



On description of cellular automata by stochastic Ito equations

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The histogram method [1] of reconstruction of the Ito equation from the time series data was tested successfully by its authors in cases of time series generated by Ito equations only. However, for real, geophysical time series the following question arises: whether the resulting Ito equation (in which both terms have simple physical interpretations) is physically adequate to the phenomenon under investigation [2], [3].

Here, a simpler problem is considered: a geophysical phenomenon is replaced (modeled) by a simple cellular automaton. The evolution of the model leads to the time series of some variable, which is interesting for the observer. The aim is to derive analytically, on the basis of automaton rules, the stochastic Ito equation for the variable and to compare the equation with that reconstructed by using the histogram method from time series data generated by the cellular automaton. This task was realized for the example of a very simple 1D cellular automaton. Some other aspects of the analytical description of the cellular automaton were extracted and investigated.

The results may constitute a motive for the application of the procedure of construction of the Ito equation to geophysical time series. Then, Ito equations can be useful macroscopic models of phenomena in which microscopic interactions are averaged in an adequate way.

References:

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3. Rozmarynowska A., (2009) On the reconstruction of Ito models on the base of time series with long-tail distributions, *Acta Geophysica*, 57, no 2.