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Boundary conditions in the stochastic description of the scattered wave-field: checking tomographic structures in an active caldera.

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The mixing between coherent and incoherent signals in volcanic seismic recordings is continuous. To highlight the actual limit between these two means discerning the soil at which a deterministic or stochastic approach can be applied, as well as providing a better image of a volcanic structure. In order to model volcano-tectonic envelopes in a caldera we show the importance of including in the usual stochastic approach (i. e. Monte Carlo simulations based on the Radiative Transfer Theory) the effects induced by a drastic change in the scattering properties of the medium. Even if caused by a deterministic boundary, these effects are still stochastic in their mathematical and physical form, and can be modeled by using a second set of transport equations. In our approach, coda envelopes in the caldera are ruled by three different length scales: the mean free path, the transport mean free path, and the distance between the source and a large scale boundary - as the caldera rim. We use this model for a first order check of large scale tomographic anomalies in the caldera, giving important markers on the minimum frequency at which a deterministic approach (e. g. a ray approximation) can be used. We compare velocity, attenuation, and scattering tomography images of the caldera, as well as the recorded data envelopes, with the synthetic envelopes obtained by using our 2D codes. The result is a first order model which fits data only in case of a large scale change into the heterogeneity distribution - like the one induced by a caldera rim. We recognize that a 3D model is necessary to discern between the presence of a vertical and/or of a horizontal anomaly, as well as to fit smaller scale envelopes changes and tomography anomalies. We proved anyway that, in the range between 1 and 20 Hz, the exclusive application of a deterministic or stochastic approximation to interpret seismic data provides unfeasible results. A mixed approach can account for the correct values of quantities which are currently employed to obtain attenuation and scattering tomography images - like envelope broadening and coda decay.