A Fully-integrated Groundwater – Surface-Water Modelling Platform for Southern Ontario

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Objectives

• Develop a prototype fully-integrated GW-SW modelling platform for the S. Ont Phanerozoic Basin Region (HydroGeoSphere)
• Evaluate spatial and temporal sensitivities (within the model)
• Demonstrate the utility of such a platform for multiple endpoints
• Simulate possible future hydrologic conditions under a range of projected climate conditions
Currently developing 2 versions
- V1: With offshore lake area
- V2: Trimmed to land perimeter
To evaluate
  - Boundary effects
  - Influences on GW-SW interactions

- 42,000 and 38,000 nodes per layer, respectively.
- Models are currently of lower resolution, but fast.
Surface Water Resolution

Strahler Order 4+ Stream Network: ~ 14,000 km of linear features

From: Ontario Integrated Hydrology Data

Note that we are aiming for Strahler Order 3+ in future...
Currently:
• 7.5 km max in lakes
• 1 km max along surface water features
• 2.5 km max across unconstrained land surface

Zoomed into Grand R. for example
Topography, Soil, and Land Cover

**DEM**
Ontario Integrated Hydrology Data DEM
stitched to GLIN lake bathymetry

**Landuse (NALCMS)**
9 Major LU Classes – 250 m resolution

**Soil (AAFC)**
267 SLC Soil Polygons in Domain
From Terry Carter
3D Model Framework

Currently 17 layers

50x Vertical Exaggeration
Water Chemistry – Fluid Density Influences
Forcing 1: Annual Average (1971 – 2000)
Forcing 2: Monthly Average (1971 – 2000)

Monthly Average Liquid Water Influx

Monthly Average Potential Evapotranspiration
Forcing 3: Projected Future Climate

Using Grand River Watershed as an Example

Climate Change Projections for Sub-watersheds

1. Grand River at Brantford
2. Nith River at Canning
3. Grand River at Marsville
4. Speed River at Guelph
5. Conestogo at Glen Allan
6. Whitemans at Mount Vernon

From Erler et al., (Under Revision) Simulating Climate Change Impacts on Surface Water Resources within a Lake Affected Region using Regional Climate Projections, Water Resour. Res
Using Grand River Watershed as an Example

Observation Wells in the GRW (10km, AABC)

From Erler et al. (In preparation)
The Bigger Picture

[3D map image with elevation and pressure heads indicated]

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