Groundwater Connections

A Community-Based Watershed Program for Sustainable Groundwater Management

July 19, 2011

RBC Groundwater Connections is a collaborative project between University of Calgary and Rocky View County to develop tools and strategies to sustainably manage groundwater resources in the County. Our approach will address three important components: **groundwater monitoring**, **groundwater modeling** and **groundwater education**.

This newsletter issue is an update of developments and progress for the RBC Groundwater Connections project including:

- progress on the development of the coupled surface-groundwater model
- the expansion of stream monitoring efforts to Big Hill Creek north of Cochrane
- some examples of water level data for wells in Rocky View County
- Our other collaborations with **Agriculture and Agri-foods Canada**, **Geosensorweb Lab** (Dr. Steve Liang; University of Calgary), **Energy Resources Conservation Board**, and the **Biogeosciences Institute** (University of Calgary)

Groundwater Education with BGS

In conjunction with the **Biogeoscience (BGS) Institute** at the University of Calgary, our group has been working to develop groundwater educational material to foster a better understanding of groundwater resources in Rocky View County and why it is critical to protect them.

A distinguishing characteristic of our educational material is incorporation of research and context-specific materials. For the past two summer; our group been participating in courses for teachers on environmental science and how to incorporate latest scientific research and tools into school curriculum. In addition, educators will provide us with the necessary feedback on how to best deliver this material from their perspective.

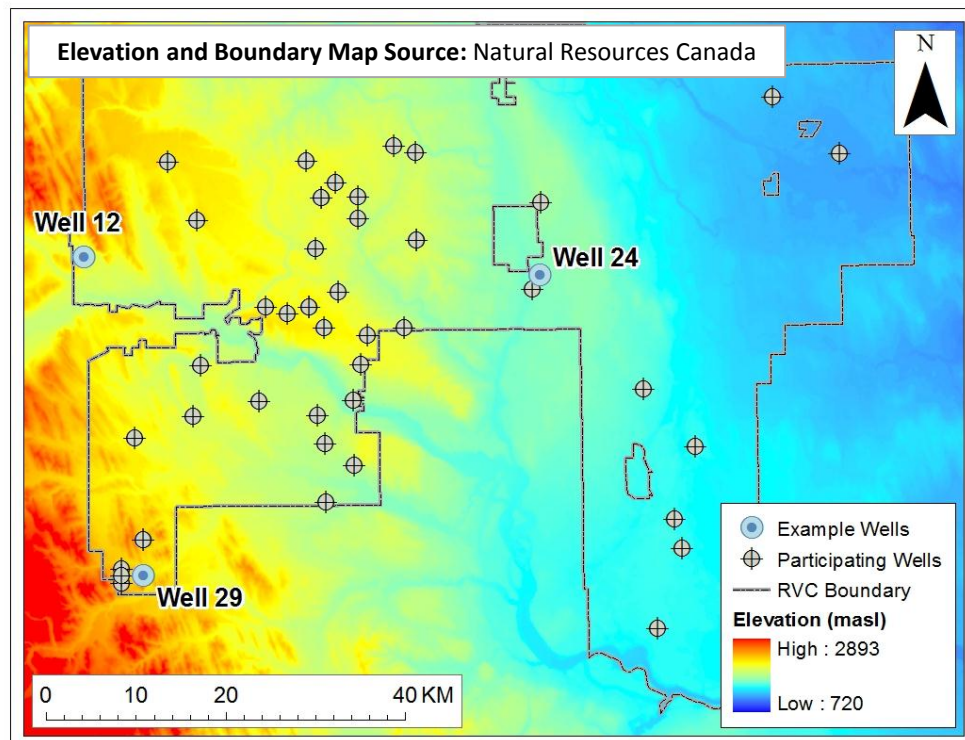Dr. Masaki Hayashi delivering a lecture on the fundamentals of groundwater sustainability to teachers

Teachers learning about one of thousands of Paskapoo bedrock springs in Rocky View County

To learn more about the BGS, please visit: **http://bgs.ucalgary.ca/**

Groundwater Monitoring Database

The following figure is a map of the distribution of monitoring wells, with a few examples of the locations and water levels from the groundwater monitoring database (plots on adjacent page).

Elevation and Boundary Map Source: Natural Resources Canada

Well 12

Well 24

Well 29

- Example Wells
- Participating Wells
- RVC Boundary

Elevation (masl)
High : 2893
Low : 720

0   10   20   40 KM

Not only does monitoring well water levels indicate the normal and abnormal fluctuations over time for a given well; it also provides information about the **degree of connectedness** between aquifer and surface water features such as **streams** and **wetlands**. Typically, a "flashier" plot means a greater connection. Therefore, monitoring can identify risk to surface water features from groundwater overexploitation.
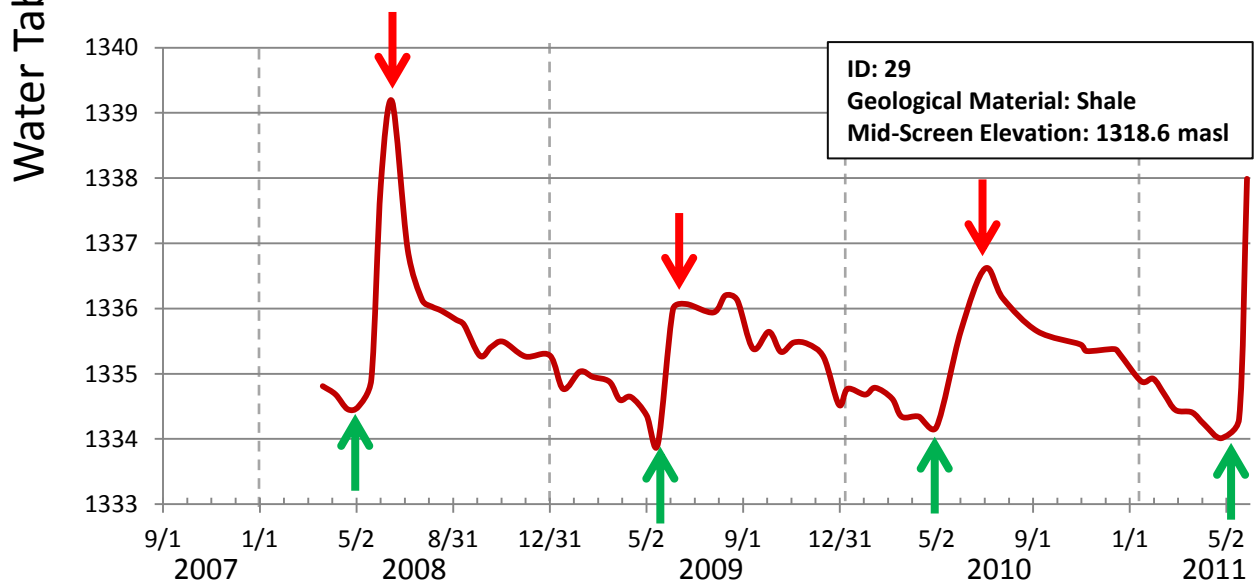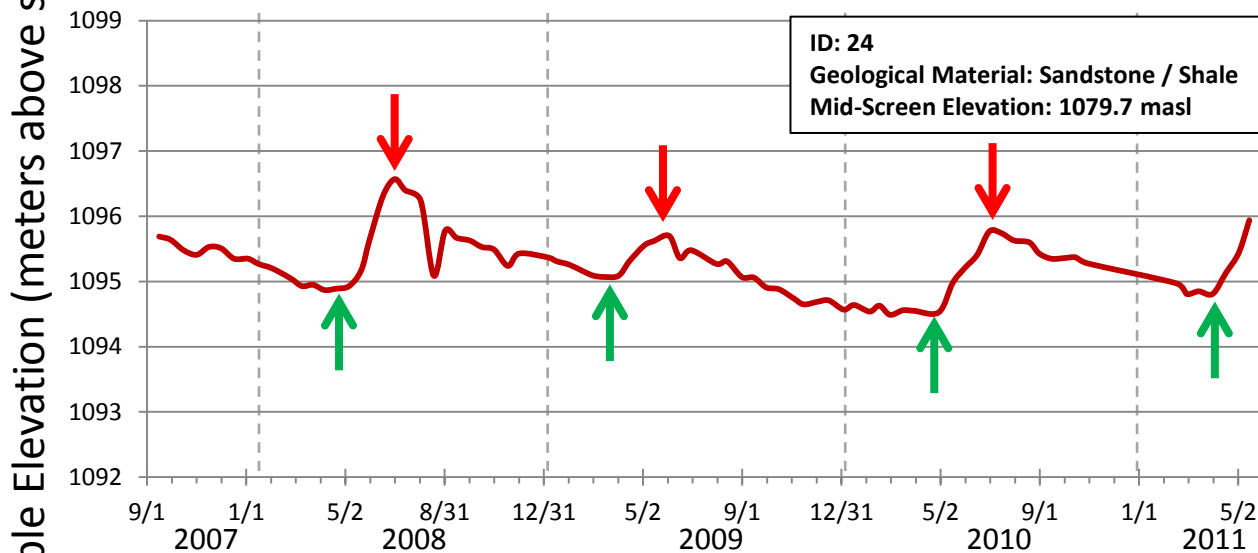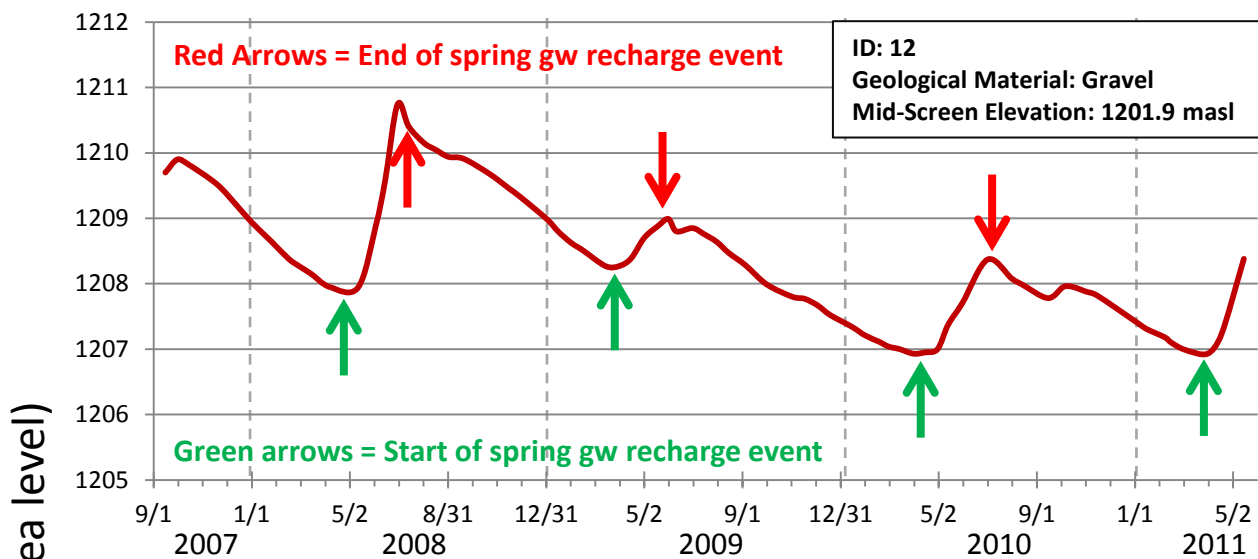
Coupled Surface-Groundwater Modeling

Getachew Adem Mohammed (post-doctoral fellow in our group) has made significant progress in the development of our coupled surface-groundwater model methodology for Rocky View County (beginning with **West Nose Creek** and then expanding to **Big Hill Creek**).

The model has two main components: **groundwater** and **surface water**. The **surface water component** computes the amount of **groundwater recharge** (the **amount of water** that makes it to the **water table**) as a function of meteorological conditions, land (use and cover) and soil (type and measurements). The **groundwater component** computes the elevation of the water table, subsurface flow rates and direction and the rate of groundwater discharge in streams as a function of the underlying geological materials (geological interpretation provided by the **Energy Resources Conservation Board**) and **groundwater recharge** modeled by the **surface water component**.
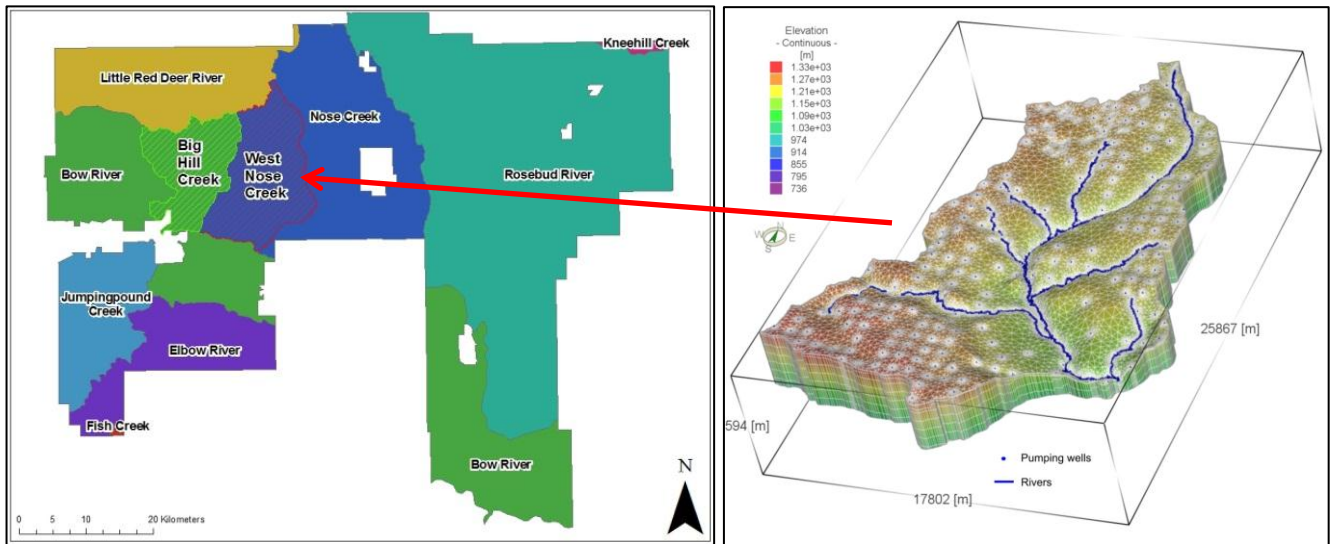
Historically, groundwater and surface water were often treated as separate entities, independent of each other. However, this is not the case in reality. These two components of the hydrological cycle are intimately connected and it is important to treat them as such in our modeling to represent reality as accurately as possible.

These models are driven by real physical measurements. The water levels collected through the groundwater monitoring program are used to force and validate our groundwater model. Groundwater modeling is a **very data-intensive** procedure, hence the need for large spatial (geographic) and temporal (time) datasets to ensure our modeling efforts are appropriately representing the reality of hydrological situation in Rocky View County.

Getachew will present the methodology development and results of his modeling research at the GeoHydro2011 conference in Quebec City. This is the annual meeting of the Canadian National Chapter of the International Association of Hydrogeologists, attended by scientists and researchers from universities, government agencies, and consulting companies across Canada.
For more information about the Geohydro conference, please visit:
http://geohydro2011.ca/

Stream Monitoring in Big Hill Creek

With the help of Rocky View County, our group has expanded our stream monitoring efforts into the Big Hill Creek Catchment near the outlet into the Bow River just to the northeast of Cochrane.

The monitoring of the stream will supplement our stream monitoring station in West Nose Creek in terms of the intensive data needs for the groundwater component of the coupled model and will provide greater insight into groundwater-surface water interaction in this area.

Automated Groundwater Measurements with AAFC

The **Agriculture and Agri-foods Canada (AAFC) Agri-Environment Services Branch (AESB)** has come on board to the RBC Groundwater Connections project by allowing us to test out automated, user-friendly water level measuring sensors in a few of the participating wells.

Photo Credit: wellminder.ca

This technology allows for: (1) a higher volume of data collection to better understand the fluctuation patterns of the water level in the well (which is also beneficial from a modeling perspective); and (2) owners view what their water level is at any given time (user-friendly)! The sensor was developed by Nyquest Manufacturing Limited (**http://wellminder.ca/).**

GeoCENS

Geospatial Cyberinfrastructure For Environmental Sensing

The GeoCENS project (displayed below) is a tool developed by Dr. Steve Liang at the University of Calgary in the Department of Geomatics Engineering.

The need for such a tool is to disseminate **sensor** data via the world-wide-web to promote access of data to scientists and researchers in fields such as hydrology, climate science and ecology.

Dr. Liang and his research group are developing a customized version of GeoCENS for the objectives of our project such as online data submission. This custom application of GeoCENS is tailored toward various users in Rocky View County such as:

- Private citizens of Rocky View County and general interest seekers
- Educators and schools
- Non-for-profit groups such as watershed groups
- Municipal, provincial, and federal government
- Environmental and hydrogeological consultants

Additionally, various maps of modeling outputs (e.g., water table elevation; groundwater risk zones) will be disseminated through this online application. Please visit: **http://www.geocens.ca/** for more information.
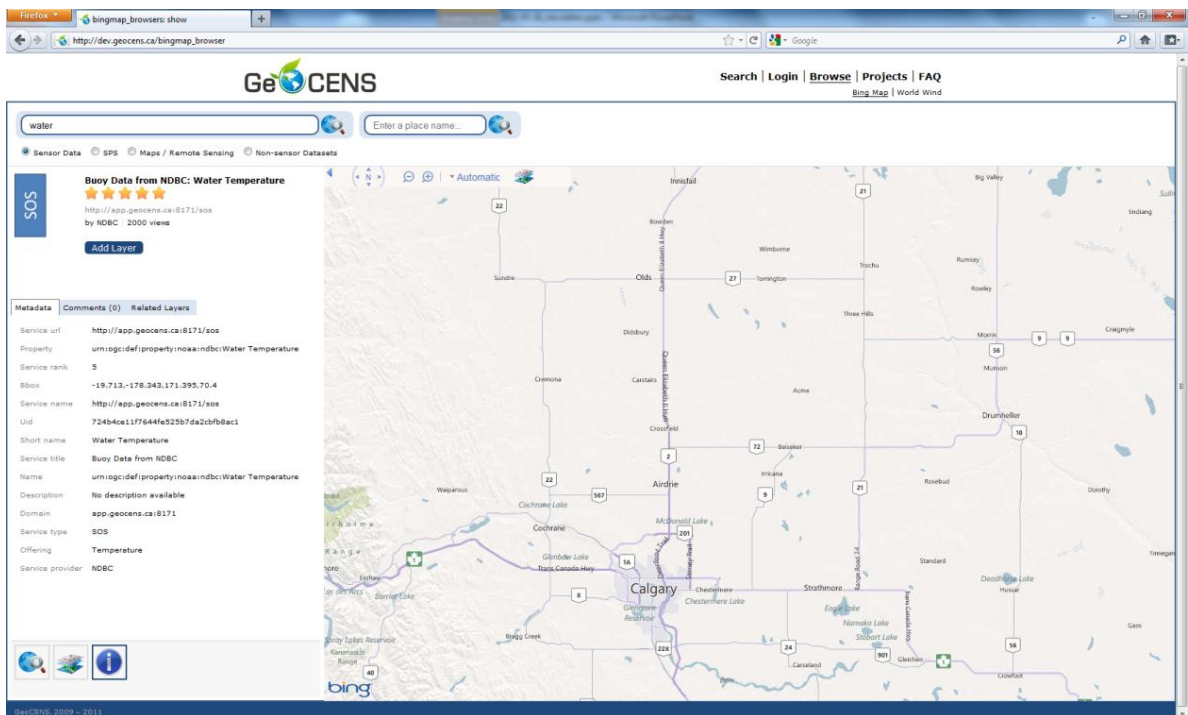
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