



Dynamic of the lava flows during the Tolbachik Fissure eruption in 2012-2013 (Kamchatka) inferred from the satellite and ground-based observations

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Fissure eruption on the slope of Plosky Tolbachik volcano continued from November 27th, 2012 until September 2013. It was named as The Institute of Volcanology and Seismology 50th Anniversary Fissure Tolbachik Eruption. The eruption started from the 5 km-long fissure opening and continued with the intensive lava effusion from it. During the first two days of eruption the length of the lava flows was 9 km, and lava covered the area of 14.4 km² (Gordeev et al., 2013). Lava discharge rate at this period was about 400 m³/sec. Two eruptive centers were formed on the fissure – upper (Menyailov vent) and lower (Naboko vent), and lava gushed from them to the height up to 200-300 meters. On December 1st, the Menyailov vent activity ceased, and the eruption concentrated at the Naboko vent. Cinder cone was formed here, and lava flows effused from the base of the cone. Lava erupted from the Menyailov vent, is different from the Naboko vent lava by higher silica content (SiO₂ 55.35 wt.% vs. 52.5 wt.%, respectively). That may be caused by the discharge of two levels of the magma chamber, fractionated to a different extent. Morphologically, lava flows from the beginning of eruption until April 2013 were dominantly aa-lava type, and from April until September 2013 pahoehoe type dominated.

For distinguishing of the dynamic of the lava flows the following methods were applied. As remote sensing methods we used different satellite data – for specification of the area covered by lava flows, their length, temperature we used Landsat 7 ETM+, Landsat 8, ASTER, EO-1 ALI and HYPERION. For time averaged discharge rate (TADR) and lava flow area determination we used AVHRR data. We detected that in December 2013 lava discharge rate varied from 120 to 40 m³/sec, and then it gradually decreased to average values 5-15 m³/sec and remained on this level until the end of eruption. These data are confirmed by the ground-based observations, which were conducted during the entire period of eruption. At the end of eruption in September 2013, lava flows area was about 36 km², the maximum length of the lava flow – 15 km.