National Elevation Dataset

October, 2012 Release Notes
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Contents

Latest Release

The October, 2012 update of the National Elevation Dataset (NED) 1-, 1/3- and 1/9-arc-second collections were released on October 2, 2012. This marks the 68th update of the 1-arc-second layer since bi-monthly revisions began in June, 2000. This release incorporates 22,881 square miles of new light detection and ranging (LiDAR) data in addition to some standard production 10-meter digital elevation models (DEMs).

The next release is scheduled for December 4, 2012.

Highlight

Highlighted new elevation data featured in this release include coverage over more than 3,800 square miles of the San Luis Valley in Colorado, the largest alpine valley in the world, and elevation data from high-resolution LiDAR over the area of the 2011 Virginia earthquake (fig. 1).

The San Luis Valley provides the setting for a wide range of scientific applications, such as mapping fault scarps and sand dune migration, delineating potential flood zones, studying geothermal energy potential, monitoring vegetation change, determining wetland capacity, and conducting soil surveys. The project is a collaborative, multi-agency effort comprised of the U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service, National Park Service, Department of Homeland Security, Federal Emergency Management Agency, Natural Resources Conservation Service, and the State of Colorado, Colorado Geological Survey.
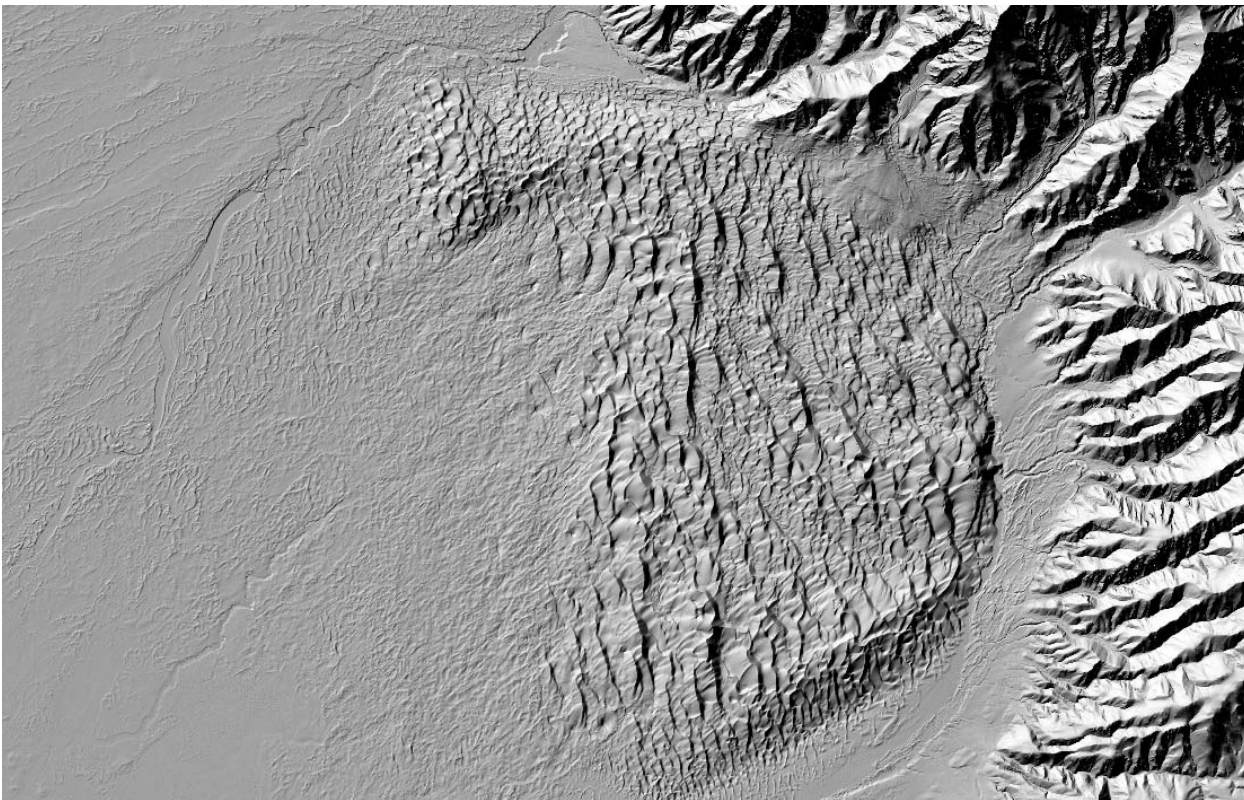

Figure 1. Area of the San Luis Valley, Colorado.

A LiDAR dataset is being released over the epicentral area of the August 23, 2011 Virginia earthquake, one of the strongest earthquakes, 5.8 magnitude, to hit the East Coast in nearly seventy years. This LiDAR coverage includes parts of Louisa, Fluvanna, Goochland, and Spotsylvania counties. The USGS has identified the Central Virginia seismic zone as an area of elevated earthquake hazard since the middle 1970s. However, other than the infrequent small to moderate earthquakes that have occurred there in historical time, little is known about the earthquake potential in this area. The USGS has placed a high priority on understanding why earthquakes are occurring in this region, and the LiDAR data will hopefully allow for new understanding of the earthquake hazard there.

TopoBathy

The August, 2012 NED Release marked the addition of the first set of topobathymetric data into the NED. Topobathymetric data are created by merging topography (land elevation) and bathymetry (water depth) into a seamless elevation product useful for applications such as modeling sea level rise and storm surge. The initial dataset is centered over Mobile Bay (fig. 2), Alabama and was constructed using a combination of 71 disparate topographic and bathymetric datasets from the USGS, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Army Corps of Engineers (USACE); ranging in temporal variation from 1917 to 2011. It was developed in collaboration between the USGS Coastal and Marine Geology Program (CMGP) and the USGS National Geospatial Program (NGP). In the next five years, the CMGP has plans to expand its research and modeling along the northern Gulf of Mexico coastline, and San Francisco and Chesapeake Bays.
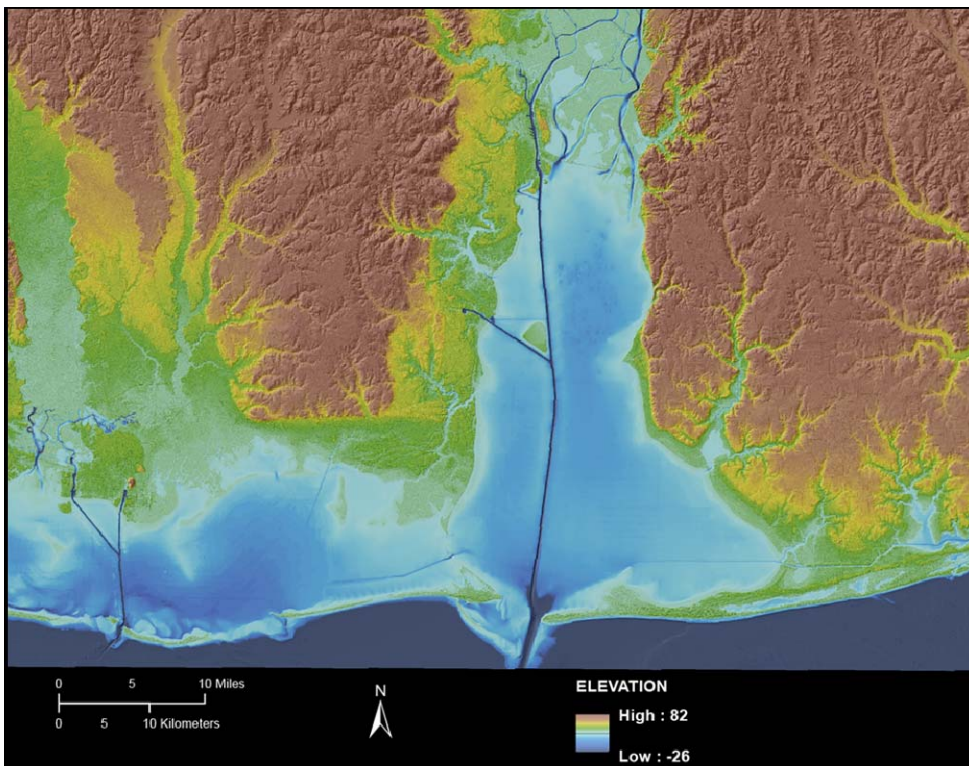

Figure 2. NED 1/9-arc-second first topobathymetric dataset—Mobile Bay, Alabama.

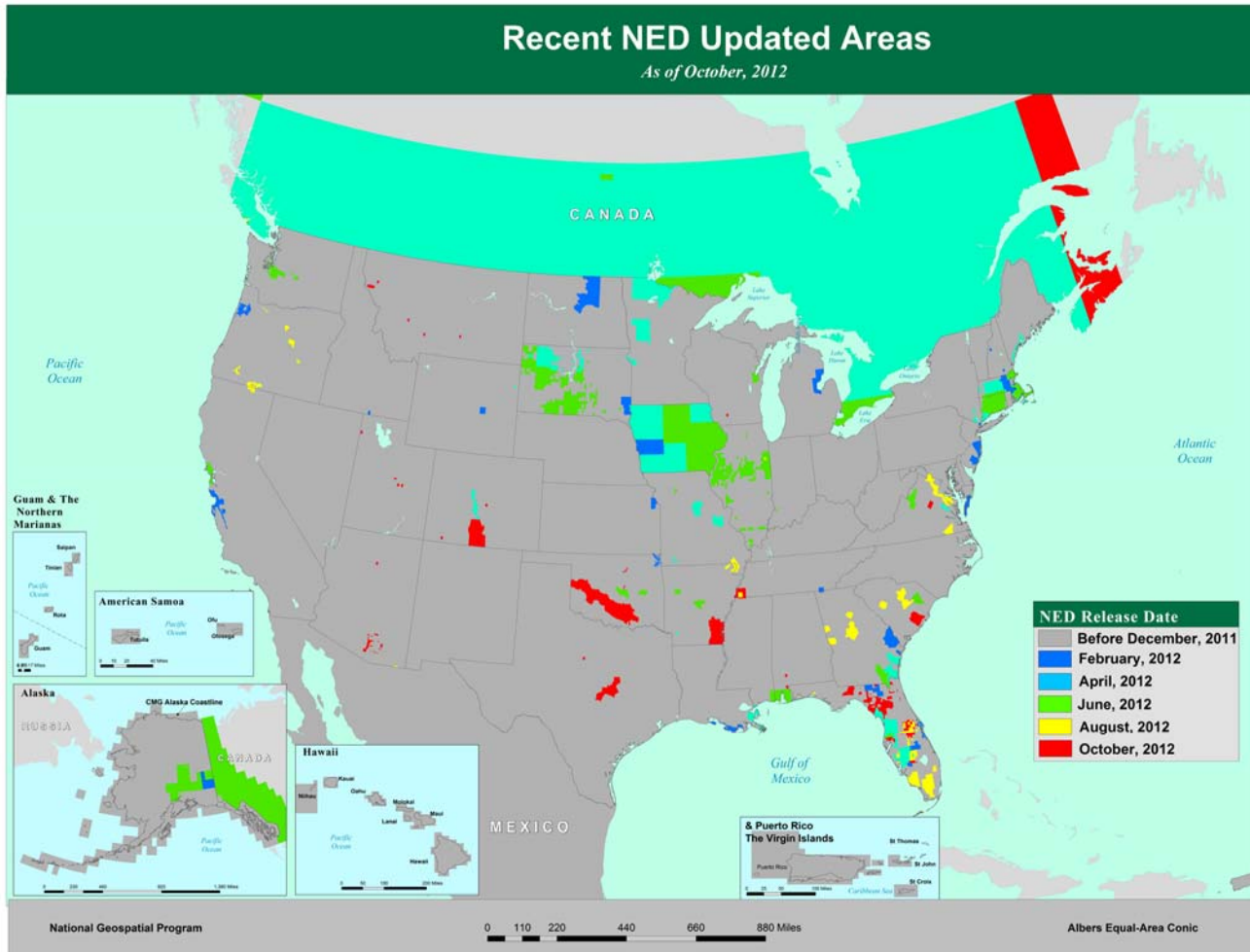Areas where new data were incorporated in this and other recent releases are indicated in Figure 3.

Figure 3. NED updated areas by release date -- October, 2012 release.
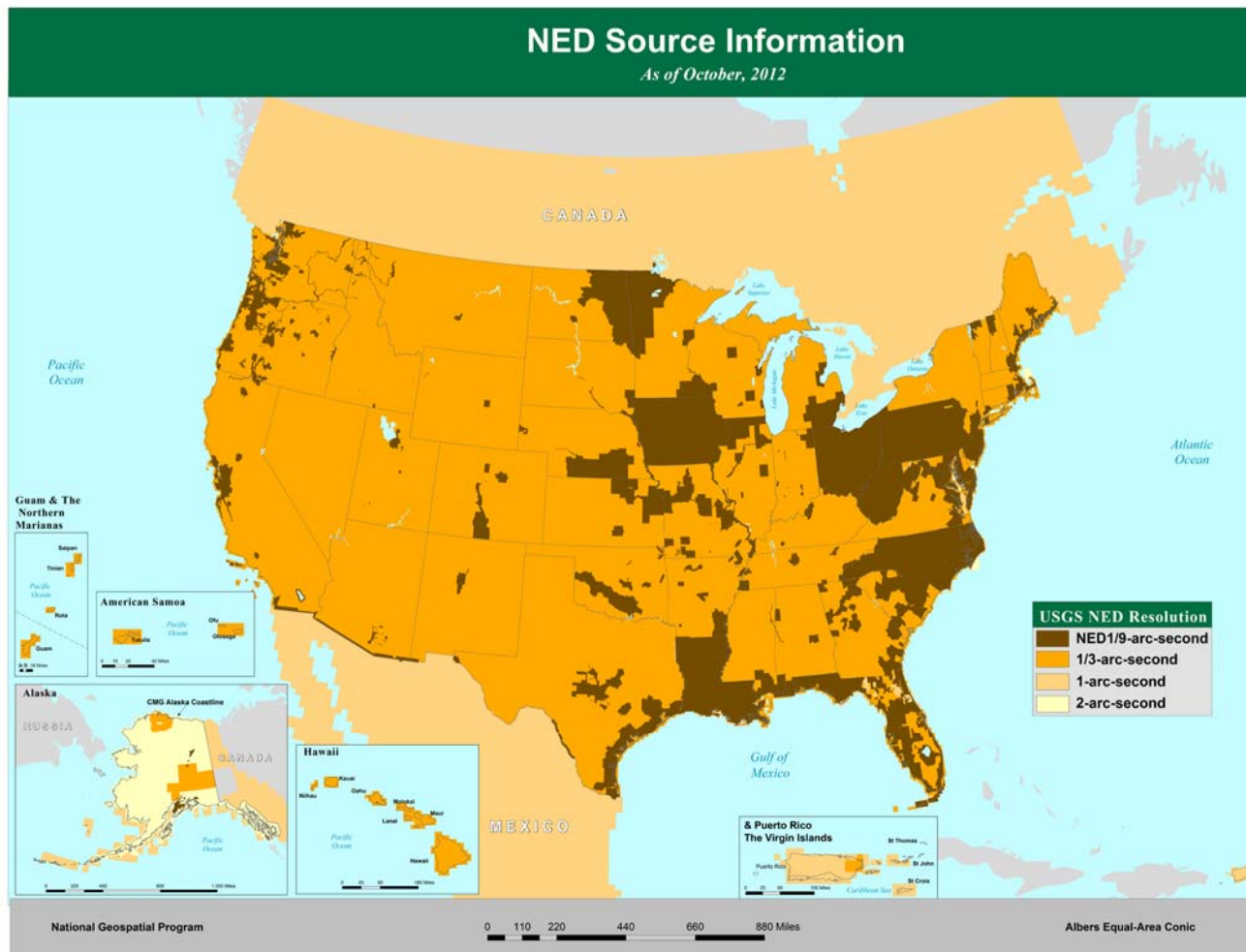
Resolutions of Data Available

Figure 4. Composite of source data by resolution – October, 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 updated through the integration of data from various sources using new technologies acquired through 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 4 shows the areas that reside in the NED 1/9-arc-second layer, as of October, 2012.
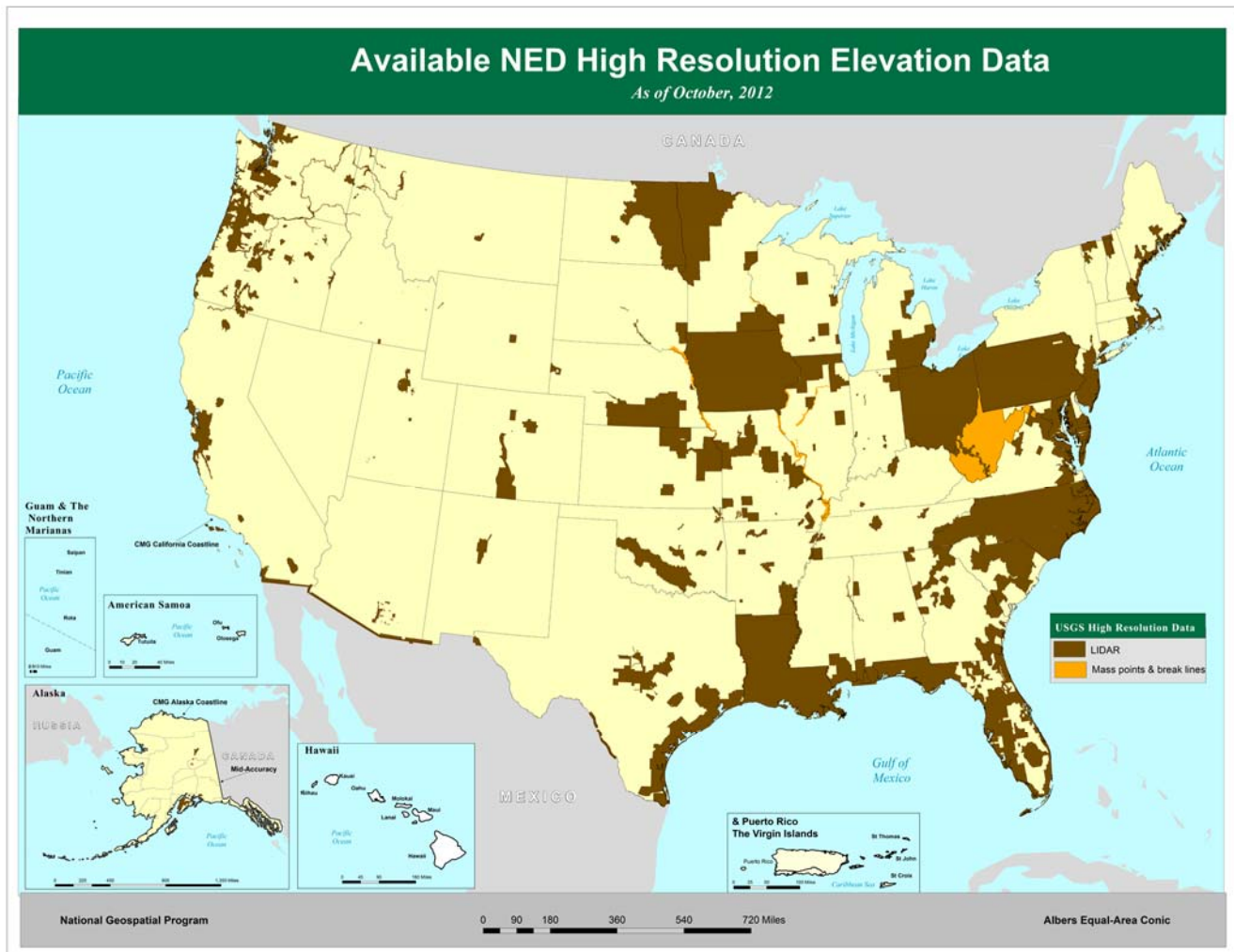
Figure 5. Available 1/9-arc-second data from all sources – October, 2012 release.

The following are NED 1/9-arc-second datasets released during the October, 2012 update.

- Arkansas—FEMA Ashley, Chicot and Drew counties, 2012—3574 square miles
- Arizona—Tucson area, 2011—585 square miles
- Colorado—San Luis Valley, 2011—3882 square miles
- Florida—Hillsborough Co, 2011—279 square miles
- Florida—Leon County, 2009—716 square miles
- OK—Washita River, 2010—9270 square miles
- South Carolina—Berkeley County, 2009—1316 square miles
- Tennessee—Shelby County, 2012—574 square miles
- Texas—Bell, Burnet, and McLennan counties, 2011—2348 square miles
- Utah—Lowry Water River Basin, 2011—60 square miles
- Virginia—Middle 1/3 of Louisa County, 2012—277 square miles
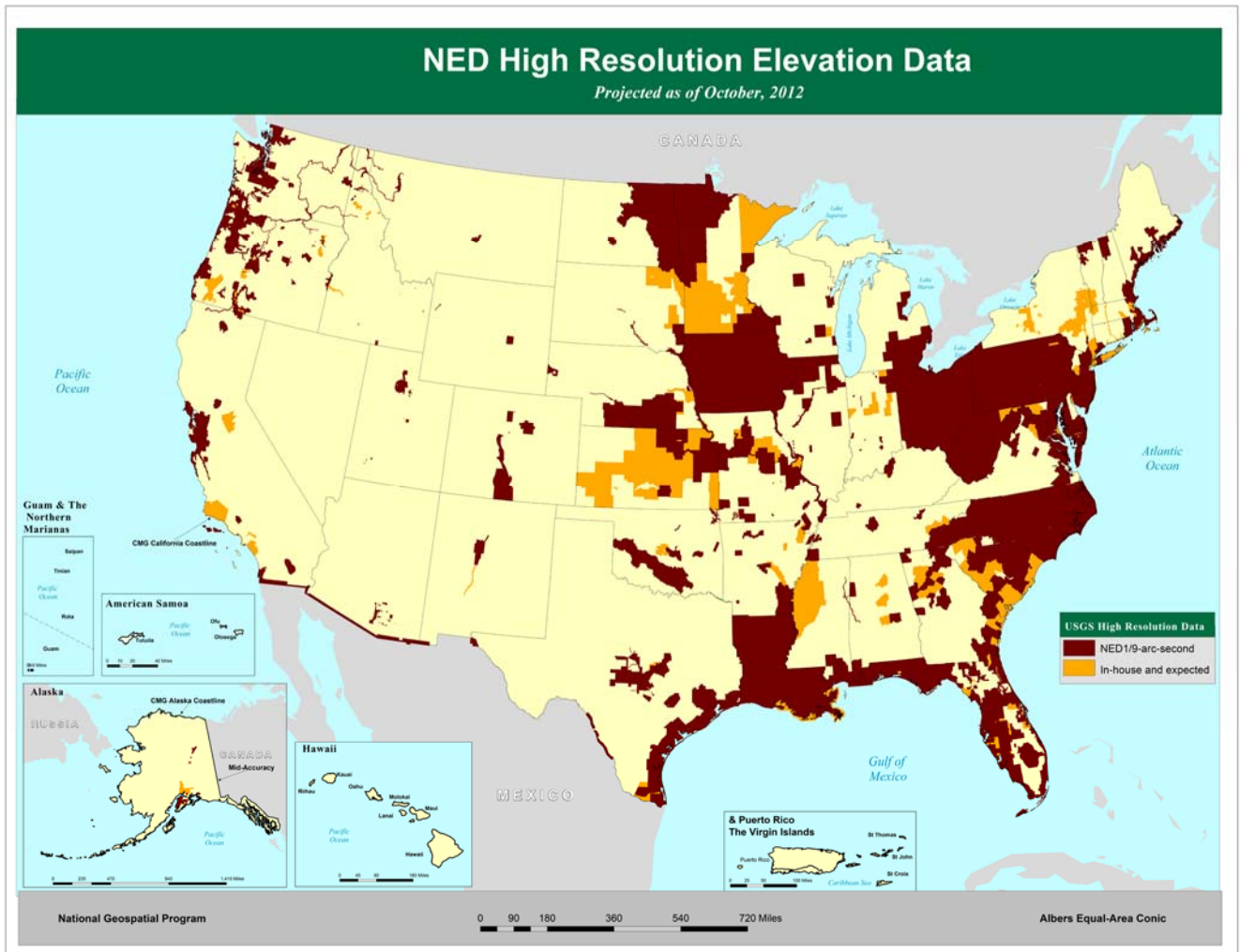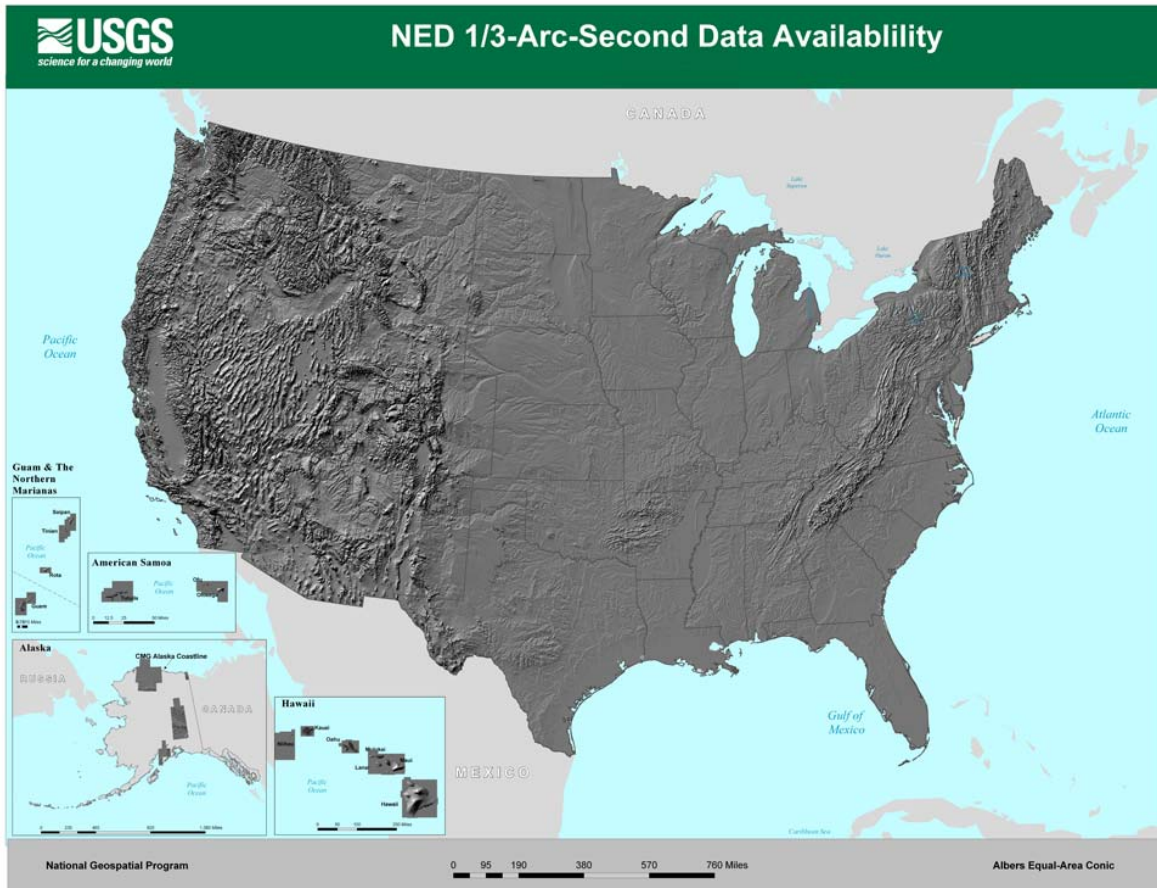
Figure 6. Available and anticipated high-resolution data – October, 2012 release.

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 (October 2, 2012) includes all USGS 10-meter as of September 7, 2012 (Figure 7).

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

Source data with a resolution of 10-meters or higher currently exists for 99.8% 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.
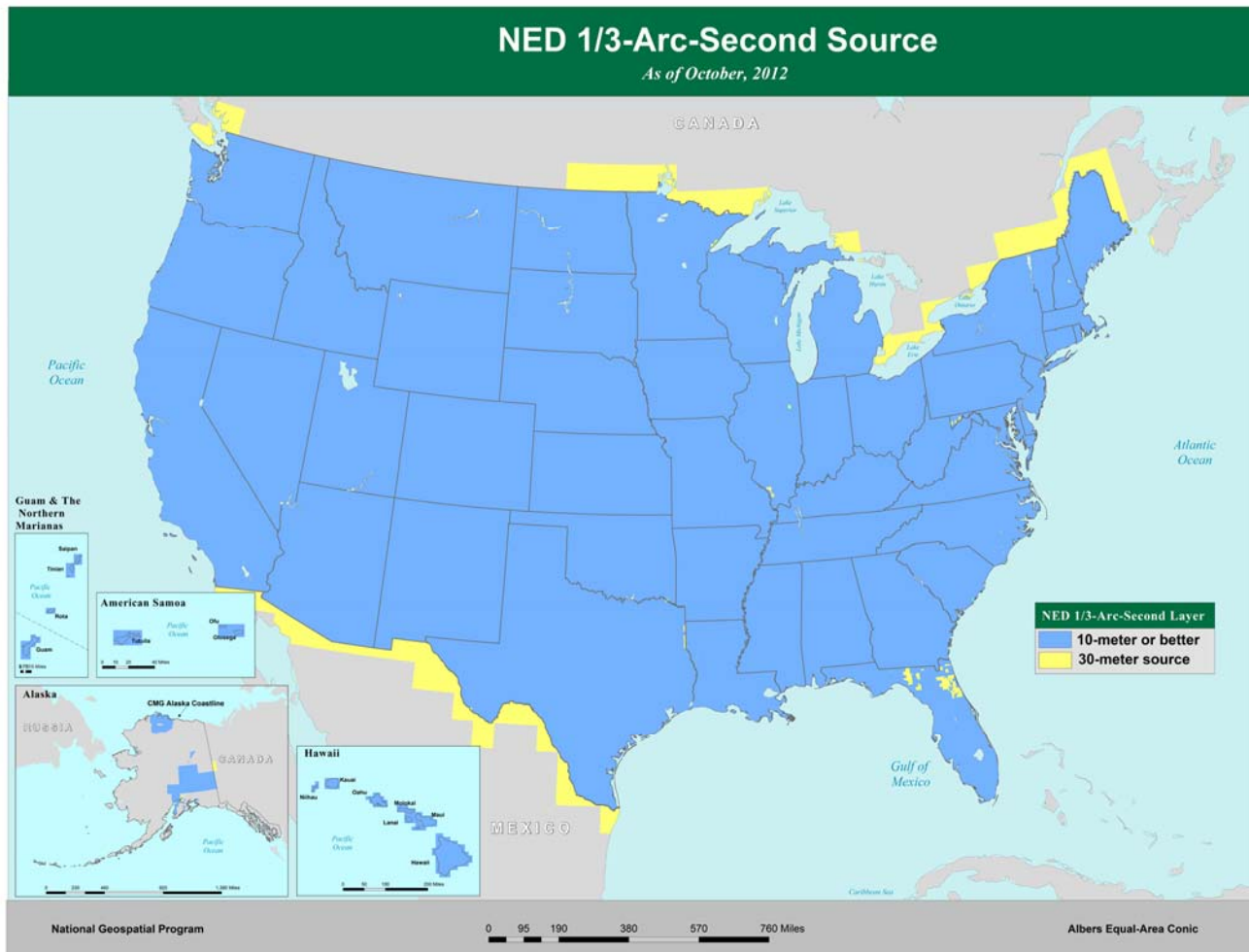
Figure 8. 1/3-arc-second NED, October, 2012 release by source resolution.

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- and 1/3-arc-second layer. Also, Puerto Rico, the Virgin Islands, Mexico, and parts of Canada are only supported in the NED 1-arc-second layer.
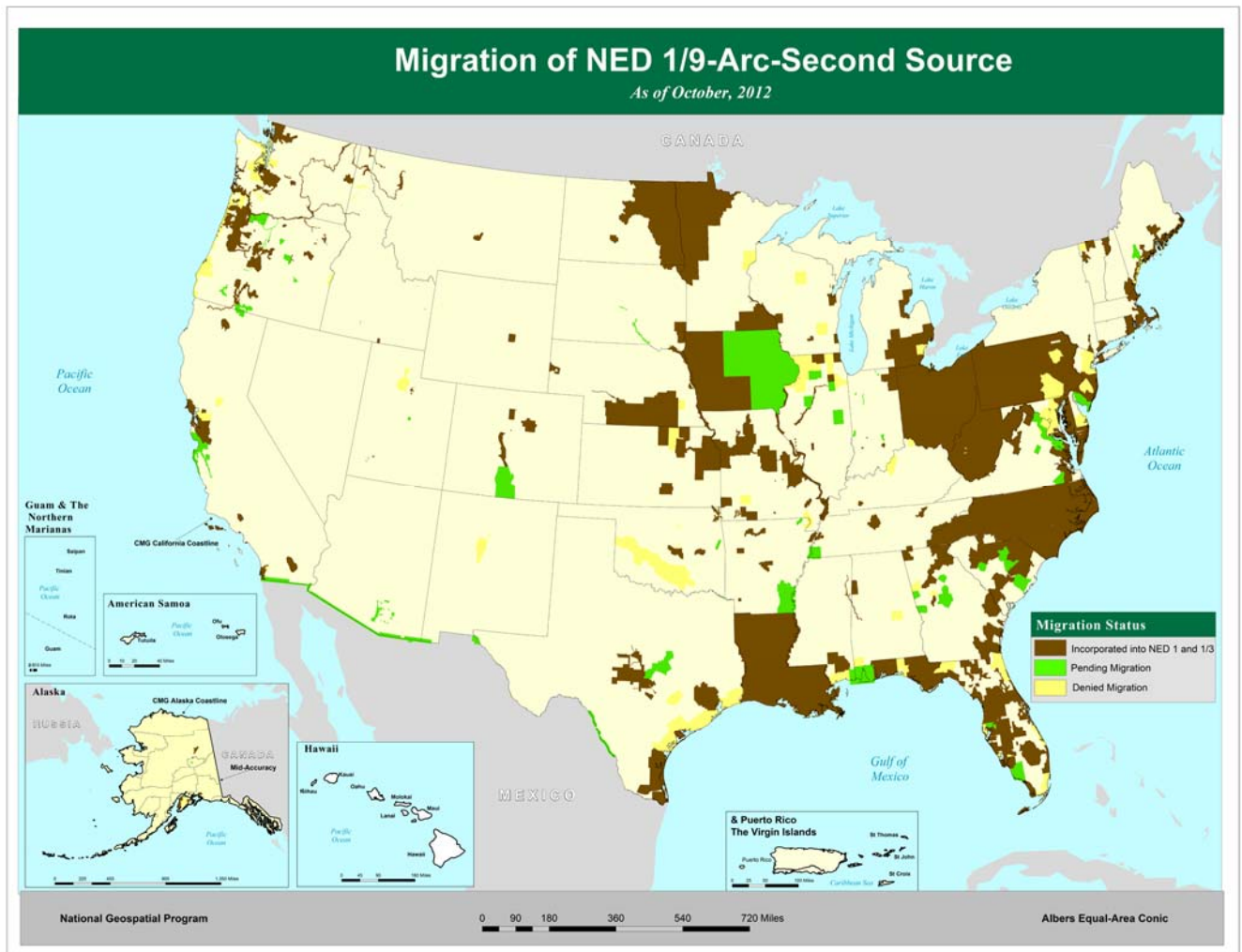
Figure 9. Migration status of NED 1/9 to other NED layers—October, 2012 release.

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.

Parts of Canada Available in the 1-arc-second Layer

Elevation data along the U. S. and Canada borders have been added to the 1-arc-second NED layer during the April, June, and October, 2012 updates. These data are the result of collaboration between USGS and Natural Resources Canada (NRCAN) Centre for Topographic Information–Sherbrook, Ottawa. 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.

Alaska Highlights

Portions of Alaska are now available at resolutions of 1-, 1/3-, and 1/9-arc-second. The recent additions to the Alaska collection consist of either Interferometric Synthetic Aperture Radar (IFSAR) or LiDAR data. Per the statewide elevation plan, IFSAR will be the primary source for elevation data over Alaska. Currently, 15.77% of Alaska is covered by 10-meter or better source data.

Timeline of Alaska additions:
- August, 2008—Addition of Shuttle Radar Topography Mission (SRTM) data in the Aleutian chain
- December, 2008—Addition of the first LiDAR collection in Alaska over the port city of Valdez
- September, 2009—LiDAR area of the Kenai Peninsula
- July-August, 2010—LiDAR over Yukon Flats and additional areas of Kenai Peninsula
- February, 2011—LiDAR over a central Kenai Peninsula
- April, 2011—Pilot area of mid-accuracy 5-meter IFSAR and a small piece of LiDAR along the northeast coast
- August, 2011-April 2012— Addition of 27 more 1 degree cells of mid-accuracy 5-meter IFSAR central Alaska

The resolution of available and anticipated Alaska data for the coming year are shown below in Figure 10.
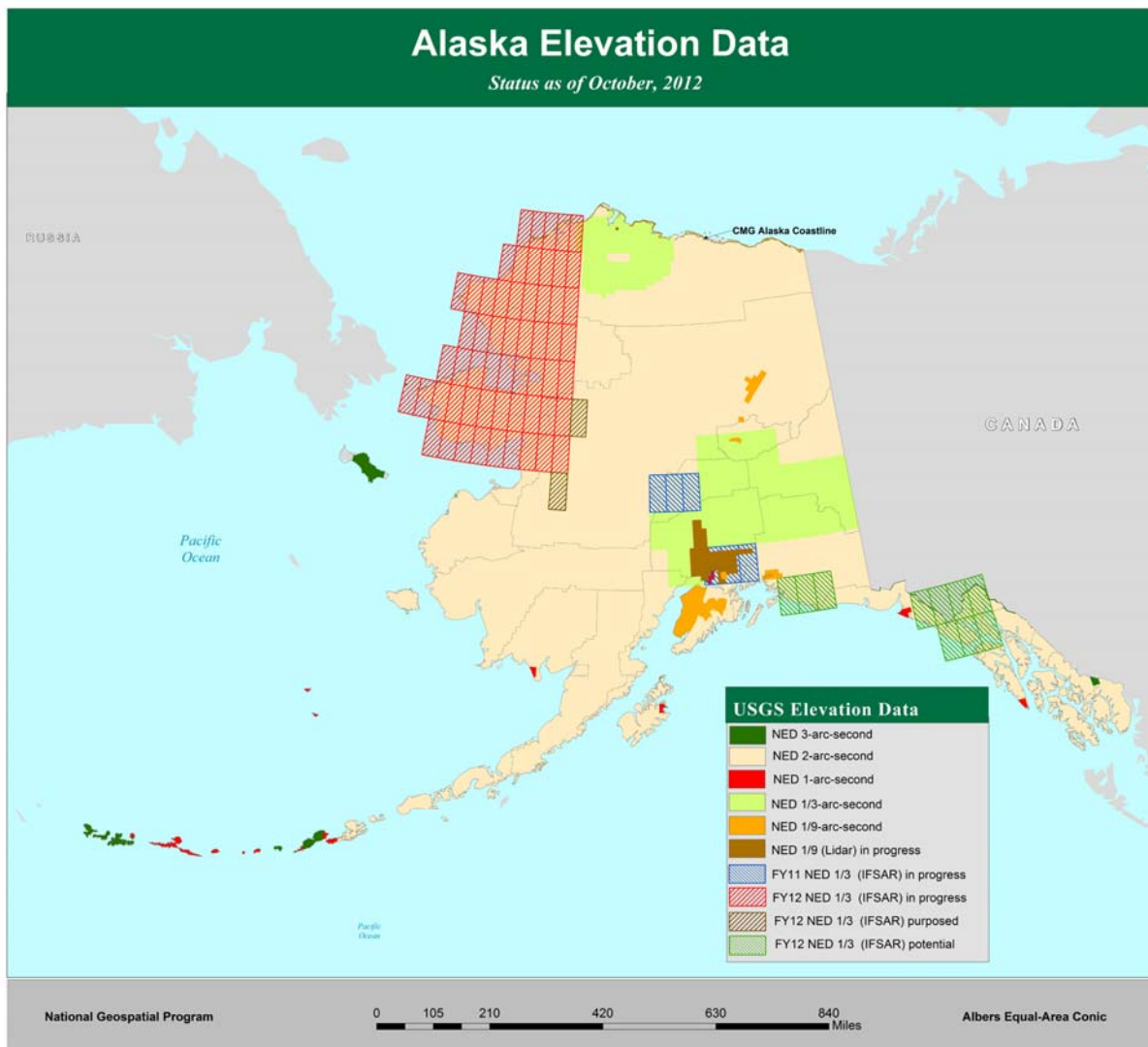

Figure 10. Available and anticipated Alaska elevation data.

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.
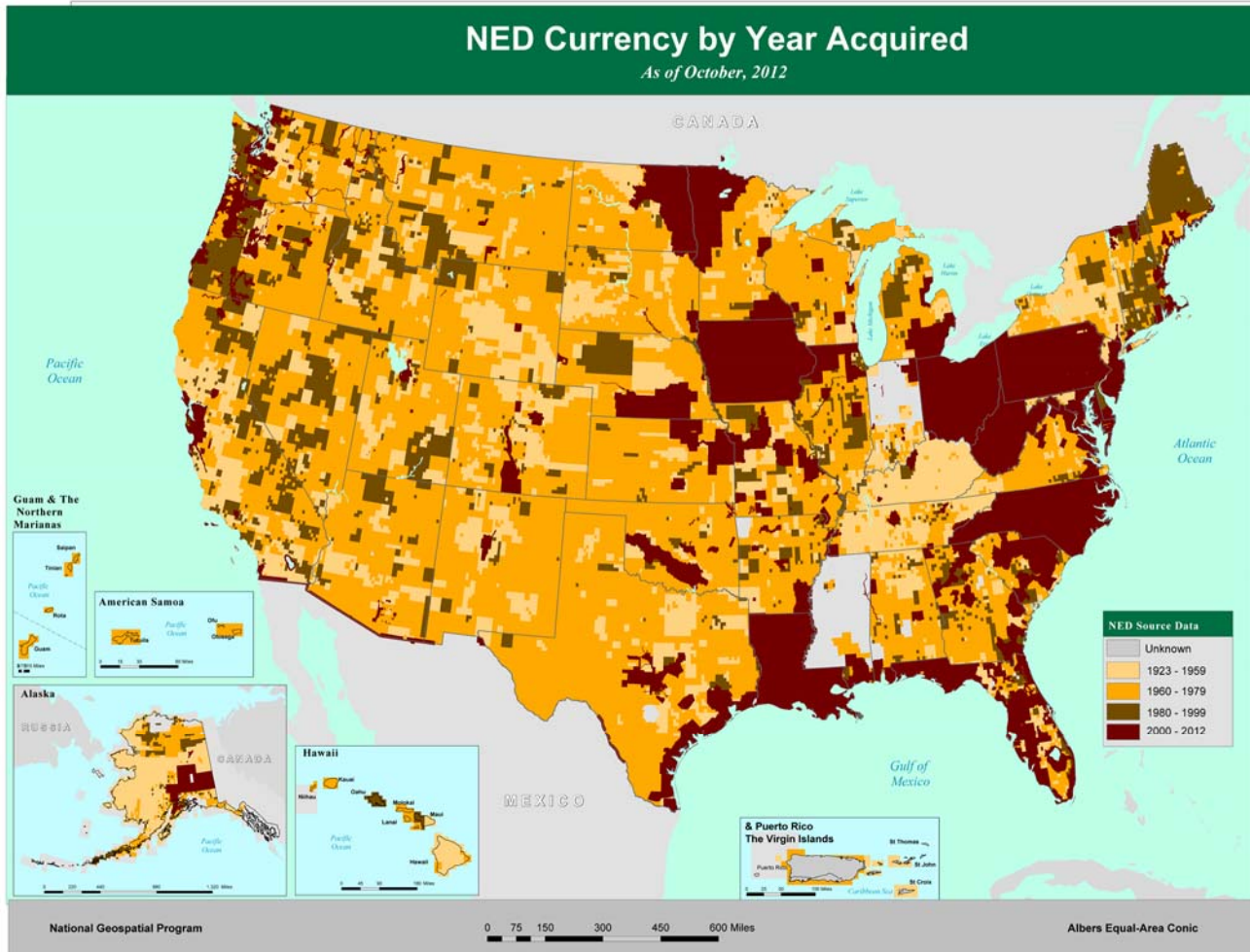

Figure 11. Currency of the NED shown by acquisition year – October, 2012.

Datums

All NED data are currently distributed in the North American Datum of 1983 (NAD83).

Production Methods

Figure 12 shows the production methods used to produce NED data. The number of DEMs created using older production methods is small and they 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.
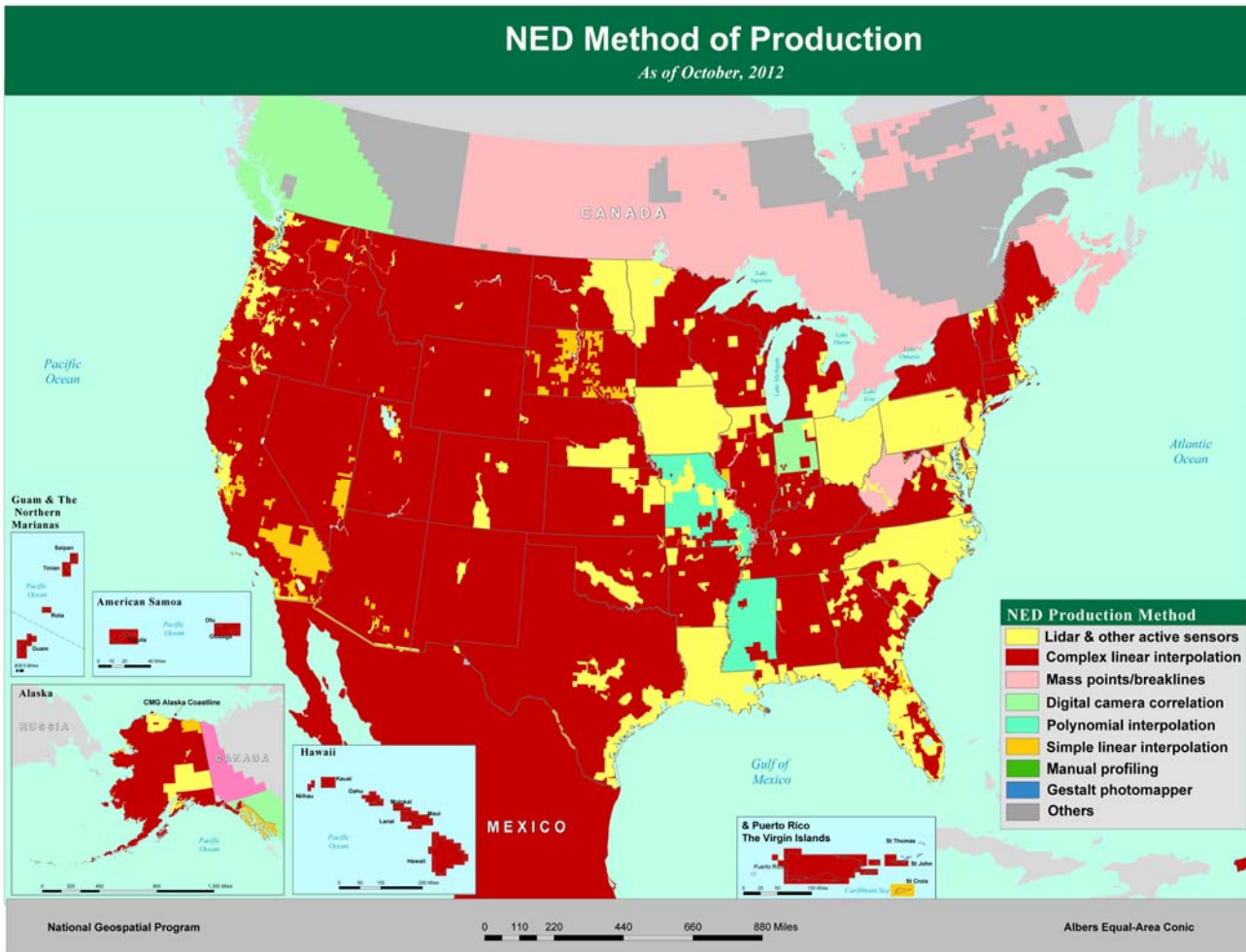
Figure 12. NED source data by production method – October, 2012 release.

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 October, 2012 NED release continues the trend seen in previous releases with an increase in coverage from 10-meter or better sources to the point that there is very little 30-meter source in the NED 1/3-arc-second layer. However a new trend has developed this year where as the 10-meter source is declining as it is replaced by high-resolution source (Figure 13).
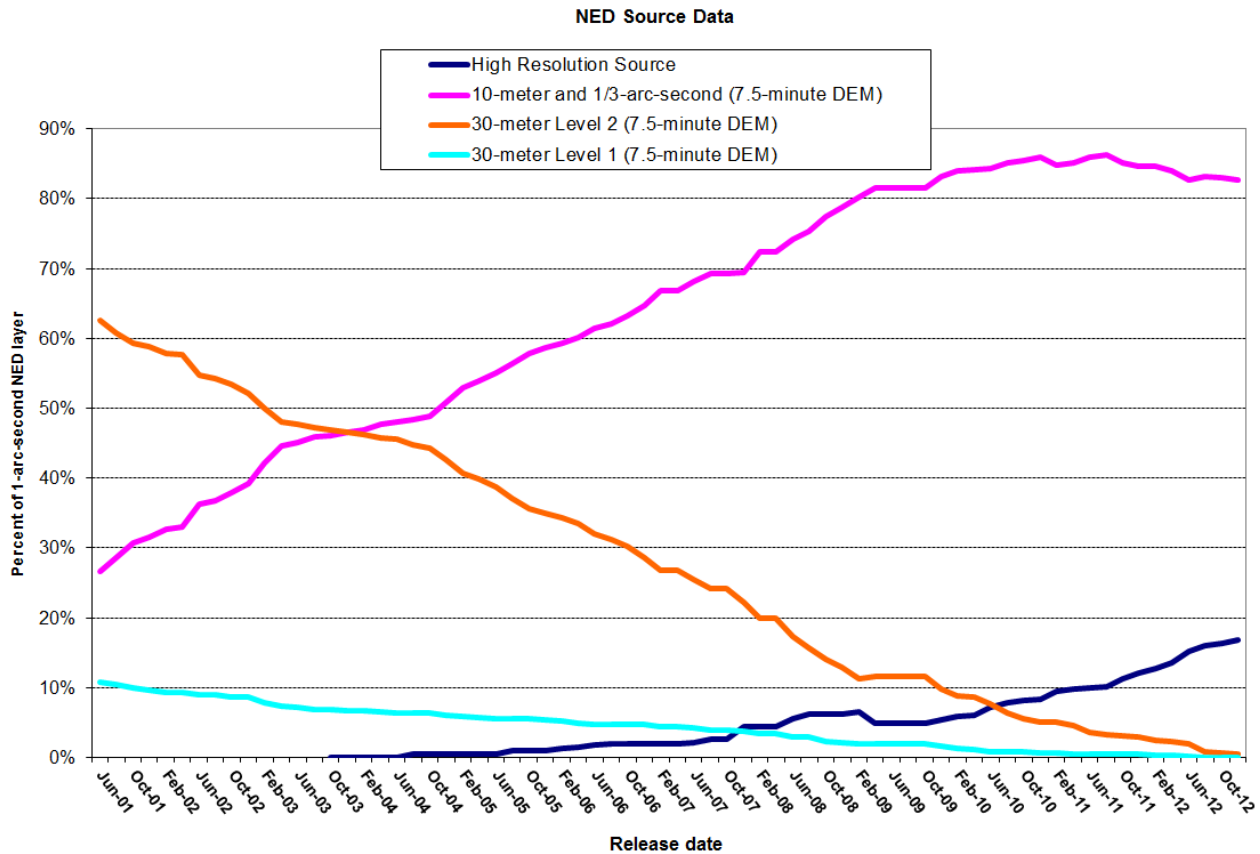
Figure 13. Type of 1-arc-second NED source data by release date.

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	2,073	422 tiles added: Canadian data adjoining U.S.
June, 2012	2,159	86 tiles added: Canadian data adjoining Alaska
October, 2012	2,188	29 tiles added: Canadian data over Gulf of Maine

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

In the current release, 155 tiles were updated, representing 16% of NED, excluding Alaska and Mexico, for which the extent of coverage is resolution-specific (Figure 14).

NED Update Processing

Legend:
- Number of tiles updated (blue bars)
- Percent of NED (without AK tiles) (red diamonds)
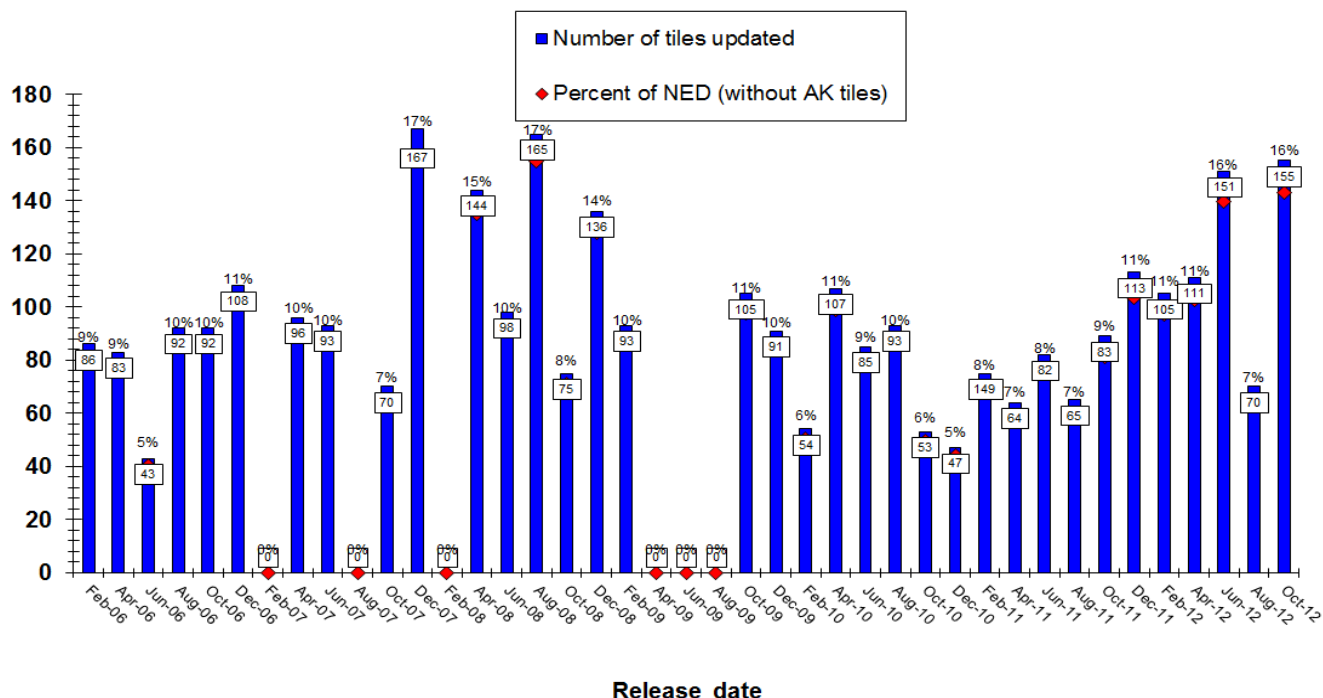
Release date

.

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

How to Obtain NED Data

Newly released and existing elevation data of the (NGP) are available for download via *The National Map* Viewer (http://viewer.nationalmap.gov/viewer/). 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 provides the LiDAR point cloud data for download (http://earthexplorer.usgs.gov/).
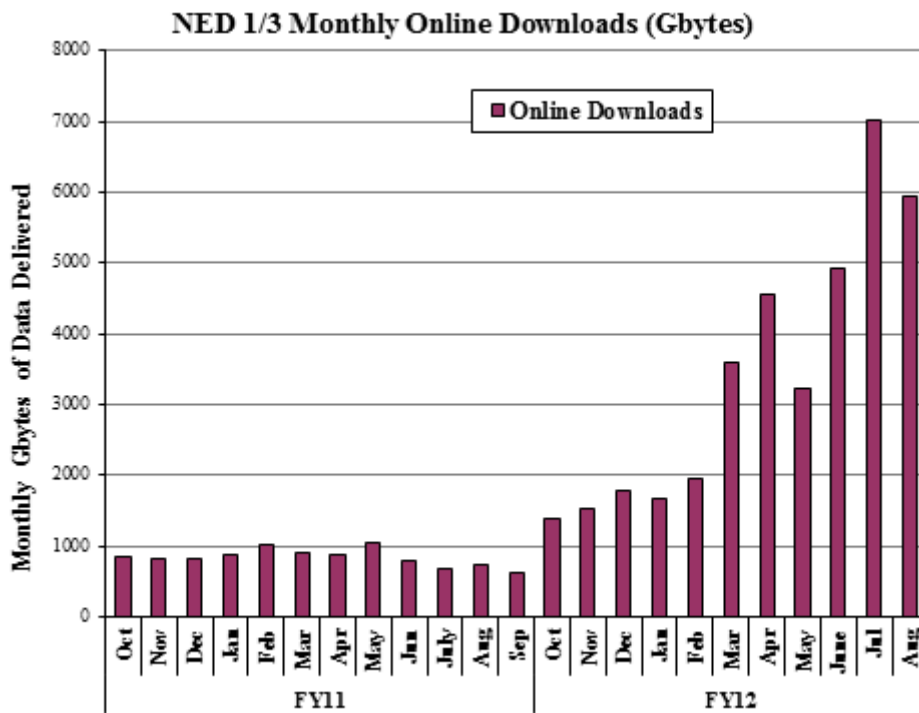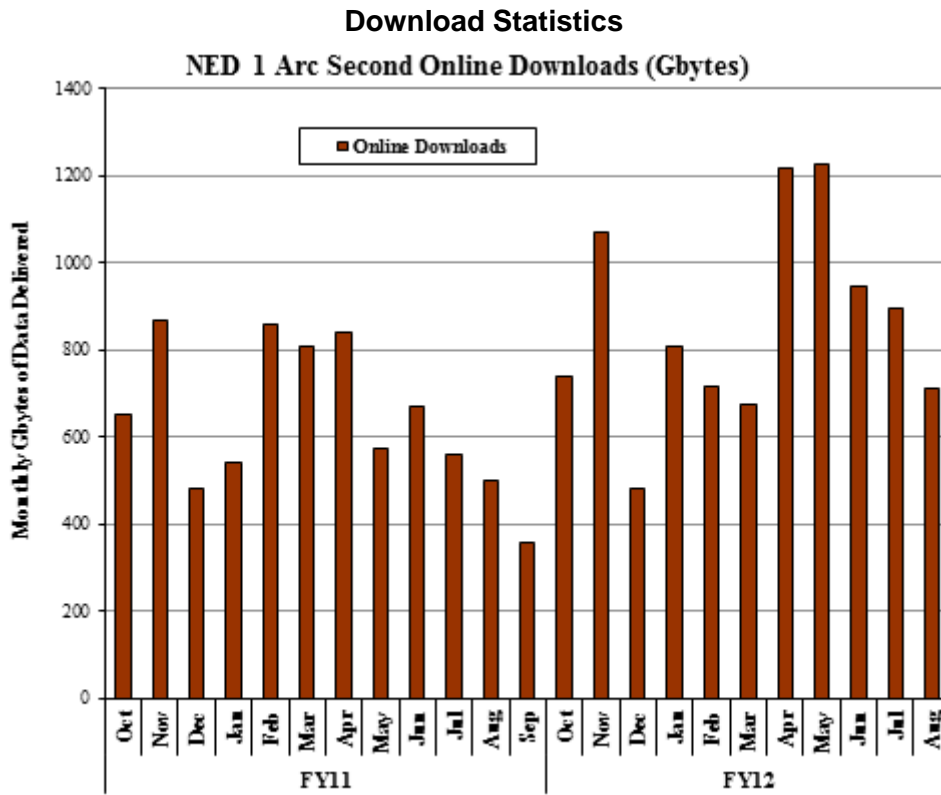
Additional Information Available

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
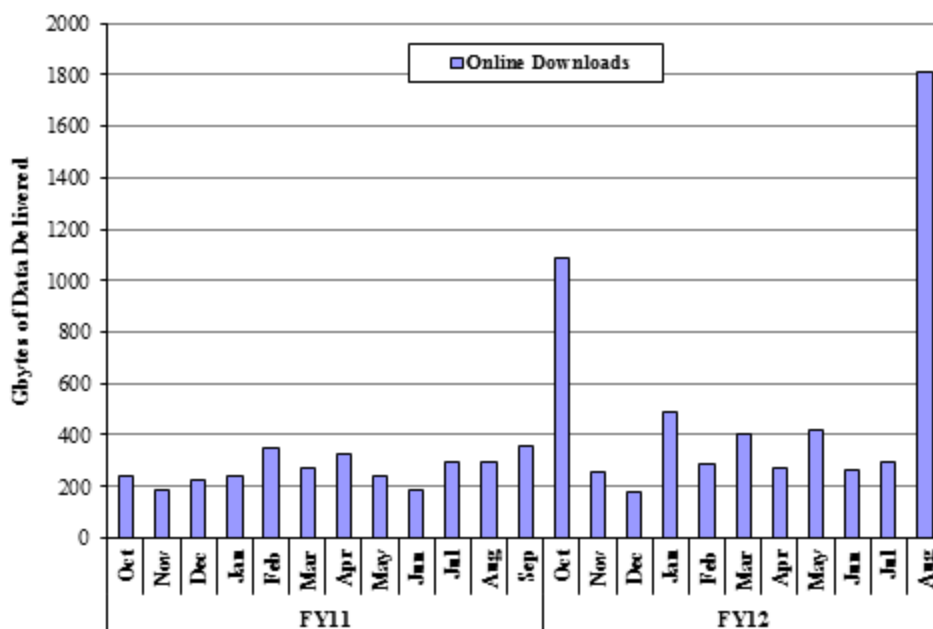- spatial metadata shapefiles of previous releases

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

Distribution Statistics

NED 1 Arc Second Online Downloads (Gbytes)

NED 1/3 Monthly Online Downloads (Gbytes)

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 60⁰ 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.