2016-2017 explosive eruptions of Kamchatka volcanoes based on KVERT data

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Strong explosive eruptions of volcanoes are the most dangerous for aircraft because they can produce in a few hours or days to the atmosphere and the stratosphere till several cubic kilometers of volcanic ash and aerosols. Ash plumes and the clouds, depending on the power of the eruption, the strength and wind speed, can travel thousands of kilometers from the volcano for several days, remaining hazardous to aircraft, as the melting temperature of small particles of ash below the operating temperature of jet engines.

There are 30 active volcanoes in the Kamchatka, and several of them are continuously active. Scientists of KVERT monitor Kamchatkan volcanoes since 1993. Since 2014, satellite monitoring of volcanoes is carried out with the help of the Information System "Remote monitoring of activity of volcanoes of Kamchatka and Kuril Islands". In 2016-2017 six of these volcanoes (Sheveluch, Klyuchevskoy, Bezymianny, Karymsky, Zhupanovsky and Kambalny) had strong and moderate explosive eruptions.

The eruptive activity of Sheveluch volcano began since 1980 (growth of the lava dome) and is continuing at present. Strong explosive events of the volcano occurred in 2016: on 10, and 29 January, 18, and 27 February, 23 March, 02 April, 02 May, 18 September, 09 and 19 December: ash plumes rose up to 10-12 km a.s.l. and extended more 2000 km to the different directions of the volcano. And in 2017: on 04 February, 28 and 30 April, 02, 11, 16, 24 and 31 May, 03, 07, 08, 10, 14, 15, 16, 18 and 27 June, 02 and 23 July, 08 August, 07, 08, 11 and 13 September, 10 October, 02 and 07 November, 04 and 26 December; ash plumes rose up to 10-12 km a.s.l. and extended more 4000 km to the different directions of the volcano. Satellite data by KVERT showed a thermal anomaly over the volcano all year. Activity of the volcano was dangerous to international and local aviation.

Explosive-effusive eruption of Klyuchevskoy volcano lasted from 03 April till 06 November, 2016. Strombolian explosive volcanic activity began from 03 April, and on 23-24 April a lava flow began to effusing along the Apakhonchich chute on the southeastern flank of the volcano. Vulcanian activity of the volcano began from 02 May. Ash plumes rose up to 7-8 km a.s.l. and extended more 600 km to the different directions of the volcano. Next moderate explosive eruption of Klyuchevskoy volcano lasted from 02 March till 30 August, 2017 and after three months of relative lull, in December. Ash plumes rose up to 6-8 km a.s.l. (up to 8 km a.s.l. - 02 March and 06 May; and up to 7 km a.s.l. - 29 March, 23 April, 10-11 and 14-15 June, 18-20 August and 21 December), and extended more 600 km to the different directions from the volcano. Activity of the volcano was dangerous to international and local aviation.

Extrusive-explosive-effusive eruption of Bezymianny volcano began from 05 December 2016 (extrusive and effusive phases). A moderate explosive phase probably occurred on 15 December, 2017 – gas-steam plume containing some amount of ash drifted for about 118 km to the west of the volcano. Three strong explosive eruptions occurred in 2017: the first began at 01:30 UTC on 09 March (explosions sent ash up to 7-8 km a.s.l., ash plumes drifted more 400 km to the north-west and north from the volcano); the second began at 04:53 UTC on 16 June (explosions sent ash up to 12 km a.s.l., an ash cloud drifted more 2000 km to the east and south-east from the volcano); the third began at 03:40 UTC on 20 December (explosions sent ash up to 15 km a.s.l., an ash cloud drifted more 400 km to the north-east from the volcano). Two explosive eruptions were predicted by scientists of KVERT: the second - 18 hours before the event (VONA/KVERT at 10:50 UTC on 15 June: http://www.kscnet.ru/ivs/kvert/van/?n=2017-136); and the third – 35 minutes before the event (VONA/KVERT at 03:05 UTC on 20 December: http://www.kscnet.ru/ivs/kvert/van/?n=2017-266). Activity of the volcano was dangerous to international and local aviation.

Karymsky volcano was in a state of relative rest in October 2016 – May 2017, but from 03 June its episodic explosive activity was resumed. Ash plumes rose up to 4-5 km a.s.l. and extended more 400 km to the different directions from the volcano. Strong explosive events of the volcano occurred on 19 September, 2017 (up to 7 km a.s.l.). Activity of the volcano was dangerous to local aviation.

Explosive eruption of Zhupanovsky volcano was observed on 19, 21, and 24 January; 05, 07, 09, and 12 February; 24 March, and 20 November, 2016: explosions sent ash up to 8-10 km a.s.l.. Ash plumes extended for about 550 km mainly to the eastern directions of the volcano. One explosive event at Zhupanovsky volcano occurred at 23:03 UTC on 16 September, 2017. The gas-steam column with some amount of ash rose up to 7 km a.s.l. Activity of the volcano was dangerous to local aviation.

The first historical eruption of Kambalny volcano lasted from 24 March till 11 April, 2017. According to satellite data, the explosive eruption began near 21:10 UTC on 24 March. Ash plumes rose up to 7 km a.s.l. and extended more 4000 km to the different directions from the volcano. The area of land and sea covered by ash trails was about 650 thousand km^2. Activity of the volcano was dangerous to local aviation.

Unique event occurred in 2017: first historical explosive eruption of Kambalny volcano. Activity of Sheveluch volcano was significantly higher in 2017 than in previous years. After the relative rest, there were four eruptions of the volcano Bezymianny. As a result of explosive eruptions of six volcanoes of Kamchatka, ash clouds and plumes extended for distances up to several thousand kilometers, mainly in the eastern and southern directions from volcanoes, creating a real danger to air transportation in the Asia-Pacific region.