Making Groundwater Science Visible to Citizens and Clients

How do we expose BIG DATA?

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Overview

- Large open access data bases, aka Big Data, have changed how we do science.
 - Procedural changes
 - Ethical changes
- Tools for practitioners.
- Example for managers and planners.

The Scientific Method

- 1. Define a question > Boss Assigns a Project
- 2. Gather information and resources- Mourn Tiny Budget
- 3. Form an explanatory hypothesis Use Pervious Approach
- 4. Test hypothesis, make measurements Add to existing data
- 5. Analyze the data> Compare conceptual model to others.
- 6. Interpret the data and draw conclusions Adjust as needed
- 7. Publish results> <u>Revise Report Template</u>
- 8. Retest→ Pray

Procedural and Ethical Changes

- 4. Gather information and resources: Information:
 - CWI, CWI, CWI
 - Surface Water Coverages
 - Elevation Grids
- 5. Analyze Data:

Resources:

- MGS/DNR products (County Atlas...)
- Metro Model
- Recharge grids

Procedural and Ethical Changes

7. Publish Result

Scientists have an ethical responsibility to publish new findings. – Prof. Pat Brezonik via Dr. Melinda Erickson

We have an equal responsibility to publish in databases, if available.

When is there enough data?

- We can only answer in the context of a question.
 - Is the probability that the next sample will exceed the MCL below 5 percent?
- We do not know what questions the future will bring.
- From the future perspective, there is never enough data.

Tools

- GIS is an analysis tool, not just a map making tool.
- Scripts are a necessary for using big data sets.
 - Model Builder and Python in ESRI products.
 - Scripting 101 in slides at the end of this presentation.
- Geostatistics are essential for gridding data.
 - A grid for the value and a grid for the uncertainty.
- Use simple statistical tools to check data (see cheat sheet).
 - Check for outliers.
 - A large data set of low precision can outperform a small data set of high precision.
 - Calculations: the variance of a sum is the sum of the variances.
- Expertise requires practice.

Http:\ Where does your water come from.org



It is possible to build a web site that can provide an estimated capture area for any well in the state.





We have heads at 300,461 Location Verified Wells

We have Heads and Stratigraphic Interpretations at 221,916 **Location Verified Wells**

We can Identify Upper and Lower Aquifer Boundaries at 221,916 Location Verified Wells

The Thickness of the Paleozoic Aquifers is Well Studied

The Hydraulic Conductivity of the Paleozoic Aquifers is Well Studied

The Hydraulic Conductivity of Glacial Aquifers can be Estimated from 172,688 **Specific Capacity Tests At Location Verified Wells**

If Not Now, When?

END

