Irikura Recipe Method 2: High-frequency module by the stochastic Green's function method

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Release Notes (V. 19.4)

This is the initial release of the Irikura Recipe Method 2 on the SCEC broadband platform. The Irikura Recipe Methods 1 and 2 share identical methods for generating kinematic model, and for computing the low-frequency part of synthetic ground motion; the only difference is that the Irikura Recipe Method 2 computes the high-frequency part of ground motion using the stochastic Green's function method. The original codes of Senna and Fujiwara (2011) and related references can be found in: https://www.j-shis.bosai.go.jp/map/JSHIS2/download.html?lang=en

Method Overview

The original description of the stochastic Green's function method is included in the paper written by Kamae et al. (1998). The method for computing the high frequency part of ground motion, included in the Irikura Recipe Method 2, is based on the work of Dan and Sato (1999) and Fujiwara et al. (2009). Applications of the Irikura recipe in modelling and simulations of Japanese crustal earthquakes are described in Morikawa et al. (2011) and Iwaki et al. (2016). First, a stochastic Green's function for a small earthquake on the seismic bedrock is generated by the method of Boore (1983) following the ω^{-2} spectrum model and the envelope shape parameterized by Satoh et al. (1994). The horizontal and vertical components on the seismic bedrock are computed by considering SH and SV waves, respectively, with a vertical incidence. An empirical vertical-to-horizontal spectral ratio is used to adjust the amplitude of the vertical component. Then, the stochastic Green's function on the engineering bedrock for the small earthquake is simulated by 1D multiple reflection theory. Finally, the stochastic Green's function for a large earthquake on the engineering bedrock is summed over the fault by the semi-empirical waveform synthesis method by Dan and Sato (1999) which considers variable slip on the fault. Note that the direct P-waves are not included in the computed ground motion.

Release Notes (V. 19.8)

High-frequency wave amplification algorithm has been improved for shallow faults when the fault top lies inside the sedimentary layers.

Release Notes (later than V. 19.8)

The rupture modeling module is now applicable to multi-segmentation faults. Consistency between low-frequency and high-frequency source models (stress parameter in "stress_drop.out") has been improved (see Miyake et al., 2020).

Ensured band width: 0.1-10 sec (see Iwaki et al., 2016)

Regional parameters: Q value for high-frequency module

Variable parameters: rupture velocity, mesh size of high-frequency source model (The mesh size of the high-frequency source model must be an integral multiple of that of the low-frequency source model.)

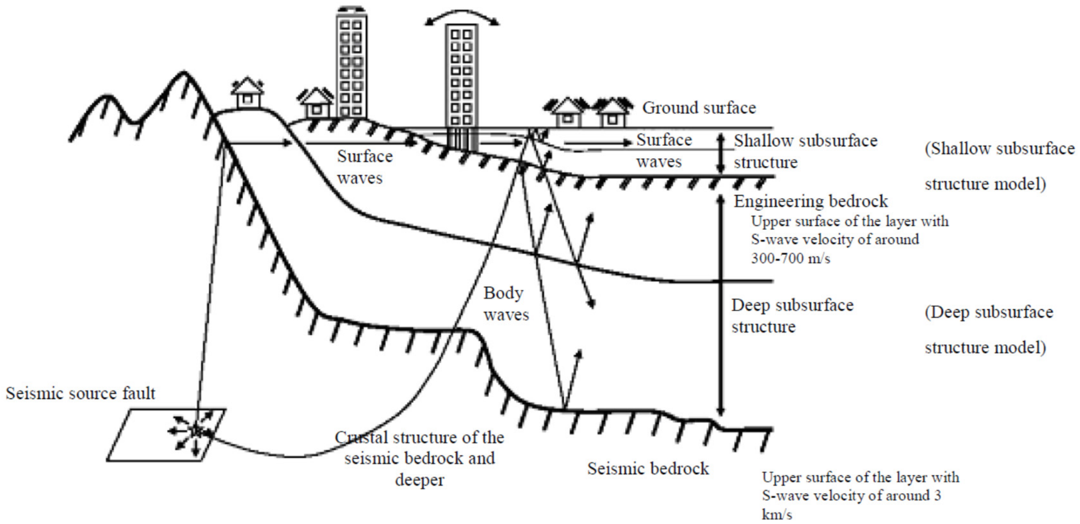

Figure 1. Schematic view of the seismic bedrock and the engineering bedrock (Fujiwara et al. 2009).

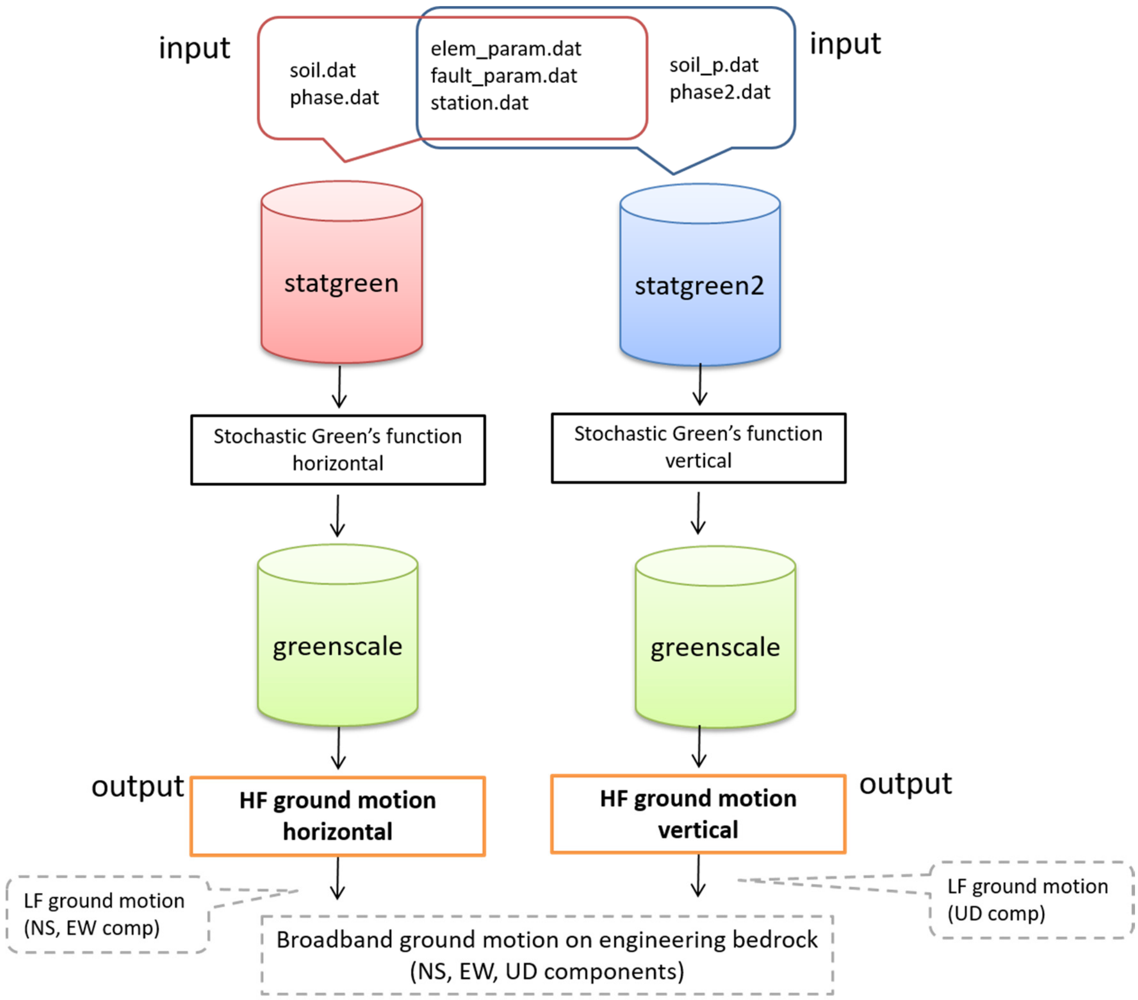

Figure 2. Components of the stochastic Green's function method in the Irikura Recipe Method 2

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