DIGITAL MAPPING TECHNIQUES 2016

The following was presented at DMT’16
(May 22-25, 2016 - Florida Geological Survey,
Tallahassee, FL)

The contents of this document are provisional

See Presentations and Proceedings from the DMT Meetings (1997-2016)

http://ngmdb.usgs.gov/info/dmt/
Managing a Potentiometric Surface Mapping Program

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The Florida statewide potentiometric surface mapping program was reestablished in 2013 in cooperation with Florida’s five water management districts (WMD) to map the upper Floridan aquifer (UFA) semiannually in May and September. Water-level data is submitted by numerous agencies with the majority coming from the WMD. Collaboration with WMD staff is critical due to the expertise they provide in data assurance and technical review of potentiometric surface contour lines. The well network currently comprises over 1,400 wells with approximately 1,100 used in each surface creation.
Large amounts of data require that data be organized as efficiently as possible. This begins with setting up a data structure that minimizes input error while concisely managing a “tidy” database. Data from eight sources is converted into the same format and then imported into the database. Summary statistics are run to check for any errors in the data and are corrected prior to any analysis.

Data is stored in an ArcGIS file geodatabase consisting of feature classes for the well network and contour lines of the potentiometric surfaces developed for the UFA. Water-level and water-quality tables are included in the geodatabase providing information about each well during a specified date. Finally, a relationship class is established to link the many water-level measurements to the appropriate well.

Creating the potentiometric surface contour lines is a two-step process. First, an automated process using kriging is used to make a raster surface of the water-level data. This process is saved and documented in an ArcGIS Toolbox.
An error report is included to help identify overall error and trouble spots in the raster surface. This report can aid in identifying locations where additional wells can improve the interpolated surface.

Next the raster surface is refined using post editing rules to create the final contour lines:

- Rivers intersecting the UFA follow the rule of V’s.
- Potentiometric surface contour line values do not exceed the topographic digital elevation model (DEM) in unconfined areas.
- Potentiometric surface contour lines do not violate valid measured water-level data.

Data is shared as an interactive ArcGIS Online map or by downloading the entire geodatabase.

FDEP ArcGIS Online projects

http://fdep.maps.arcgis.com/home/

FDEP Geospatial Open Data Portal

http://geodata.dep.state.fl.us/
Managing a Potentiometric Surface Mapping Program

James Cichon - Hydrogeologist

May 24, 2016
Statewide potentiometric surface mapping of the upper Floridan aquifer (UFA)

- Reestablished in 2013 in cooperation with Florida’s five water management districts (WMDs)

- WMDs provide:
  - Water level data* – last two weeks of May and September
  - Product review

- FGS/FDEP provide:
  - Generation of statewide potentiometric surface (contours, raster)
  - Final products shared as a geodatabase, pdf and ArcGIS online map

- *Additional water level providers are Geological Survey of Alabama, Alachua County and the USGS
Florida’s five water management districts:

Currently 1,411 wells in network

1,192 WMDs
175 Alachua County
17 Geological Survey of Alabama
27 USGS

Approximately 80% of wells have daily water level readings
Project Goals

• Develop Statewide potentiometric surface maps for the months of May and September

• Manage and **share** a geodatabase of wells, water level data and contour lines for agency/public use

• Develop raster surfaces from wells and contour lines

• Collect, compile and digitize (GIS format) historic potentiometric surface maps
Wells and water level linked through relationship class. There are currently 1,411 wells and 9,119 averaged WL readings.

- Domains to restrict data entry
- Contour lines symbolized using cartographic representation.
- Metadata included
Put a process in place to manage your data – Don’t create digital litter

- USGS data – R script to download and export WL data to csv file
  
  ```
  install.packages("dataRetrieval")
  library(dataRetrieval)
  well <- readNWISdv(c("304313081330001", "304406081330504", "304712084395801", "304756081311101", "304942082213801", "304949083165301", "305356084534601", "310427084591101", "305235084125101", "304806084404101"), startDate = "2015-09-17", endDate = "2015-09-30")
  write.csv(well, file = "sept2015_well.csv", row.names = FALSE)
  ```
  
- dataRetrieval -
  [http://usgs-r.github.io/dataRetrieval/#1](http://usgs-r.github.io/dataRetrieval/#1)

- Load WL data into GDB using the simple data loader and update attribute fields

- Summarize WL data by min, max, avg, SD and variance

- Check for new wells

Source: Seth Bassett
What is kriging?

Kriging – interpolation technique that uses distance and spatial arrangement of points to predict a value where one does not exist.

Kriging will also predict a value at the well point. This is how we get the error value from the interpolation process.

The benefit of kriging is generation of an error report and it’s a good interpolator where data is sparse.
Potentiometric Surface Tool

File containing parameters

WL value in table

Info about tool and inputs
1.) Wells with WL value

2.) Geostatistical Analyst xml file
   - Contains kriging model inputs

3.) Error Report
   Largest errors occur along edges and where gradient is steep.

4.) Rough contours
Geostatistical Analyst layer created from points used in the kriging process is converted to permanent grid.

- Automation provides a nice starting point for potentiometric surface
- Surface needs manual refinement
Error report – shows difference between measured and predicted water level values.

Will be used to analyze surface creation results to improve model or locations for new wells.

September 2012
- 73% of predicted water level values are within 5 feet of measured value.
- 89% of predicted water level values are within 10 feet of measured values.
- Greatest errors occur where gradient changes rapidly and along edges of State.
• Rivers intersecting the UFA follow the rule of V’s

• Potentiometric surface contour line values do not exceed the topographic digital elevation model (DEM) in unconfined areas

• Potentiometric surface contour lines do not violate valid measured water level data
Contour lines post manual edits

Lines created from grid are smoothed and checked to see if they make sense with WL data

Cartographic representation rules set and stored in geodatabase
May 2014 pot map raster

Data sources:

- May 2014 edited contour lines.
- May 2014 well water level values.
- Estimated zero contour placed near shoreline (Wakulla to Pinellas counties, Volusia County).
- Estimated river values along Suwannee River.

Topo to Raster tool to create 500 m² Raster.
Data Sharing

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http://fdep.maps.arcgis.com/home/

FDEP Geospatial Open Data Portal

http://geodata.dep.state.fl.us/

FDEP GeoData Directory

http://www.dep.state.fl.us/gis/datadir.htm

Shiny App coming soon...
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