

Preparing for NSRS 2022

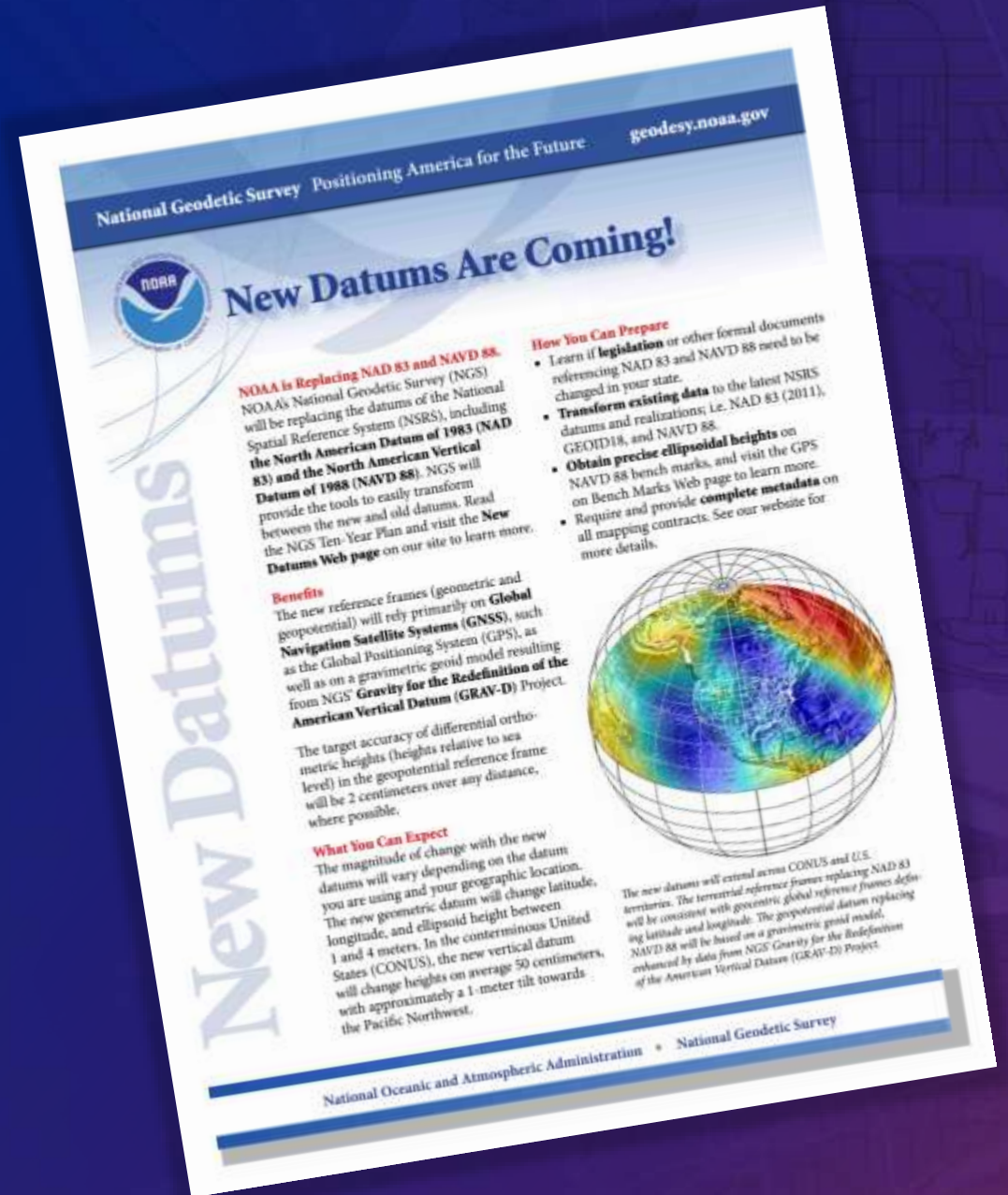
Melita Kennedy



Presentation topics

Our plan to get you ready for 2022

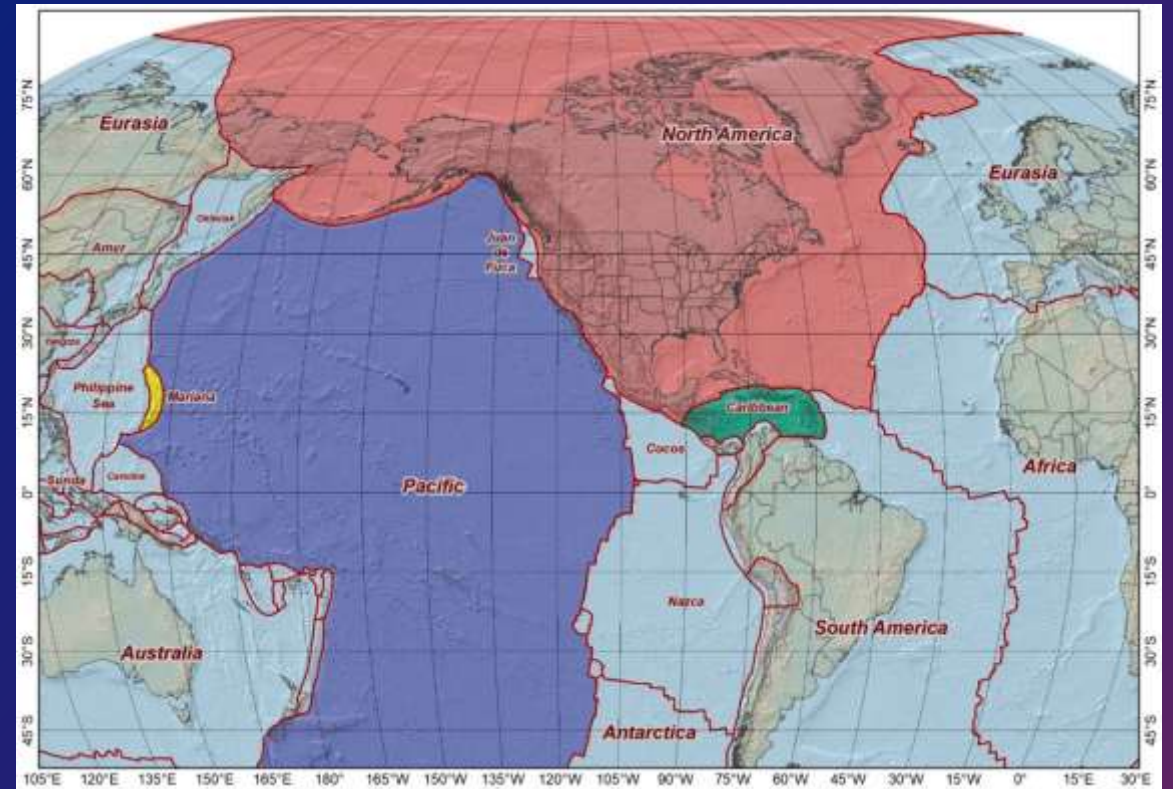
- Facts to know about NAD83 realizations
- Converting existing data with ArcGIS (Demo)
- Debugging NAD83 data (Demo)
- How you can get ready for NSRS 2022
- Questions



National Spatial Reference System (NSRS) modernization

Big changes ahead: no more NAD83 and NAVD88

- Update all NSRS coordinates
 - Replace existing datums with new datums
 - Account for coordinates changing with time
- Improved NGS products and services
 - New State Plane Coordinate System with new zones
- Make the NSRS more accurate, accessible, efficient, and compatible with GNSS
- Beta release for “testing” in 2026 and production release expected in 2027



Four new plate-fixed terrestrial reference frames of 2022
North America, Pacific, Caribbean, and Mariana

National Spatial Reference System for the U.S.

NAD83 and NAVD88 will be replaced by NATRF2022 and NAPGD2022

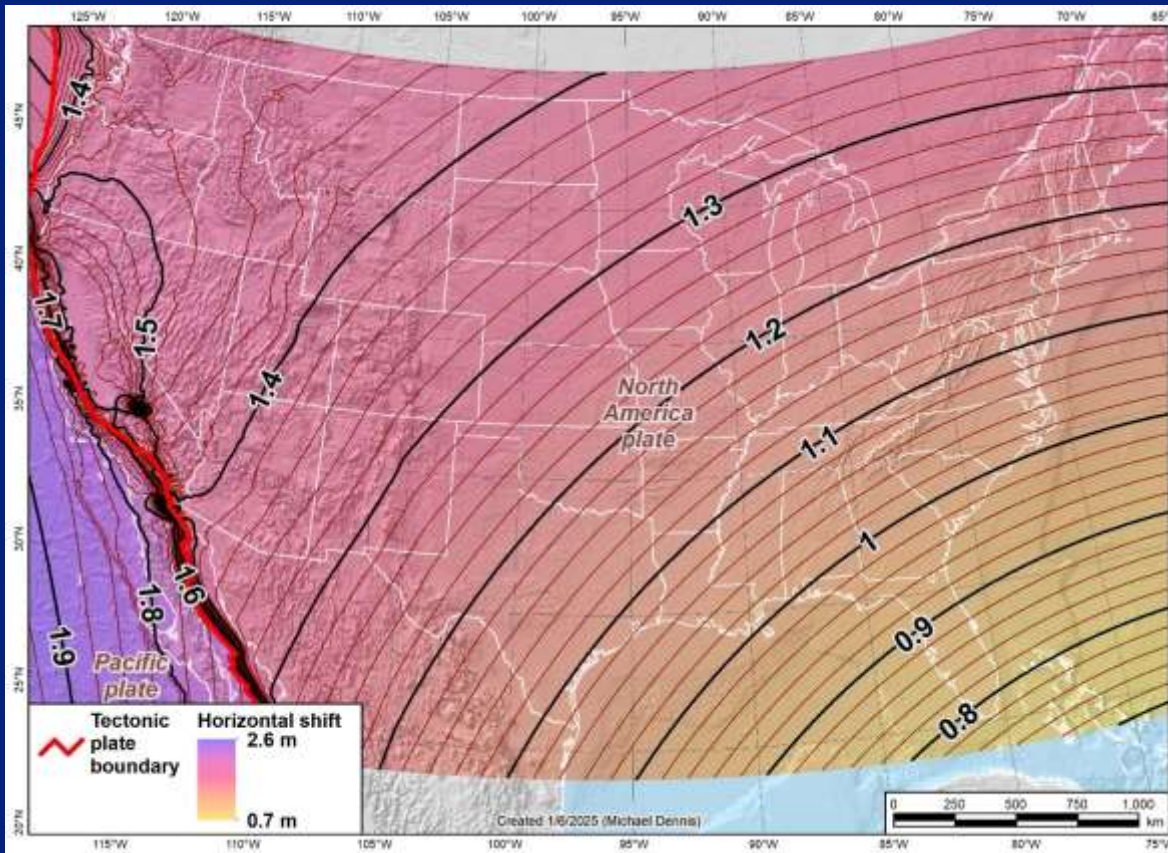
CURRENT

- Horizontal datums
 - *NAD83 (2011)*
 - *NAD83 (PA11)*
 - *NAD83 (MA11)*
- Vertical datums
 - *NAVD88*
 - *PRVD02, VIVD09, GUV D04, NMVD03*
- Hybrid geoid models (*GEOID18*)
- 125 State Plane zones
 - *Meters, Int. Feet, US Survey Feet*

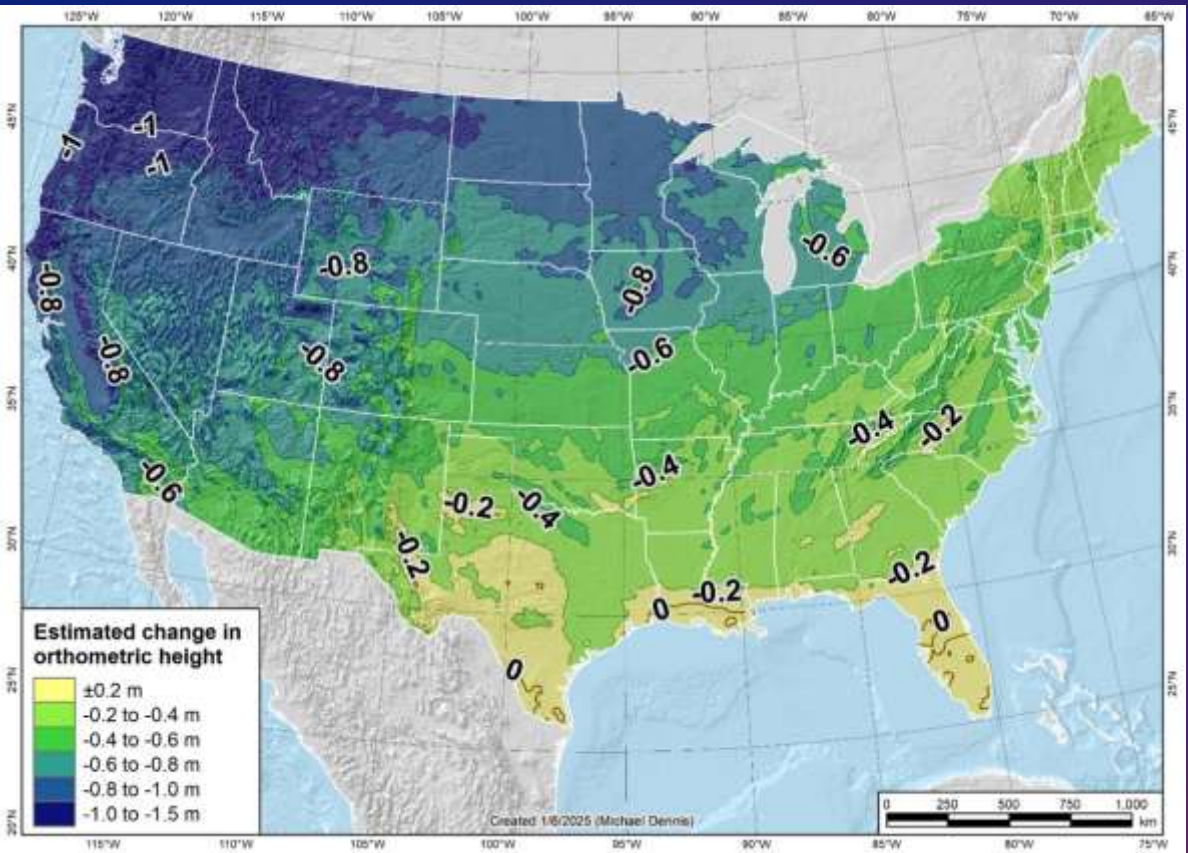
NSRS 2022

- Terrestrial reference frames
 - *NATRF2022 (North American Plate)*
 - *PATRF2022 (Pacific Plate)*
 - *MATRF2022 (Mariana Plate)*
 - *CATRF2022 (Caribbean Plate)*
- Geopotential datum and heights
 - *NAPGD2022*
- Gravimetric geoid model (*GEOID2022*)
- 953 State Plane zones
 - *Meters, Int. Feet*

Estimated shifts in coordinates



Horizontal shift between NAD83 (2011) and
NATRF2022 (epoch 2020.0)



Change in orthometric height between NAVD88 and
NAPGD2022 (epoch 2020.0)

Implementation dependent on Federal Register Notice

- NGS Beta last year—CRS including state plane (953 pcs)
- All deliverables in 2026 which starts a 6-month Beta
- F GCSC and FGDC must certify so a Federal Register Notice can be published
- ArcGIS Pro releases Q2, so may be a later release
- Enterprise releases about 1 month after ArcGIS Pro
- ArcGIS Maps API is off-cycle but will support with next release after Pro
- Apps often use Maps API
- AGOL off-cycle; will work with them to add support ASAP

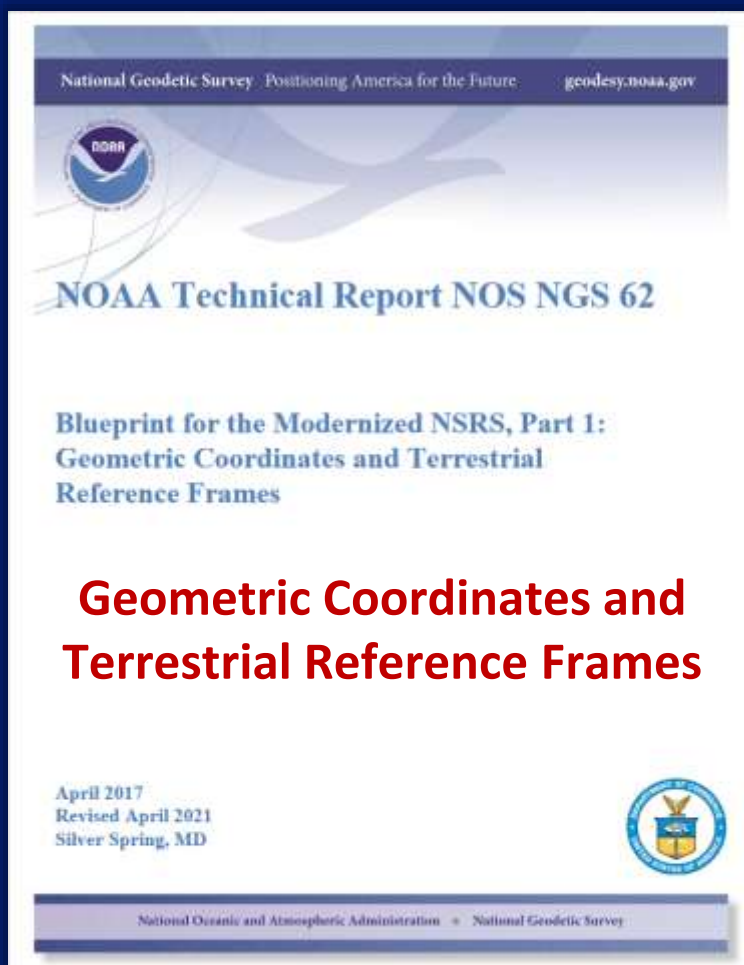
Canada

- CGS plans similar release timeline as NGS
- Federal adoption in early 2027
- Provincial and territorial adoption by 2030
- Unlike US, cannot mandate that provinces adopt the new systems
- Software will be updated to support NTRF2022 and GEOID2022
- Canadian Spatial Reference System (CSRS) modernization - Natural Resources Canada

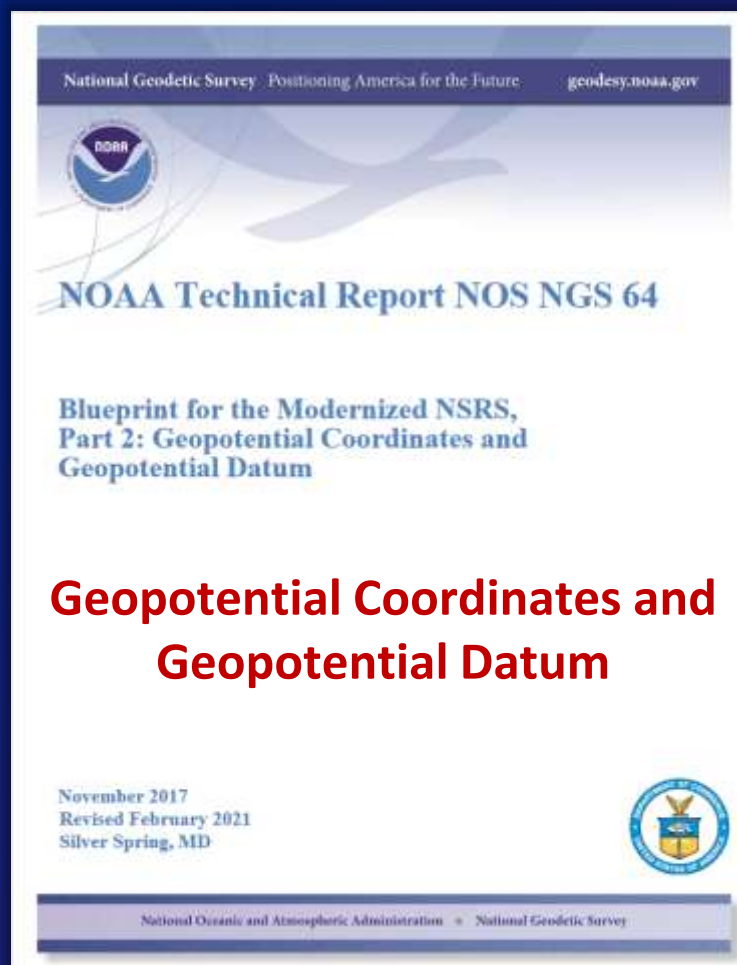


NSRS modernization blueprint documents

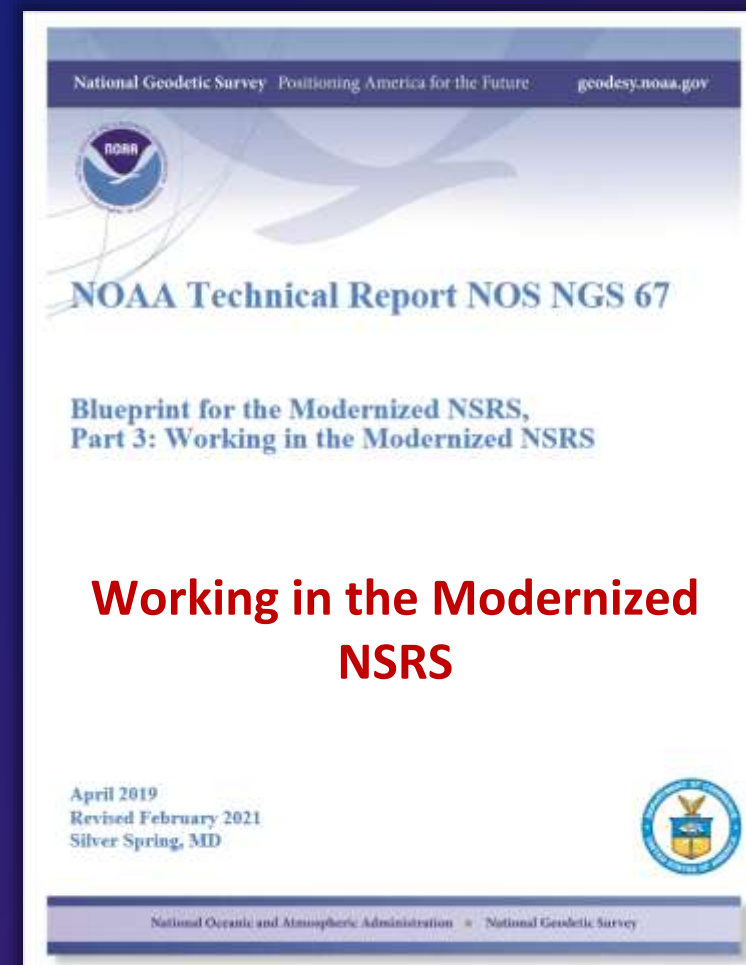
Three documents that provide technical details



Geometric Coordinates and Terrestrial Reference Frames



Geopotential Coordinates and Geopotential Datum



Working in the Modernized NSRS



New Datums Are Coming!

NOAA is Replacing NAD 83 and NAVD 88.

NOAA's National Geodetic Survey (NGS) will be replacing the datums of the National Spatial Reference System (NSRS), including **the North American Datum of 1983 (NAD 83) and the North American Vertical Datum of 1988 (NAVD 88)**. NGS will provide the tools to easily transform between the new and old datums. Read the NGS Ten-Year Plan and visit the **New Datums Web page** on our site to learn more.

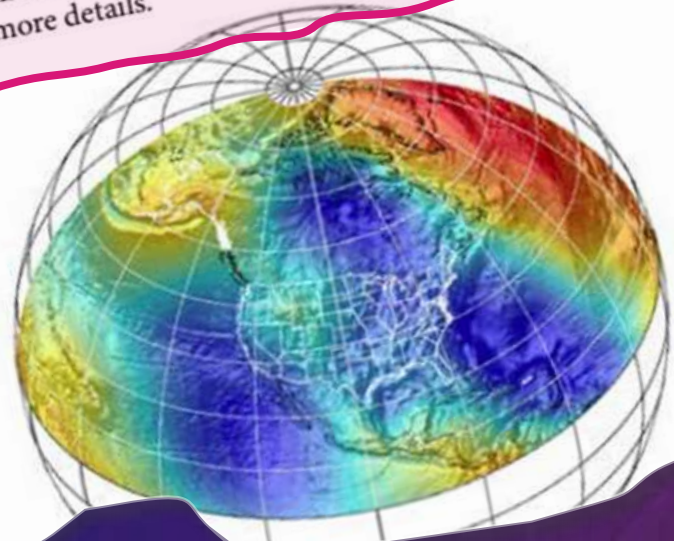
Benefits

The new reference frames (geometric and geopotential) will rely primarily on **Global Navigation Satellite Systems (GNSS)**, such as the Global Positioning System (GPS), as well as on a gravimetric geoid model resulting from NGS' **Gravity for the Redefinition of the American Vertical Datum (GRAV-D)** Project.

The target accuracy of differential orthometric heights (heights relative to sea level) in the geopotential reference frame is 1 millimeter over any distance,

How You Can Prepare

- Learn if **legislation** or other formal documents referencing NAD 83 and NAVD 88 need to be changed in your state.
- **Transform existing data** to the latest NSRS datums and realizations; i.e. NAD 83 (2011), GEOID18, and NAVD 88.
- **Obtain precise ellipsoidal heights** on NAVD 88 bench marks, and visit the GPS on Bench Marks Web page to learn more.
- Require and provide **complete metadata** on all mapping contracts. See our website for more details.



Get Prepared



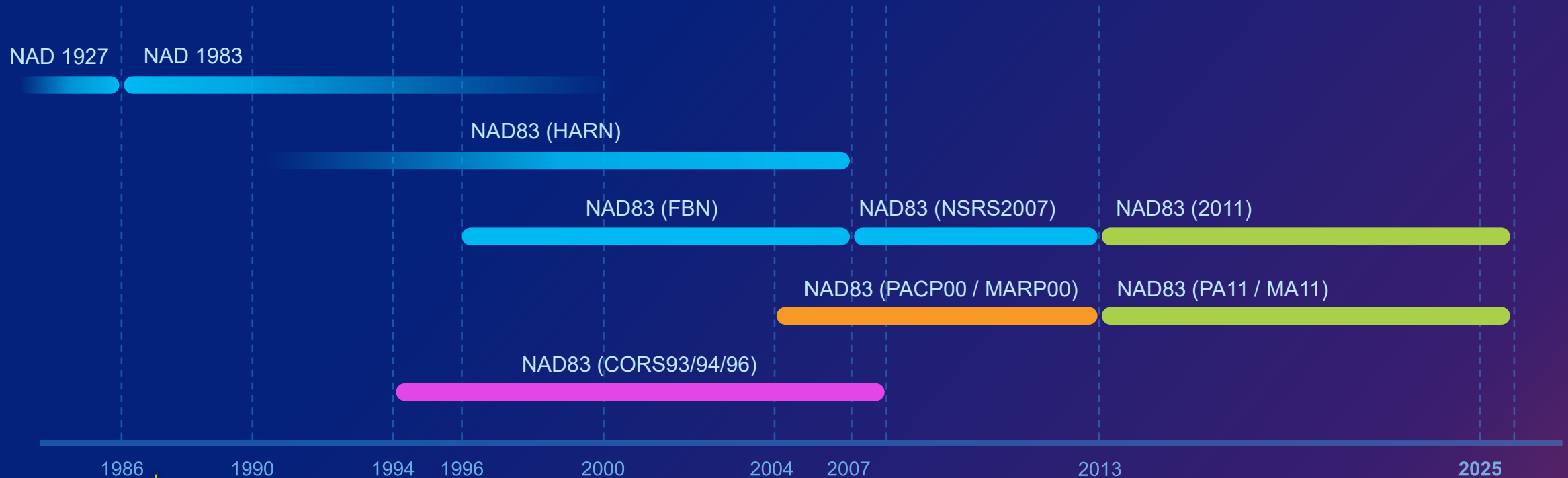
Preparing your existing data for NSRS 2022

What you need to know to do it correctly



North American Datum of 1983

Brief history, timeline, all realizations and re-adjustments



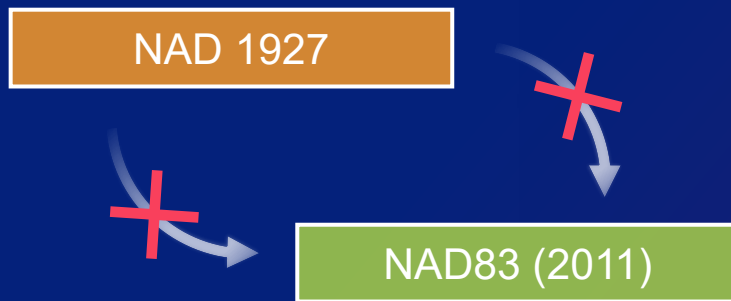
Timeline can help you identify a correct NAD83 realization if you know when data was collected and correctly convert it to the latest realizations.

How to upgrade your data

- Re-survey (best)
 - Time, money, and resources
- Re-process existing survey data
 - Less time, money, and resources
- Use NGS transformation files
 - Use NADCON 5.0 / 6.0
 - Beta files in summer 2026

Transforming 2D data to the latest realizations

Converting data for the contiguous United States



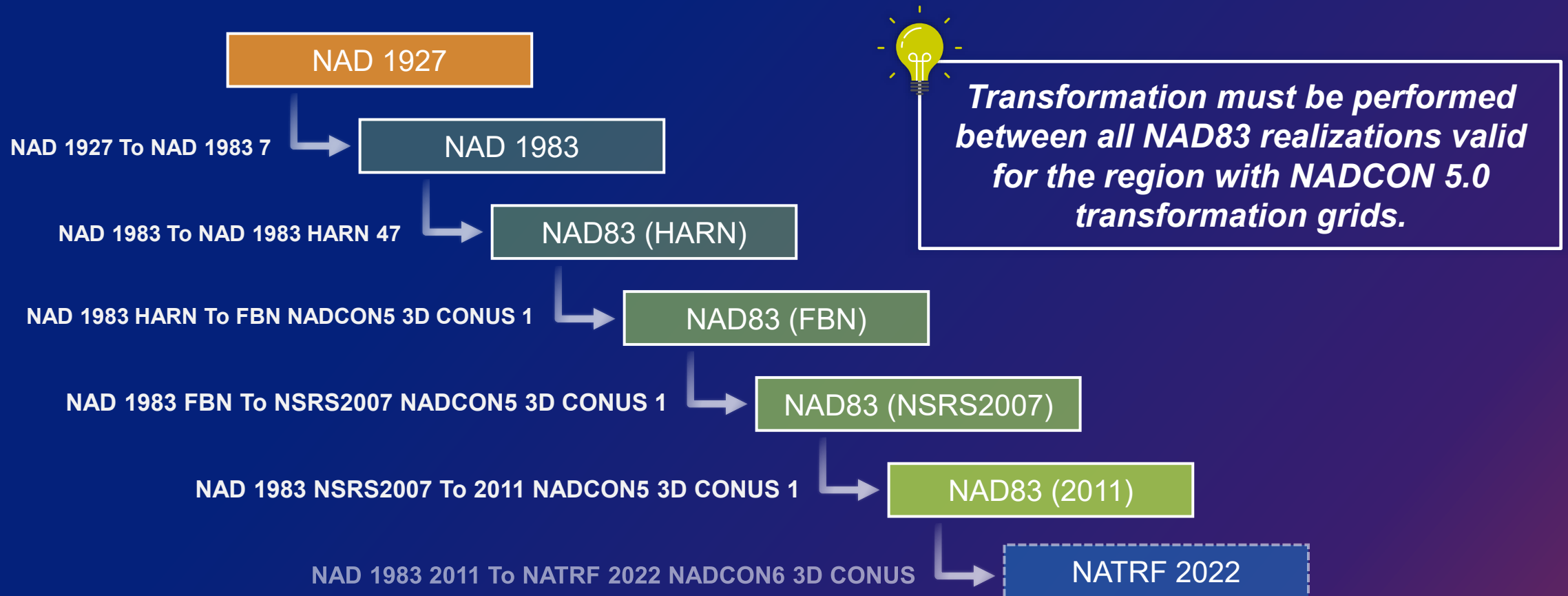
Transformation should never be performed between unrelated systems, such as WGS 1984!

- This data cannot be correctly transformed on-the-fly in ArcGIS software
 - Transformation lookup returns 2D paths with maximum 2 steps

Layer coordinate system	Transformation path	Map coordinate system
NAD 1927	NAD 1927 To WGS 1984 79 CONUS + WGS 1984 (ITRF08) To NAD 1983 2011	NAD 1983 (2011)
No vertical CS	Details	No vertical CS

Transforming 2D data to the latest realizations

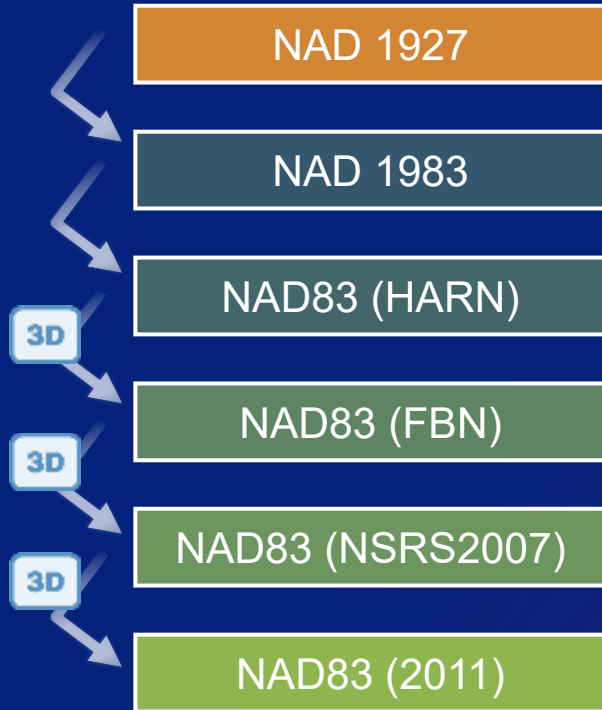
Converting data for the contiguous United States



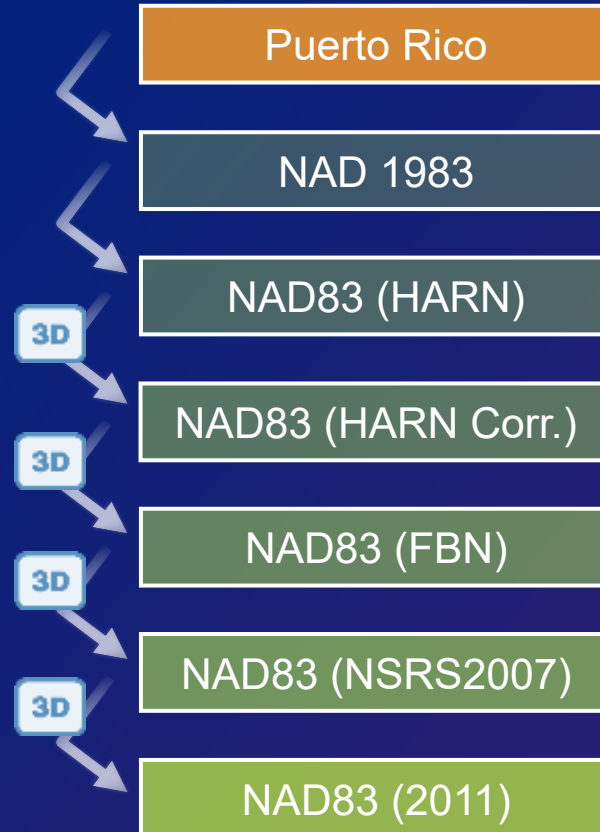
Transforming 2D data to the latest realizations

NADCON 5.0 transformation grids for each region

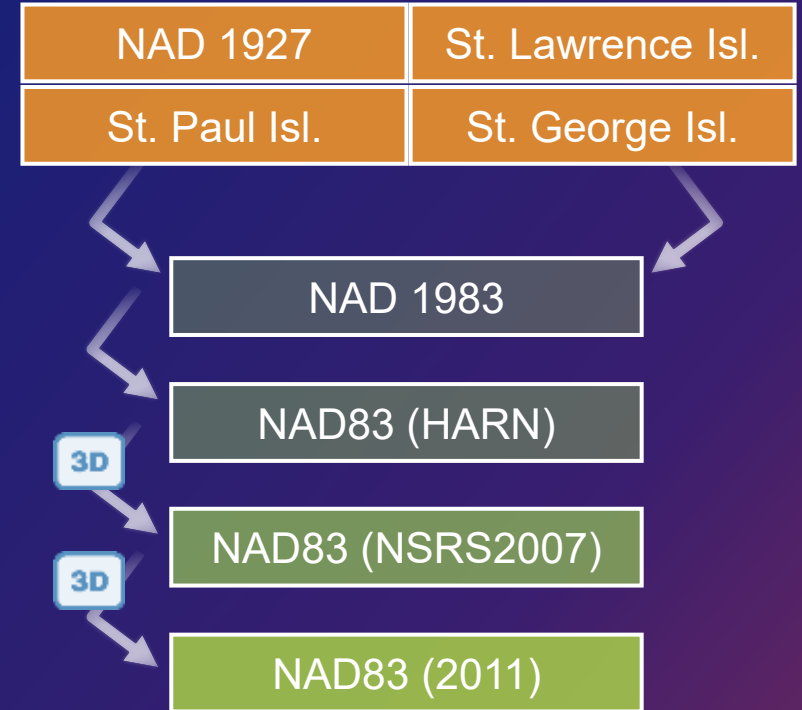
Contiguous U.S.



Puerto Rico & U.S. Virgin Islands

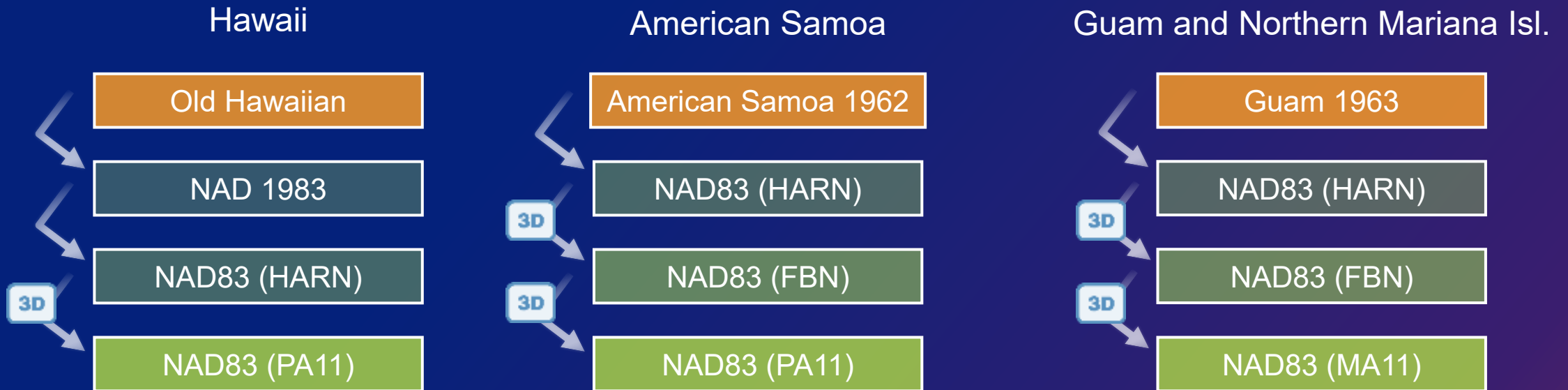


Alaska



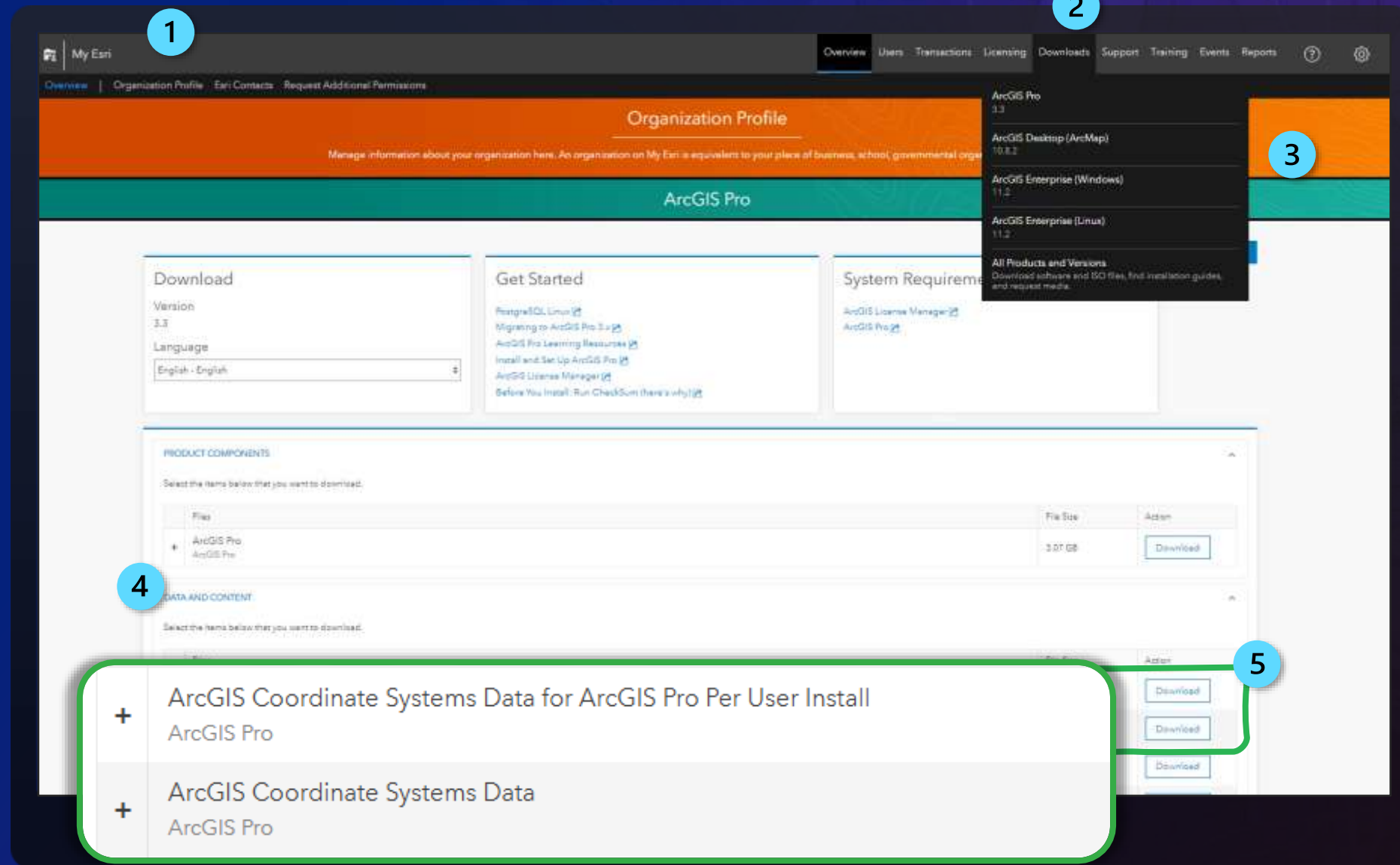
Transforming 2D data to the latest realizations

NADCON 5.0 transformation grids for each region



To activate all NADCON 5.0 transformations, you must install the ArcGIS Coordinate Systems Data component with ArcGIS software.

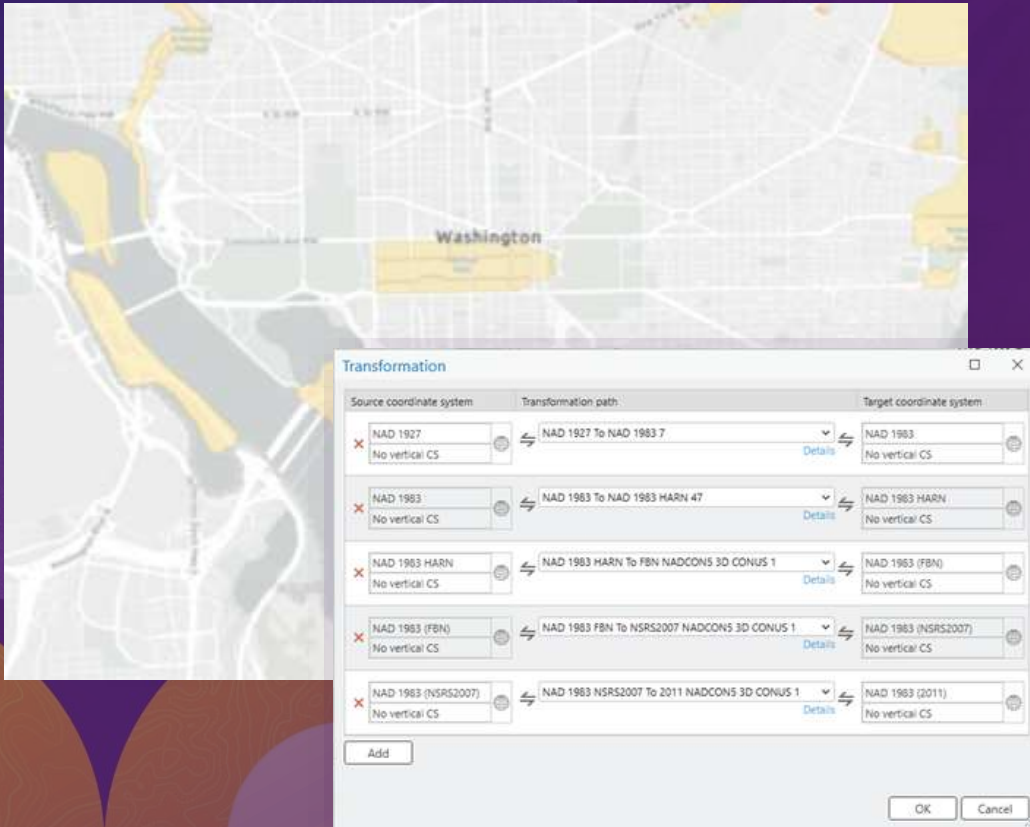
- 1 Go to MyEsri site
- 2 Open Downloads Dropdown
- 3 Select a product
- 4 Scroll to Data and Content section
- 5 Click Download next to ArcGIS Coordinate Systems Data





Converting existing data with ArcGIS

Demo in ArcGIS Pro



Transforming existing data to the latest realizations

United States country-wide data requires multiple datasets for different regions

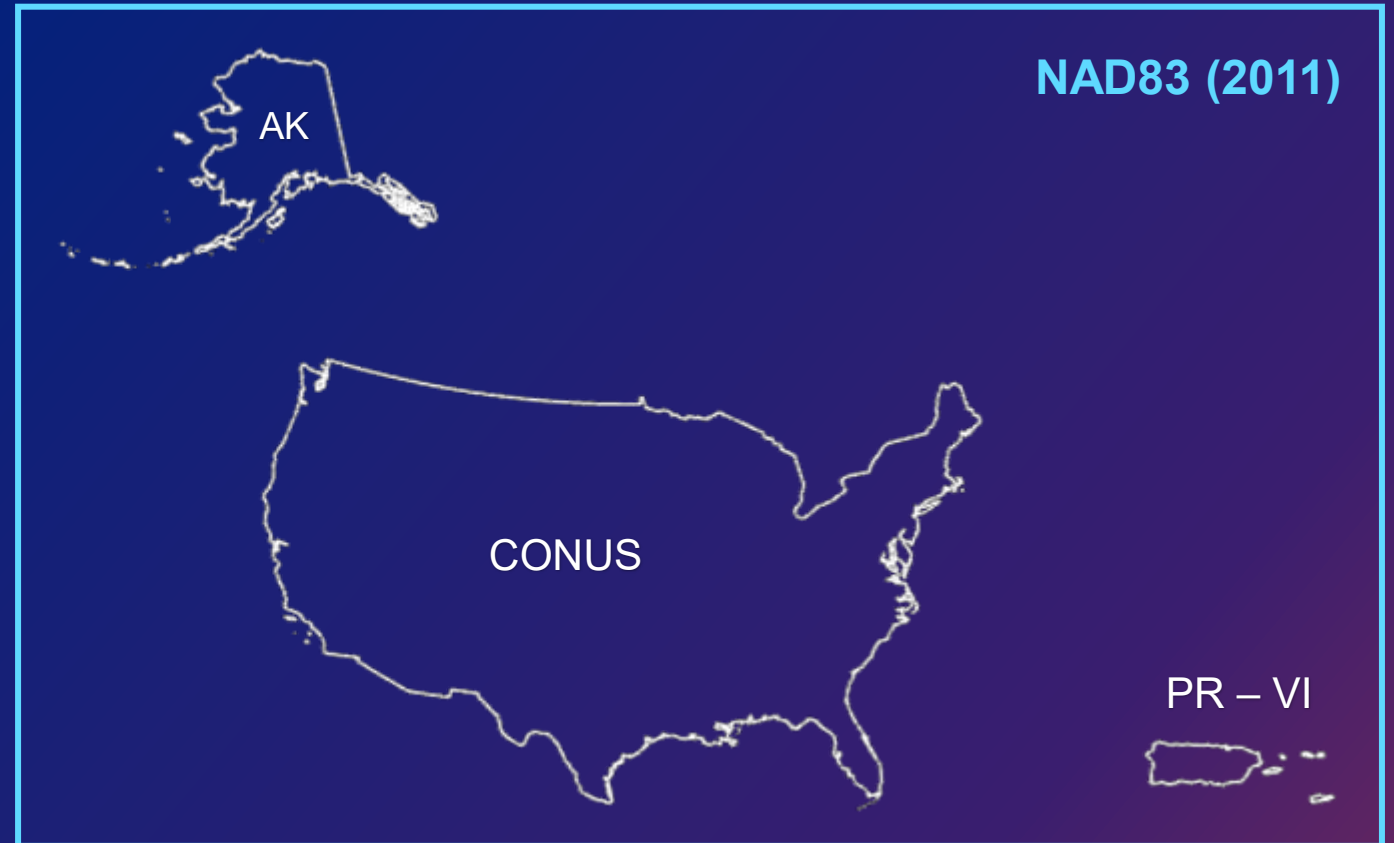
NAD83 (MA11)



NAD83 (PA11)



NAD83 (2011)



Transforming existing data to the latest realizations

United States country-wide data requires multiple datasets for different regions

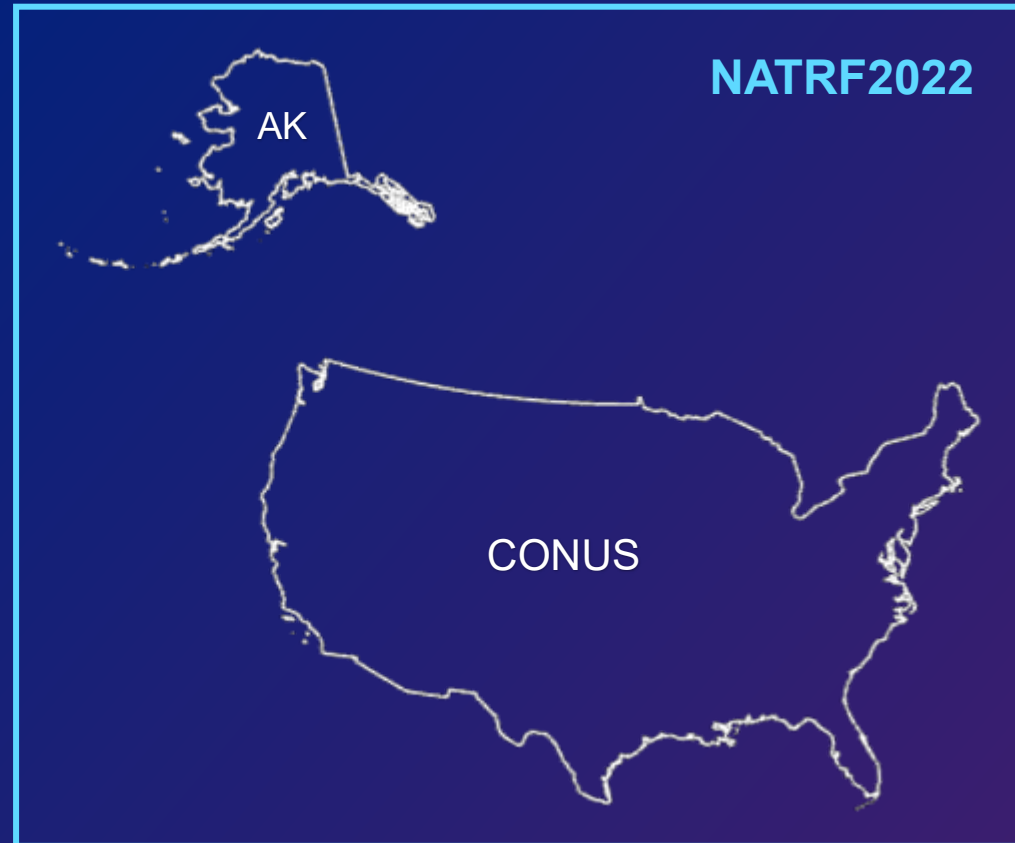
MATRF2022



PATRF2022



NATRF2022



CATRF2022



Transforming existing data to the latest realizations

United States country-wide data requires multiple datasets for different regions

MATRF2022



PATRF2022



NATRF2022



CATRF2022



Transforming 3D data to the latest realizations

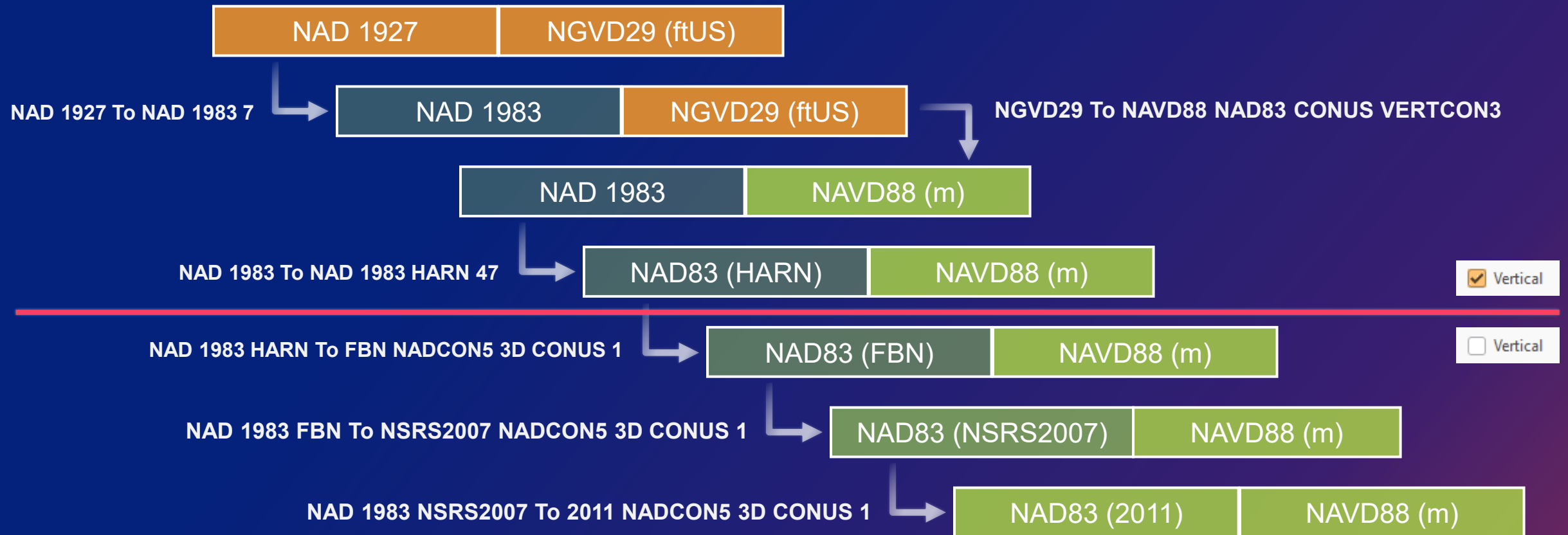
Converting data for the contiguous United States



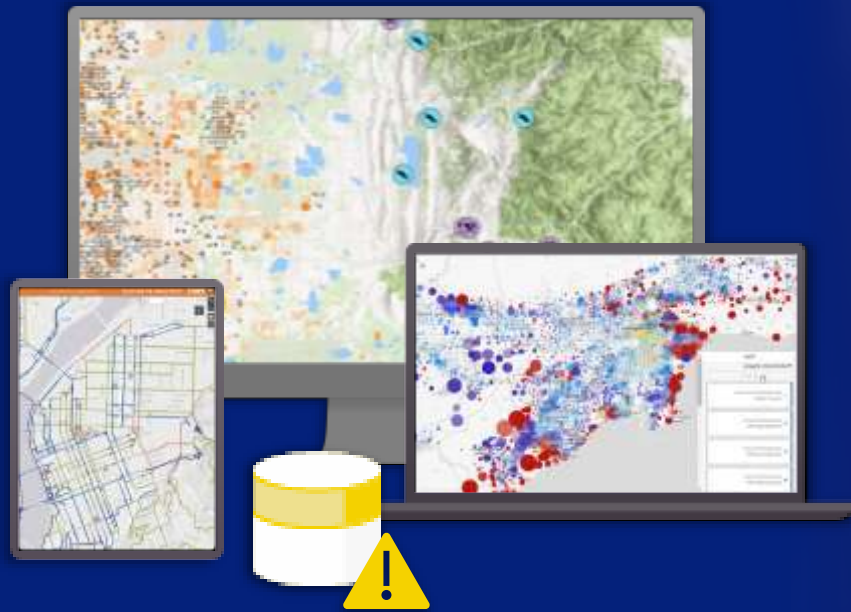
- This data cannot be correctly transformed on-the-fly in ArcGIS software
 - Transformation lookup returns 3D paths with maximum 4 steps

Transforming 3D data to the latest realizations

Converting data for the contiguous United States



Is your NAD 1983 data really NAD 1983 data?



Is your NAD 1983 data really NAD 1983 data?

Some recent data is often tagged with the original NAD83 (1986) realization

- Find out how (origin) and when (epoch) data was collected
 - Knowing the epoch can help you identify the actual NAD83 realization
- Compare your data to local authoritative data (if possible)
 - Basemaps and data published in *WGS 1984 Web Mercator (EPSG::3857)* cannot be trusted
- Compare your offsets with expected differences between NAD83 realizations
 - Use NADCON 5.0 transformations to generate local differences

Offsets between NAD83 realizations

Expected differences for San Diego area

WGS 1984 from NAD83 (2011)

88 cm

1.24 m

NAD83 (2011)

13 cm

NAD83 (NSRS2007)

35 cm

NAD83 (FBN)

29 cm

NAD83 (HARN)

13 cm

NAD 1983

1.23 m

WGS 1984
from NAD 1983

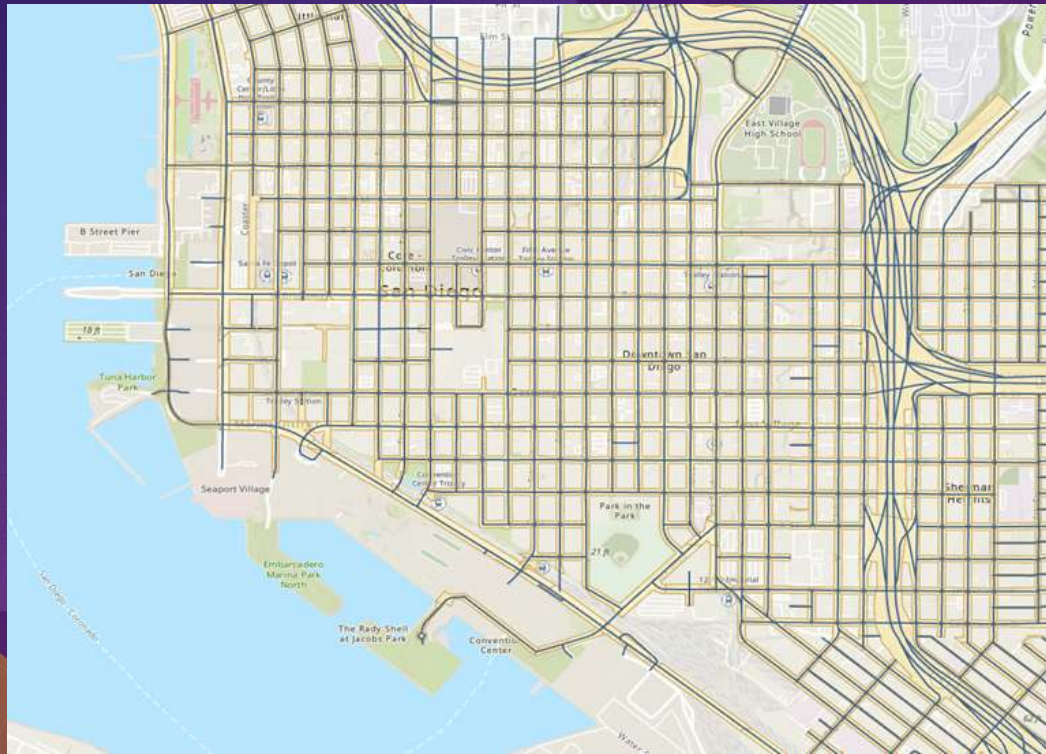
81.41 m

NAD 1927



To properly see differences in ArcGIS Pro:

- ✓ *Set a map to an appropriate State Plane zone*
- ✓ *Turn off all on-the-fly transformations for a map*



Debugging NAD83 data for San Diego

Demo in ArcGIS Pro

Time to get prepared

How can you get ready for NSRS 2022?

- Familiarize yourself with all valid and historic datums for the U.S.
 - Which ones, when, and where NAD83 realizations are or were valid
- Evaluate the quality of existing geospatial data
 - Origin, epoch, accuracy, and any other relevant metadata
- Transform existing data to the latest NSRS datums and realizations
 - E.g., NAD83 (2011) and NAVD 88
- Document all procedures and any assumptions made in detail

Get Prepared



Prepare your data for the National Spatial Reference System modernization of 2022 in the U.S.

By Bojan Šavrič

To improve the National Spatial Reference System (NSRS) in the United States, the National Oceanic and Atmospheric Administration's National Geodetic Survey (NGS) is preparing to replace all [three current North American Datum of 1983 \(NAD83\) frames](#) and all [current vertical datums](#), including the North American Vertical Datum of 1988 (NAVD88), with four new terrestrial reference frames and a vertical geopotential datum. These new reference frames will be easier to access and maintain than the current NSRS, which relies on physical survey marks that deteriorate over time. Complete information about the NSRS modernization can be found on the [NGS website](#). NGS is currently doing a "phased roll-out and testing" of the modernized NSRS. Some preliminary products are available at the [NGS NSRS Beta Product Release Site](#). The official release of various NSRS 2022 products will be done in phases during 2026 (see [NSRS Modernization - Big Steps Forward and What Comes Next webinar](#) from August 2025).

The State Plane Coordinate System of 2022 (SPCS2022) will also be part of the modernized NSRS. The NGS has released a [beta \(preliminary\) version of SPCS2022](#). The NGS currently estimates [953 new SPCS zones](#) (as of June 2025), including statewide zones and zones for special use that encompass more than one state. All definitions will be based on meters and international feet as the linear units. The official release of SPCS2022 is expected to occur during 2026 with the first set of products. You can explore the preliminary zone designs in the [Beta SPCS2022 online interactive map](#).



Coordinate Systems and Transformations

Useful resources for ArcGIS users

Projection Engine Team

October 24, 2025





esri®

THE
SCIENCE
OF
WHERE®