

# NGS Leveling for CONUS

NOAA's National Geodetic Survey

## Geodetic Leveling

"Geodetic leveling has been defined as '... leveling of a high order of accuracy, usually extended over large areas, to furnish accurate vertical control for all surveying and mapping operations.' There are two important considerations involved in this definition, 'high order of accuracy' and extension 'over large areas.'

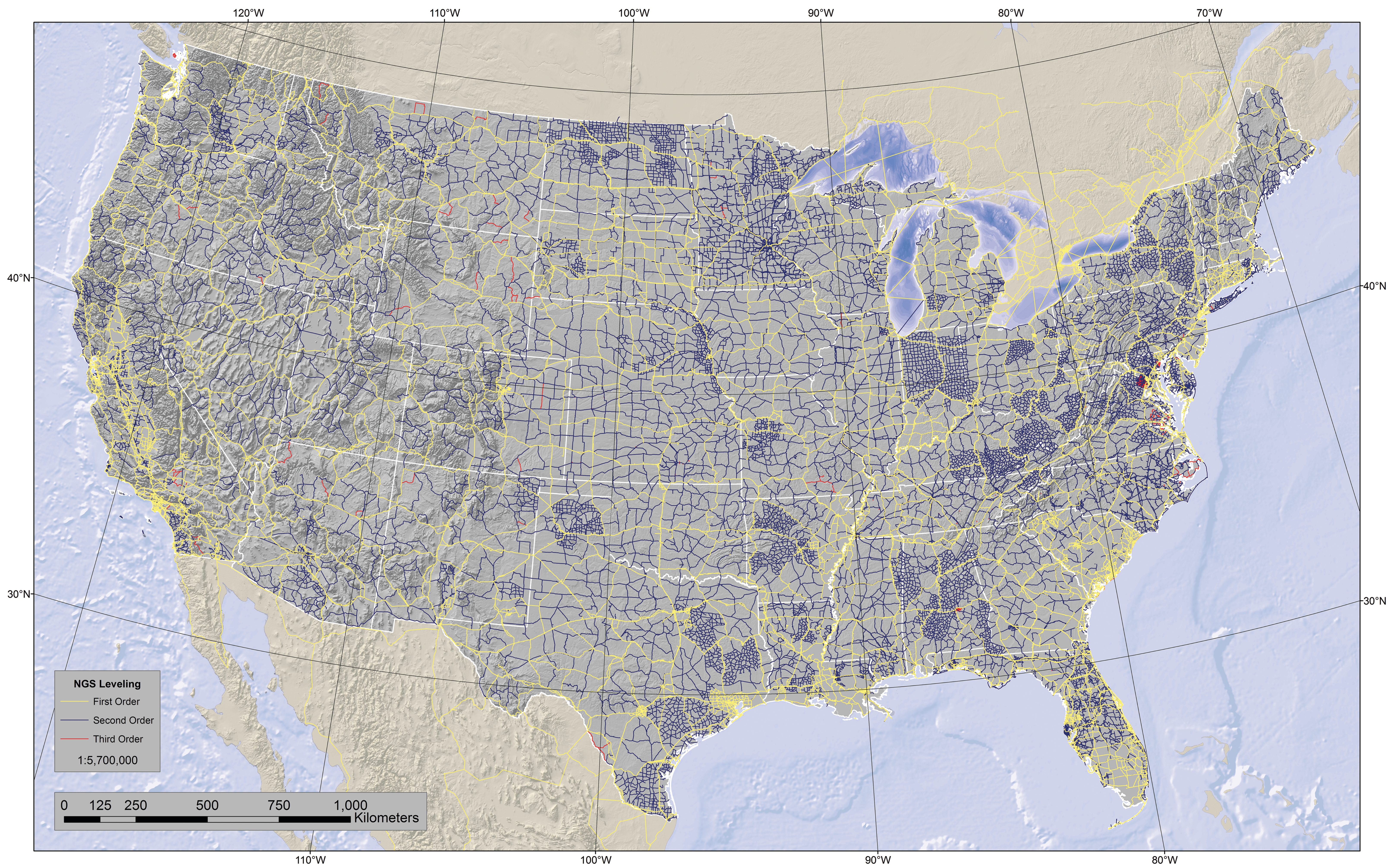
Although some localized leveling was undoubtedly done in the United States in pre-Revolutionary times and also by the U.S. Coast Survey from its establishment in 1807 (tidal bench marks, etc.), the first effort on record to run what can be called geodetic levels was made by the U.S. Coast Survey in 1856-1857, when a line of levels was run by G. B. Vose in connection with a detailed study of the tides and currents in New York Bay and the Hudson River. A series of tide gauges was established along the Hudson River from New York to Greenbush (on the east side of the Hudson River, opposite Albany), and all were interconnected by the line of levels run by Mr. Vose."

Berry, R. M. (1976, June). History of Geodetic Leveling in the United States. [http://www.ngs.noaa.gov/web/about\\_ngo/history/Berry1.pdf](http://www.ngs.noaa.gov/web/about_ngo/history/Berry1.pdf)

Throughout the National Geodetic Survey existence, a tremendous effort has accumulated over 20 thousand geodetic leveling projects in the NGS database. The oldest project in the database is from 1893 and NGS continues to load projects today, continuing to densify the nets that help NGS determine elevations. There were several periods through the 1900s where the leveling network grew at a rapid pace.

"The vertical control network grew from 45,000 miles in 1929 to about 260,000 miles in 1940 and more than 420,000 miles by 1970 -- and with little fanfare. Geodetic leveling has none of the glamour or adventure, associated with triangulation, and receives little publicity about its operations. There are no high mountains to climb or tall towers to build, no 100 mile long sights, nor 15 mile base lines to measure, only endless hours walking along railroad tracks and roads day after day, making observations every 400 ft. Yet, the work gets done and to a high accuracy, as well. And, so it was for the period 1940 - 1970. About the only changes were the Fischer level, in use since 1899 and C&GS designed invar rods from 1916, both replaced by equipment of European design and manufacture, about 1967."

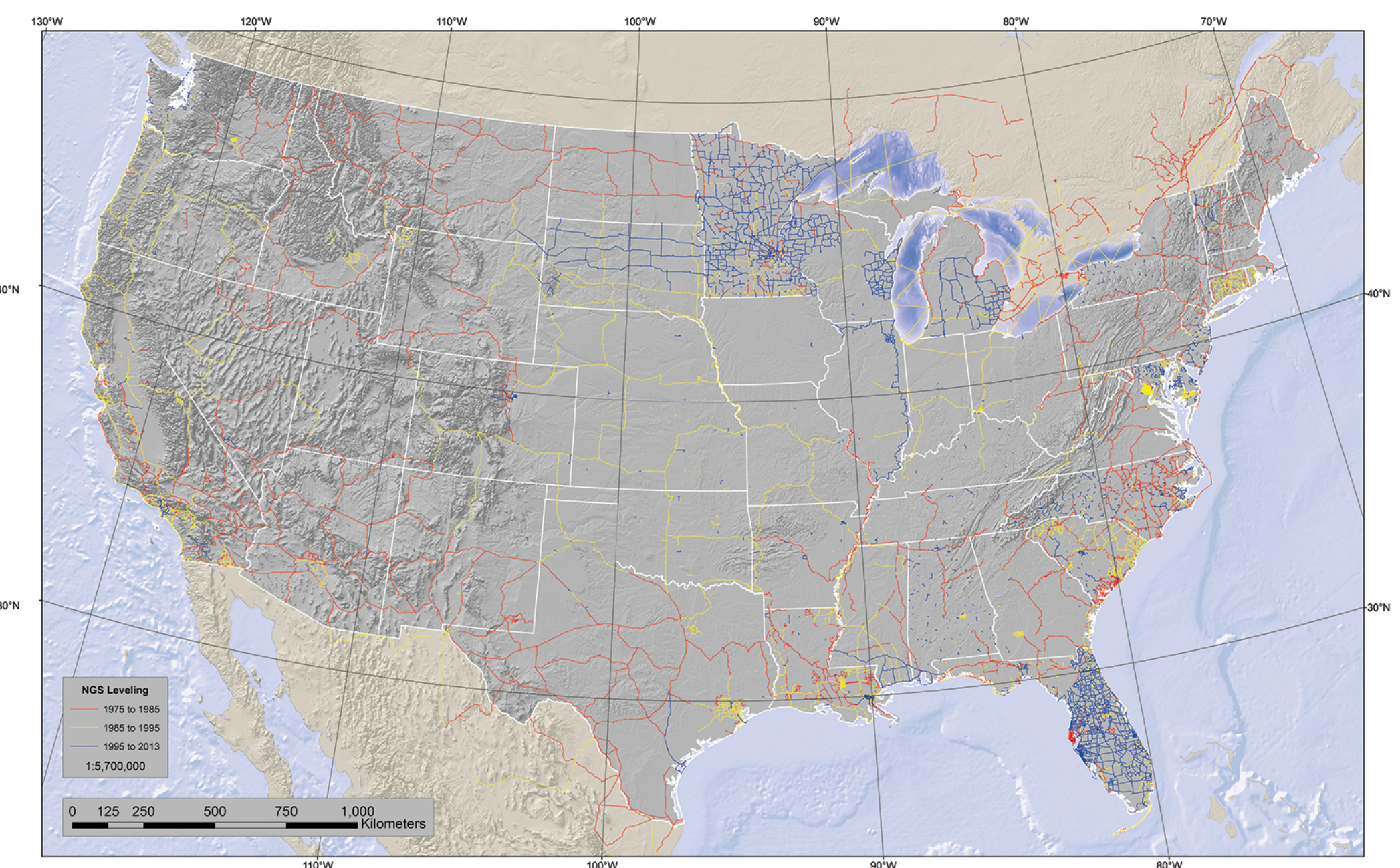
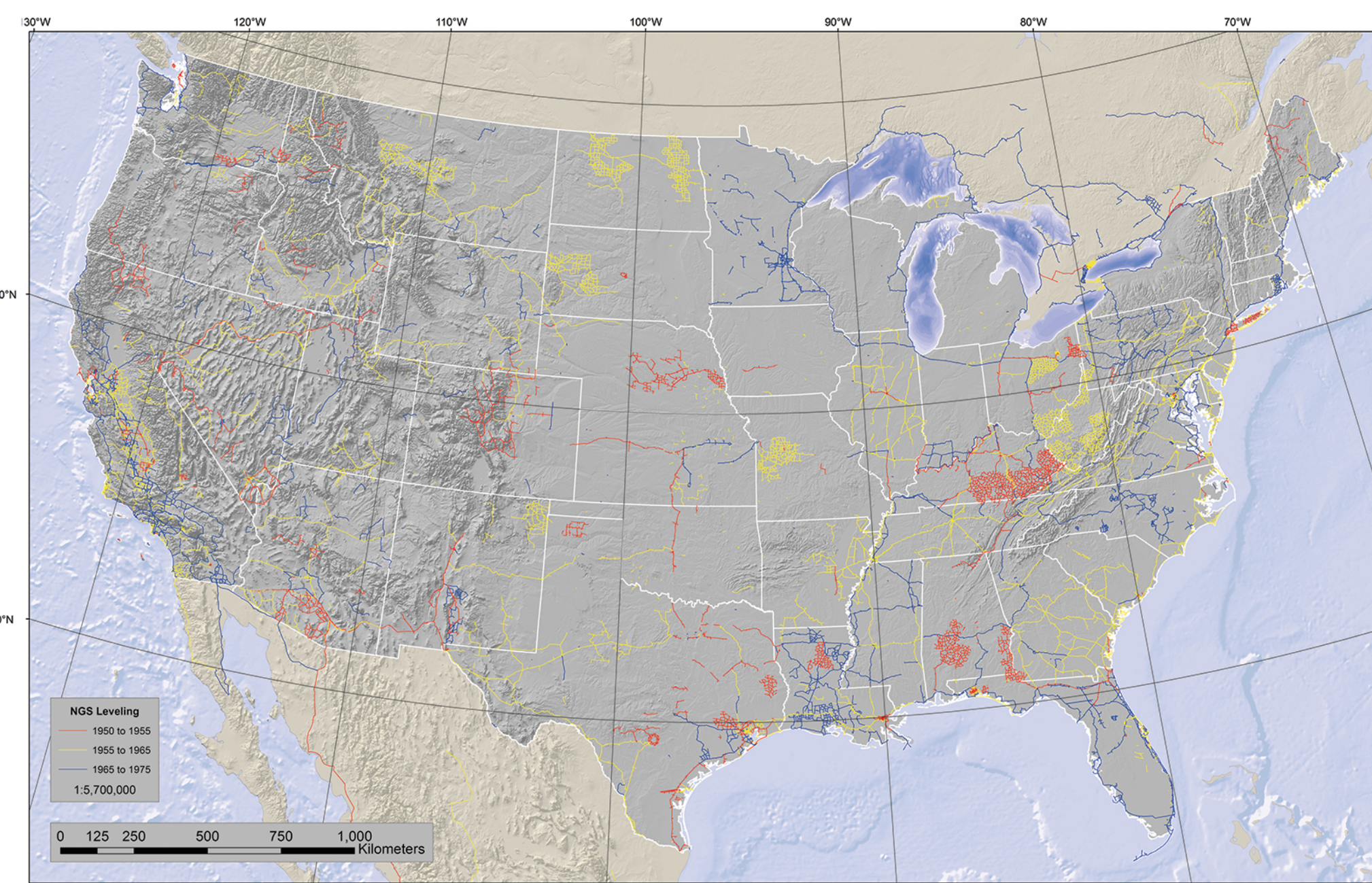
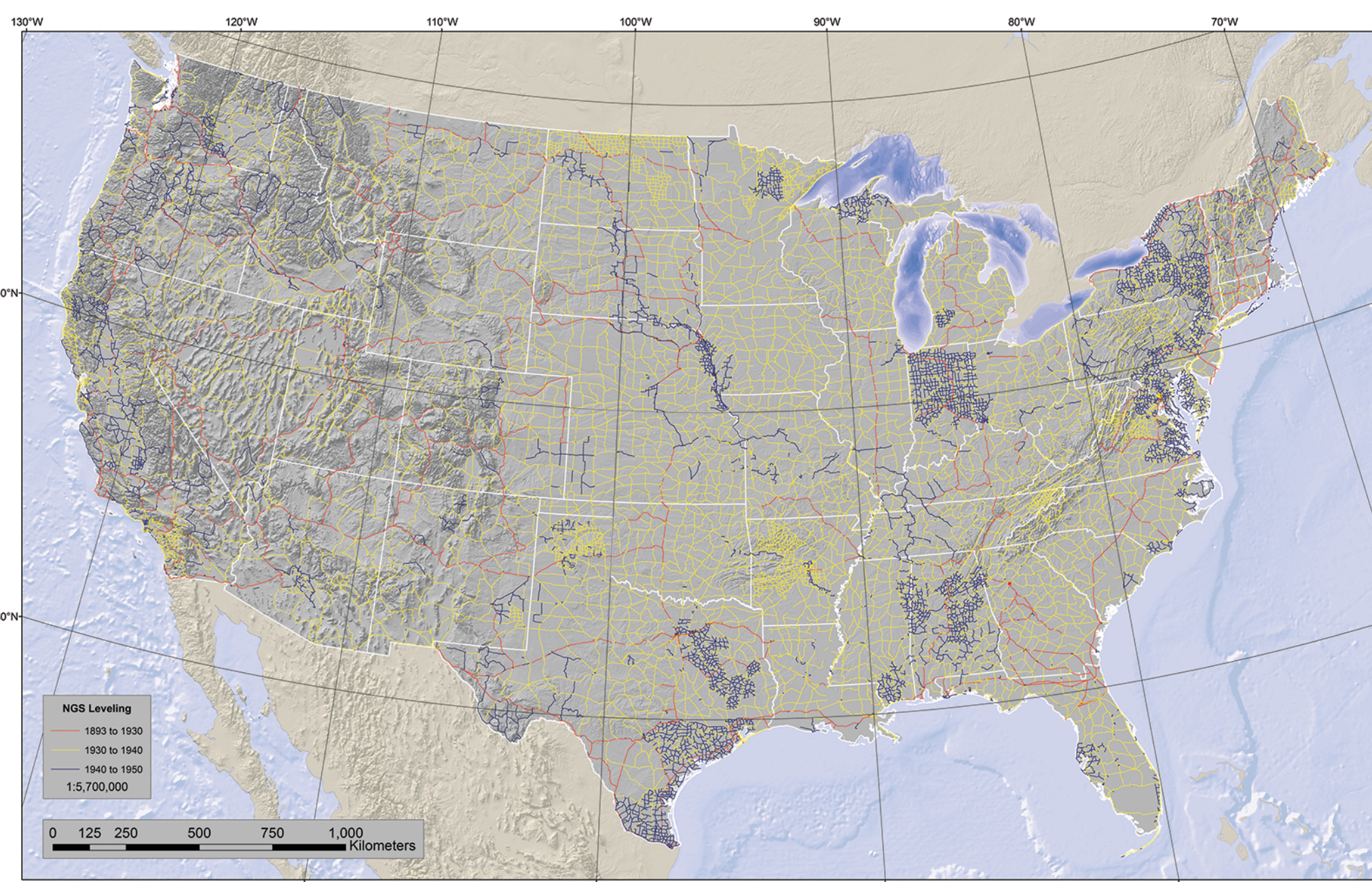
Dracup, J.F. (2006, June). Geodetic Surveying 1940-1990. [http://www.history.noaa.gov/stories\\_tales/geod2.html](http://www.history.noaa.gov/stories_tales/geod2.html)



1893 to 1950

1950 to 1975

1975 to 2013



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

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 Projections: North American Lambert Conformal Conic  
 The World From Space (Orthographic)

