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Success Story

iSatis

INRS
UNIVERSITÉ DE RECHERCHE

# INRS draws on Isatis powerful algorithms to generate large scale 3D geological models

The "Eau Terre Environment" Research Centre (ETE - Research Centre on Water, Earth and the Environment) of INRS (National Institute for Scientific Research) in Quebec City is actively engaged in the sustainable development of the country, particularly in the fields of groundwater science, ground resources and environment. It is within this framework and to generate quality 3D geological models that the group led by Professor Erwan Gloaguen uses Isatis for nearly 10 years. Erwan Gloaguen holds the Canada Research Chair in Assimilation of Geophysical and Geological Data for Stochastic Geological Modeling and is co-director of LIAMG (http://liamg.ca).

## The challenges

### Optimization of the integration of data from different sources

The research conducted by Erwan Gloaguen is at the junction of geophysics, geostatistics, geology and hydrogeology. His team is working on large-scale projects and builds hydrogeological as well as oil reservoir and mining models. To do this, they need to smoothly integrate different data formats and characteristics, i.e. well, borehole or seismic data, into a single model. They also need efficient algorithms for processing large data sets.

### Representativeness of geological models

All geological modeling methods are not suited to all types of geology. The LIAMG must have access to the largest range of possible methodologies because some respond better to given geological data configurations than others.

## The solution

"We have selected Isatis 8 years ago because it was and is still **the only software that offers all the geostatistical functionalities in one single package**. Once data is imported, we access quickly and in the same way advanced methodologies which have proven their effectiveness", Erwan Gloaguen explains.

In particular, the ETE center applies Isatis geological facies modeling tools such as **the Truncated Gaussian Simulations** to model a multi-layer geology or **the Multi-point Simulations** (Isatis implements the Impala library) or the **Plurigaussian Simulations** when geology gets complex.

The LIAMG team works on models from half a million to several million cells. This is why they also enjoy Isatis for its **efficient algorithms**. Developed for 64-bit multicore systems, the software facilitates the processing of large data sets. In addition, the team must be able to manage the whole set of model simulated realizations to estimate their spatial uncertainty and to enter them in their optimization algorithms.

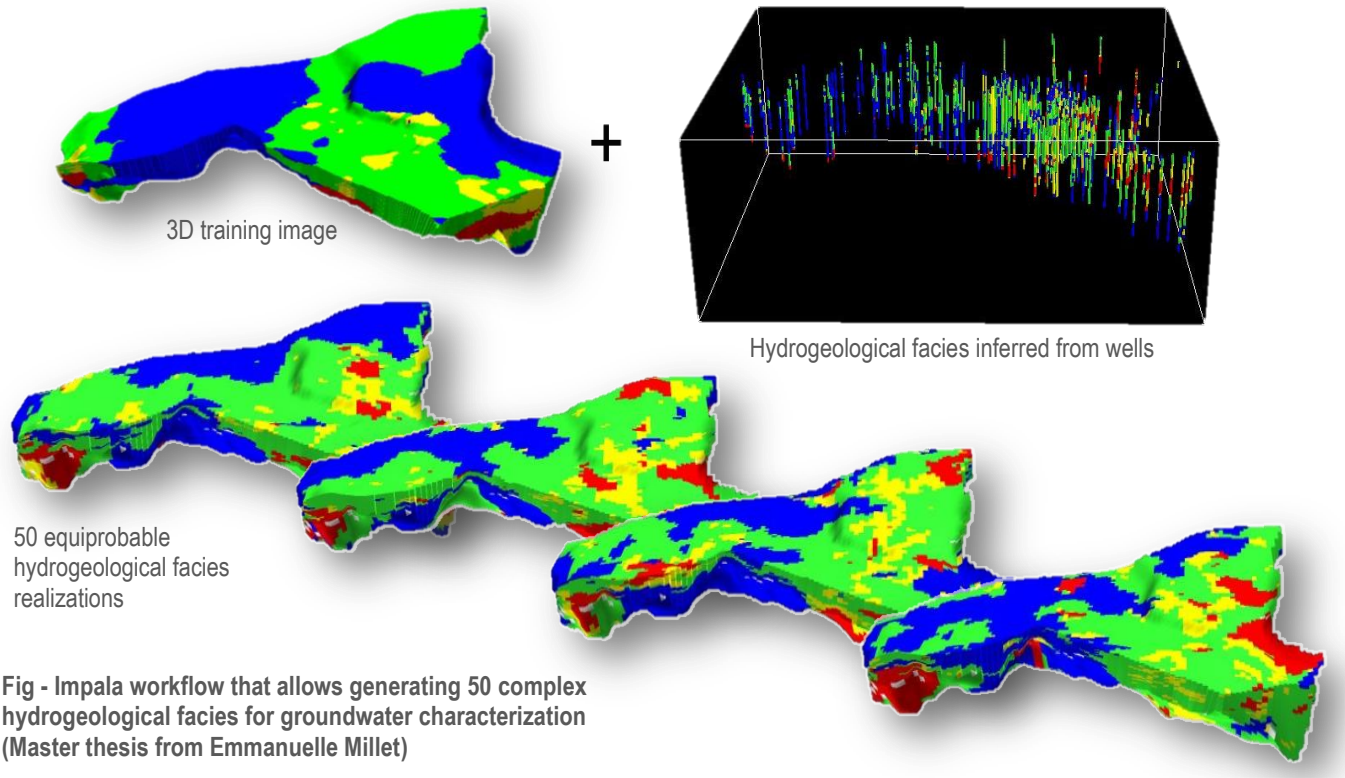


**Fig - Impala workflow that allows generating 50 complex hydrogeological facies for groundwater characterization (Master thesis from Emmanuelle Millet)**

# Results

## Models usable out of research laboratories

"The solutions that we present are not only for academic purposes but must also **answer concrete issues**. Moreover, even in the context of research projects, some of our industrial partners are interested in getting applied deliverables, as geological models or results of simulations", says Erwan Gloaguen. "Because it is used in academia as well as in professional circles, **Isatis is an ideal bridge between the industrials and us**. The software allows us to provide them with models developed at the center they appropriate and modify in turn according to their needs."

## Model optimization through data assimilation

With **multivariate geostatistics**, Isatis allows **coupling numerical modeling results and measured data** to improve the reliability and the realism of the models. Thus, the INRS' LIAMG can, for example, integrate in the same aquifer model a numerical simulation of the groundwater age, a flow model or a mass transport model, which **improve consistency between the model from Isatis and what is observed in-situ.**

# About Isatis by Geovariances

**Isatis® is a comprehensive software solution** and is regarded as the reference in geostatistics for nearly 25 years. **Isatis** is implemented by more than 3500 users worldwide.

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