



Background

Who is NGS?

NOAA's National Geodetic Survey (NGS) is responsible for defining, managing, and providing public access to the National Spatial Reference System (NSRS), a consistent national coordinate system that provides the foundation for mapping and charting; state boundaries; transportation, communication, and land records systems; and numerous scientific and engineering applications. The NSRS provides an accurate geographic framework throughout the United States and its possessions. NGS also develops standards and guidelines for conducting field surveys and helps to coordinate surveying methods among federal government agencies.

NGS GIS Toolbox

The NGS Toolbox lets users convert NGS "**bluebook**" ASCII format data into GIS-friendly formats. Developed as Python script tools for use in ArcGIS, these tools parse NGS files to create attribute-rich geospatial data sets. These data sets are used to plot geodetic data, perform spatial analysis, visualize spatial distribution, and analyze adjustment results. The NGS Toolbox has been used in projects such as the National Adjustment of 2011 (NA2011), GEOID12A, leveling analysis, and Web maps. The toolbox includes several toolsets described below.

GPS Tools Toolset

The GPS Toolset enabled NGS to visualize all of the stations throughout the United States and was developed primarily for use in the National Adjustment of 2011 (NA2011). These tools allow NGS to analyze attributes from both the stations and vectors that are derived from GNSS observations. The tools provided tremendous benefits to analyze **Least Squares Adjustments** (LSA) that were done on a national scale and created station and vector features allowing NGS to visualize the results of these network adjustments. These attribute rich features assisted the ability to analyze the data temporally, the spatial distribution of stations and vectors, as well as the residuals of the adjustment networks. These tools were instrumental in the success for analyzing such a large adjustment that included 81,055 stations and 424,711 GNSS vectors. The NA2011 project manager does not believe this project would have been done as efficiently without them. Converting these ASCII files to shape files provides the ability to join attributes from the **Datasheet** shape files to the project data allowing for the comparison of the adjusted coordinates to the published coordinates analyzing the coordinate shifts.

Glossary

Bluebook – Legacy formatting for survey project submission to be included in the NGS Database

Least Squares Adjustment – a statistical method of estimating values from a set of observations

Datasheet – NGS product that provides Latitude, Longitude, Heights and more information for geodetic control marks.

Benefits

- Integrate geodetic data into GIS environment for analysis
 - Visualize spatial distribution
 - Analyze geodetic adjustments
 - Create graphics used in reports and websites for many NGS products and services
 - Perform spatial analysis
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- Data visualization and spatial distribution of GPS networks
- Plotting GPS stations and vectors to perform spatial analysis
- Identification of duplicate GPS vectors that can provide an over optimistic accuracy
- Identification of no-check stations that have only one tie
- Provides an easy way to analyze changes in coordinates after the National Adjustment of 2011
- Visualizing the coordinate accuracies while performing LSA adjustments
- Ability to perform analysis on coordinate shifts
- Ability to perform temporal analysis on the GPS surveys



Background

Leveling Tools Toolset

The Leveling Toolset provides the means to visualize leveling data sets in a geospatial environment. Historically at NGS processing leveling data consisted of running programs and analyzing the ASCII outputs or manually hand drawing the leveling lines to visualize relationships. These tools provide a graphical interface to view the spatial distribution of leveling lines as well as the ability to analyze Least Squares Adjustment (LSA) output. Making the leveling data available in ArcGIS provides vast benefits for analyzing adjustment results with the ability to query and symbolize data sets highlighting potential errors or problems. These tools greatly enhance the ability to visualize and assess leveling data improving previous methods of analysis and saving tremendous amounts of time.

- Data visualization and spatial distribution of leveling networks
- Plotting bench marks and observations of leveling projects to perform spatial analysis
- Visualizing spatial distribution of leveling adjustment results
- Analyzing how heights change over time and assisting with change detection between surveys
- Graphically identifying outliers

Grid Tools Toolset

The NGS Grid Toolset provides users with the ability to convert modern NGS ASCII grid files – such as the geoid models and deflection of the vertical models – to a point shape file or an Esri Raster. These tools have been instrumental in assisting the creation of maps used in presentations and the NGS website. These tools have also proved very useful in helping NGS to analyze changes in the geoid that have occurred with each model. By showing other federal, state and local governments the changes that have occurred in the geoid models in their area of interest, NGS helps educate them why it is best to use the most recent geoid model. This helps show users why they should not mix and match geoid models and keep their data consistent using the same model for analysis.

- Visualization of NGS grids in ArcGIS for spatial analysis
- Perform change detection between different geoid models
- Gap analysis of geoid models and where observations can be made to improve the models
- Comparative analysis to educate constituents on improvements between models
- Create aesthetically pleasing maps for presentations and web

NGS Geospatial Data and Application URLs

NGS Archived Datasheet Shape Files – Shape files with attributes from the NGS Datasheets. It is recommended to download the Archived state of interest due to download limits through the interactive site. The beta version of the shape files have more attributes including SPC and UTM coordinates.

Interactive web retrieval: <http://geodesy.noaa.gov/cgi-bin/datasheet.pr1>

Archived Datasheets Production: http://geodesy.noaa.gov/cgi-bin/sf_archive.pr1

Archived Datasheets Beta: ftp://ftp.ngs.noaa.gov/dist/BETA_PRODUCTS/DS_ARCHIVE/Shapefiles/

NGS Data Explorer – A web mapping application that allows users to locate geodetic control.

<http://geodesy.noaa.gov/NGSDataExplorer/>

CORS Map – A web mapping application that allows users to view the US CORS sites.

http://geodesy.noaa.gov/CORS_Map/

GRAV-D Data – Aerogravity data

http://geodesy.noaa.gov/GRAV-D/data_products.shtml

NGS Shoreline Data Explorer – A web mapping application to view and download shoreline data.

<http://geodesy.noaa.gov/NSDE/>

CUSP Web Map Service – Shoreline web map service
<http://geodesy.noaa.gov/GeoServer/NSDE/ows?service=wms&request=GetCapabilities>

Geoid Models – All NGS geoid models for US and territories

<http://geodesy.noaa.gov/GEOID/>