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Tuesday, March 30
1:30 PM – 3:00 PM
SESSION 20: Integrating Time Series Data

Data Interoperability Between Generic Hydrologic and Hydraulic Databases and Models - Steve Jencen, Michael Baker Jr Inc, Manassas, VA (co-author: Raja Srinivasan)

Significant strides have been made recently in the creation of large regional hydrological datasets. However, the volume of data in these datasets requires use of tools for import and export of data into formats compatible with multiple models for multiple uses. The representation of hydrologic and hydraulic features within an ESRI GIS system, using an ArcHydro based framework allows for easier transition between different modeling platforms as well as helps with the ability to conduct other spatial analyses on the datasets. Large regional datasets like South West Florida Water Management District's (SWFWMD) Geographic Watershed Information Systems (GWIS) built on the ArcHydro framework, allow the ability to collect and store pertinent structure information including bridges, culverts, levees, storage areas, etc. in an enterprise data structure, in addition to other ESRI ArcHydro generated hydrologic data. While helping to standardize the hydrological information storage and survey data collection / inventory, the approach moves beyond any model specific data storage. In addition, the Consortium of Universities for the Advancement of Hydrologic Science, Inc - Hydrologic Information System (CUAHSI HIS) provides web services, tools and standards, for enhanced access to storage and retrieval of hydrological data. These user friendly tools and web services allow for automated retrieval of streamflow gage data, EPA Storet and SNOTEL data. SWFWMD provides several tools along with the GWIS database for data management and formatting. However, conversion of these datasets into formats required for input in Hydrological and Hydraulic (H&H) models such as HEC-RAS, SWMM, ICPR, etc. can be a significant bottleneck. We present here a set of tools that are compatible with the existing tools and can import/export data from these generic geodatabases into formats specific to different H&H models. These tools can be easily incorporated within the above mentioned GIS data frameworks and can significantly reduce the burden usually associated with traditional data processing tasks for modelers.

ArcGIS Tools for Importing, Storing, and Analyzing Reservoir Vertical Profile and Other Water Quality Data - James Nelson, Brigham Young University, Provo, UT (co-authors: Caleb Buahin, Rushit Hila, Tamara Rabadi, Oliver Obregon, Reed Chilton, Ashley Childers, Gustavious Williams)

Modern field water quality sensors, probes, and sondes allow the collection of significant quantities of data with high temporal resolution. These instruments can also collect high-resolution vertical profile data with multiple parameters. Regular collection of large numbers of vertical profiles has traditionally has been rare in water quality studies and tools to work with these data are rare. We developed a set of tools to import, store, and analyze vertical profile data and single point measurements. We use Excel to perform the initial data evaluation and processing, Access as a personal geodata base, and ArcInfo tools to analyze, visualize, and communicate the data. The Arc tools provide vertical plots of multiple variables, spatial distributions of variables at a specific elevation or depth, and animations of any of the data presentations over time. The tools also compute statistics and correlations among the variables fro quantitative analysis. The collected data are stored referenced by collected location, time, depth, elevation, and interpolated to even 0.25 foot elevations to allow spatial analysis of the data across monitoring points and through time. Vertical profiles can be analyzed in various ways. For example, the profile at a monitoring point can be plotted over time, this can show correlation among parameters, reservoir processes associated with depth such as thermal clines or oxygen deficient areas, and other issues. These data could be analyzed at multiple monitoring points at a single depth over time, for example looking at spatial averages of selected depth measurements to analyze reservoir spatial processes such as the impact of inflows or using simple time plots of parameters at a single monitoring point at selected depths. Data can also be analyzed by elevation rather than depth since, for most reservoirs, significant depth changes occur annually. Elevation, rather than depth, can be important in some cases such as issues associated with a dam outlet elevation.

ArcHydstra: Integrating Kisters' hydrologic Software Hydstra into ArcGIS for Mapping Reports Development – Brian McKay, BCI Engineers and Scientists, Inc., Palatka, FL (co-author: Kyle Knoche, Aisa Ceric)

HydstraTM is software for managing large amounts of time-series data for water resources. The St. Johns River Water Management District (SJRWMD) utilizes HydstraTM to monitor, store and analyze data from hydrologic monitoring sites within its area. SJRWMD is also involved in a large-scale GIS program that uses the ESRI suite of products including ArcSDETM for enterprise level data storage and ArcInfoTM Desktop for users to access, modify and analyze this data. The SJRWMD programs require detailed reports using data that has been collected from the sites. In order to draw the most logical and comprehensive conclusions using these two technologies, a custom application, named ArcHydstra, was developed. ArcHydstra allows a GIS user that is moderately familiar with the HydstraTM functions HYFLOW, HYDIST, and HYPEAKS to run these functions within ArcMap. From the map view, a user is able to select sites in ArcMap and then use those sites to run the Hydstra's functions. The derived data are stored in an access database and then used to create custom charts for mapping reports in the page layout view of ArcMap. ArcHydstra allows the user to customize the type of chart (line or bar) as well as overlay multiple sites onto a single chart. There are no limits to the number of charts or their placement on a page layout. In addition, the user is afforded a custom configuration file so that the maps can be recreated and/or modified at their leisure.

Turning Your GIS into a Temporal Information System (TIS) - How to Plot, Visualize and Analyze Time-Series Data Within the GIS Environment - Richard Koehler, NOAA - NWS, Boulder, CO (co-author: Jennifer Boehner)

Plotting a time-series dataset as a “map” in a GIS environment offers water resources scientists and professionals an innovative approach to examine the multiple time scales of a riverine system. In the case of streamflow, such a plot reveals the entire temporal signature of a river – with the annual, seasonal, and daily discharge patterns easily seen within a single graph. These patterns determine many of the physical and biological properties of a stream. Visualizing the natural short- and long-term variation of streamflow identifies the normal processes of a river or stream and is important when detecting artificial fluctuations which disrupt the natural processes. It is critical to recognize and identify such natural patterns from artificial fluctuations and disturbances to have a more complete understanding of river systems.

For daily streamflow data, values are plotted as an event layer where years are plotted as the Y field, days are plotted as the X field and magnitude is the value of interest. The resulting graphic can be interpreted just like a map, with patches and discontinuities representing seasonal and annual hydrologic patterns.

Such a temporal information system (TIS) provides additional tools to aquatic ecologists and scientists studying the physical hydrologic environment. Water resources managers can use such temporal maps to achieve more natural flow regimes. When examining other time-series such as drought indices, both spatial and temporal variation can be detected within such a map.

Streamflow records from the Colorado River in Colorado and Arizona along with western state climatic indices are provided as examples of this technique.