Numerical experiment of sequential data assimilation for crustal deformation between Tonankai and Nankai earthquakes along the Nankai trough, southwest Japan

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In Japan, great interplate earthquakes have repeatedly occurred and cause severe damages along its Pacific coast. For southwest Japan, we need to prepare for the M8 earthquakes along the Nankai trough. The rupture history indicates that M8 earthquakes occurred sequentially and their time interval varies from less than 1 hour to a few years. We propose here a possible estimation procedure for the time interval between the earthquakes. We apply sequential assimilation for the crustal deformation data which will obtain from hour to hour between the first earthquake to the next one. The former and latter earthquakes are assumed to occur at the eastern and western sides of the Kii peninsula as in 1944 Tonankai and 1946 Nankai earthquakes, respectively. We demonstrate numerical experiments of the assimilation using the surface deformation calculated from the results of earthquake generation cycle simulations along the Nankai trough. For the observation noise, we use the real ocean bottom pressure gage data excluding the tidal modulation at a station of the Dense Oceanfloor Network Sytem for Earthquakes and Tsunamis (DONET) in the 1944 source area . As a data assimilation method, we use Sequential Importance Sampling (SIS) which is a kind of particle filter. Data assimilation is done sequentially every 5 hours. As the data increase, the estimated time interval between Tonankai and Naknai earthquakes becomes closer to the "true" time interval. How early the true value is estimated depends at least on the noise level and crustal deformation pattern. It is important to note that the real noise level of the pressure gage data of DONET including the long-term drift is small enough to distinguish the simulated crustal deformation patterns for the different cases in the time interval. This study is part of a project to develop simulation systems for predicting earthquake and tsunami disasters using "K computer" which is the over 10 petaflops supercomputer building in Kobe. In the presentation, we also introduce this project.