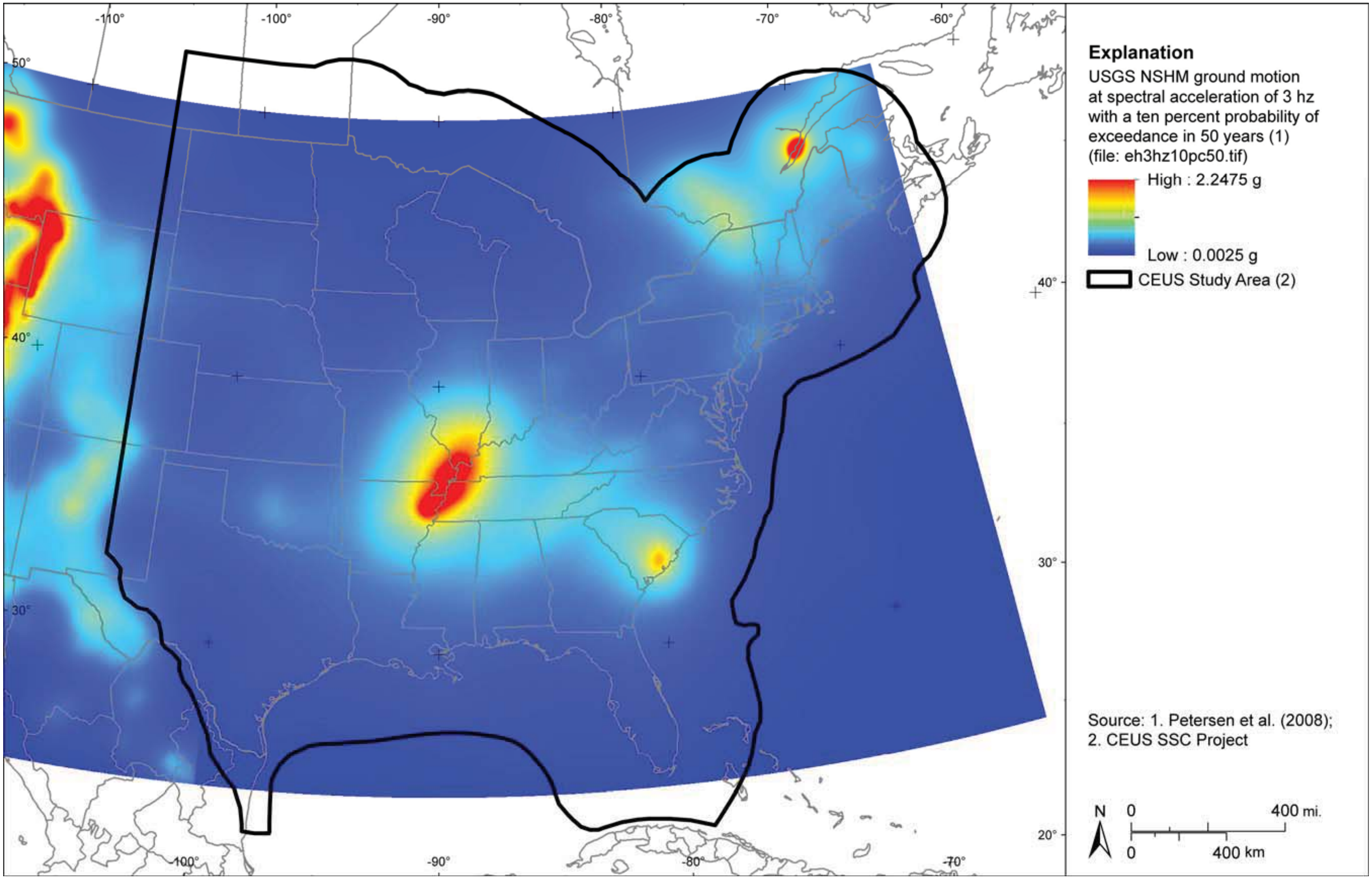

Figure A-56
USGS NSHM ground motion hazard at spectral acceleration of 5 hz with 2% probability of exceedance in 50 years (Petersen et al., 2008)

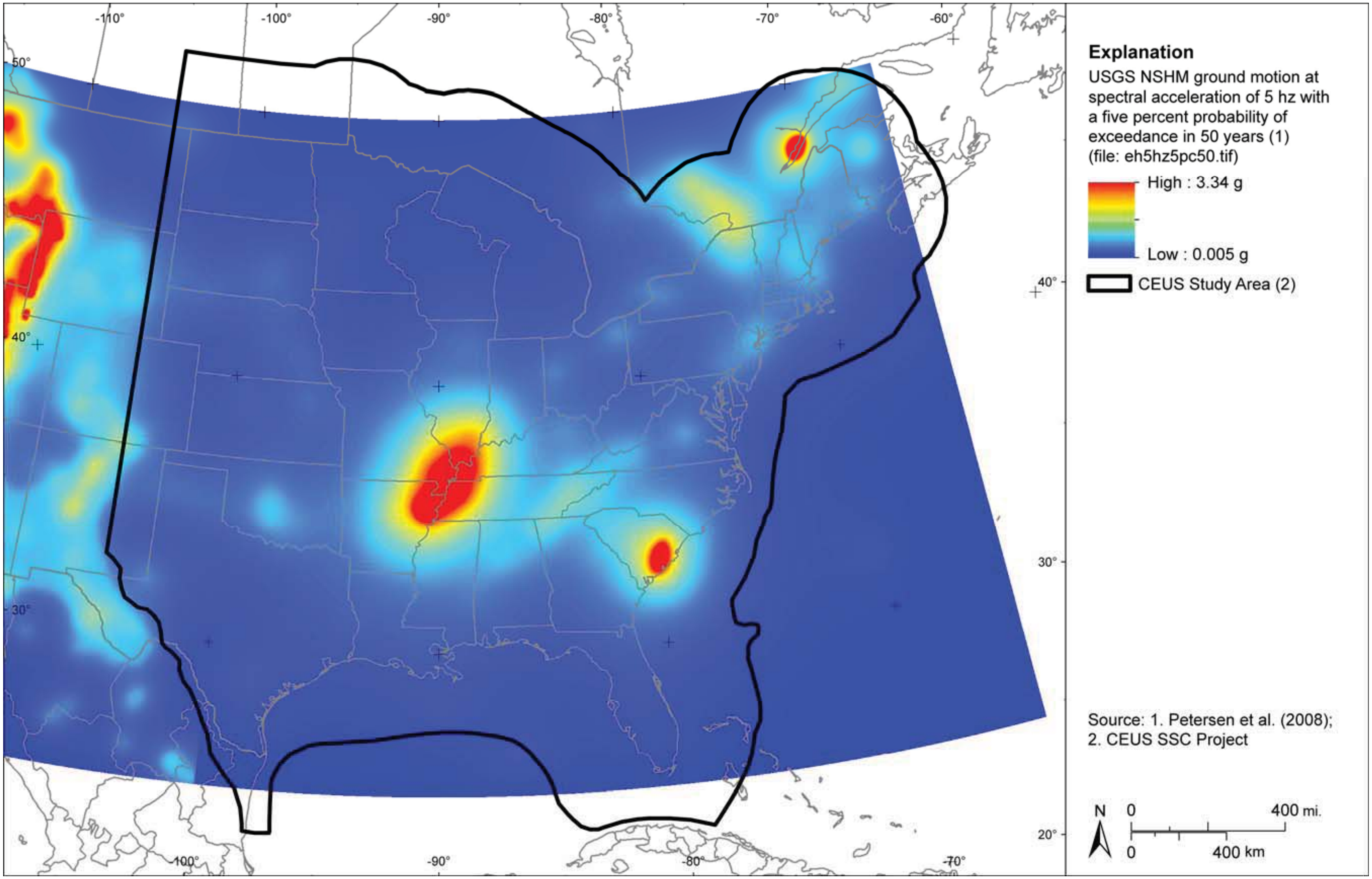

Figure A-57
USGS NSHM ground motion hazard at spectral acceleration of 5 hz with 5% probability of exceedance in 50 years (Petersen et al., 2008)

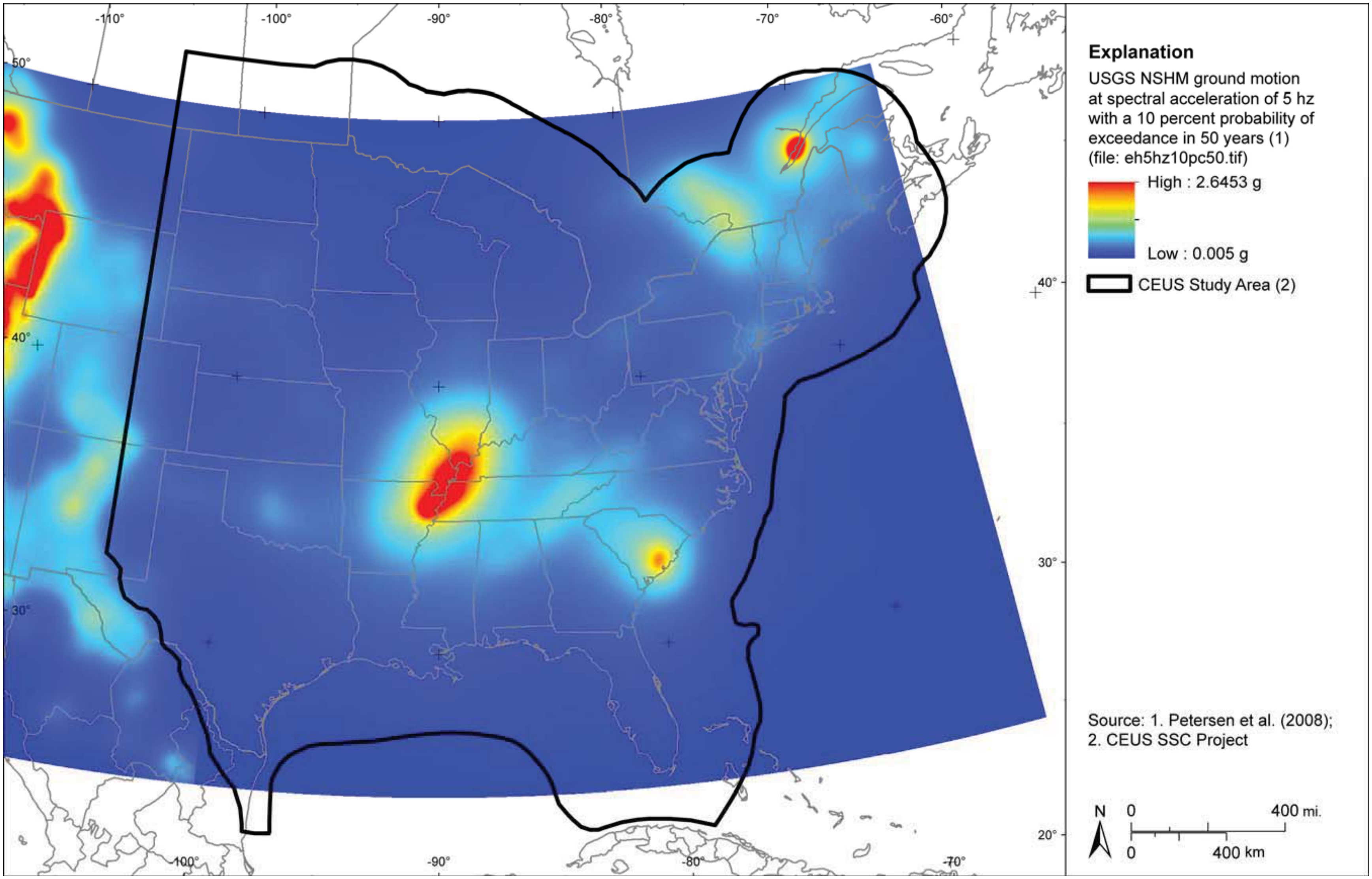

Figure A-58
USGS NSHM ground motion hazard at spectral acceleration of 5 hz with 10% probability of exceedance in 50 years (Petersen et al., 2008)

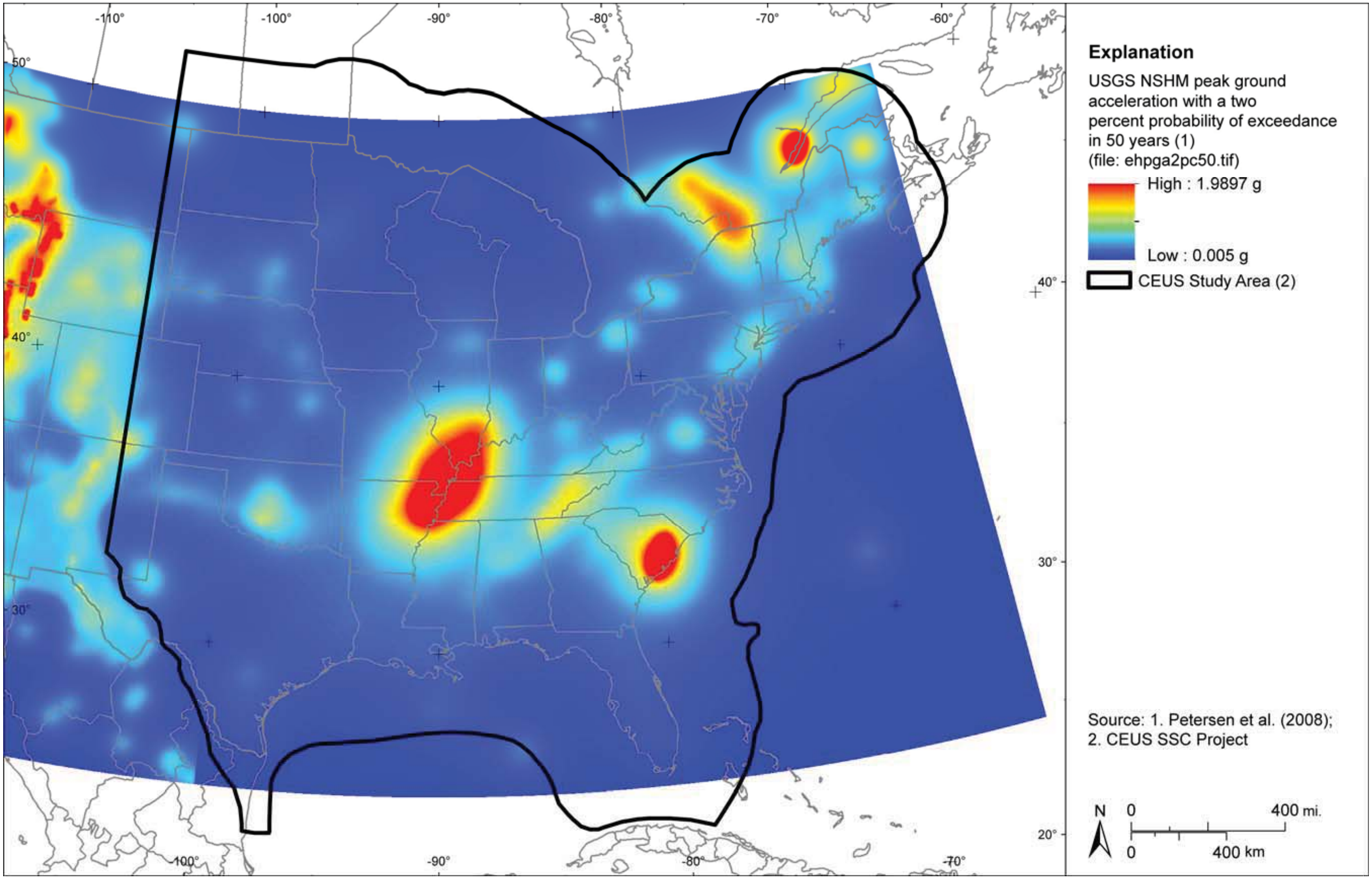

Figure A-59
USGS NSHM peak ground acceleration with 2% probability of exceedance in 50 years (Petersen et al., 2008)

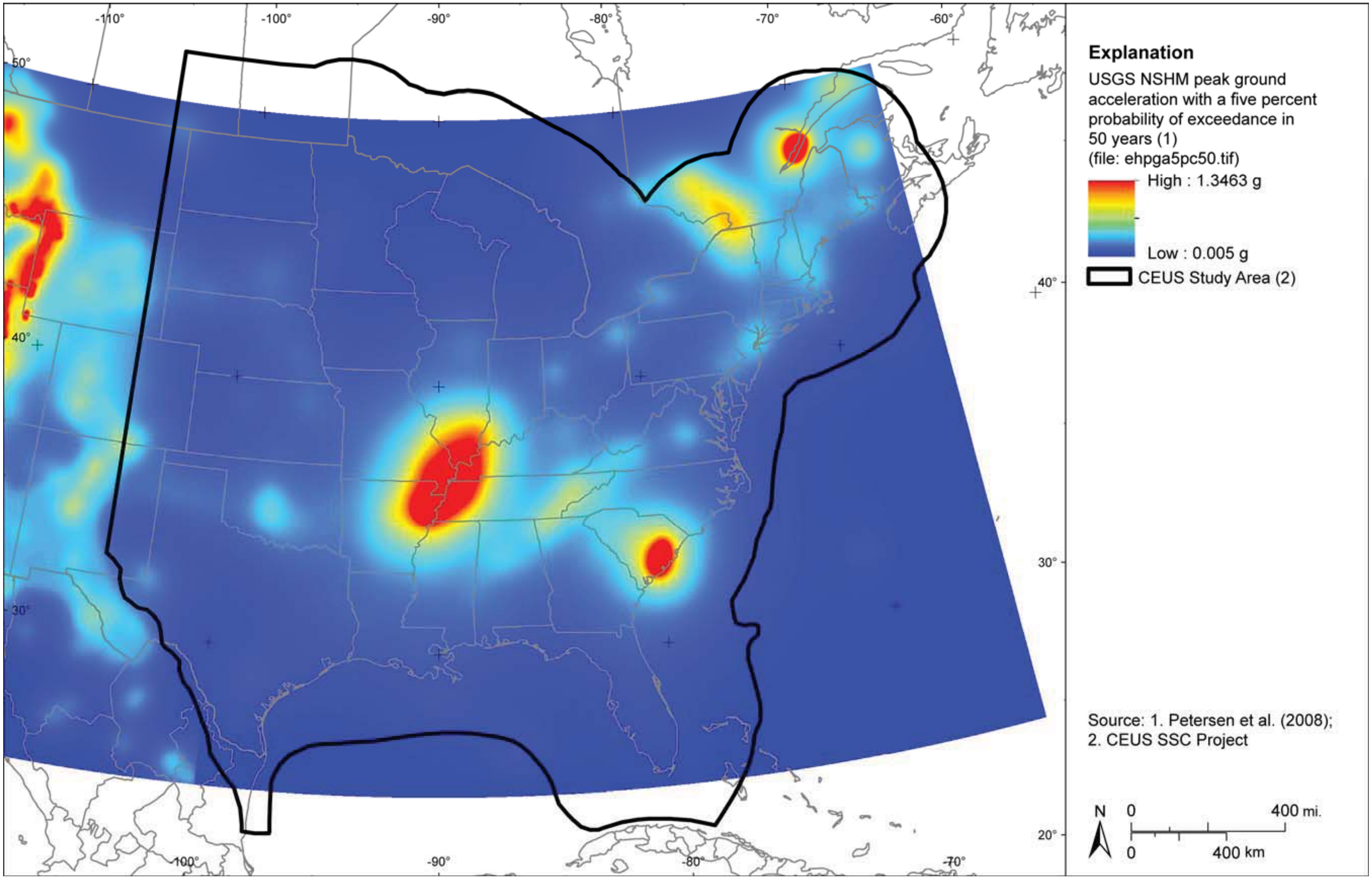

Figure A-60
USGS NSHM peak ground acceleration with 5% probability of exceedance in 50 years (Petersen et al., 2008)

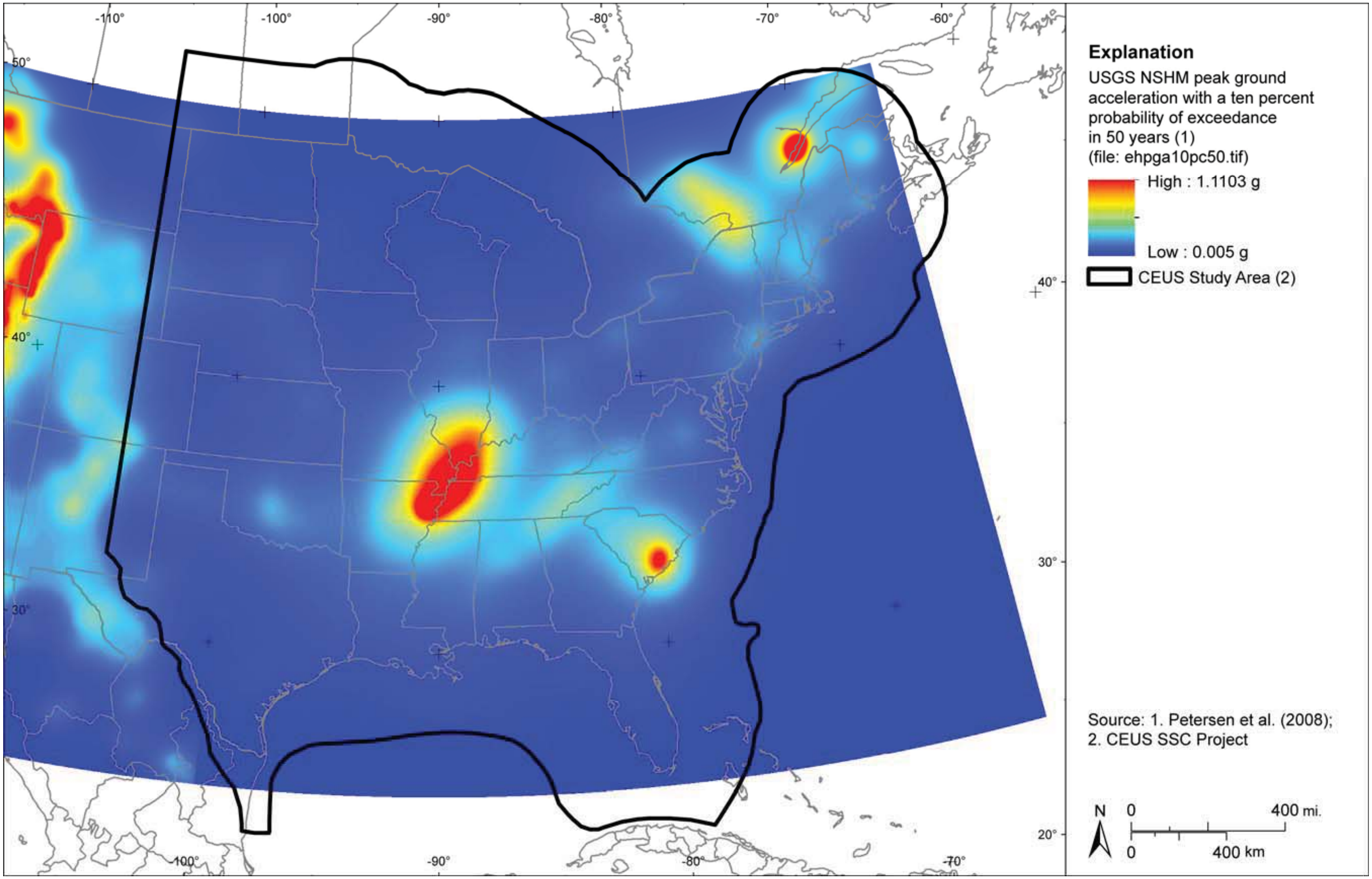

Figure A-61
USGS NSHM peak ground acceleration with 10% probability of exceedance in 50 years (Petersen et al., 2008)

Sheet A-21—CEUS SSC Project GIS Data Summary

Calais—Deformation of the North American Plate Interior Using GPS Station Data

CEUS_GPS_NA_ITRF2000_Calais_R0.shp

Data Description: Surface deformation in the North American Plate interior using GPS-based station data. Surface deformation is measured by approximately 300 GPS stations. Deformation is best explained by a rigid rotation model and strain components consistent with that expected from glacial isostatic adjustment (GIA). Residual horizontal velocities show a north-to-south deformation gradient of 1 mm/yr mostly localized between 1,000 and 2,200 km from the GIA center.

Source (Internet URL, CD/DVD-ROM): Calais, E., 2008, personal communication.

Author/Publisher/Year: Calais, E., Han, J.Y., DeMets, C., and Nocquet, J.M., 2006, Deformation of the North American Plate interior from a decade of continuous GPS measurements: *Journal of Geophysical Research,* v. 111, B06402, doi:10.1029/2005JB004253.

Data Summary: Point data were obtained from the author in digital form and converted to ESRI point shapefile. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

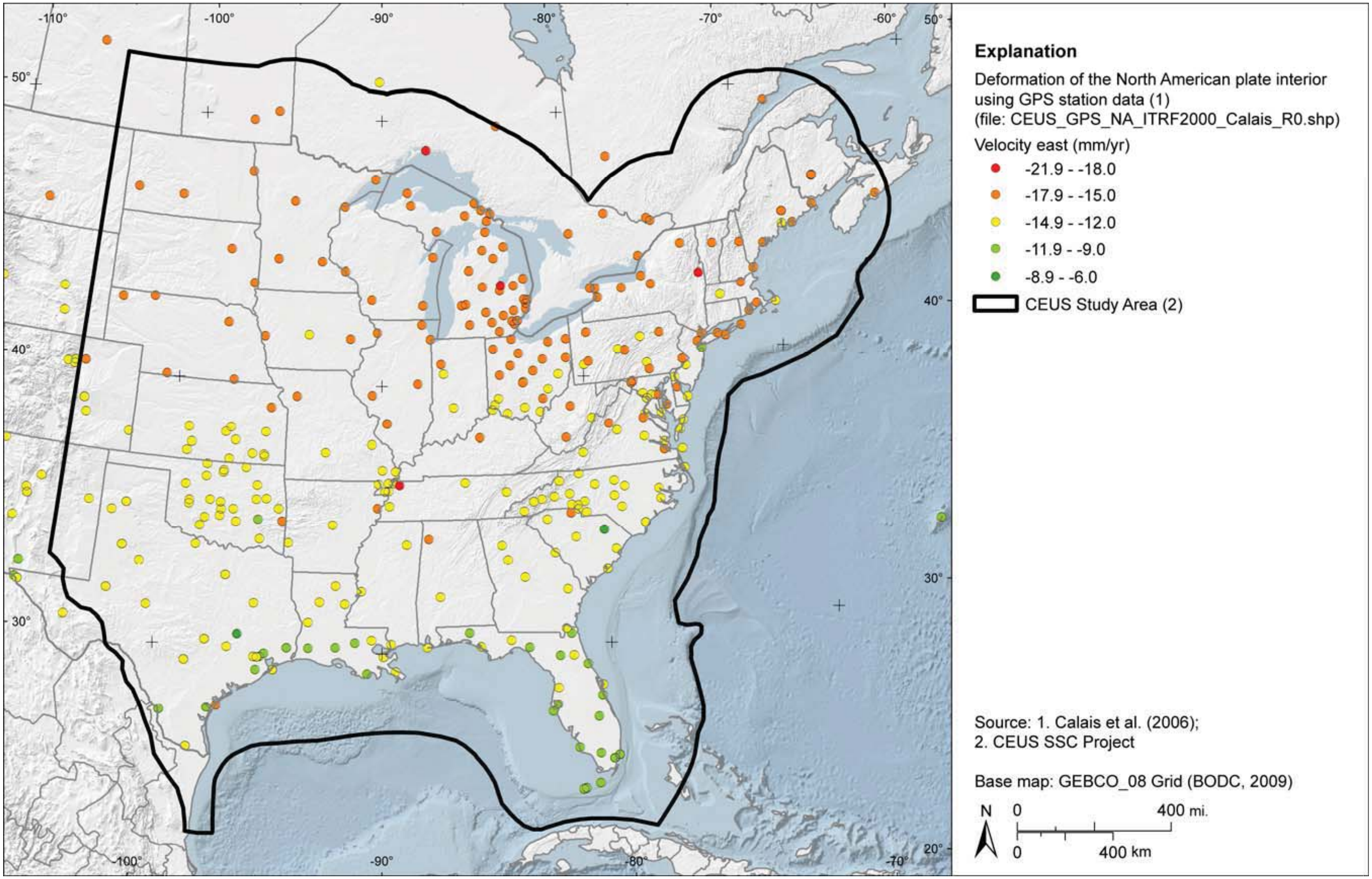

Figure A-62
Deformation of the North American Plate interior using GPS station data (Calais et al., 2006)

Sheet A-22—CEUS SSC Project GIS Data Summary

World Stress Map of 2008 Updated by Owen Hurd, Stanford University

CEUS_WSM_Hurd2010_R0.shp

Data Description: This GIS layer presents updated crustal stress data not previously found in the World Stress Map Project's (WSM) 2008 release. These 49 updates were found through a literature review by Dr. Owen Hurd of Stanford University. The data, in combination with the WSM 2008 release, covers the area of the CEUS. Stress indicators are taken from four general types of sources including: earthquake focal mechanisms, well bore breakouts and drilling-induced fractures, in situ stress measurements, and young geologic data (fault-slip analysis and volcanic vent alignments). Several ESRI symbology layers are provided to assist in the presentation of the attributes included with the data.

Summary of explanation labels in Figure A-63 and the GIS layer's attribute table:

Quality		Regime	
A =	S_H is within ± 15 degrees	NF =	Normal faulting
B =	S_H is within ± 20 degrees	SS =	Strike-slip faulting
C =	S_H is within ± 25 degrees	TF =	Thrust faulting
		U =	Unknown regime

where S_H is the maximum horizontal compressional stress.**Source (Internet URL, CD/DVD-ROM):** WSM 2008 release is available at http://world-stress-map.org. Updates from Dr. Owen Hurd obtained 2010 via personal communication.

Author/Publisher/Year: Heidbach, O., Tingay, M., Barth, A., Reinecker, J., Kurfess, D., and Müller, B., 2008, The World Stress Map database release 2008 doi:10.1594/GFZ.WSM.Rel2008.

Hurd, O., 2010, Stress Measurement Update for the Central and Eastern United States, 5 pp.

Data Summary: WSM 2008 data in Microsoft Excel (xls) format were converted to ESRI point shapefile using latitude and longitude values. Updated stress measurements from Dr. Hurd were provided in the same attribute layout as the WSM 2008 and converted to ESRI point shapefile.

Disclaimer or Constraints on Use: Disclaimer from the WSM Project website, http://dc-app3-14.gfz-potsdam.de/pub/introduction/introduction_frame.html:

> "Information at this site is general information provided as part of World Stress Map project's role in publishing its activities and disseminating information. We aim to ensure that all information we maintain is accurate, current and fit for the purpose intended. Because the World Stress Map (WSM) team must rely on information provided by others, it makes no guarantees, expressed or implied, as to the accuracy of the data, opinions, interpretations, conclusions, or recommendations contained herein. By using this information the user agrees to release and indemnify the WSM team from any liability for injury, loss, damages, or

expenses resulting therefrom, even if caused by the negligence of the WSM team.

Links and frames connecting this site with other sites are for convenience only and do not mean that the WSM team endorses or approves them. We cannot guarantee that these links will work all of the time and we have no control over the availability of linked pages.

Generally, it is the responsibility of the user to ascertain the accuracy, currency, reliability and correctness of information found in this database and at sites linked from this website."

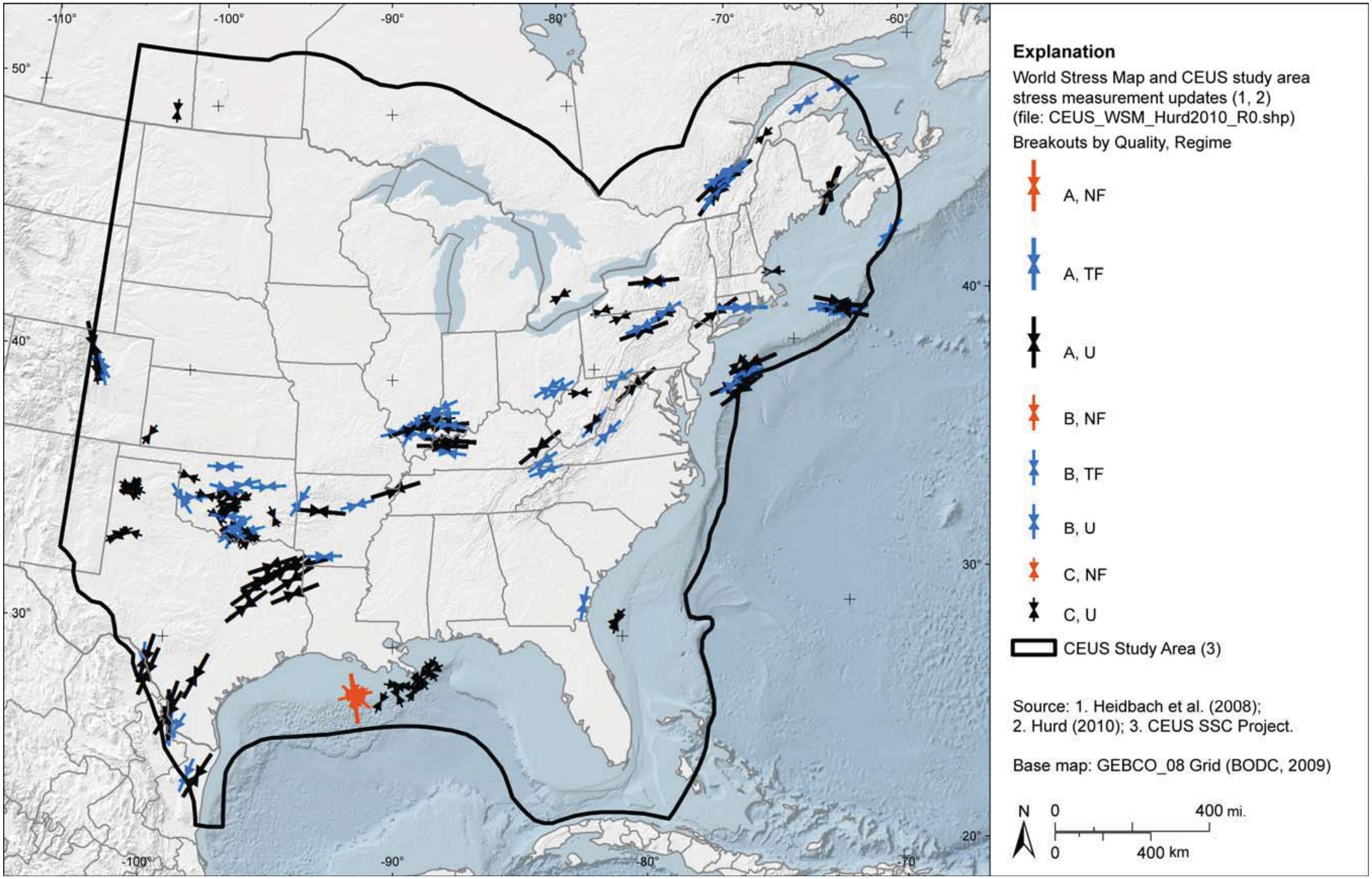

Figure A-63
Stress measurement update for the CEUS (Hurd, 2010)

Sheet A-23—CEUS SSC Project GIS Data Summary

CEUS SSC Study Area Boundary

CEUS_boundary_R0.shp

Data Description: The CEUS study area boundary was developed to include the area of the CEUS and adjacent portions of Canada and Mexico. The western limit was set to 105 degrees west longitude, roughly corresponding to the Rocky Mountains eastern extent, and extending 200 miles into Canada and the Atlantic Ocean, with modifications according to the edge of the Continental Slope and the edge of extended terrain. The southern and southeastern extent of the study area was modified to follow the assumed extent of Paleozoic accreted terrain and the oceanic crust boundary in the Caribbean Sea and Gulf of Mexico, respectively. The extent of the study area in Mexico follows the northeastern extent of the Sierra Madre Occidental range up to 105 degrees west longitude.

Source (Internet URL, CD/DVD-ROM): Study area extent was proposed for this study.

Author/Publisher/Year: CEUS SSC Project.

Data Summary: ESRI polygon shapefile created from geographic references and data developed during this study. Study area boundary is presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

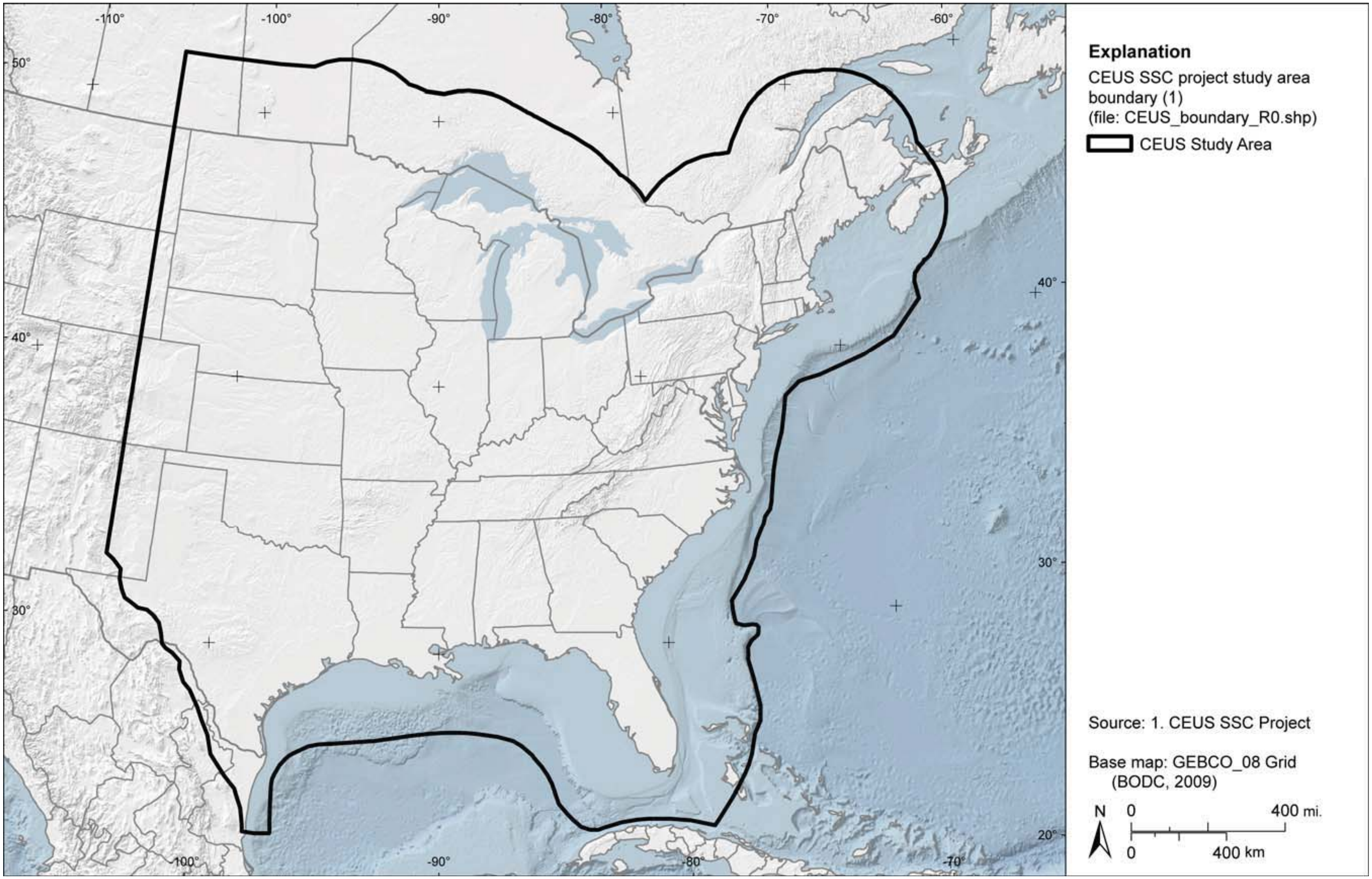

Figure A-64
CEUS SSC Project study area boundary

Sheet A-24—CEUS SSC Project GIS Data Summary

Faults and Seismic Areas Associated with Quaternary Seismicity, USGS Quaternary Fault and Fold Database

CEUS_Q_faults_USGS_pl_R0.shp
CEUS_Q_faults_USGS_po_R0.shp

Data Description: The USGS Quaternary fault and fold database presents the locations of faults, associated folds and, in the CEUS, areas of faulting, Quaternary paleoseismic features and seismicity, that are believed to be the sources of magnitude 6 or greater earthquakes in the Quaternary period (less than 1.6 Ma). The USGS uses the database as a source for studies involving probabilistic seismic-hazard analyses. Data are compiled from published literature review and M.S./Ph.D. theses and dissertations. State geologic surveys assisted in the development of the database as well as National Earthquake Hazards Reduction Program (NEHRP) studies. The USGS continually updates this database. See the website for the most current data.

Source (Internet URL, CD/DVD-ROM): Data accessed February 16, 2009, from http://earthquakes.usgs.gov/qfaults/.

Author/Publisher/Year: U.S. Geological Survey (and supporting state agency if appropriate)Quaternary Fault and Fold Database for the United States: http://earthquakes.usgs.gov/regional/qfaults/; accessed June 9, 2008.

Data Summary: Obtained from the above website in ESRI shapefile format. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

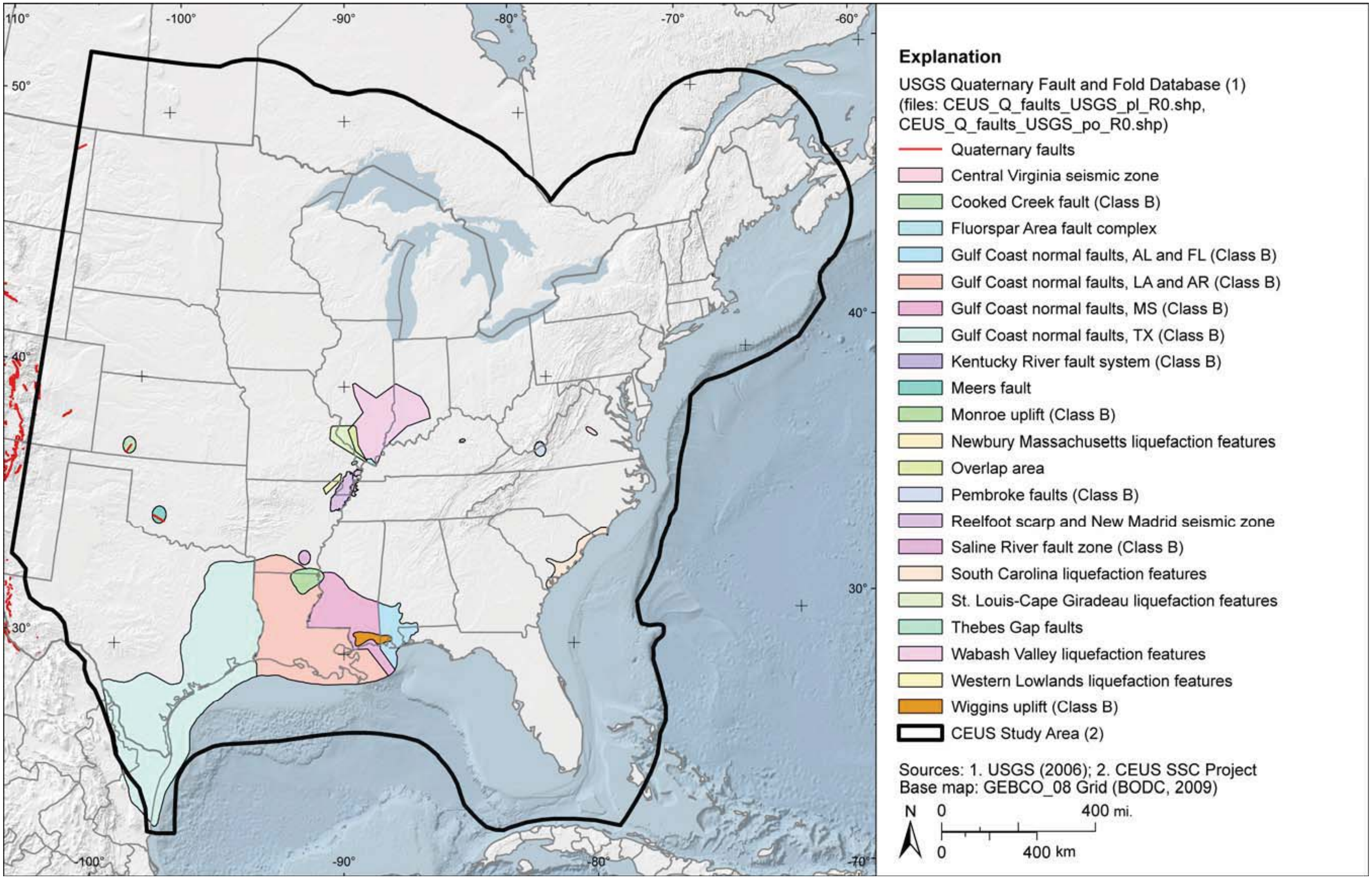

Figure A-65
USGS Quaternary fault and fold database (USGS, 2006)

Sheet A-25—CEUS SSC Project GIS Data Summary

Data for Quaternary Faults, Liquefaction Features, and Possible Tectonic Features in the CEUS

CEUS_Q_features_USGS_(pt/pl/po)_R0.shp

Data Description: This layer combines Quaternary tectonic features representing known or suggested Quaternary faults, folds, fields of paleoliquefaction features, seismic zones, and geomorphic features. Feature descriptions were obtained from Crone and Wheeler (2000), Wheeler (2005), and USGS features downloaded from the USGS Quaternary Fault and Fold Database for classes A through C. Locations of classes A & B features were obtained from USGS Quaternary Fault and Fold database or from original reference noted in Wheeler (2005). Location of Class C features were obtained from descriptions, latitude/longitude coordinates, or small-scale figures in Crone and Wheeler (2000), or from original references noted in Crone and Wheeler (2000) or Wheeler (2005). The attributes of the shapefiles note the reference information, location notes, and feature names.

Source (Internet URL, CD/DVD-ROM): USGS Quaternary Fault and Fold Database: http://earthquake.usgs.gov/hazards/qfaults/.

Author/Publisher/Year: Crone, A.J., and Wheeler, R.L., 2000, *Data for Quaternary Faults, Liquefaction Features, and Possible Tectonic Features in the Central and Eastern United States, East of the Rocky Mountain Front*: U.S. Geological Survey Open-File Report 00-0260, 342 pp.

Wheeler, R.L., 2005, *Known or Suggested Quaternary Tectonic Faulting, Central and Eastern United States— New Updated Assessments for 2005*: U.S. Geological Survey Open File Report 2005 1336, 40 pp.

USGS Quaternary Fault and Fold Database; website: http://earthquake.usgs.gov/hazards/qfaults/.

Data Summary: USGS Quaternary fault and fold database features as polylines and polygons were included with features digitized from the above references to create the ESRI shapefiles. Features were digitized at, or better, than the scale of the source figures. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

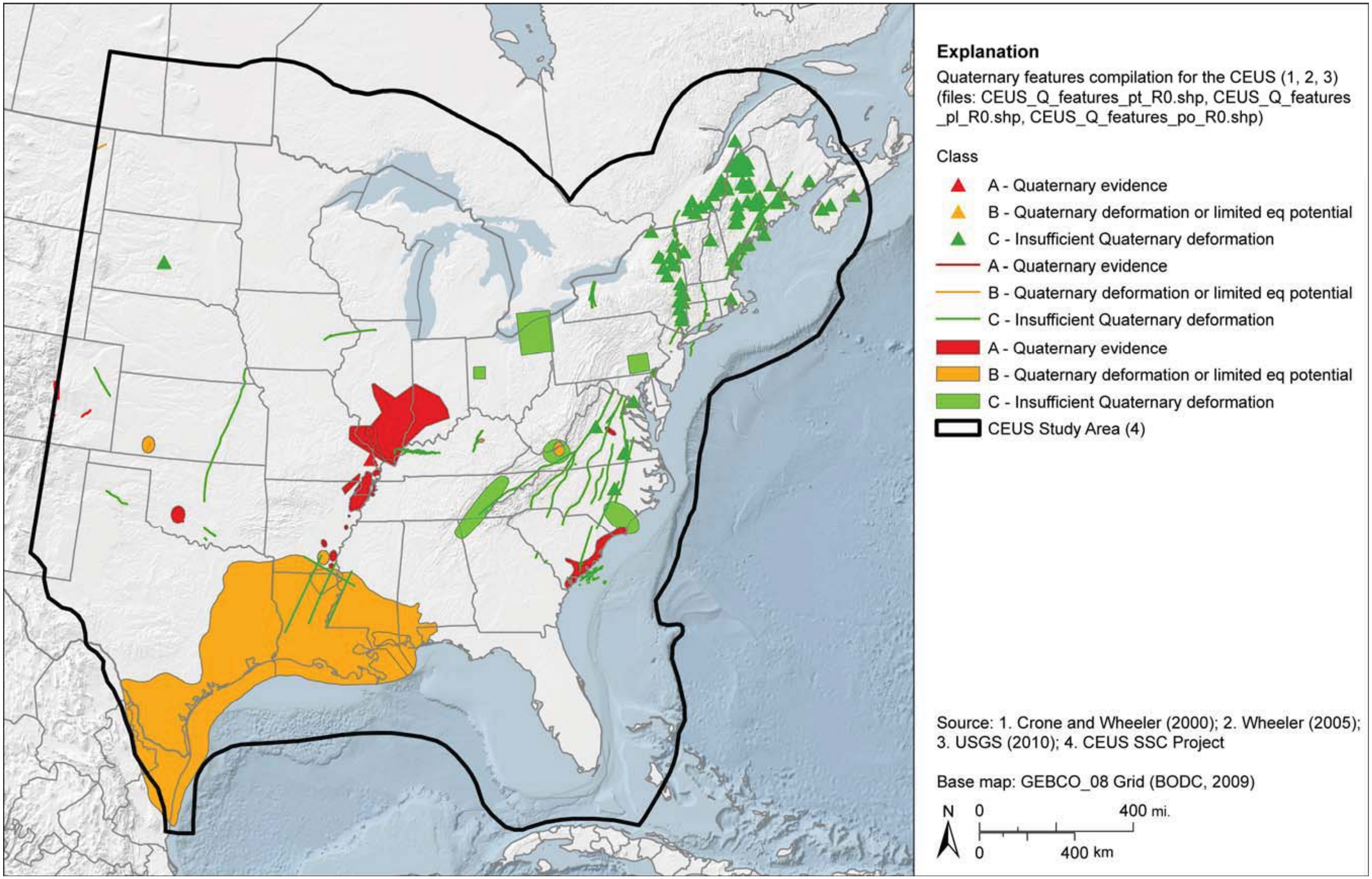

Figure A-66
Quaternary features compilation for the CEUS (Crone and Wheeler, 2000; Wheeler, 2005; USGS, 2010)

Sheet A-26—CEUS SSC Project GIS Data Summary

Mesozoic Rift Basins after Benson (1992)

CEUS_basins_Benson1992_R0.shp

Data Description: This data layer presents the locations of Mesozoic-age rift basins as presented by Benson (1992).

Source (Internet URL, CD/DVD-ROM): Figure from publication cited below.

Author/Publisher/Year: Benson, R.N., 1992, *Map of Exposed and Buried Early Mesozoic Rift Basins/Synrift Rocks of the U.S. Middle Atlantic Continental Margin*: Delaware Geological Survey Miscellaneous Map Series No. 5.

Data Summary: Source figure was originally published at a scale of 1:1,000,000. Features were digitized at a scale of 1,000,000 or better and saved as an ESRI polygon shapefile. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

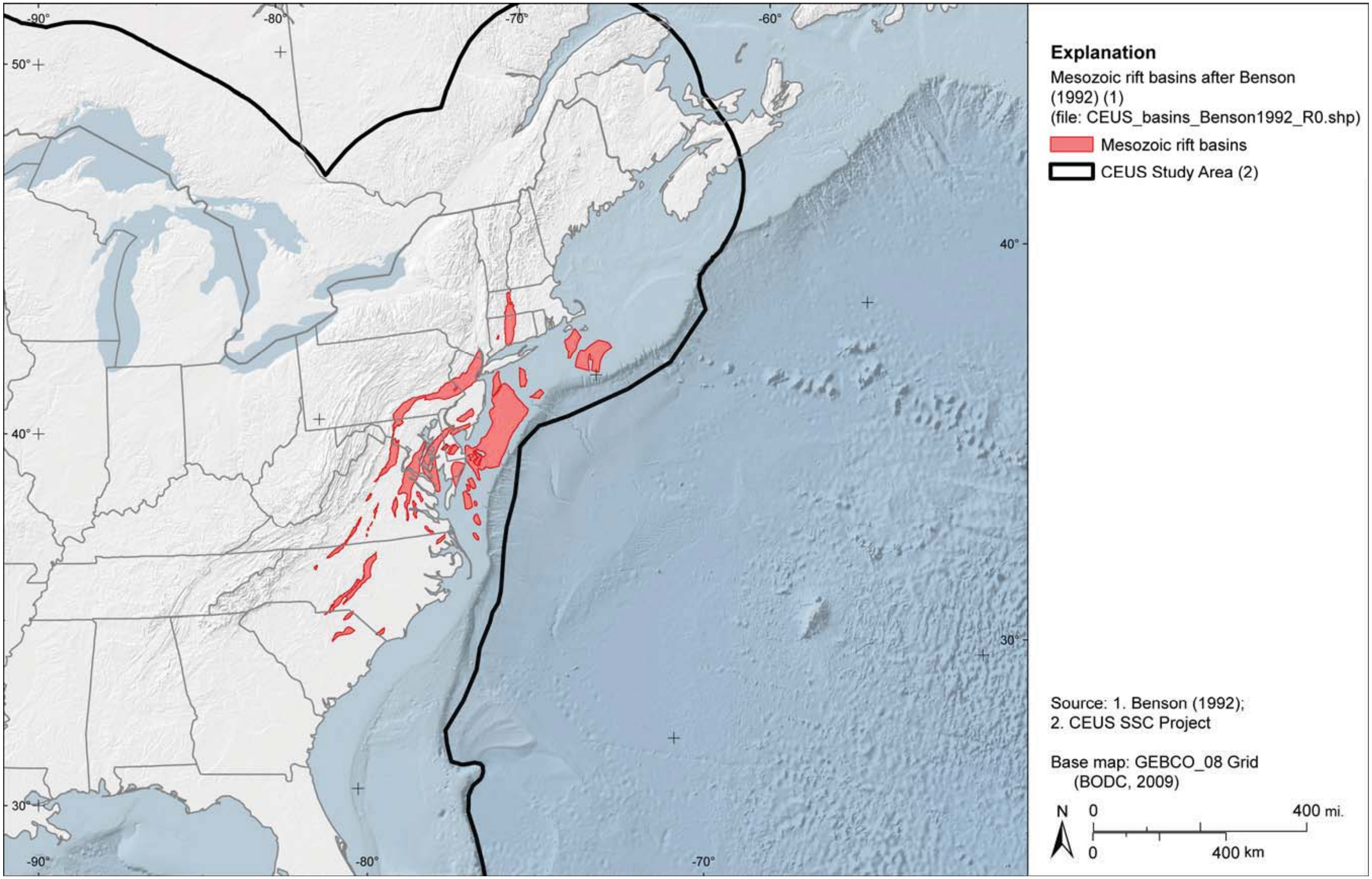

Figure A-67
CEUS Mesozoic rift basins after Benson (1992)

Sheet A-27—CEUS SSC Project GIS Data Summary

Mesozoic Rift Basin after Dennis et al. (2004)

CEUS_basins_Dennis_etal_2004_R0.shp

Data Description: This data layer presents the location of the Dunbarton rift basin in South Carolina as presented by Dennis et al. (2004). The western portion of the basin is truncated as presented in the source figure.

Source (Internet URL, CD/DVD-ROM): Figure from publication cited below.

Author/Publisher/Year: Dennis, A.J., Shervais, J.W., Mauldin, J., Maher Jr., H.D., and Wright, J.E., 2004, Petrology and geochemistry of Neoproterozoic volcanic arc terranes beneath the Atlantic Coastal Plain, Savannah River Site, South Carolina: *GSA Bulletin*, v. 116, pp. 572-593.

Data Summary: Source figure was originally published at a scale of 1:450,000. Feature was digitized at a scale of 1:450,000 or better and saved as an ESRI polygon shapefile. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

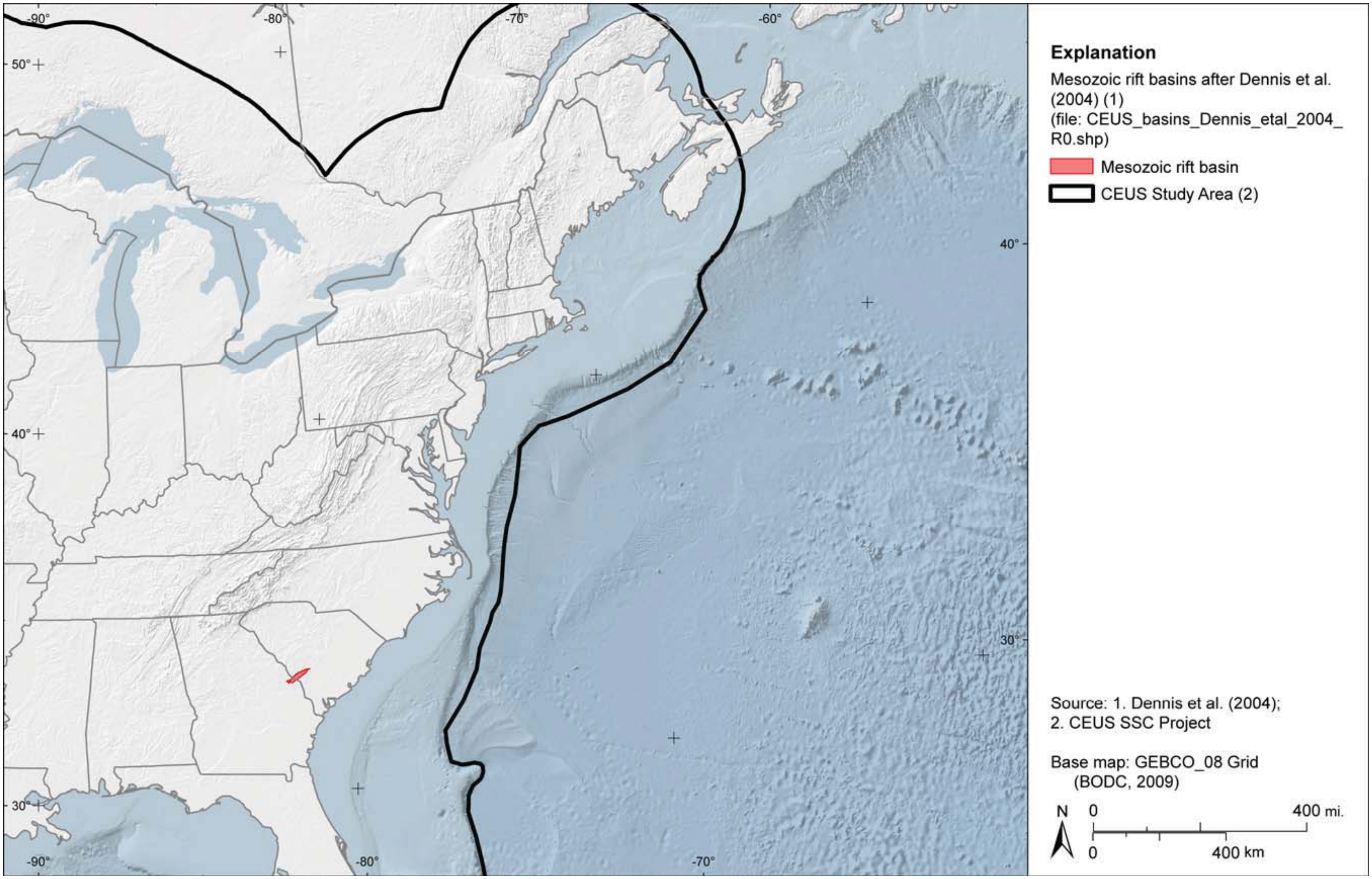

Figure A-68
CEUS Mesozoic rift basins after Dennis et al. (2004)

Sheet A-28—CEUS SSC Project GIS Data Summary

Mesozoic Rift Basins after Schlische (1993)

CEUS_basins_Schlische1993_R0.shp

Data Description: This data layer presents Mesozoic rift basins as presented by Schlische (1993). The basins shown include the Newark/Gettysburg, Danville/Dan River, Deep River, Richmond, Culpepper, and Fundy basins.

Source (Internet URL, CD/DVD-ROM): Figure from publication cited below.

Author/Publisher/Year: Schlische, R.W., 1993, Anatomy and evolution of the Triassic-Jurassic continental rift system, eastern North America: *Tectonics*, v. 12, pp. 1026-1042.

Data Summary: Basins were digitized and saved as an ESRI polygon shapefile. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

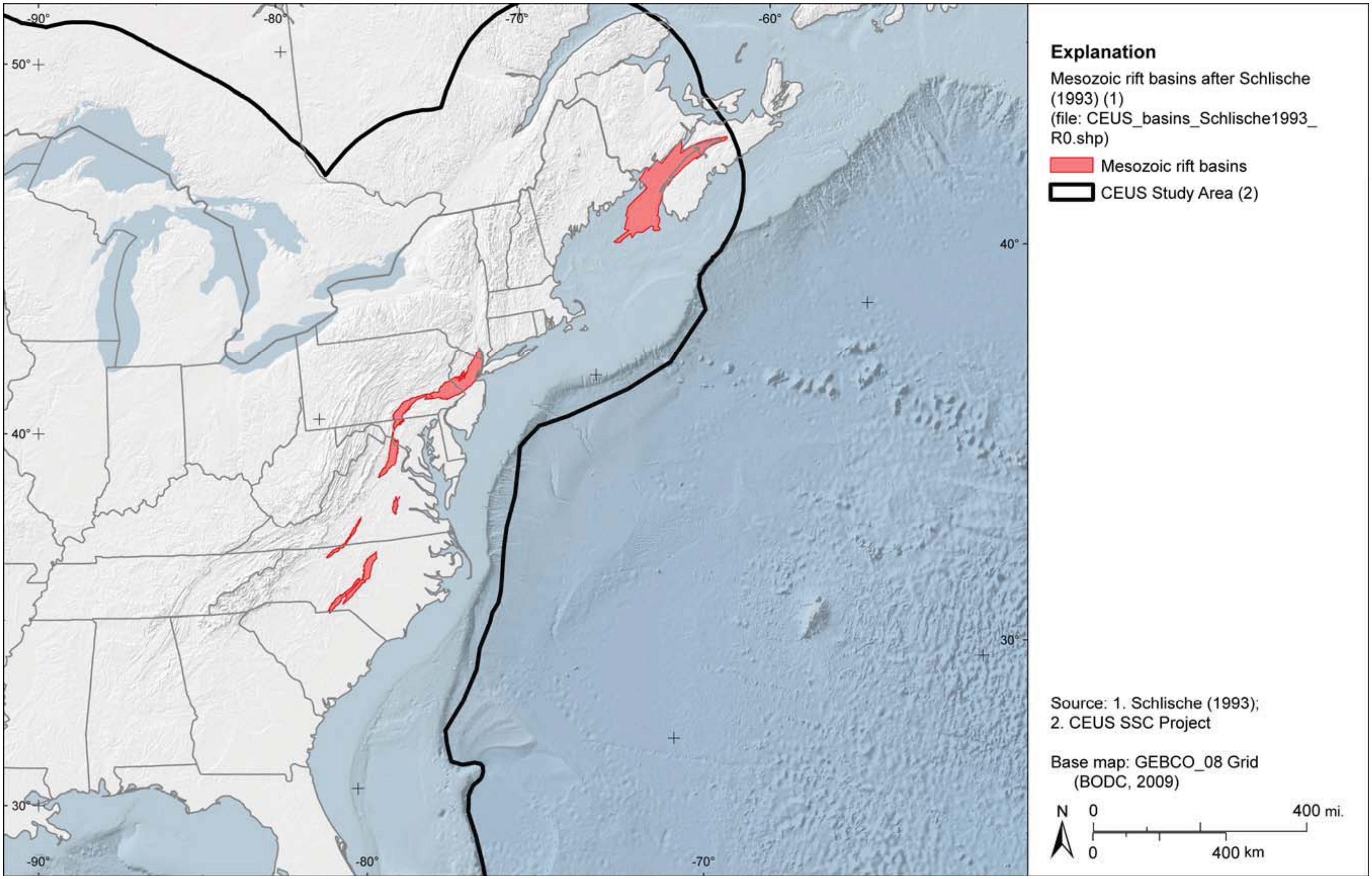

Figure A-69
CEUS Mesozoic rift basins after Schlische (1993)

Sheet A-29—CEUS SSC Project GIS Data Summary

Mesozoic Rift Basins after Withjack et al. (1998)

CEUS_basins_Withjack1998F2_R0.shp
CEUS_basins_Withjack1998F7_R0.shp

Data Description: These data layers present Mesozoic rift basins as presented by Withjack et al. (1998) in Figs. 2 and 7 from the source reference.

Source (Internet URL, CD/DVD-ROM): Figures from publication cited below.

Author/Publisher/Year: Withjack, M.O., Schlische, R.W., and Olsen, P.E., 1998, Diachronous rifting, drifting, and inversion on the passive margin of central eastern North America: An analog for other passive margins: *AAPG Bulletin*, v. 82, pp. 817-835.

Data Summary: Basins were digitized and saved as ESRI polygon shapefiles. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

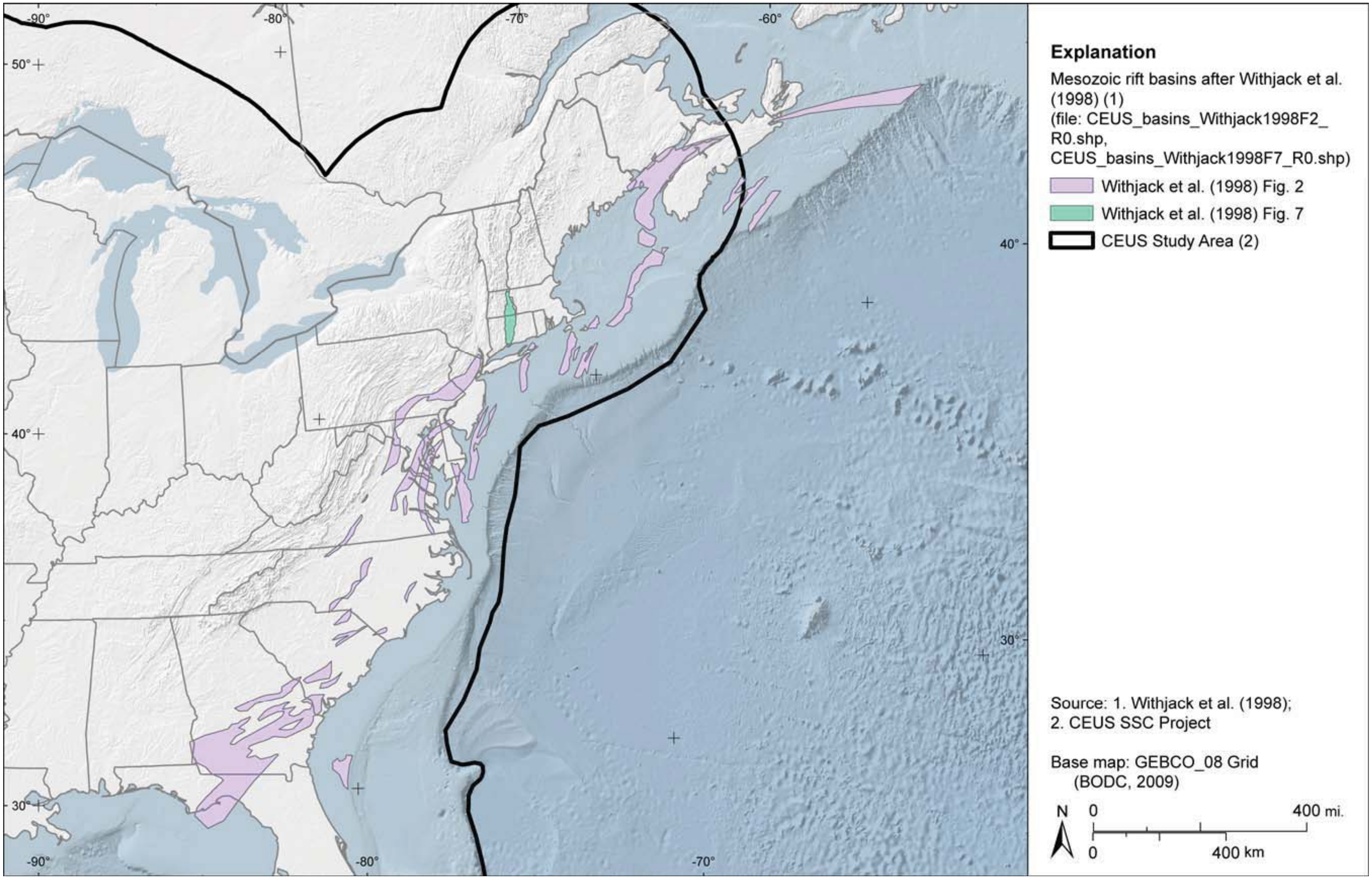

Figure A-70
CEUS Mesozoic rift basins after Withjack et al. (1998)

Sheet A-30—CEUS SSC Project GIS Data Summary

CEUS SSC Repeated Large-Magnitude Earthquake (RLME) Zones

CEUS_RLME_CEUSSSC_pl_R0.shp
CEUS_RLME_CEUSSSC_po_R0.shp

Data Description: These data layers present the zones of repeated large-magnitude earthquakes (RLME) developed from the CEUS SSC Project. Zones are separated into separate lines or polygon data layers depending on the geometry of the RLME zone.

Source (Internet URL, CD/DVD-ROM): CEUS SSC Project.

Author/Publisher/Year: CEUS SSC Project.

Data Summary: Data layers are in the ESRI line and polygon shapefile formats. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

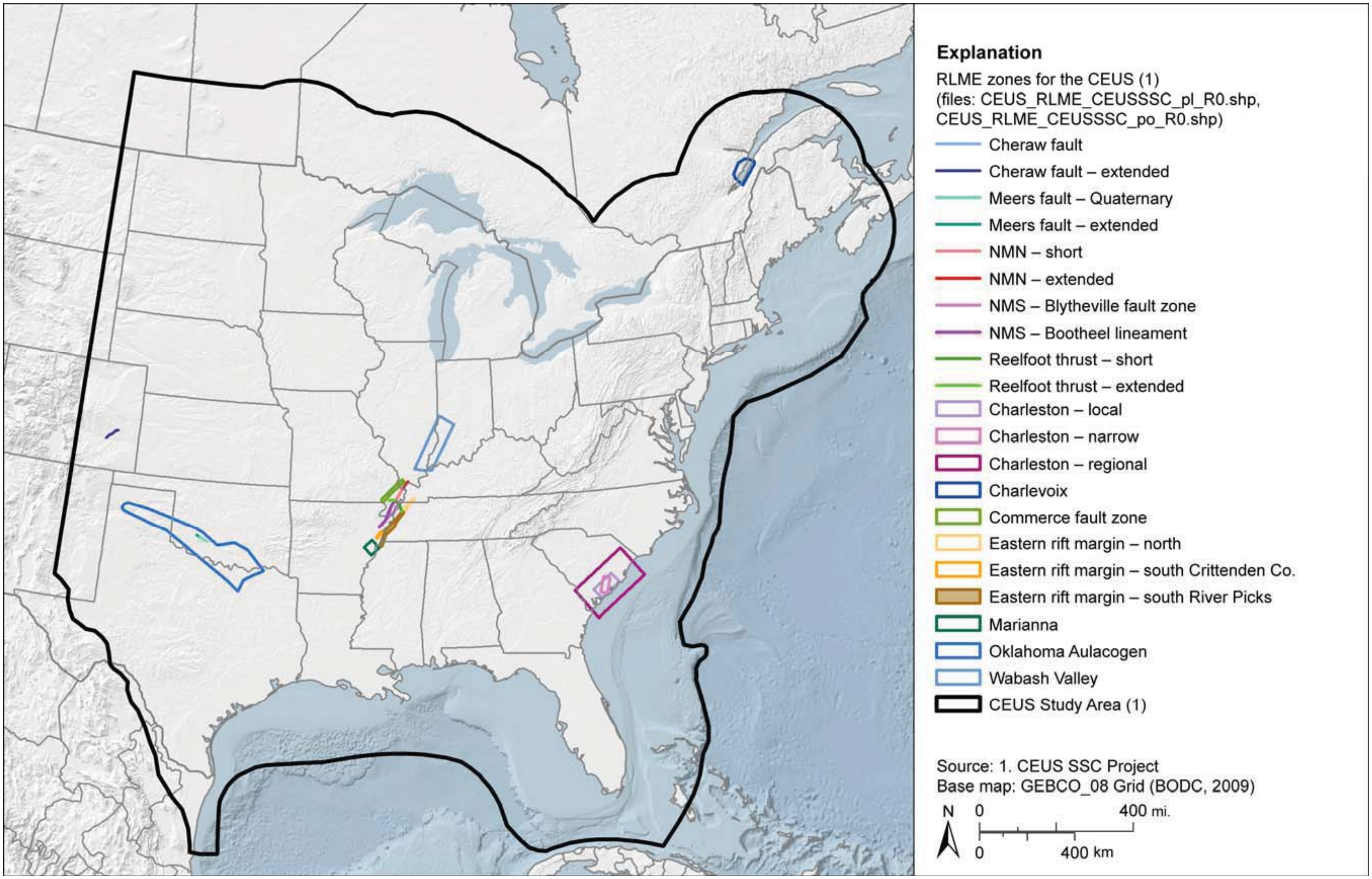

Figure A-71
RLME zones for the CEUS

Sheet A-31—CEUS SSC Project GIS Data Summary

CEUS SSC Mesozoic and Non-Mesozoic Zones and Seismotectonic Zones

CEUS_STZones_CEUSSSC_pl_R0.shp

Data Description: This data layer presents the Mesozoic and Non-Mesozoic zones and seismotectonic zones developed from the CEUS SSC Project. Zones are presented as polygon data layers attributed with the name of the zone.

Source (Internet URL, CD/DVD-ROM): CEUS SSC Project.

Author/Publisher/Year: CEUS SSC Project.

Data Summary: Data layer is in ESRI polygon shapefile format. Data are presented in geographic coordinates on the North American Datum of 1983.

Disclaimer or Constraints on Use: No constraints have been identified.

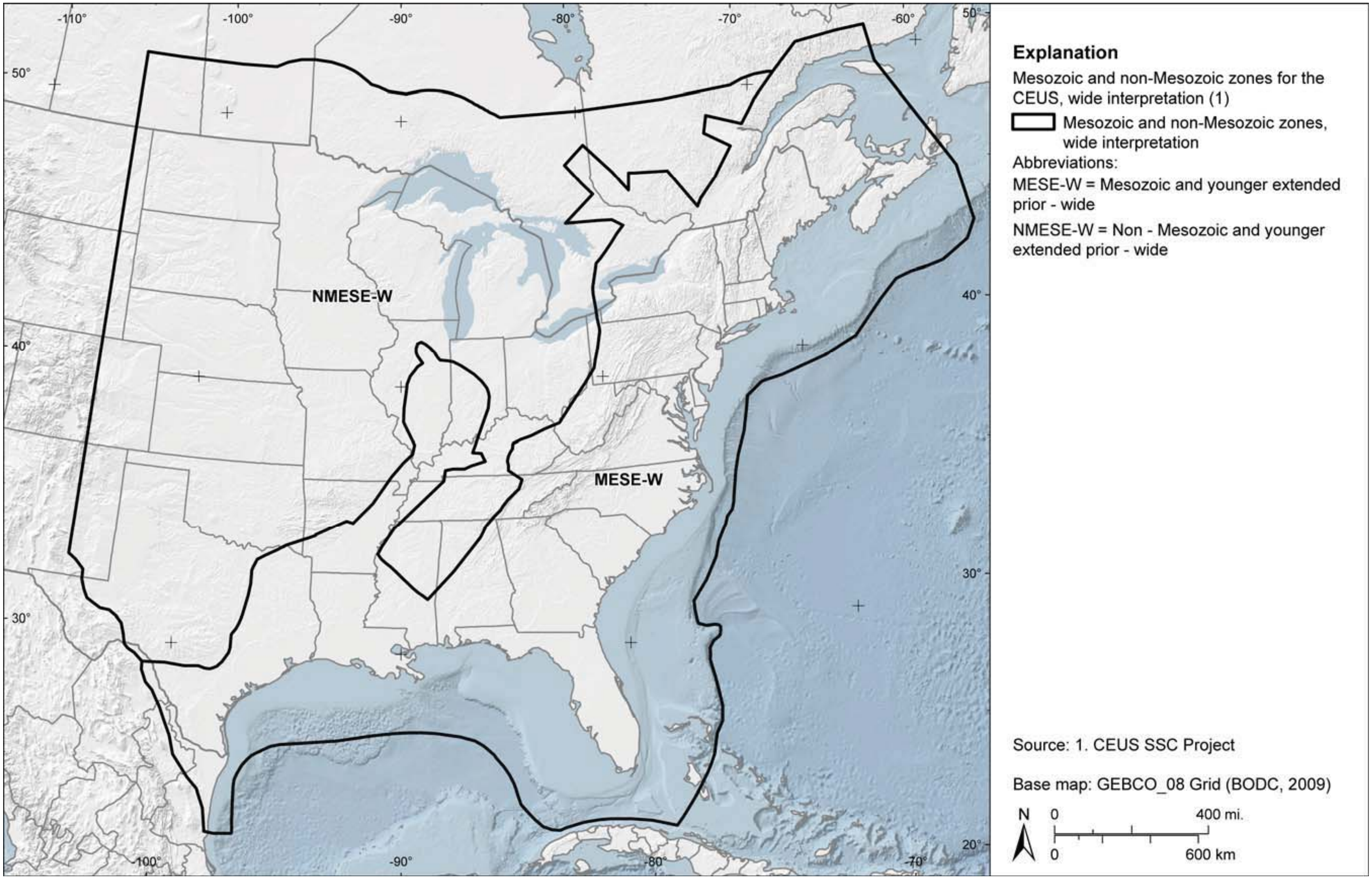

Figure A-72
Mesozoic and non-Mesozoic zones for the CEUS, wide interpretation

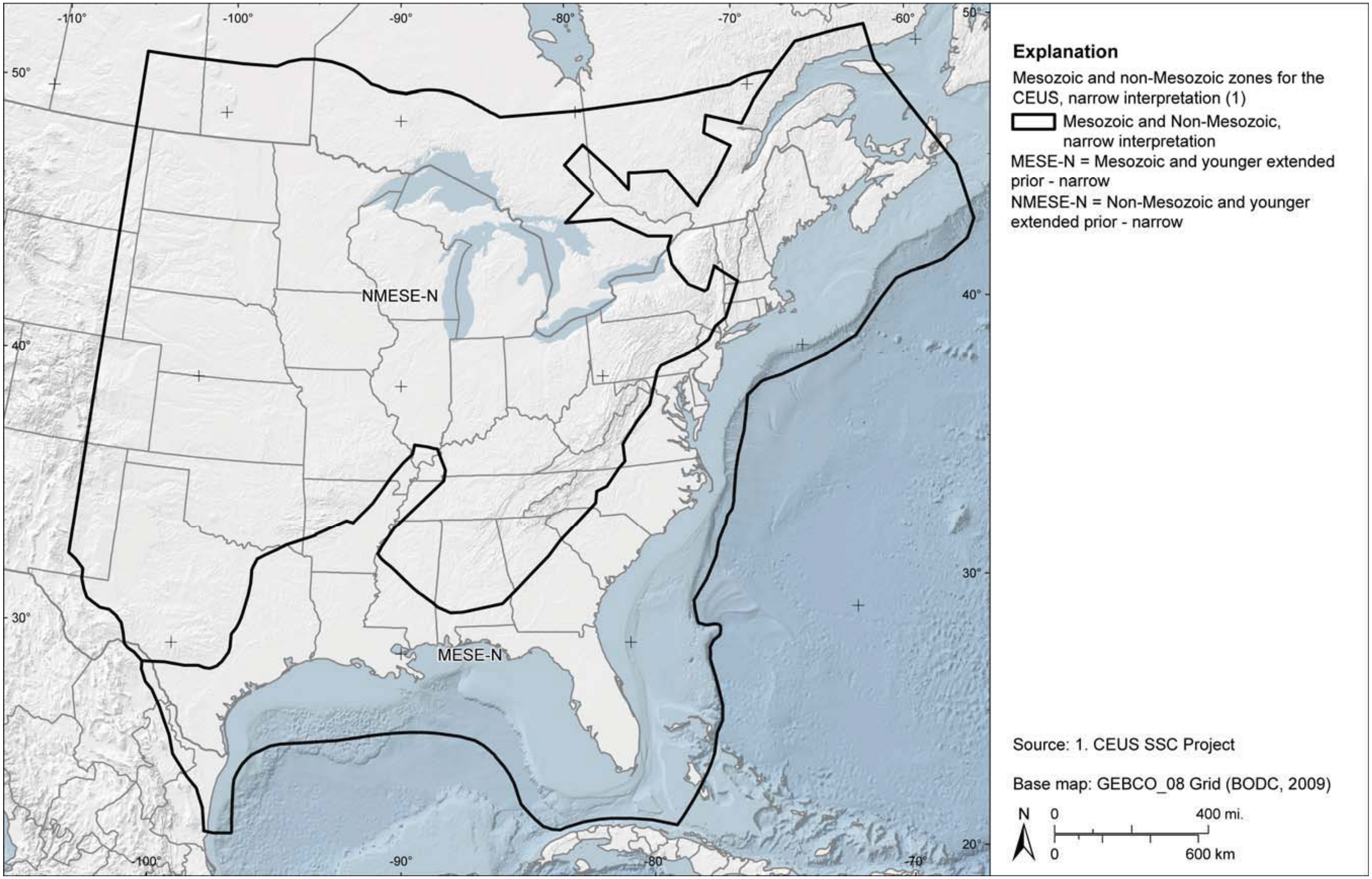

Figure A-73
Mesozoic and non-Mesozoic zones for the CEUS, narrow interpretation

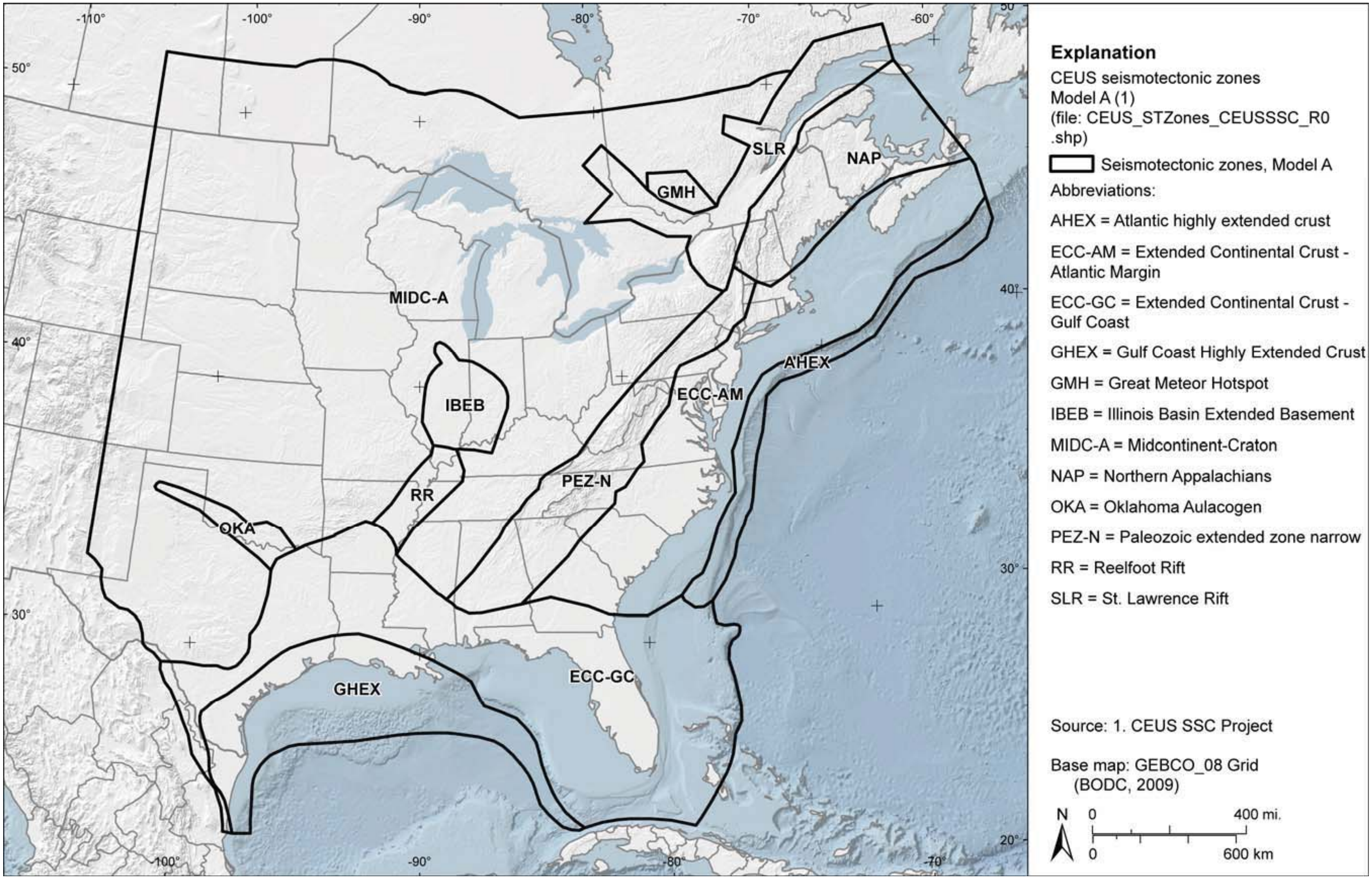

Figure A-74
CEUS seismotectonic zones model A

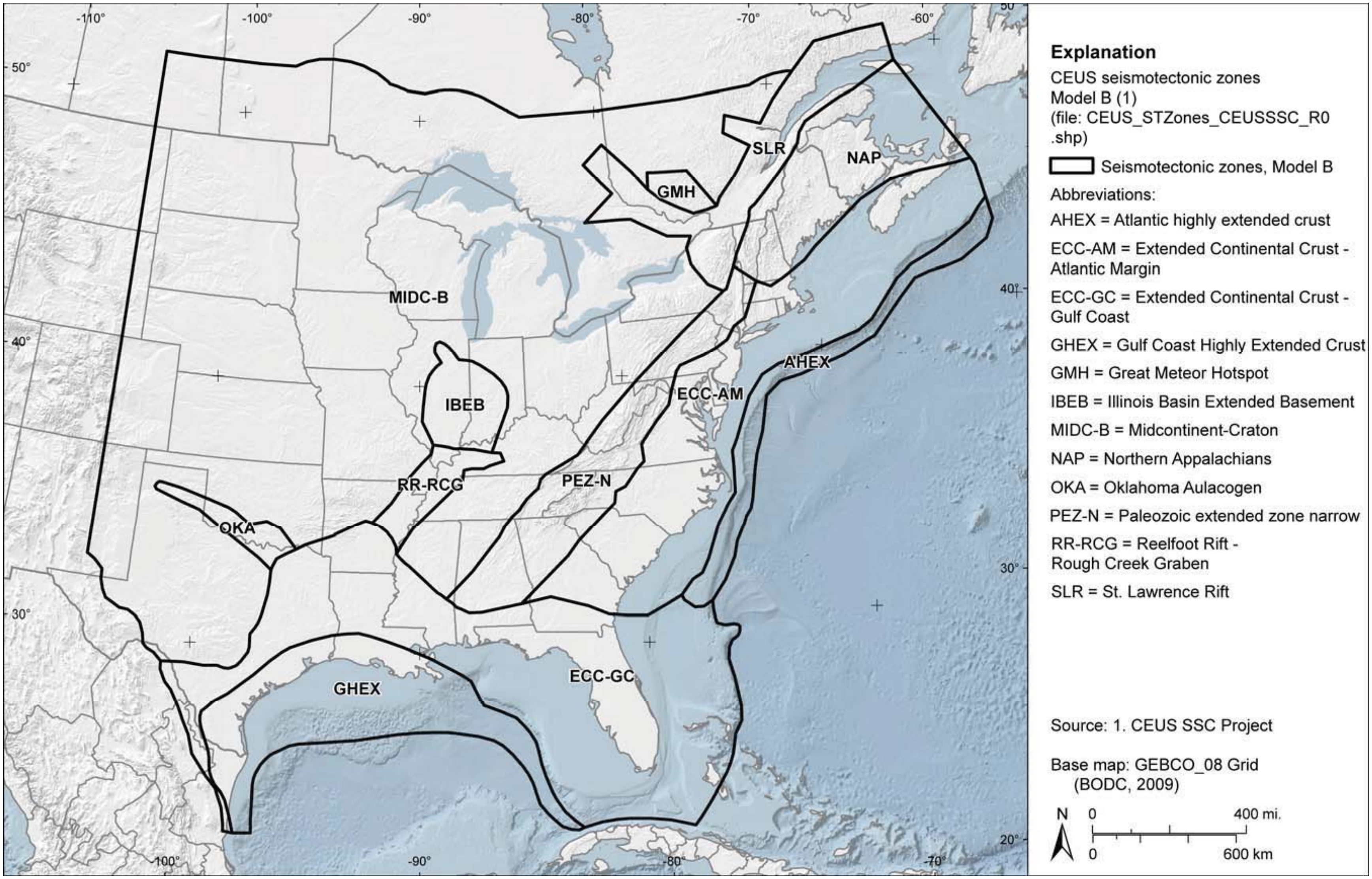

Figure A-75
CEUS seismotectonic zones model B

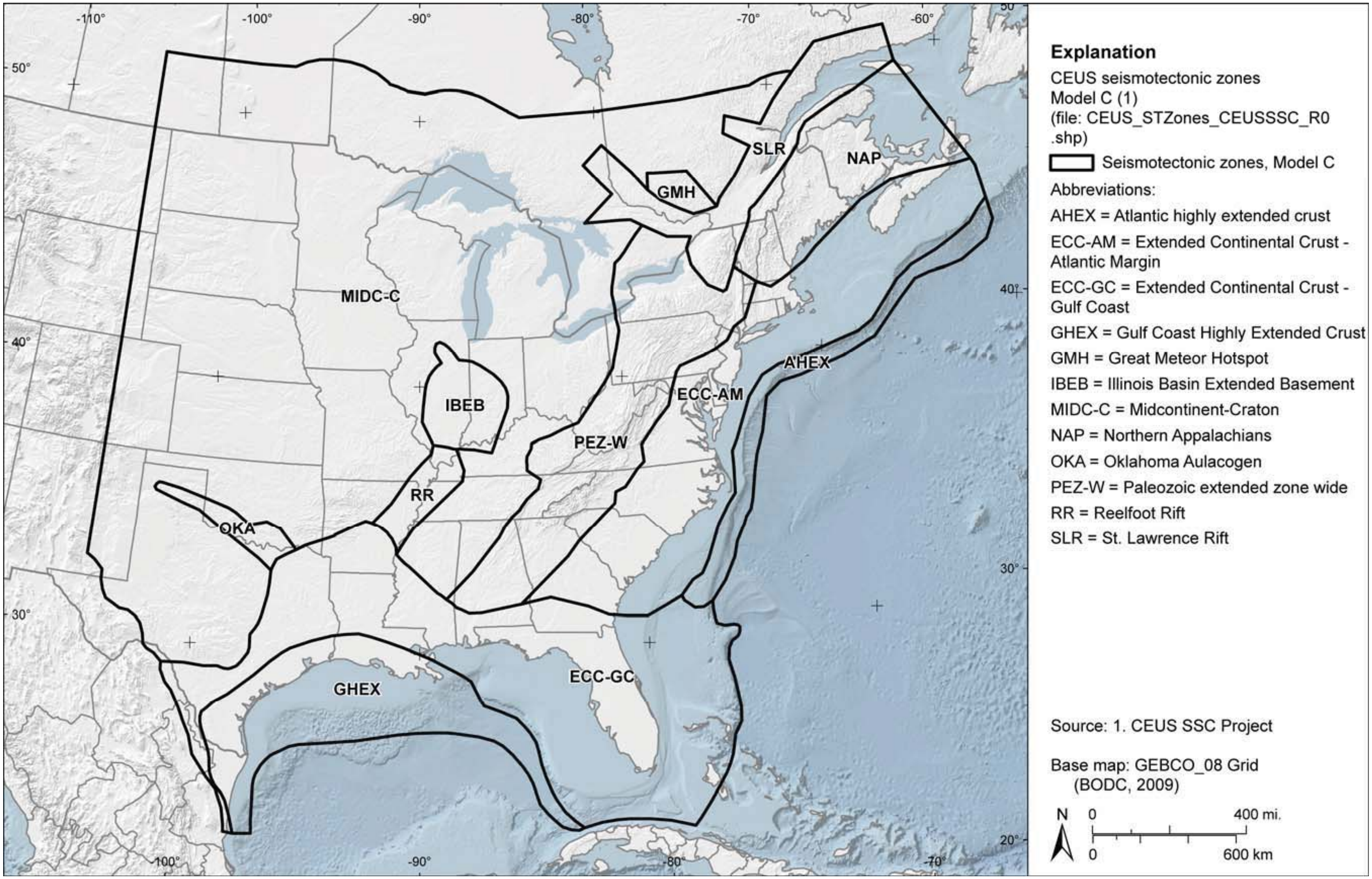

Figure A-76
CEUS seismotectonic zones model C

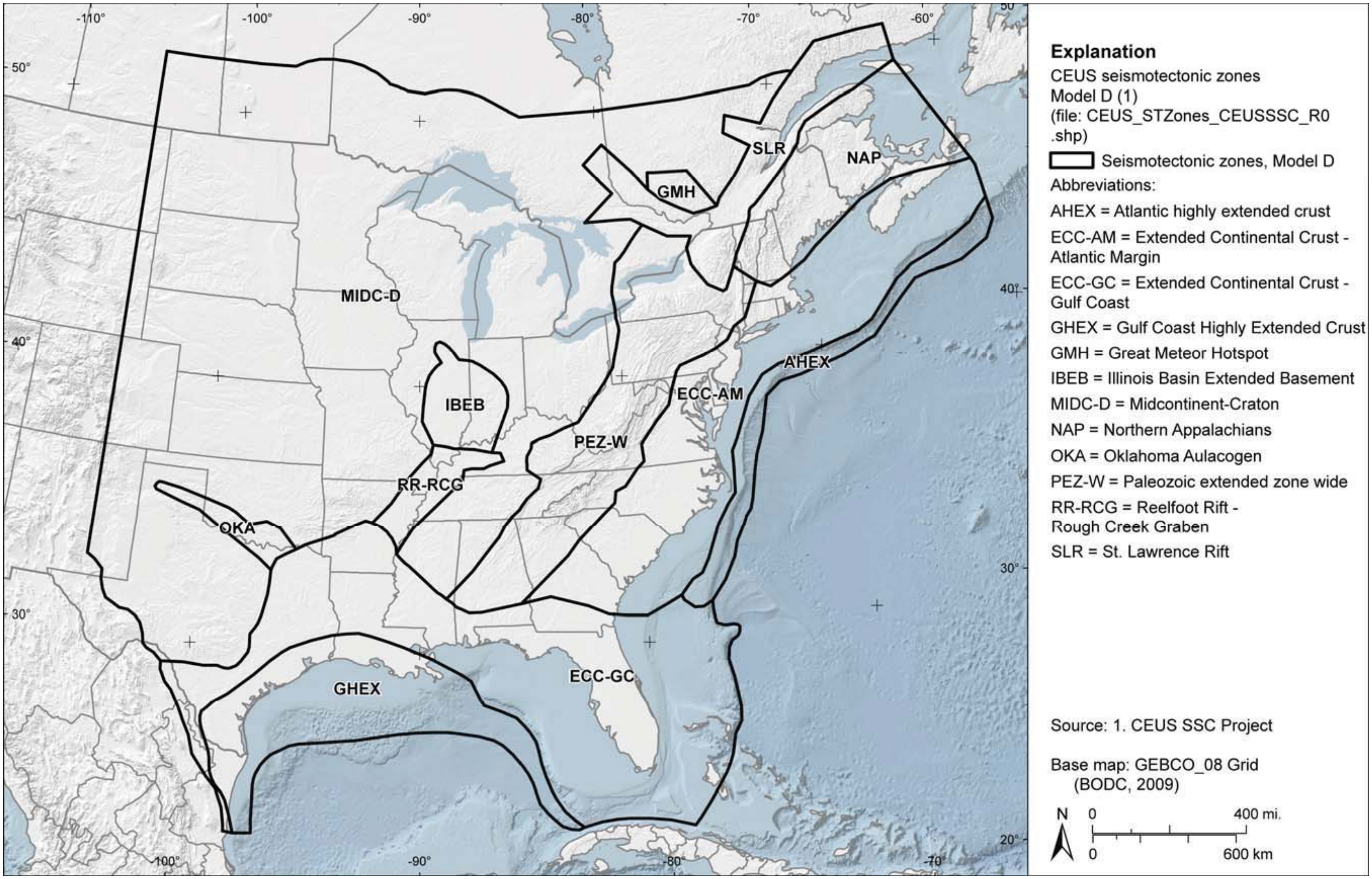

Figure A-77
CEUS seismotectonic zones model D