【Grant-in-Aid for Scientific Research (S)】

Broad Section C

Title of Project : Development of crust imaging enhanced by hetero-computing for reducing earthquake disaster

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Research Project Number : 18H05239 Researcher Number : 20333833
Keyword : Earthquake engineering, Earthquake disaster mitigation, Applied mechanics, Computer science

【Purpose and Background of the Research】

The goal of this study is to develop next-generation crustal imaging methods for estimating crustal structure, source area state, etc. for earthquake disaster mitigation through a combination of cutting-edge computational science and observations. Although the recent development of seismological and geodetic observations (e.g., observations of the ocean bottom just above the offshore source area of megathrust earthquakes) has increased the possibility of developing such imaging methods, they remain difficult to realize due to the huge analysis cost. In this study, we aim to realize crustal imaging methods by using a heterogeneous computing approach. Furthermore, using the developed methods and real observation data, we will attempt to perform crustal imaging of real targets.

【Research Methods】

Prof. Tsuyoshi Ichimura's group will develop an optimization method based on an ultra-high-speed computing method for seismic waves and crustal deformation, using heterogeneous computing and a large-scale finite element method. These methods will be implemented in a heterogeneous computing environment and their effectiveness will be investigated. Dr. Takane Hori's group will develop a method to assimilate on- and offshore crustal data and a model of spatiotemporal variation in the source area. Furthermore, the methods developed by Prof. Ichimura's group will be introduced stepwise to construct a prototype of a crustal imaging system with the aim of conducting crustal imaging using real observation data.

【Expected Research Achievements and Scientific Significance】

Earthquake damage estimation is important for mitigating earthquake disasters. To estimate the damage, information about the crustal structure and source area state is of fundamental importance. This study aims to improve the reliability of such information by combining cutting-edge computational science and observations. Hence, a substantial contribution toward earthquake disaster mitigation is expected.

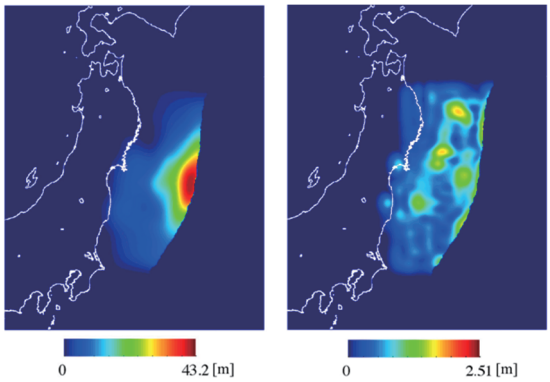

Fig: Example of the fault slip distribution considering the uncertainty of the crust structure (left: mean, right: deviation).

【Publications Relevant to the Project】

・Ichimura, T., Fujita, K., Quinay, P. E. B., Maddegedara, L., Hori, M., Tanaka, S., Shizawa, Y., Kobayashi, H. and Minami, K., Implicit Nonlinear Wave Simulation with 1.08T DOF and 0.270T Unstructured Finite Elements to Enhance Comprehensive Earthquake Simulation, SC15: International Conference for High Performance Computing, Networking, Storage and Analysis, Article No. 4, 2015.
・Hori, T., Hyodo, M., Nakata, R., Miyazaki, S., Kaneda, Y., A forecasting procedure for plate boundary earthquakes based on sequential data assimilation, Oceanography, 27, 2, 94-102, 2014.

【Term of Project】 FY2018-2022

【Budget Allocation】 144,700 Thousand Yen

【Homepage Address and Other Contact Information】

http://www.eri.u-tokyo.ac.jp/sensing_and_simulation/index.html
http://www.jamstec.go.jp/ceat/e/etfsrg/