Modeling of pyroclastic flows to predict pyroclastic hazard zone in Merapi volcano after 2010 eruption

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Merapi eruption in 2010 was the tremendous phenomenon of natural disaster in Indonesia. The pyroclastic materials moved ∼15 km from the summit of Merapi and destroyed many monitoring equipments. This emergency situation made the local government to evacuate more than 200.000 people who lived within 20 km distance from the summit of Merapi. The pyroclastic hazard map was not appropriate for this eruption scenario. It is because the map was just based on delineation of pyroclastic deposit in the previous eruption. Here, we purpose a method to predict the pyroclastic distribution in the future eruption based on mathematical approach.

We used Titan2D software to produce the pyroclastic flow in 2010 eruption and the pyroclastic prediction after 2010 eruption. The method consists of parameterization, validation, and prediction. At least 39 models have been produced to obtain the best input parameters for 2010 eruption. Validation has been done by integrating between seismic refraction method and remote sensing interpretation. Seismic refraction method provides the information of pyroclastic deposit thickness, while remote sensing interpretation gives the information of pyroclastic distribution. The best model shows similarity with the reality. Analysis of bed friction parameter and build an eruption scenario are the most essential part in prediction. Analysis of bed friction was done by comparing the bed friction from 2006 eruption and 2010 eruption, while eruption scenario has been built by studying the historical eruption.

The result shows that three villages are located in high pyroclastic hazardous area, six villages are located in moderate pyroclastic hazardous area, and three villages are located in low pyroclastic hazardous area. Those three villages are KepuhHarjo, GlagahHarjo, and Balerante. Therefore, the local government should concern for those three villages in the next eruption. This information can help the local government to make evacuation plan for the future eruption.

Keywords : pyroclastic hazard, Merapi, Titan2D, pyroclastic prediction