



Lava emplacements at Shiveluch volcano (Kamchatka) from June 2011 to September 2014 observed by TanDEM-X SAR-Interferometry

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As part of the Ring of Fire, Shiveluch volcano is one of the largest and most active volcanoes on Kamchatka Peninsula. During the Holocene, only the southern part of the Shiveluch massive was active. Since the last Plinian eruption in 1964, the activity of Shiveluch is characterized by periods of dome growth and explosive eruptions. The recent active phase began in 1999 and continues until today. Due to the special conditions at active volcanoes, such as smoke development, danger of explosions or lava flows, as well as poor weather conditions and inaccessible area, it is difficult to observe the interaction between dome growth, dome destruction, and explosive eruptions in regular intervals. Consequently, a reconstruction of the eruption processes is hardly possible, though important for a better understanding of the eruption mechanism as well as for hazard forecast and risk assessment.

A new approach is provided by the bistatic radar data acquired by the TanDEM-X satellite mission. This mission is composed of two nearly identical satellites, TerraSAR-X and TanDEM-X, flying in a close helix formation. On one hand, the radar signals penetrate clouds and partially vegetation and snow considering the average wavelength of about 3.1 cm. On the other hand, in comparison with conventional InSAR methods, the bistatic radar mode has the advantage that there are no difficulties due to temporal decorrelation. By interferometric evaluation of the simultaneously recorded SAR images, it is possible to calculate high-resolution digital elevation models (DEMs) of Shiveluch volcano and its surroundings. Furthermore, the short recurrence interval of 11 days allows to generate time series of DEMs, with which finally volumetric changes of the dome and of lava flows can be determined, as well as lava effusion rates.

Here, this method is used at Shiveluch volcano based on data acquired between June 2011 and September 2014. Although Shiveluch has a fissured topography with steep slopes, DEMs with a resolution of about 6 m can be calculated and the changes caused by volcanic activity can successfully be derived and quantified.