Hydrography Webinar Series

Session 2
May 21, 2015
Hydrography Webinar Series—Session 2 Agenda:

1. Introduction
2. NHDPlus Flow Computation and Analysis—Al Rea
3. The National Flood Interoperability Experiment (NFIE)—Ed Clark
4. Discussion

USGS
Hydrography Webinar Series—
Purposes:

- Share success stories from users who have solved real world problems using hydrographic data
- Provide information on the NHD, WBD and related products
- Provide a forum for users similar to what might be encountered in a conference setting
Hydrography Webinar Series—Example Topics:

- Hydrology
- Resource Management
- Pollution Control
- Fisheries
- Emergency Management
- Mapping
- Elevation/Hydrography Integration
NHDPlus Flow Computation and Analysis

Introductory Concepts

by Al Rea
Hydrography Webinar Series—Seminar Formats:

- Use cases
- Underlying technology
- “Rapid Fire” sessions
- Collect feedback
Hydrography Webinar Series—Seminar Information:

- NHD Newsletter & Mailing list – nhd@usgs.gov
- AWRA and other organization emails
- Contact info from webinar signup

- Expected Interval—every 6-8 weeks
- Questions during webinar—Q&A tab
NHDPlus V1 and V2 Team:

- Tommy Dewald – EPA Project Manager
- Tim Bondelid – Consultant to EPA, Hydrologist
- Cindy McKay – Contractor to EPA, NHDPlus Technical Lead, Database & Software Design
Overview—Flow computation and analysis:

- NHDPlus Components
  - Surface Water Network
  - NHDPlus Network Attributes
  - Catchments
  - Catchment & Watershed Attributes
  - Points of Interest Linked the Network (gages, forecast points, dams)

- Analysis Example—EROM Flows and Velocities
NHDPlusV2 Components

Vectors
- NHD Snapshot
- WBD Snapshot
- Hydro-Enforcement Features
- Catchment Polys

Rasters
- NED Snapshot
- Hydro DEM
- FDR/FAC
- Catchments
- More…

Many Attributes

USGS
Value Added Attributes (VAAs) For the Stream Network

Analysis

- Stream Order
- Waterbody Identifier
- Network Identifier
- Level Path Identifier
- Distance to Terminus

Navigation

- Stream Level
- FromNode/ToNode
- Hydrologic Sequence
- Divergence Main Path
- Start/Terminal Flags
- QA/QC’ed Connectivity Table
From node/To node

- Nationally unique ID’s
- These are conceptual
- No feature class exists
Hydrologic Sequence Number

- Nationally unique sequence number
- All upstream flowlines have higher hydrologic sequence numbers and all downstream flowlines have lower hydrologic sequence numbers.

Sort:
Ascending = downstream to up
Descending = upstream to down

USGS
VAA Navigation By Query

- Four types of traversal
  - Upstream Mainstem
  - Upstream with Tributaries
  - Downstream Mainstem
  - Downstream with Divergences
- Various stopping conditions
- Well suited to large navigations
Navigation by Query Tools

- **ArcMap Tools** –
  - VAANavToolbarCom.dll &
  - VAANavigatorCom.dll

- **Callable Tools** –
  - VAANavigatorCom.dll
NHDPlus Concepts: Rapid Navigation of the Linear Surface Water Network

Susquehanna River Drainage Basin

Susquehanna River Main Stem
Catchments

- Catchment delineation process developed out of the New England SPARROW project (USGS) and the “Agree” aml (University of Texas)
- Creates a hydrologically-conditioned DEM (HydroDEM) which integrates information from three datasets
- Catchments are generated from this HydroDEM
- Catchments provide linkage between landscape processes and stream network
Hydrologically-Conditioned DEM Incorporates:

- National Hydrography Dataset (NHD)
- Watershed Boundary Dataset (WBD)
- National Elevation Dataset (NED)
Catchment attributes included (incremental and cumulative):

- Climate (mean annual and monthly)
  - Precip
  - Temperature
- Runoff (mean annual and monthly by Wolock and McCabe)
- NLCD 2011 (all categories)
- Mean Latitude (incremental only)
Example Points/Lines of Interest along the Network:

- Stream Flow Gages (NHDPlus)
- Dams (restricted distribution)
- Water Quality Monitoring Stations, Discharge Permits, WQ Standards, Assessments, Impairments, and TMDLs (EPA)
- Road Crossings
- Habitat
- Others…
NHDPlus V02
EROM Flow Estimation Steps

1. Runoff based on water balance model (RO)
2. “Excess ET” component that takes into account excess evapo-transpiration in the stream channel area (EET)
3. A regression of Step 2 flows on Gage flows using Reference gages (RGR)
4. A capability for users to add, remove and transfer flows (PlusFlowAR)
5. Adjustments to observed gage flows
6. A flow QA module to evaluate accuracy of the flow estimates
Step 1: Mean Annual Runoff Grid

U.S.: Wolock and McCabe;
Canada and Mexico: Canadian Forest Service 1971 - 2000
Step 1: Runoff (SR)

QA Statistics

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Step 2: **Excess Evapotranspiration (EET)**

Method developed by Dave Wolock of USGS.
(graphic courtesy of Dave Wolock)
Step 2: EET (10L)

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Step 3: Reference Gage Regression (SR)

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Gage Flow (cfs)

EROM Flow (cfs)
Step 4: Transfer, Withdraw, Augment Flows ("PlusFlowAR")

Transfer 2 cfs
Step 4: “PlusFlowAR” (NE)

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Step 5: Gage Adjustment

Flowline adjustments closest to the gage will get higher weights than Flowlines farther from the gage.

Gage DA = 12
Gage Q = 13
EROM Flow = 12
QAdj = 13 – 12 = 1
Gage Adjustment: Re-Accumulated Flows

Gage DA = 12
Gage Q = 13
Flowline Flow = 12
QAdj = 13 – 12 = 1
Gage Adjustment QA:

- Randomly remove 20% of the gages from the gage adjustment
  - Called “Gage Sequestration”
- Provides a ballpark estimate of how well the final, gage-adjusted flows match gage flows

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Streams symbolized using EROM flows:
Teaser…

- USGS and the NHDPlus team have begun work on High Resolution NHDPlus based on HiRes NHD and 10-m NED/3DEP

- … but that’s a topic for another day…
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NFIE PRESENTATION ...
U.S. GEOLOGICAL SURVEY
HYDROGRAPHY
WEBINAR SERIES

SESSION 3

JULY 30, 2015
USGS Hydrography Webinar Series

Closing

Poll

Recording and Presentations

http://nhd.usgs.gov/HydrographySeminarSeries.html