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# AUTOMATED DELINEATION OF STREAM CENTERLINES FOR THE USGS NATIONAL HYDROGRAPHY DATASET

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An algorithm is presented for creating a continuous centerline utilized in base mapping with the National Hydrography Dataset (NHD). This research is part of ongoing efforts to fully automate generalization processing for use on the NHD as part of planned updates to The National Map maintained by the USGS. For cartographic purposes it is necessary to delineate a hydrographic centerline feature which is appropriately continuous and represents the visual main channel of any basin. This paper describes a database enrichment process which adds attribution delineating a continuous channel centerline through a set of hydrographic flowlines.

The algorithm is placed within the context of a generalization routine for a NHD high-resolution subbasin. Given the size and extent of the terrain of the United States, the NHD is a substantially large and varied dataset. The USGS maintains and coordinates the NHD as a vector database containing surface water features of the United States. Several versions of this database include high resolution, compiled for use at 1:24,000 (24k) and medium resolution compiled for use at 1:100,000 (100k) (http://nhd.usgs.gov/data.html). For best cartographic practice, it is necessary to enrich the high resolution NHD with continuous centerline information. Once delineated, centerlines can be generalized for use at smaller mapping scales. A stream centerline can be thought of as the primary channel flowing through a subbasin. At present, stream channel priority is not attributed for the high-resolution NHD (http://nhd.usgs.gov/nhd_faq.html) and, as the paper demonstrates, requires database enrichment to proceed.

Centerlines are delineated through spatial overlay operations and logical analysis of the NHD data structure (or schema). Initial sections of the centerline are delineated from an intersection of flowlines with polygonal river channels, and gaps between these sections are filled by tracing operations through lists of nodes associated with candidate flowlines. The process of filling in gaps in the centerline is iterative, and it relies on the confluence-to-confluence reaches delineated in the flowline network. The candidate list of flowlines is scanned for reaches that contain at least one node coincident with a node from a feature tagged as a centerline through the spatial intersection. Reaches with one coincident node are further scanned to check if both nodes are coincident with the tagged centerline features.

The next step works with reaches in the candidate list sharing at least one node with the centerline and one node with each other. In cases where a centerline gap spans more than two reaches, a successive range based on unique numerical identifiers is added to the candidate list. These groups of successive reaches are then iteratively dissolved and each group tested to see if the nodes of dissolved reaches are coincidental with nodes of a centerline gap.

The algorithm is being refined to narrow the candidate flowlines for the current algorithm using enriched stream attributes such as upstream drainage area in order to reduce processing time. Currently, the solution represents a step towards a purely geometric approach to centerline selection. For validation, the algorithm is tested on several NHD subbasins and evaluated for completeness by creating a flowline network of the delineated centerline. Initial results indicate successful centerline delineation with further testing planned on larger datasets.