An application of reversible-jump MCMC method for simultaneous determinations of 1-D velocity structures and hypocenters around a fault (II): Synthetic analyses

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Our series of presentation (this study and Kano and Shiina [this meeting]) proposes an approach that can simultaneously estimate one-dimensional (1-D) velocity models and hypocenters based on a reversible-jump Markov chain Monte Carlo (rj-MCMC) method. A location of earthquake is routinely determined by using locally optimized 1-D velocity model, such as the JMA2001 1-D velocity model [Ueno et al., 2002]. Meanwhile, two or more 1-D velocity model can improve estimation accuracy of hypocenters of which earthquakes occur at around structural boundary [e.g., Sakai et al., 2004].
As described in Kano and Shiina [this meeting], we developed the rj-MCMC method for determining hypocenters and structures when a number of 1-D velocity models is given. In this presentation, therefore, we evaluate the developed method by using synthesized data sets that derived from two 1-D velocity models. Since the rj-MCMC requires only travel times between an earthquake and a receiver, we employ fast-marching method [e.g., Sethian and Popovici, 1999; Rawlinson and Sambridge, 2004] for travel time calculations. Note that a rj-MCMC-based estimations of 1-D velocity model and hypocenters had been suggested [e.g., Ryberg and Haberland, 2019]. However, the previous studies for the 1-D case mainly handled earthquakes which widely distributed in the targeted area. We thus discuss advantages and shortenings of the rj-MCMC method to simultaneous determinations of hypocenter and single 1-D velocity model for concentrated hypocenters, i.e., seismic swarms and aftershocks of a large earthquake.

Keywords: Hypocenter, 1-D velocity structure, rj-MCMC

