



Volcano-tectonic control of Merapi's lava dome splitting observed from high resolution TerraSAR-X data

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Volcanism at active andesite–dacite volcanoes is often associated with the formation and collapse of circular shaped protrusions of extruded, highly viscous lava, the so-called domes, which are emplaced in the near summit region. Growing domes may experience stable and instable structural phases, with a gradual transition in between. Dome collapse and the break-off of instable blocks of viscous lava may lead to pyroclastic flows, one of the most lethal hazards at stratovolcanoes. At Merapi volcano, Indonesia, nearly 50 % of all eruptions are accompanied by these phenomena. After the climactic eruption in 2010 which left an amphitheater in the summit region, a new dome started growing. Three years later, the dome reached a height of approximately 100 m and diameters of 220 and 190 m with a plateau-like surface area of 40,000m² approximately.

On 18/11/2013, an explosion occurred without identified precursors, leaving a major fracture cutting the complete dome structure. Based on high resolution TerraSAR-X satellite radar imagery, we could identify this linear fracture, traceable over ~200m in the long axis, and up to 40m width. After geocoding of the radar amplitude imagery, the fractures azimuthal trend could be compared to other structural lineaments, indicative of a significant NNW–SSE structural direction that has formed on Merapi volcano in the past. This alignment is also visible in a seismic velocity tomographic imagery for the upper crust, down to 15 km depth. The Merapi dome fractured in a NW–SE direction, and is consistent with the alignment of regional tectonic structures and of anticipated directions of pyroclastic flows. The fracture may be part of a larger volcano-tectonic system and may affect the dynamics and the stability of the Merapi dome.