# Research the use of "Finite Difference Neural Net" simulation concept for Geological Process Modeling

## Introduction

Geological Process Modeling is an application for simulating the forming or creation of geology using $1^{st}$ order physics by solving a set of mathematical equations. The pictures included show a turbiditic flow from a recent system onshore Italy and a deltaic system that was modelled for a client in the O&G business.

The current focus for the application is to increase predictions for various purposes in the O&G industry. We envisage that this application will also be used for other industries in the future where better predictions of geology is important. Like $co2$ sequestration, hydrothermal energy, mining for minerals etc.
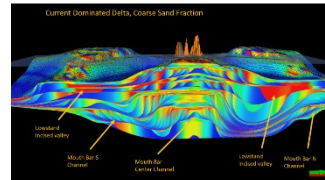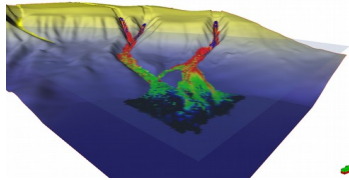


The result of modelling the formation of the geology by simulating this over geological time with river systems, various gravity flows like turbidites, carbonate growth etc – will be a model of current day geology for the area simulated.
The application is architected as a framework for many simulators, one simulator for each type of geological process, working in iterative coupling fashion to simulate the processes and the impact of other processes.

These simulators are implemented using finite difference element simulation.

## Challenge

Over the last few years many groups, pioneered by the gaming industry, have started to use ways to couple full physics simulations of real world phenomena with neural net modeling to speed up the "solving" of the equations used to simulate the physics.
We would like to test this for geological process modeling. Test the concept of training neural nets on the model being simulated and speed up the modeling by letting the neural net take over parts of the "simulation".

Many examples of this can be found in papers from academia and industry

The project should research and implement one of the existing process simulators in the GPM system. The results should be compared with the full physics simulator for speed of simulation and consistency of the result.