

# Geoids

## Who is NOAA/NGS?

The National Oceanic and Atmospheric Administration (NOAA) is the nation's oldest scientific agency dating back to 1807 when Thomas Jefferson created the Survey of the Coast. This agency was created to assist the United States of America increase commerce by providing maps of the land, shore and waterways to assist shipping, the main form of commerce, and avoid ship wrecks. NOAA's mission is Science, Service and Stewardship, to understand and predict changes in climate, weather, oceans, and coasts; to share that knowledge and information with others; to conserve and manage coastal and marine ecosystems and resources.

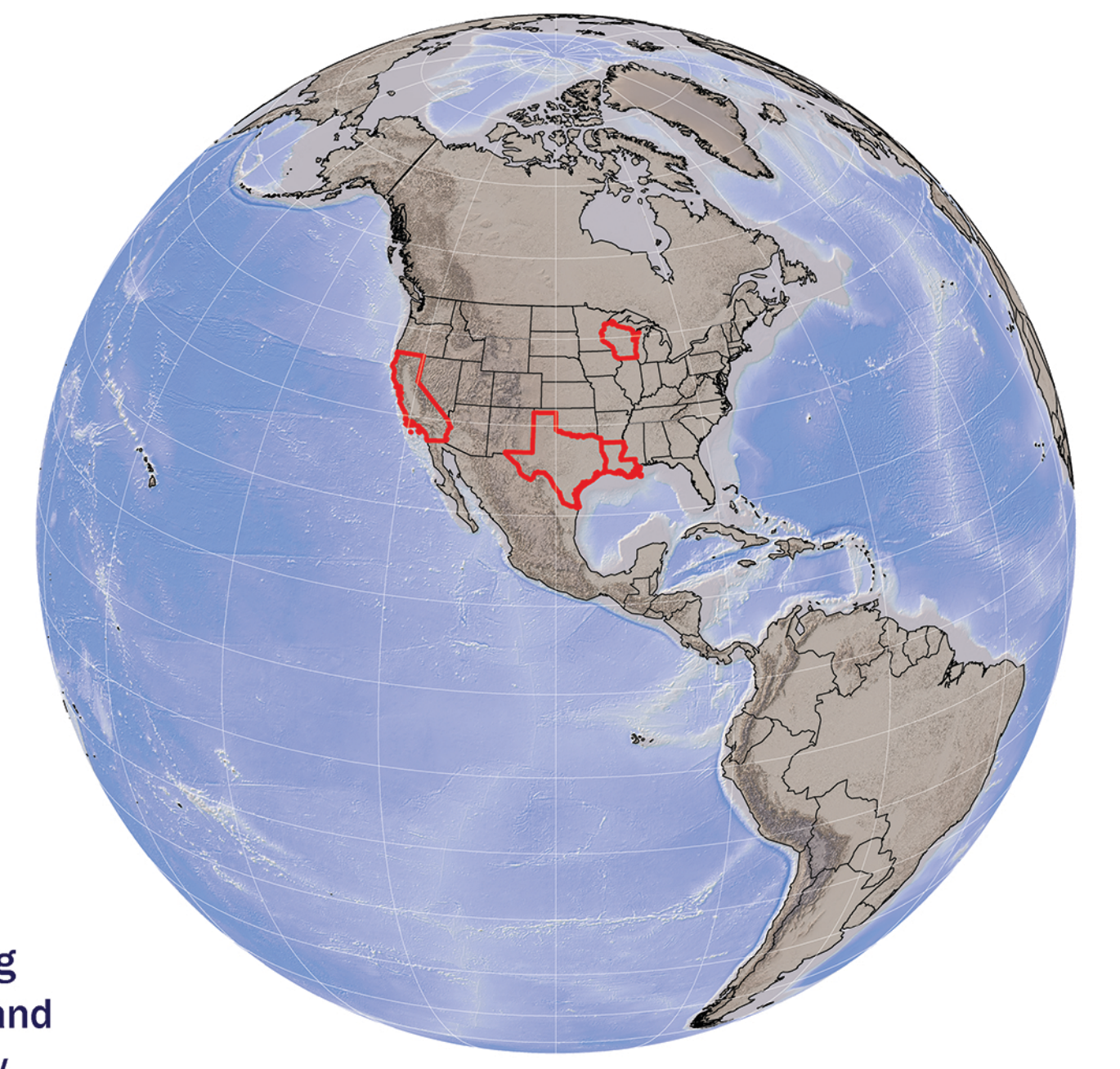
The National Geodetic Survey (NGS) is a program office within NOAA's National Ocean Service. NGS defines the shape of the US and all its territories by developing the official US datums, and geoid models used for positioning. NGS' mission is to define, maintain and provide access to the National Spatial Reference System (NSRS) to meet our nation's economic, social, and environmental needs. One critical component of the NSRS is the determination of "height" –specifically ellipsoid height, orthometric height and dynamic height – of any point in the United States or its territories. Creating more accurate geoid models for determining or computing these heights greatly assists NGS to fulfill its mission.

## What is a Geoid?

A geoid is a model of global mean sea level that is used to measure precise surface elevations. ([www.oceanservice.noaa.gov/facts/geoid.html](http://www.oceanservice.noaa.gov/facts/geoid.html))

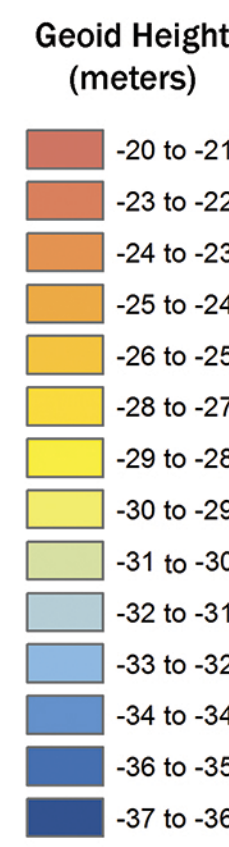
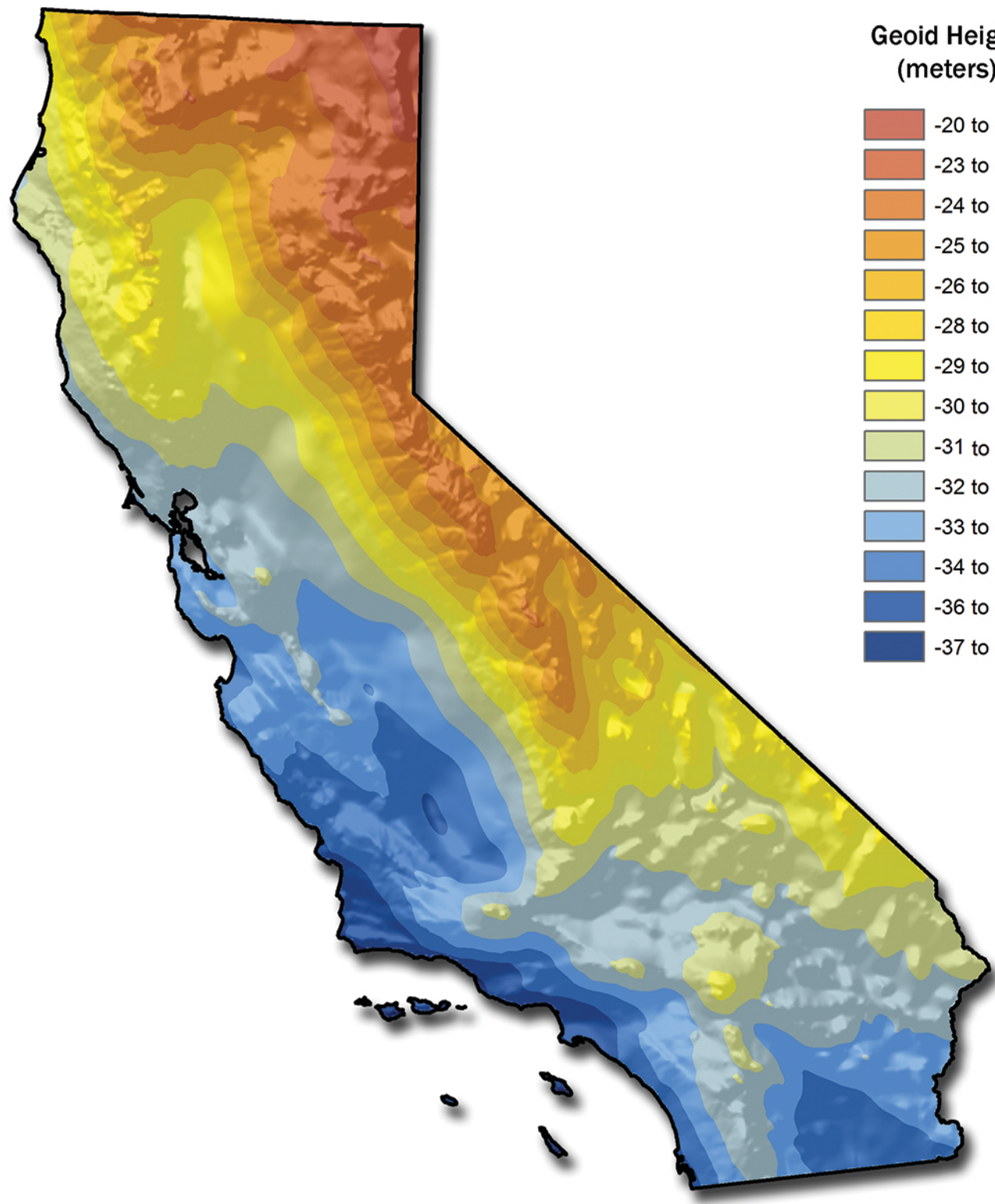
The equipotential surface of the Earth's gravity field which best fits, in a least squares sense, global mean sea level. Even though we adopt a definition, that does not mean we are perfect in the realization of that definition. For example, altimetry is often used to define "mean sea level" in the oceans, but altimetry is not global (missing near Polar Regions). As such, the fit between "global" mean sea level and the geoid is not entirely confirmable. Also, there may be non-periodic changes in sea level (like a persistent rise in sea level, for example). If so, then "mean sea level" changes in time, and therefore the geoid should also change in time. These are just a few examples of the difficulty in defining "the geoid". ([www.geodesy.noaa.gov/GEOID/geoid\\_def.html](http://www.geodesy.noaa.gov/GEOID/geoid_def.html))

Our universe is transient and constantly changing every second. The world is similarly transient and today's scientists continue to gain a better understanding of the constantly changing dynamics. With improvements in theory, methods and technology NGS is able to model this infinitely complex system more accurately. Some of these improvements include improved mathematical modeling; a better understanding of gravity due to new satellite gravity missions and aerogravity surveys; improved computing technologies to handle much larger equation unknowns. These improvements have helped NGS to create more accurate geoid models providing the United States and its territories constant improvements.

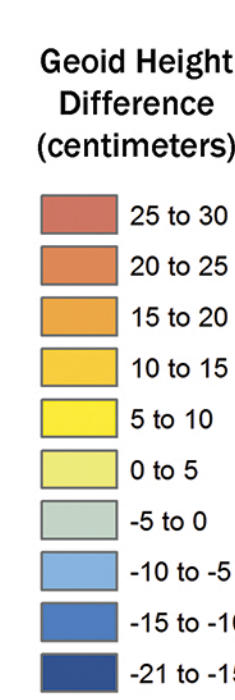
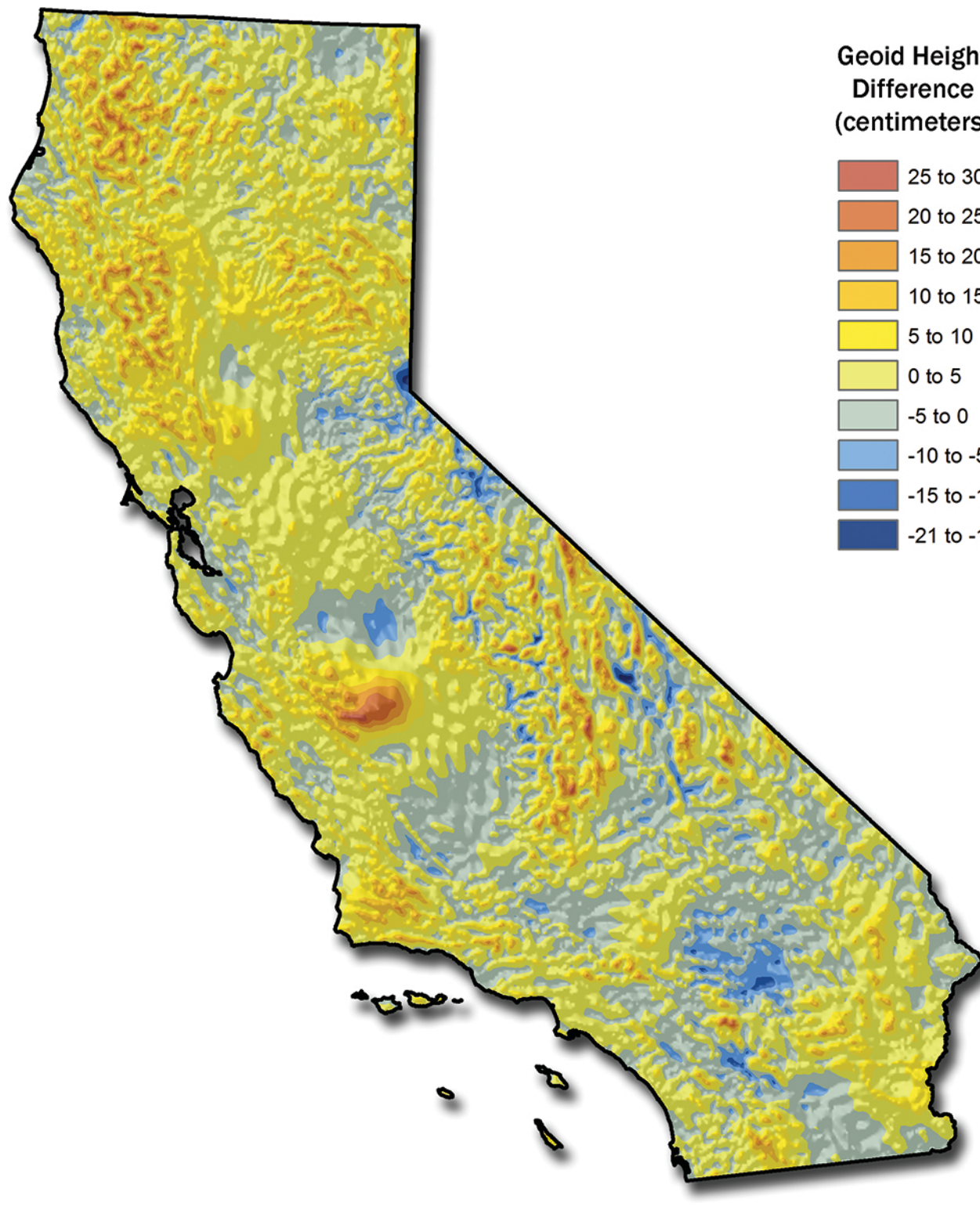


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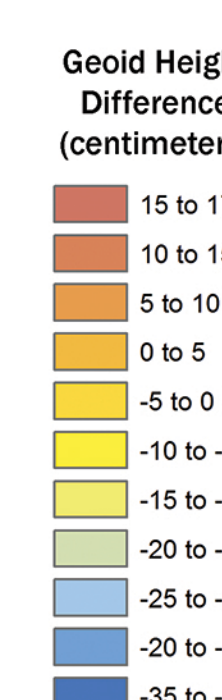
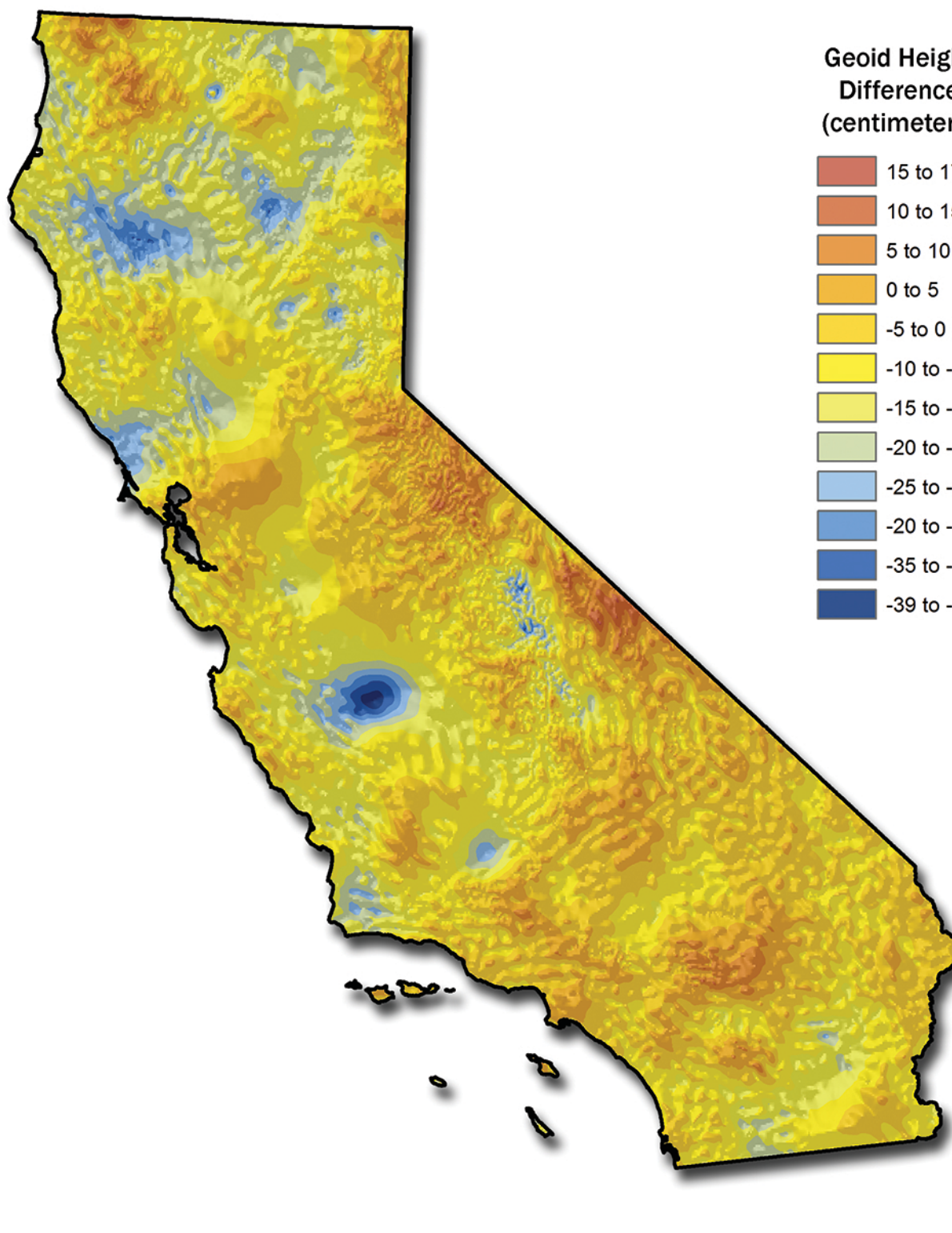
GEOID12A



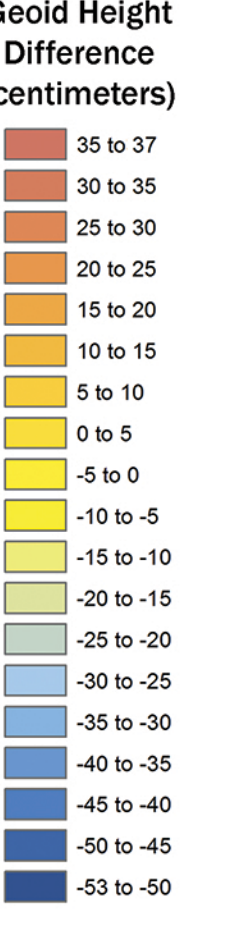
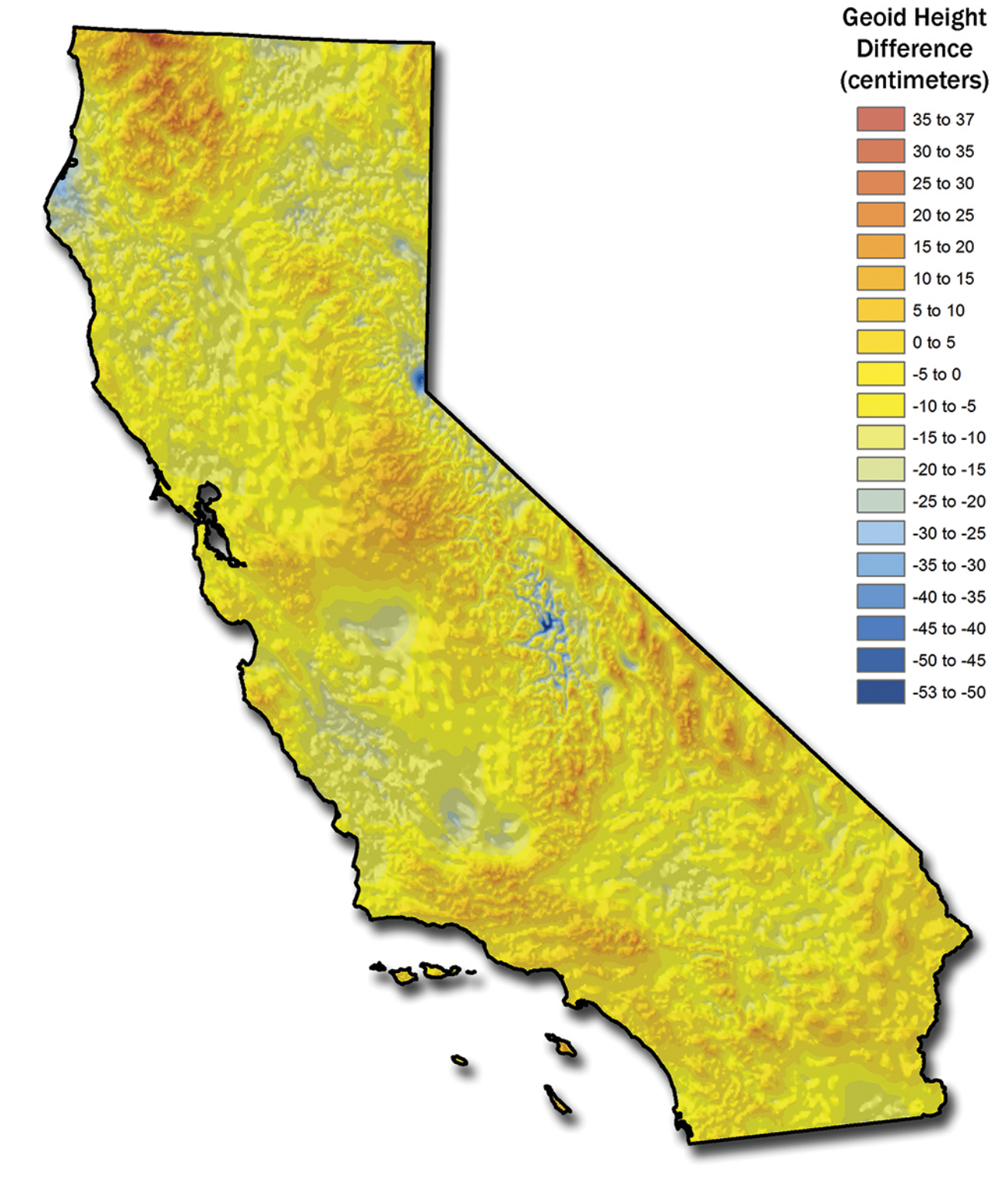
GEOID12A - GEOID09



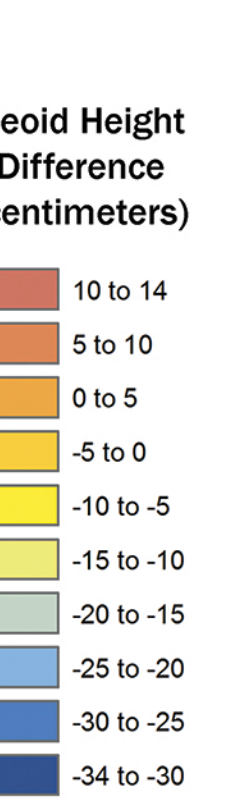
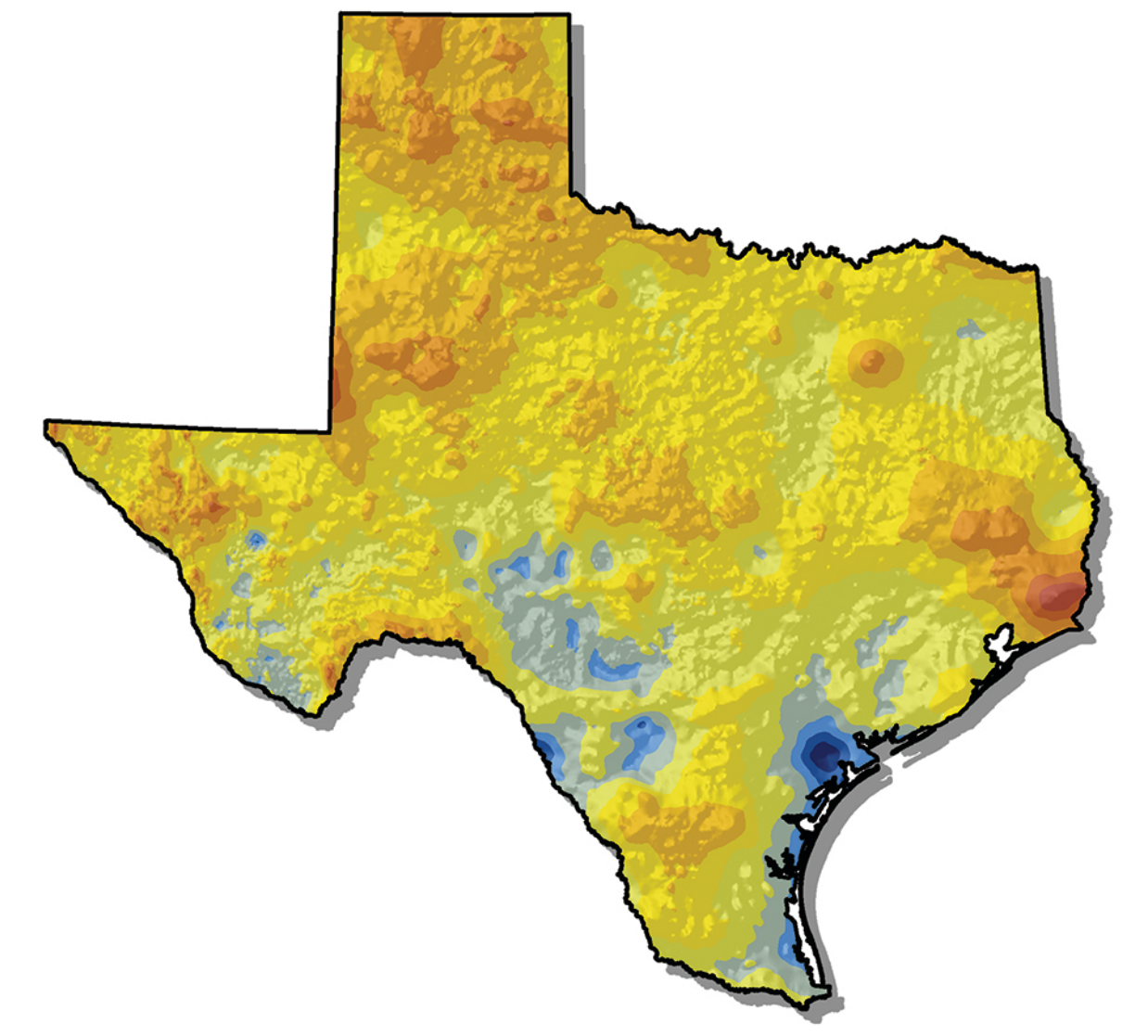
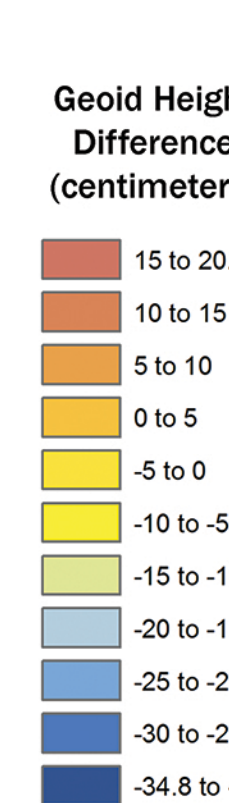
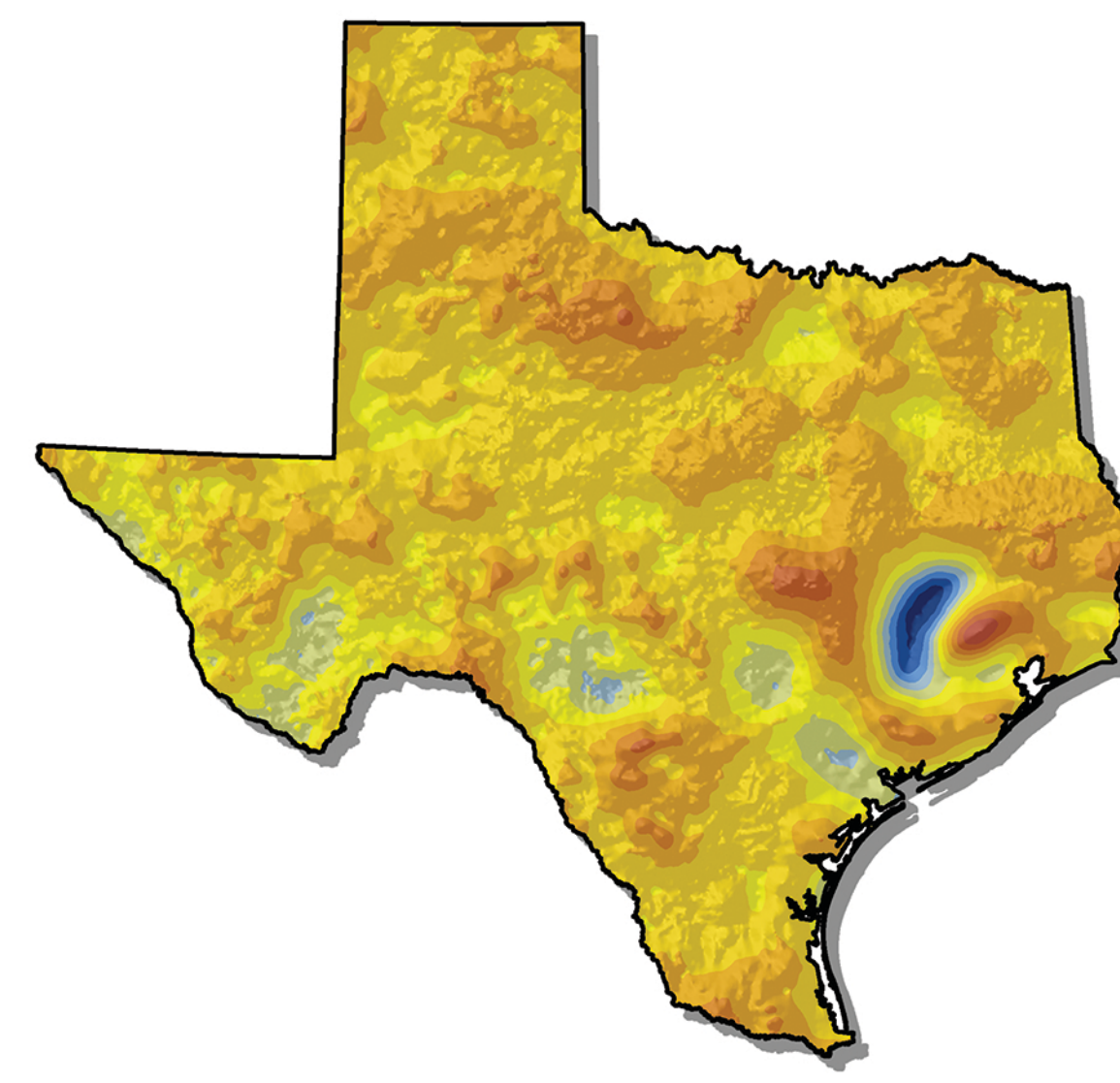
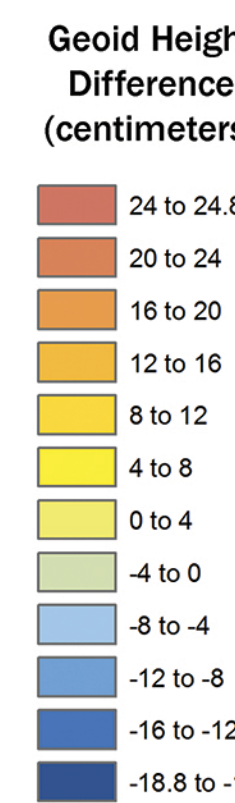
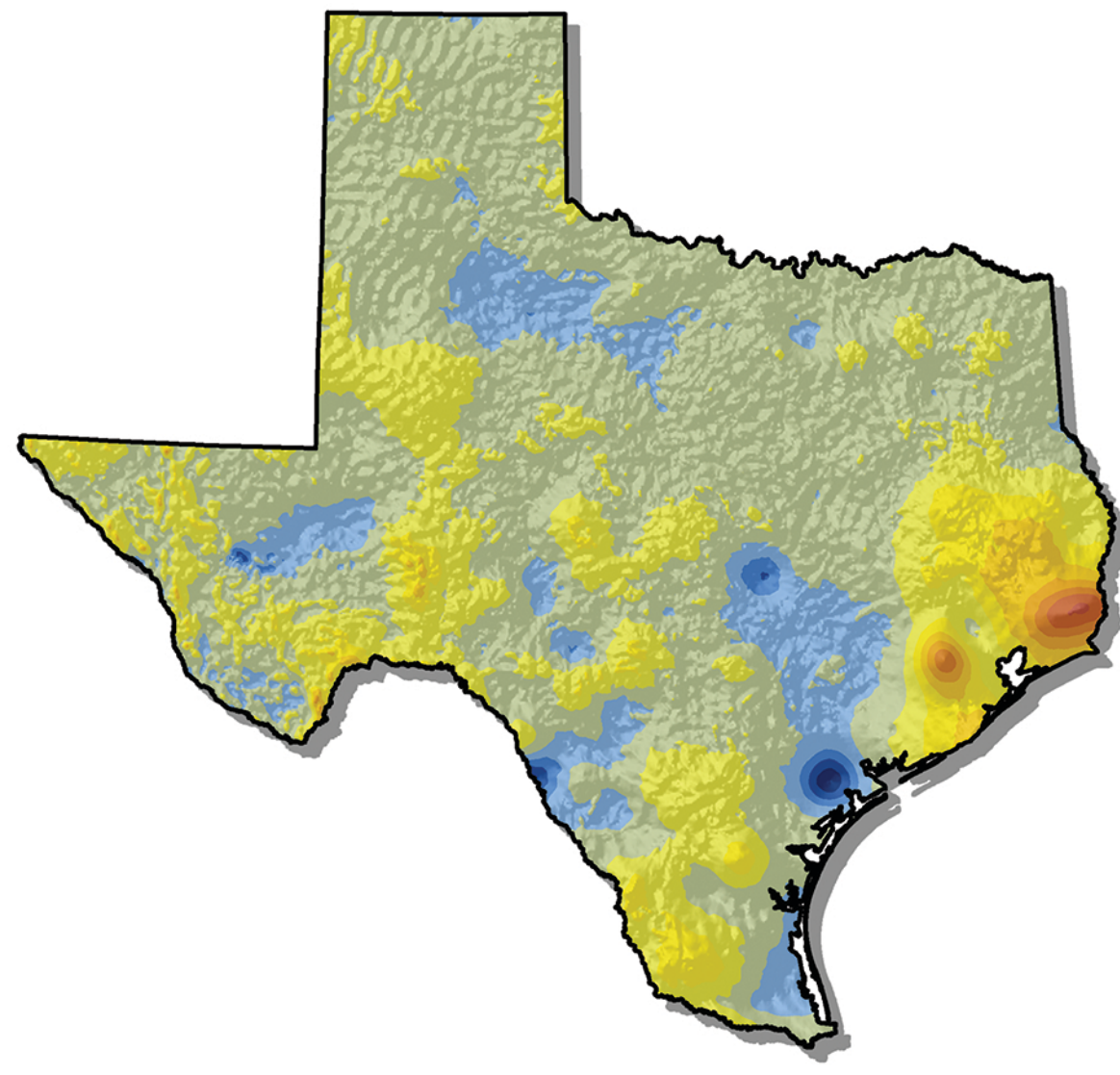
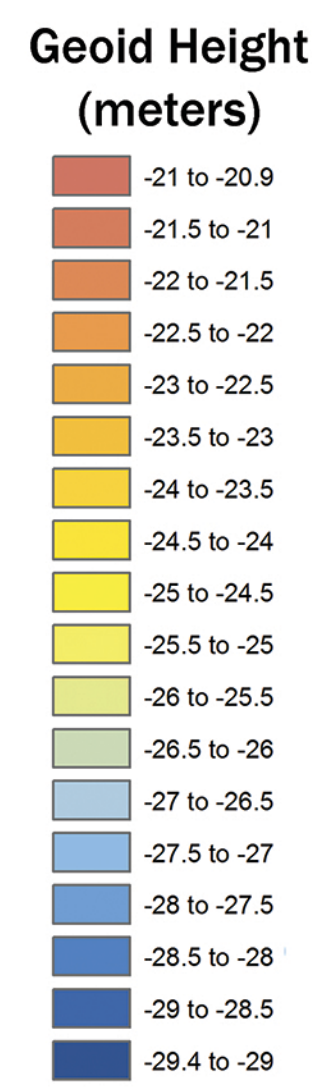
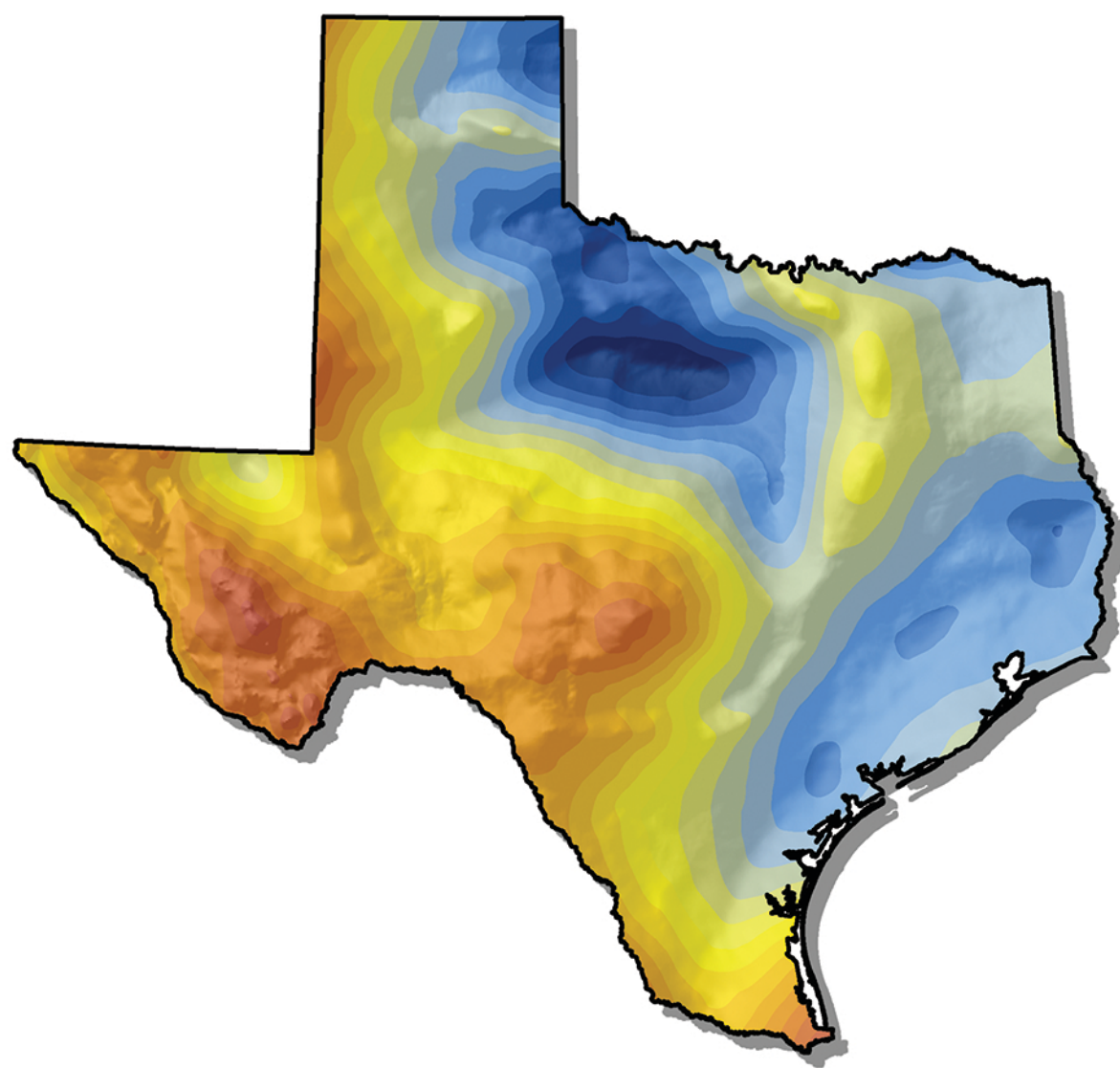
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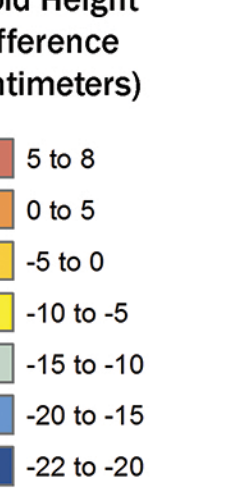
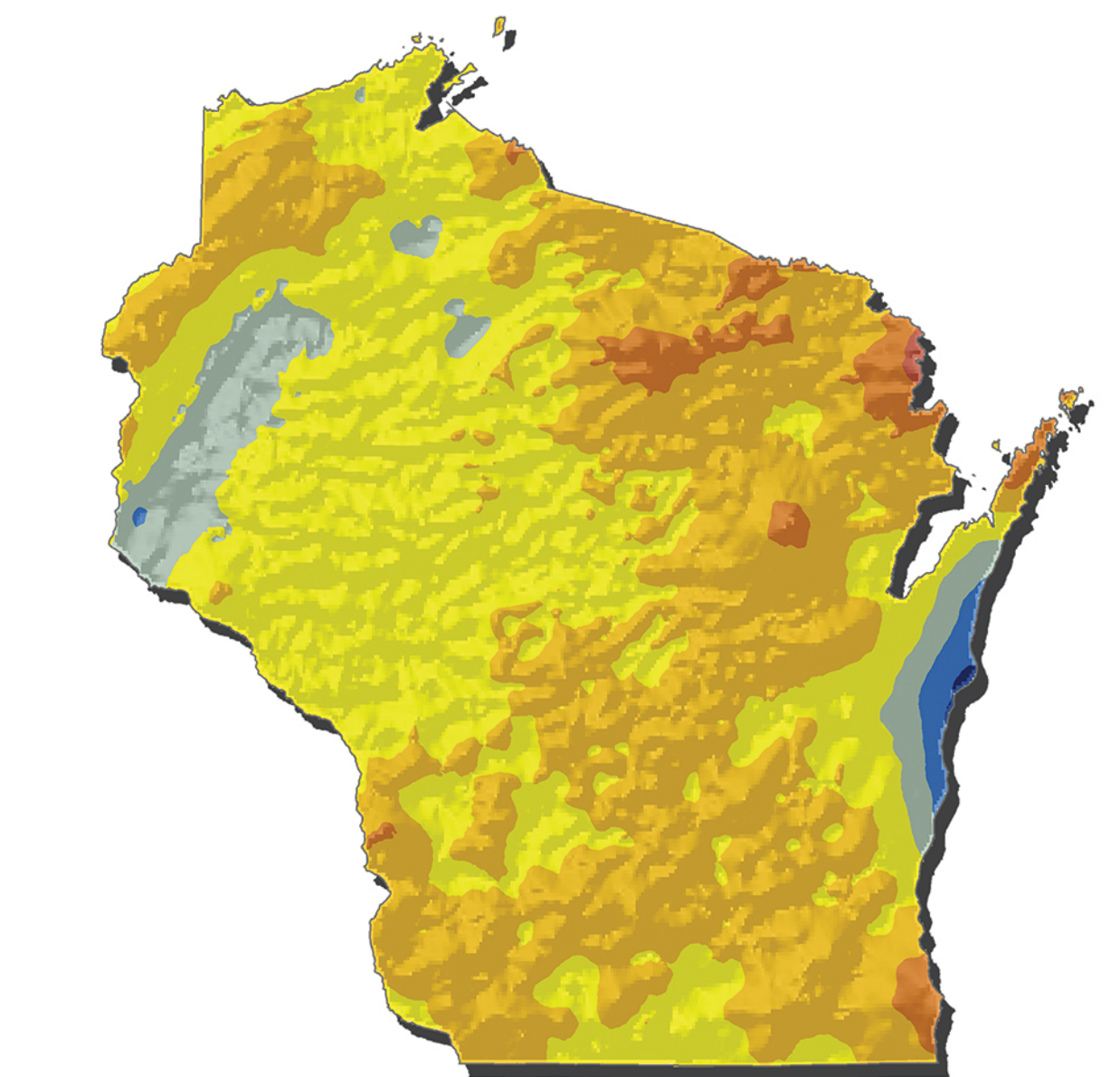
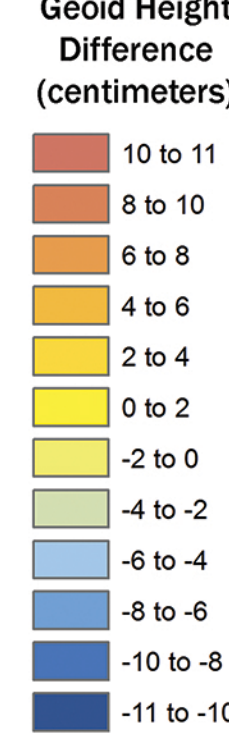
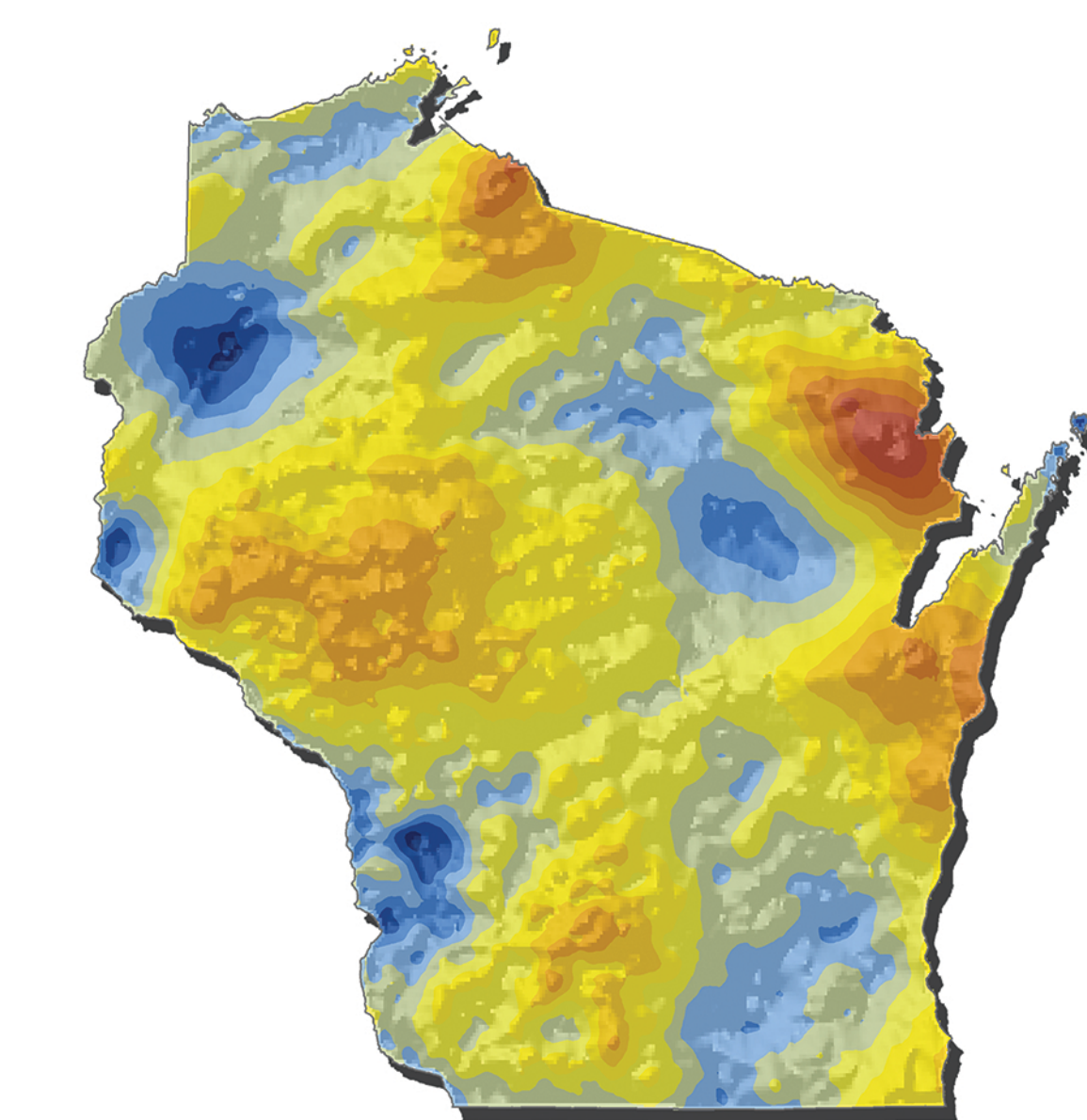
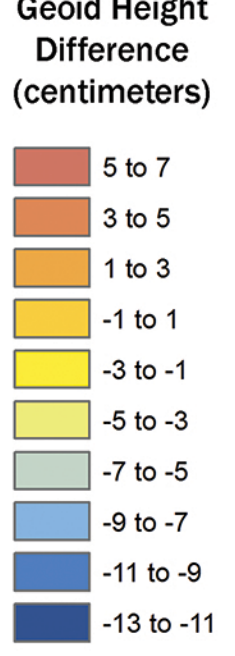
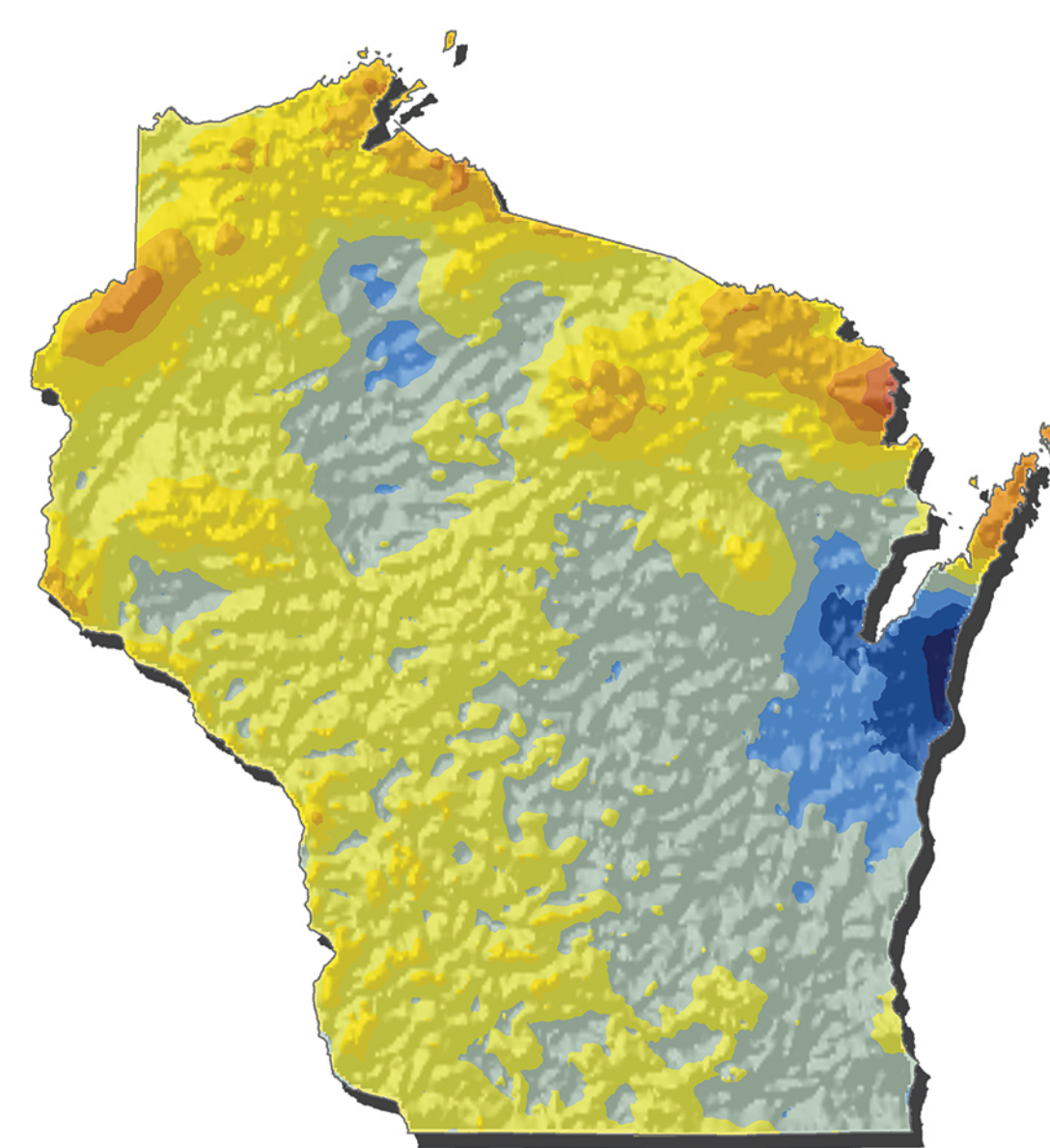
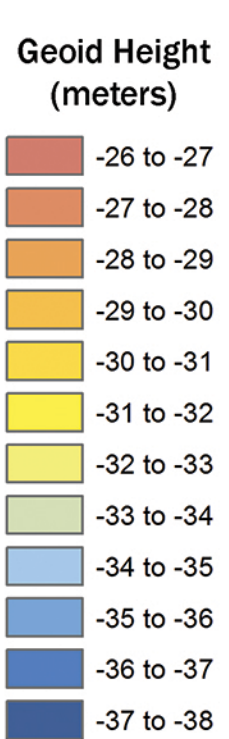
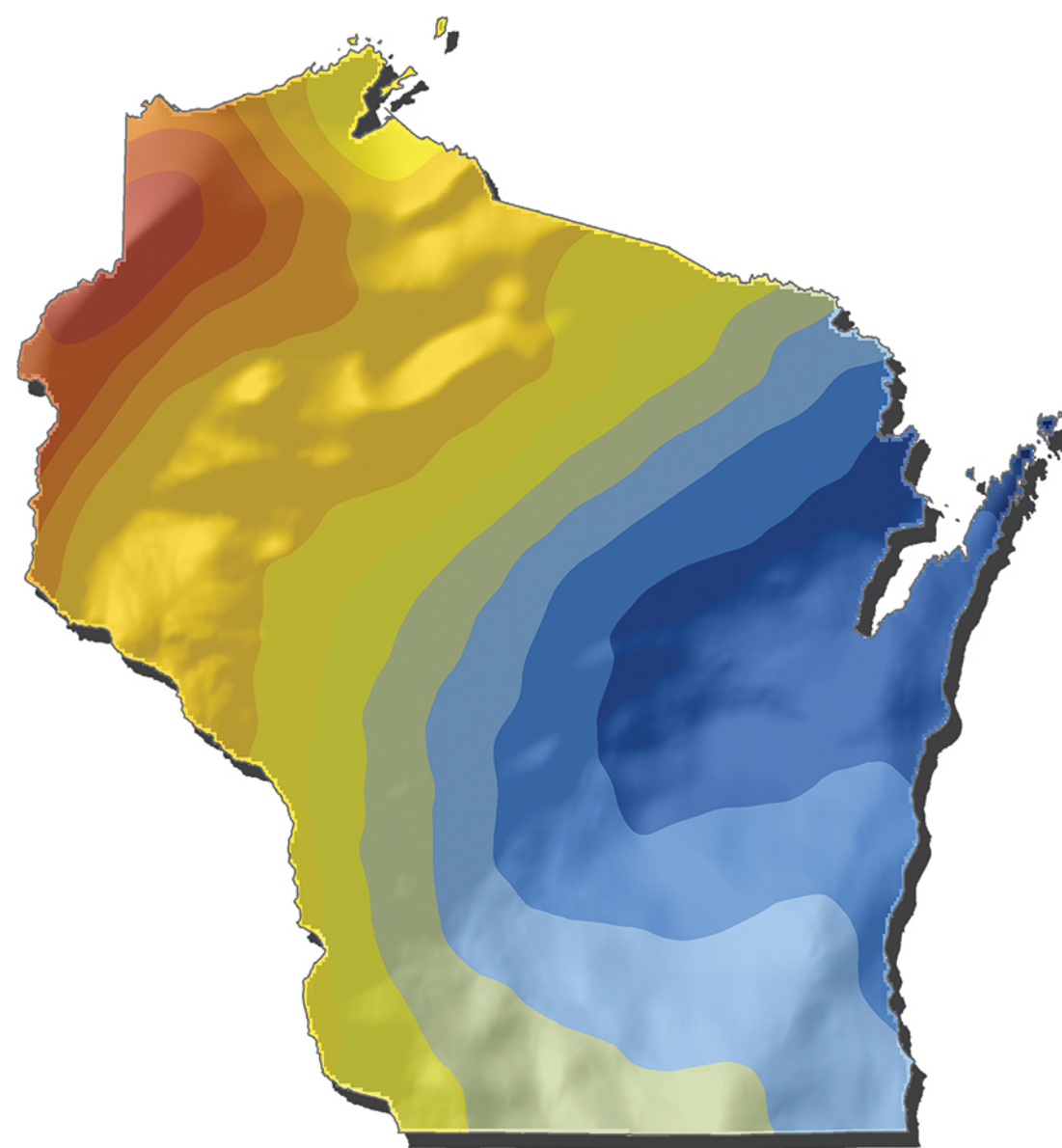
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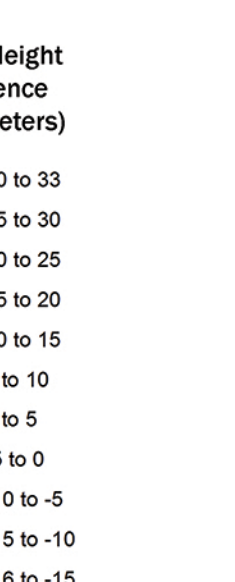
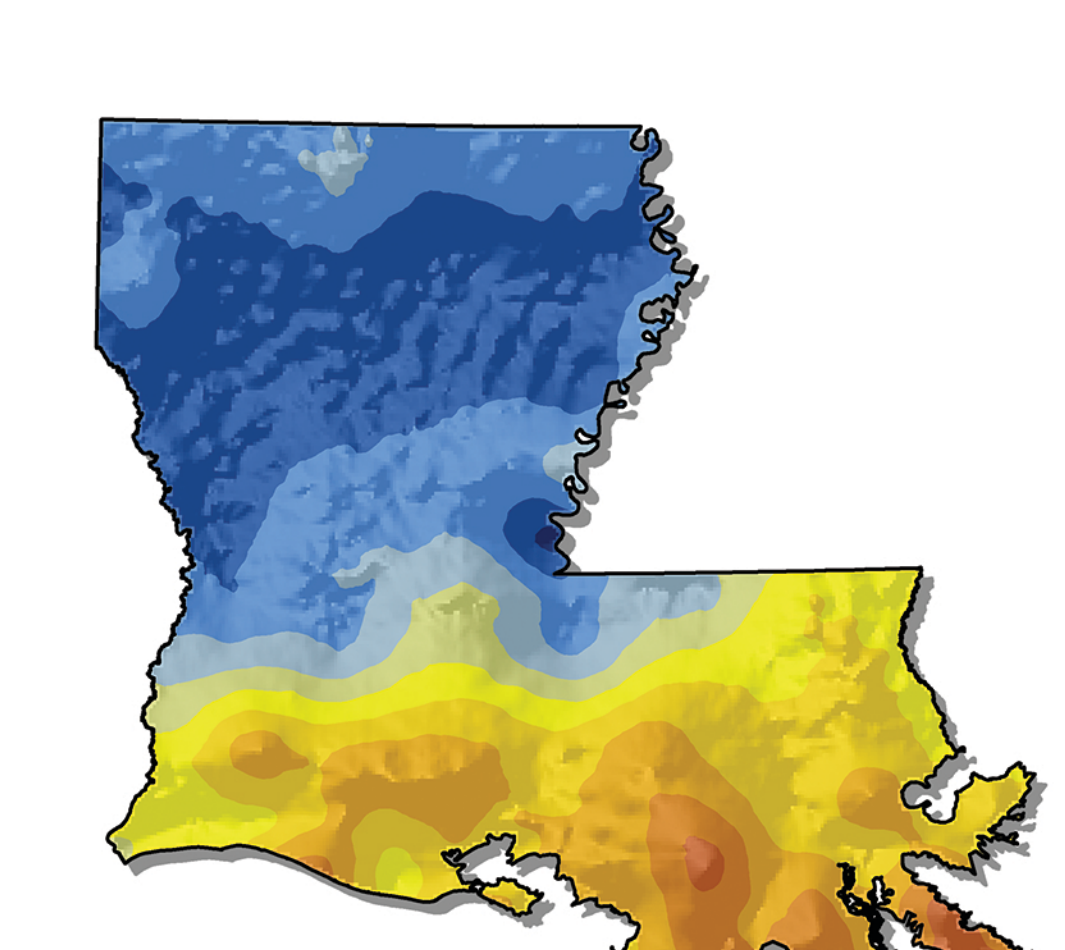
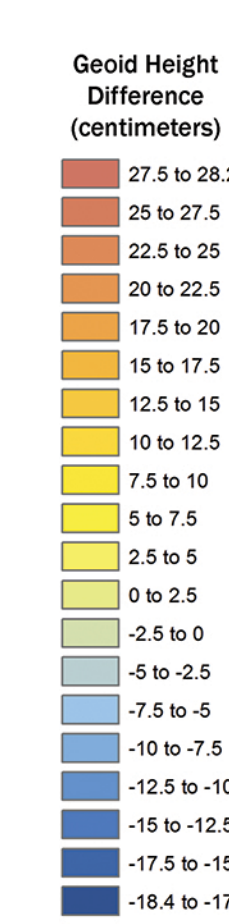
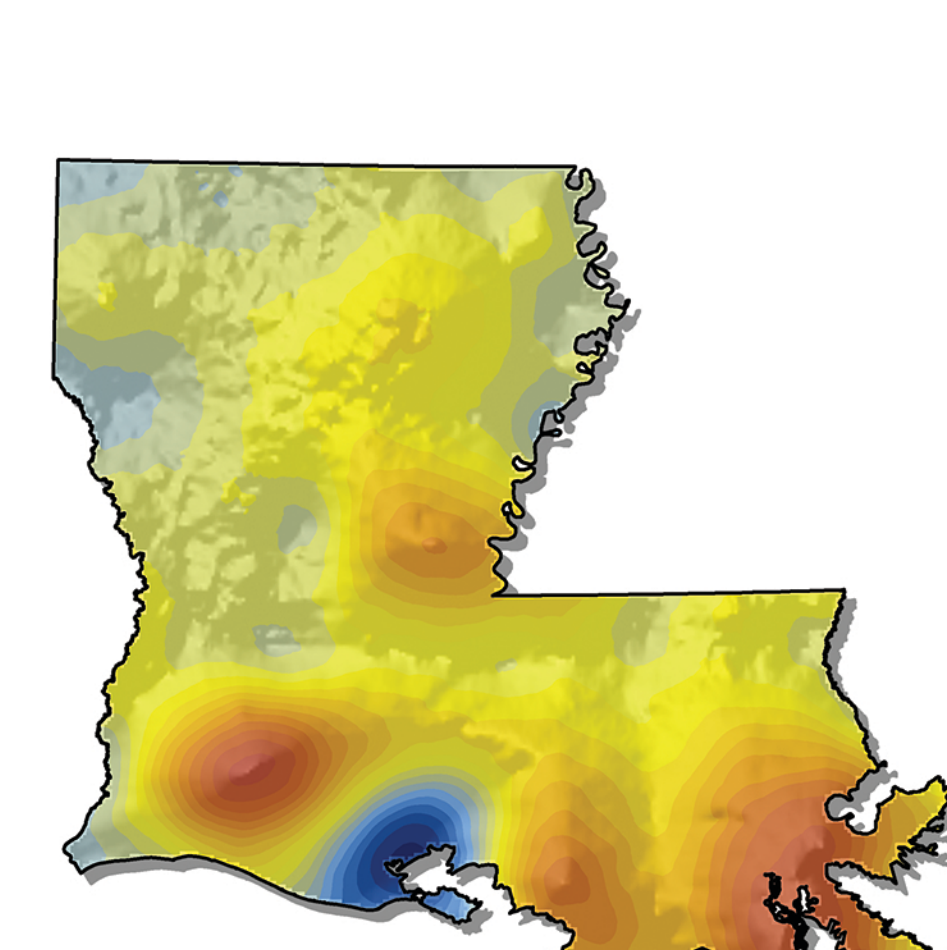
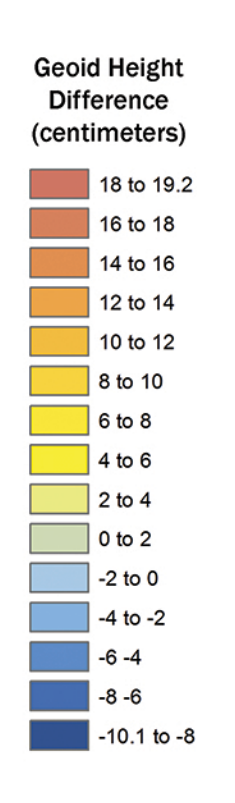
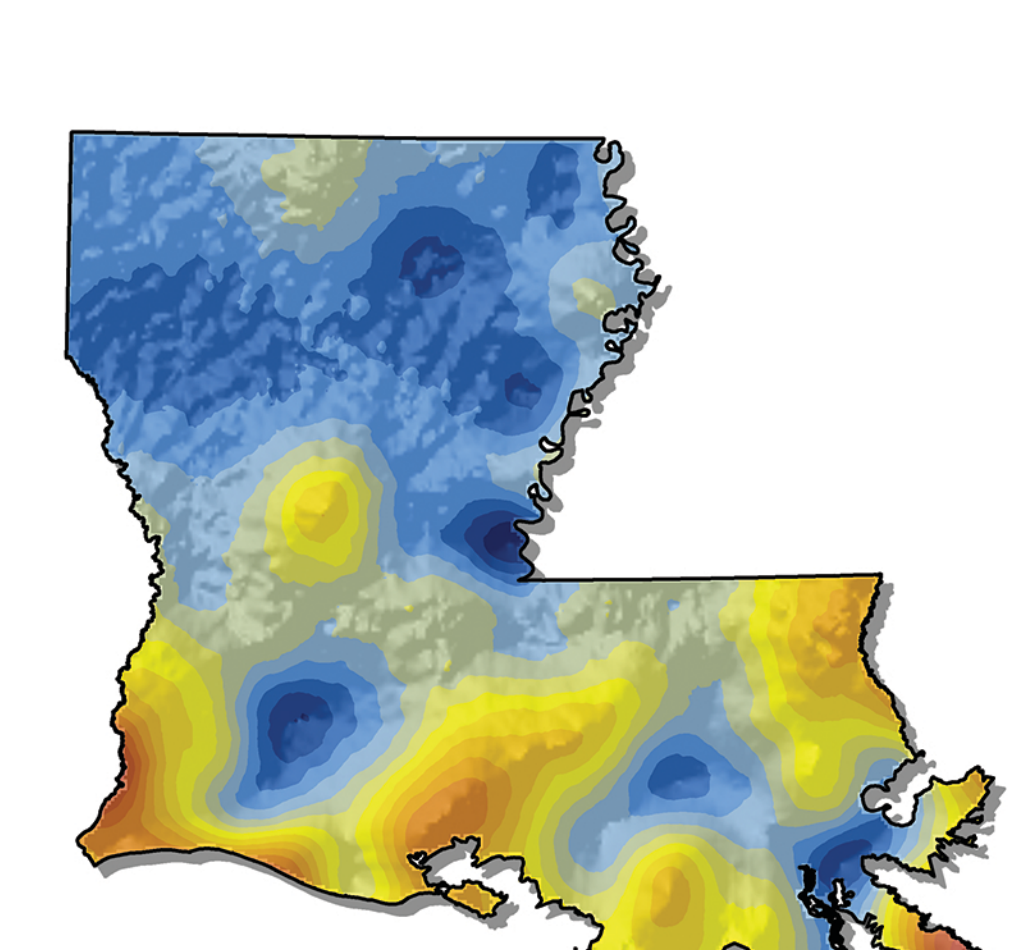
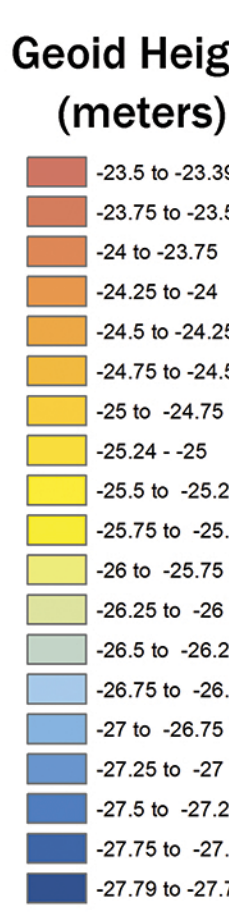
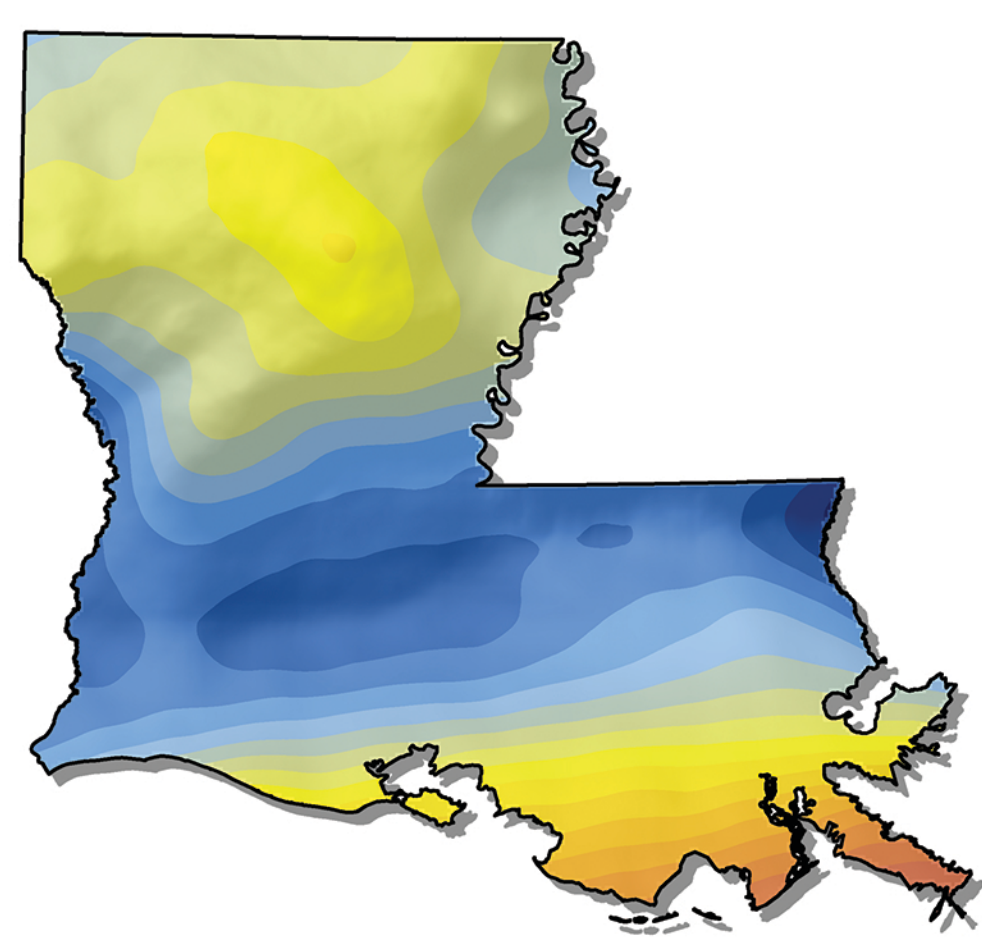
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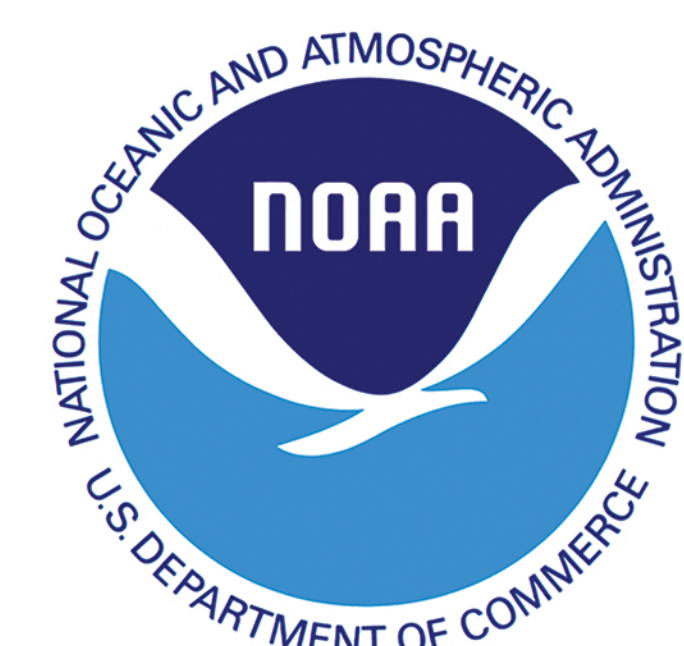


GEOID12A

GEOID12A - GEOID09

GEOID09 - GEOID03

GEOID12A - GEOID99



**National Geodetic Survey**  
**National Ocean Service**  
**National Oceanic and Atmospheric Administration**  
**United States Department of Commerce**

By: Brian Shaw  
 Created for: Esri International User Conference 2014  
 Data Sources: NOAA, USGS, U.S. Census, Esri  
 Data Contributions by NGS Geoid Team  
 Datum: North American Datum of 1983 (2011)  
 Projections: USA Contiguous Lambert Conformal Conic  
 The World From Space

