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トンガリロ火山（ニュージーランド）における防災対策のための火山弾三次元数値モデル
Numerical model of 3D ballistic trajectory for hazard assessments at Upper Te Maari eruption of Tongariro volcano in New

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Ballistic bombs and blocks are energetic pyroclasts deposited around volcanic craters. Hazard assessments of ballistic projectiles are important for people, buildings, and roads around vent especially in tourist and residential areas. Tongariro volcano, an active volcano in a popular national park in New Zealand, erupted August 6th, 2012 after one hundred years. By combining acoustic signals with eyewitness descriptions, five eruption pulses from fissures around Upper Te Maari crater were characterized and conditions of particle ejection were defined. A distribution of ballistic blocks was mapped from orthophotos and field campaigns. In order to clarify characteristics of ballistics at Tongariro volcano and assess future hazards, a numerical model of ballistics is modified and applied to the 2012 eruption. At first, 3D multiparticle model based on Discrete Event Simulation (DES) method is converted to the model based on semi-Lagrangian method to include an effect of air drag and gas flow around airborne particles. Initial conditions, such as ejection direction and speed, were calibrated to explain both spatial and size distribution of deposit bombs. Finally, an initial particle velocity of 200 m/s and gas flow velocity (constant) of 150 m/s are obtained as conditions of best fit. Furthermore, we applied this model to the assessment of future eruption regarding Tongariro Alpine Crossing, a walking trail in the national park frequented by ˜80,000 people each year. Impacts of two extreme eruption cases are simulated by the numerical model. Negligible probabilities of fatality along the TAC are found from a magnitude smaller eruption, similar in size to the November 2012 eruption. However, a magnitude larger eruption could result in higher probabilities in certain areas of the track which it would be unlikely to survive the eruption. Varying the input parameters from the calibrated model allows for the assessment of future ballistic hazard from larger and smaller eruptions of Upper Te Maari Crater. A possibility of applying this model to the assessment of Japanese volcanoes such as Mt. Fuji will be discussed.

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