Geophysical Research Abstracts
Vol. 21, EGU2019-6819-3, 2019
EGU General Assembly 2019

Inferring the Source of String Vibrations

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In seismological applications the spatial extent and duration of an earthquake are in general uncertain. The associated inverse problem is to work backwards characterizing the source that gave raise for the wave field. The idea behind that work is to adopt the concept of Gaussian processes regression to seismic source inversion.

To work towards that goal, a fixed ends damped vibrating string subject to some external force is considered. Although being an oversimplification, it catches the essence of seismic source inversion at a comprehensive level. The presented correlation-based Bayesian approach will provide new insight into source inversion focusing on exploring variabilities and uncertainties.

The corner stone of the modelling approach is formed by correlations amongst external force field and recorded time series. The space-time covariance function is deduced from physical principles i.e. the equation of motion. Therefore we a priori assume the external force to be a Gaussian process. That approach makes the force's conditional distribution posterior to time series records accessible. The most probable force field is given by the posterior mean whereas uncertainties are described by the posterior covariance.