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Scaled Langevin equation and the inversion for viscoelastic behaviour of rocks

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We investigate a dynamics of a complex system representing viscoelastic behaviour of rocks. A simple formulation of viscoelastic behaviour is described by the generalized Maxwell model, and the elements are formulated by a set of the Langevin equations. By introducing a scaling rule on the deformation time and size for the elements, the Langevin equations for the respective elements become conformal equations on the time evolutions. The scaled Langevin equations generate the dynamics of the complex system, and yield an input-output function with a response function (Green function) having a temporal fractal property. When we regard the input and output as a dynamical stress or strain and a seismic waveform data, respectively, the response function can describe the viscoelastic property of rocks. Specifically, we apply a flow law of rocks (e.g. lherzolite) with the temporal fractal relaxation property to the response function. Moreover, we give an inverse formulation of the response function which enables us to infer the source field from seismic waveform data.