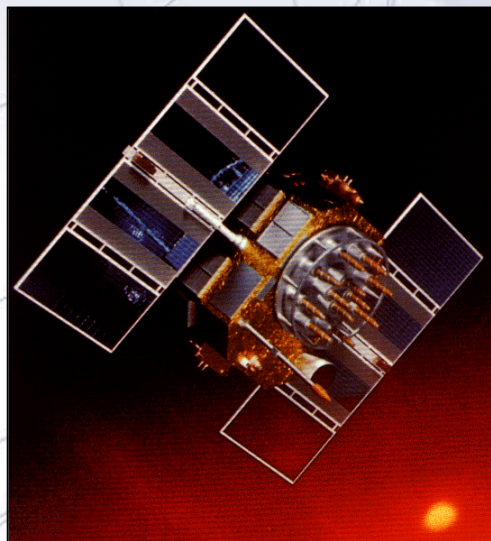




National Adjustment of 2011

Project Update



National Geodetic Survey
Observations and Analysis Division
April 25, 2012 ● Silver Spring, MD

Michael L. Dennis, RLS, PE
NA2011 Project Manager
michael.dennis@noaa.gov

When will it all be done?

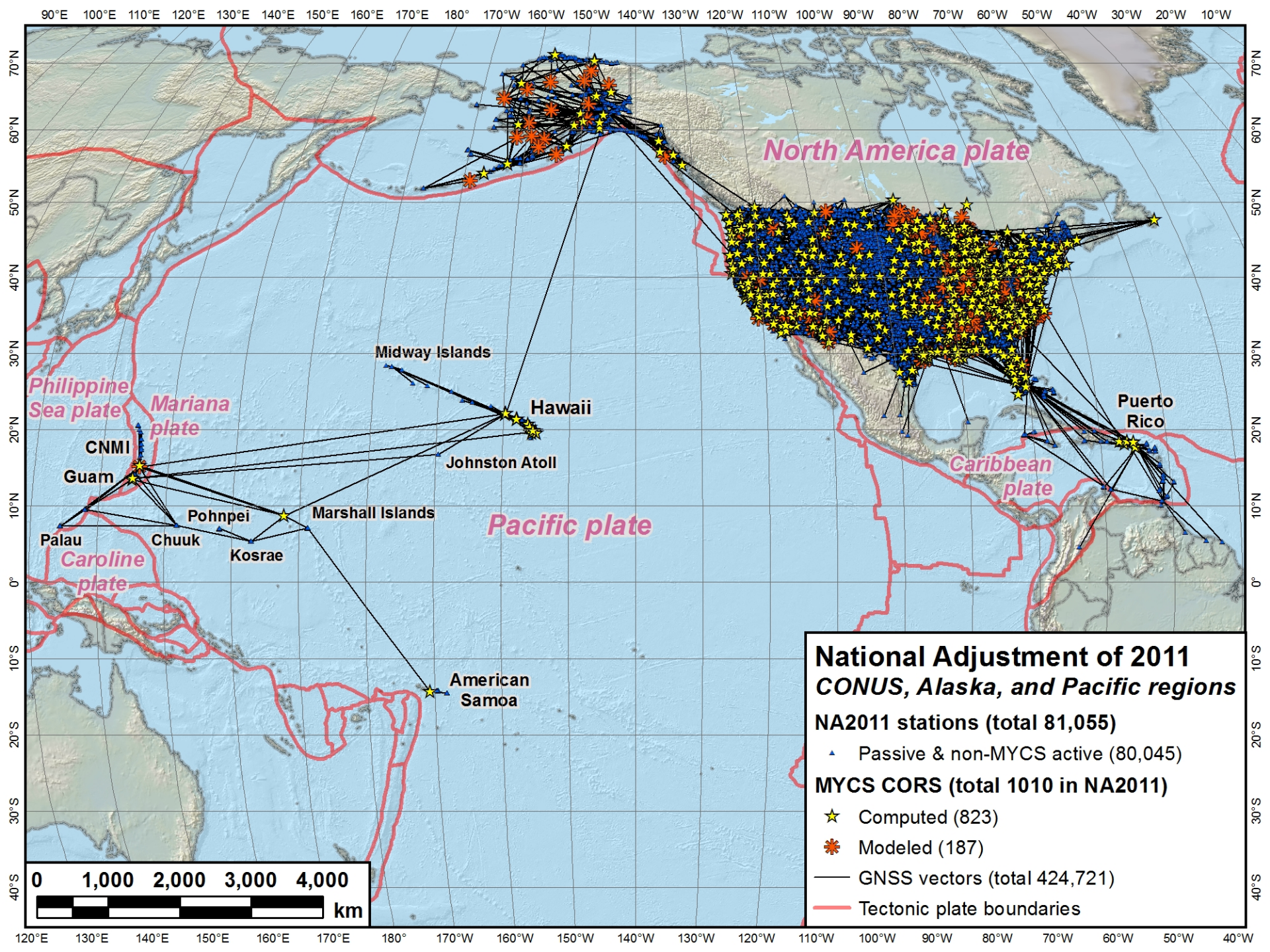
- National Adjustment of 2011
 - Completion date scheduled for May 18, 2012
 - Publication no later than ***June 30, 2012***
 - ***Simultaneous with release of GEOID12***
- Related and dependant products and services
 - Multi-Year CORS Solution (finalized in Sep 2011)
 - Will publish in NGS database simultaneously with NA2011
 - OPUS (Online Positioning User Service)
 - Dual solutions (CORS96 and MYC) available until NA2011 complete
 - New hybrid geoid model (GEOID12)
 - Use NAD 83(2011) ellipsoid heights on leveled NAVD 88 BMs
 - New NAD 83 coordinate transformation tools
 - HARN \leftrightarrow NSRS2007 \leftrightarrow 2011
 - HARN \leftrightarrow 2007 done (still need to implement)
 - NSRS2007 \leftrightarrow 2011 soon after NA2011 done

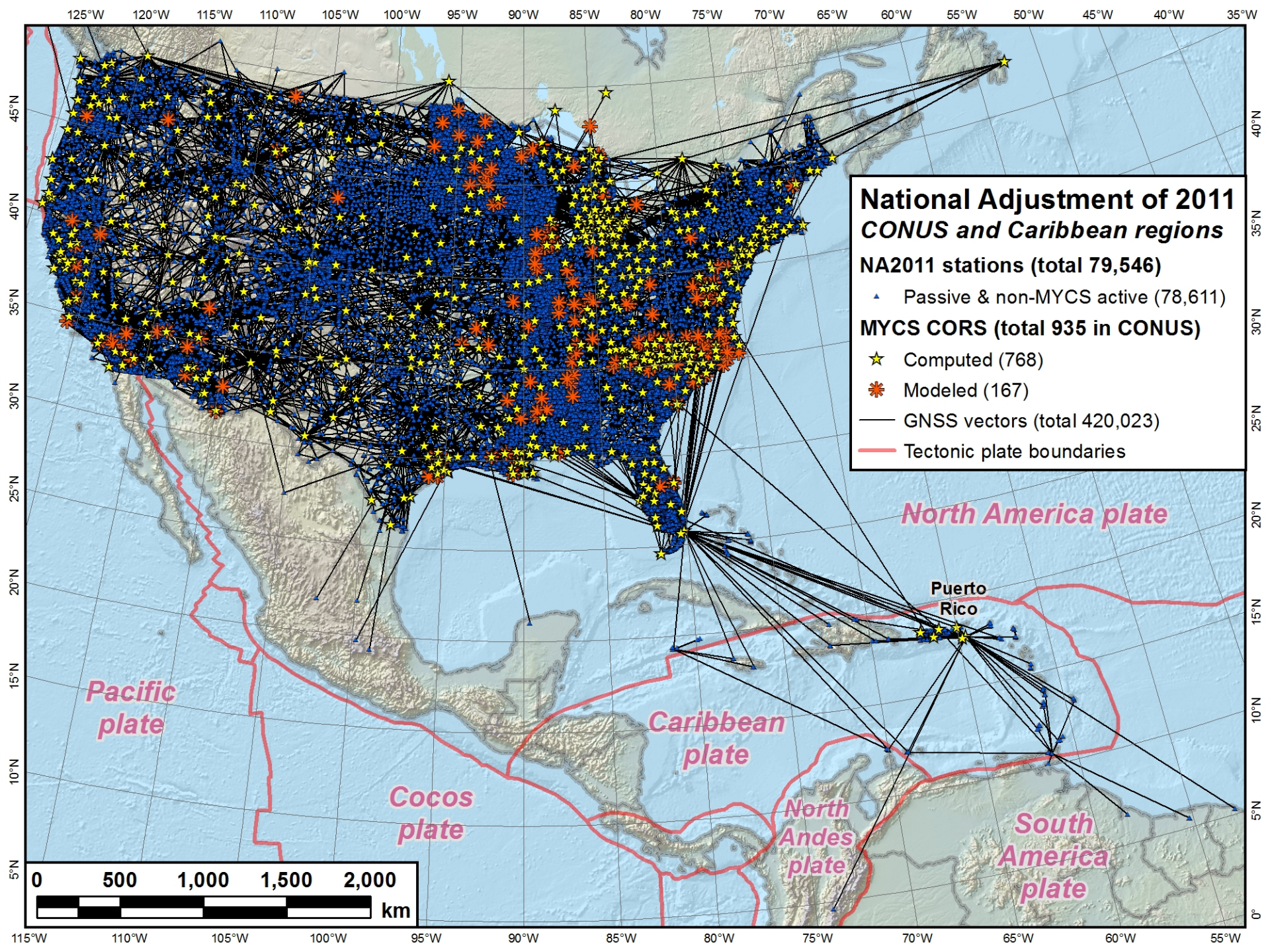
NA2011 project status

- Total: 4267 GPS projects; 81,055 stations; 424,721 vectors
 - Observations from April 1983 thru Dec 2011
 - Includes 1010 CORS with Multi-Year CORS Solution coordinates
 - Adjustment constrained **ONLY** to MYCS CORS coordinates
- CONUS and the Caribbean (plus Alaska)
 - 4228 GPS projects and 80,515 stations
 - 422,869 vectors total (approximately **405,000** enabled)
 - All referenced to North America tectonic plate
- *Comparison to NSRS2007 network (also CONUS+Carib+AK)*
 - 3418 projects → **24% more in NA2011**
 - 67,693 stations → **19% more in NA2011**
 - 283,691 vectors enabled → **43% more in NA2011**

NA2011 adjustment regions

- CONUS and Caribbean adjusted together
 - Both referenced to North America tectonic plate
- AK adjusted separately from CONUS and Caribbean
 - 142 projects, 969 stations, 2846 vectors
 - No useable ties to CONUS
 - Also referenced to North America tectonic plate
- Pacific region also adjusted separately
 - 39 projects, 540 stations, 1852 vectors
 - Referenced to different tectonic plates
 - Hawaii, American Samoa, Marshall Is., etc. → **Pacific plate**
 - Guam, Northern Mariana Islands, Palau → **Mariana plate**
 - ***Pacific not adjusted in NSRS2007 project***





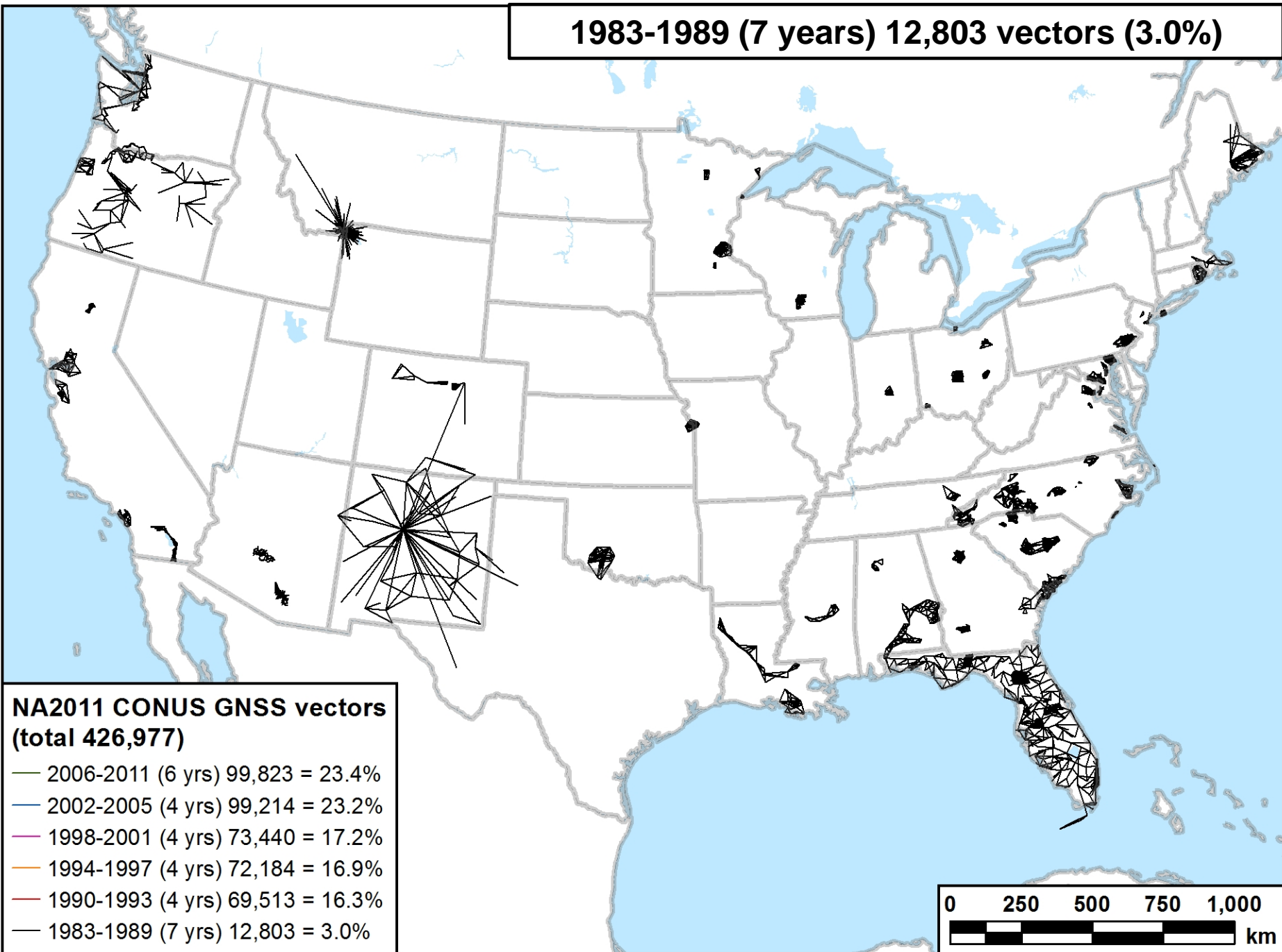
The building of a network

- Consists of many GPS vectors over time
 - Earliest vectors determined in April 1983
 - Last vectors determined in October 2011
- Vectors prior to ~1993/1994 may be problematic
 - Orbits not accurately determined
 - Poor or no models (e.g., tropo, ocean loading, etc.)
 - Early generation of receivers and antennas (noisier data)
 - Incomplete GPS constellation
 - No antenna phase center models
 - MYCS positions based only on data to 1994
- What should be done about the “old” data...?
 - Was project scaling sufficient? Do additional scaling?
 - Consider removing “old” data from adjustment?

A way to deal with the old & infirm?

- Remove “old” observations from overall network
 - Use cutoff of early 1994 (more or less)
 - Problem: Many projects include data spanning years
 - Solution: Remove projects with **first** observation before 1/1/1994 and **last** observation before 1/1/1995
 - **Primary network:** Observations from ~1994 and later
 - **Secondary networks:** Observations before ~1994
- 614 projects removed from primary network
 - 16,299 stations determined in secondary adjustments
 - 5321 stations in both primary and secondary groups
 - These will get adjusted coordinates in primary adjustment
 - Constrain secondary stations to NA2011 coords of these stations

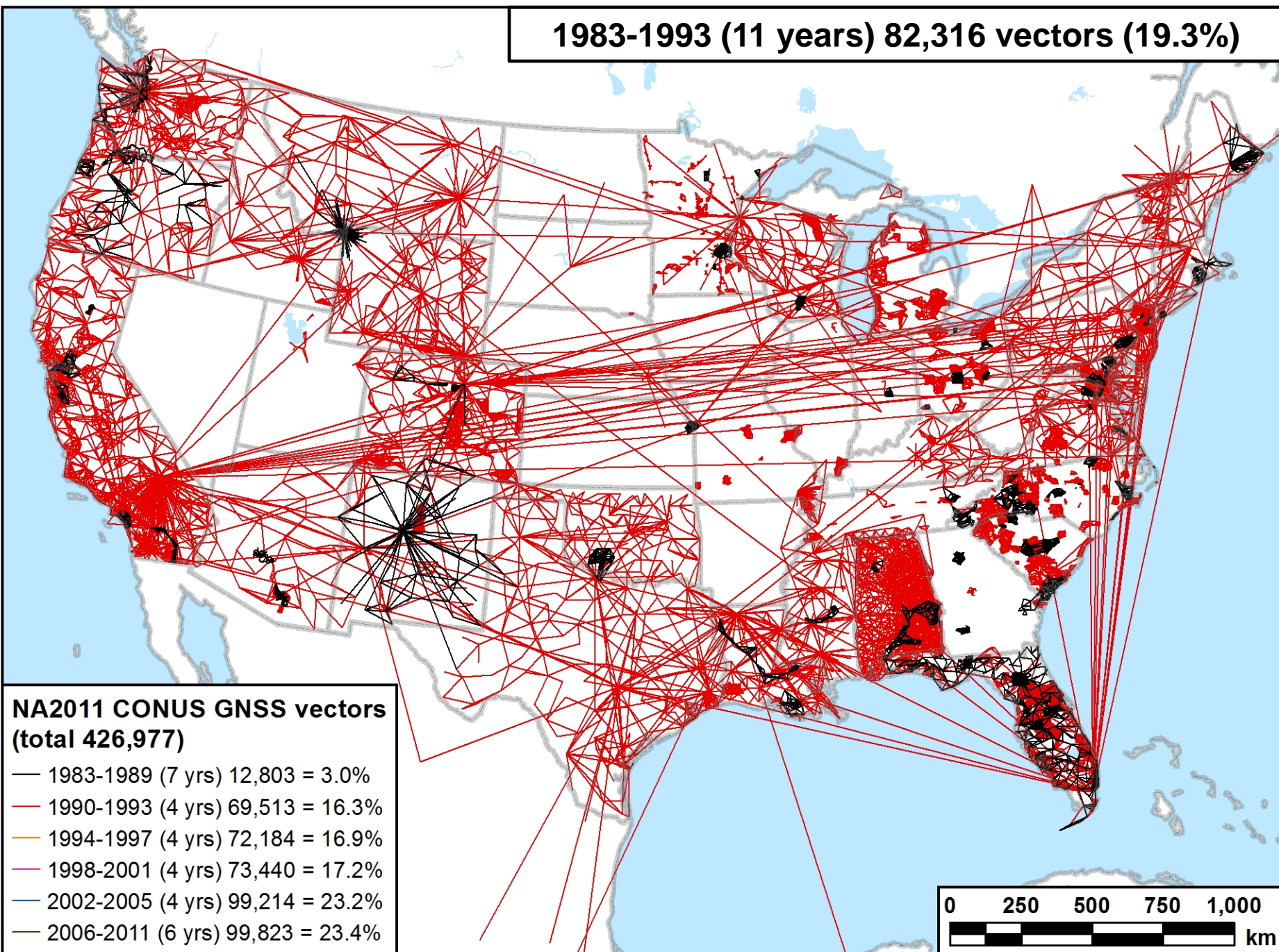
1983-1989 (7 years) 12,803 vectors (3.0%)



**NA2011 CONUS GNSS vectors
(total 426,977)**

- 2006-2011 (6 yrs) 99,823 = 23.4%
- 2002-2005 (4 yrs) 99,214 = 23.2%
- 1998-2001 (4 yrs) 73,440 = 17.2%
- 1994-1997 (4 yrs) 72,184 = 16.9%
- 1990-1993 (4 yrs) 69,513 = 16.3%
- 1983-1989 (7 yrs) 12,803 = 3.0%

1983-1993 (11 years) 82,316 vectors (19.3%)

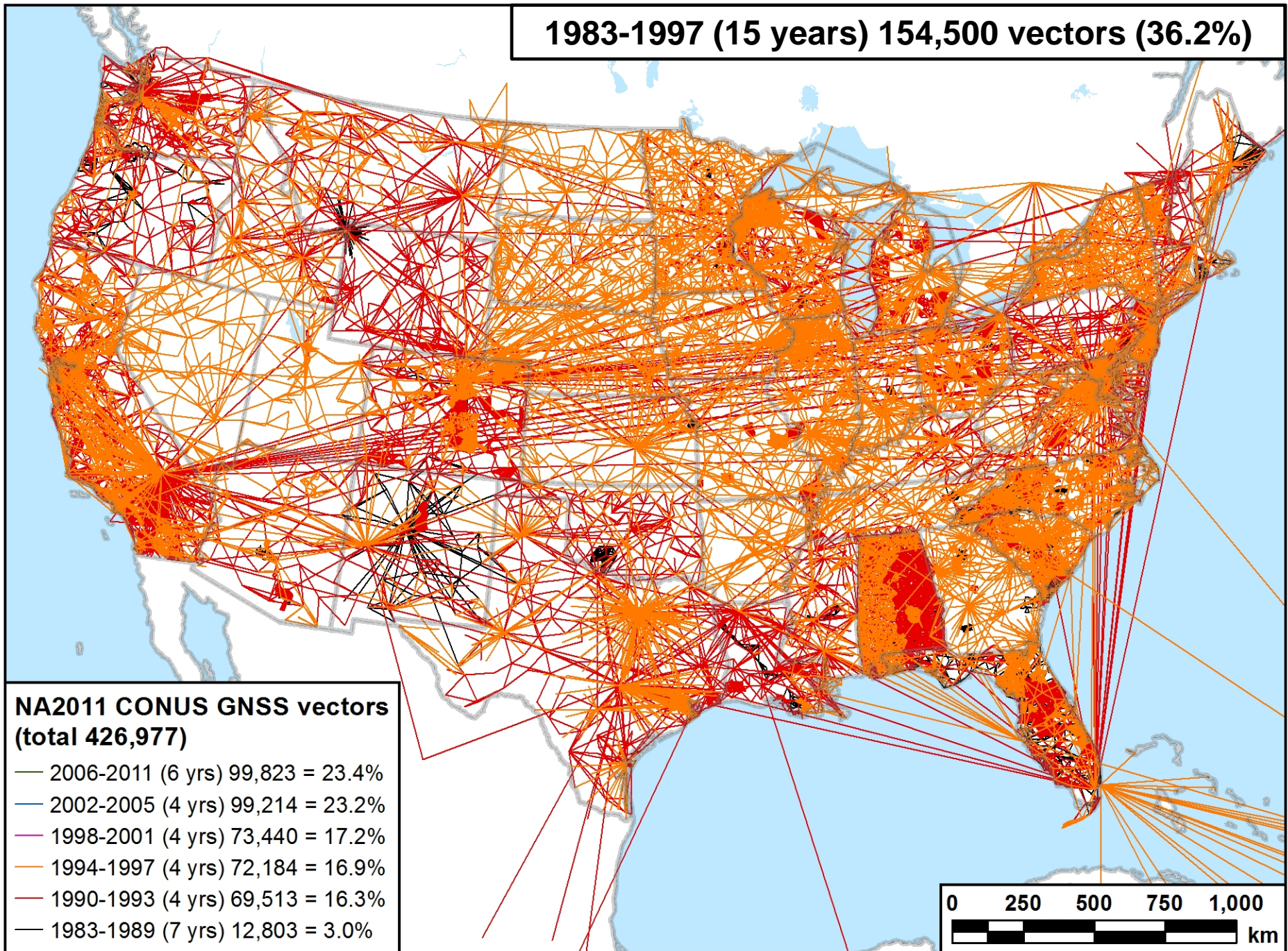


1983-1997 (15 years) 154,500 vectors (36.2%)

**NA2011 CONUS GNSS vectors
(total 426,977)**

- 2006-2011 (6 yrs) 99,823 = 23.4%
- 2002-2005 (4 yrs) 99,214 = 23.2%
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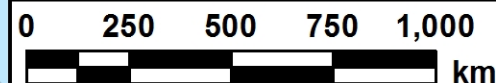
0 250 500 750 1,000
km



1983-2001 (19 years) 227,940 vectors (53.4%)

**NA2011 CONUS GNSS vectors
(total 426,977)**

- 2006-2011 (6 yrs) 99,823 = 23.4%
- 2002-2005 (4 yrs) 99,214 = 23.2%
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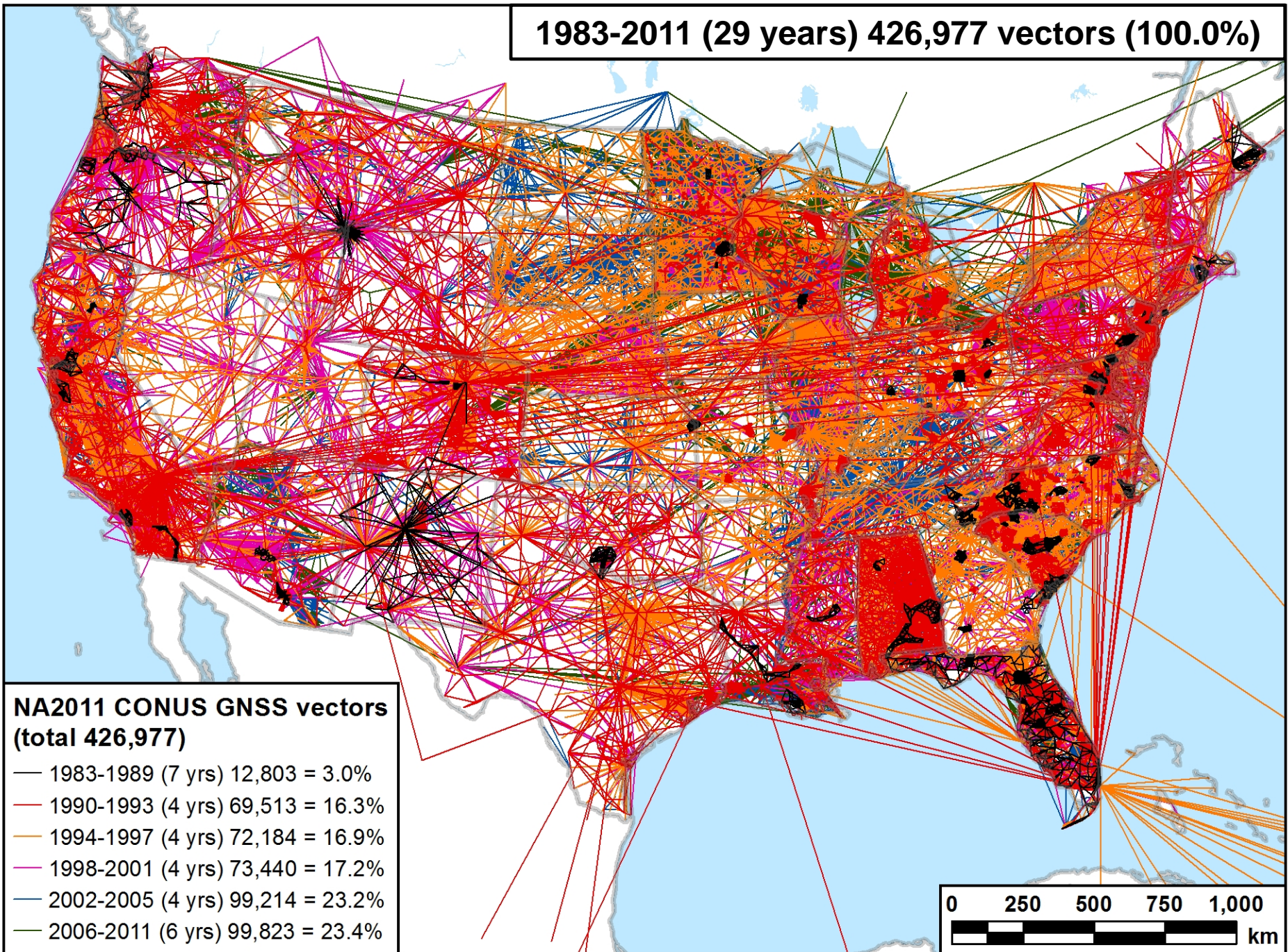


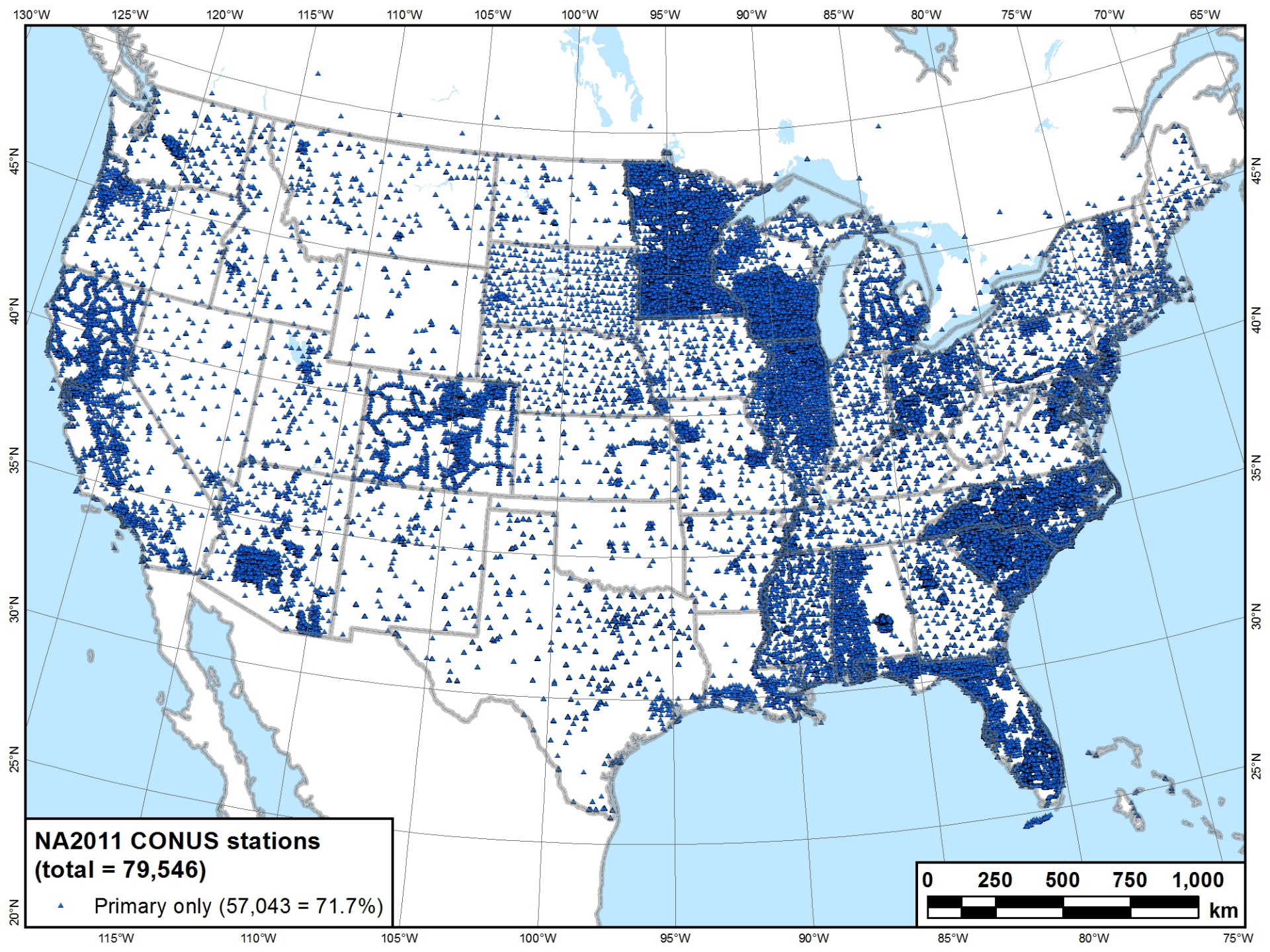
1983-2011 (29 years) 426,977 vectors (100.0%)

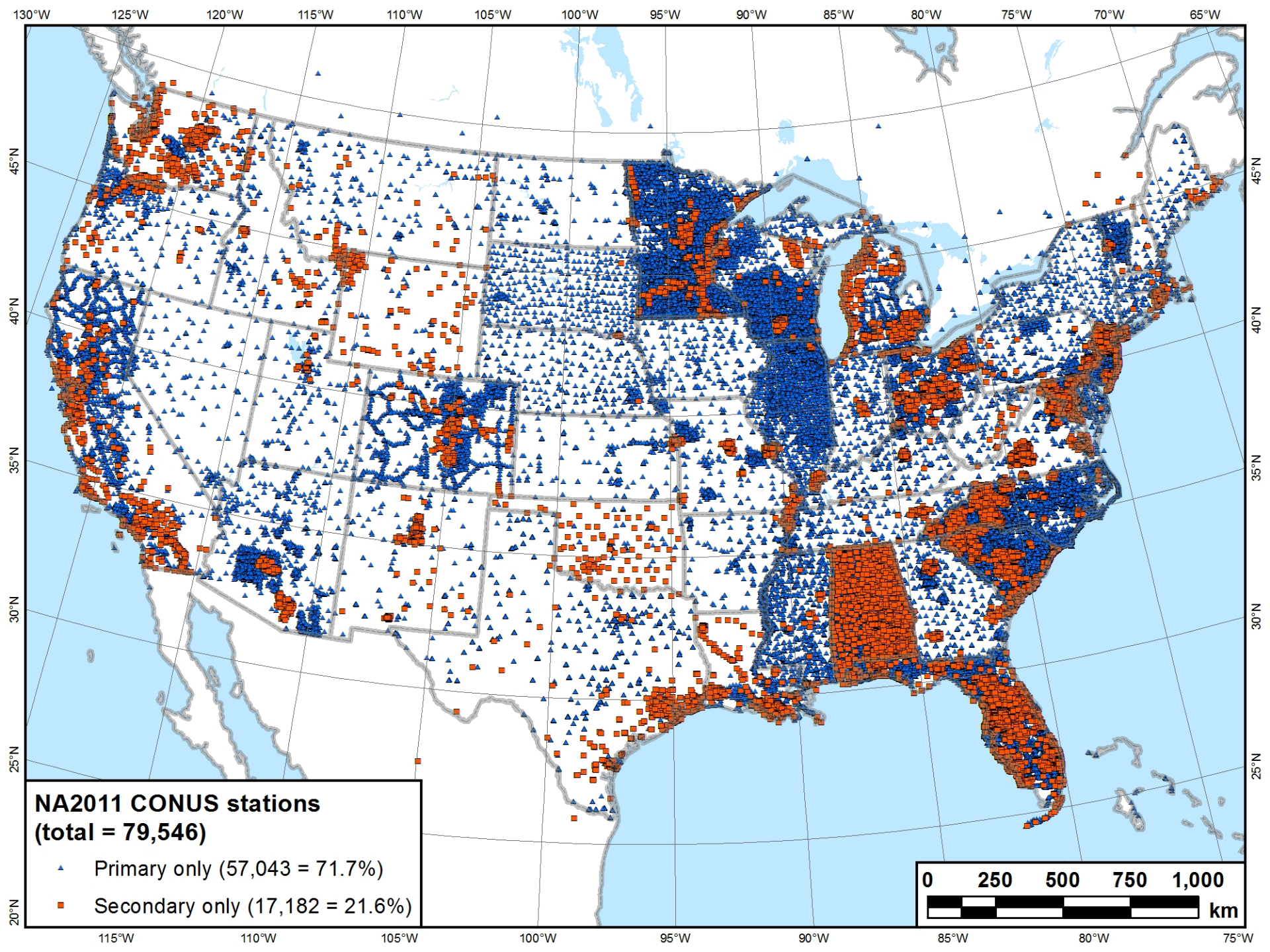
**NA2011 CONUS GNSS vectors
(total 426,977)**

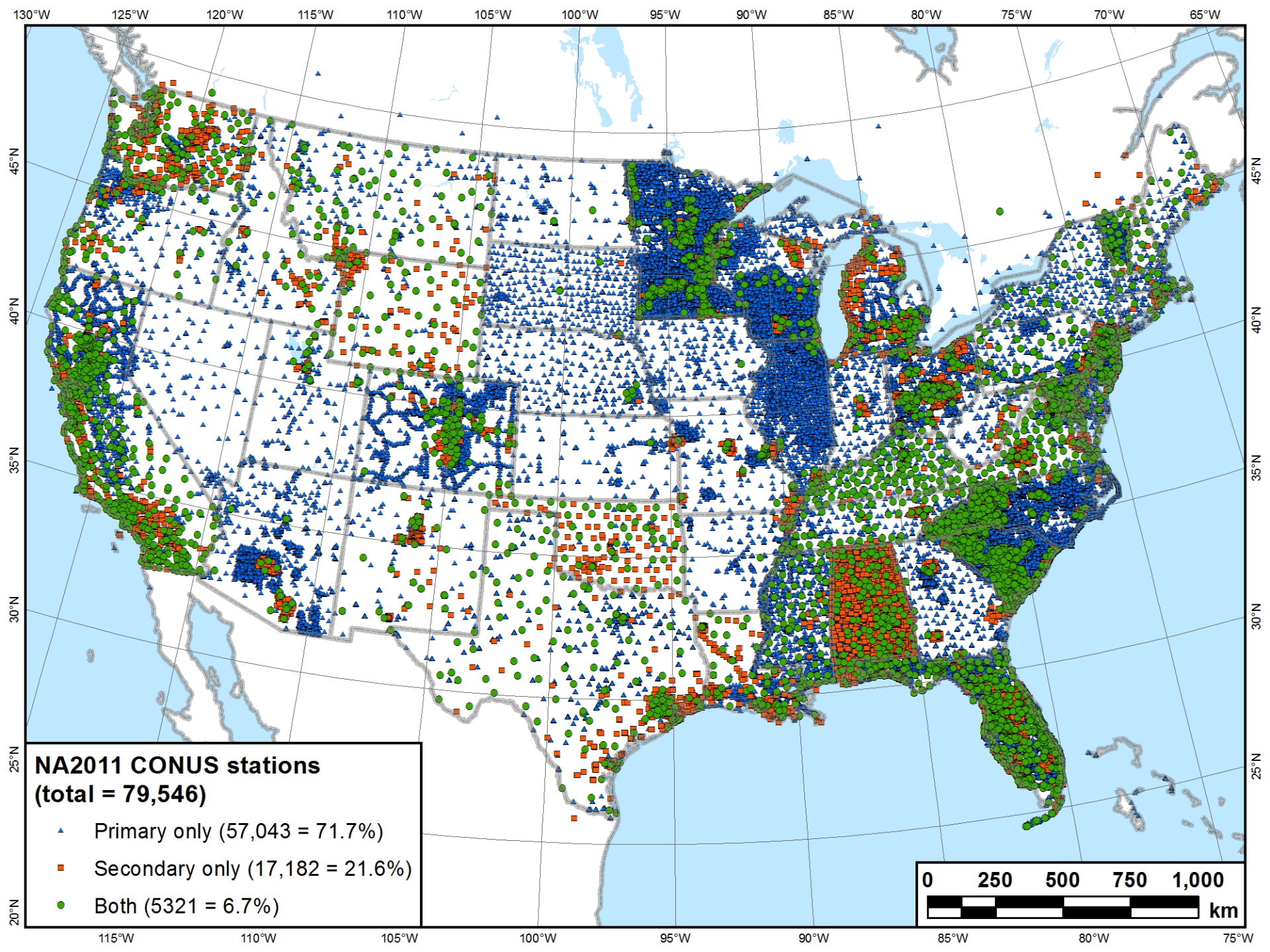
- 1983-1989 (7 yrs) 12,803 = 3.0%
- 1990-1993 (4 yrs) 69,513 = 16.3%
- 1994-1997 (4 yrs) 72,184 = 16.9%
- 1998-2001 (4 yrs) 73,440 = 17.2%
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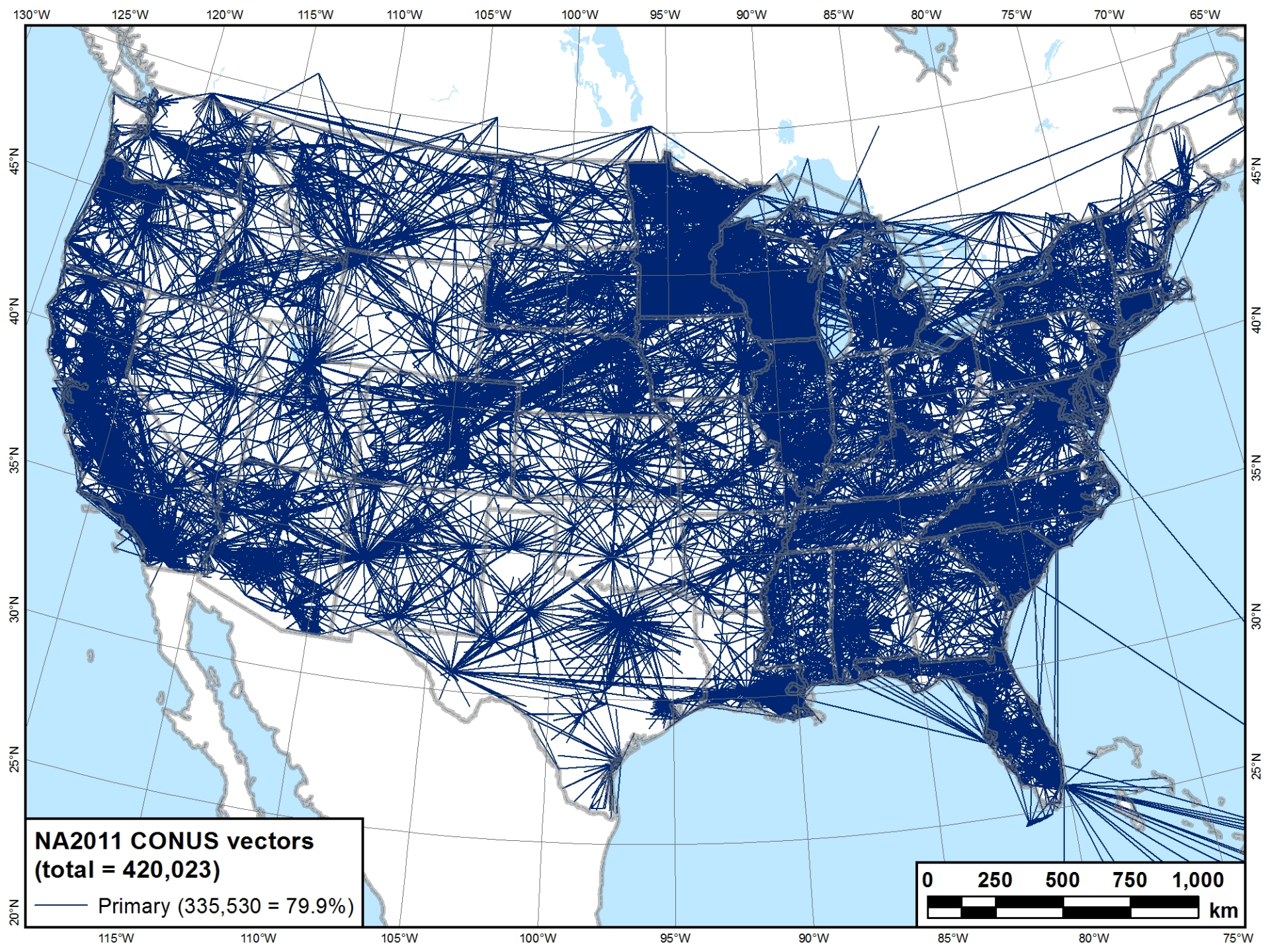
0 250 500 750 1,000
km

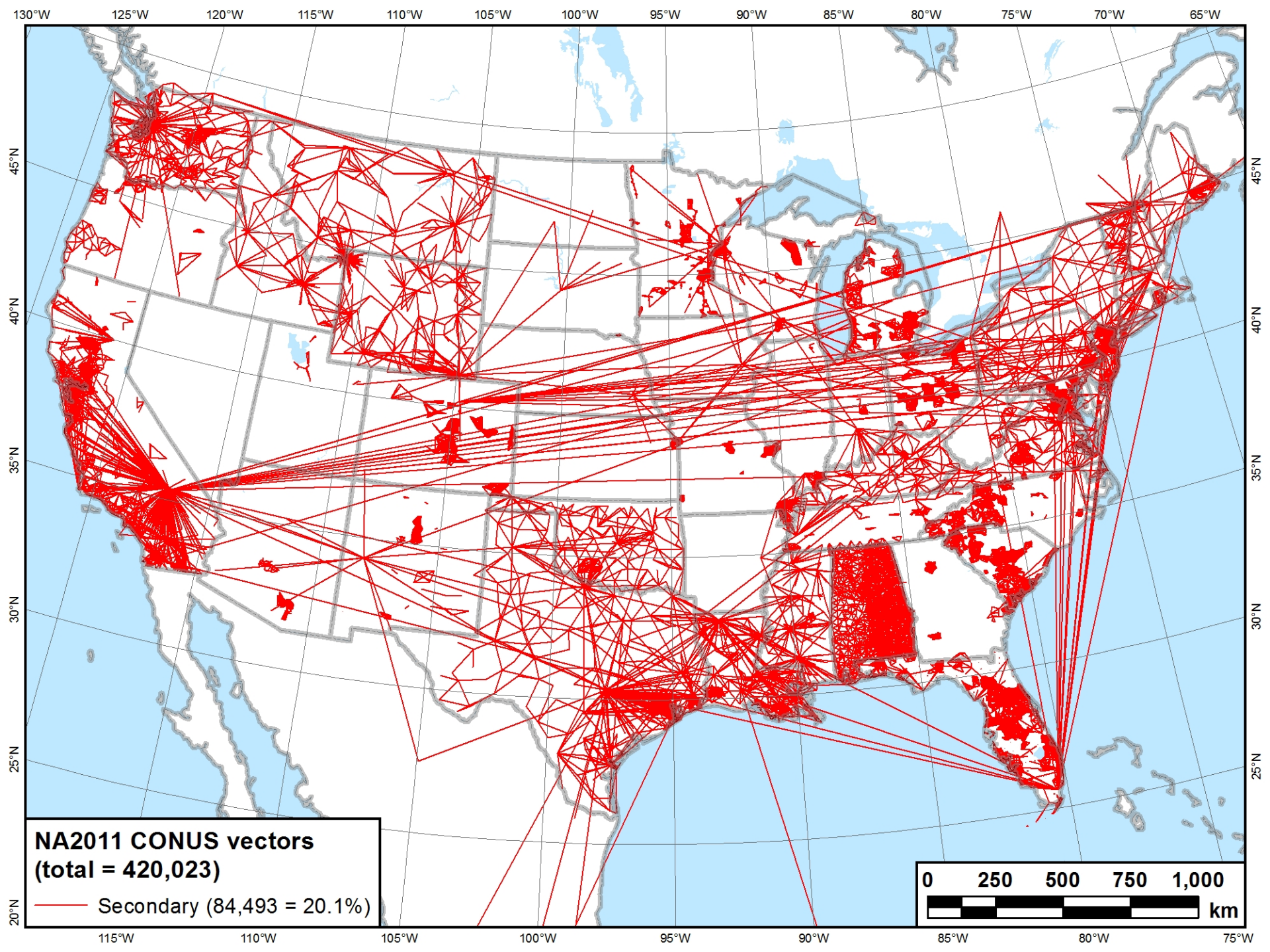


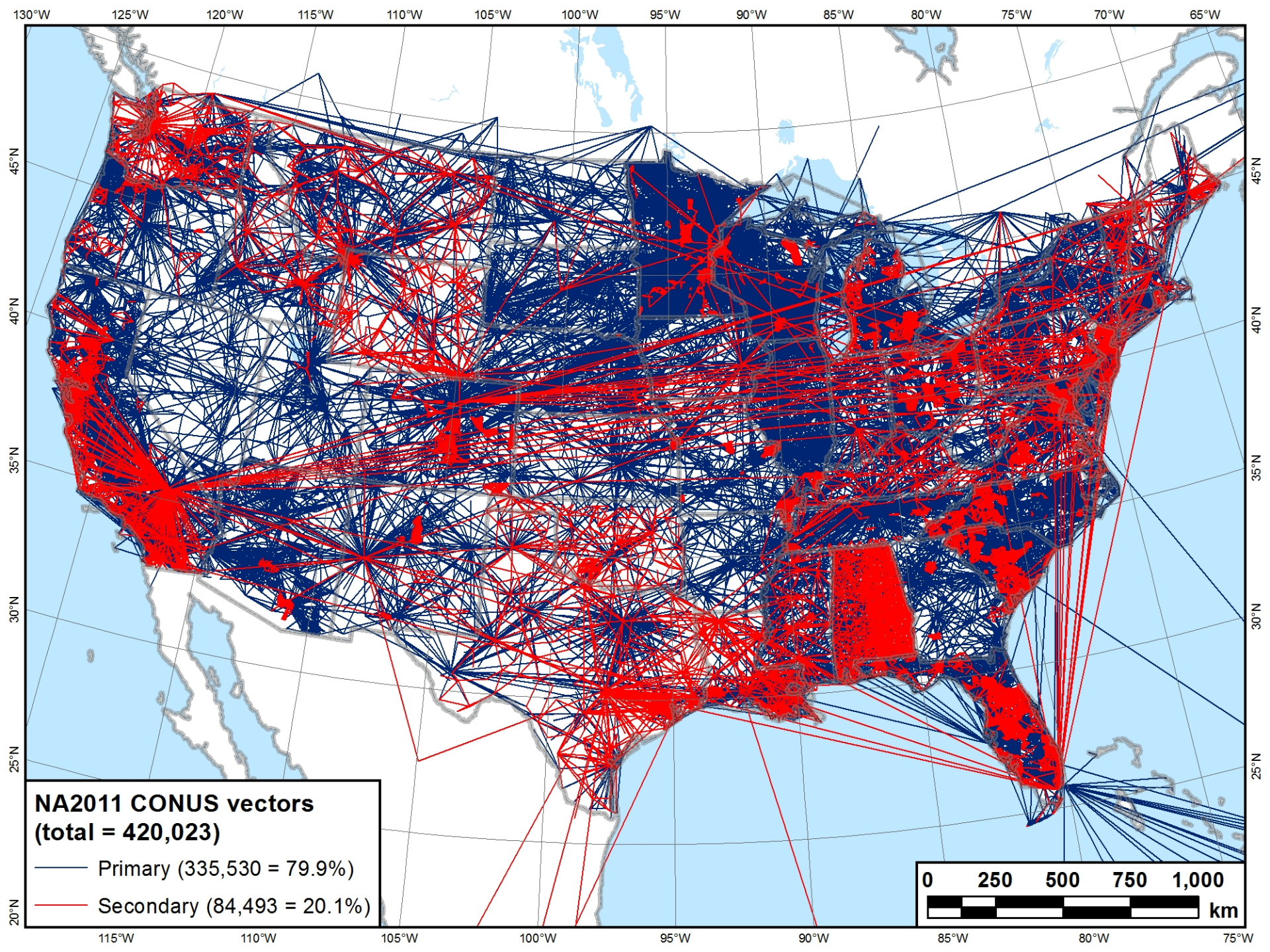


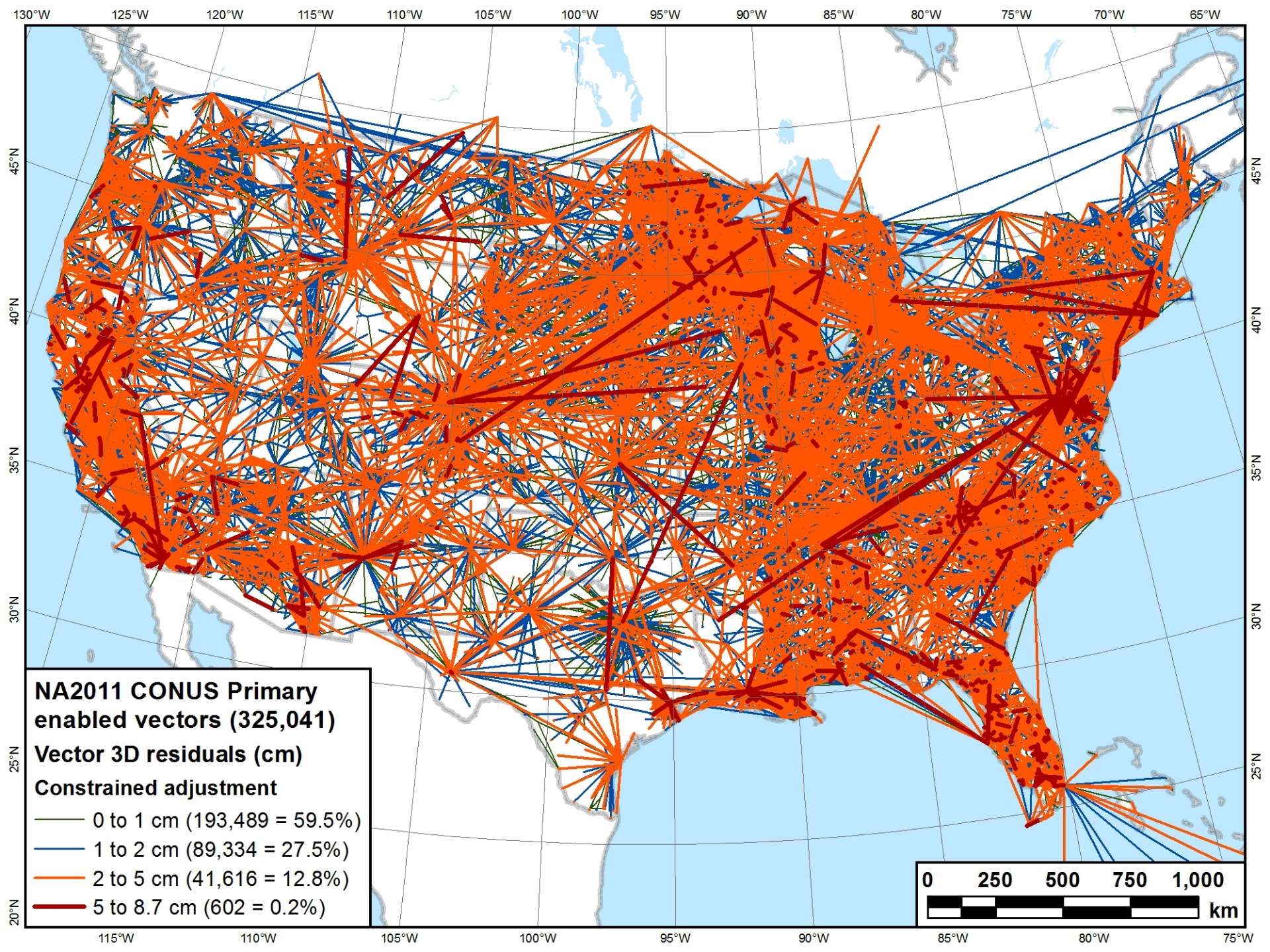






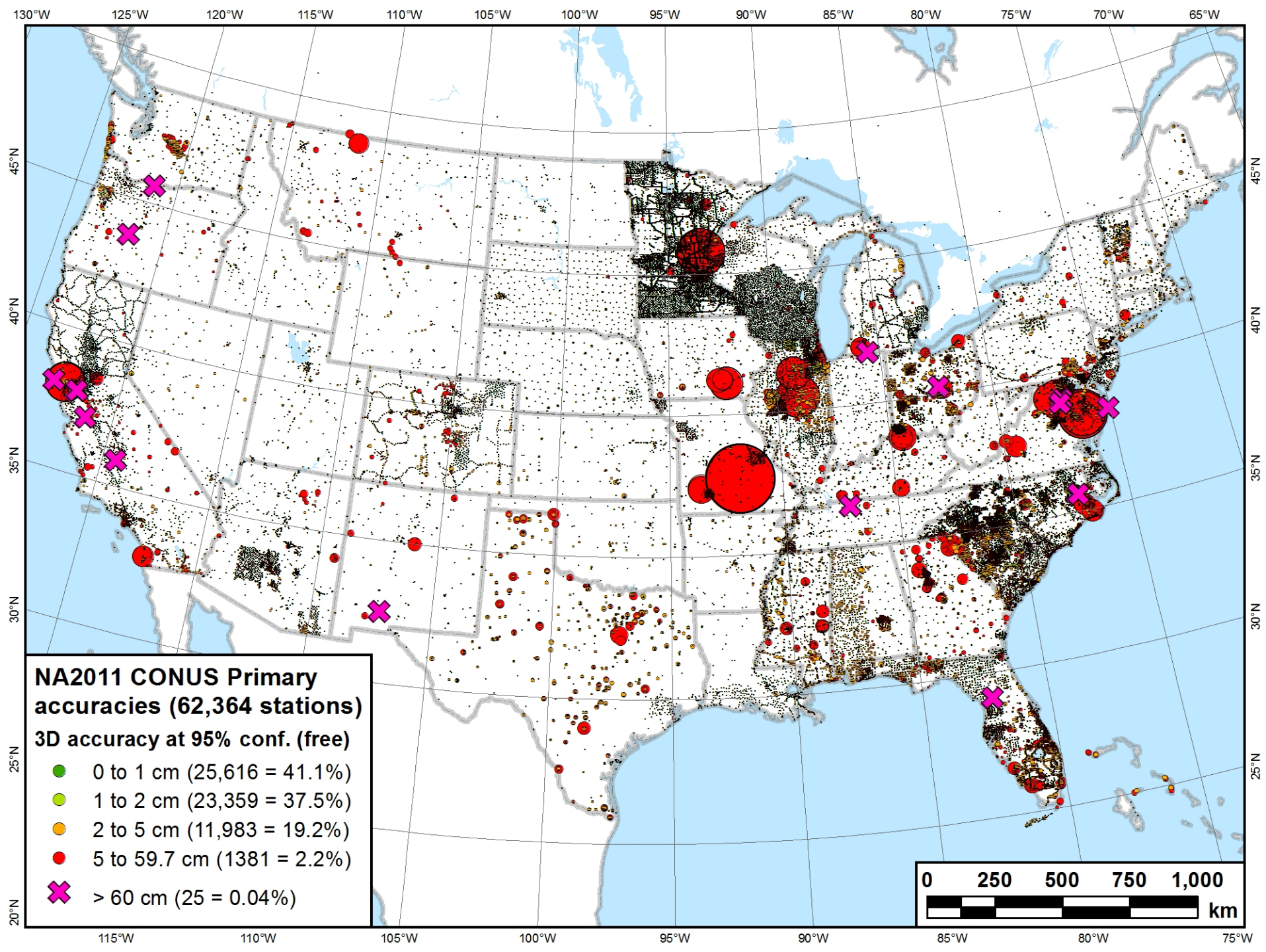


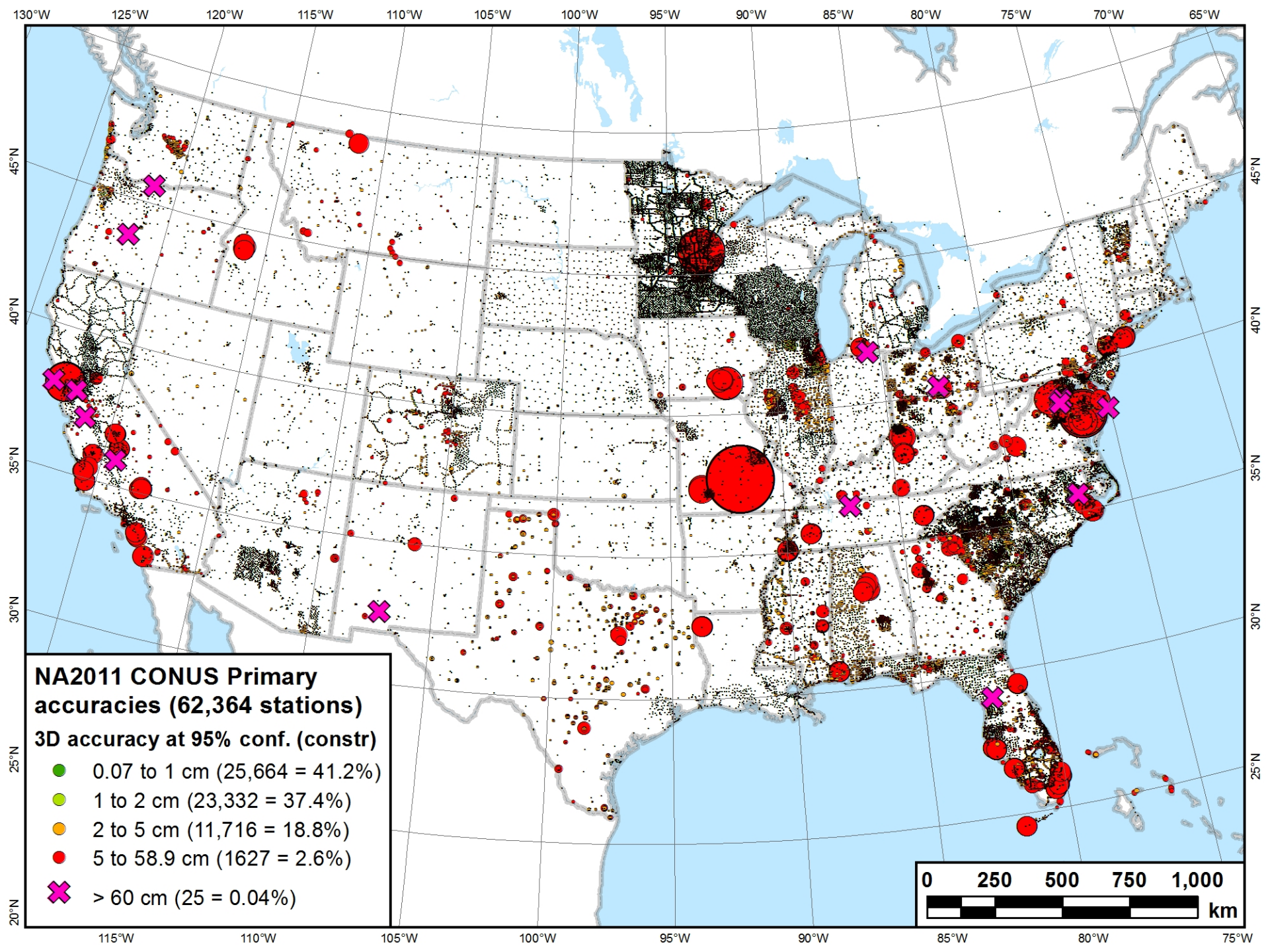




Preliminary results (4/5/2012)

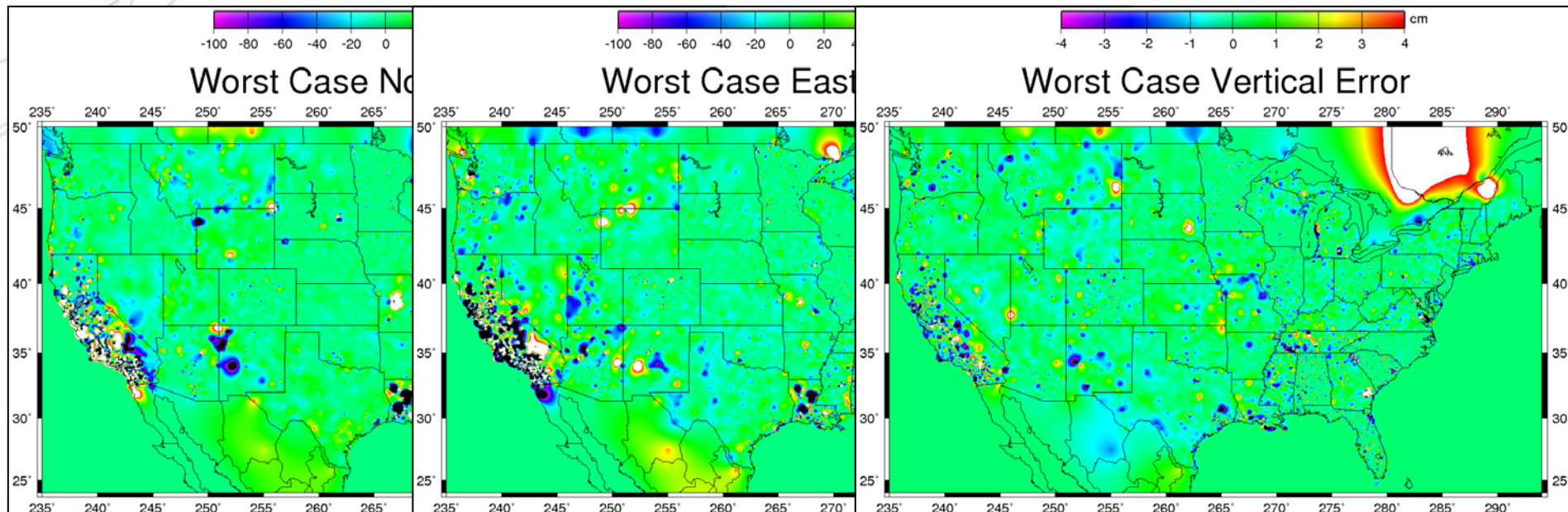
- CONUS Primary constrained adjustment
 - Station accuracies at 95% confidence
 - 62,351 stations connected with enabled vectors
 - Median accuracy **0.7 cm** horizontal, **1.2 cm** vertical
 - ***95% better than 3 cm horiz, 96% better than 5 cm vert***
 - Station coordinate and height changes
 - Median and mean position and height change **2 cm**
 - Max horiz = 39 cm, max and min height = -41 cm, +21 cm
 - ***4% changed position and 2% changed height > 5 cm***
 - Vector residuals (325,041 enabled)
 - Median absolute value **0.5 cm** horizontal and vertical
 - ***99% of residuals < 3 cm horizontal and < 4 cm vertical***



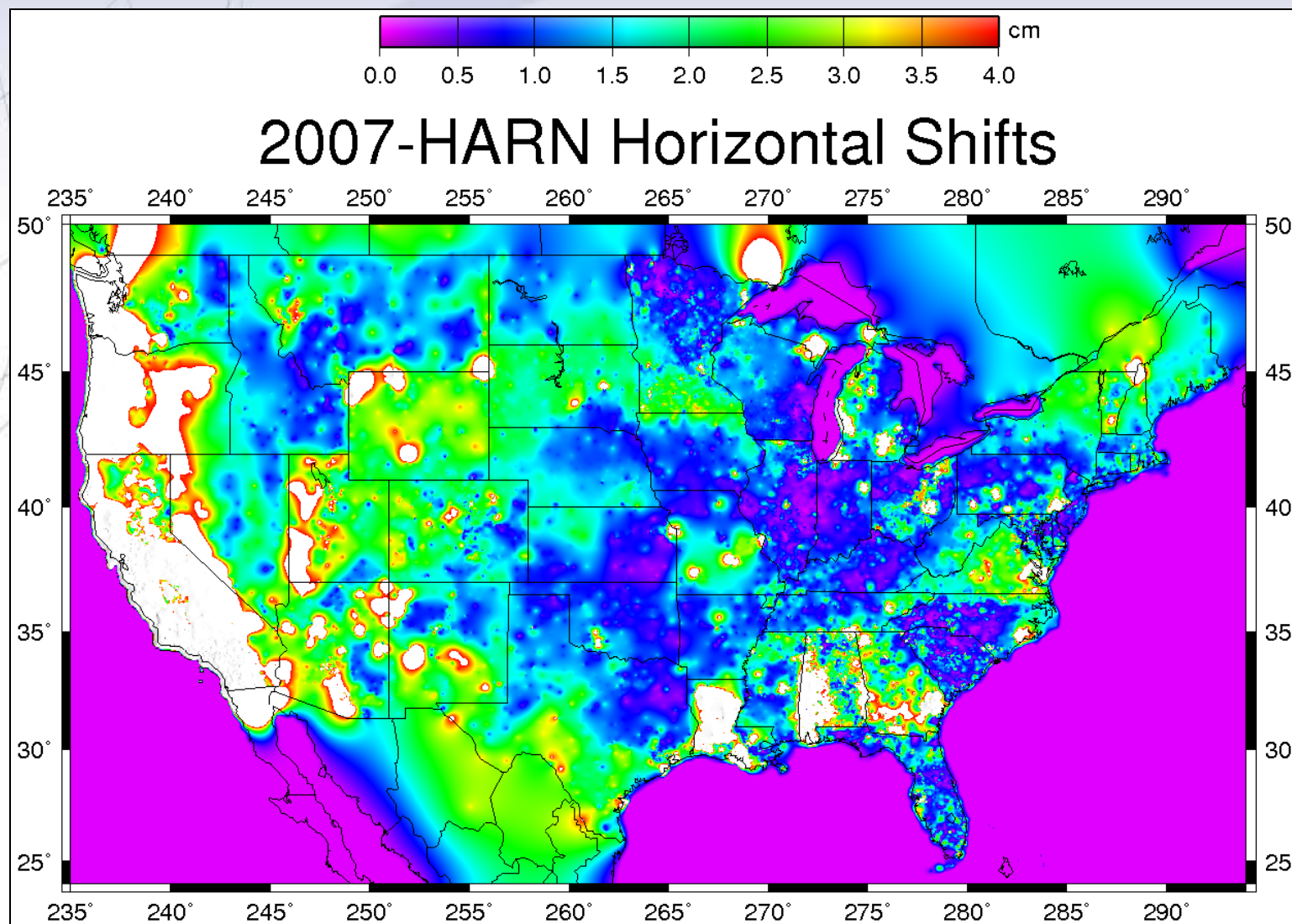


Related Tasks, Products & Deliverables

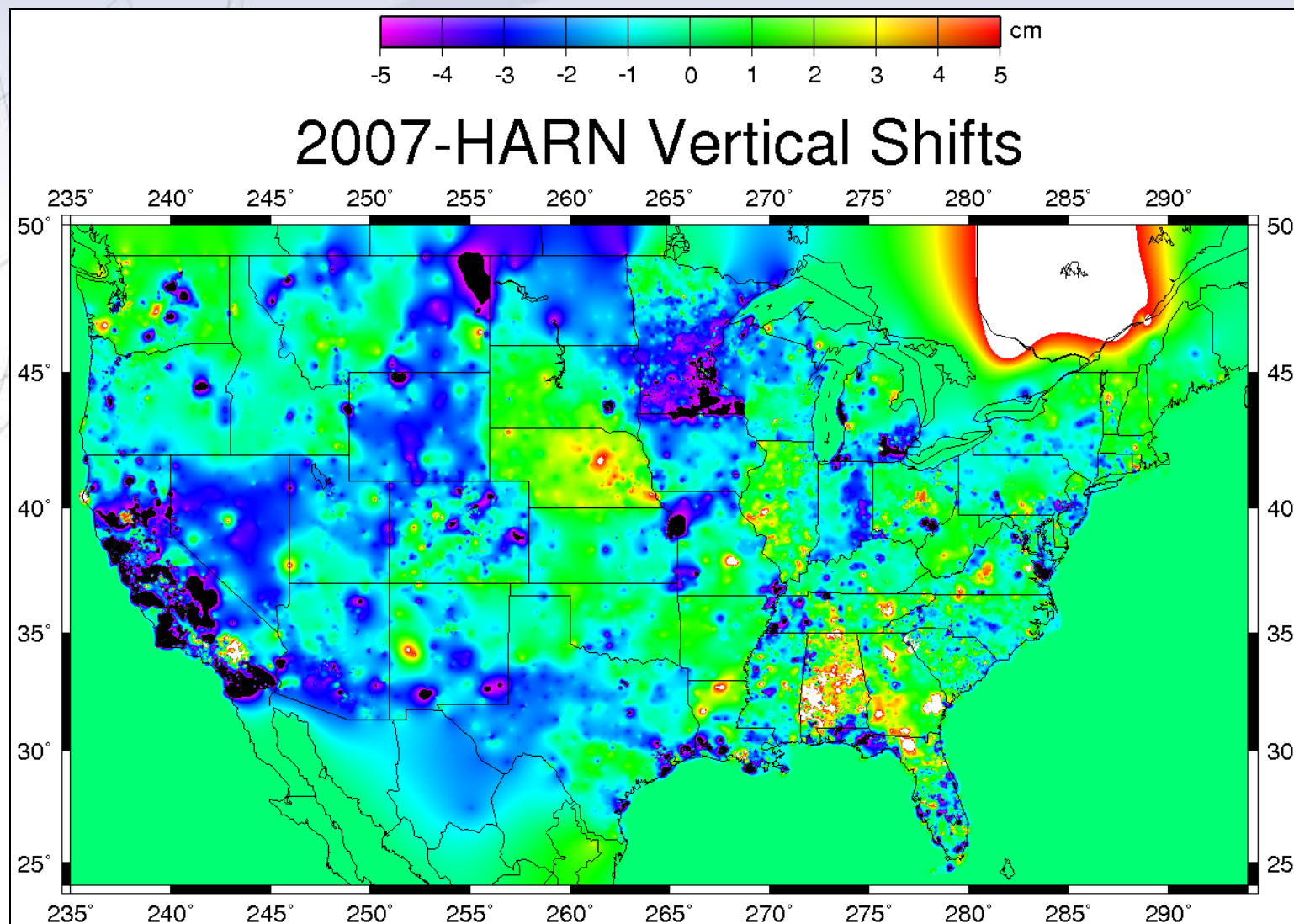
- New NAD 83 coordinate transformations
 - NAD 83 “HARN” \leftrightarrow NAD 83(NSRS2007/CORS96)
 - Algorithm for this tool already created
 - NAD 83(NSRS2007/CORS96) \leftrightarrow NAD 83(2011)
 - Will build this tool as soon as NA2011 results available
 - Include output that indicates quality
 - Provided as (conservative) error grids and reports



Related Tasks, Products & Deliverables

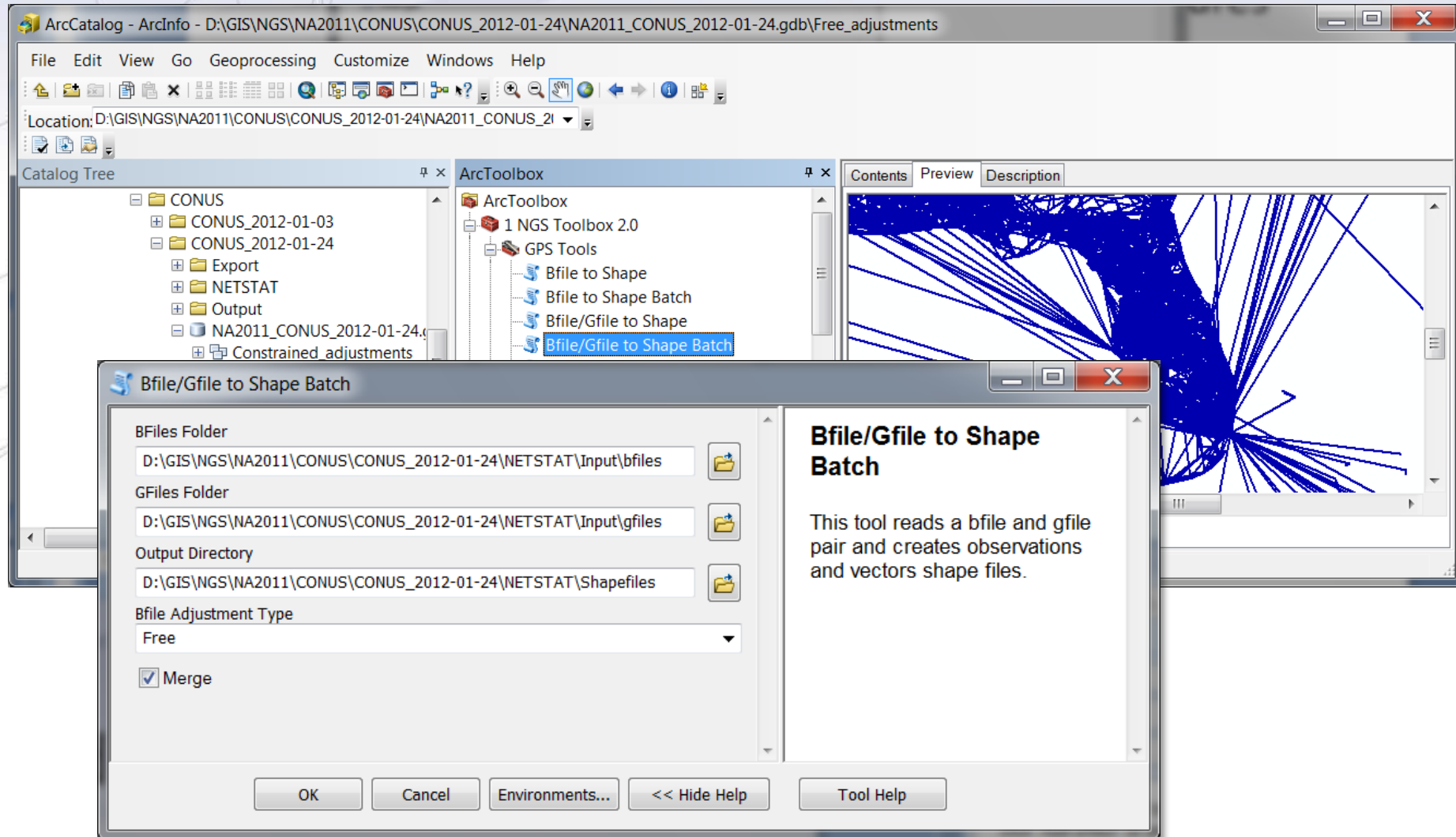


Related Tasks, Products & Deliverables



Related Tasks, Products & Deliverables

- New Geodetic GIS tools





More information...

National Geodetic Survey

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January 10, 2012

Announcements

The NGS Map and Shoreline Data Explorer Applications will be unavailable Tuesday, January 10th from 9am until 12pm Eastern Time due to security patching. If you have any questions, please contact the **NGS Webmaster**.

NGS Releases Beta LOCUS for Testing

NGS has released a Beta version of the **Leveling Online Computations User Service**, LOCUS, for a 90-day comment period. Through the end of March 2012, NGS is requesting our stakeholders and constituents to test their leveling projects with LOCUS and provide feedback to us at...**more**

NGS Announces New Photo Submission Guidelines:

http://geodesy.noaa.gov/web/surveys/photo_submissions/

NGS Releases Final Report for Floodplain Mapping Pilot Project

As NGS moves closer to 2022 and replacing the **North American Datum of 1983** (NAD 83) and the **North American Vertical Datum of 1988** (NAVD 88), NGS is interacting closely with agencies that use the datums to assist in the transition...**more**

Notice: Planned Updates to NGS Datasheet Format

In response to stakeholder and NGS staff concerns, NGS has developed several modifications to the format of the **NGS datasheet**—the primary method for accessing the passive control network of the National Spatial Reference System (NSRS)...**more**

NRC Highlights Importance of NGS Products...



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