



NOAA/NGS

Aligning RTNs with the NSRS

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Common Referencing Datum in US

- Official horizontal datum: **NAD83(2011) epoch 2010.0** (GRS80 ellipsoid)
- Official vertical orthometric datum: **NAVD88 (GEOID12B)**
- GPS referencing datum: WGS84(G1762) (WGS84 ellipsoid)
- IGS08 epoch 2005.00: GPS satellite orbits
- ITRF08 epoch 2005.0 defines the motions of sites
- Different state, different projection: SPC
- Historical referencing datum: NAD27, HARN, WGS84(1986), NGVD29

- In the early 2000, NGS had assembled a team of over 60 experts to work together to provide recommending procedures/best practices for RTNs.
- 2011: NGS had released the draft Guidelines for Real-time GNSS Networks for public comment.
- 2013: The Guidelines for Real-time GNSS Networks version 2.2 was released:
https://www.ngs.noaa.gov/PUBS_LIB/NGSGuidelinesForRealTimeGNSSNetworks.pdf
- 2014 : The Guidelines for Single base Real time GNSS Positioning, version 3.1:
https://www.ngs.noaa.gov/PUBS_LIB/UserGuidelinesForSingleBaseRealTimeGNSSPositioningv.3.1APR2014-1.pdf



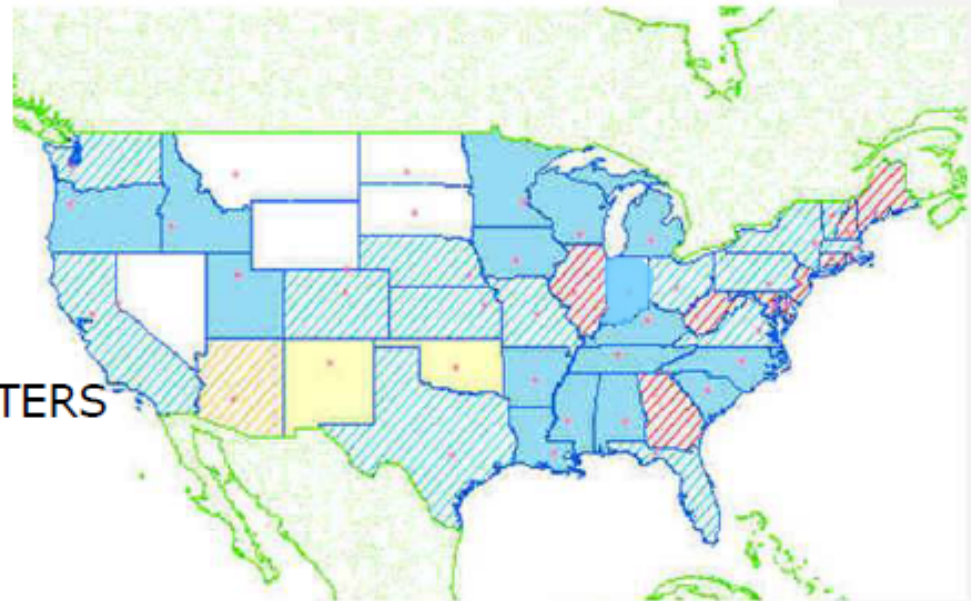
**≥200 RTN
WORLDWIDE**

≥80 RTN USA

≥35 DOT

- ACADEMIC/SCIENTIFIC
- SPATIAL REFERENCE CENTERS
- VARIOUS DOTS
- COUNTY
- CITY
- GEODETIC SURVEYS (NC, SC)
- MANUFACTURERS
- VENDOR NETWORKS
- AGRICULTURE
- MA & PA NETWORKS

**Municipal, Public Statewide and
Private Statewide RTN in the USA**



- Public and Private Statewide
- Public Statewide - Planned or Operating
- Private Statewide
- Public and Private Municipal - No Statewide
- Private Municipal - No Statewide

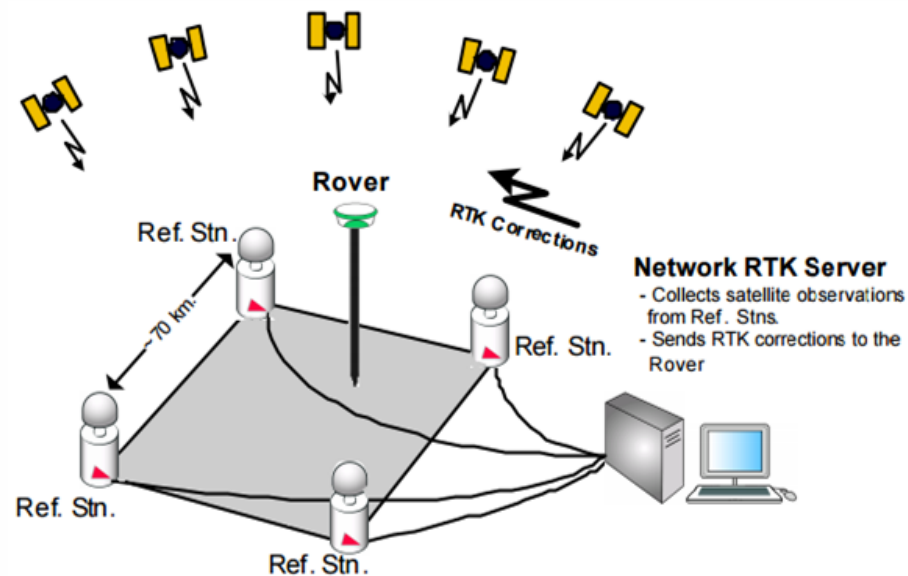


NOAA/NGS seven “C”

- **C**heck equipment, data collector parameters & site information
- **C**onditions: DOP, weather, multipath
- **C**oordinates: datums with epoch, accuracy requirement of both user’s project and those provided by the RTN
- **C**ommunication between rover and RTN servers: radio or mobile (NTRIP or TCP/IP, which port)
- **C**alibration: constrain to passive monuments for acquiring orthometric heights
- **C**ollections: check known points before, during and at the end of data collections
- **C**onfidence: redundancy: satellite config., field conditions

• Network Planning & Implementation:

- RTN monument guidelines: power supply, mounting, security
- Network design: station spacing, use/become CORS, central processing servers, data communication
- Network Administration: communication, referencing datums, station coordinates, maintenance



- **Network Administration:** Obtaining Station Coordinates Consistent with NSRS
 - NGS encourages RTN admins to use both NAD83 and ITRS
 - » NAD83(2011) epoch 2010.0
 - » ITRF08 epoch 2005.0
 - Rec. #1: some RTN stations should be CORS
 - Rec. #2: each RTN station as CORS, should adopt 3-D coordinates & velocities at a selected reference date that are **consistent** with corresponding NGS-adopted values at this station, to within 2cm horizontally and 4cm vertically
 - Rec #3: **test** the continued consistency of the station's positional coordinates & velocities, and **revise** these values if coordinate differences in excess of 2cm horizontally and 4cm vertically persist over a period of several days.

Where now ?

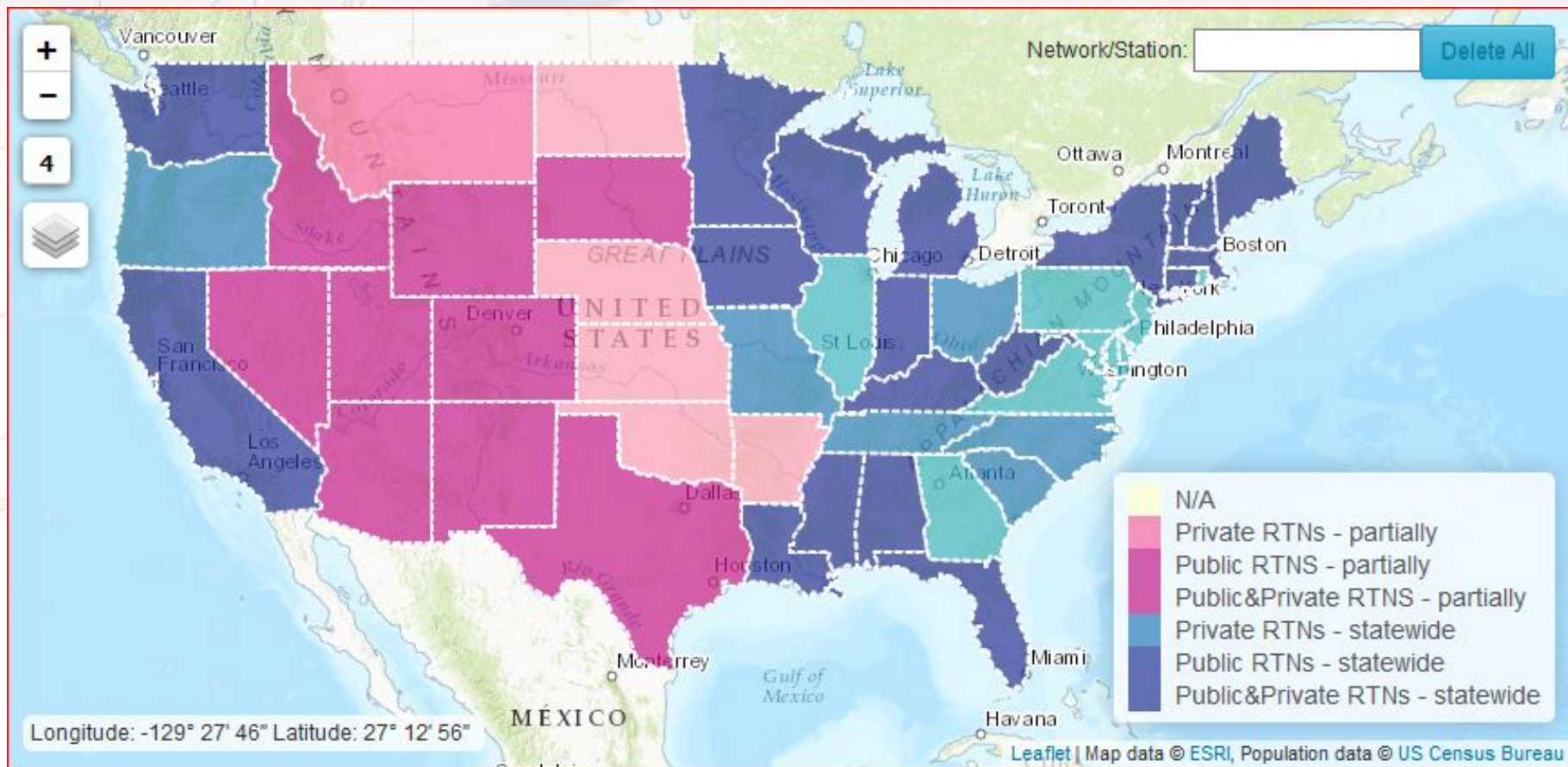
What next ?

<https://geodesy.noaa.gov>

Overview

RTN User Guidelines

RTN Operator Guidelines



RTN Coverages



Where now ?

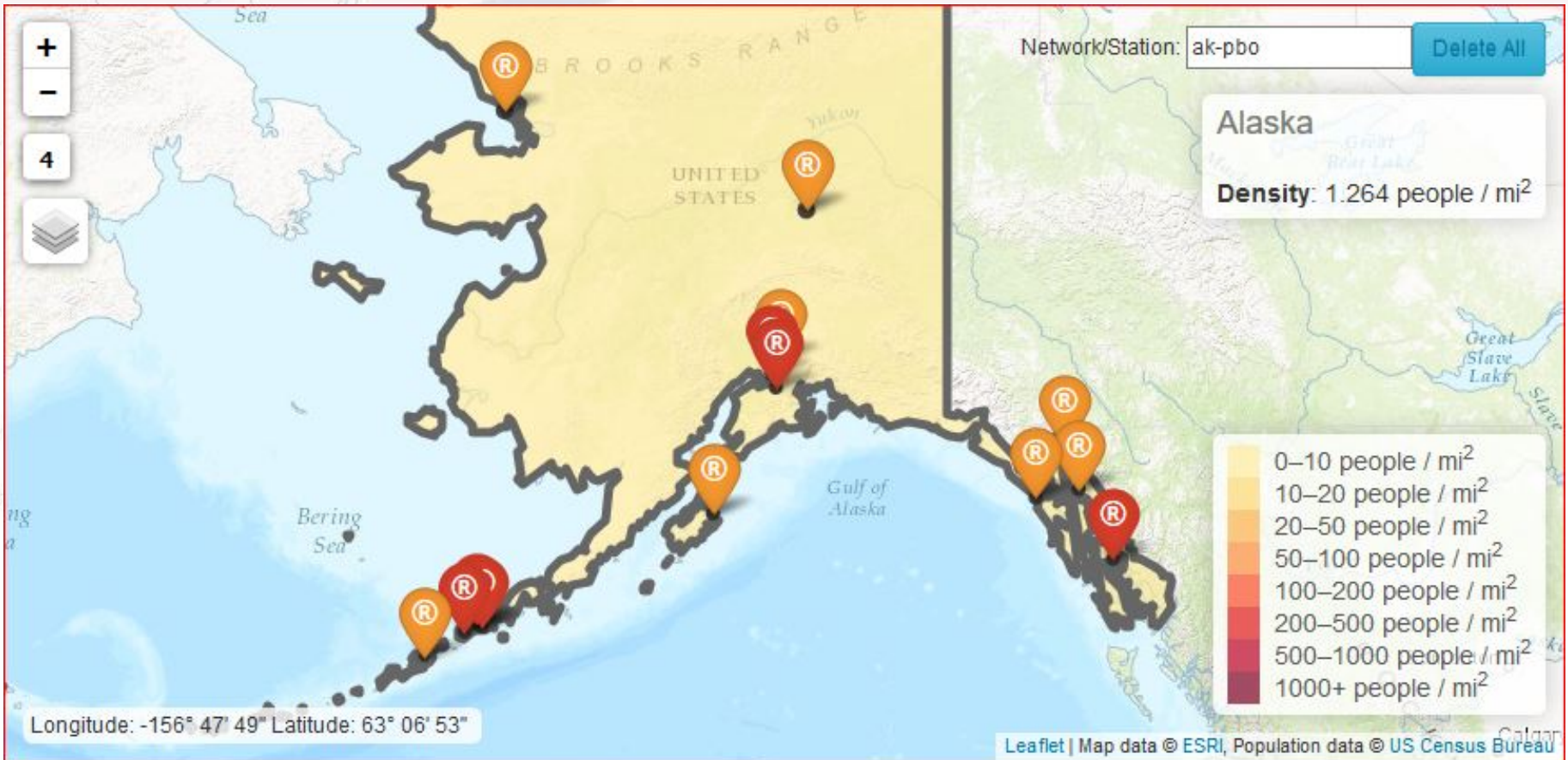
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Alaska – UNAVCO Real-time GNSS Network stations (14)



Where now ?

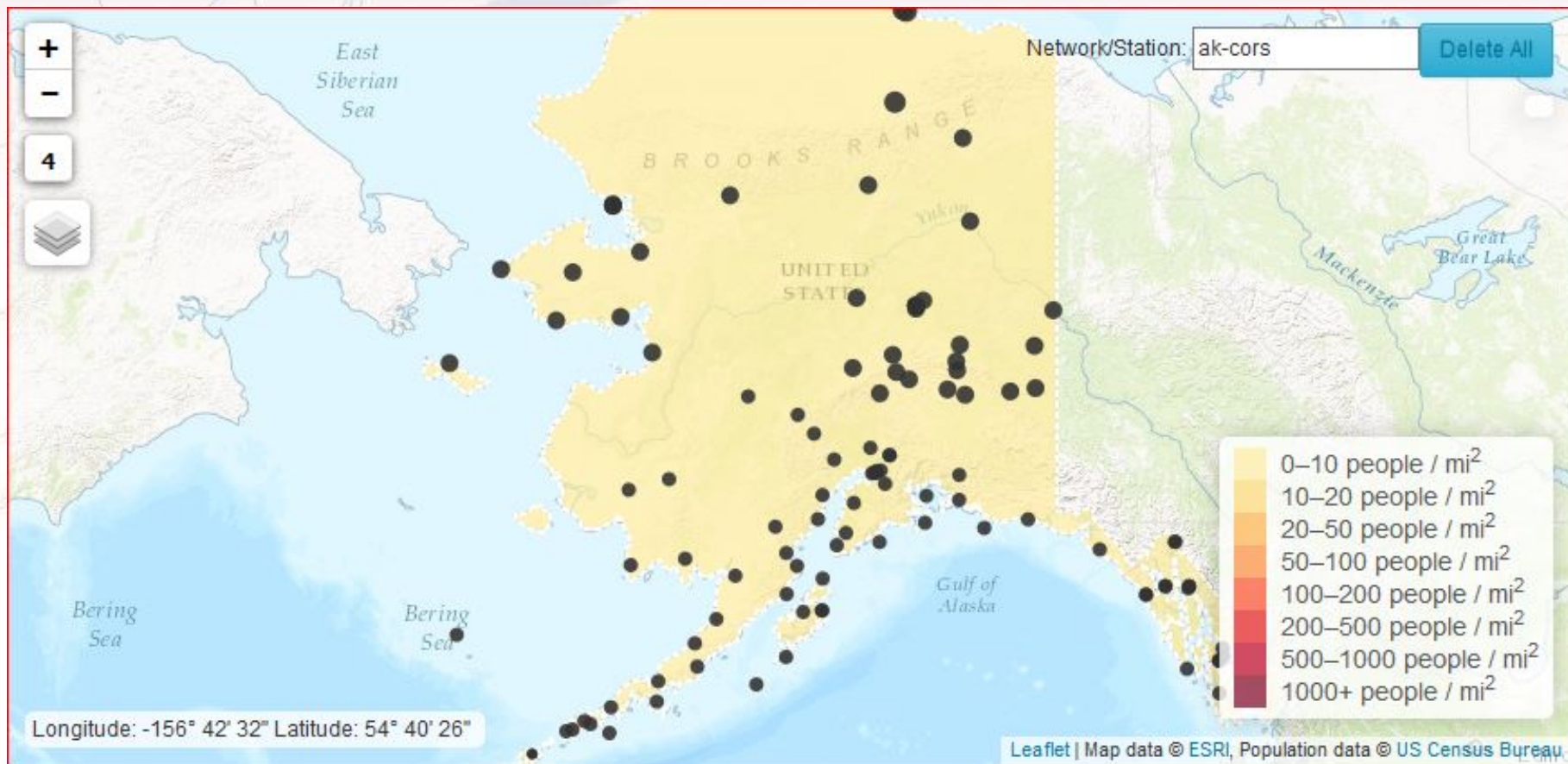
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Alaska – CORS (97)



Where now ?

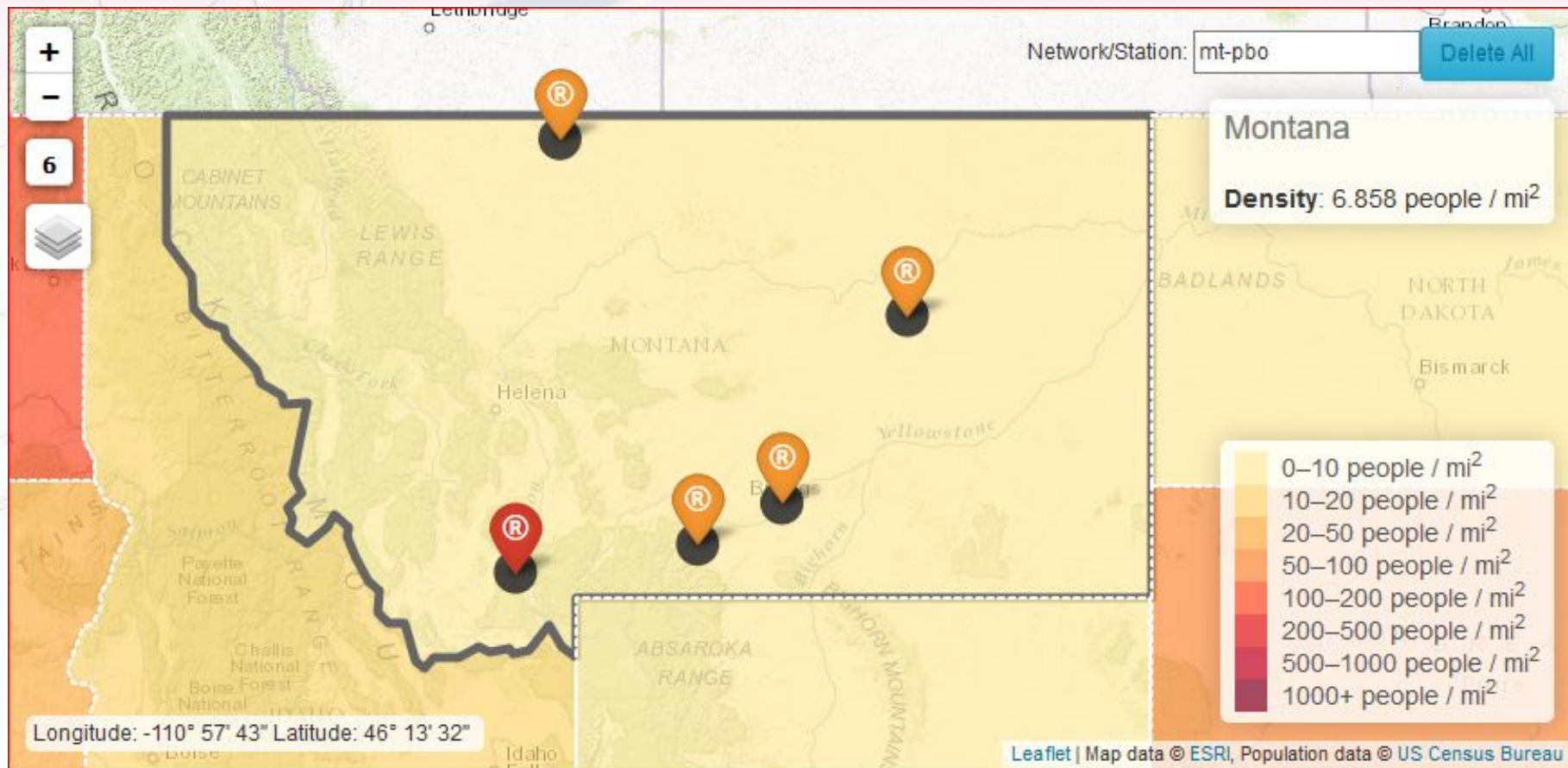
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Montana – UNAVCO Real-time GNSS Network stations (5)



NOAA/NGS: Aligning RTNs with the NSRS

Where now ?

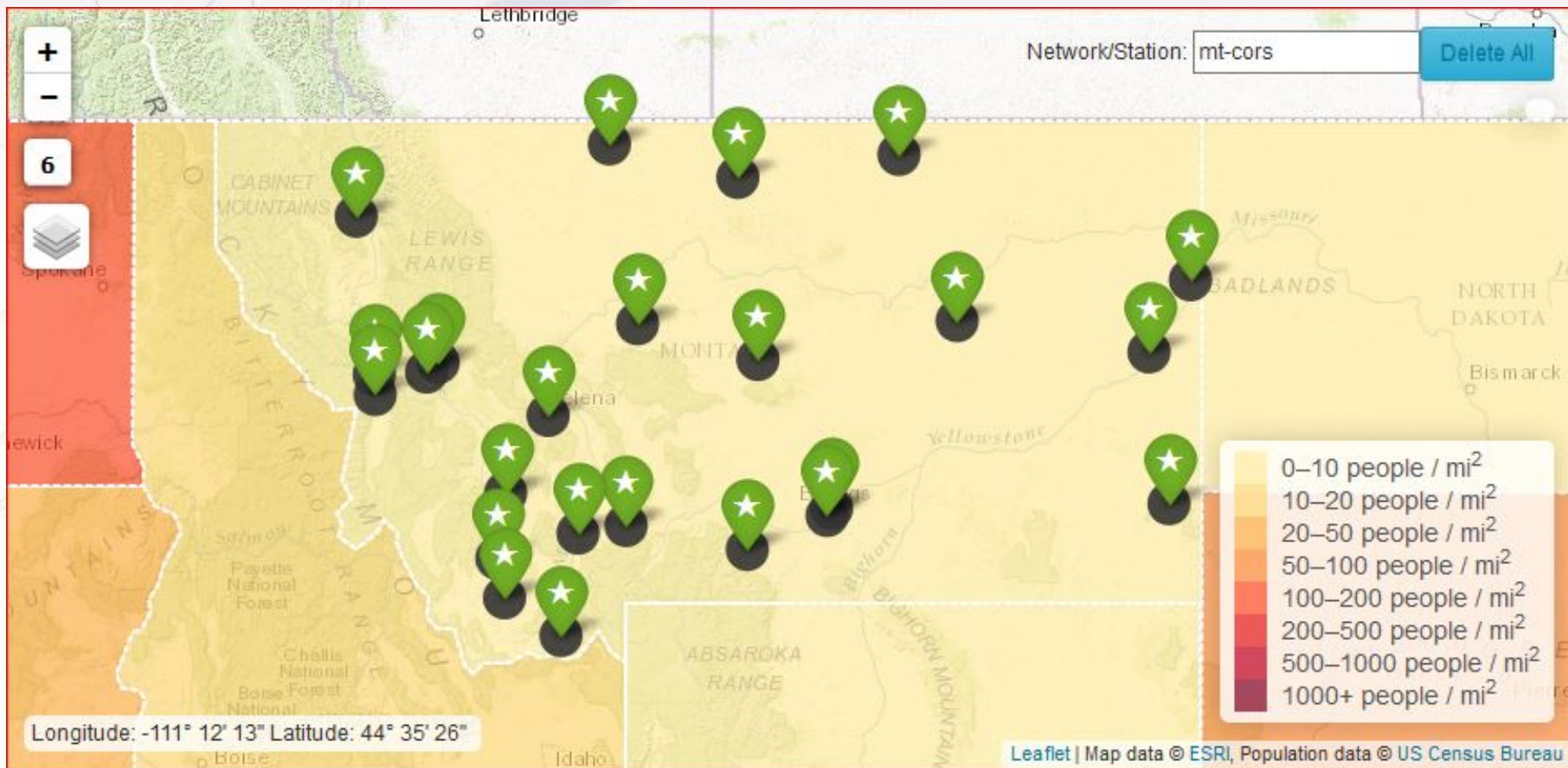
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Montana – CORS (24)



NOAA/NGS: Aligning RTNs with the NSRS

Where now ?

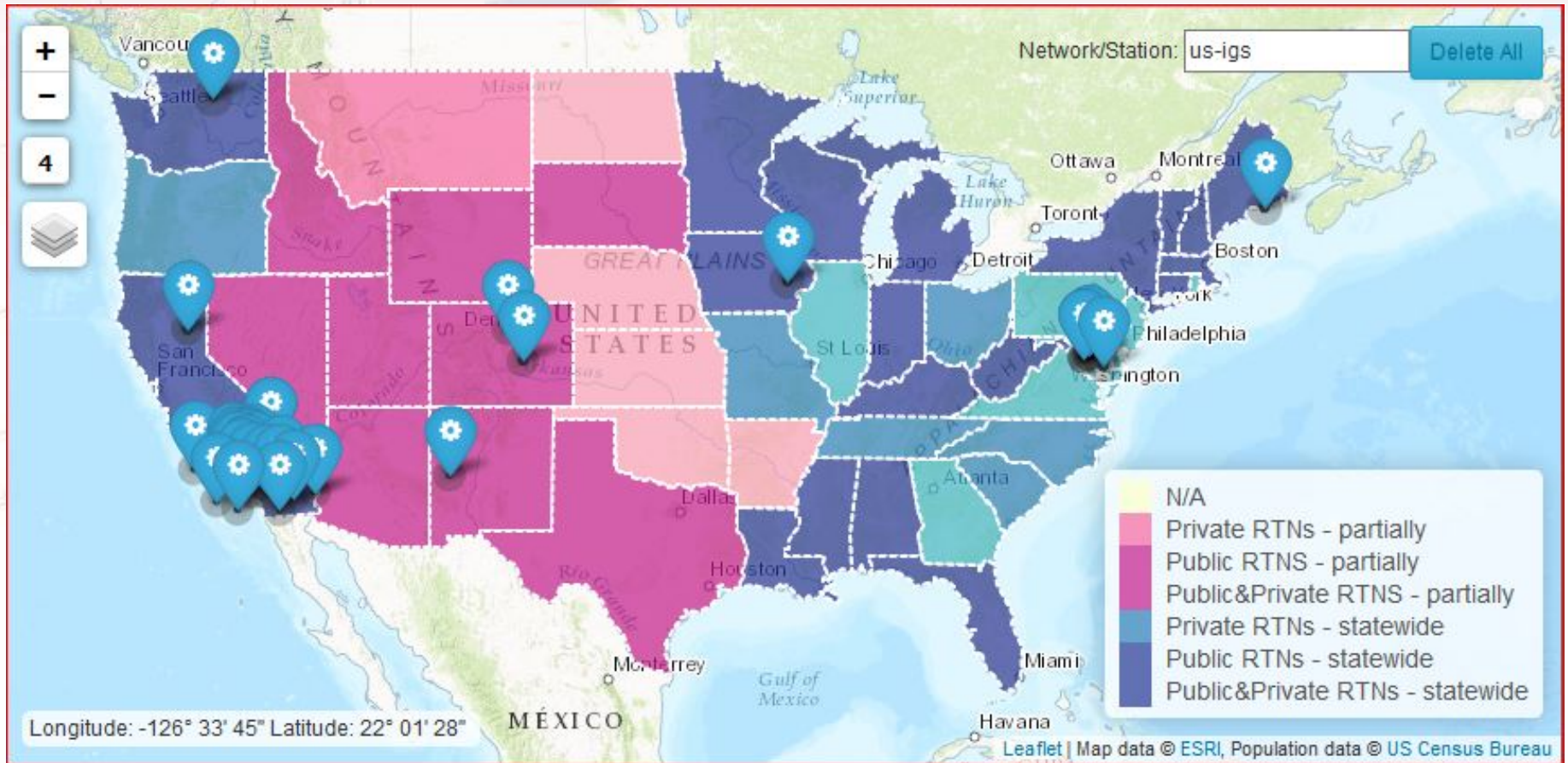
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Operating IGS stations in CONUS (44/53)

Where now ?

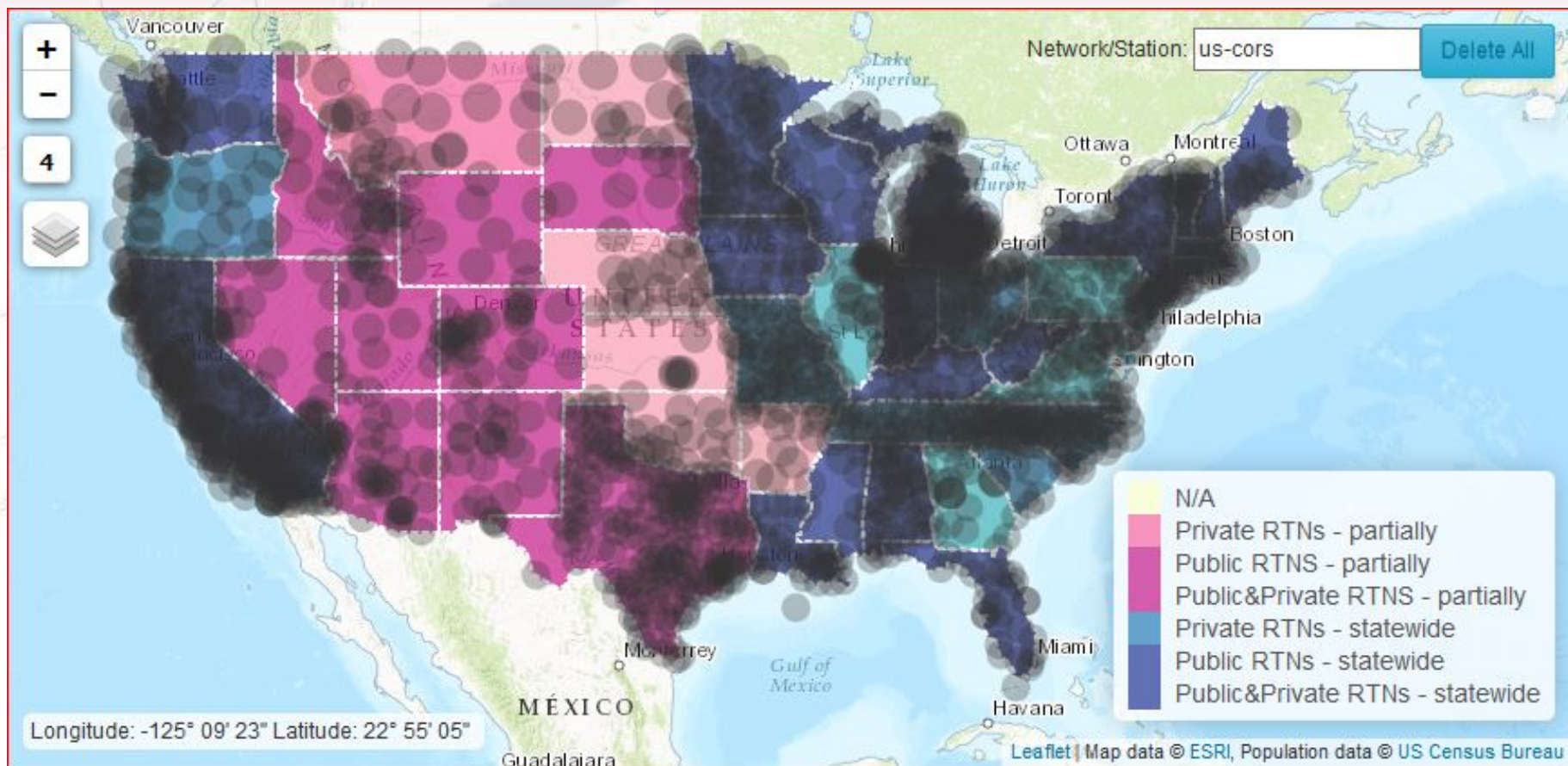
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Operational CORS (~1700) with 70km-buffer

NOAA/NGS: Aligning RTNs with the NSRS

Where now ?

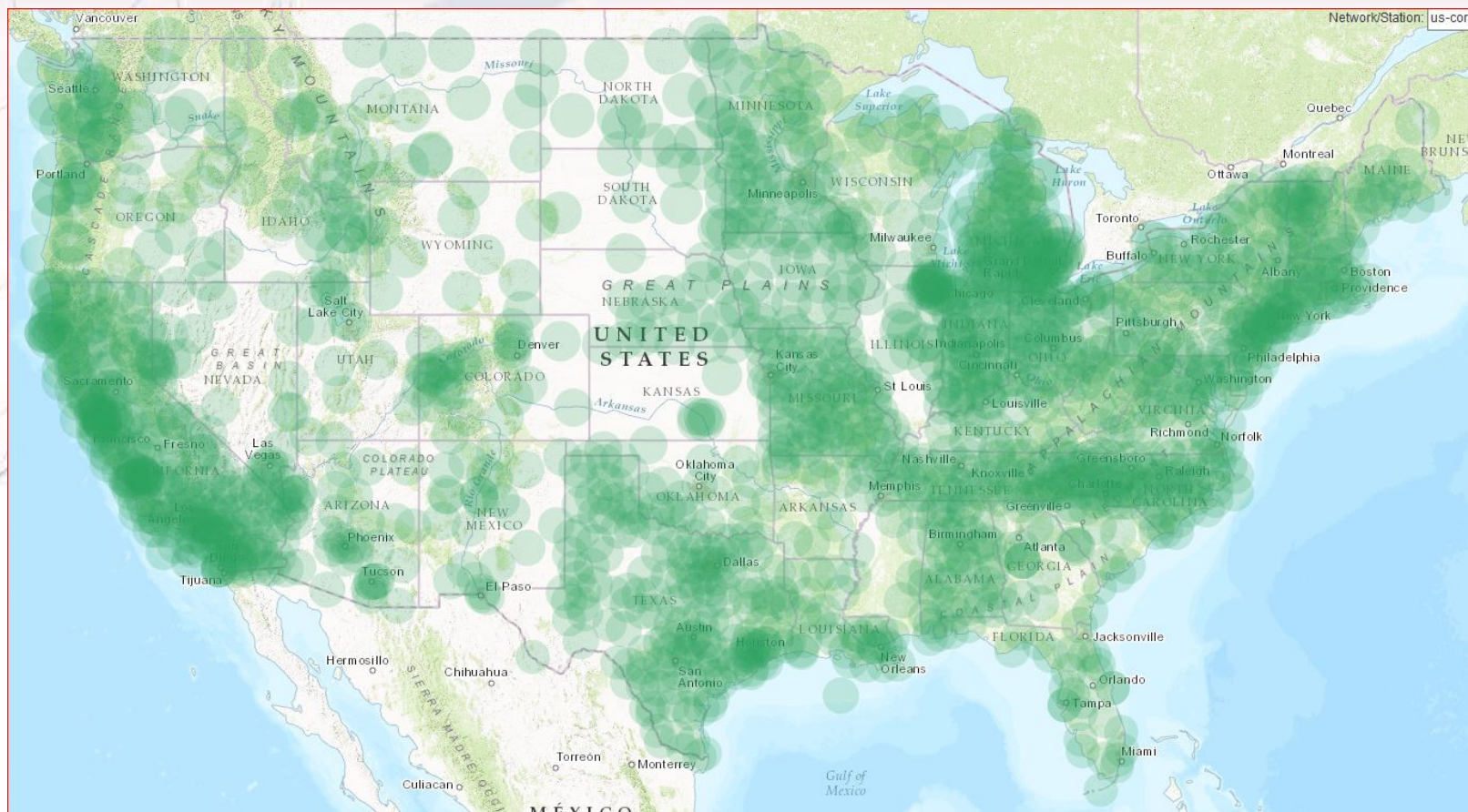
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Operational CORS (~1700) with 70km-buffer



NOAA/NGS: Aligning RTNs with the NSRS

Where now ?

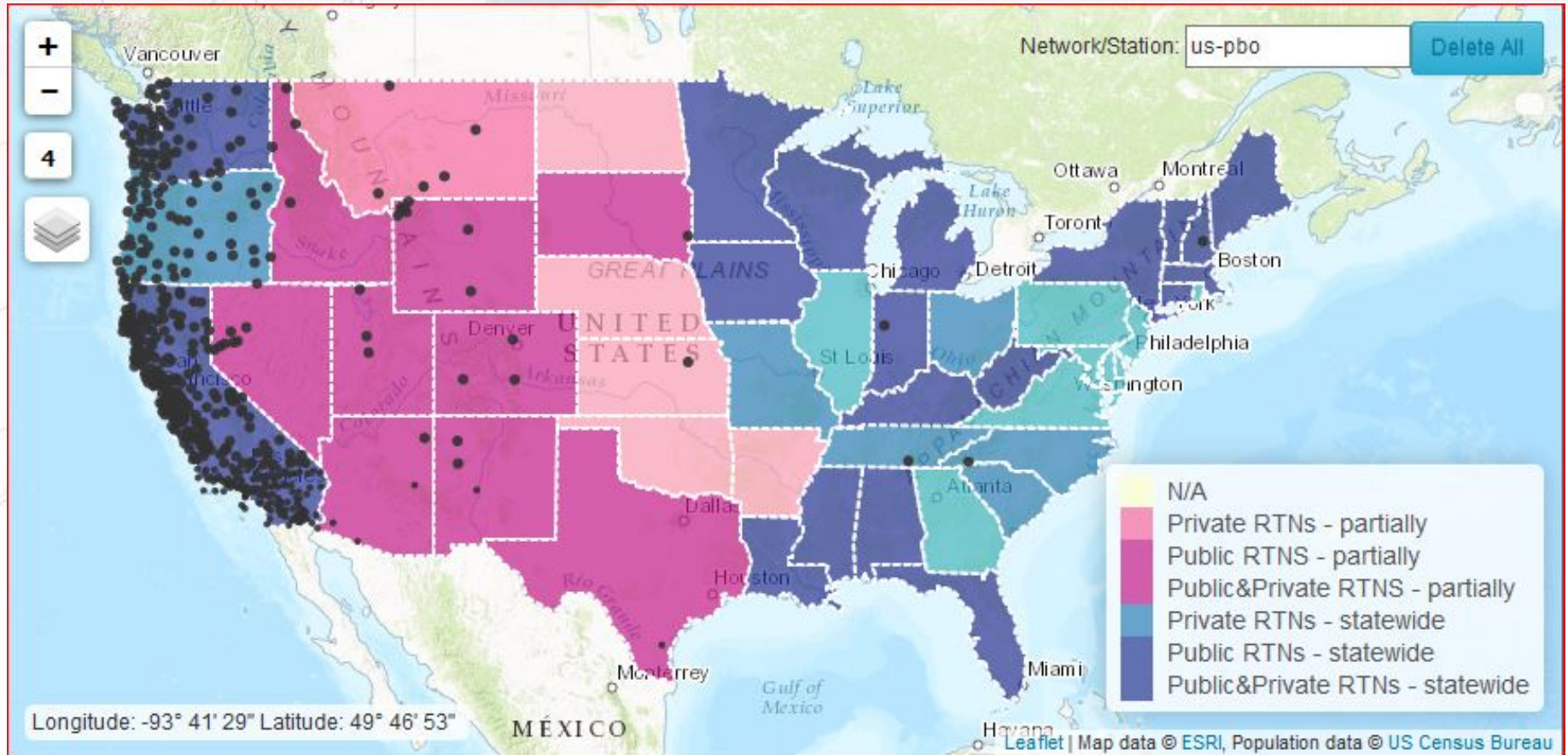
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UNAVCO Real-time GNSS Network stations (560) with 20km-buffer

NOAA/NGS: Aligning RTNs with the NSRS

Where now ?

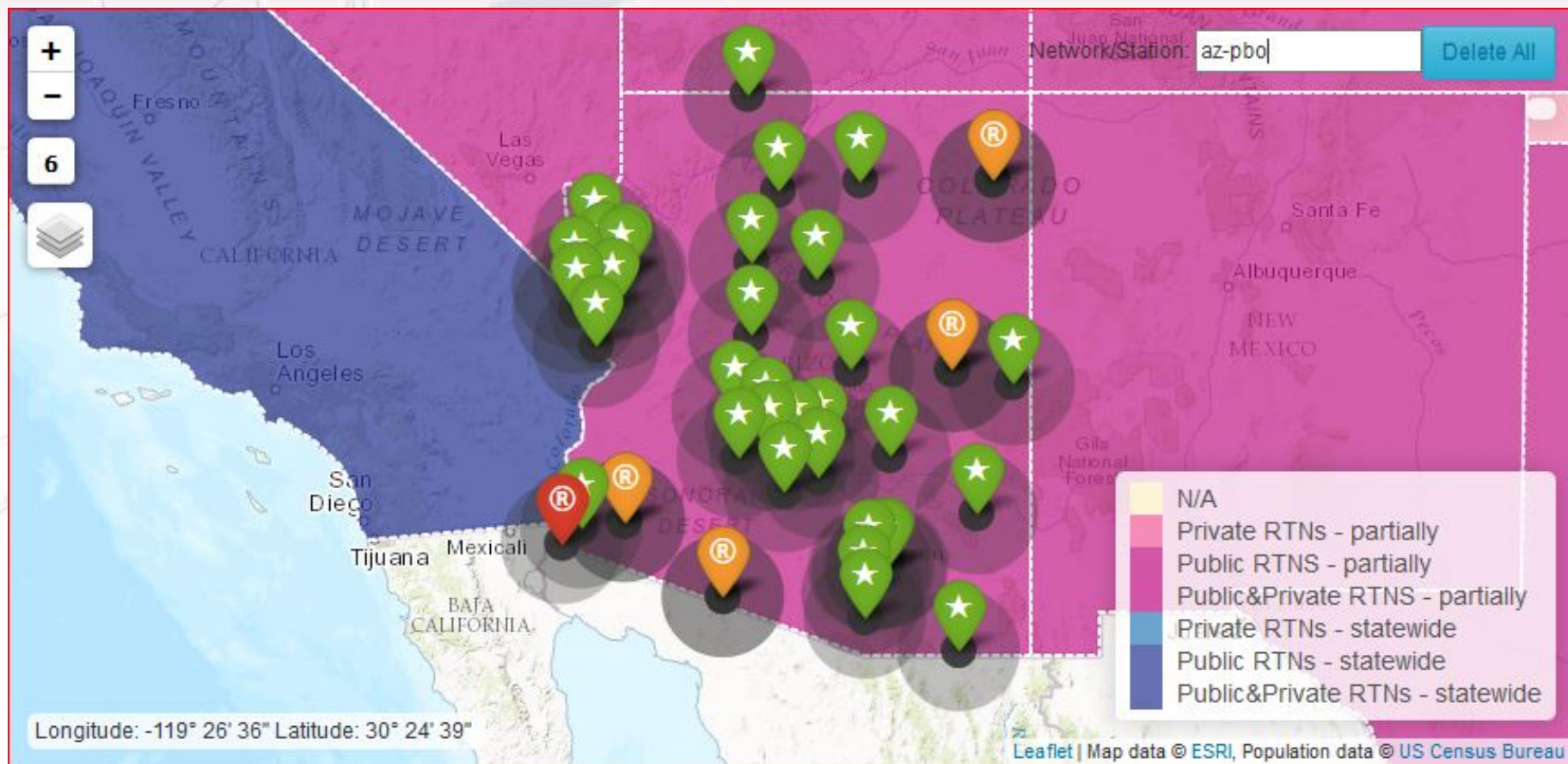
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Arizona – Operational CORS & UNAVCO Real-time

Where now ?

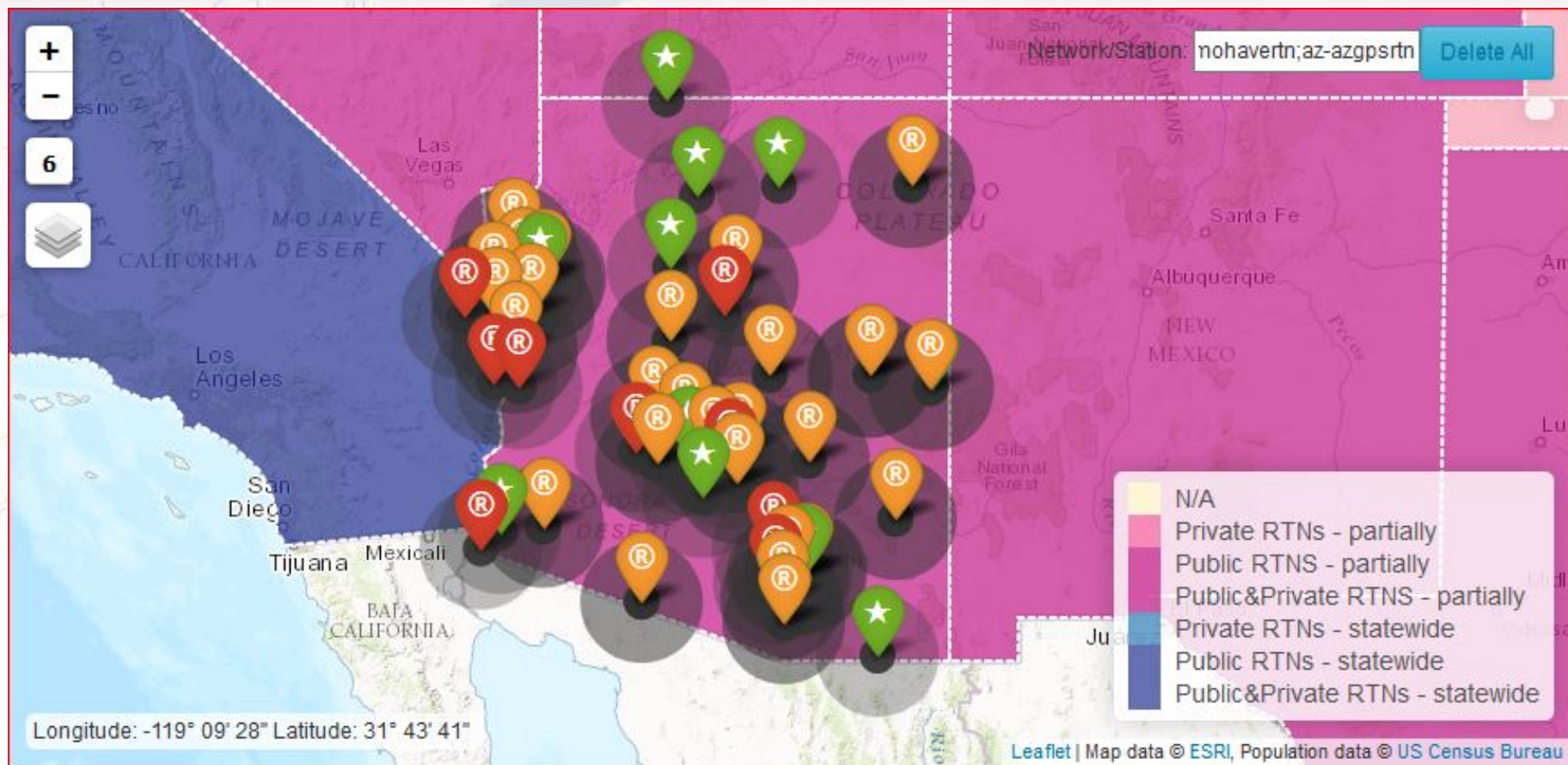
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Arizona – RTN networks: AZGPS, MohaveRTN

NOAA/NGS: Aligning RTNs with the NSRS

Where now ?

What next ?

<https://geodesy.noaa.gov>

The screenshot displays the NOAA/NGS website interface. On the left, a sidebar titled "NGS & RTN" contains a "Station List" button and a table with columns for "ID", "Type", and "Provider". The table lists various station identifiers and their corresponding types and providers. The main area features a map of the Pacific Northwest region, densely populated with red and orange location pins representing RTN stations. A tooltip for station "PLNA" is visible over the map. The map includes geographical labels such as "COASTAL RANGES", "CASCADE RANGE", "BLUE MOUNTAINS", "GREAT SANDY DESERT", and "HARNEY BASIN". A search bar and a "Delete All" button are located in the top right corner of the map area. The bottom of the map shows coordinates: "Longitude: -119° 44' 24\"

ID	Type	Provider
ANAT	RTN	ORGN
ARLN	RTN	ORGN
ASHL	RTN	ORGN
BEND	RTN	ORGN
BLY1	RTN	ORGN
BNDM	RTN	ORGN
CABL	CORS&RTN	ORGN
CATH	RTN	ORGN
CHEM	RTN	ORGN
COBO	RTN	ORGN
COND	RTN	ORGN
CROK	RTN	ORGN
CTPT	RTN	ORGN

NGS's RTN website with all-in-one map (on-going)

- Update the RTN Guidelines
- Network validation service for RTN operators to align network RTK with NSRS:
 - Using OPUS-Project:
 - Automatic, multiple sites upload to OPUS-Project instead of 5 clicks per site x 99 sites maximum
 - Another OPUS “extension” ~ OPUS-Project for non-GUI lovers with minimum interactive
- Other suggestions/requests/feedback from surveying community, please feel free to send to Ira.Sellars at Ira.Sellars@noaa.gov

Thank you!