The calibration of complex system models with OpenMOLE

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ABSTRACT
A complex-system can be defined as a "system comprised of a great number of heterogeneous entities, among which local interactions create multiple levels of collective structure and organization"(1). Using simulation models is required to observe the emergence of a collective structure from numerous local interactions since it is generally not predictable analytically.

The calibration of such models, representing multi-scale, stochastic and individual centered processes is computationally intensive. A numerical experimentation on these models (using the genetic algorithms, the sensitivity analysis, the viability approach, etc) might imply million of executions.

This huge computational load can only be carried out by high performance computing environments, which are however tricky to access and use.

OpenMOLE is born in the context of adressing this issue: how to run very large sets of experiments on the complex-system models ? OpenMOLE represents a large effort of simplification of the access of state of the art optimization and calibration models. It gives tools to modelers to easily access to large computing resources without being an expert in computer sciences.

OpenMOLE offers a rich workflow system approach to design large scale optimization experiments. The naturally parallel aspects of the workflow structure enables to simply define independant replications of a model. OpenMOLE proposes:

- a simple workflow description embedding models as black boxes,
- a transparent access to massively parallel computing environments (such as culsters, european computing Grid EGI, ...).

OpenMOLE is mature and has already helped modellers in the production of significant scientific results in various
application fields:

- food processing (2), (3),
- biology (4),
- bayesian networks (5),
- environmental sciences (6),
- and recently in geography (7) in the context of the *Geodivercity ERC*

KEYWORDS
Complex-system, calibration, modelisation, intensive computing, design of experiments.

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