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PREFACE

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Special issue, "Kurile arc subduction zone: View of great earthquake generation and disaster mitigation of related phenomena"

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Various great earthquakes have occurred in the past along the Kurile subduction zone where the Pacific plate subducts along the Kurile Trench. The Headquarters for Earthquake Research Promotion, Japan, published a long-term evaluation report on the occurrence of large subduction earthquakes along the Kurile Trench (Headquarters of Earthquake Research Promotion 2018). They reported that the probability of a giant earthquake with a magnitude exceeding M_w 8.8 along the Kurile trench in 30 years is between 7 and 40%, as of 2021. Mitigation of disasters due to the giant earthquake along the Kurile arc subduction zone has become one of urgent challenges in Japan. This special issue covers various researches concerning earthquake generation and postseismic processes, seismic wave attenuation, forecast of seismic activities, and mitigation of tsunami disasters in and around the subduction zone.

First, precise hypocenter estimation of micro-earthquakes along the Kurile subduction zone is a key to understand seismic activity and the stress field. Ichiyanagi et al. (2020) presented that the estimation error of hypocenter along the Kurile trench was significantly reduced using both Japanese and Russian data. In addition, Shiina et al. (2021) indicated that high-attenuation zones in the backarc mantle wedge controlled propagations of high-frequency S-wave later phases in addition to the scatterers in the forearc region.

Next, using precise micro-earthquake data, the stress field due to the Kurile subduction can be studied. Maeda et al. (2020) studied the spatiotemporal variation in stress from eastern Aomori to Tsugaru Strait using those data. Their results indicated that those variations reflected the effects of the upper-plate bending and the 2011 Tohoku-Oki earthquake, and that the compressional stress caused by the Pacific plate was relatively weak. Using aftershock data of the 2018 Eastern Iburi earthquake, Susukida et al. (2018) studied the stress field in the aftershock area in the western boundary of the Hidaka Collision Zone. Their results showed that the reverse-fault-type stress field was predominant in this area.

Finally, forecast of future earthquake activities and precise tsunami forecast are challenges for disaster mitigation. Katsumata and Nakatani (2021) tested the seismic quiescence hypothesis through retrospective trials of alarm-based earthquake prediction in the Kurile–Japan subduction zone. Their conclusion is that there is a reasonable chance that their tested quiescence will pass the cross-validation test when more target earthquakes become available in the near future. Kano et al. (2020) developed an adjoint method assimilating GNSS time series data to optimize the frictional parameters that control the slip behavior on the fault. They applied the method to the observed GNSS time series for the first 15 days following the 2003 Tokachi-oki earthquake and found that the optimized frictional parameters quantitatively predicted the postseismic GNSS time series. Therefore, their data assimilation method is an effective evaluation method for assessing risks of subsequent earthquakes and for monitoring the recovery process of megathrust earthquakes. As a near-field tsunami

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forecasting method, Tanioka (2020) developed a method assimilating ocean-bottom pressure sensor network (S-net) without any information of earthquakes. The method was numerically tested for two large underthrust fault models, a giant earthquake (M_w8.8) and the Nemuro-oki earthquake (M_w8.0) models along the Kurile arc subduction zone. The results indicated that the method was applicable to the data at the S-net stations.

This special issue presents promising results for mitigation of disaster due to giant earthquakes along the Kurile arc subduction zone although some of researches are still primitive and also challenging. Continuation of studies is necessary to mitigate disaster due to future giant earthquakes. Most of researches presented in this special issue were supported by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan, under "The Second Earthquake and Volcano Hazards Observation and Research Program".

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