



Roy Cooper, Governor
Erik A. Hooks, Secretary

Michael A. Sprayberry, Director

Replacing the North American Datum of 1983 and North American Vertical Datum of 1988 in 2022

ISSUES AND STATUS

The replacement of the North American Datum of 1983 (NAD83) and the North American Vertical Datum of 1988 (NAVD88) will dramatically impact everyone in the North Carolina (NC), from professional applications and services to recreational users who use maps, charts and satellite positioning systems such as GPS (Global Positioning System).

The National Geodetic Survey (NGS) defines and manages the National Spatial Reference System (NSRS), a consistent coordinate system that defines latitude, longitude, height (elevation), scale, gravity, and orientation throughout the United States. Today, various layers of The National Map are produced with centimeter-level absolute accuracy relative to NGS' official horizontal and vertical datums that establish the origin of horizontal coordinates and elevations above mean sea level. This ensures that orthophotos, elevation data, hydrography, transportation, administrative boundaries, and other mapped features fit together with centimeter-level precision when one mapping layer is registered to another.

However, in 2022, NAD83 and NAVD88 will be replaced with new interrelated reference frames (geometric and geopotential) which will rely on Global Navigation Satellite Systems (GNSS) such as the Global Positioning System (GPS) as well as an updated and time-tracked geoid (gravity) model. The new geometric reference frame will change latitude, longitude, and ellipsoid heights approximately 1-2 meters from the current NAD83 (2011) values, and the new geopotential reference frame will change orthometric heights (elevations) on an average of -50 centimeters (from -1 meter in the Pacific Northwest to zero in south Florida).

The replacement of NAD 83 and NAVD88 with new reference frames (datums) will impact all maps, charts, geographic information systems, surveying and engineering operations that federal, state, and local agencies produce and perform, to include hydrographic charts produced by NOAA; 3DEP elevation datasets and National Hydrography Datasets produced by USGS; and

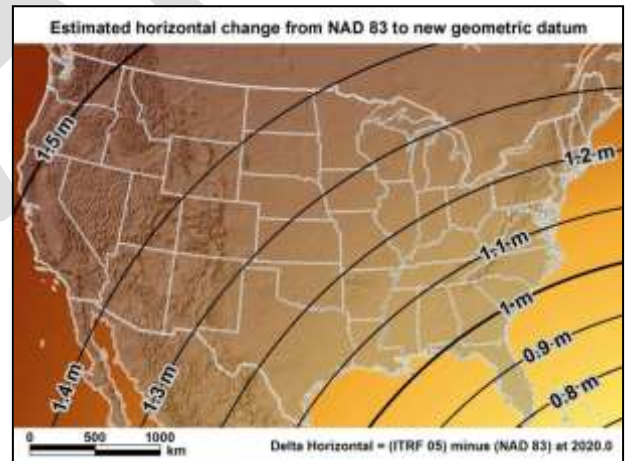


Image source: National Geodetic Survey

MAILING ADDRESS:
4298 Mail Service Center
Raleigh, NC 27699-4298
geodeticsurvey.nc.gov



An Equal Opportunity Employer

OFFICE LOCATION:
4105 Reedy Creek Rd
Raleigh, NC 27607
Telephone: (919) 733-3836
Fax: (919) 733-4407

Flood Insurance Rate Maps produced by FEMA, for example. Furthermore, The North Carolina State Plane Coordinate System will change. It is critical that federal, state, and local agencies along with the private sector are made aware of this change and develop plans for a transition to the new reference frames.

New Reference Frame Names:

NAD83 becomes:

North American Terrestrial Reference Frame (NATR2022)

NAVD88 becomes:

North American-Pacific Geopotential Datum of 2022 (NAPGD2022)

The new 2022 geometric (horizontal) reference frame (NATR2022) will be based on a Cartesian coordinate system with positions represented as sets of X/Y/Z coordinates with the origin of the coordinate system (0/0/0) at the center of the earth (the origin of the International GNSS Service (IGS) reference frame at a chosen epoch). It will be Earth Centered, Earth Fixed (ECEF), aligned with the International Terrestrial Reference Frame (ITRF) at a particular epoch (TBD). It is likely to contain aspects of some well-modeled velocities, e.g., plate rotations. Passive control will continue to be used as a secondary method to access the NSRS.

The new 2022 geopotential (vertical) reference frame (NAPGD2022) will be accessed with GNSS technology, and a gravimetric geoid model and passive monuments will continue to be used as a secondary method to access the NSRS. It will be based on a spherical harmonic model (SHM) of Earth's external gravity potential. This will be partly derived from airborne gravity data collected as part of the Gravity for the Redefinition of the American Vertical Datum (GRAV-D) and likely build upon the planned "EGM2020" model from the National Geospatial-Intelligence Agency (NGA). This SHM will be used to derive various quantities, such as dynamic heights, surface gravity, and a gravimetric geoid serving as the zero height surface of orthometric heights (commonly known as "elevations"). The target accuracy is 2-centimeter in both absolute and relative (over all distances) orthometric heights using GNSS and a geoid model. It will monitor time-varying nature of gravity field, including the geoid.

GRAV-D is an NGS project being performed to: (a) complete an airborne campaign to develop a high-resolution snapshot of gravity in the U.S., supporting gravimetric geoid accuracy, and (b) monitor changes to the gravity field at decadal scales, including changes to the geoid.

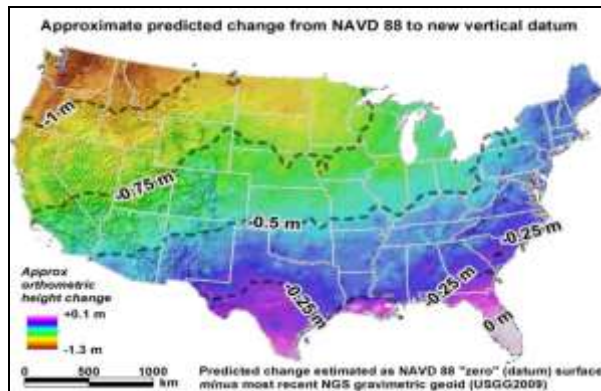


Image source: National Geodetic Survey

North Carolina products/services that will be impacted:

- North Carolina Continuously Operating Reference Station (CORS) network
- NC State Plane Coordinate System (NCSPC)
- All activities/services related to highway construction
- All public/private sector construction projects
- Land Records Management Program
- State/local agencies geographic information systems
- Charting and navigation systems
- Aerial imagery projects
- Precision agriculture
- NC OneMap
- NC Geodetic Survey geodetic database
- Flood Risk Information System (FRIS)
- Flood Inundation Mapping Alert Network (FIMAN)

North Carolina Action Items:

- Recommend that state/local agencies using or producing geodetic coordinates of any type to prepare and develop an orderly transition to the new geometric and geopotential reference frames.
- NCGS create a link on their web page for 2022 datum change information
- Create a 2022 Datum Working Group to develop implementation recommendations (in progress)
- NCGS and NCDOT partner with South Carolina (SC) Geodetic Survey, SC Department of Transportation (DOT), Georgia DOT, and Tennessee DOT to develop common implementation plans (in progress)

- NCGS partner with NGS to complete GRAV-D in North Carolina (airborne campaign completed)
- NCGS collect terrestrial gravity data and develop a monitor plan (in progress)
- NCGS obtain ellipsoid heights on NAVD88 bench marks (height modernization surveys) (in progress)
- NC Emergency Management/Risk Management collect statewide elevation data (QL1 and OL 2) (in progress)
- Education outreach (in progress)