Assessment on the impacts of Yogyakarta earthquakes 27 May 2006 on volcanic activities of Merapi volcano in March-July 2006

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Merapi volcano is the most active volcano in Indonesian archipelago and is situated in the vicinity of major Yogyakarta city, central Java. Explosive eruptions since the 18th century were few and during the 20th century eruptions were dominated by effusive growth of viscous lava domes and occasional gravitational collapses of domes to produce the glowing avalanches-commonly defined as 'Merapi-type' eruption (MacDonald, 1972; Voight et al., 2000). Although rarely produced explosive eruptions, this volcano erupts in every few years interval and the last eruption cycle ended in year 2002. The 2006 volcanic eruptions were especially special due to the presence of strong (M 6.3 SR) and shallow earthquakes on 27 May 2006 that took more than 5,700 lives. The 2006 volcanic activities started by increasing seismic activities around 20 March 2006. The first lava flow was seen flowing about 350 m from the crater in the second week of April 2006. Up to the end of April 2006, increasing volcanic activities were noted by lava flows up to 1.5km long from crater, rock falls and slides, and small amount of ass fell. In the first week of May 2006 the growing of lava dome was observed. The alert level was raised into the highest level (4) on 13 May after several small avalanches of volcanic materials were observed up to 1.5km long. The highest alert level of 4 was maintained up to the end of June 2006. Activities decreased since early July, and the alert level was lowered one level to 3 on 10 July in all areas except the S slope.

During the highest alert level starting on 13 May, a strong earthquake hit on 27 May. Although main and after shocks were reported to be located about 50 km to the south of Merapi, landslides and human casualties were confirmed to occur up to the vicinity of the volcano. In order to assess the scale of impacts of these tectonic earthquakes on Merapi activities, we collected field data as well as analyzed time-series ASTER satellite images, seismic data, and visual observations data of Merapi during the period of April to July 2006. Thermal analysis on night TIR images of ASTER suggests thermal activities have increased dramatically immediately after the 27 May earthquakes. More important aspect related with hazards assessment was the abrupt shift of direction of eruption. Historical eruptions of Merapi were dominated by lava avalanche and pyroclastic flow towards the SW slope; after 27 May 2006 eruptions shifted to-

ward SSE slope. Pyroclastic flow on 14 June 2006 that reached the Kaliadem resort (7 km from the peak) was also among the biggest eruption since the 20^{th} century. Mapping volcanic facies of pyroclastic flow using SWIR and TIR also suggest that large amount of hot materials (likely to be lava flows) were present; this is also different from typical Merapi eruptions that usually contain no juvenile materials. This analysis is supported by seismic data, visual observation records. Seismic records show show dramatic increased of avalanche and pyroclastic flow equivalent events immediately after the main shock. Visual observation records also show change of avalanches direction from SW to SSE after the quakes. We conclude that earthquakes on 27 May 2006 affected considerably the volcanic eruptions of Merapi in two ways: increasing outflow of lava and changing direction of eruptions. We consider that the direct influence of earthquakes was causing collapse of a topographic barrier near the lava dome that in turn changed the direction of lava overflow.