A Real Space Cellular Automaton Laboratory (ReSCAL) to analyze complex geophysical systems

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The Real Space Cellular Automaton Laboratory (ReSCAL) is a generator of 3D multiphysics, markovian and stochastic cellular automata with continuous time. The objective of this new software released under a GNU licence is to develop interdisciplinary research collaboration to investigate the dynamics of complex geophysical systems.

In a vast majority of cases, a numerical model is a set of physical variables (temperature, pressure, velocity, etc...) that are recalculated over time according to some predetermined rules or equations. Then, any point in space is entirely characterized by a local set of parameters. This is not the case in ReSCAL where the only local variable is a state-parameter that represent the different phases involved in the problem. An elementary cell represent a given volume of real-space. Pairs of nearest neighbour cells are called doublet. For each individual physical process that we take into account, there is a set of doublet transitions. Using this approach we can model a wide range of physical-chemical or anthropological processes.

Here, we present different ingredients of ReSCAL using published applications in geosciences (*Narteau et al. 2001 and 2009*). We also show how ReSCAL can be developped and used across many displines in geophysics and physical geography.

Supplementary informations:

Sources files of ReSCAL can be download on
> `http://www.ipgp.fr/~rozier/ReSCAL/rescal-en.html`

References :

Narteau C., J.L. Le Mouël, J.P. Poirier, E. Sepulveda & M. Shnirman, *On a small scale roughness of the core-mantle boundary*, Earth and Planetary Science Letters, **191**, 49-60, 2001.

Narteau C., D. Zhang, O. Rozier & P. Claudin, *Setting the length and time scales of a cellular automaton dune model from the analysis of superimposed bed forms*, J. Geophys. Res., **114**, F03006, 2009.