

USGS National Hydrography Dataset Newsletter
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Maryland High Resolution is Done!

The high resolution National Hydrography Dataset (NHD) covering Maryland is now complete. This effort is the result of the partnership between the U.S. Geological Survey and the Maryland Department of Natural Resources. Also contributing significantly to the Maryland effort has been a USGS program to support initiatives of the Department of Interior, in this case the Chesapeake Bay Watershed program, covering the 64,000 square miles that drain into the Chesapeake Bay. Additionally, some Maryland coverage has been made available through the Delaware Geological Survey's partnership with the USGS for NHD coverage in that state. The NHD will be used in many applications, including studies on the health of the riparian habitat bounding the streams of the Chesapeake Bay watershed, and Total Maximum Daily Load reports provided to the U.S. Environmental Protection Agency by the Maryland Department of the Environment.

The NHDGEOinARC

The NHD was originally made available in the NHDinARC model to work in ArcView 3.x. With the switchover to the Geodatabase in April of 2004, it became necessary to create a new model to work in ArcView 3.x, now called the NHDGEOinARC. The name comes from the fact that this NHD data is derived from the Geodatabase, but available in an Arc coverage format. To accommodate the new model, the NHD Toolkit has been upgraded. It can be obtained at <http://nhd.usgs.gov/tools.html#nhdgeo>. NHDGEOinARC data is obtained from the NHD web site data viewer at <http://nhd.usgs.gov> by selecting the output option for NHDGEOinARC. Data is delivered as a zip file. Once unzipped, you will find a main folder and five subfolders plus the Openme.txt file. To use the data, go to the NHDGEO ArcView Toolkit and use the NHDGEO Load/Unload Workspace extension where you will click on NHD Tools and the Load NHDGEO Workspace option. Then navigate to the openme file and load all themes. The data will display and you are ready to begin work. You will find 8 themes in four basic categories. In the first category you will find the hydrography network composed of flowlines. This is divided into the Drain and Reach themes. Remember that the NHD is based on reaches, which are permanently identified stretches of water. But these reaches may be composed of multiple flowlines, which are called drains in the NHDGEOinARC. The flow network is based on the drains, so make this theme active when navigating. Familiarize yourself with the various fields found in the Drain and Reach themes. You will find the feature type codes are in the Drain theme and the stream names are in the Reach theme. There are also ID's in each theme to cross-reference each other. In the second category you will find the Waterbody and Waterbody Reach themes. These are the surface water polygons. The Waterbody provides both the feature type and the name, but not the reach code. The Waterbody Reach provides the reach code. Again, both themes cross-reference each other. The third category contains three themes of Point, Line, and Area. These are descriptive themes of hydrography features that help identify characteristics that are not directly a part of the network, such as a spring, dam, or rapids. The fourth category contains one theme named DUU, which is basically the subbasin boundary. Additional tables, such as the flow table, can be found in ArcView by opening INFO tables. To navigate the NHDGEOinARC, make the Drain theme active and use the navigation arrow icon after activating the NHDGEO Navigate extension. To do linear referencing, make the Reach theme active and use the Point or Linear/Area Add Event icons after activating the NHDGEO Reach Indexing Tool extension. These operations will be familiar to users who have used the ArcView Toolkit with the NHDinARC.

Introducing the NHDPlus – Tommy Dewald

The NHDPlus Version 1.0 is an integrated suite of application-ready geospatial data sets that incorporate many of the best features of the National Hydrography Dataset (NHD) and the National Elevation Dataset (NED). NHDPlus is the outcome of a multi-agency effort aimed at developing NHD flow volume and velocity estimates to support pollution fate-and-transport models, such as the USGS SPARROW model. NHDPlus includes a stream network, based on the medium resolution NHD, improved networking, naming, and “value-added attributes” (VAAs). NHDPlus also includes elevation-derived catchments produced using a drainage enforcement technique first broadly applied in New England, and thus dubbed “The New-England Method”. This technique involves “burning-in” the 1:100,000-scale hydrography, and when available, building “walls” using the national Watershed Boundaries Dataset (WBD). The technique was enhanced to impose a “bathymetric gradient” in water bodies to ensure that catchments for centerline reaches passing through water bodies agree with the associated shorelines. The resulting modified digital elevation model (DEM) is used to produce hydrologic derivatives that closely agree with the NHD and WBD. An interdisciplinary team from the USGS, U.S. Environmental Protection Agency (USEPA), and contractors, over the last two years has found this method to produce the best quality catchments feasible in a relatively short time frame.

The VAAs include greatly enhanced capabilities for upstream and downstream navigation, analysis and modeling. Examples include: (1) stream order, retrieve all flowlines and catchments upstream of a given flowline using queries rather than by slower flowline-by-flowline navigation; (2) subset a stream level path sorted in hydrologic order for stream profile mapping, analysis and plotting; and, (3) calculate cumulative catchment attributes using streamlined VAA hydrologic sequencing routing attributes. The VAAs include results from the use of these cumulative routing techniques, such as cumulative drainage areas and land cover distributions. These cumulative attributes are used to estimate mean annual flow and velocity as part of the VAAs.

The NHDPlus is made from a snapshot of the 1:100,000-scale NHD that has received various improvements. The updates will eventually make their way back to the main NHD distribution database at the USGS when the update process becomes operational, but not until after the NHDPlus is made available. Consequently, the NHDPlus will contain some temporary database keys. Therefore, NHDPlus users may not make additional updates to the NHD portions of NHDPlus with the intent of sending these additional updates back to the USGS. Once the NHDPlus updates have been posted to the main NHD database, a fresh copy of the improved data can be pulled from the NHD web site and that copy will be usable for data maintenance.

The geospatial data sets included in NHDPlus are used to develop estimates of mean annual streamflow and velocity for each NHD flowline in the conterminous United States. The results of these analyses are included with the NHDPlus data.

In addition, the locations of approximately 22,000 USGS Stream Gages in the conterminous U.S. have been positioned to the NHD and checked for accuracy. The updated location data will be initially released in shapefile form, but without reach indexing attributes (reach and measure). This data set will be called “USGS Streamgage Network Locations for NHD Version June 2002 Medium Resolution”. Once the NHDPlus V1.0 data are ready for a hydrologic region, the gage locations will be reach indexed to this version of the NHD and will become known as “USGS Streamgage Network Locations for NHDPlus Version 1.0”. This will be distributed as a shapefile, but will now include the reach address fields in the .dbf file, so it also can be used as an event table.

Other event tables for databases maintained by EPA, such as impaired waters, permitted dischargers, etc., will eventually become available, but may not be available immediately.

NHDPlus is currently under production and is planned to be completed in late summer, 2005. For additional information, please contact Tommy Dewald at dewald.tommy@epa.gov.

The NHD and World Hunger

You probably wouldn't expect to see these two words in the same phrase, but yes, there is a relationship. A study at the University of Colorado at Boulder by Professor Kenneth Strzepek is investigating the potential for supplying food to the world's population. The study, funded by the International Food Policy Research Institute, the Center for Environmental Economics and Policy for Africa, and NASA, is based on the two principal drivers for food production: water and economics. Basically, water equals food. But, the problem is that not enough is known about the world's water supply to provide good estimates for food production. However, there is very good data on worldwide precipitation and it is possible to convert that data into available water for food production through modeling techniques. In order to calibrate the model, it is necessary to look somewhere on Earth where a lot is known about water supply and usage. As you might expect, the United States has excellent data on water supply and usage from the U.S. Geological Survey's National Hydrography Dataset, and basin and county level water usage data. By looking at precipitation over the many varied basins of the U. S., and translating that into available water using the NHD; and by looking at water usage from other USGS databases, it is possible through additional modeling to estimate food production. Obviously it is more complex than described here, but this is the basic premise. The story is not quite finished, however, until the second major variable is added, which is economics. Food will not be grown unless there is a way to pay for it. Due to political forces, the economics for food production are tremendously varied around the world. Professor Strzepek is working on developing rigorous models in the two disciplines of hydrology and economics to yield accurate estimates for world food production of which the NHD is one of many key inputs. To find out more, see <http://ceae.colorado.edu/hydroclimate/>

Upcoming NHD Workshops

May 18, 2005, Denver, Colorado – U.S. Geological Survey. Lecture/demonstration in the morning and hands-on workshop in the afternoon. Contact jdsimley@usgs.gov.

May 26, 2005, Lincoln, Nebraska – 2005 Nebraska GIS Symposium. Half-day lecture/demonstration. http://www.gislis.org/2005_symposium.htm. Contact Josh Lear at jlear@dnr.state.ne.us.

August 31, 2005, Lafayette, Louisiana – U.S. Geological Survey. All-day workshop. Contact Pat O'Neil at pat_o'neil@usgs.gov.

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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The NHD Newsletter is published monthly. Get on the mailing list by contacting jdsimley@usgs.gov.

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Jeff Simley, USGS, assumes full responsibility for the content of this newsletter.