HydroGeoSphere Modelling to Support Mine Operations and Closure Planning

A mine-scale **HydroGeoSphere** (HGS) integrated groundwater-surface water model is ideal for assessing mine site design performance, including the quantification of pit inflows during operation and the impact of mine operations on the surrounding landscape. Additionally, climate change projections can be used in conjunction with HGS models to investigate potential climate change impacts on mine operations and long-term sustainability. HGS simulation technology is emerging as an integral part of mine closure design optimization to verify that post-mining hydrologic conditions meet regulatory criteria.
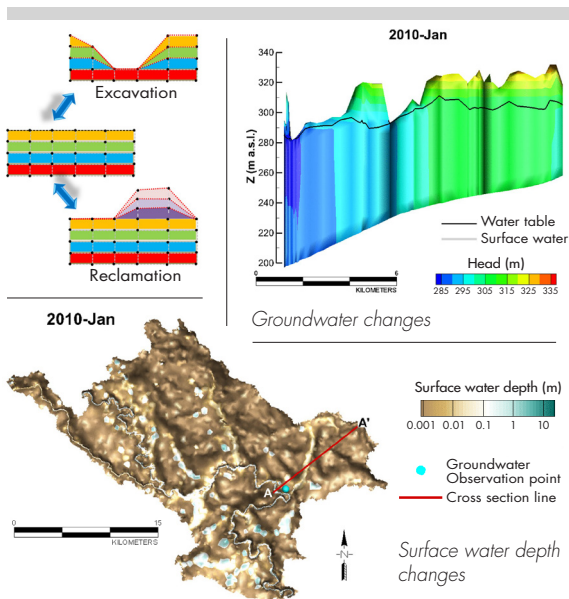
Benefits

- **Boost operational efficiency**
- **Foster interdisciplinary collaboration**
- **Enhance decision support**
- **Reduce uncertainty**
- **Secure regulatory approval**
- **Model the entire mine life-cycle**
- **Improve accuracy**

Applications

- Engineering scenario support for mine mitigation strategies and closure planning; model water quantity and quality impacts from mine pit advance, backfilling, and reclamation activities.
- Provide real-time forecasting of water budgets from pit-dewatering, tailings ponds management, & regional groundwater and streamflow
- Estimate dewatering needs of underground infrastructure and open-pit designs.
- Hydraulic and tracer experiments for site characterization
- Reclamation design verification; a physics-based modelling approach to engineered designs.
- Long-term predictions for mine scenarios, closure planning, and climate change impacts

Key Features

- HGS fully-integrated groundwater-surface water modeling **boosts operational efficiency** and **fosters interdisciplinary collaboration** by eliminating the need for separate surface/groundwater teams/models.
- **Enhanced decision support** using HGSRT (near real-time daily simulations) providing comprehensive understanding of mine-water management; including pit dewatering, tailings ponds, and regional groundwater/streamflows.
- **Reduce uncertainty** with HydroGeoSphere's physics-based approach; ideal for modeling designed topographies & engineered systems.
- Successfully model hydrologic impacts of mine evolution including pit advance, backfilling, and reclamation activities. HGS has **secured regulatory approvals** for open-pit and underground operations in diverse geological settings.
- **Model the entire mine life-cycle** and topographic evolution in a single continuous simulation using Aquanty's patented **dynamic meshing technology**.
- **Improve understanding** of hydrologic systems by simulating explicit water exchanges between domains. Use the unique **Hydraulic Mixing Cell** technique to trace the origin and fate of tagged water sources.
- Evaluate preferential flow paths using several methods including equivalent porous medium, dual domain formulation and **discrete fracture networks**.
- **Enhance flow solution precision** with polygon tracking, providing detailed reporting of lateral and vertical flows at any scale.

Groundwater changes

Surface water depth changes

FURTHER READING

HydroGeoSphere: A Fully Integrated, Physically Based Hydrological Model. In Groundwater, 2012.
Hydrological sustainability of in-pit reclaimed oil sands landforms under climate change. In Frontiers in Environmental Science, 2022.
Integrated surface-subsurface water and solute modeling of a reclaimed in-pit oil sands mine: Effects of ground freezing and thawing. In Journal of Hydrology: Regional Studies, 2022.
Numerical simulations of water flow and contaminants transport near mining wastes disposed in a fractured rock mass. In International Journal of Mining Science and Technology, 2015.
Geothermal Energy Potential of Active Northern Underground Mines: Designing a System Relying on Mine Water. In Mine Water and the Environment, 2022.

For more information contact us at **info@aquanty.com** or visit **Aquanty.com**

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Aquanty – World-Class Water Resources Science and Technology

Aquanty specializes in predictive analytics, simulation and forecasting, and research services. Our technology and services are deployed globally across a broad range of industrial sectors including; agriculture, oil and gas, mining, watershed management, contaminant remediation, and nuclear storage and disposal. Aquanty's scientists are recognized as leading international experts in integrated climate, groundwater & surface water modelling. Our mission is to deliver holistic water resource and climate solutions to support informed decision making for our clients in a rapidly changing world.

HydroGeoSphere™

The world's most powerful hydrologic modelling platform

- **Fully integrated surface and groundwater simulations** provide a holistic understanding of complex and interconnected watershed dynamics for water resources management.
- **Reactive solute and thermal energy transport** capabilities give you the tools to predict contaminant fate and travel time probability statistics for source identification.
- **Advanced numerical methods** to support simulations of unprecedented scale and complexity; fully-implicit coupling for all domains provides for a robust, mass conserved solution.
- **A physics-based approach** to hydrology greatly reduces the inherent uncertainty of empirical modelling techniques and provides the most robust approach to simulating the effects of climate change.

HGS REAL TIME

Reliable hydrologic forecasting powered by HydroGeoSphere

- **Multi-objective hydrologic forecasting** for flood, drought, base-flow, soil moisture, surface water and groundwater.
- **Enhanced decision support** for water resources management based on a holistic, integrated approach to watershed hydrology.
- **Synergize operational data sources** including near-real-time field observations and remote sensing products with meteorological predictions to produce reliable forecasts.
- **Cloud-computing architecture** supports ensemble of weather forecast scenarios, forecast outputs analyzed and reported in a probabilistic framework.

HydroGeoHub™

Aquanty's web architecture puts earth system modelling within reach of every person

- **Unify data management and analytics** for an integrated understanding of hydrology, geology, meteorology and climatology.
- **White label web infrastructure** to deliver best-in-class hydrologic modelling and decision support to your clients.
- **Flexible and extensible** architecture to handle any data pipeline world-wide, putting the right information in front of the right people at the right time.
- **Analytical tools and custom workflows** to simplify your unique operational requirements.

Modelling On Demand™

Automatic web-based simulations for decision support and scenario analysis

- **Time saving through automation:** models constructed at the click of a button using comprehensive geological data framework producing results in minutes for rapid decision support.
- **Flexible and agile** model inputs allow you to adapt to changing requirements. When needs evolve, models can be created or modified as necessary, enabling quick responses to dynamic situations.
- **Globally scalable, versatile and ready to deploy** for field-scale soil moisture forecasting and pesticide/nutrient runoff and fate; watershed-based customizable scenario analysis and climate change assessment.

Proud Partner of the Canada1Water initiative

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