[JJ] Evening Poster | S (Solid Earth Sciences) | S-TT Technology & Techniques

[S-TT51]Creating future of solid Earth science with high performance computing (HPC)

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Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Due to the development in computer science and computational science, large-scale or many times forward simulations and/or inversion analyses have become available recently. In solid Earth science, large-scale seismic wave propagation and crustal deformation with high fidelity model based on high resolution observation data have been demonstrated; uncertainty in crustal deformation caused by material properties and structures can be investigated based on many-time calculations for different material properties and structures; fault slip inversion analyses for non-Gaussian error distribution, etc. Thus, we will invite researchers who are facing problems in forward simulations and inversion analyses and discuss how to solve such problems by the collaboration between computer &computational sciences and solid Earth science. We are welcome submission by the researchers who are interested in this scope, especially students and young researchers.

[STT51-P01]A Proposal of Monitoring and Forecasting Method for Crustal Activity in and Around Japan with 3D Heterogeneous Medium Using a Large-Scale High-Fidelity Finite Element Simulation

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Keywords:Earthuake Forecasting , 3D Heterogeneous Medium, High-Fidelity

Recently, we can obtain continuous dense surface deformation data on land and partly on the sea floor. The obtained data are not fully utilized for monitoring and forecasting of crustal activity, such as spatio-temporal variation in slip velocity on the plate interface including earthquakes, seismic wave propagation, and crustal deformation. For construct a system for monitoring and forecasting, it is necessary to develop a physics-based data analysis system including (1) a structural model with the 3D geometry of the plate interface and the material property such as elasticity and viscosity, (2) calculation code for crustal deformation and seismic wave propagation using (1), (3) inverse analysis or data assimilation code both for structure and fault slip using (1) &(2). To accomplish this, it is at least necessary to develop highly reliable large-scale simulation code to calculate crustal deformation and seismic wave propagation for 3D heterogeneous structure. Unstructured FE non-linear seismic wave simulation code has been developed. This achieved physics-based urban earthquake simulation enhanced by 1.08 T DOF x 6.6 K time-step. A high fidelity FEM simulation code with mesh generator has also been developed to calculate crustal deformation in and around Japan with complicated surface topography and subducting plate geometry for 1km mesh. This code has been improved the code for crustal deformation and achieved 2.05 T-DOF with 45m resolution on the plate interface. This high-resolution analysis enables computation of change of stress acting on the plate interface. Further, for inverse analyses, waveform inversion code for modeling 3D crustal structure has been developed, and the high-fidelity FEM code has been improved to apply an adjoint method for estimating fault slip and asthenosphere viscosity. Hence, we have large-scale simulation and analysis tools for monitoring. We are

developing the methods for forecasting the slip velocity variation on the plate interface. Although the prototype is for elastic half space model, we are applying it for 3D heterogeneous structure with the high-fidelity FE model. Furthermore, large-scale simulation codes for monitoring are being implemented on the GPU clusters and analysis tools are developing to include other functions such as examination in model errors.