NGS Update

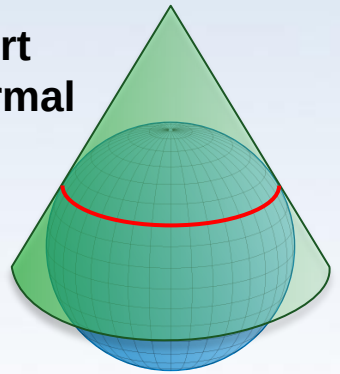
State Plane Coordinate System of 2022 and Deprecation of the U.S. Survey Foot

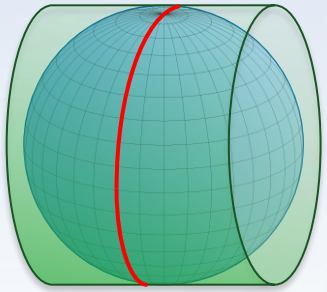
Federal Geodetic Control Subcommittee meeting
February 7, 2023

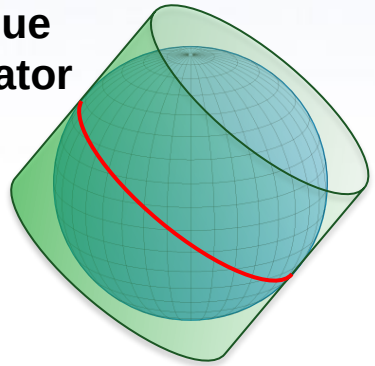
Michael L. Dennis, PhD, PE, PLS
SPCS2022 Project Manager

State Plane Coordinate System of 2022 (SPCS2022)

- ***Similar to existing State Plane…***
  - Same 3 map projection types
  - Same ellipsoid (GRS 80)







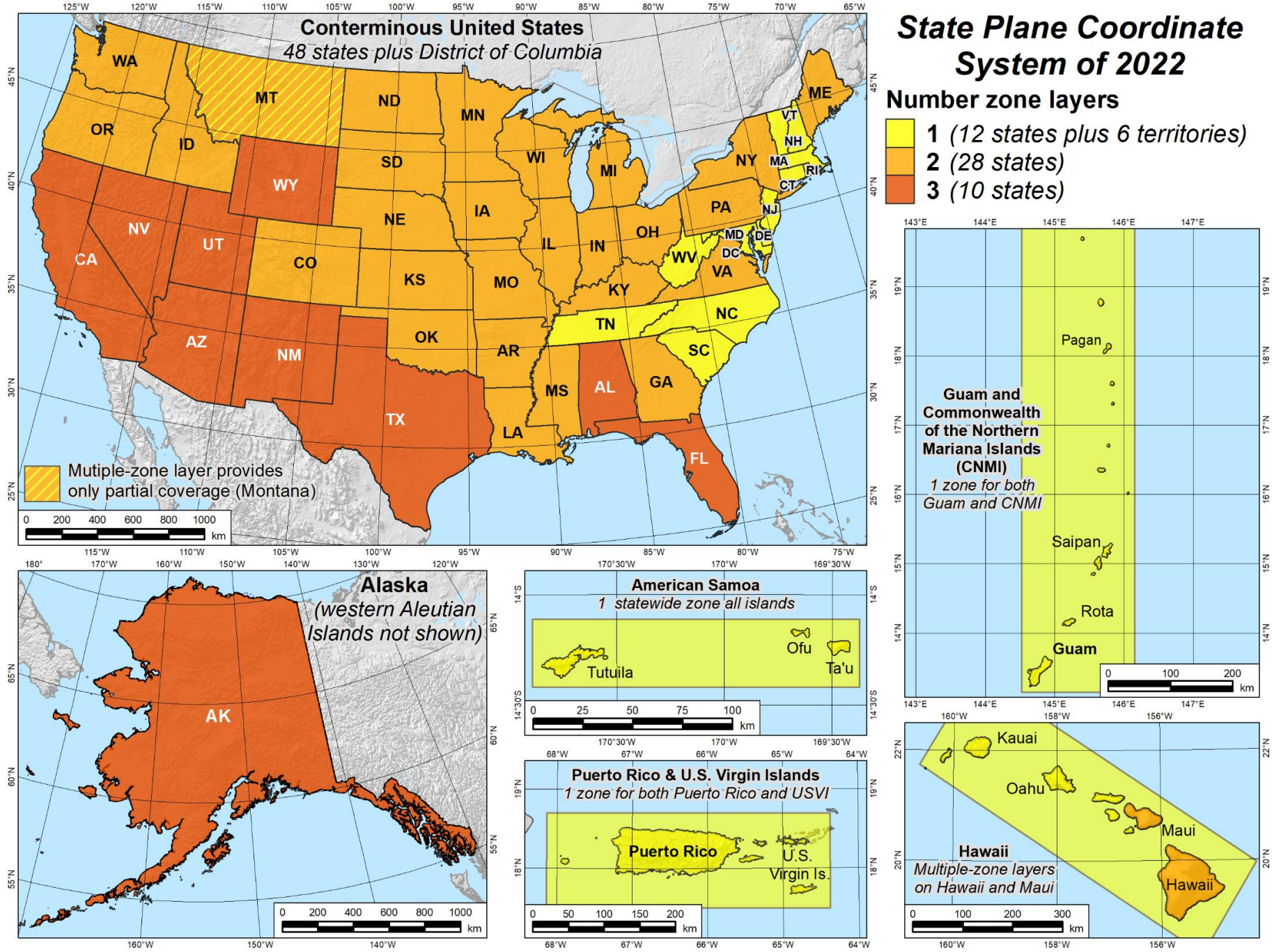
- ***But different…***
  - Based on new terrestrial reference frames instead of NAD 83
  - Designed to reduce linear distortion at topographic surface (i.e., reduce difference between "grid" and "ground")
  - Many more zones
  - Zones "layers" will exist in most states

SPCS2022 zone layers

1 layer: 12 states plus 6 territories

2 layers: 28 states

3 layers: 10 states

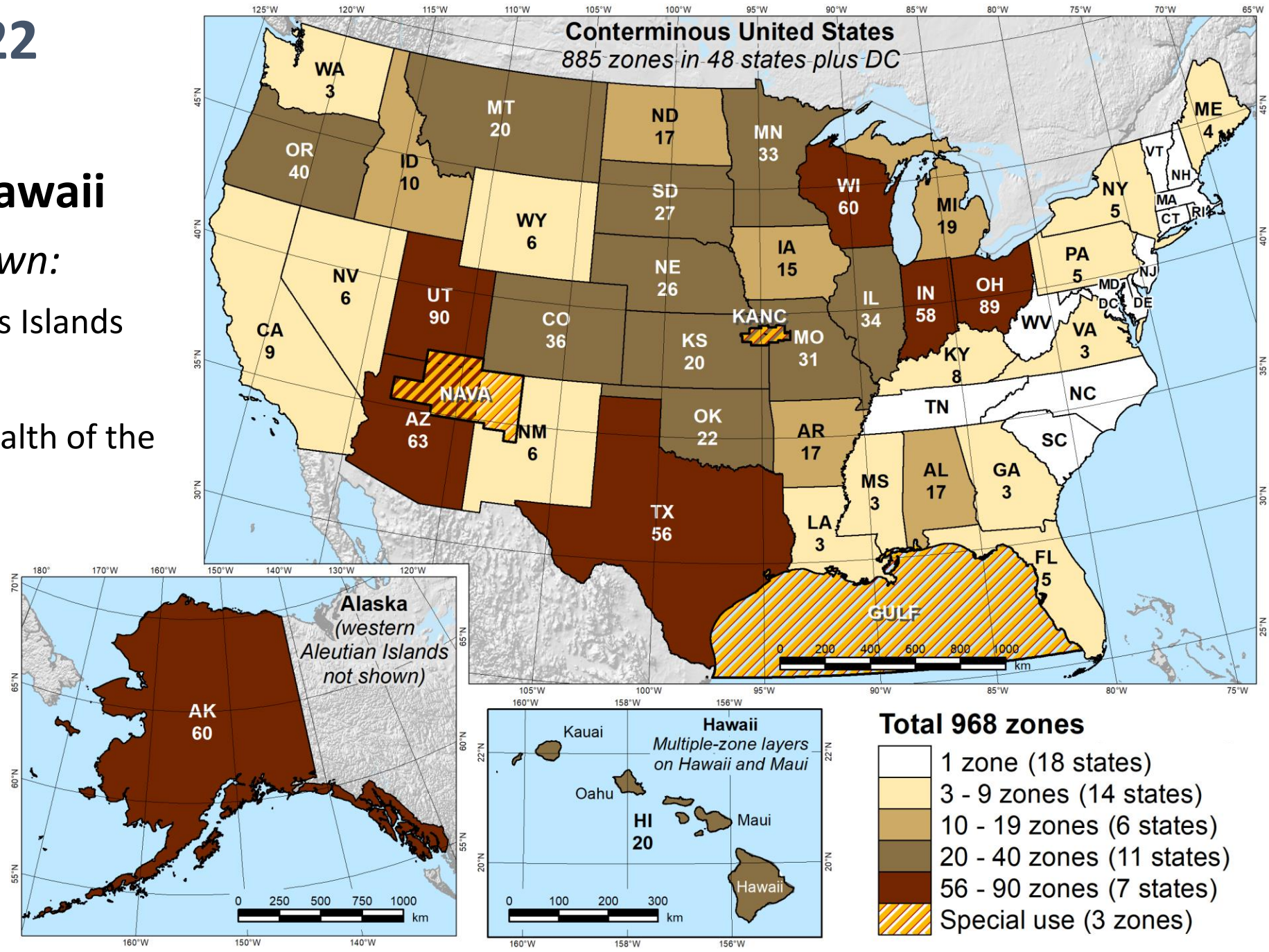


Number of SPCS2022 zones *(preliminary)*

CONUS, Alaska, and Hawaii

Three island zones not shown:

1. Puerto Rico and U.S. Virgins Islands
2. American Samoa
3. Guam and the Commonwealth of the Northern Mariana Islands

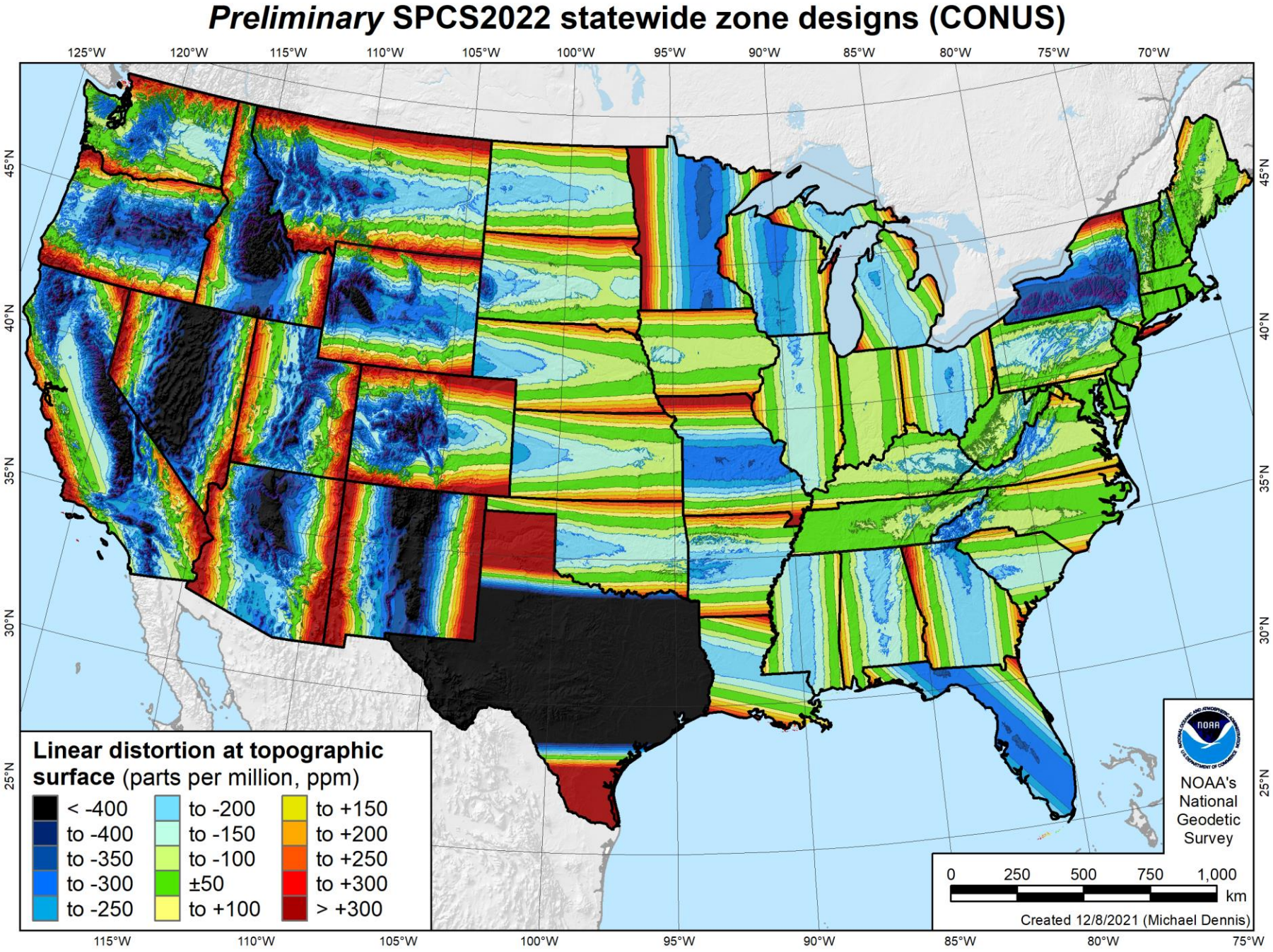


SPCS2022 linear distortion (prelim)

49 zones (CONUS)

Percent within distortion (ppm):

Distor	Pop	Cities	Area
±20	14%	12%	7%
±50	27%	26%	18%
±100	48%	48%	36%
±400	91%	93%	88%
City and area statistics (ppm):			
	Min	-1512	-1627
	Max	+2888	+2987
	Range	4400	4614
	Mean	-86	-120
Mean weighted by pop = -100			

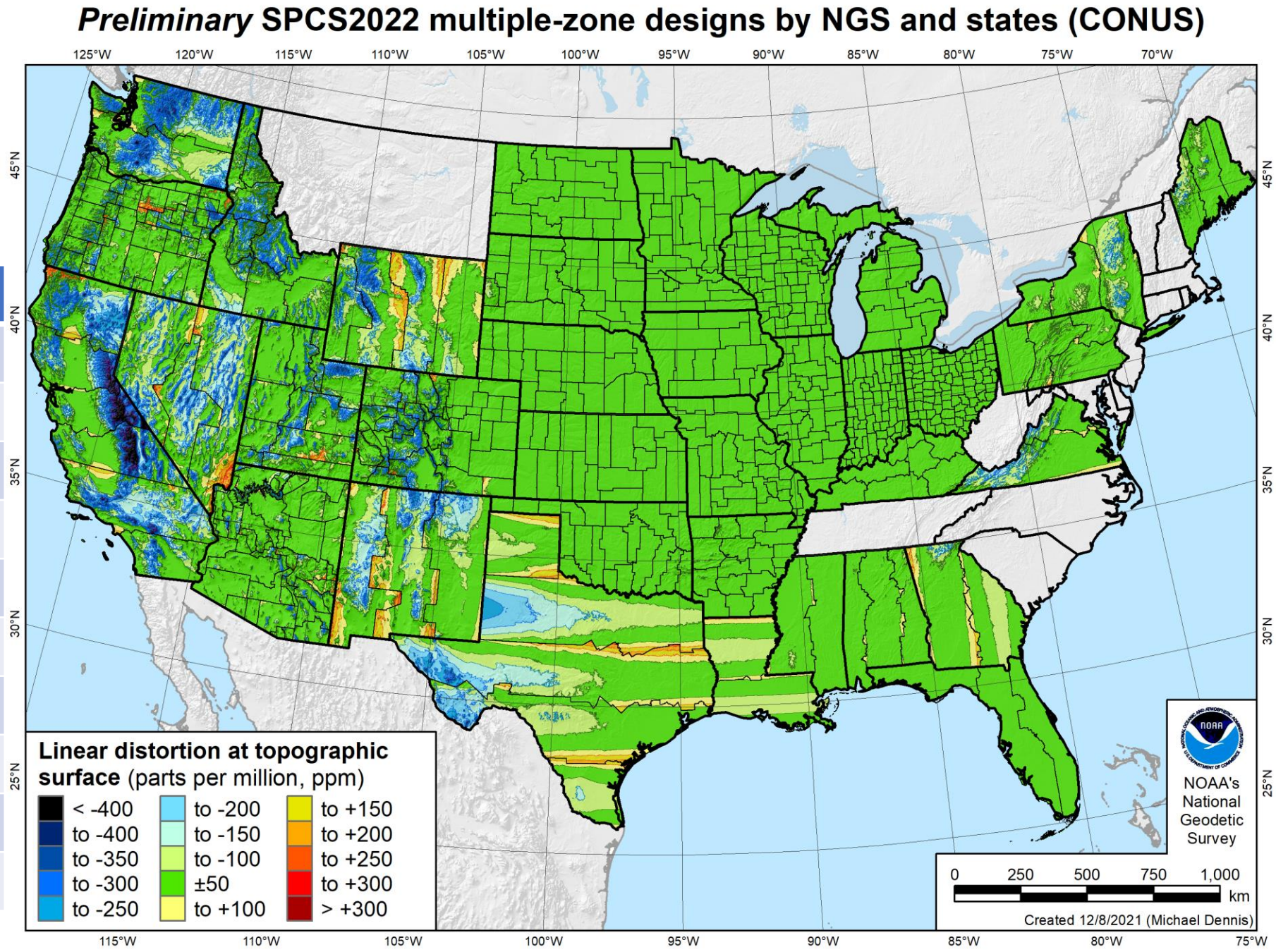


SPCS2022 linear distortion (prelim)

646 zones (35 states)

Percent within distortion (ppm):

Distor	Pop	Cities	Area
±20	76%	70%	54%
±50	92%	88%	73%
±100	98%	97%	89%
±400	100%	100%	99.9%
City and area statistics (ppm):			
	Min	-400	-684
	Max	+245	+295
	Range	644	979
	Mean	-5	-23
Mean weighted by pop = -4			

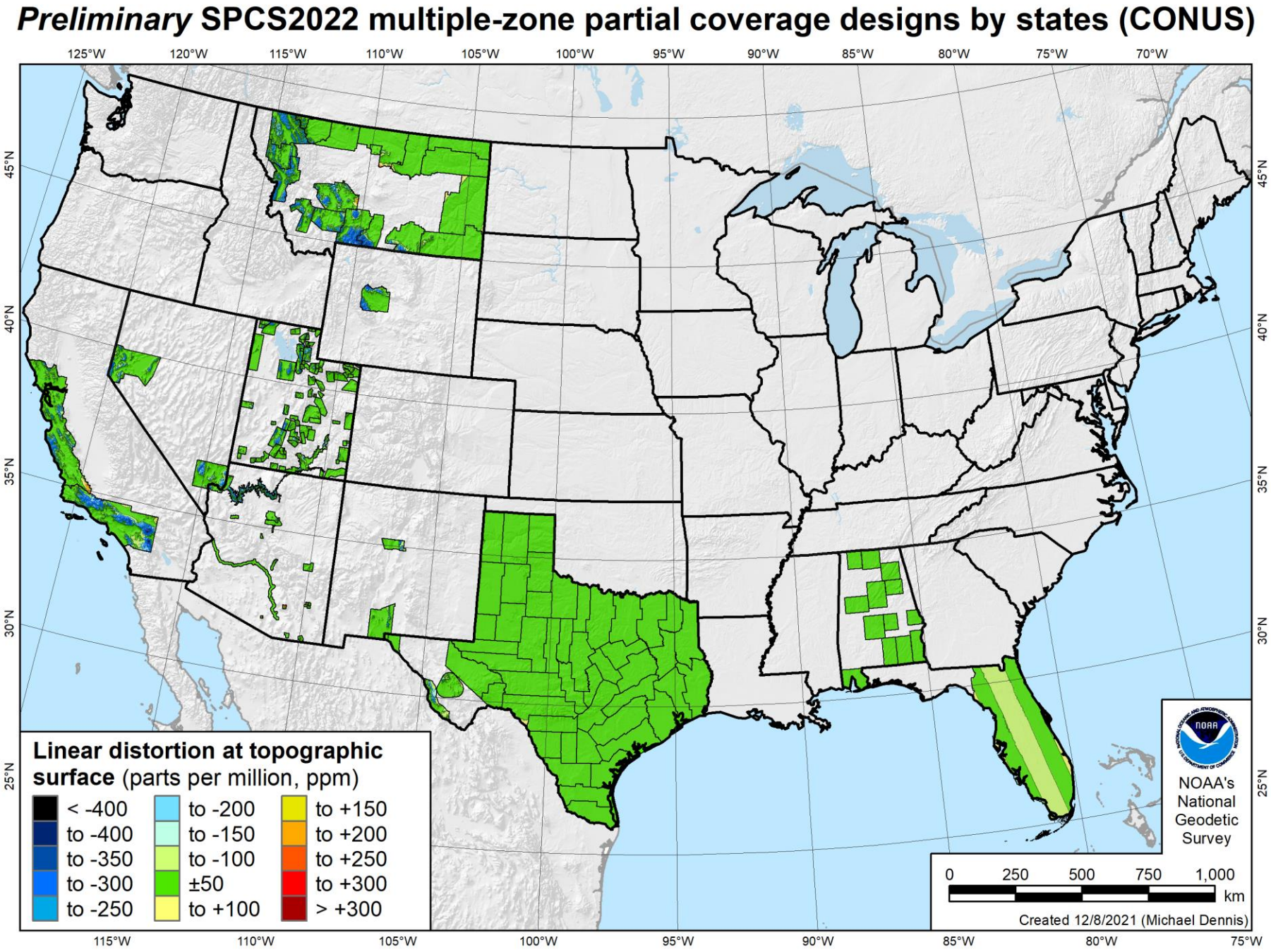


SPCS2022 linear distortion (prelim)

187 zones (10 states)

Percent within distortion (ppm):

Distor	Pop	Cities	Area
±20	78%	78%	73%
±50	91%	90%	88%
±100	99.8%	99%	97%
±400	100%	100%	100%
City and area statistics (ppm):			
	Min	-261	-465
	Max	+120	+240
	Range	381	705
	Mean	-3	-12
Mean weighted by pop = -1			



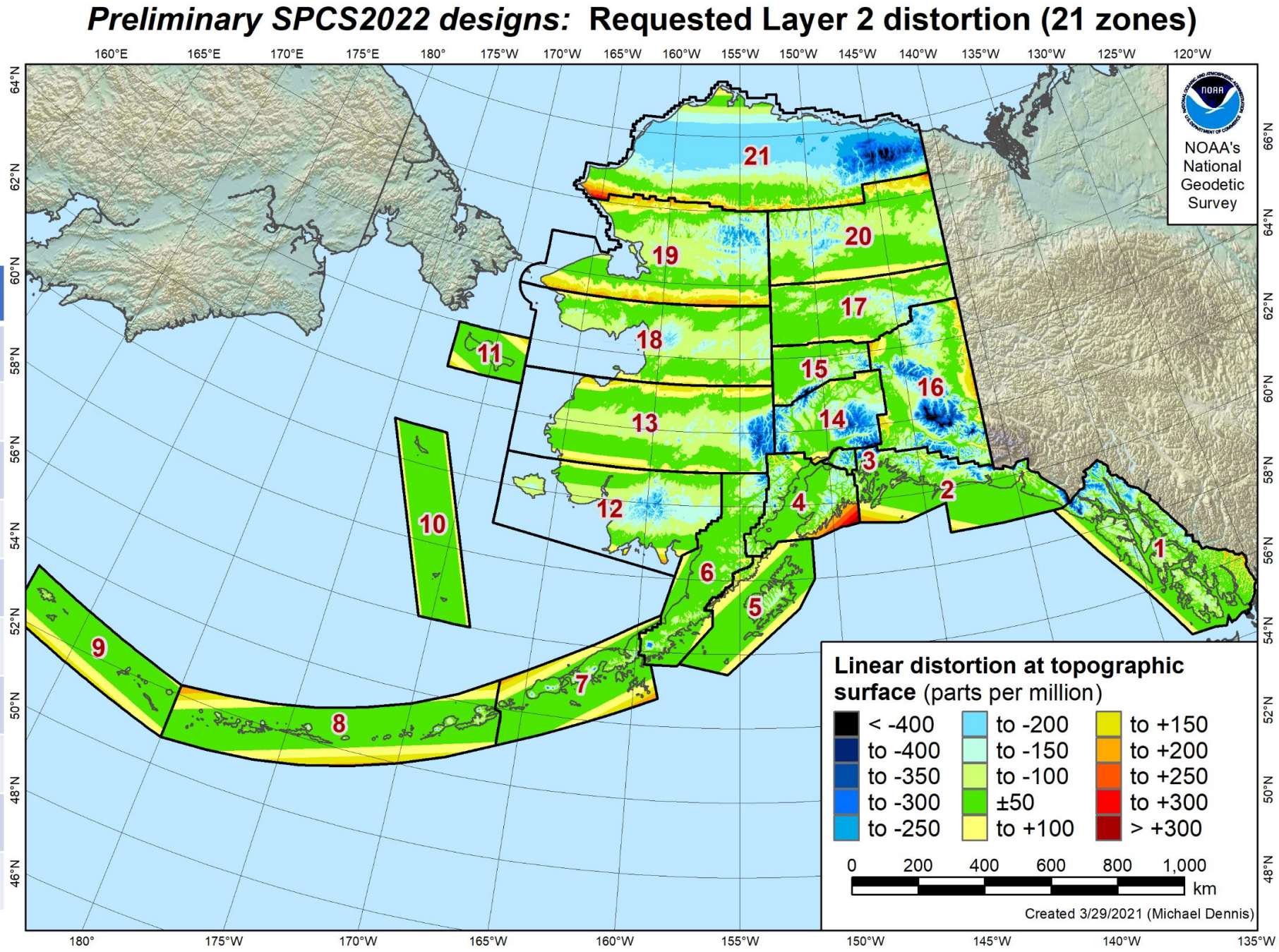
SPCS2022 linear distortion (prelim)

21 zones (Alaska)

Percent within distortion (ppm):

Distor	Pop	Cities	Area
±20	77%	38%	17%
±50	90%	67%	38%
±100	98%	93%	68%
±400	100%	100%	99.8%
City and area statistics (ppm):			
	Min	-177	-794
	Max	+321	+331
	Range	498	1125
	Mean	-7	-53
Mean weighted by pop = -4			

Statistics are for land areas only



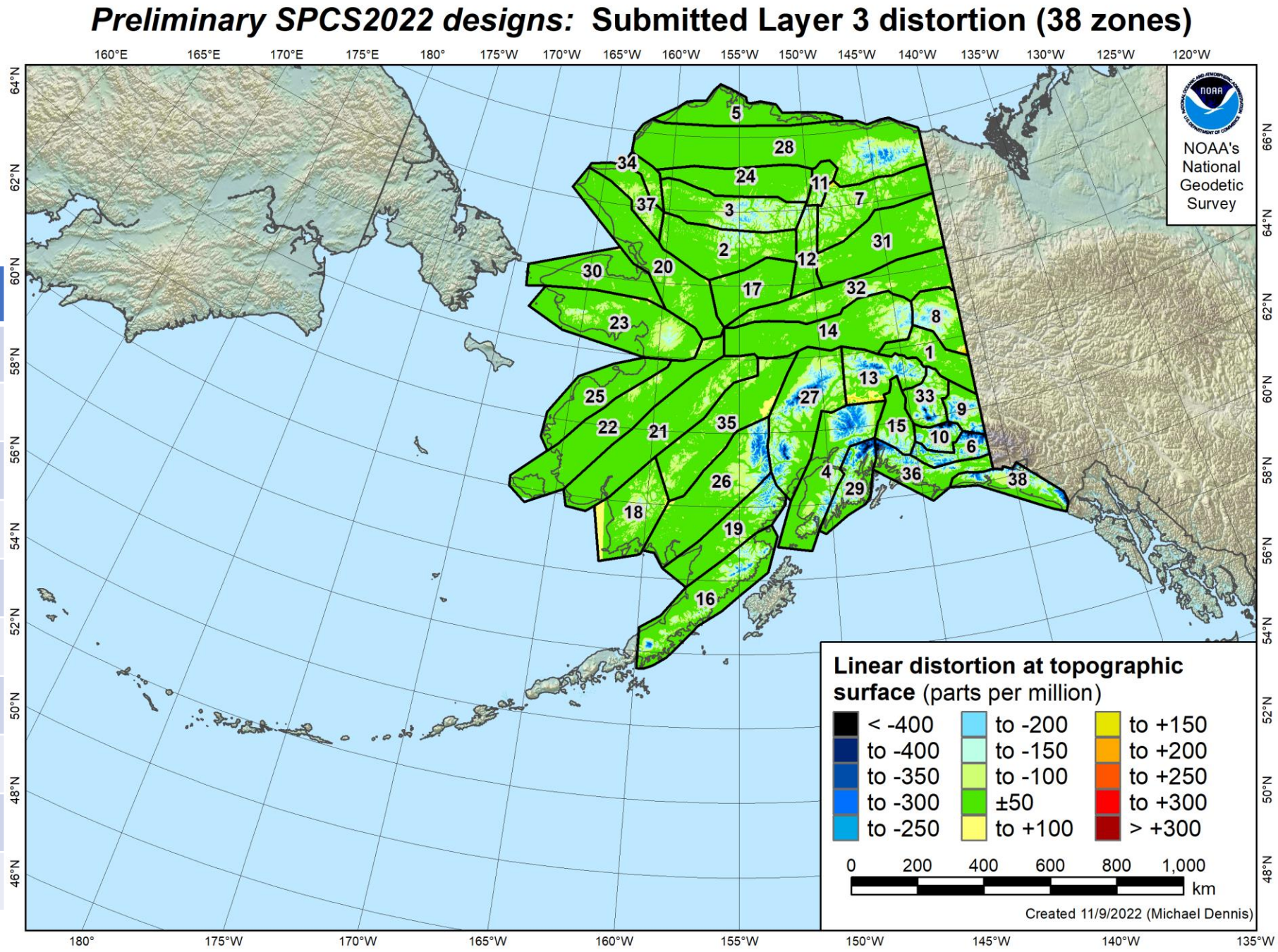
SPCS2022 linear distortion (prelim)

38 zones (Alaska)

Percent within distortion (ppm):

Distor	Pop	Cities	Area
±20	89%	93%	49%
±50	98%	99.7%	74%
±100	99.7%	100%	88%
±400	100%	100%	99.9%
City and area statistics (ppm):			
	Min	-59	-937
	Max	+49	+190
	Range	108	1127
	Mean	+0.4	-34
Mean weighted by pop = -8			

Statistics are for land areas only



About the timing of it all…

- **Timeline**
  - Review of stakeholder submittals (DONE)
  - Early 2023: Preliminary designs for stakeholder review
  - Mid-2023: Finalize all zone designs
- **Other things in 2023**
  - Provide machine-readable definitions
  - Modify NGS algorithms (e.g., 1-parallel Lambert)
  - Document new projection algorithms
- **Release with rollout of modernized NSRS**
  - Final definitions available by late 2023
  - Release with "new datums" in 2025

A tale of two feet

Two versions of "foot" in current use:

"Old" U.S. survey foot → "New" international foot

1 ft = 1200/3937 m = 0.3048006096… m

1 ft = 0.3048 m *exactly*

Differ by
2 parts per million (ppm) or
~0.01 ft (~1/8 inch) per mile

A ***real*** problem with ***real*** costs

Requiem for the U.S. survey foot

Deprecated on Dec 31, 2022

- Per final determination Federal Register Notice issued on Oct 5, 2020
- Collaborative action by National Institute of Science and Technology (NIST) and NGS
- Describes public comments received, along with the plan, resources, training, and other information for an ***orderly transition with minimum disruption***

NATIONAL ARCHIVES

FEDERAL REGISTER

The Daily Journal of the United States Government

Notice

Deprecation of the United States (U.S.) Survey Foot

A Notice by the National Institute of Standards and Technology and the National Oceanic and Atmospheric Administration on 10/05/2020

(this image is hyperlinked to the Federal Register page)

PUBLISHED DOCUMENT

AGENCY:

The National Institute of Standards and Technology and National Geodetic Survey (NGS), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce (DOC).

ACTION:

Notice; final determination.

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SUMMARY:

The National Institute of Standards and Technology (NIST) and the National Geodetic Survey (NGS), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), have taken collaborative action to provide national uniformity in the measurement of length. This notice announces the final decision to deprecate use of the "U.S. survey foot" on December 31, 2022. Beginning on January 1, 2023, the U.S. survey foot should not be used and will be superseded by the "international foot" definition (*i.e.*, 1 foot = 0.3048 meter exactly) in all applications. The international foot is currently used throughout

DOCUMENT DETAILS

Printed version: PDF

Publication Date: 10/05/2020

Agencies: National Institute of Standards and Technology; National Oceanic and Atmospheric Administration

Dates: Use of the U.S. survey foot will be deprecated on December 31, 2022.

Document Type: Notice

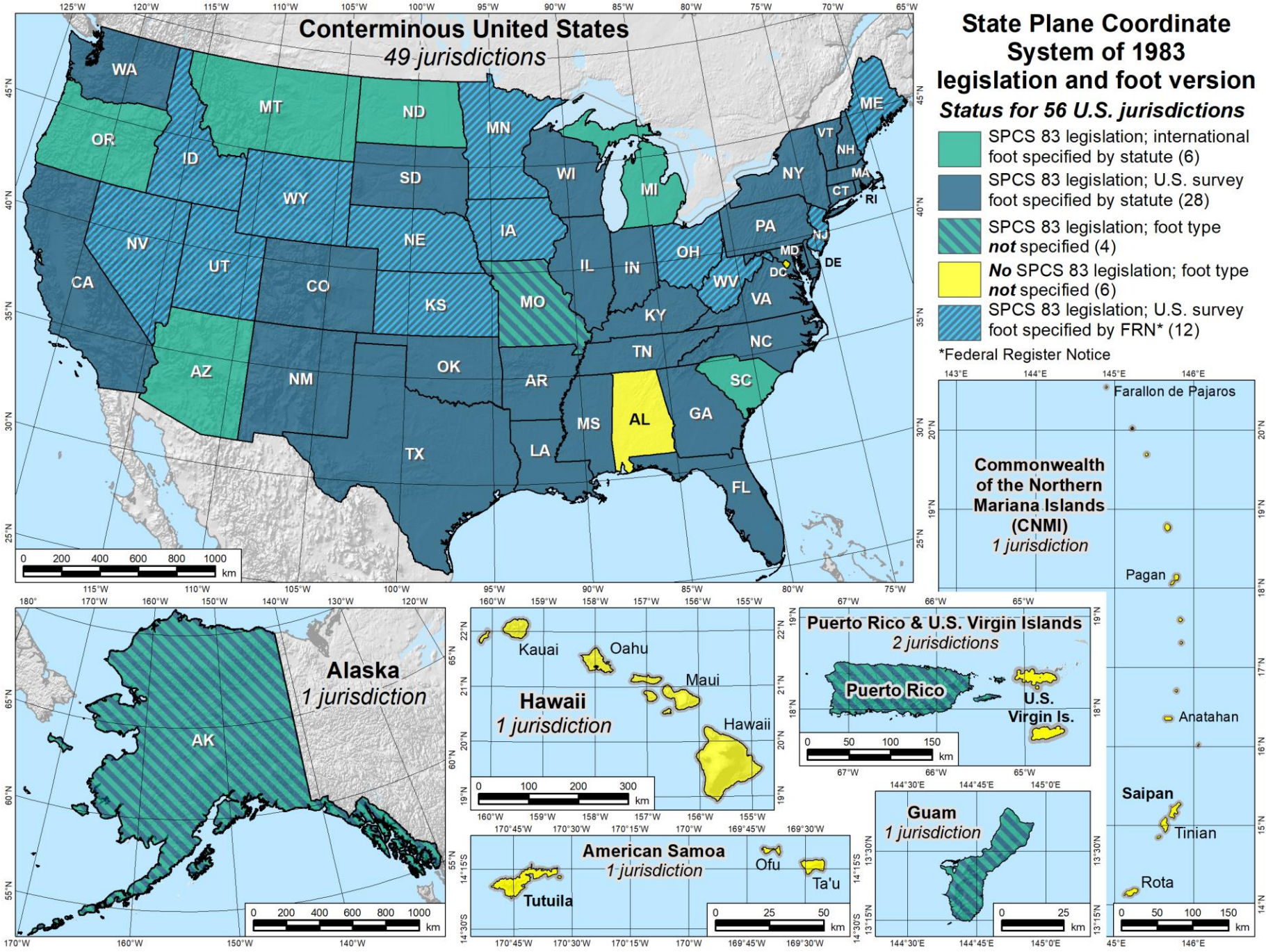
Document Citation: 85 FR 62698

Page: 62698-62708 (11 pages)

Document Number: 2020-21902

SPCS 83 legislation and foot version

- 56 U.S. jurisdictions
- Legislation
  - International foot: 6
  - U.S. survey foot: 28
  - Neither: 16
  - No legislation at all: 6
- Fed Register Notice
  - U.S. survey foot: 12
  - In lieu of legislation
  - Done 2006-2009



Putting the "best" foot forward

- U.S. survey foot has been retired
  - Not supported for State Plane Coordinate System of 2022 (or any part of modernized NSRS)
  - Only ***international foot*** will be supported by NGS
- Effective December 31, 2022
  - Independent of NSRS modernization
  - U.S. survey foot will still be supported for legacy products (e.g., existing State Plane)…

Rumor of U.S. survey foot death greatly exaggerated

- Can continue for SPCS 83 (and SPCS 27) after December 31, 2022
  - The 40 states that "officially" use U.S. foot for SPCS 83
  - All SPCS 27 zones
  - NGS will support such "legacy" use forever
  - But ***NOT*** supported for ***ANY*** zones in SPCS2022
- Please repeat:

NGS will always support
U.S. survey foot for SPCS 83 and 27

Thank you.

- ***However,*** NGS will ***NOT*** support NAD 83 after NSRS Modernization complete

Why allow U.S. survey foot after Dec 31, 2022?

- Key idea: done in an ***"orderly fashion with minimum disruption"***
  - Sudden switch for existing coordinate system too disruptive
  - Will give states more time to prepare
  - U.S. survey foot usage will diminish over time (especially after 2025)
- Better to have change occur with new State Plane
  - Change in length of foot "hidden" in change of projection scale
  - Projection scale change ***much*** greater than 2 ppm for most zones
- ***NGS and NIST are not regulatory agencies, so can't "enforce" change***

Questions?