

Supplementary Materials

Table S1. Descending spotlight TSX amplitude image pairs of Bezymianny. Data are acquired during the 2016–2017 eruption sequence and used to track surface deformation. Temporal (ΔT) and vertical (BL) baselines between adjacent pairs are indicated.

Volcanic phase	SAR pair	ΔT	BL
	20160125–20160216	22	−198.5
	20160216–20160227	11	159.7
	20160227–20160309	11	−8.9
	20160309–20160320	11	135.8
	20160320–20160331	11	−188.8
	20160331–20160422	22	215.4
	20160422–20160503	11	−12.8
	20160503–20160514	11	−58.4
	20160514–20160525	11	82.2
	20160525–20160605	11	−24.3
	20160605–20160616	11	6.6
Episode before eruption climax on 5 December 2016	20160616–20160627	11	−54.6
	20160627–20160708	11	30.8
	20160708–20160719	11	−41.1
	20160719–20160730	11	−95.7
	20160730–20160810	11	−30.5
	20160810–20160821	11	71.6
	20160821–20160901	11	61.1
	20160901–20160912	11	−59.1
	20160912–20160923	11	−72.5
	20160923–20161004	11	75.9
	20161004–20161015	11	−125.1
	20161015–20161026	11	69.9
	20161026–20161106	11	2.8
	20161106–20161117	11	28.7
Lava effusion (5 December 2016– 28 February 2017)	20161117–20161220	33	−14.1
	20161220–20161231	11	84.3
	20161231–20170202	33	−188.6
	20170202–20170213	11	202.9
	20170213–20170224	11	−139.1
	20170224–20170307	11	−63.6

Table S2. Ascending spotlight TSX amplitude image of Bezymianny. Data acquired during the 2016–2017 eruption sequence and used to track surface deformation. Temporal (ΔT) and vertical (BL) baselines between the adjacent pair are indicated.

Volcanic phase	SAR pair	ΔT	BL
Lava effusion (5 Dec. 2016— 28 Feb. 2017	20170217–20170228	11	344.3

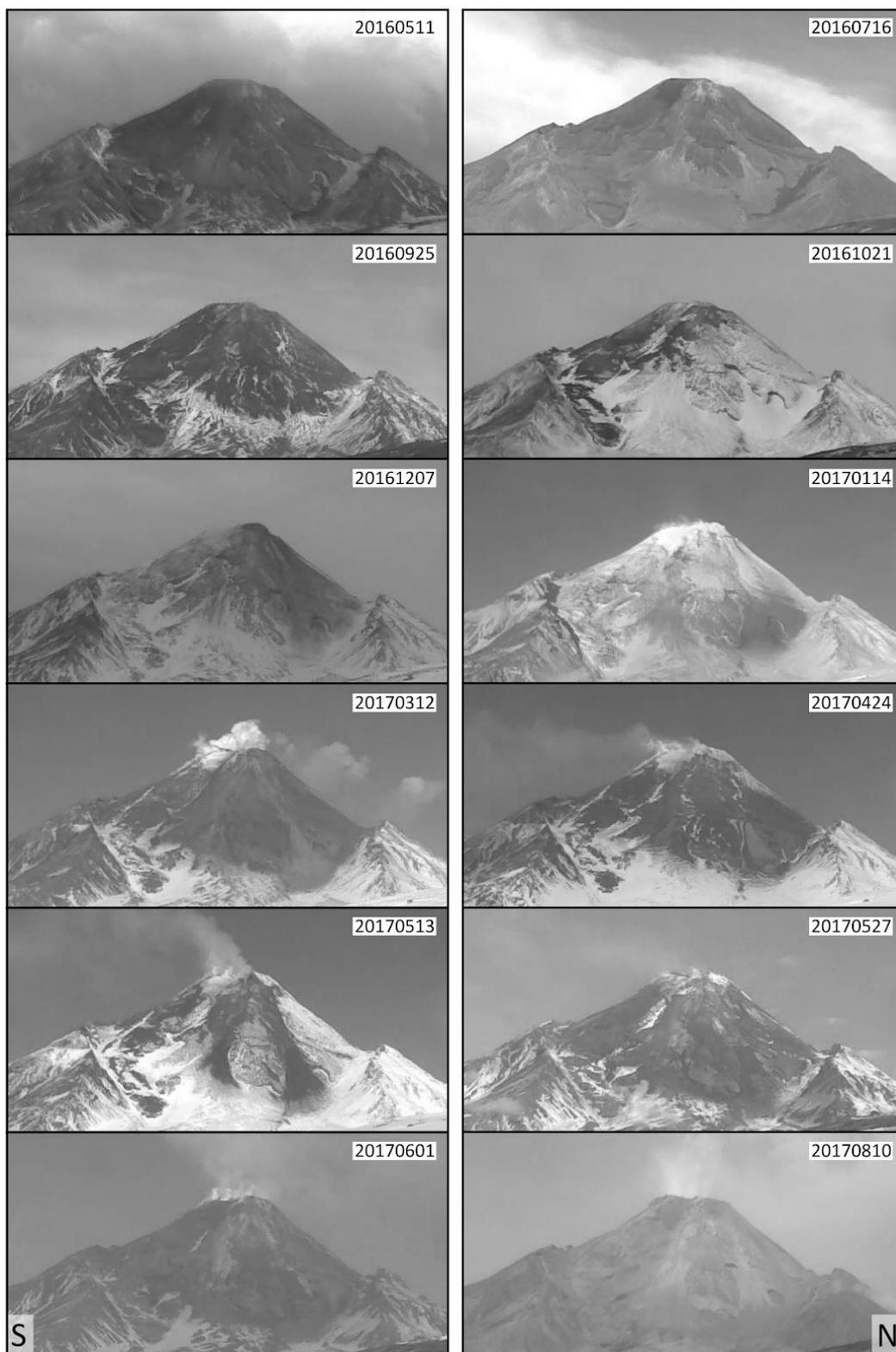


Figure S1. Selected clear view images that cover the 2016-2017 eruptive sequence of Bezymianny. See Figure 2b for extent and scale.

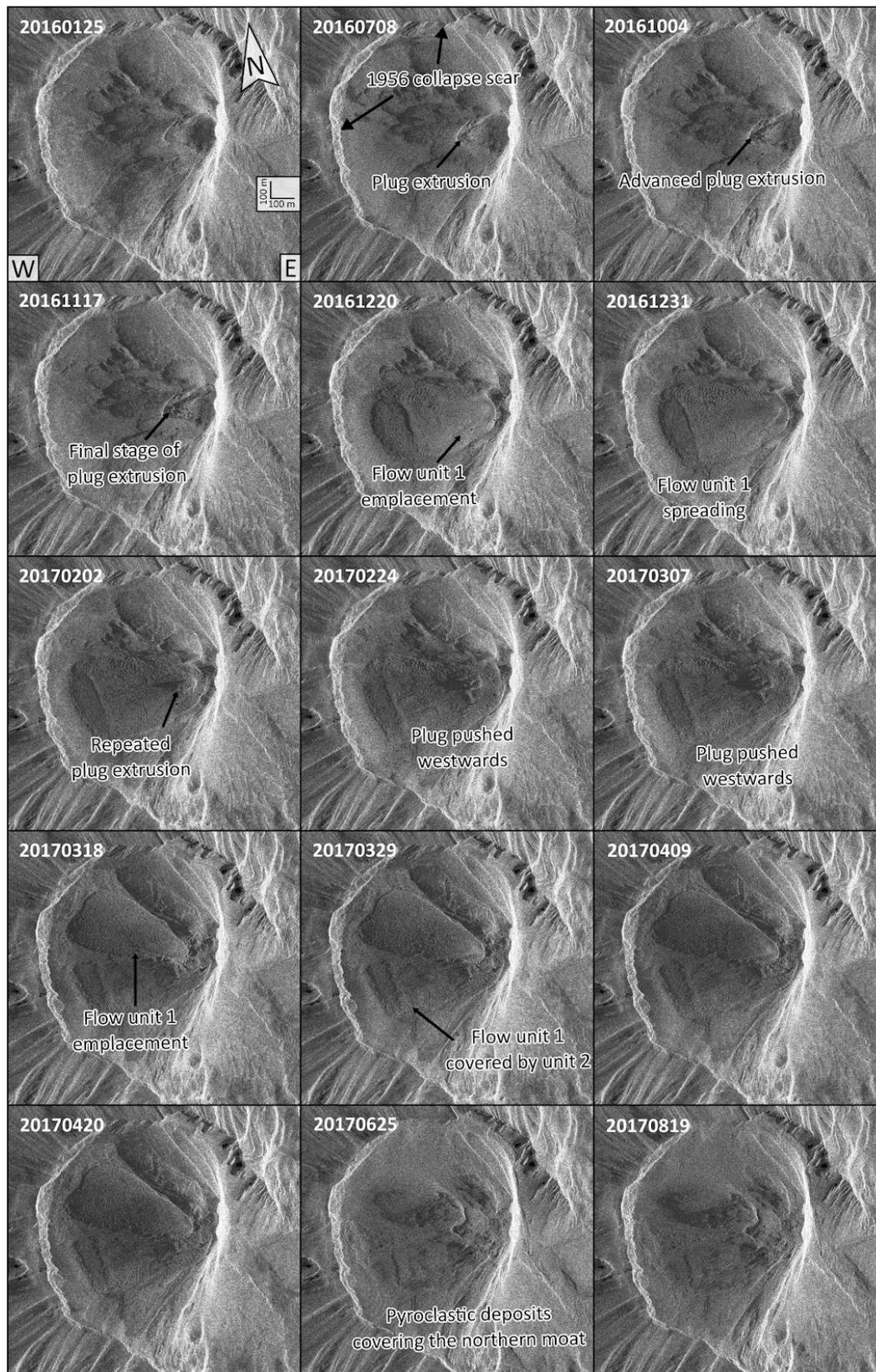


Figure S2. Selected co-registered descending TSX amplitude images. The images cover the eruption series at Bezymianny between Jan. 2016 and Aug. 2017. See Figure 2d for approximate scale and extent.

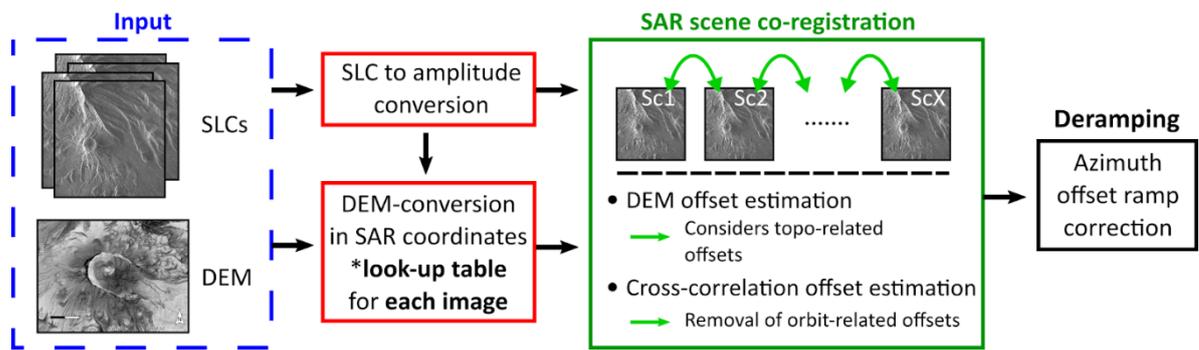


Figure S3. Co-registration processing chain of the TSX amplitude data time-series.

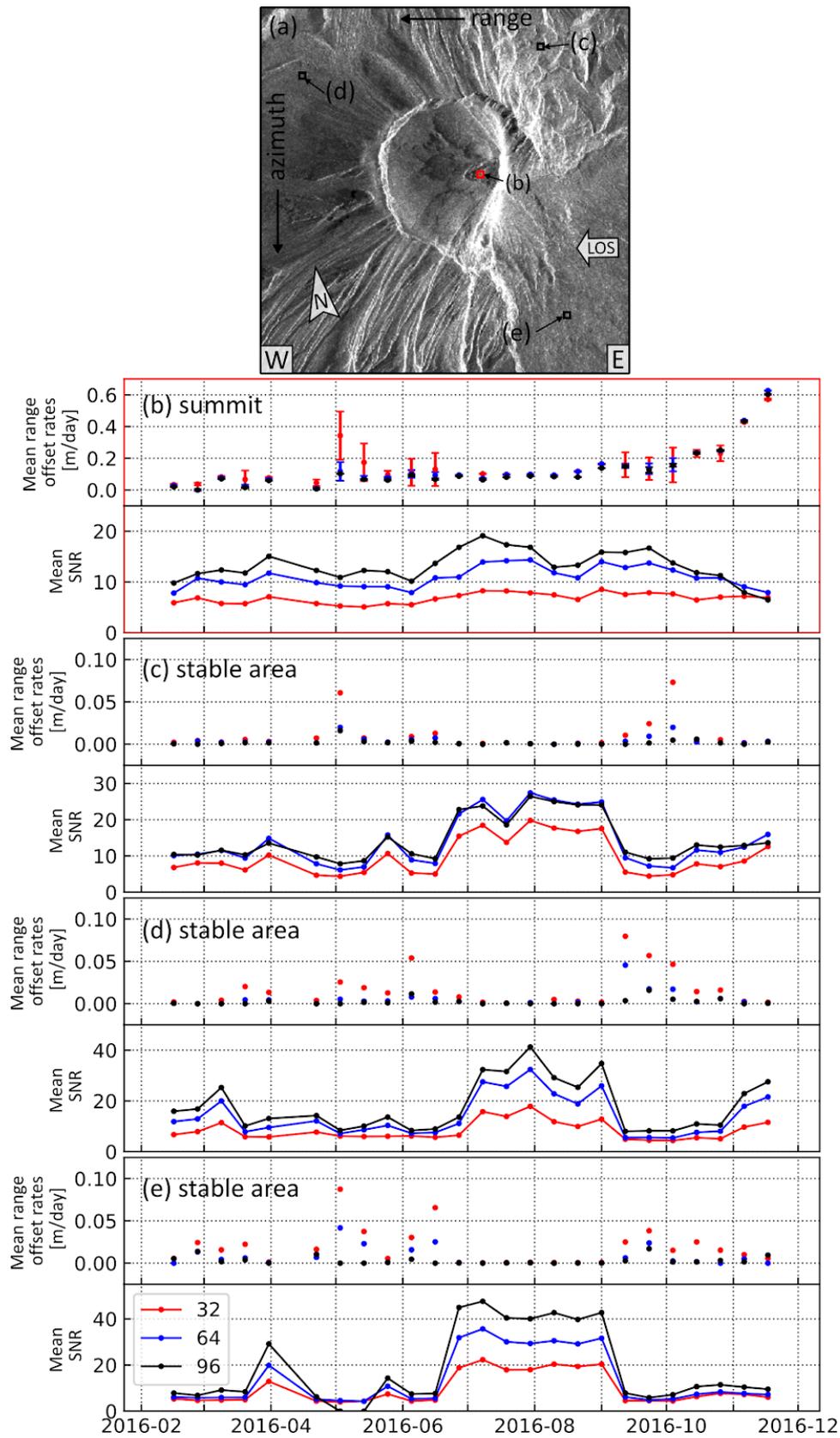


Figure S4. Summit range pixel offsets compared with stable areas (i.e., no deformation). (a) Amplitude image from 17 November 2016. Red and black boxes indicate areas of calculated offsets and Signal-to-Noise Ratios (SNR) at the summit (b) and stable areas (c,d,e), respectively.

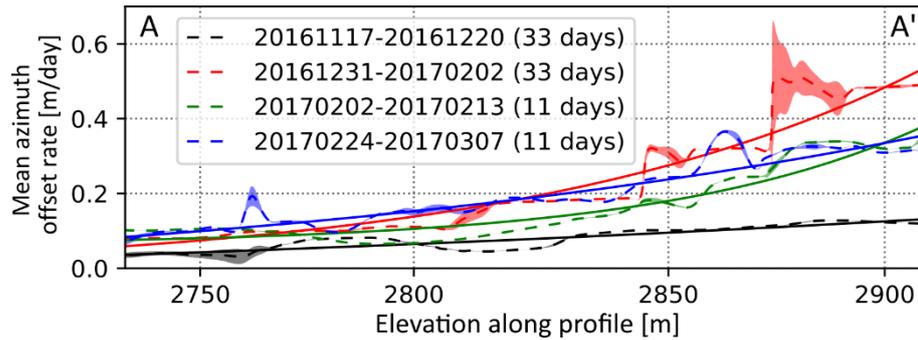


Figure S5. Average azimuth pixel offset rates during December 2016–March 2017. Rates (10-90 percentile) are calculated for a swath profile along Bezymianny’s northern flank (cf. Figure 5). Please note the increase towards the summit (solid lines = trend lines). Stepwise increases (e.g., 20161231–20170202) are related to topography related bright scatterers that dominate the cross-correlation patch. Shaded areas indicate variance of the offset rates.

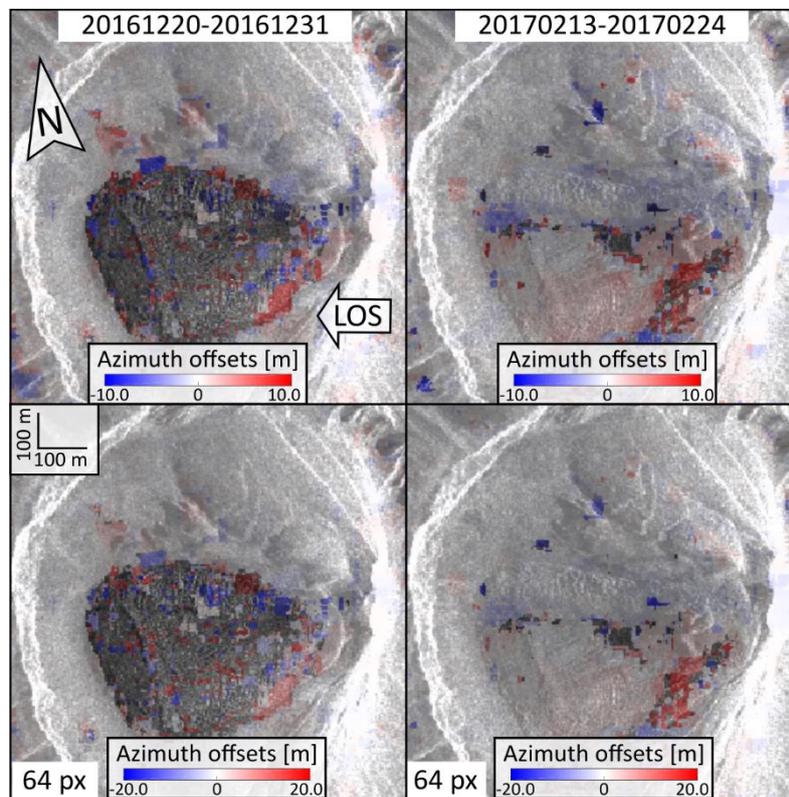


Figure S6. Azimuth offset maps for descending acquisition intervals without northward dome bulging. Red and blue colour coding depict movement along (~southward motion) or against (~northward motion) the TSX flight direction. Areas where no motion is detected corresponds to strong ground movement undetectable for the employed cross-correlation algorithm. Please note that there is no northward motion detected at the northern dome flank discernable independent of the scale size.

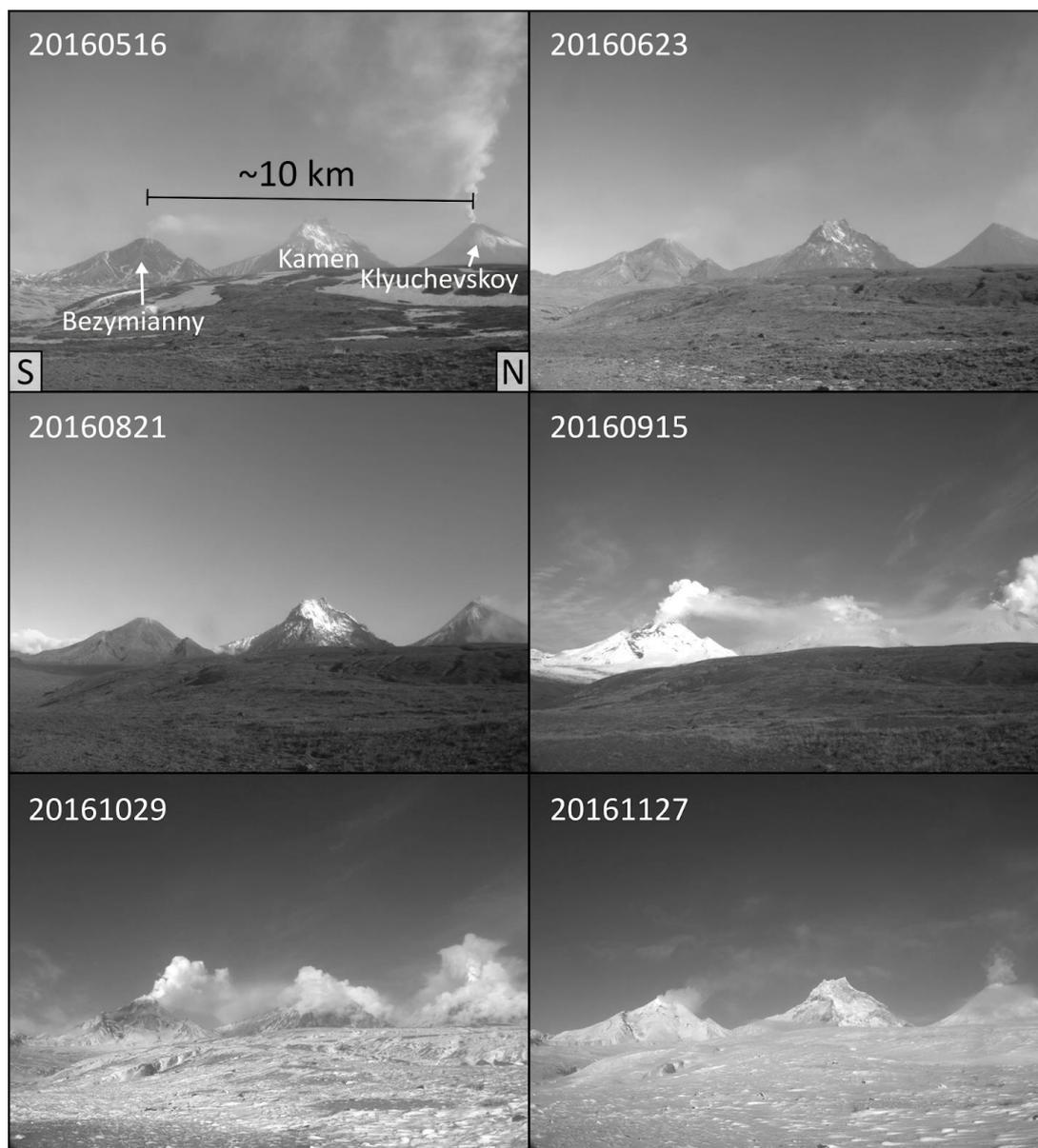


Figure S7. Webcam images showing episodic degassing (cf. Figure S1) at Bezymianny during May–Nov. 2016. Please note Klyuchevskoy’s degassing activity during most of this time.

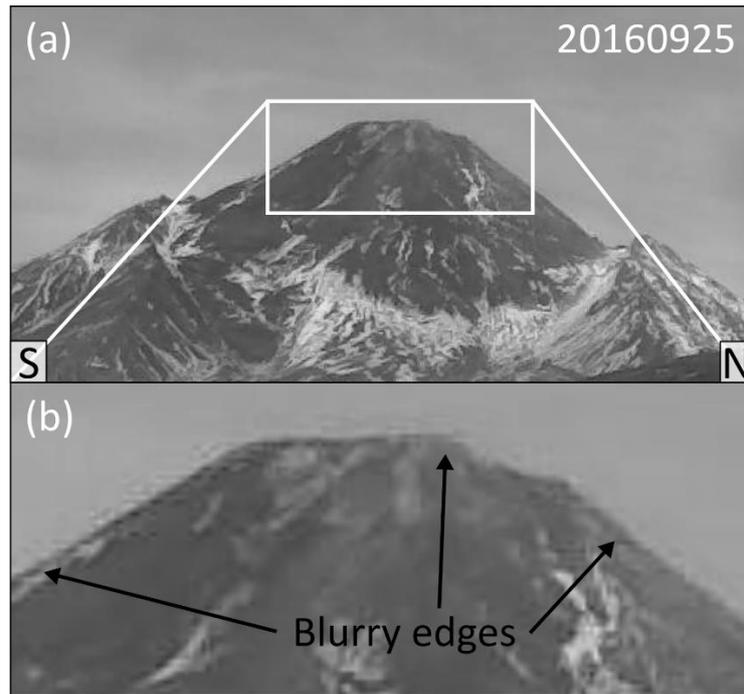


Figure S8. Illustration demonstrating constraints on the Mimatsu mapping quality because of blurry edges of Bezymianny's dome. Blurriness comes mostly from far distance (approx. 7 km) of camera position.

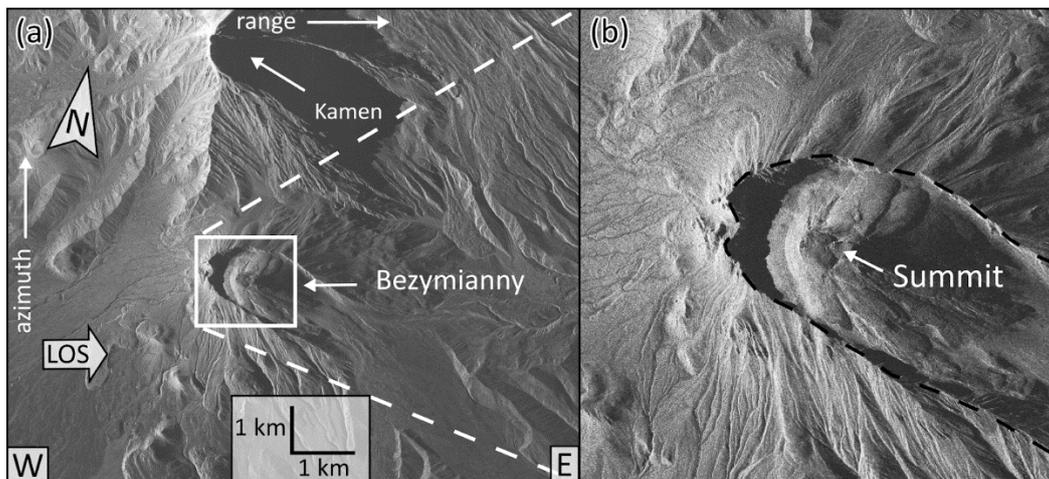


Figure S9. (a) Ascending non-geocoded spotlight-mode TSX amplitude image (track 64) acquired on 17 February 2017 (cf. Figure 1). Flight direction (azimuth) and line-of-sight (LOS) or range direction of the satellite are indicated. White box indicates the area used for pixel offset tracking and close-up of Bezymianny in: (b) Black dashed line delineates the 1956 collapse scar.

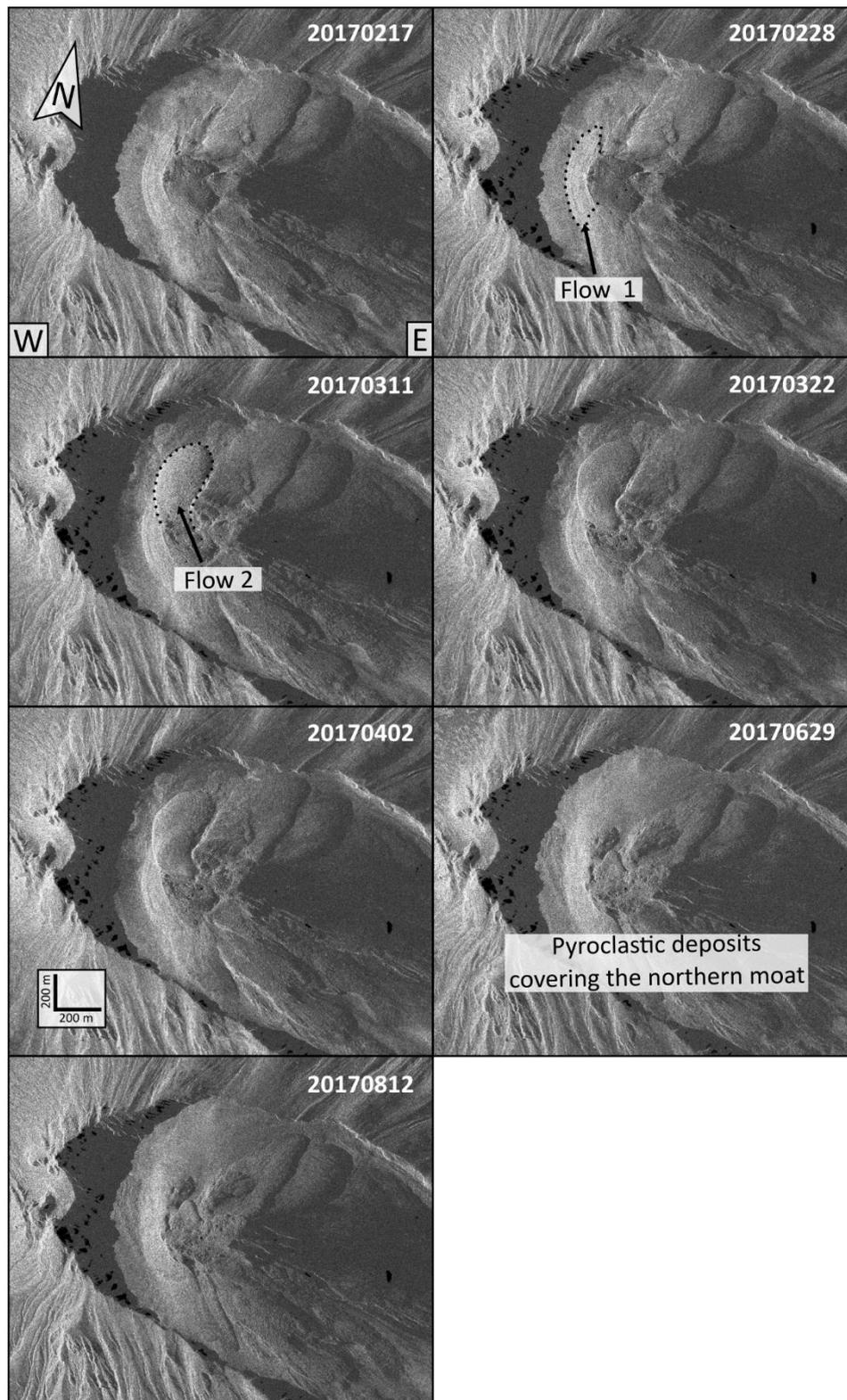


Figure S10. Co-registered ascending TSX amplitude images. They cover the eruption series at Bezymianny between February and August 2017. See Figure S9 for scale and extent. Please note that foreshortening of the western flank prohibited examination of lava flow processes.

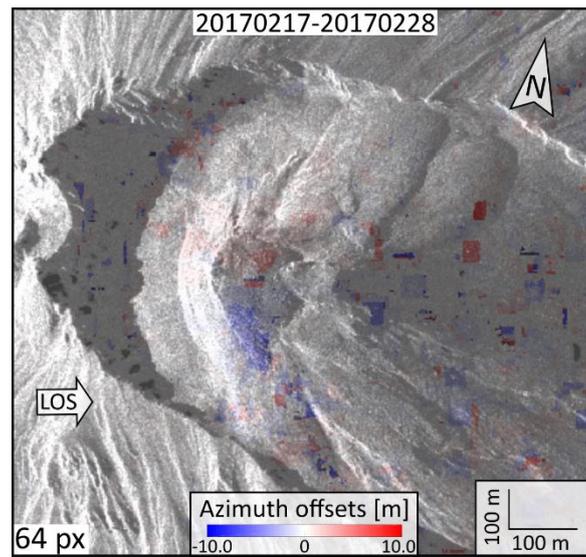


Figure S11. Azimuth offset map between the ascending TSX acquisitions from 17–28 February 2017. Blue and red colour coding reflect movement along (southward motion) or against (northward motion) the TSX flight direction.