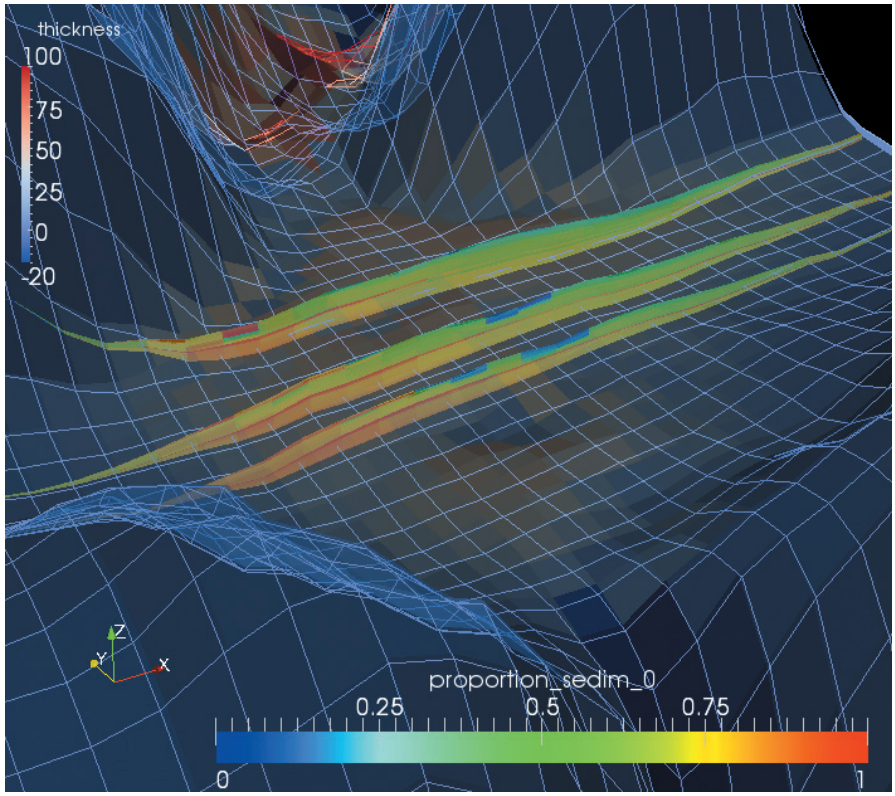
CATS 2

A Joint Industry Project

Cellular Automata for Turbidite Systems Second phase

Objectives of the CATS project

- to characterize the 3D sedimentary architecture of turbidite reservoirs using a process-based modeling approach and predict the distribution of reservoir heterogeneities;
- to provide reservoir geologists with a prototype software producing realistic numerical simulation of turbidite systems in order to reduce uncertainties in static and dynamic reservoir models using the geological information embedded in the process-based simulation results.



Cross-sections with proportions of sands in a confined basin case.

Background

The CATS algorithms produce a realistic, full 3D description of the sedimentary architecture and heterogeneities on a reservoir scale. The sedimentary processes are simulated with a limited set of physical parameters. The model takes into account local changes in these processes and simulates the associated deposits.

The integration of physical processes and their simulation over time also yields a better understanding of the construction of the system.

CATS prototype software is embedded into an IFPEN OpenFlow software platform dedicated to petroleum applications. It includes a simple OpenFlow graphical user interface for the prototype code. The code can be run on parallelized clusters to enhance code efficiency and handle complex geological architectures.

CATS 2 objectives

The second phase of the JIP (CATS 2) aims to extend the capabilities of the CATS model: new features for the physical model, various improvements made to the prototype, assessment of uncertainties. Moreover, comparison with analogical and numerical models and calibration based on real-case data will be provided.

Technical Program

The proposed technical program for the CATS 2 consortium has been designed on the basis of the wishes of the partners in the first CATS JIP, as well as identified new partners. It is divided into three work packages (WP):

WP1: Physical model evolution

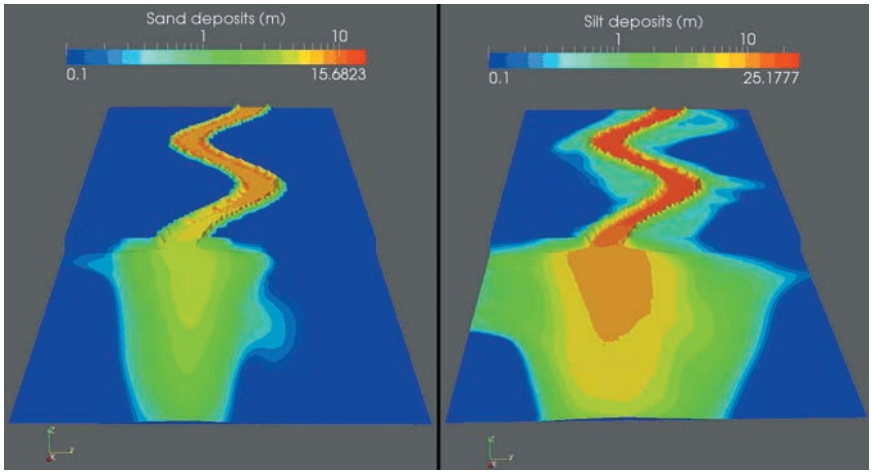
- improve coupling between the current processes implemented;
- implement a cellular automata module for granular flow physics;
- couple granular physics with turbulent physics;
- additional process: mud decantation between turbidite events.

WP2: Prototype improvements and new functionalities

- input a spatially heterogeneous substratum using an input map of lithology proportions;
- launch a new simulation from a given CATS-simulated result;
- optimize the parallel computing capabilities.

WP3: Multi-realizations and uncertainty

- generate multi-realizations taking into account uncertainty on flow parameters and topography.



Sand and silt deposits from a multi-event simulation on a synthetic topography with a sinuous channel and downstream unconfined area.

Deliverables

Year 1

- prototype software for turbulent turbidite flow models (Version 4), including:
  - model improvements, with the possibility of inputting a heterogeneous initial map for bed composition;
  - possibility of using a previous CATS result as the initial point for a new simulation.

Year 2

- CATS prototype software (Version 5), including:
  - optimization for faster computing in both sequential and parallel modes;
  - a turbulent turbidite flow model and a granular flow module;
  - mud decantation between turbiditic events.

Year 3

- CATS prototype software (Version 6), including coupled granular and turbulent turbidite flows, with associated erosion and deposition processes;
- report on CATS model tests;
- report describing the methodology used to incorporate and assess uncertainty on flow parameters and topography.

Project organization

The program is scheduled to last three years. Two workshops per year will be held to present progress reports and trigger discussion with partners relative to future strategy. Users' meetings will also be organized, for both technical discussion and the collection of feedback.
New versions of the CATS prototype will be released at the end of each year of work and will include the latest validated improvements and implementations.

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