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
- GUVD04
- 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)

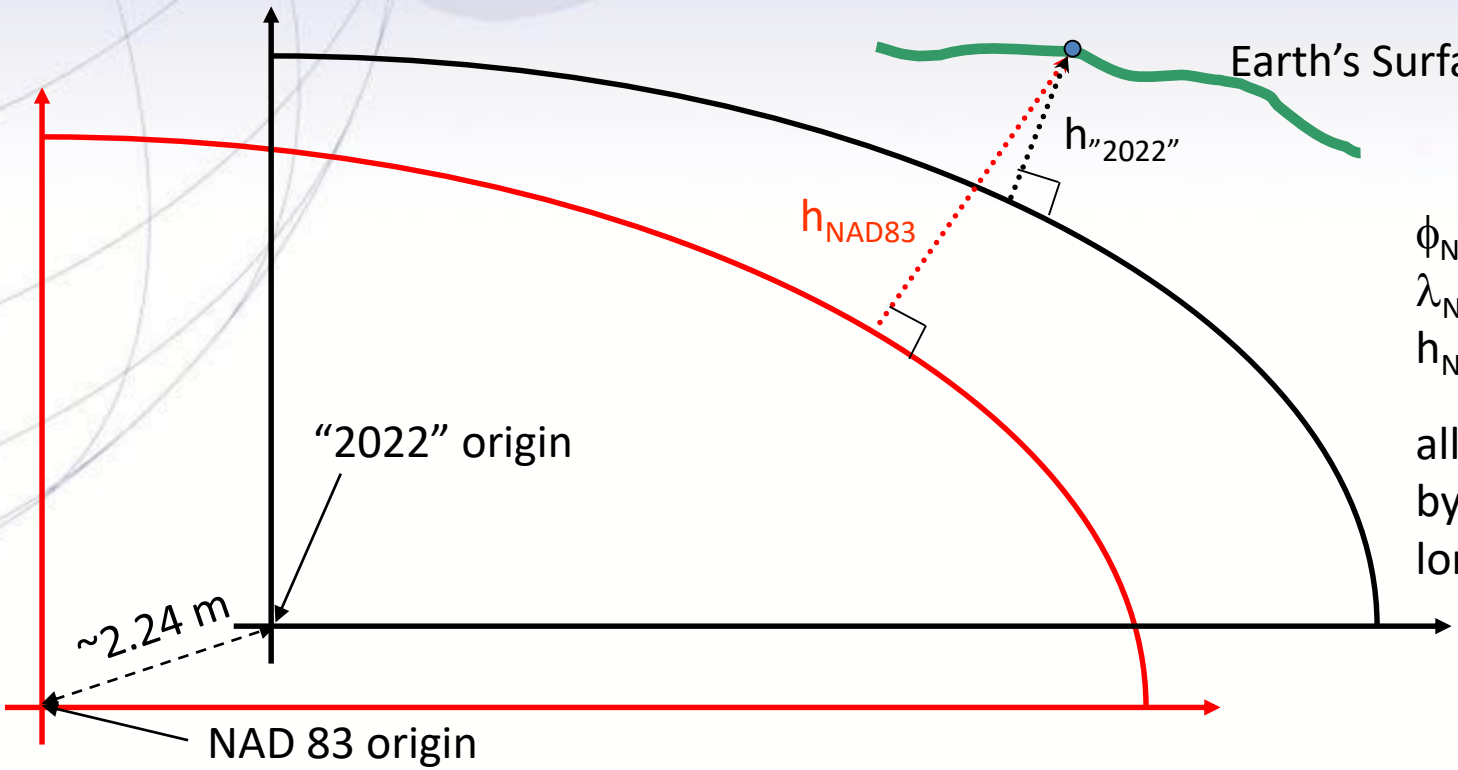
NAVD88 becomes:

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

(Realized by GEOID2022)

Replace NAD 83

Simplified concept of NAD 83 vs. "2022"

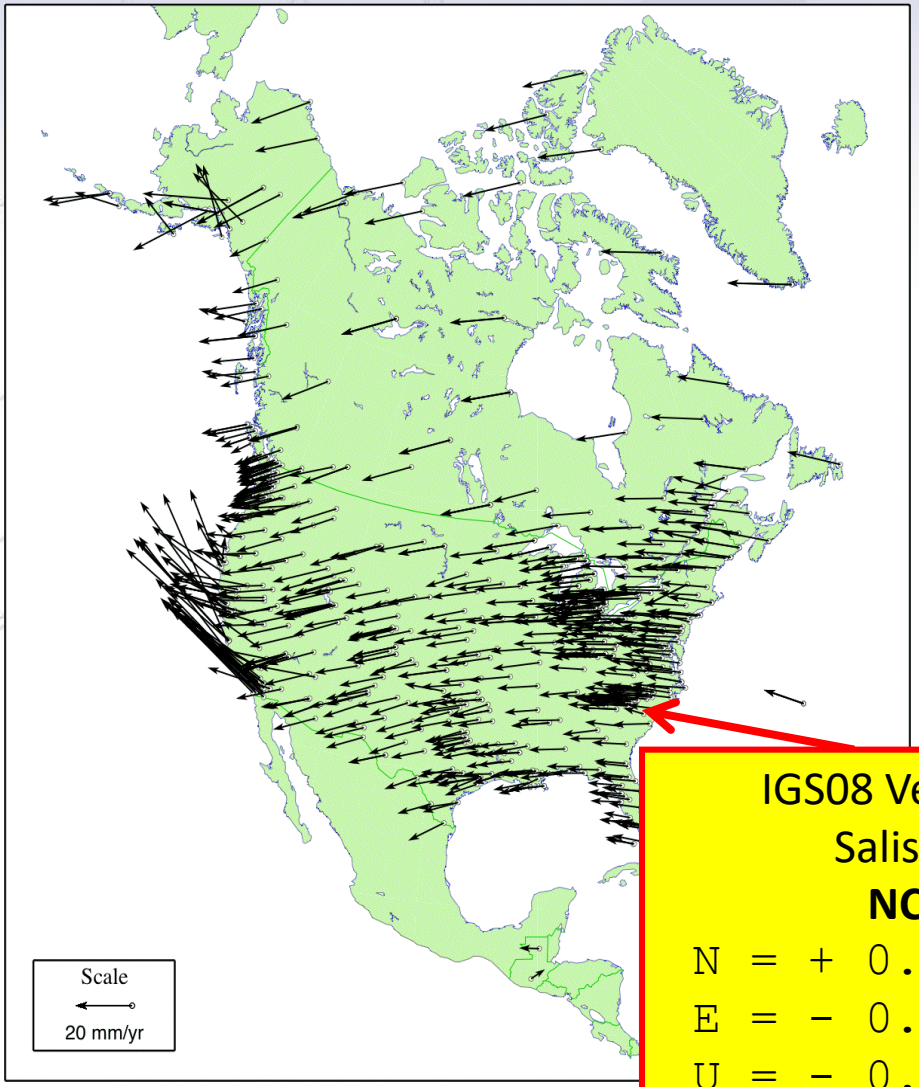


$\phi_{NAD83} - \phi_{"2022"}$
$\lambda_{NAD83} - \lambda_{"2022"}$
$h_{NAD83} - h_{"2022"}$

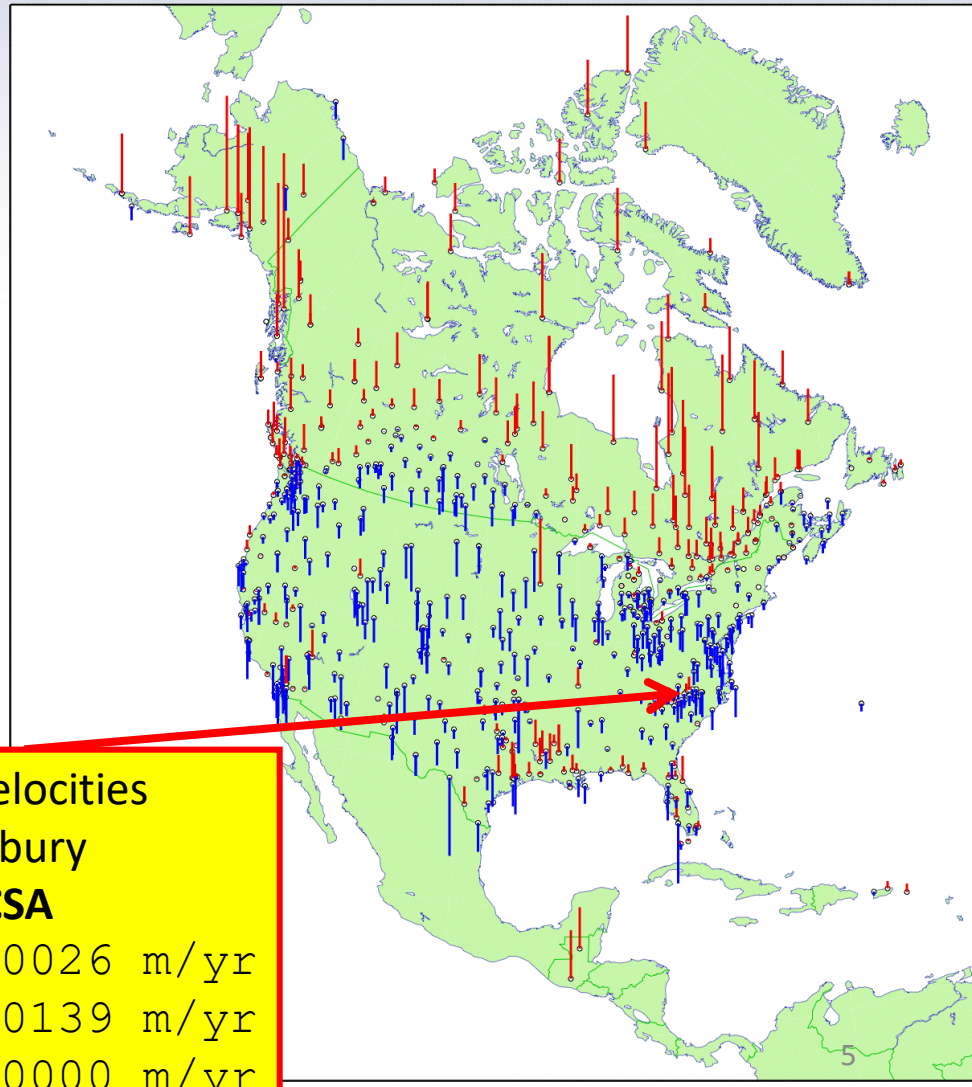
all vary smoothly by latitude and longitude

Tectonic Plate Velocities

Horizontal



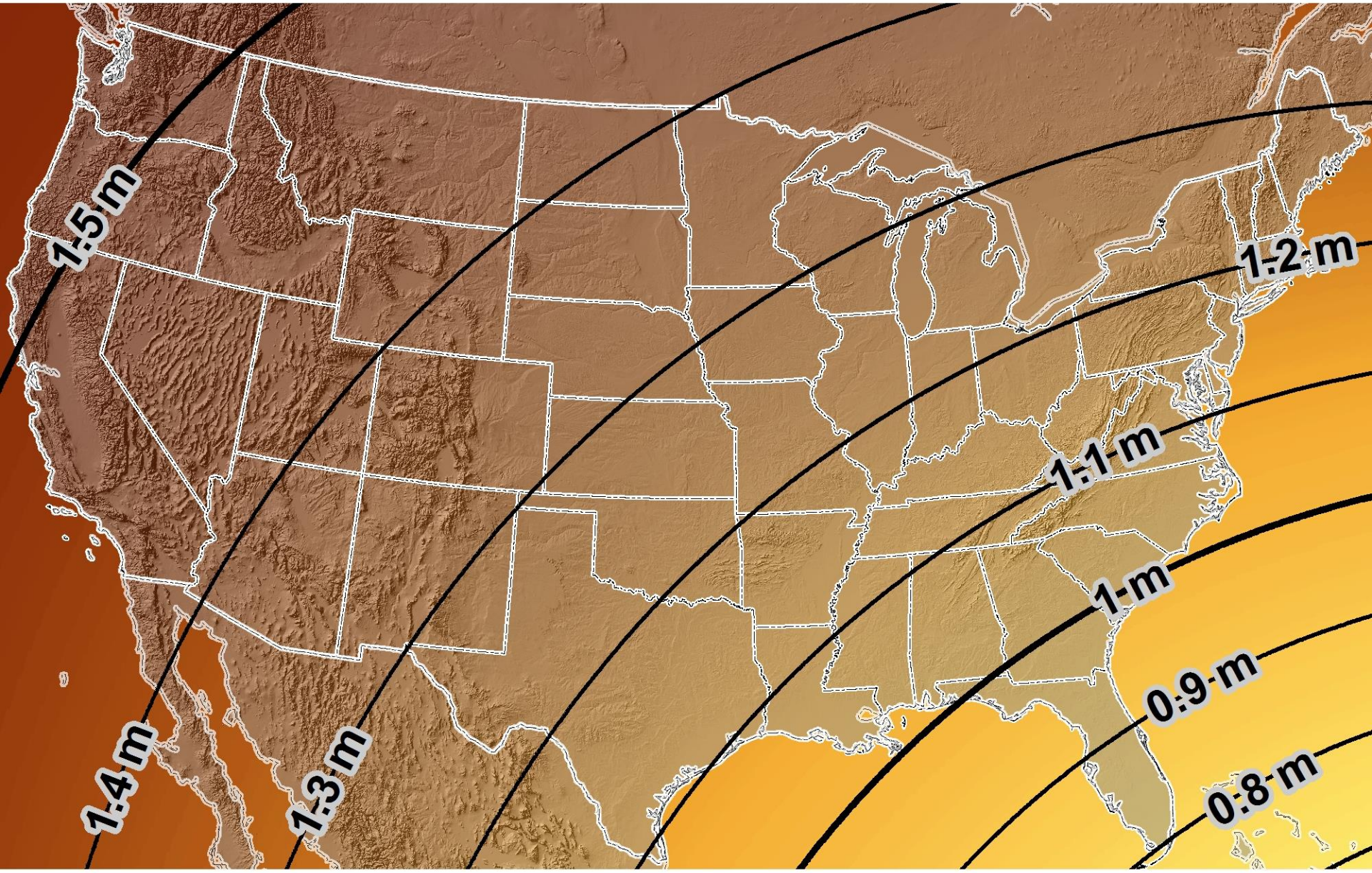
Vertical



IGS08 Velocities
Salisbury
NCSA

N = + 0.0026 m/yr
E = - 0.0139 m/yr
U = - 0.0000 m/yr

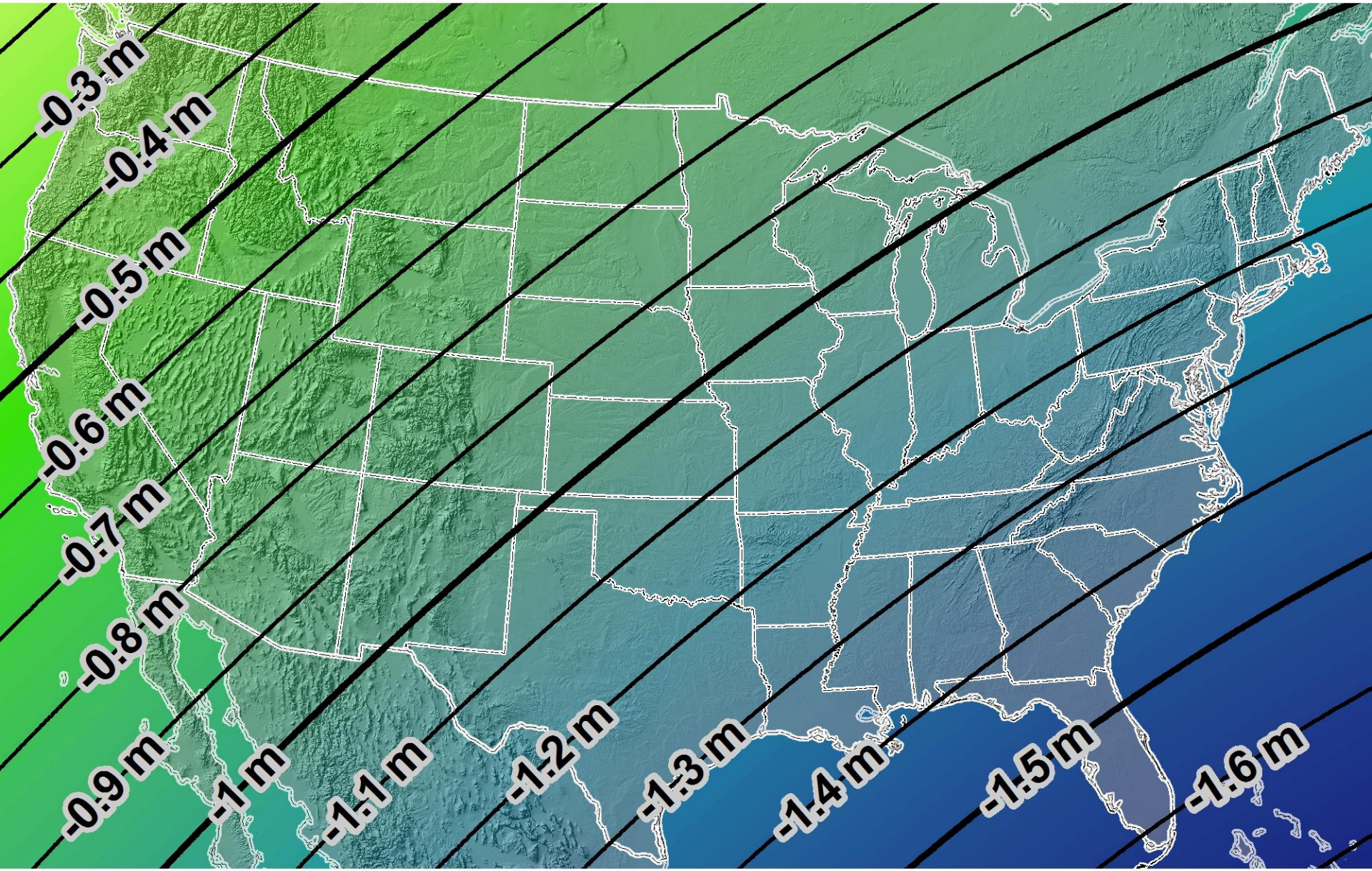
Estimated horizontal change from NAD 83 to new geometric datum



0 500 1000 km

Delta Horizontal = (ITRF 05) minus (NAD 83) at 2020.0

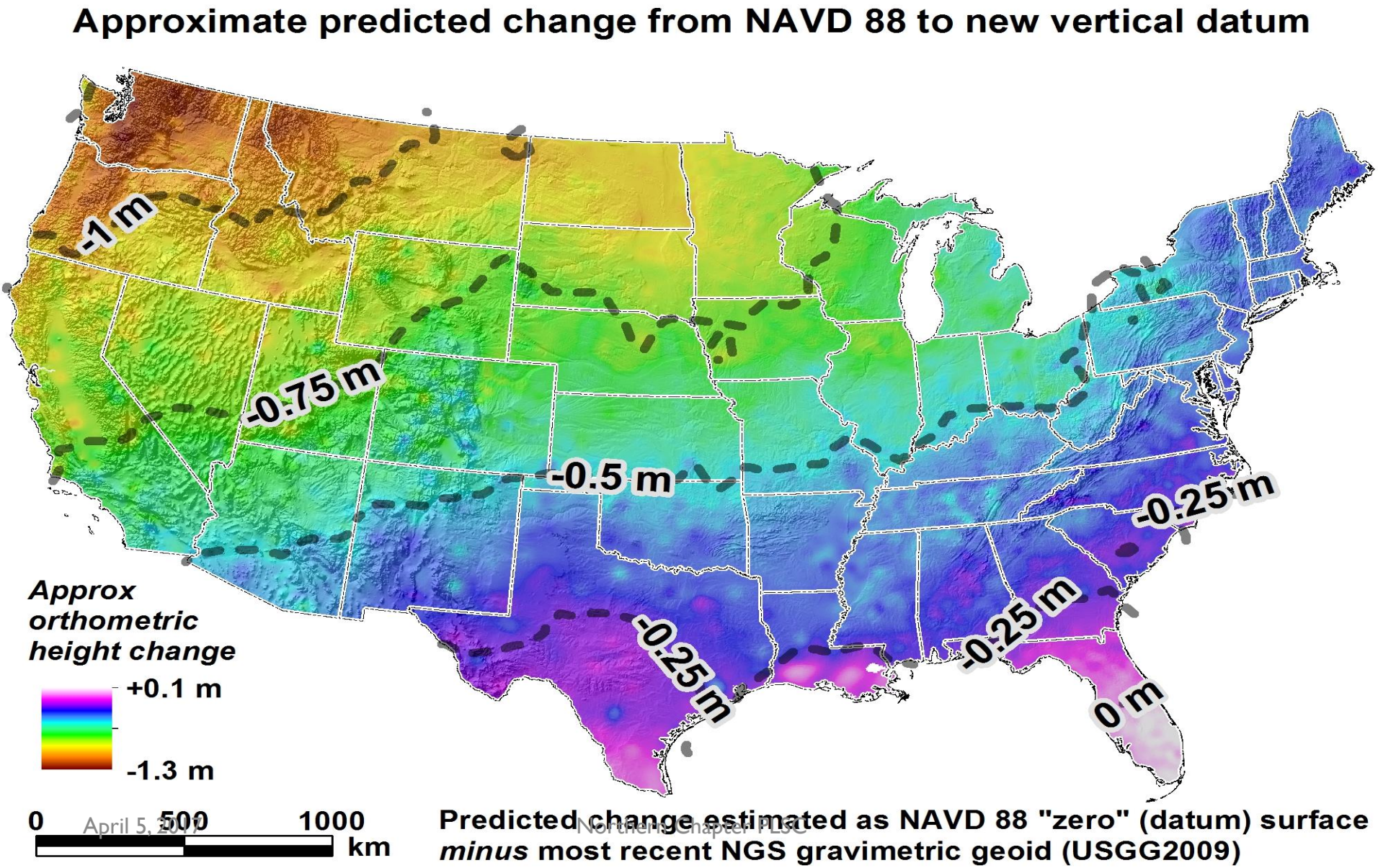
Estimated ellipsoid height change from NAD 83 to new geometric datum



0 500 1000 km

Delta h = h(ITRF 05) minus h(NAD 83) at 2020.0

New Vertical Datum



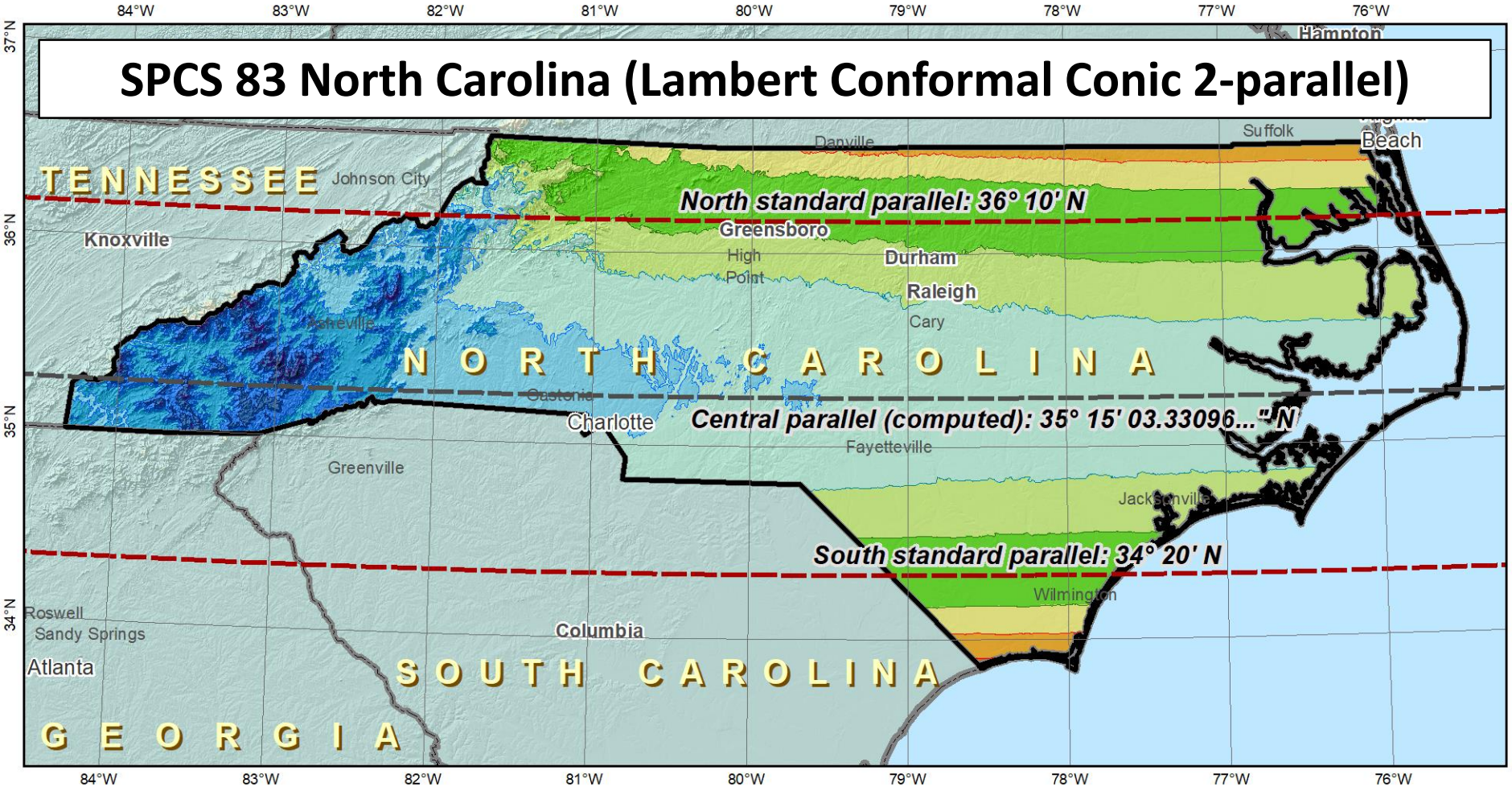
SPCS2022 in North Carolina

- 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 **≤ 6 decimal places**
  - Coordinates must change **≥ 10,000 m (~33,000 ft)**
  - Grid origins rounded to **nearest 1000 m**

SPCS 83 North Carolina (Lambert Conformal Conic 2-parallel)



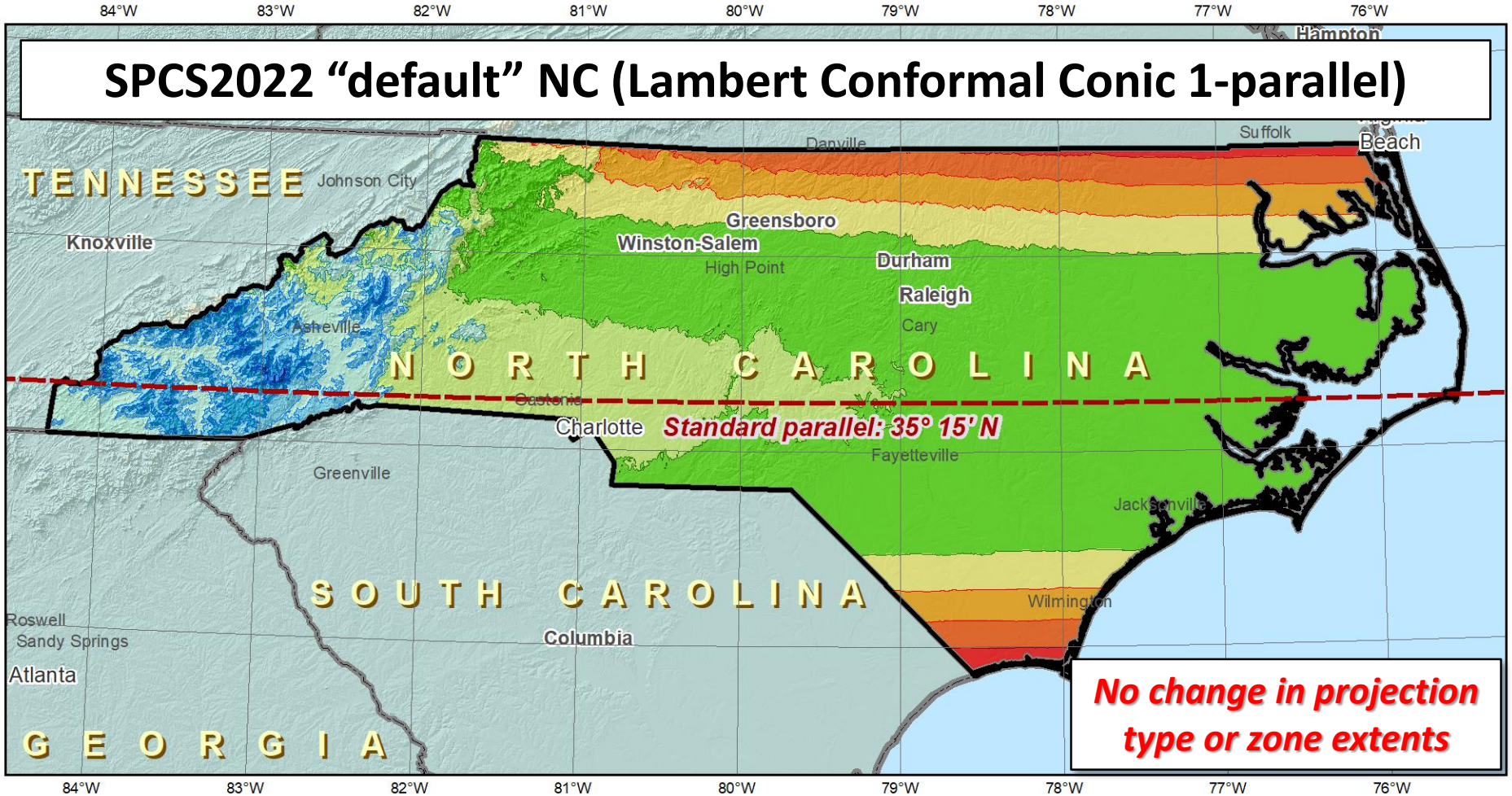
Linear distortion (parts per million)

< -400	to -200	to +150
to -400	to -150	to +200
to -350	to -100	to +250
to -300	±50	to +300
to -250	to +100	> +300

0 50 100 150 200 250 km

	SPCS 83 NC	
Central parallel	35°15'06.33..."N	
Cen parallel scale	0.9998 7259...	
	Height (m)	Distortion (ppm)
Min	-41	-413
Max	1939	+176
Mean	197	-93

SPCS2022 “default” NC (Lambert Conformal Conic 1-parallel)



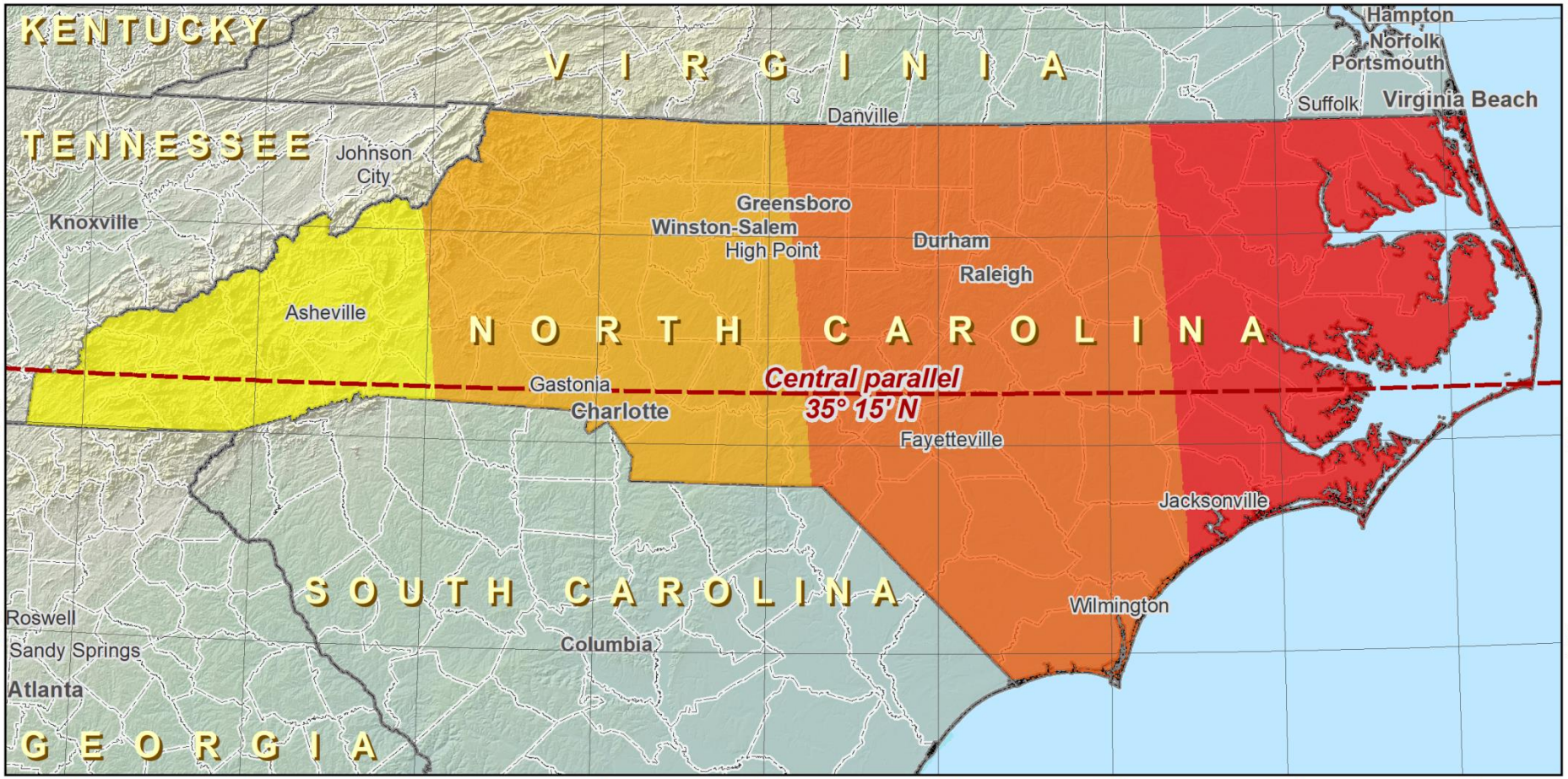
Linear distortion (parts per million)

< -400	to -200	to +150
to -400	to -150	to +200
to -350	to -100	to +250
to -300	±50	to +300
to -250	to +100	> +300

0 50 100 150 200 250 km

		SPCS 83 NC	SPCS2022
Central parallel		35°15’06.33…”N	35°15’N
Cen parallel scale		0.9998 7259…	0.99996
	Height (m)	Distortion (ppm)	
Min	-41	-413	-325
Max	1939	+176	+263
Mean	197	-93	-5

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)

NOAA's National Geodetic Survey

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

Option 2b: ***Reference frame plus parameter change:***

False northing = 200,000 m

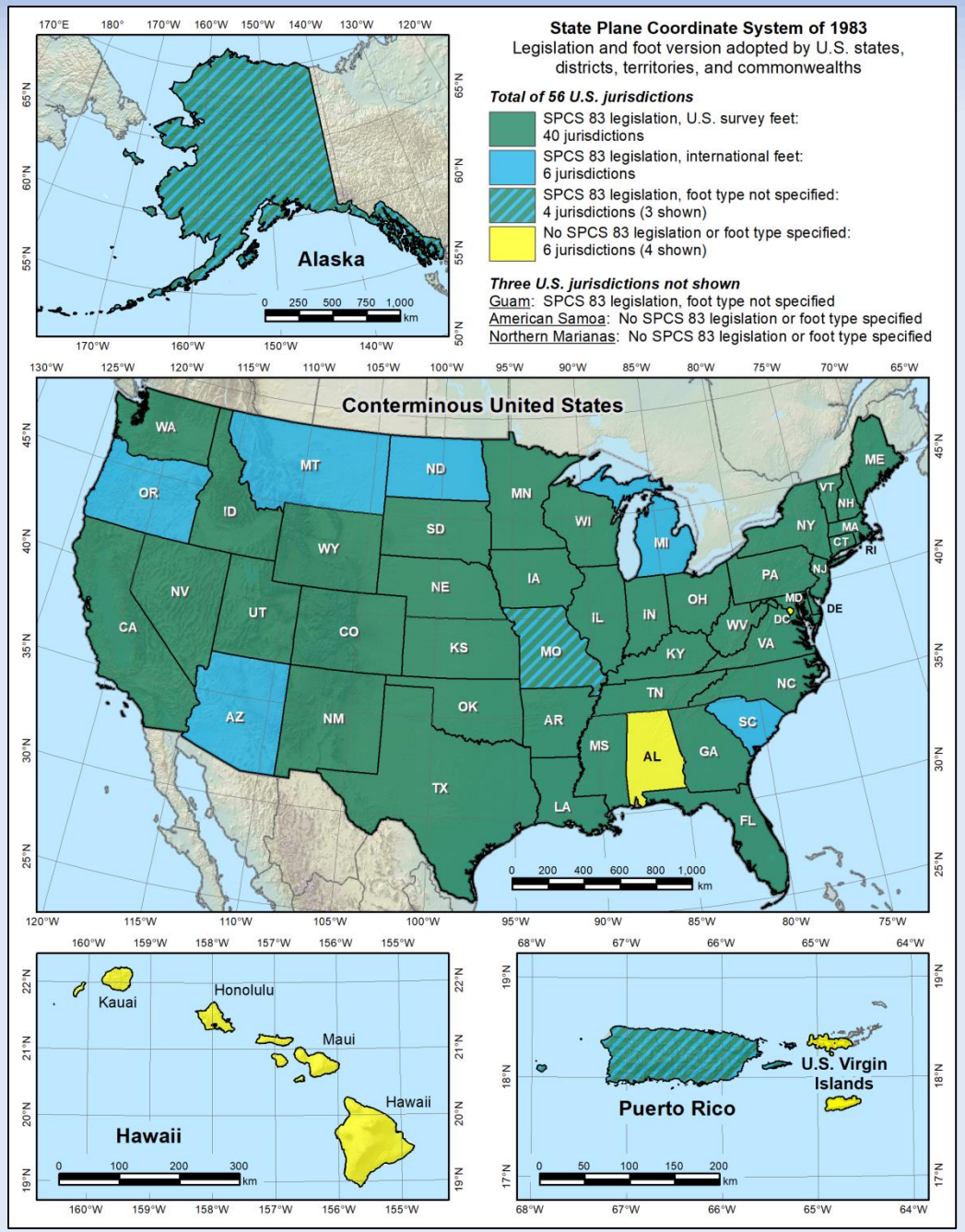
False easting = 1,000,000 m

(same central meridian as SPCS 83)

Horizontal change in coordinates

- 1,285,445 to 1,285,500 sft
- 1,285,500 to 1,285,550 sft
- 1,285,550 to 1,285,600 sft
- 1,285,600 to 1,285,650 sft

0 50 100 150 200 250 km



DEPARTMENT OF PUBLIC SAFETY

NORTH CAROLINA EMERGENCY MANAGEMENT

To Learn More

Visit the New Datums web page

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

Questions?

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