Reduced Order Methods in HPC
Model order reduction aims at attaining the result of many simulations with a single, larger, high-dimensional simulation. The benefit is double: enabling real-time access to an arbitrary scenario and speeding up multiparametric simulations.

Actual computer science understands the geophysical simulations as complex HPC algorithmics trying to reproduce datasets that must be reproduced from the numerical simulations (e.g., inverse modeling). In both cases, thousands of offline solutions to 3D complex geophysical problems are constantly required. This research line works towards constructing a generalized (high-dimensional) solution capable of providing fast online simulations for all the parameters at once. Thus, it enables the possibility of drastically accelerating the modeling. Model order (ROM) methods are worked out to find an optimal HPC-driven approximation of the targeted generalized solution.

Objectives

- Develop ROM techniques for direct modeling applications in geophysics including seismic and electromagnetic fields.
- Analyze the potential use of different parameterizations of the proposed high-dimensional models and the capabilities of actual ROM methods to provide feasible solutions.
- Analyze the HPC potential of the current ROM algorithms and explore novel strategies to maximize their efficiency with our HPC technology.
- Generate efficient HPC-driven ROM algorithms to accelerate the most challenging inverse modeling problems in geophysics.