



## Fault geometry and rupture patterns of the 2018 Lombok earthquakes – complex thrust faulting in a volcanic retro-arc setting

Shengji Wei<sup>1</sup>, Karen Lythogoe<sup>1</sup>, Muzli Muzli<sup>2</sup>, Andri Dian Hugraha<sup>3</sup>, Kyle Bradley<sup>1</sup>, and Zulfakriza zulhan<sup>3</sup>

<sup>1</sup>EOS/ASE, NTU, Singapore (shjwei@ntu.edu.sg)

<sup>2</sup>BMKG, Indonesia (muzli@ntu.edu.sg)

<sup>3</sup>ITB, Indonesia

The 2018 Lombok earthquake sequence, which took place ~10km to the north of the Rinjani volcano on the Flores thrust fault, are distributed beneath the northern coast of the island, composing of two Mw6.4 and two Mw6.9 earthquakes and numerous aftershocks. The first Mw6.4 earthquake was followed by the first Mw6.9 event in a week, which was located only a few kilometers to the west of the Mw6.4 event, characterized with strong westwards rupture directivity and multiple asperities (rougher source time function). Two weeks later, the second Mw6.4 event took place a few km to the east of the first Mw6.4 event and triggered the second Mw6.9 event 12 hours later. In contrast, the second Mw6.9 ruptured towards east with a single major asperity, with a centroid depth of ~18km, ~5km shallower than the first Mw6.9 event. The seismicity was well captured by 7 broadband stations and 6 short period nodes deployed just before the first Mw6.9 event, mostly concentrated within a depth range of 5km. Relocated seismicity shows shallower depth to the west and deeper to the east, in consistent with the coseismic rupture of the largest events. Aftershocks are shallowest below the volcano due to an elevated Brittle-Ductile-Transition (BDT) zone depth controlled by the thermal structure. A few anomalous earthquakes were identified between the  $M_w$ 6.9 events below the BDT zone that could be related to the basaltic conduit of the volcano. Several sets of repeating earthquakes were identified and are mostly located in the rupture area of the first Mw6.9 event, indicating a highly heterogeneous friction on the fault that is probably caused by to the stronger thermal gradient compared with the second Mw6.9 event. The earthquake sequence highlights the strong interaction between the volcanic system and the tectonic faulting process.