Fostering the use of methods for geosimulation models sensitivity analysis and validation

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In recent years, there has been a significant increase in the development of methods to explore, validate, calibrate and optimize geosimulation models. These methods and tools remain, however, underused by simulation communities, despite an ever improved and easier access to high performance computation facilities. The OpenMOLE model exploration software (Reuillon et al., 2013) is one of the reliable approaches fully dedicated to promote these techniques. This presentation offers some feedback on the recent initiative of a researcher school in model validation, focused around models and practices linked to the OpenMOLE platform. We present the iterative exploration and validation protocol developed during the school, with methods of increasing refinement deployed on a toy geosimulation model (spatialized prey-predator agent-based model of a zombie infection, with multi-modeling paradigms to include diverse processes for agent behavior). First, we illustrate classical sensitivity analysis methods (stochasticity, design of experiments, global sensitivity indices), and then specific methods to study spatial configuration sensitivity, evolutionary computation methods for calibration and diversity search, and Bayesian calibration methods. They are applied on diverse specific submodels, highlighting specific mechanisms of the model, in order to answer associated thematic questions. We also illustrate the comparison with competing model ontologies by calibrating an ODE-based model on data generated by the simulation model. We finally synthesize lessons learned in the final challenge part of the school, consisting of the autonomous exploration of a new model instance by participants, including defining a thematic question and applying appropriate validation methods. This experiment both introduces a broad overview of new geosimulation model methods, and suggests ways to disseminate these into the modeling communities through similar pedagogical implementations.

References

Reuillon, R., Leclaire, M., and Rey-Coyrehourcq, S. (2013). Openmole, a workflow engine specifically tailored for the distributed exploration of simulation models. *Future Generation Computer Systems*, 29(8):1981–1990.