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Solid Earth
Discussions

Interactive comment on "The stochastic quantization method and its application to the numerical simulation of volcanic conduit dynamics under random conditions" *by* E. Peruzzo et al.

Anonymous Referee #1

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article

Paper SED-2010-2 by Peruzzo et al. "The stocastic quantization method and its implication to the numerical simulation of volcanic conduit dynamics under random conditions"

General comment

The paper presents a technique for generating an optimal set of input parameters of simulation codes, usefull when the comupational costs do not permit to produce large numbers of simulations. The tool is applied to a specific case (magma flow in a volcanic conduit), but it is of general interest. The mathematical method is not new in the mathematical literature, however, its application in the Earth Science could be helpfull. The procedure is quite well described, with the exception described in the "Specific comment N.1", reported below.

The application to the volcanic conduit is just an example, and probably does need to be strongly outlined in the title of the paper (more than an "implication" it is an "application" to the numerical simulation of volcvanic conduit dynamics).

Figures, Tables and equations are all needed and cannot be reduced.

Specific comment N.1

The paper presents a method for generating the distribution of the output of a simulation code by knowing the distribution of the input parameters. The input parameters are threated as a vector of random variables with a priori known probability distribution. Each vector represents a point in the d-dimensional space, corresponding to a single set of input parameters. Each point is assigned a weight, based on the known probability distribution. The key point is the choice of few (order of ten) points that will be used to perform the simulations, reducing the computational costs.

The numerical algorithm is described in the Appendix where the authors reduce the problem in the minimization of function $h(x^{(1)}, ..., x^{(N)})$.
They say that “The program which performs the minimization moves the points $x^{(1)}, ..., x^{(N)}$, starting from an initial guess; for each new choice of $x^{(1)}, ..., x^{(N)}$ it goes through steps 1-4 above, until the minimum value of the function h is found”.

However, they do not describe this critical point, that is how to preceed in selecting the N vectors $x^{(1)}, ..., x^{(N)}$ at each iteration step.

Specific comment N.2

In Table 1, a comparison between the SQ method and the result from 10^3 MC simulations is reported. Are the number of digits reported in the quantities appearing in the Table (related to the statistical error) consistent with the number of MC simulations?