



NSRS Modernization

New Datums are Coming in 2022

What's Being Replaced?

Horizontal

- NAD 83(2011)
- NAD 83(PA11)
- NAD 83(MA11)

Latitude
Longitude
Ellipsoid Height
State Plane Coordinates

Vertical

- NAVD 88
- PRVD 02
- VIVD09
- ASVD02
- NMVD03
- GUV D04
- IGLD 85

Heights

New Reference Frame Names

NAD 83 becomes:

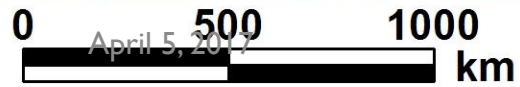
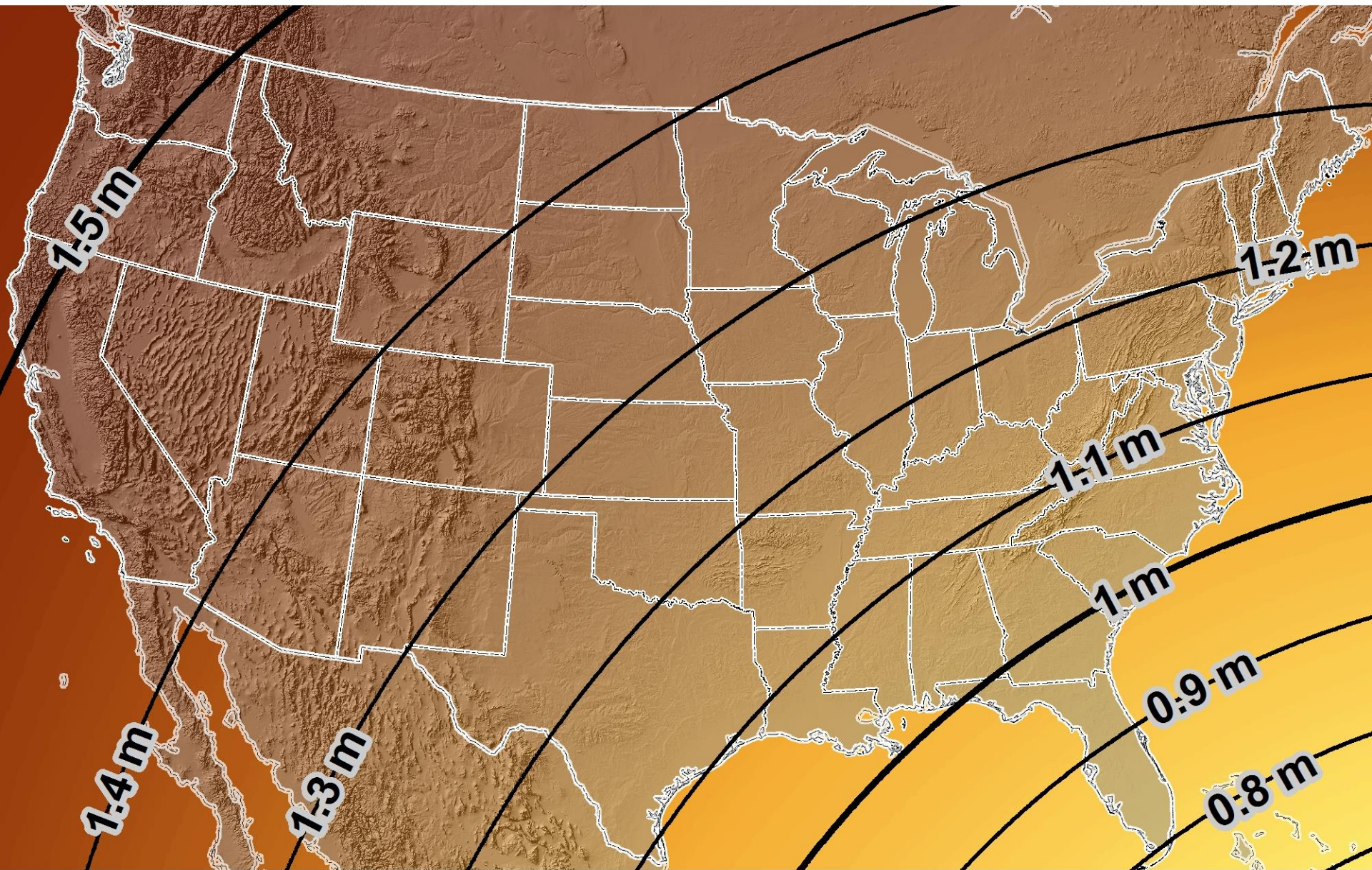
- North American Terrestrial Reference Frame (NATRF2022)
- Caribbean Terrestrial Reference Frame (CATRF2022)
- Mariana Terrestrial Reference Frame (MATRF2022)
- Pacific Terrestrial Reference Frame (PATRF2022)

NAVD88 becomes:

- North American-Pacific Geopotential Datum of 2022 (NAPGD2022)

(Realized by GEOID2022)

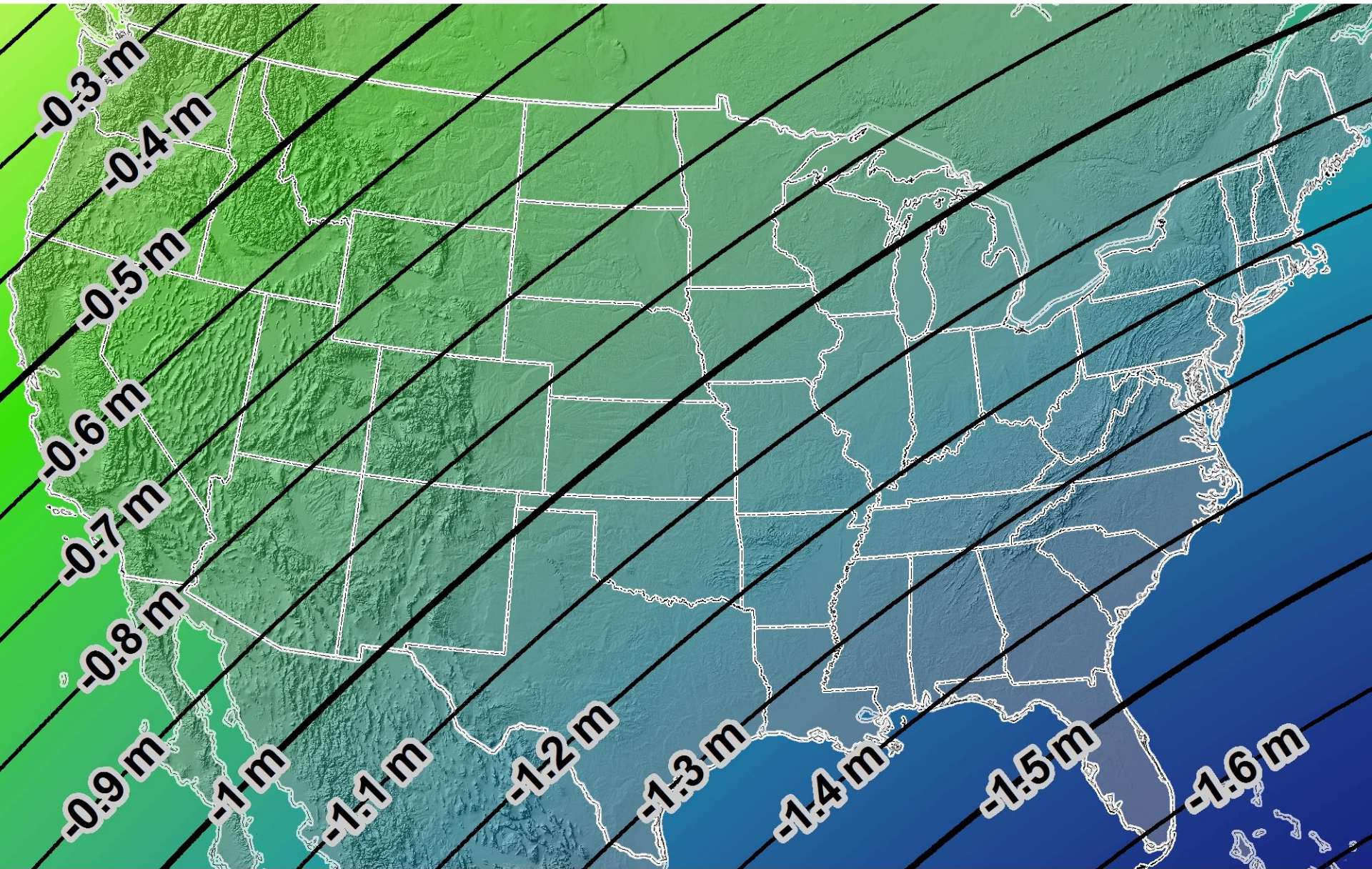
Estimated horizontal change from NAD 83 to new geometric datum



April 5, 2017

Northrup Chapter PL 86
 Δ Horizontal = (ITRF 05) minus (NAD 83) at 2020.0

Estimated ellipsoid height change from NAD 83 to new geometric datum

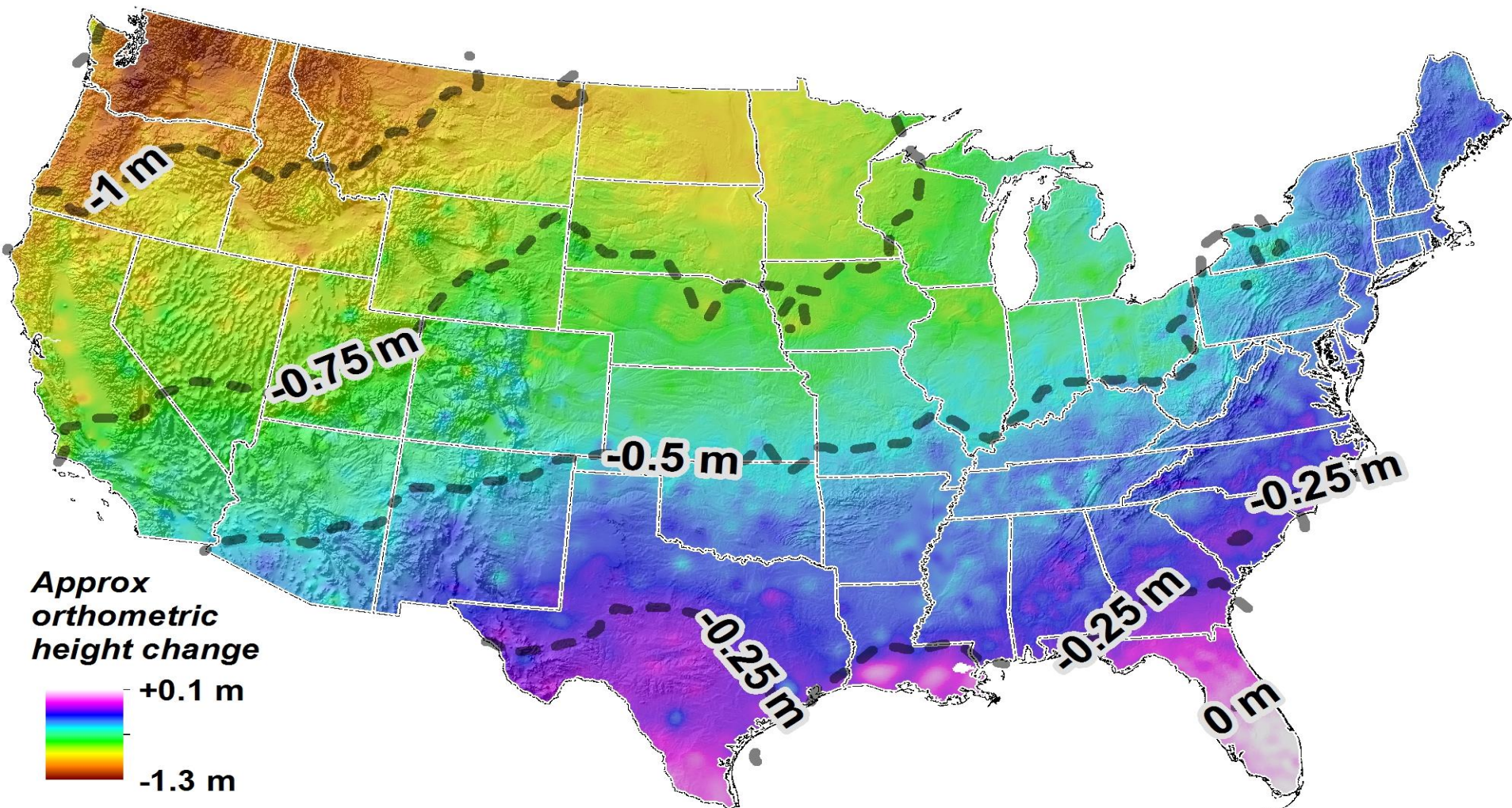


0 500 1000
April 5, 2017
km

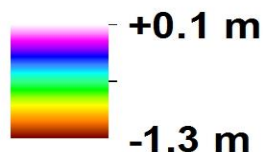
Northern Chapter PLSC
 $\Delta h = h(\text{ITRF 05}) \text{ minus } h(\text{NAD 83}) \text{ at } 2020.0$

New Vertical Datum

Approximate predicted change from NAVD 88 to new vertical datum



Approx
orthometric
height change



Predicted change estimated as NAVD 88 "zero" (datum) surface *minus* most recent NGS gravimetric geoid (USGG2009)

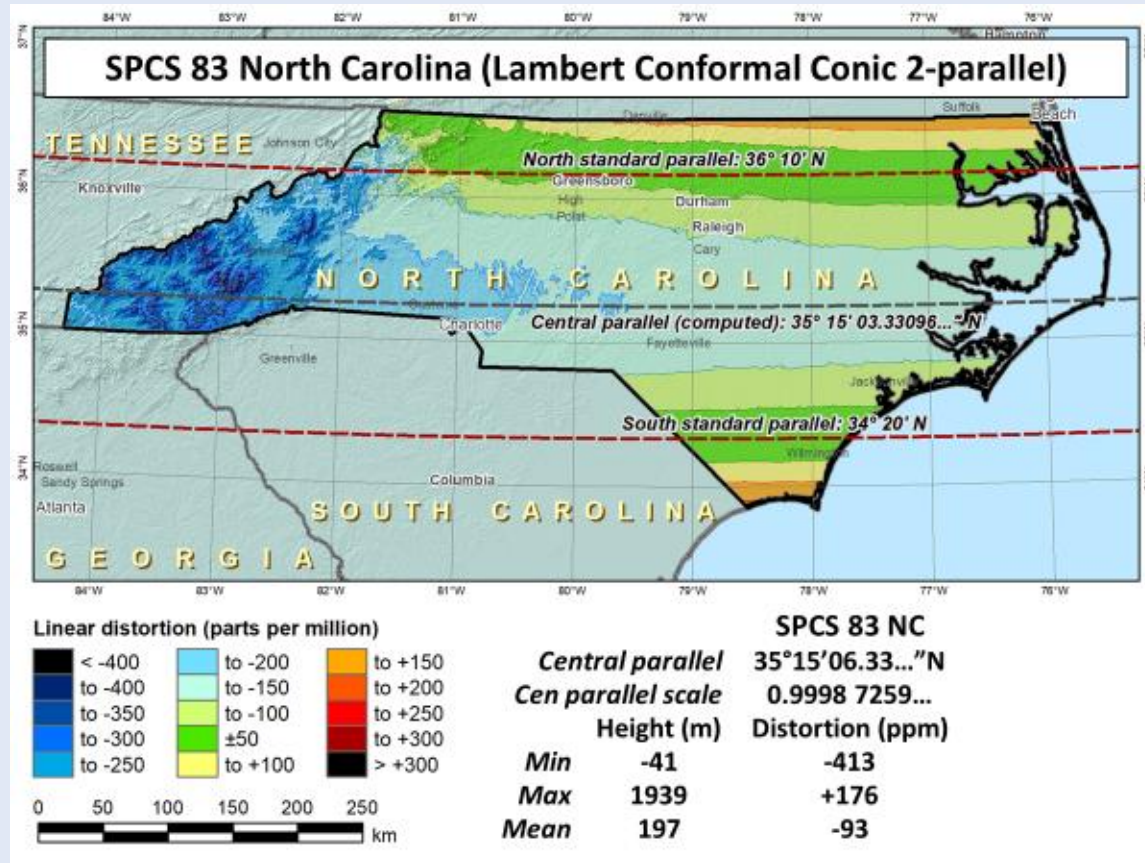
SPCS2022 in North Carolina

- New State Plane Coordinate System in 2022
 - Will replace SPCS 83
 - Referenced to new terrestrial reference frames
- Two conflicting desires for SPCS2022 coordinates:
 - Change coordinates as little as possible
 - Preserve systems based on SPCS 83 coordinates (sft)
 - E.g., parcel numbering system, FEMA flood mapping tiles
 - Change coordinates by large amount
 - Reduces confusion with SPCS 83 coordinates
 - Satisfies NGS policy on SPCS2022

SPCS2022 characteristics

- Characteristics pertinent to North Carolina:
 - Minimize distortion at **ground surface**
 - Lambert Conformal Conic: **1-parallel definition**
 - Central parallel defined to **nearest arc-minute**
 - Central parallel scale \leq **6 decimal places**
 - Coordinates must change \geq **10,000 m (~33,000 ft)**
 - Grid origins rounded to **nearest 1000 m**

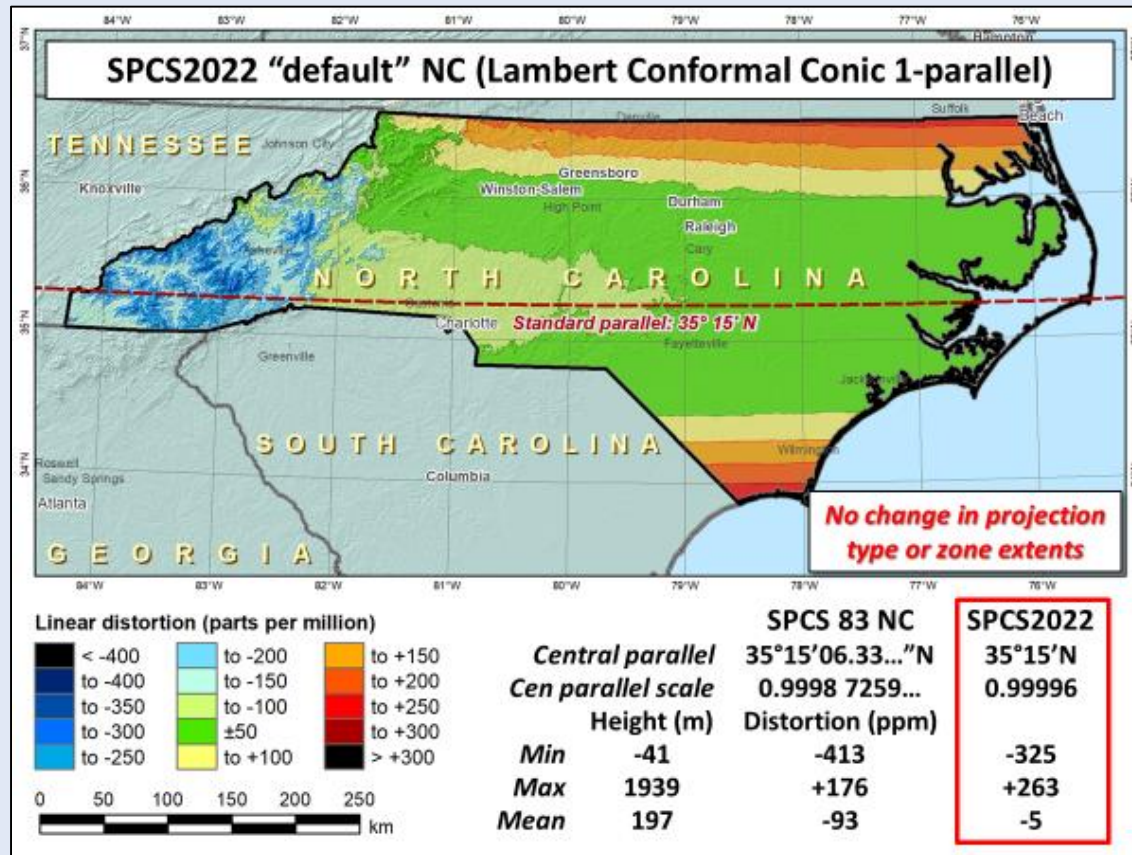
Current NC State Plane Coordinate System



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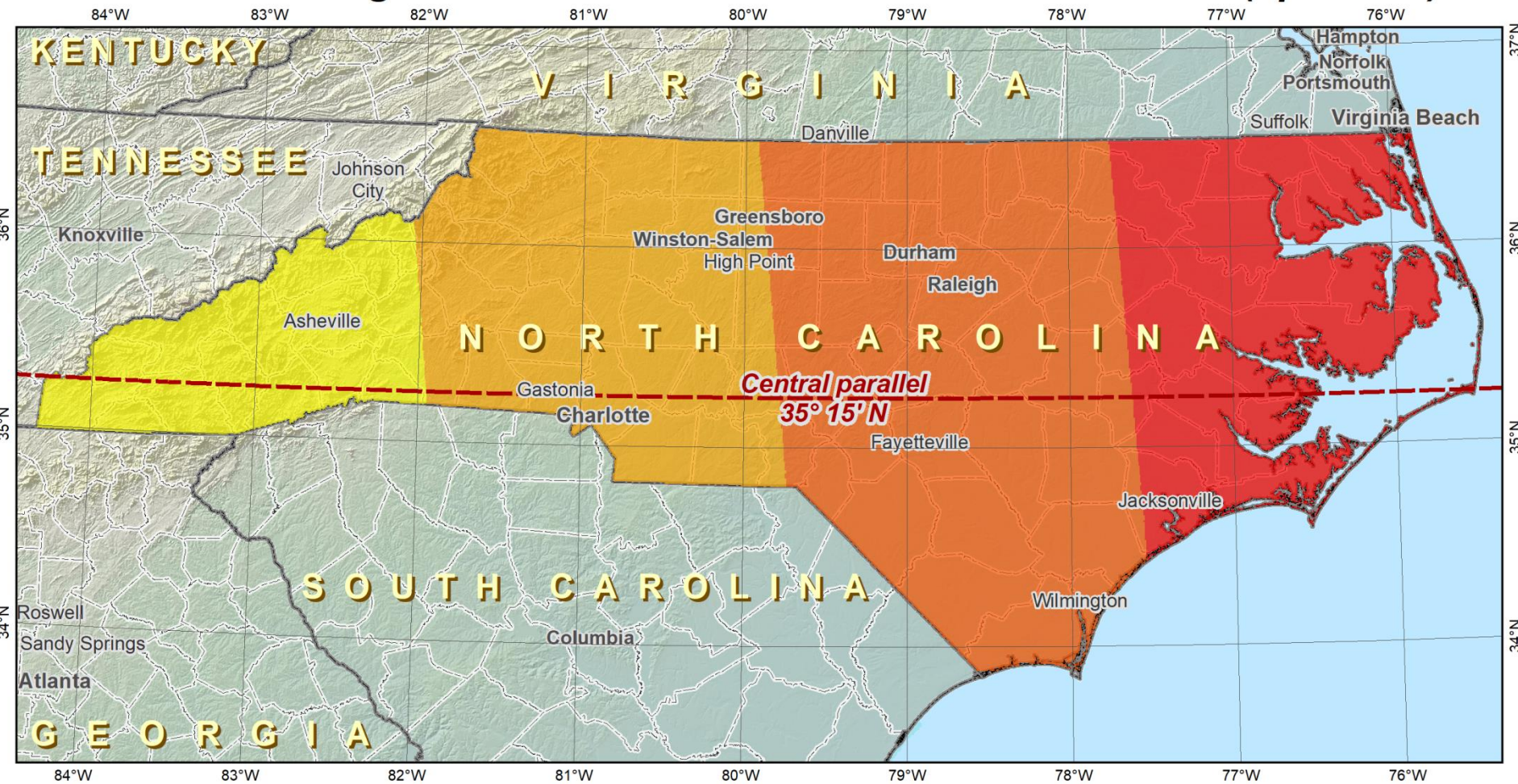
Proposed 2022 NC State Plane Coordinate System



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Horizontal change in SPCS2022 coordinates for North Carolina (option 2b)



Lambert Conformal Conic projection

North American Terrestrial Reference Frame of 2022

Central parallel: 35° 15' N

Central parallel scale: 0.999 95 (exact)

Areas within ±100 ppm distortion (1:10,000 = ±0.53 ft per mile):

- 90% of population
- 78% of all cities and towns
- 76% of entire zone area

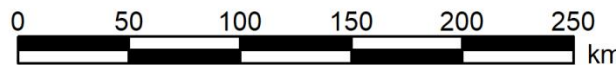
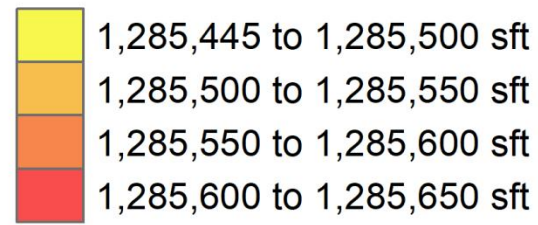


NOAA's National Geodetic Survey

Option 2b: Reference frame plus parameter change:

False northing = 200,000 m
 False easting = 1,000,000 m
 (same central meridian as SPCS 83)

Horizontal change in coordinates



North Carolina 2022 PIN conversion

- Equations for generating SPCS 83 (2011) epoch 2010.00 coordinates from SPCS2022 epoch 2020.00 coordinates, for the purpose of creating parcel IDs consistent with those currently used in North Carolina:
 - $N83 = S * N2022 + T_n$
 - $E83 = S * E2022 + T_e$
- $N83$ and $E83$ = Output SPCS 83 northing and easting coordinates in US sft
- $N2022$ and $E2022$ = Input SPCS2022 northing and easting coordinates (in survey or international feet as indicated)
- S = Scale factor
- T_n and T_e = North and east translations (actually combined translation, origin, and scaled origin).



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North Carolina 2022 PIN conversion

- For input SPCS2022 coordinates in U.S. survey feet (sft), the equations are:

$$N83(\text{sft}) = 0.9999222 * N2022(\text{sft}) - 110,204$$

$$E83(\text{sft}) = 0.9999222 * E2022(\text{sft}) - 1,280,576$$

- The horizontal accuracy is:
 - Maximum error of 1.6 ft
 - Average error of 0.5 ft
 - Radial root mean square error of 0.5 ft
- Preliminary until projection definition has been finalized



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New Datums are Coming in 2022

Our preparations to date include:

- Created a 2022 Datum Working Group to develop implementation recommendations ✓
- Working with SC Geodetic Survey, SC, NC, and VA Department's of Transportation to develop common implementation plans ✓
- Working with the National Geodetic Survey to complete GRAV-D in North Carolina
 - Collecting terrestrial gravity data ✓
 - Collection of airborne gravity data completed ✓
- Partnering with UNCC to purchase an absolute gravity meter ✓
- Obtaining ellipsoidal heights on NAVD88 bench marks ✓
- Collecting statewide LiDAR elevation data (USGS QL1 and QL2) ✓
- Created 2022 Datum web page ✓
- Education outreach ✓
- National Geodetic Survey GPS on Bench Marks project ✓

In progress = ✓
Completed = ✓



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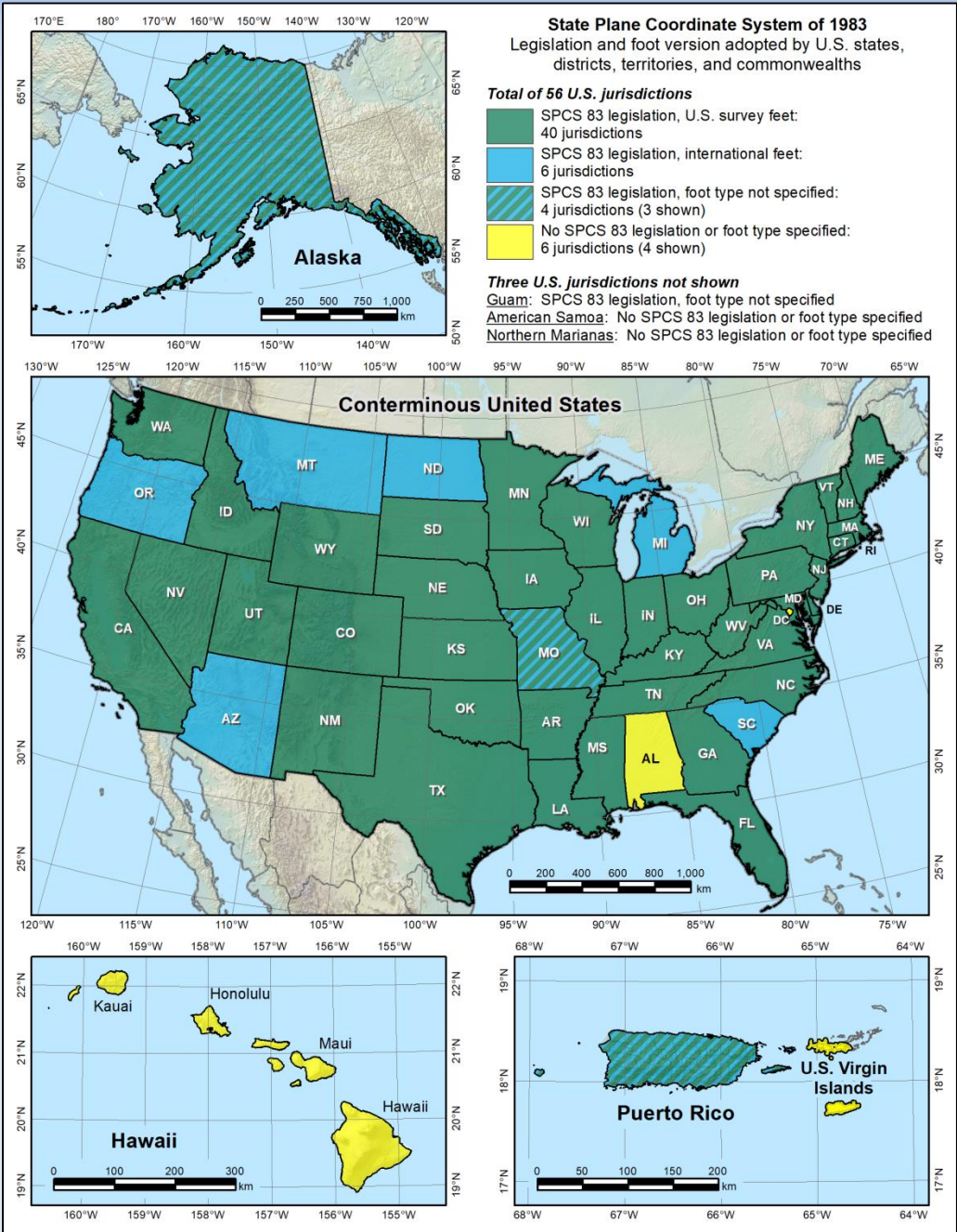
Comments Requested

- Provide comments on the proposed North Carolina 2022 NCSPCS
- Provide comments on the North Carolina 2022 PIN conversion
- What additional activity do we need implement to prepare for the horizontal and vertical datum change in 2022?



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Comments Requested

- Should NC convert from the US Survey Foot to the International Foot?



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To Learn More

Visit the New Datums web page

New Datums
National Geodetic Survey

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September 28, 2016

Replacing NAVD 88 and NAD 83
NAD 83 and NAVD 88 will be replaced in 2022, and there are many related projects to make sure the transition goes smoothly. Read the **NGS Ten-Year Plan** to learn more and continue to visit this web-page for more information.

What to Expect | **Get Prepared**
Related Projects | **Track Our Progress**
Watch Our Videos | **Learn More**

Why is NGS replacing NAD 83 and NAVD 88?
NAD 83 and NAVD 88, although still the official horizontal and vertical datums of the National Spatial Reference System (NSRS), have been identified as having shortcomings that are best addressed through defining new horizontal and vertical datums.

Specifically, NAD 83 is non-geocentric by about 2.2 meters. Secondly, NAVD 88 is both biased (by about one-half meter) and tilted (about 1 meter coast

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2015 Summit

FAQs
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NGS 2017 Geospatial Summit
April 24-25

Geodetic Datums
See our videos!

geodesy.noaa.gov/datums/newdatums/index.shtml

Questions?



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