USGS National Hydrography Dataset Newsletter
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by Jeff Simley, USGS

NHD and DFIRM in New York by Ricardo Lopez-Torrijos and Cheryl Rose

An exciting advancement in floodplain mapping will benefit National Hydrography Dataset (NHD) users and water resource modelers. The New York State Department of Environmental Conservation (NYS DEC) and the Federal Emergency Management Agency (FEMA), working with the University of Texas at Austin's Center for Research in Water Resources, have developed a data model proposal for Floodplain Mapping that is integrated with the NHD. NYS DEC performs or contracts much of the work involved in the production of FEMA's Digital Flood Insurance Rate Maps (DFIRM) for New York as FEMA's partner in the Floodplain Map Modernization Program. They currently use NHD linear referencing to manage and track the scope/status of the work. NYS DEC produced a large portion of the state's high resolution NHD and will lead the NHD stewardship for the state. Their goals are to improve NHD spatial accuracy and to use the NHD as the framework for integration of water resource information in New York, including DFIRM. FEMA, responsible for DFIRM production nationwide, wants to coordinate their current DCS (data delivery) and DFIRM (data publication) schemas and streamline the DCS in a geodatabase format. They are also developing an XML schema for data transfer. Both agencies see the benefit of an ArcHydro-like model, which could organize the wealth of data collected and developed during floodplain studies (survey points, channel cross sections, flood extents...) in a framework to support many other water resource modeling needs.

The proposed Flood Study Geodatabase responds to all of the above. It will undergo review and likely some tweaking before final acceptance by FEMA. The relationship with NHD provides a means to link FEMA's flood studies to a nationally available surface water resources schema. And to complete the symbiotic relationship, NYS DEC plans to fully integrate the flood study spatial data with NHD and to use stream segments developed for hydraulic engineering as a source of NHD updates.

The Value Added Attributes

The NHDPlus program spearheaded by the Environmental Protection Agency is an effort to add additional intelligence to the basic NHD. Doing this greatly enhances the analytical capability of the NHD to address scientific investigations. The Value Added Attributes are one of the enhancements that have been made to the NHD and included in the NHDPlus. Here is how it works: The geometry of the NHD forms a giant network in which lines flow into other lines. To figure out where the water has come from and where it is going is simply a matter of following those lines. But following those lines takes computer processing power and that can eat up a lot of time. In the relatively small 1:100,000-scale Tennessee River system, for example, there are about 60,000 of these lines. By processing much of the line following ahead of time and storing the calculations, scientists can speed up their analysis and work more productively. The Value Added Attributes are a table of pointers generated by pre-processing the NHD geometry. This is known as the VAA table, or NHDFlowLineVAA, a dbase file that comes with the NHDPlus.

Anything in the NHD that has water flow is represented by a line, known as a flowline, and each flowline has an identification number, known as the Com_ID. This is a standard part of the NHD. The VAA goes a step further and gives each flowline another identifier known as the Hydrologic Sequence Number, or Hydroseq. These numbers are ordered in a sequence so that the smaller numbers are downstream, and the higher numbers are upstream. For example, 33 will be upstream of 32. If two streams converge, generally the longer one will get the higher number. Also, the flowline has endpoints, the upstream endpoint and the downstream endpoint, and each of these endpoint nodes get an identifier. These are the

FromNode on the upper end, and the ToNode on the lower end. These values are then stored as fields in a flowline record. They are used as pointers to speed up operations.

With these values identified, it is now possible to pre-generate additional useful data and store these in fields in the same flowline record. One is the hydrologic sequence number of the flowline immediately upstream. If there is more than one, such as at a convergence, the value listed is the main one. This value is known as the UpHydroSeq. Another one is the UpMinHydro, which is the smallest value of the upstream hydrologic sequence numbers. In the downstream direction is listed the Terminal Path Identifier ID, or TerminalPa, which is the hydrologic sequence number where the flow path terminates, usually at the ocean. Then there is the Downstream Minor Hydrologic Sequence Number or DNMinHydro. These are all calculated and stored to make navigation faster.

Sound complicated? It is at first, but with a little study and practice it all makes sense. In the next NHD Newsletter we will explore the VAA fields dealing with stream level to help round out the picture. Then later we will discuss how software can use this information to speed up scientific analysis. To find out more about the NHDPlus and its VAA table, go to http://www.epa.gov/waters/ and click on NHDPlus. Then click on the NHDPlus User Guide.

Answer to June Hydrography Quiz / New July Quiz

Mike Wiedmer of the Alaska Department of Fish and Game was the first to correctly guess last month's hydrography quiz ftp://nhdftp.usgs.gov/Quiz/Hydrography13.pdf as the lakes surrounding Madison, Wisconsin. Mike is a Fish Habitat Biologist who specializes in exploring the relationships between Alaskan freshwater fish distribution and landscape characteristics including hydrography. So how did a habitat biologist in Anchorage, Alaska recognize these lakes in far off Wisconsin? Mike said the clue "The bigger lake is one of the most studied lakes in the world" gave it away. That could only mean Lake Mendota with the University of Wisconsin on its shoreline. Countless students in many disciplines during the past hundred years have written their term papers, thesis and dissertations about some aspect of Lake Mendota. Lake Mendota will return over 2,500,000 results in Google. Not bad for a puddle left behind from a glacier. One result, for example, gives us the current pH or dissolved solids in Lake Mendota - try http://limnology.wisc.edu/lake_information/mendota/mendota.html. Did you know that 22% of Lake Mendota is flushed through every year? You can get a live webcam shot of Lake Mendota at http://www.soils.wisc.edu/asig/webcam.html. You can see what students were up to in the winter of 1979 at http://www.museumofhoaxes.com/pranks/liberty.html. Lake Mendota is the larger lake to the north; Lake Monona is next to the south, followed by Lake Waubesa, and then Lake Kegonsa (all Native American names). What is the big "X" in Lake Monona? It's two railroad causeways that intersect in the lake. Others with the correct answer were Matthew Heberger, John Griffin, Walt Jaeger, Teresa Jaeger, and Joe Miller.

For the July quiz look at ftp://nhdftp.usgs.gov/Quiz/Hydrography14.pdf . Can you identify where this is? The staircase light blue polygon at the bottom is the ocean. The northeast part of the image covers the bottom half of a major city. Much of the image is covered by a national forest. Green is swamp. The straight dark blue lines are canals. There are two fairly large river systems flowing into the ocean. Send your guess to jdsimley@usgs.gov.

Current USGS NHD Data Stewardship Contacts

Maine, New Hampshire, Vermont, New York, Massachusetts, Connecticut, Rhode Island, Pennsylvania, New Jersey, West Virginia, Maryland, Delaware, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Puerto Rico, and Virgin Islands – Carl Nelson cwnelson@usgs.gov

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Wisconsin, Illinois, Iowa, Missouri, Arkansas, Kansas – Tim Hines thines@usgs.gov

Louisiana, Texas, Oklahoma, New Mexico, Colorado, Utah, Arizona Nevada, California, Hawaii, Guam, American Samoa – Bill Smith wjsmith@usgs.gov

Upcoming NHD Application Workshops

San Diego, California – August 7-11, 2006. ESRI User Conference. Various NHD papers.
NHD User Group Meeting – August 9, 12:00 PM, room 30B. http://www.esri.com/events/uc/.
Coeur d' Alene, ID – August 23 & 24, 2006. Contact Frank Roberts at fmroberts@cdatribe-nsn.gov.
Albuquerque, New Mexico – September 12, 2006. Contact Gary Kress at gekress@usgs.gov.
St. Cloud, Minnesota – October 4, 2006. Contact rwencle@usgs.gov.
Bismark, North Dakota – October 25, 2006. Contact rwencle@usgs.gov.
Salem and Portland, Oregon –November, 2006. Contact Nancy Tubbs at ntubbs@usgs.gov.
Olympia, Washington – November, 2006. Contact Sam Bardelson at stbardelson@usgs.gov.

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The NHD Newsletter is published monthly. Get on the mailing list by contacting jdsimley@usgs.gov.
You can view past NHD Newsletters at http://nhd.usgs.gov/newsletter_list.html
Jeff Simley, USGS, assumes full responsibility for the content of this newsletter.