

National Elevation Dataset

April, 2012 Release Notes

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Latest Release

The April, 2012 update of the National Elevation Dataset (NED) 1-, 1/3- and 1/9-arc-second collections were released on April 18, 2012. This marks the 65th update of the 1-arc-second layer since bi-monthly revisions began in June, 2000. This release incorporates new light detection and ranging (lidar) data in addition to new standard production 10-meter digital elevation models (DEMs).

The next release is scheduled for June 5, 2012.

Highlights

Elevation data along the U. S. and Canadian border have been added to the 1-arc-second NED layer during the April, 2012 update. These data are the result of collaboration between U.S. Geological Survey (USGS) and Natural Resources Canada (NRCAN) Centre for Topographic Information—Sherbrook, Ottawa. NRCAN delegates visited the USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, SD, and participated in technical discussions with EROS Topographic Science researchers. Both parties presented information about their respective elevation datasets, processing techniques, and future development plans. The Canadian data and accompanying metadata were provided by NRCAN. USGS EROS employees improved the topographic information along the international border by making the U.S. / Canada elevation data seamless in the 1-arc-second NED. These data complete the watersheds originating in the U.S. and fill a small void that existed between the two elevation datasets. The next release of the NED, due June 5, 2012, will include Canada elevation data along the border of Alaska.

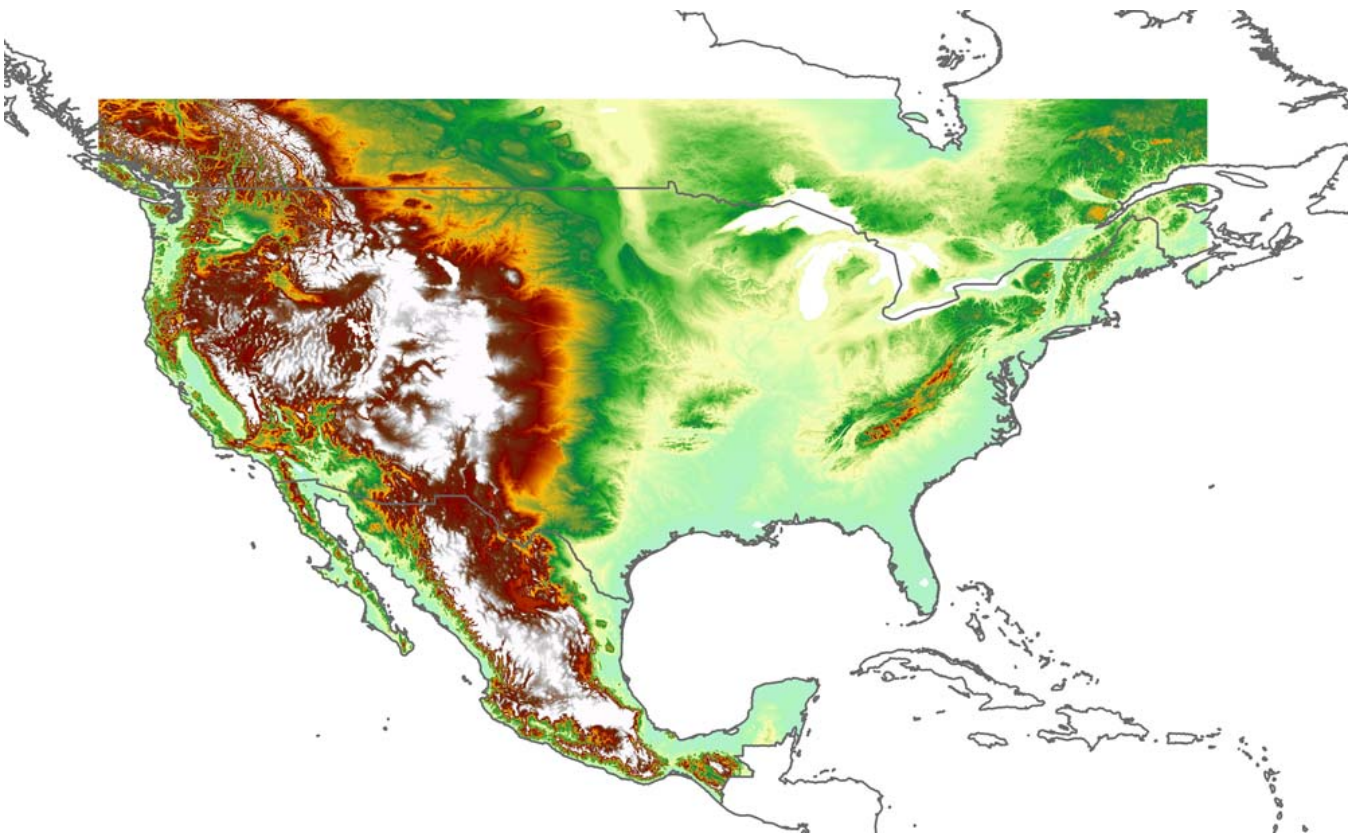


Figure 1. NED 1-arc-second coverage with the newly included Canadian data

The second highlight is the addition of a NED 1/9-arc-second dataset in northeastern Iowa that was processed through a new voids analysis procedure being developed. This procedure identifies excessive TIN artifacts in water bodies and stream channels due to the lidar pulses being absorbed by water, reducing the point densities and causing TIN artifacts during lidar DEM production. Correcting these artifacts allows the high resolution source data to be used throughout all the NED layers. This procedure is in the initial stages of development but is looking very promising for lidar feature extraction. The intention would be to reclaim lidar dataset that have been denied inclusion into specific layers of the NED because of excessive TIN artifacts over water. It is not intended to offset the Lidar Specification requirement for lidar datasets to be hydro-flattened.

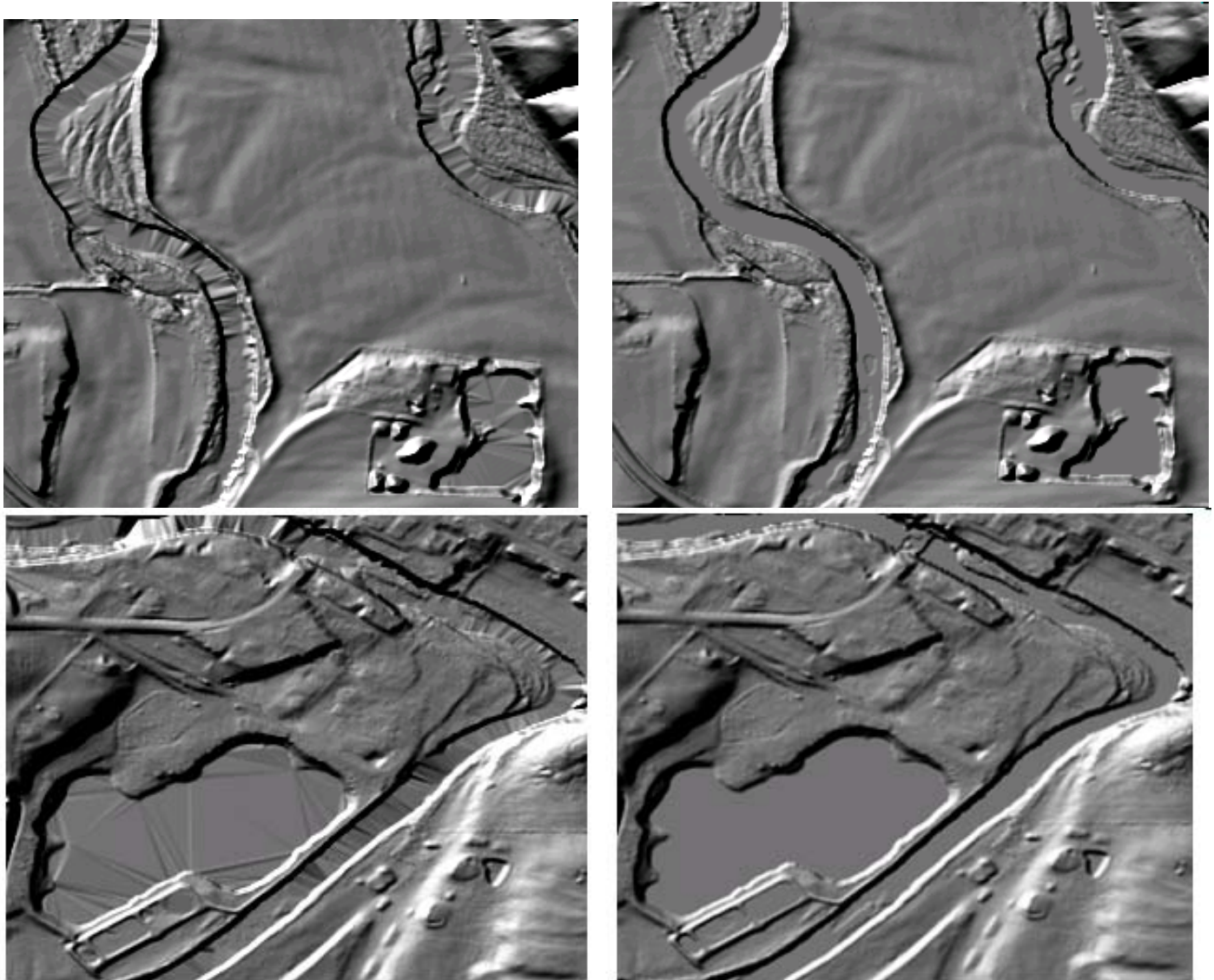


Figure 2. Examples on the left contain excessive TIN artifacts. Examples on the right were modified with voids analysis methods to correct TIN artifacts in the northeast Iowa data for incorporation into the 1/9-arc-second NED.

Areas where new data were incorporated in this and other recent releases are indicated in Figure 3.

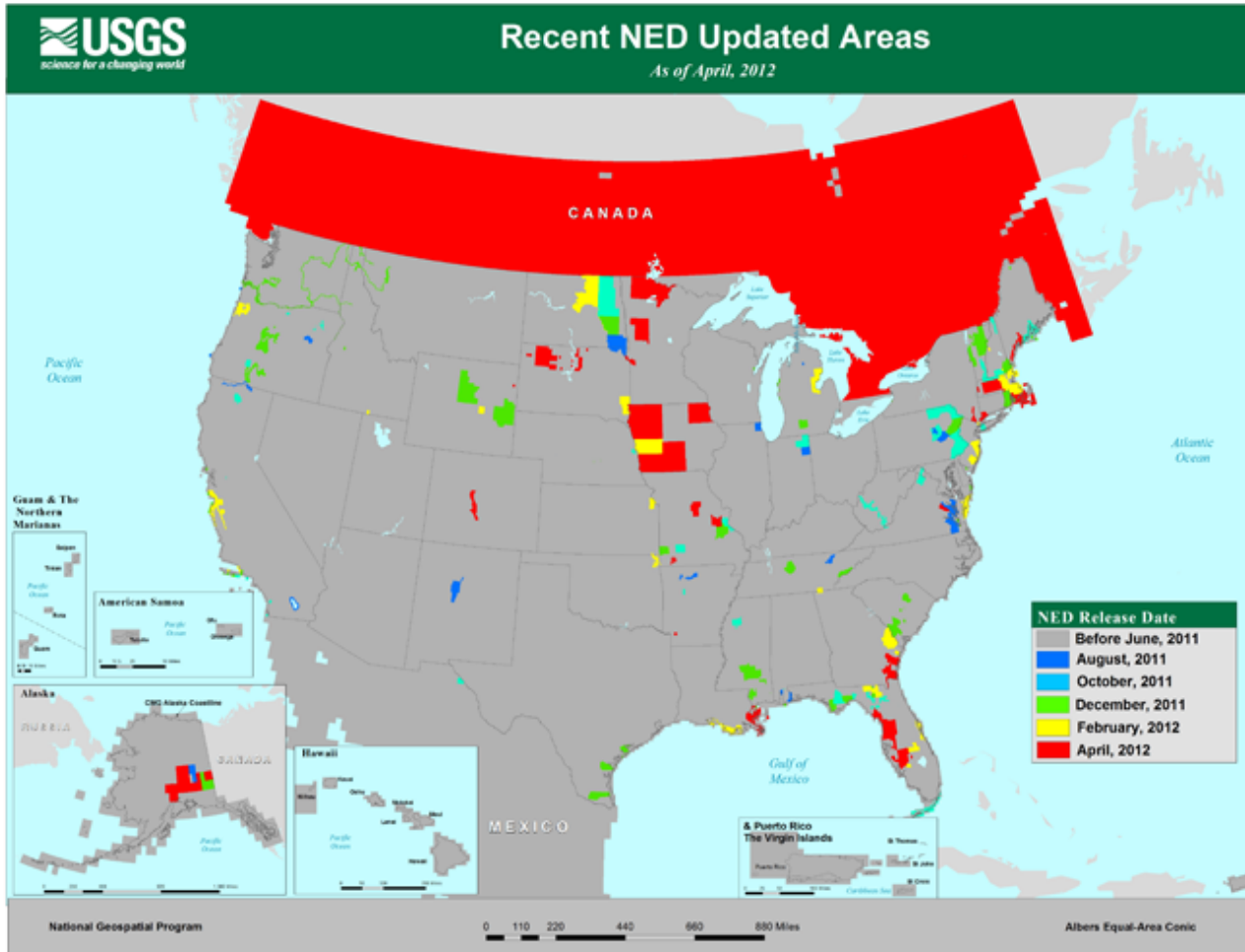


Figure 3. NED updated areas by release date -- April, 2012 release.

Resolutions of Data Available

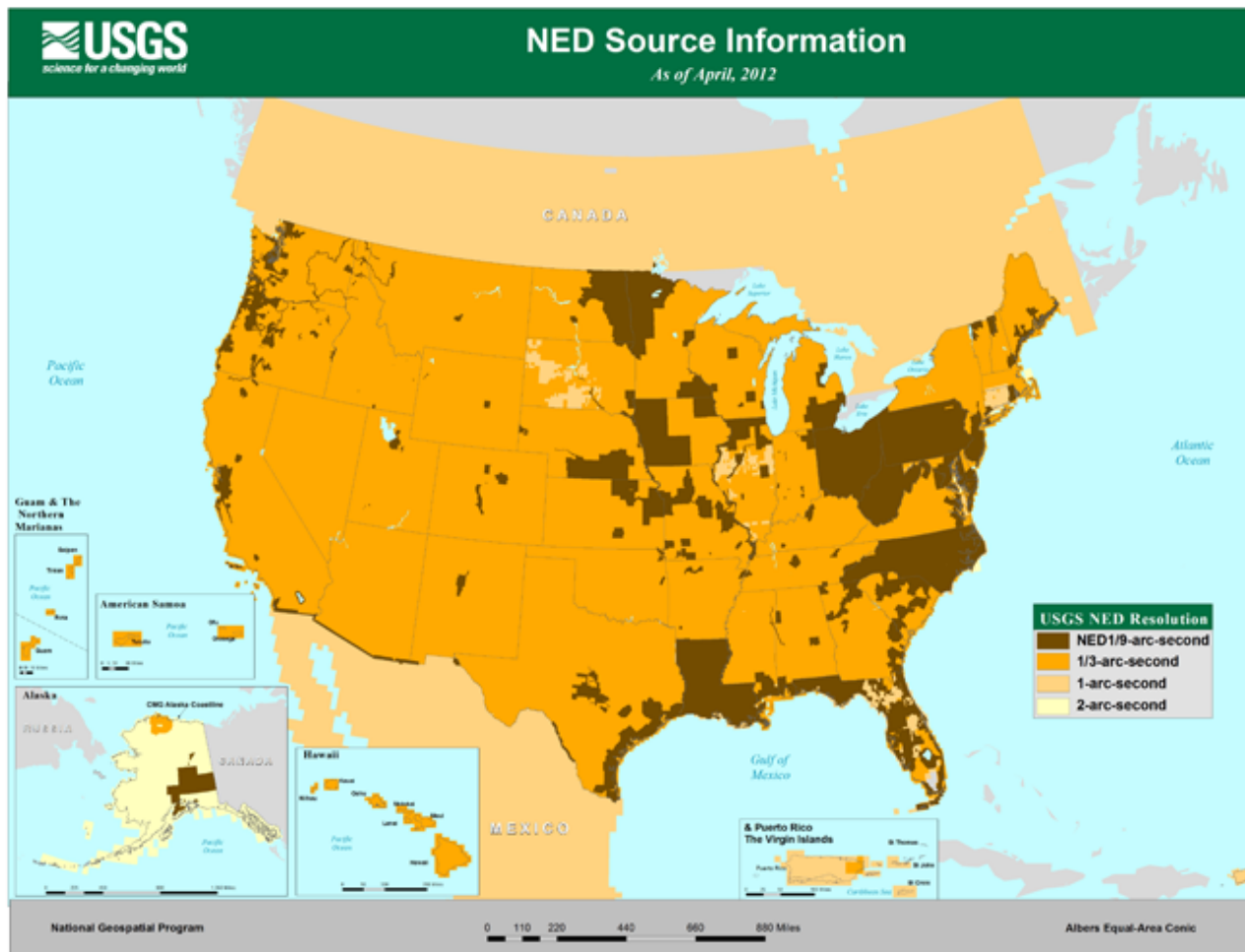


Figure 4. Composite of source data by resolution – April, 2012 release.

High-Resolution (1/9-arc-second) Data

The 1/9-arc-second NED is being developed from high resolution source data (3-meter or better point spacing from lidar, photogrammetry, or other sources). Higher resolution layers are being populated through the integration of data from various sources using new technologies, and are acquired through partnerships with Federal, State, and local partners, who provide access to the best available local information. As data are acquired and made available in the public domain, they are incorporated into the NED at a 1/9-arc-second resolution. Figure 5 shows the areas that reside in the NED 1/9-arc-second layer, as of April, 2012.

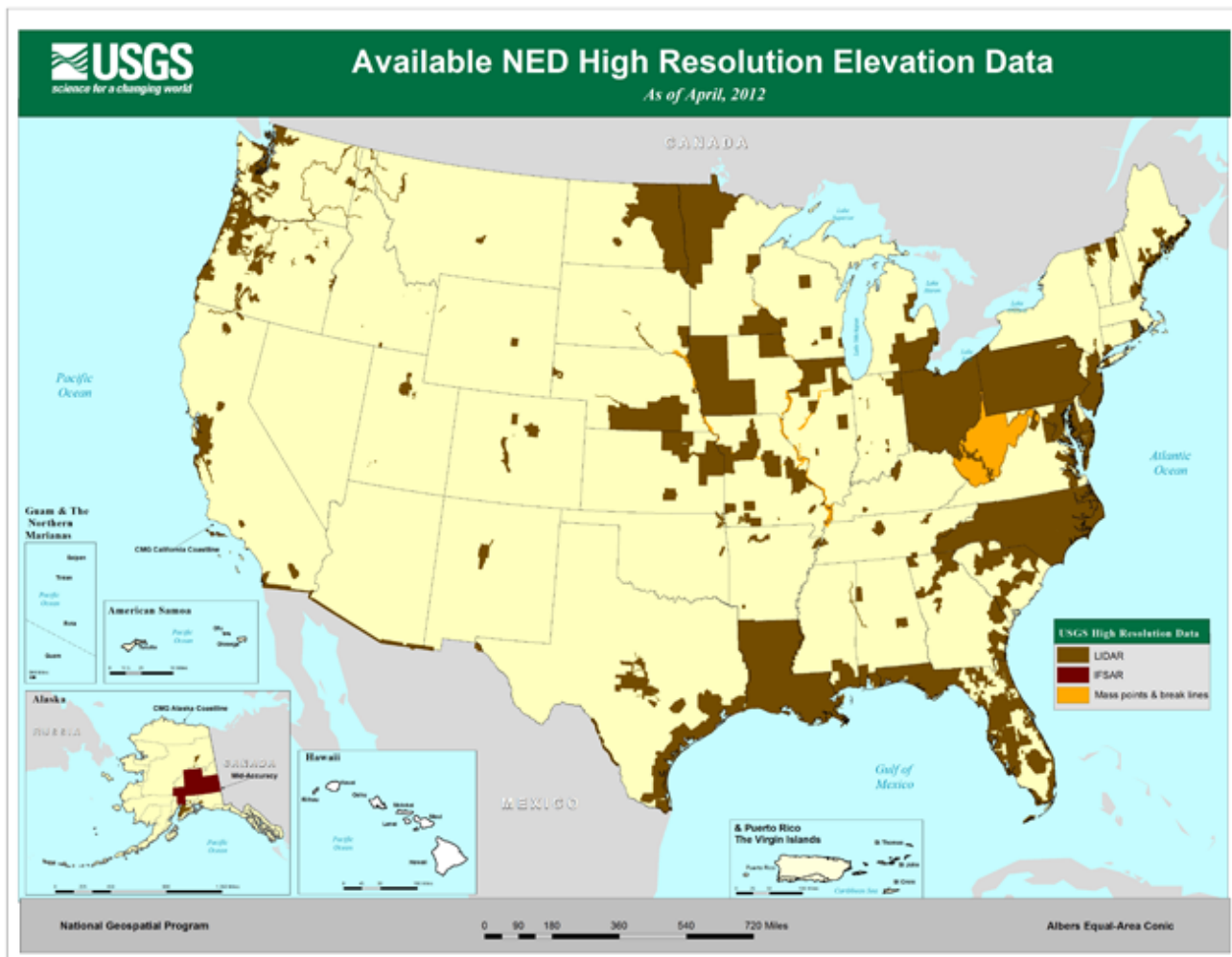


Figure 5. Available 1/9-arc-second data from all sources – April, 2012 release.

The following are NED 1/9-arc-second datasets released during the April update.

- Alaska—IFSAR portions of Fairbanks, Matanuska-Susitna, Kenai Peninsula, and Yukon-Koyukuk Boroughs, 2010
- Arkansas---McKinney-Posten Bayous watershed area, 2011
- Colorado---Arkansas Valley, 2010
- Florida---Pasco and portions of Highlands counties, 2004
- Florida---Brevard, Citrus, Hernando, Levy, Sumter, DeSoto, eastern Hillsborough and central Charlotte counties, 2007
- Florida— Sarasota County, 2008
- Florida---Hardee County, 2009
- Georgia---4 coastal counties
- Iowa—central northwest, northwest, south central, central south, and southwest areas of Iowa's statewide, 2008
- Iowa--northeastern area with void analysis techniques applied, 2008
- Maryland---Hoopers Island, 2011
- Maine---southern coastal area, 2010
- Minnesota---Red River Basin Blocks I, K, M, Koochiching County and Lake of the Woods area, 2009
- Missouri---Barry and Franklin counties, 2011
- Missouri---Boone County, 2009
- New York---Hudson Bay area, 2010
- Virginia---King William County, 2011

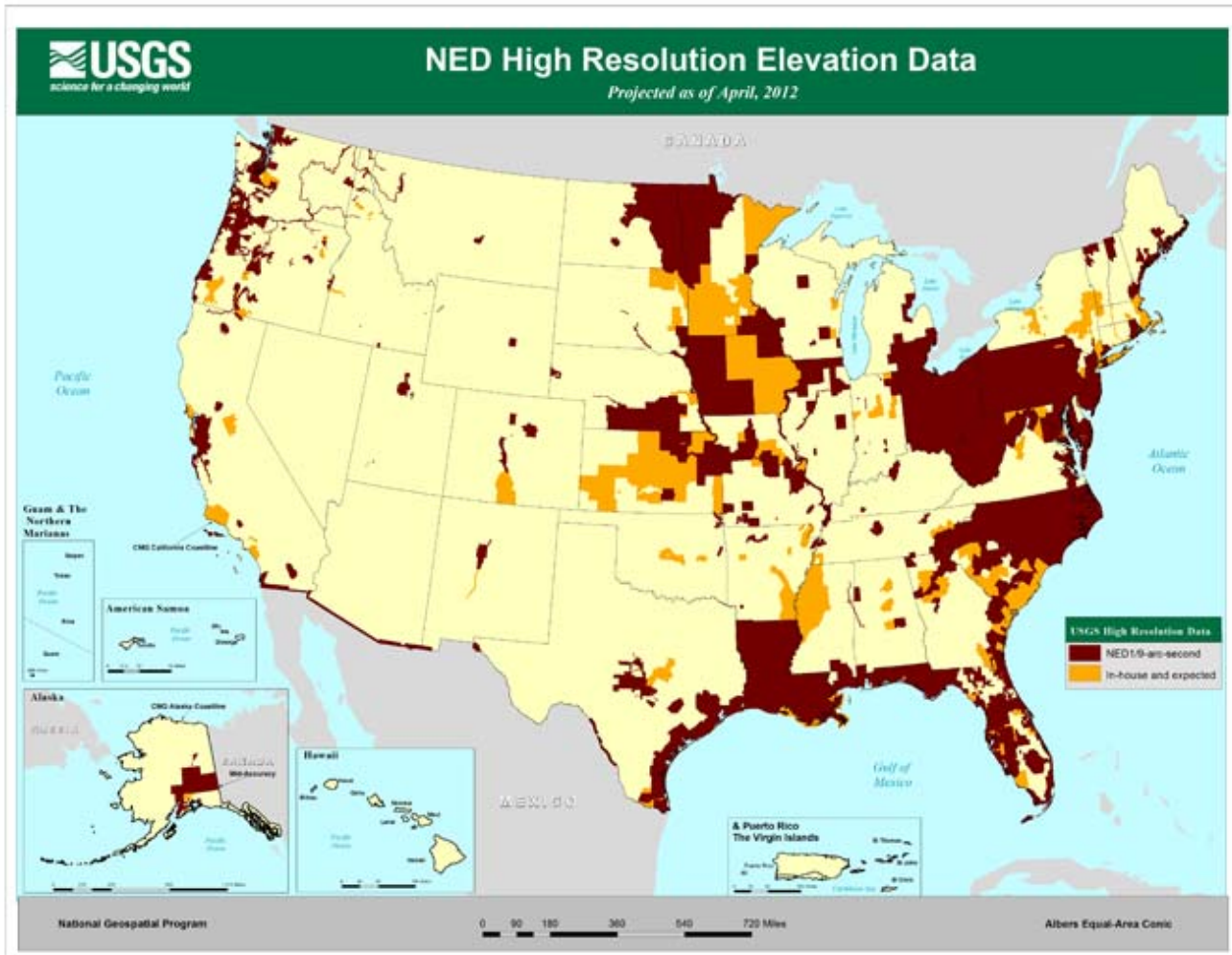


Figure 6. Available and anticipated high-resolution data – April, 2012 release.

1/3-arc-second Data

NED contains data for all of the contiguous United States, Hawaii, and many Pacific Islands at a resolution of 1/3-arc-second (~10-meters). The current release of 1/3-arc-second NED (April 18, 2012) includes all USGS 10-meter as of March 16, 2012 (Figure 7).

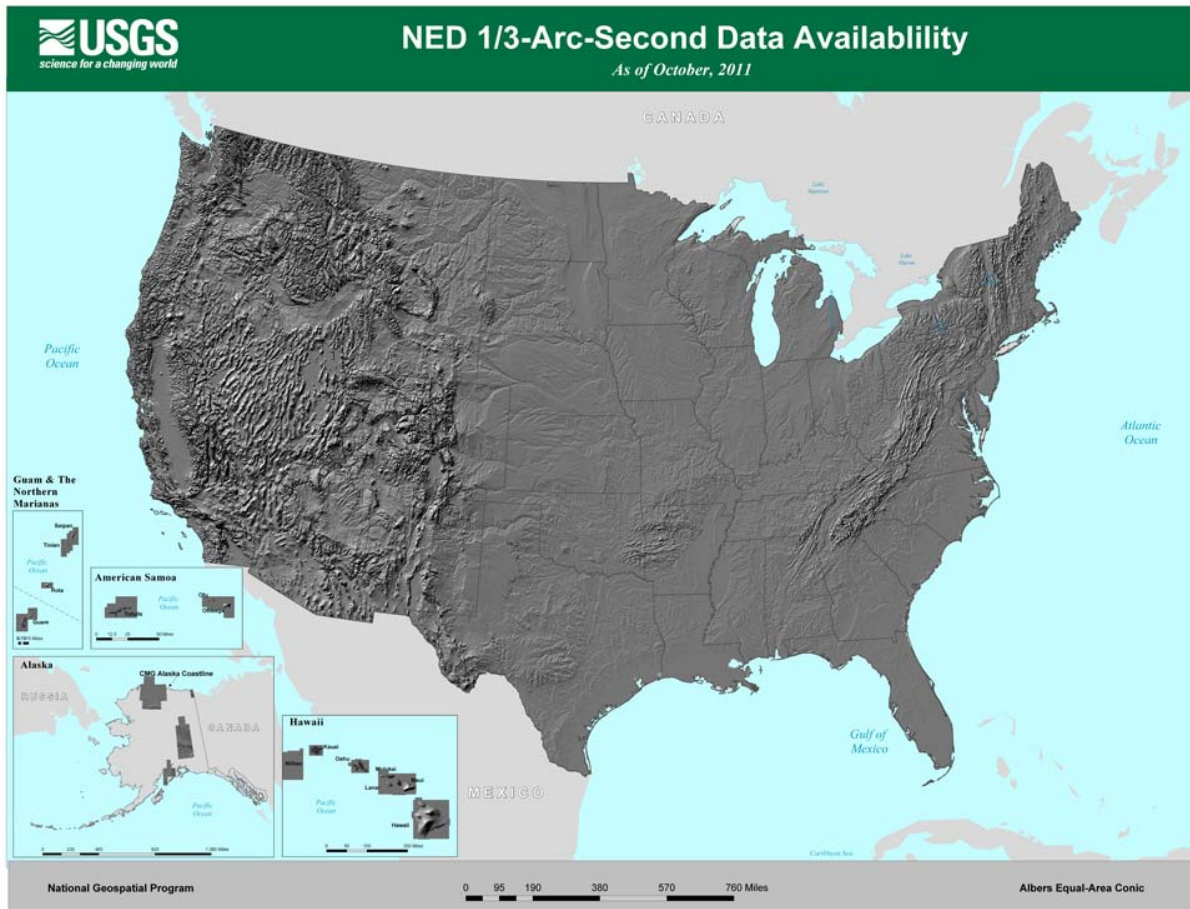


Figure 7. Available 1/3-arc-second NED.

Source data with a resolution of 10-meters or higher currently exists for 97% of the United States (excluding Alaska). To complete 1/3-arc-second coverage for areas outside the State of Alaska, the remaining areas are derived by oversampling 30-meter source data. Figure 8 shows the distribution of source data resolutions. The spatial metadata delivered with each order describe the resolution of the source data used over any given area. As higher resolution source data become available, the 1/3-arc-second data derived from 30-meter DEMs are being replaced. It is anticipated that all oversampled 30-meter source data will be replaced by the end of fiscal year 2012.

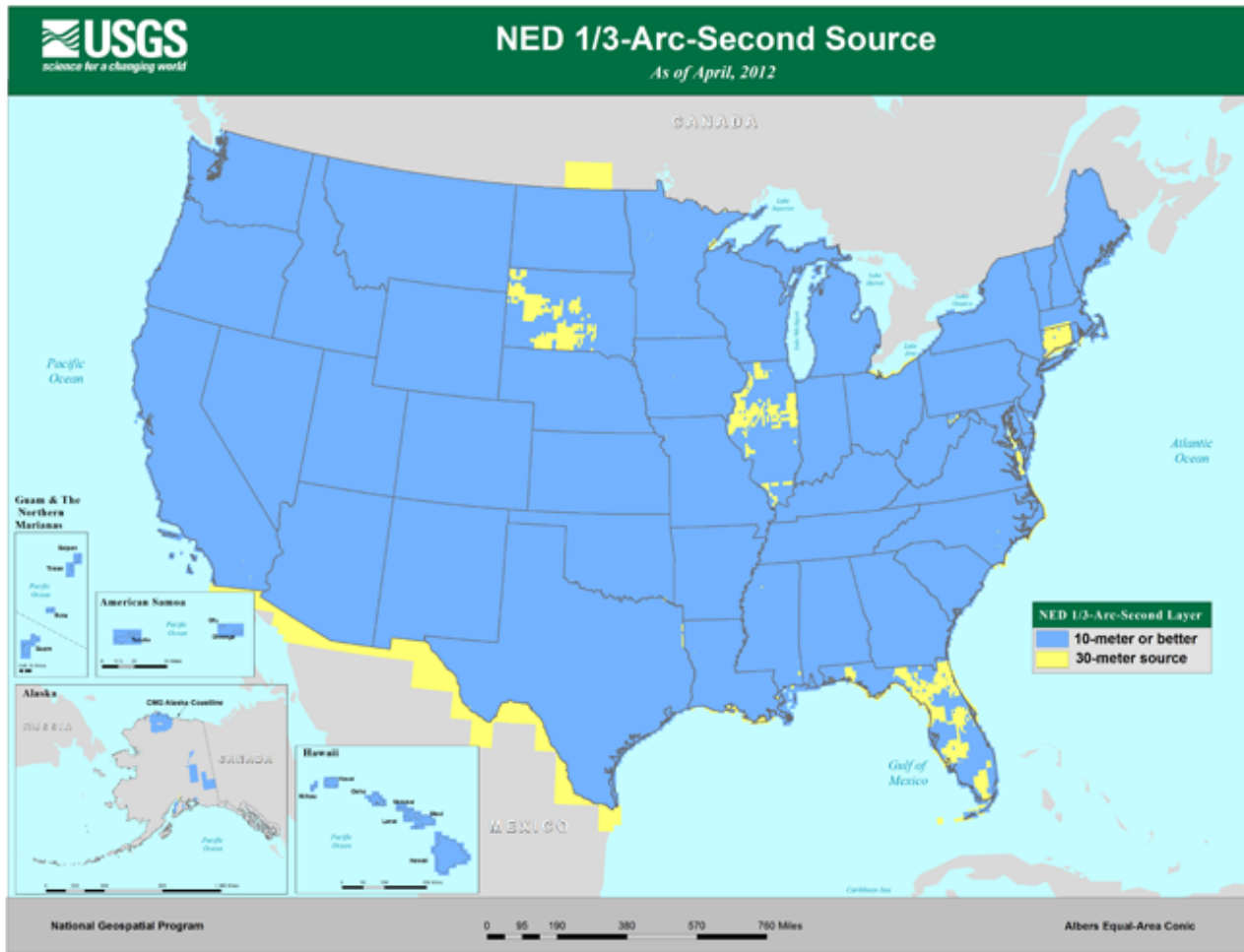


Figure 8. 1/3-arc-second NED, April, 2012 release, by source resolution.

Updates from High-Resolution Data

As higher resolution datasets are released into the 1/9-arc-second layer, they are evaluated as a source to revise the NED 1- and 1/3-arc-second layers (Figure 9). Several higher resolution datasets were used as source data for other NED layers for this update cycle. The intention was to keep the 1/9-arc-second layer in sync with both the 1- and 1/3-arc-second layers (allowing for a time delay because of differences in the data processing flows). Some 1/9-arc-second datasets do not meet certain criteria, such as the flattened water bodies or bare-earth DEM specifications, which are required for the NED 1- and 1/3-arc second layers and, therefore, will not be used as source for updates for those layers.

In Alaska there are only specific areas covered in the NED 1/3-arc-second layer. Also, Puerto Rico, the Virgin Islands and Mexico are only supported in the NED 1-arc-second layer.

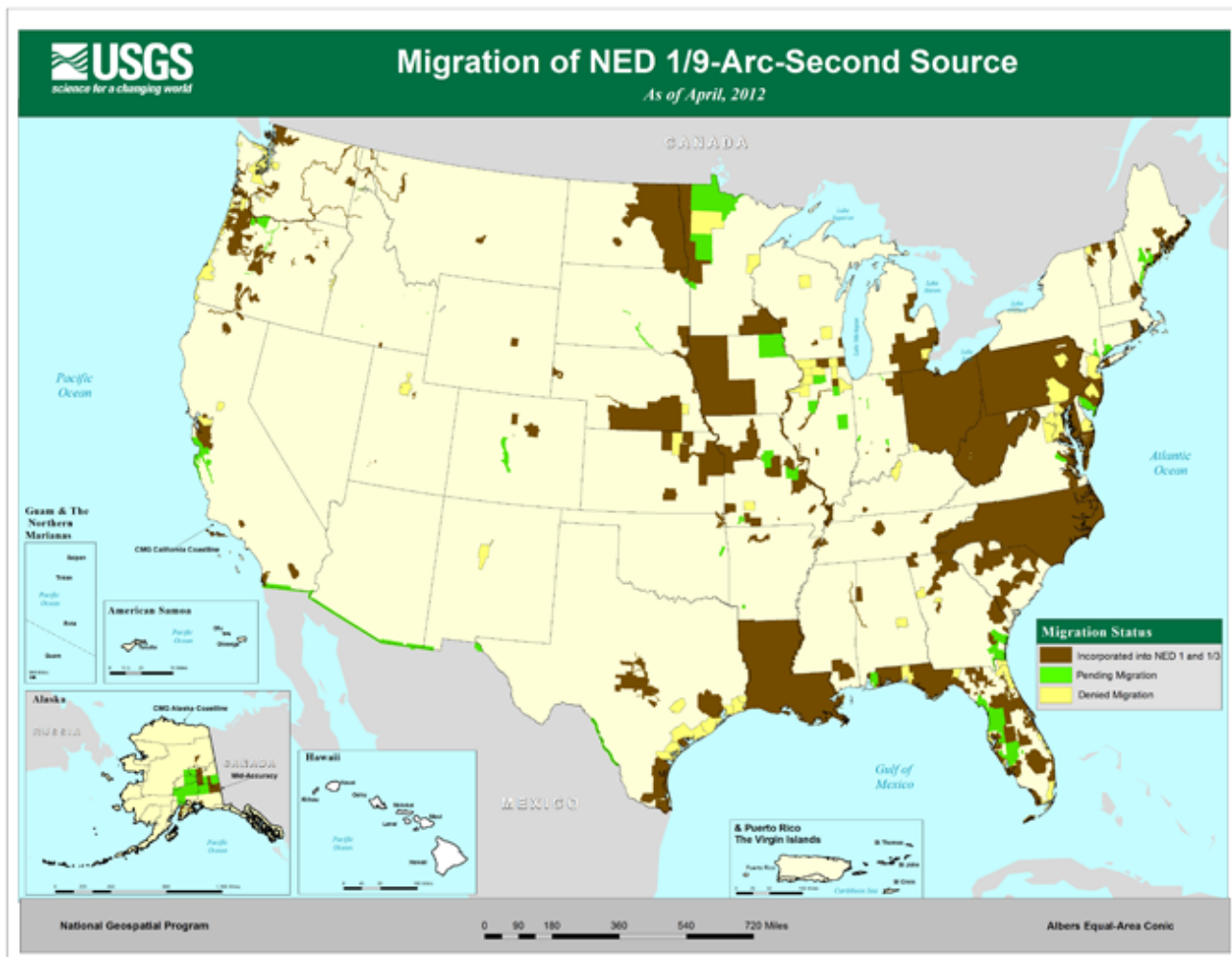


Figure 9. Migration status of NED 1/9 to other NED layers—April, 2012 release.

Mexico Available in the 1-arc-second Layer

Elevation data for the country of Mexico were added to the 1-arc-second NED in October, 2008. These data are a result of collaboration between USGS and Mexico's National Institute of Statistics and Geography (INEGI). The data were provided and quality control conducted by INEGI. Topographic staff at USGS EROS processed the data to improve edge matching, making the dataset seamless within itself and along the US / Mexico border.

Alaska Highlights

Portions of Alaska are now available at resolutions of 1-, 1/3- and 1/9-arc-second (Figure 10). The most current data are radar-derived, either from Interferometric Synthetic Aperture Radar (IFSAR) or from the Shuttle Radar Topography Mission (SRTM). The inclusion of SRTM data in the Aleutian chain is particularly significant these data replace 3-arc-second DEMs, which are generally of poor quality and are cast in the World Geodetic System of 1972 (WGS72). The first lidar data of the Kenai Peninsula were added to the 1/9-arc-second layer in September, 2009 adding to the small amount of data covering the port city of Valdez, which was added in December, 2008. Additional lidar datasets were released in July and August of 2010, including two more Kenai areas and Yukon Flats. The original Kenai dataset released in September, 2009 was reworked to fill the many data voids in December, 2010. A large portion of central Kenai area was added in February, 2011. A pilot area of mid-accuracy 5-meter IFSAR was added during the April, 2011 update as well as a small piece of lidar data along the northern coast. A total of 28 cells of the 5-meter IFSAR were added during the last several releases bringing the total of 10 meter or better source data in Alaska to 90,169 square miles or approximately 15.77% of Alaska. The 5-meter IFSAR data are going into all the NED resolution layers including the NED 1/9-arc-

second data layer and will be the primary source for elevation data over most of Alaska per the statewide elevation plan.

The resolution of existing Alaska data and of the data anticipated in the upcoming year is shown in Figure 10.

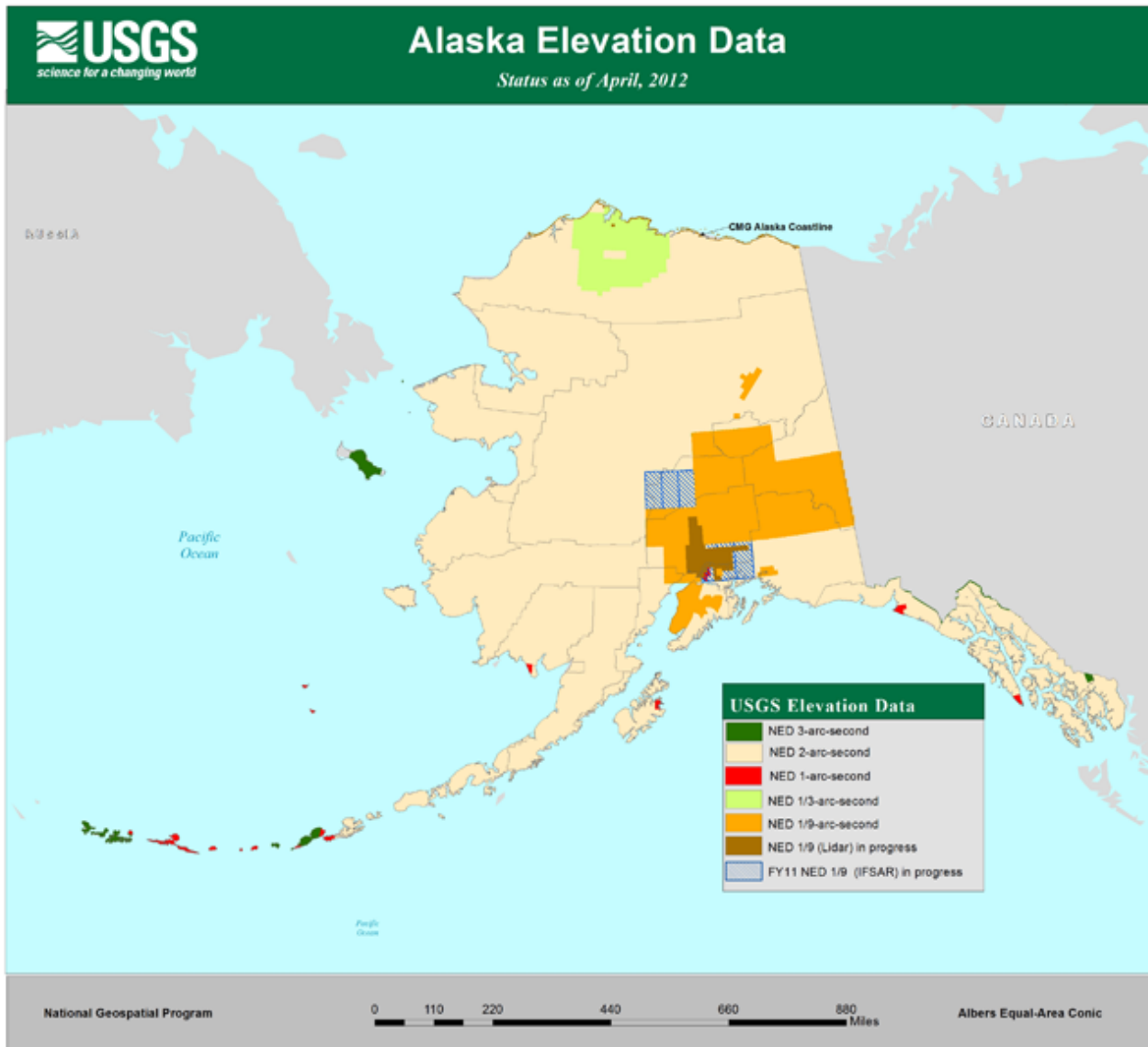


Figure 10 Available and anticipated Alaska elevation data.

Currency

Data currency (Figure 11) is an important aspect of a multiple source dataset such as the NED. Note that NED currency represents when the original source was generated or acquired depending on the data type. However, if the data is reprocessed due to new and improved processing techniques the data still retains the original date the source was generated or acquired.

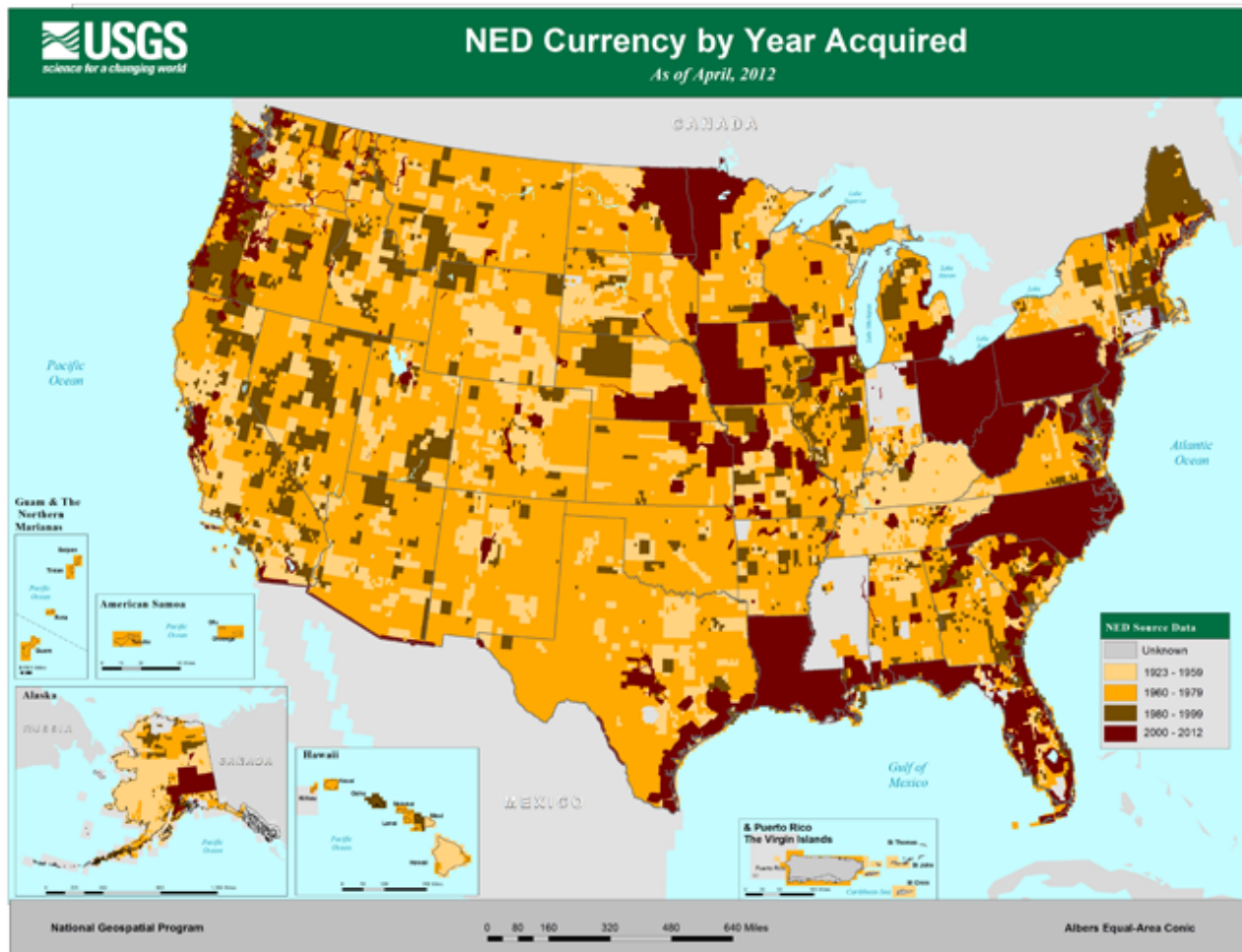


Figure 11. Currency of the NED shown by acquisition year – April, 2012.

Datums

All NED data are currently distributed in the North American Datum of 1983 (NAD83). Prior to April, 2008, NED data over Alaska were cast in the North American Datum of 1927 (NAD27).

Production Methods

Figure 12 shows the production methods used to produce NED data. Older production methods are small and will disappear as 30-meter data are replaced by higher resolution data. Production method in conjunction with data resolution, source and other factors can be used to determine data quality.

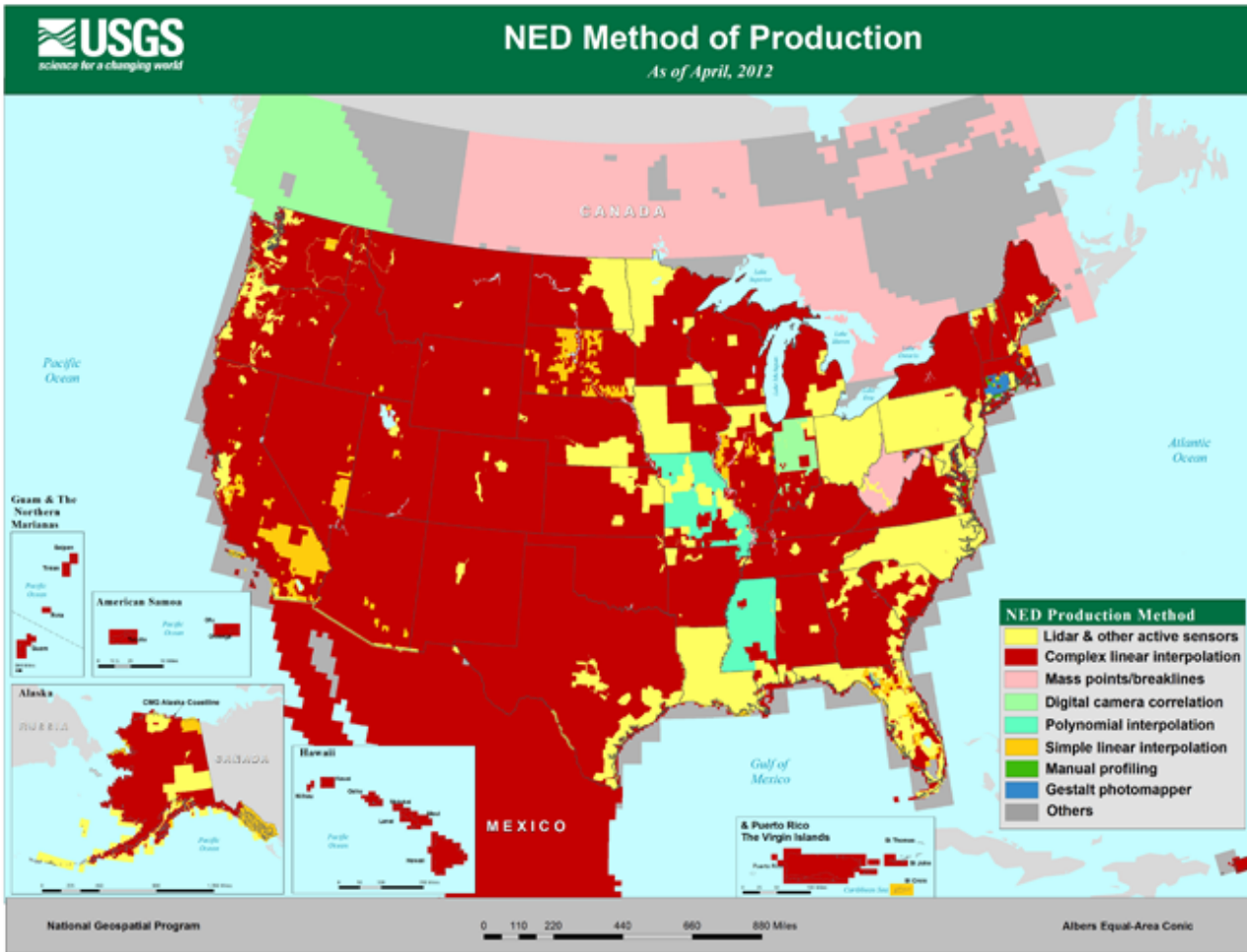


Figure 12. NED source data by production method – April, 2012 release.

The production methods are:

- Lidar, IFSAR and other active sensors including SRTM
- Complex linear interpolation from contours, often including hydrography (LT4X)
- Photogrammetrically compiled mass points and break lines
- Digital camera correlation, usually from line camera such as Leica ADS40
- Polynomial interpolation from contours, mass points, and break lines (ANUDEM)
- Simple linear interpolation from contours, (DLG2DEM and DCASS)
- Manual profiling via a mechanical or analytical stereo plotter
- Gestalt Photomapper II (electronic image correlation)

Source Data

NED source data are selected from an ever-growing inventory of DEMs produced by USGS standard and other processes. With first consideration always being given to data quality, the selections to be integrated into the NED are made according to the following ranking and listed in the order of descending priority:

- High-resolution data, typically derived from lidar or digital photogrammetry, are often break line enforced. If collected at a ground sample distance no coarser than 5-meters, such data may also be offered within the NED at a resolution of 1/9-arc-second.
- Moderate-resolution data, other than that compiled from cartographic contours. These data may also be derived from lidar or digital photogrammetry, or less often by airborne IFSAR. A typical ground sample distance is ~10-meters commonly called "1/3-arc-second data."
- 10-meter DEMs derived from cartographic contours and mapped hydrography. Most often, such data are produced by or for the USGS as a standard elevation product, and they currently account for the bulk of the NED.
- 30-meter (Level 2) cartographically derived DEMs. Similar in most respects to their 10-meter counterparts, though usually of lower overall quality.
- 30-meter (Level 1) photogrammetrically derived DEMs. These are the oldest DEMs in the 7.5-minute series. These data were derived directly from stereo photography, either by a human operator or by an early form of electronic image correlation. They are typically marred by erroneous production artifacts that are addressed to the greatest practical extent by digital filtering within the NED production process.
- 2 arc-second DEMs are a standard USGS product. They are derived from cartographic contours at a scale of 1:63,360 over the state of Alaska, and a scale of 1:100,000 elsewhere.
- 1-arc-second SRTM data to date are only used in preference to 3-arc-second data in the Aleutian Islands.
- 3-arc-second DEMs are another standard USGS product, and are generally only used within the NED as a source of fill values over large water bodies.

The composition of source data within the April, 2012 NED release continues the trend seen in previous releases with an increase in coverage from 10-meter or better sources (Figure 13).

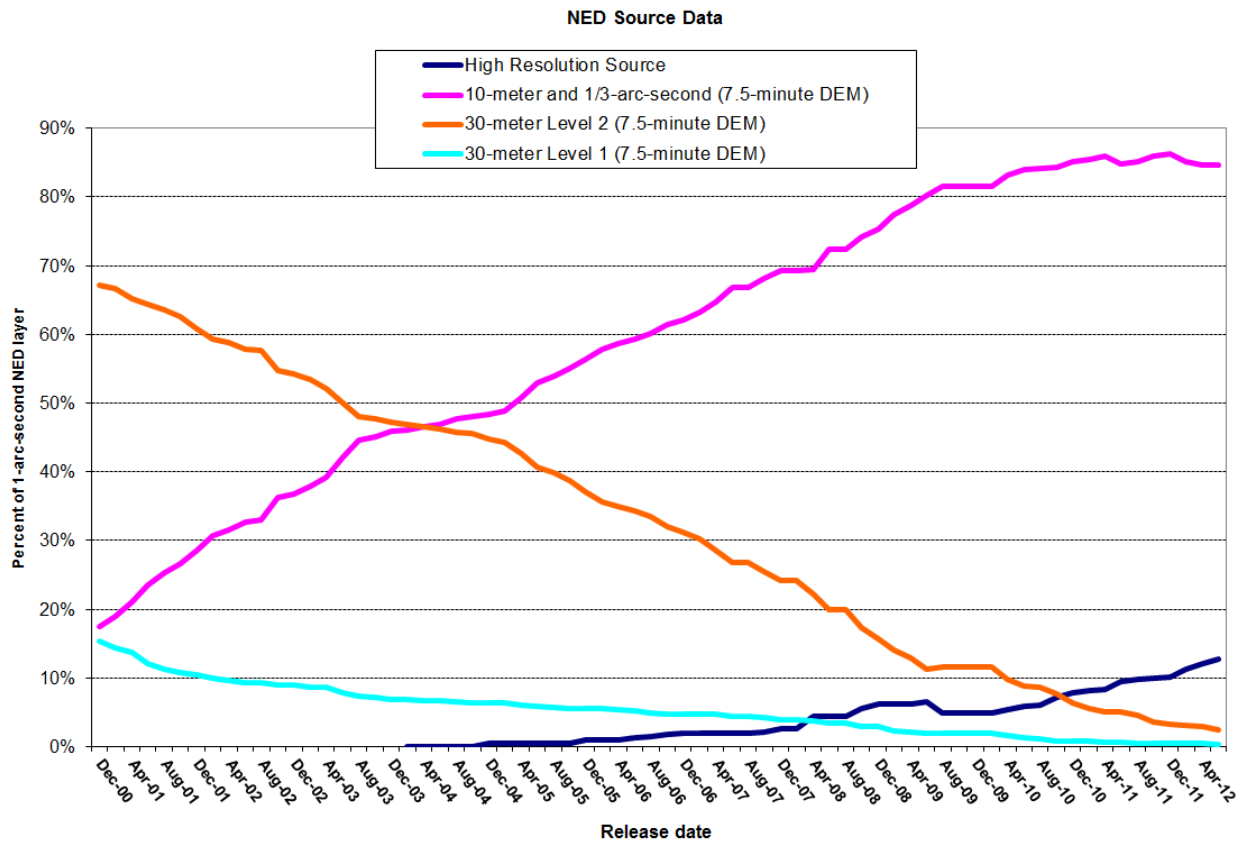


Figure 13. Type of 1-arc-second NED source data by release date.

NED Tile Processing

To address practical concerns of data processing and storage, with the exception of the 1/9-arc-second resolution, the NED is processed in 1x1-degree tiles coincident with integer degree boundaries of the Geodetic Reference System 1980 (GRS80) ellipsoid. A small amount of overlap is added to ensure that adjacent tiles are logically seamless. Additional tiles are added as required to accommodate new areas of coverage. (Table 1)

Release date	Number of tiles	Note
June, 2000	1,367	CONUS: 925 tiles; AK: 428 tiles; HI: 14 tiles
April, 2001	1,375	8 tiles added: Puerto Rico and Virgin Islands
June, 2001	1,387	12 tiles added: Pacific islands
August, 2001	1,392	5 tiles added: Pacific islands
October, 2008	1,651	259 tiles added: Country of Mexico
April, 2012	2073	422 tiles added: Canadian data adjoining U.S.

Table 1. Number of NED tiles and changes by release date.

In the current release, 105 tiles were updated, representing 11% of NED, excluding Alaska and Mexico, for which the extent of coverage is resolution-specific (Figure 14).

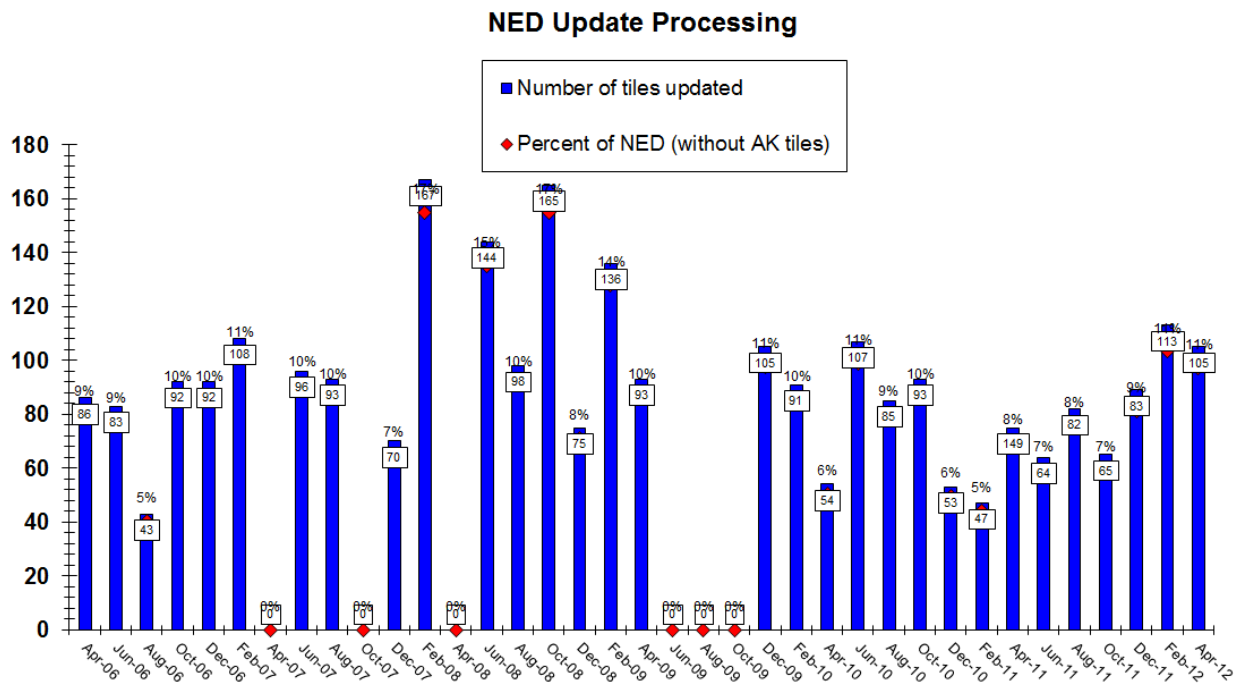


Figure 14. Number and percentage of NED tiles processed by release date.

How to Obtain NED Data

A number of tools are available for accessing elevation data and mapping services at <http://seamless.usgs.gov>. Newly released and existing elevation data of the National Geospatial Program are available for download as tiled datasets via *The National Map Viewer* (<http://viewer.nationalmap.gov/viewer/>) or The National Map Seamless Server (<http://seamless.usgs.gov/website/seamless/viewer.htm>). For NED bulk data delivery via hard drive, contact USGS EROS Customer Service – custserv@usgs.gov (605-594-6151).

Lidar Point Cloud Data Availability

Most of the high resolution DEM are being generated from lidar bare earth point data. NED distributes the elevation data but does not distribute the bare earth point cloud data. A complementary USGS activity to the NED is the Center for Lidar Information Coordination and Knowledge (CLICK) which provides lidar point cloud data for download (<http://lidar.cr.usgs.gov/>).

Additional Information Available

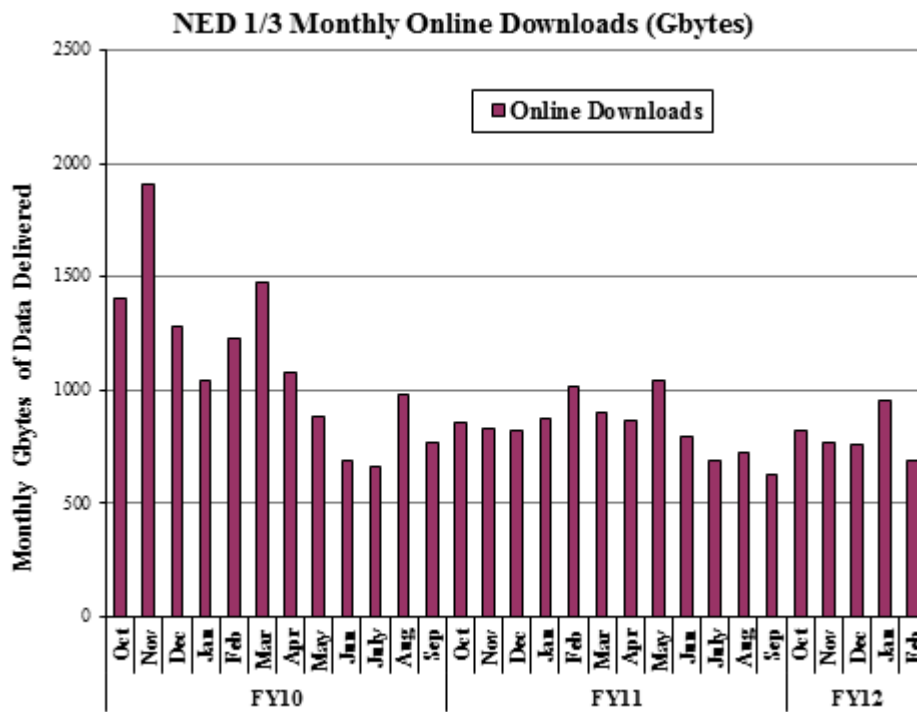
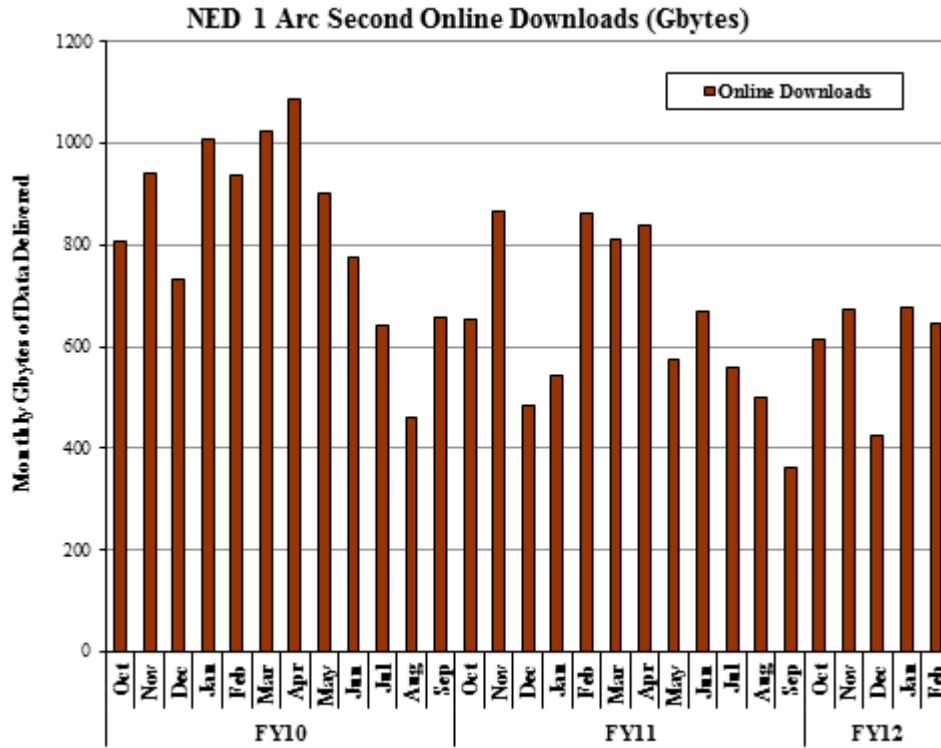
The following are available from the NED Web site (<http://ned.usgs.gov/Ned/metadata.asp>):

- the NED spatial metadata in shapefile (.shp) format
- the NED data dictionary with definitions of the attributes of the spatial metadata coverage
- previous issues of the NED Release Notes
- spatial metadata shapefiles of previous releases

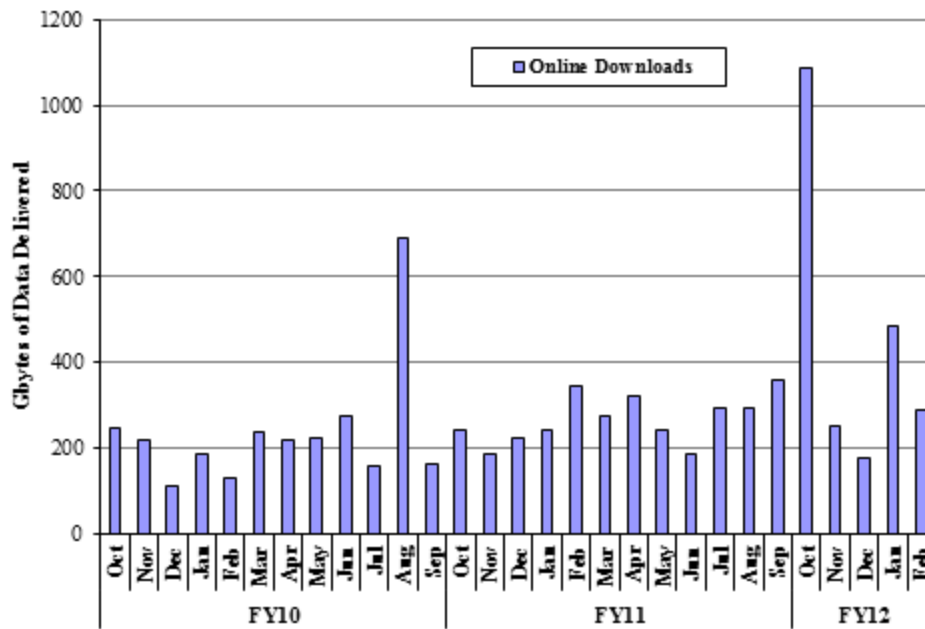
No new information was added to the FAQ list on the NED home page (<http://ned.usgs.gov>)

Distribution Statistics

Download Statistics



SDDS NED 1/9 Arc Second Online Downloads (Gbytes)



Terminology

lidar – light detection and ranging – an optical remote sensing technology that can measure the distance to, or other properties of, a target by illuminating the target with light, often using pulses from a laser.

IFSAR – Interferometric Synthetic Aperture Radar – a radar remote sensing technology that can measure the distance to, or other properties of, a target by illuminating the target with radar.

SRTM – Shuttle Radar Topography Mission – a joint project between the National Imagery and Mapping Agency (now the National Geospatial-Intelligence Agency) and the National Aeronautics and Space Administration (NASA) to produce digital topographic data for 80% of the Earth's land surface (all land areas between 60° north and 56° south latitude), with data points located every 1-arc-second (approximately 30 meters) on a latitude/longitude grid using a radar interferometry sensor on the space shuttle.