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THE JUNE 2019 ERUPTION OF RAIKOKE VOLCANO (THE KURILE ISLANDS)

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Over the last ten years volcanic activity on the Central Kurile Islands significantly increased (Girina et al., 2019; Zlobin T.K., Polets, 2010; Rybin et al., 2016, 2017, 2018 et al.). The Central Kurile Islands volcanoes are less available for visual observation. Rapid information on the beginning and progress of eruptions in this area can now be obtained thanks to remote sensing data and established contacts with representatives of the tourism industry, hydrometeorological services and the fishing industry.

On June 22, 2019 new explosive eruption in the Central Kuril Islands began. Raikoke volcanic island, which has been silent since 1924, began to erupt ash to the altitude of 10–13 km above sea level.

The 551 m high (asl) and 2×2.5 km large Raikoke stratovolcano is located in the northern part of the Central Kuril Islands. There is a crater ~700 m in diameter and up to 200 m deep at the top of the volcano (Gorshkov, 1958, 1970). The volcano is composed of medium potassium rocks of tholeiitic series from basalts to andesites (Martynov et al., 2015; Podvodnyi ..., 1992; Fedorchenko et al., 1989; Gorshkov, 1970; Tomascak et al., 2002). Olivine-plagioclase-amphibole inclusions were found in volcanic rocks of Raikoke (Levin et al., 2010).

Quaternary submarine volcano 3.18 (Podvodnyi ..., 1992), the flat top of which is located at depths of 250–240 m and Raikoke volcanic island form the single north-west directed volcanic massif with the size of 15×21 km (along the 1200 m isobath). The distance between the tops of the volcanoes is ~7 km, and the saddle is located at a depth of ~800 m. Dredging the upper part of the volcano 3.18 revealed fresh and altered andesite basalts and andesites (Brusilovskii, et al., 1994; Podvodnyi ..., 1992).

Raikoke erupted in the XVIII-XX centuries (Gushchenko, 1979; Gorshkov, 1958, 1970; Tanakadate, 1925). It is characterized by sudden paroxysmal eruptions and long periods of rest. The 1778 eruption was catastrophic (Fedorchenko et al., 1989; Newhall, Self, 1982). The strong 1924 eruption of Raikoke was accompanied by the submarine eruption near Matua island (Tanakadate, 1925). The June 12–13, 2009 satellite images showed gas and steam activity of Raikoke (Rybin et al., 2010; McGimsey et al., 2014).

A new explosive eruption of Raikoke Volcano began on June 22, 2019 at 06:05 Kamchatka time (or June 21 at 18:05 GMT). The data on the eruption progress was obtained from various satellites, the Himawari-8 including, using the VolSatView information system (Girina et al., 2018). The eruptive column reached the height of 9.5–12.5 km above the crater. Heavy ashfalls occurred throughout the entire territory of the island. Ash plume drifted mainly to the east – northeast of the volcano (Fig. 1), on June 23 it was 750–800 km wide and more than 2000 km long. Paroxysmal phase of the Raikoke Volcano eruption lasted about 15 hours. The June 23 data evidenced for the ash column to the height of 1.5 km above the crater (Fig. 2) and the ash plume drifting towards the northwest of the volcano. The effect of the eruption was observed much longer. The June 26 data from the Support to Aviation Control Service (http://sacs.aeronomie.be/) evidenced for particles of aerosol clouds from Raikoke Volcano, which continue to trace in atmosphere over the areas of the Novosibirsk Islands (Arctic Ocean) and the Great Lakes of North America.

Satellite data on the Raikoke eruption revealed also the increased gas and steam activity of Sarychev Peak Volcano (Matua Island) and the thermal anomaly in the crater area.

Satellite data from various Internet sources suggest, that most likely, the submarine volcano 3.18 also erupted during the Raikoke Volcano eruption.

Due to the fact that on June 23, 2019, the Athena passenger ship passed near Raikoke Island, the unique information on the eruption and its impact on the western part of the island (Fig. 2, 3).

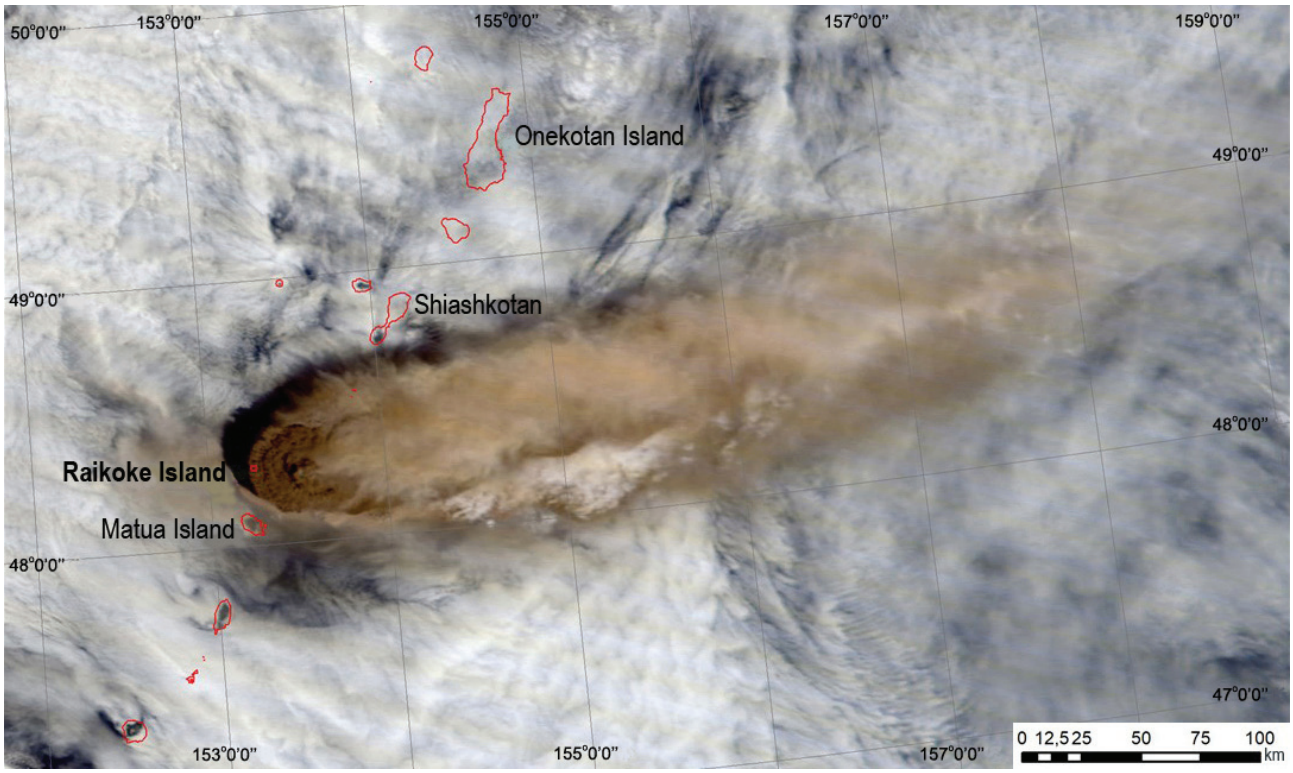

Fig. 1. Ash plume from Raikoke Volcano on June 22, 2019. Satellite image from TERRA/MODIS, courtesy of State Research Centre «Planeta».

Fig. 2. Eruptive column above Raikoke Volcano on June 23, 2019. Photo by N.N. Pavlov.

Fig 3. Ash and pyroclastic deposits on the western coast of Raikoke Island. Photo by N.N. Pavlov, on June 23, 2019.

The visual data on the western shore of Raikoke Island, obtained from the side of the vessel, and its subsequent analysis allow us to suggest active volcanic center in the southeastern part of the crater, and the ash eruption from several vents. In the result of the eruption, the slopes of the volcanic island were covered by thick white-beige pyroclastics sediments (from several tens of centimeters in the upper part to several meters near the water edge). For example, the eruption resulted in the single rock located 30 meters from the island adjoined to it. Steam and gas activity was observed near the water line and on slopes of the volcano (Fig. 3). As sea waves approached fresh deposits, they caused explosions accompanied by brown and dark brown emissions, which indicated a high temperature of pyroclastics. Sea water was of a peculiar yellowish-greenish colour, but closer to the shore it turned grey-brown due to the large amount of ash deposited on the underwater parts of the slopes of the volcano and actively washed out by sea waves.

Before the eruption that drastically impacted plants and animals there was a large seabird colony and sea lion rookery on the island (Trukhin, 2008).

The eruption began unexpectedly with no precursors detected by the remote sensing, while there are no ground-based monitoring systems installed on the island. The eruption posed a real threat to aviation and navigation. Thanks to the staff at the Tokyo VAAC (Volcano Ash Advisory Center, https://ds.data.jma.go.jp/svd/vaac/data/), the airline companies were warned about the threat.

Once again, the June 2019 Raikoke eruption showed that in order to reduce impact from volcanic activity we need an integrated satellite and ground-based monitoring of active volcanoes as well as prompt cooperation between concerned organizations.

As a part of such solutions, we suggest installation of multivariable automated complexes for remote monitoring, which are being developed at the Institute of Volcanology and Seismology FEB RAS.

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