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Development of real-time seismic analysis game for seafloor observation

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Japan Agency for Marine-Earth Science and Technology (JAMSTEC) is installing the new development system to observe seismic and tsunami waves in the anticipate source area of the Tonankai and Nankai earthquake. The observed data will be delivered to the Japan Meteorological Agency (JMA) and the other related organization for real-time data analysis. We have presented the content, role, and significance of this system to general people including community residents and persons related to education, and explained the contribution to disaster prevention and mitigation by this system. In order to understand the seafloor observation and real-time analysis easily, we developed a software game which determines an epicenter of seismic source with easy mouse operation by analyzing seismic data at the seafloor station.
The source location is basically determined by the arrival time difference among observation stations and the subsurface structure. If the structure is known, the location can be estimated by reading the arrival time as accurately as possible from the observed seismic waveform data and performing the grid search and the inversion. We here focused on the read processing of the arrival time, and developed the game which determinates the epicenter location using the read data. The analysis results in this game depend on how accurate users manually read the arrival time and how immediate they perform the analysis. On the game, after pushing the "Start" button, the earthquake occurs in the epicenter of the 1944 Tonankai earthquake, and the seismic waveform at three seafloor station selected randomly is shown in the panel. The epicenter analysis based on the least square method by the normal equation is executed by clicking the onset of P-wave and pushing the "Source Location" button. The waveform is synthesized by the reflectivity method of Nakamura and Takenaka (2006) assuming a halfspace model with Vp=5.0 km/s and Vp /Vs=1.73 and the hypocenter of the 1944 Tonankai earthquake by Yamanaka (2006). "Correct Answer" is displayed in the game if the estimated epicenter is located within the error range of 10 km from the correct solution (epicenter of the 1944 Tonankai earthquake). "Incorrect Answer" is displayed if the estimated location is out of the range or the seismic wave already arrives in Osaka city before finishing the analysis.
We developed this software with Visual C++.NET and used MFC by the static link. Users do not need to install other special libraries to run it, and can enjoy and learn seismic data analysis easily with Windows OS.

Keywords: hypocenter determination, real-time analysis, seafloor observation, game