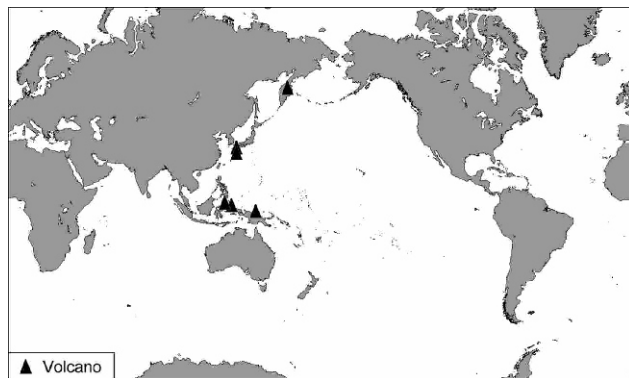


Bulletin of the Global Volcanism Network

Volume 33, Number 9, September 2008



Smithsonian
National Museum of Natural History

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Editors: Rick Wunderman, Edward Venzke, and Sally Kuhn Sennert
Volunteer Staff: Robert Andrews, Hugh Replogle, Paul Berger, Jacquelyn Gluck,
Stephen Bentley, Ludmila Eichelberger, and William Henoch

Global Volcanism Program · National Museum of Natural History, Room E-421, PO Box 37012 · Washington, DC 20013-7012 · USA
Telephone: (202) 633-1800 · Fax: (202) 357-2476 · Email: gvn@si.edu · URL: <http://www.volcano.si.edu/>

The text of the *Bulletin* is also distributed through the Volcano Listserv (volcano@asu.edu).

Kirishima

Kyushu, Japan
 31.931°N, 130.864°E; summit elev. 1,700 m
 All times are local (= UTC + 9 hours)

In 1991 there was a seismic increase at Kirishima (BGVN 25:02), a group of more than 20 Quaternary volcanoes occupying 600 km² in an area N of Kyushu island's Kagoshima Bay (figures 1 and 2). The previous eruption of Kirishima took place from 1 December 1991 to 19 April 1992, when Shinmoe-dake intermittently ejected ash (BGVN 16:11-17:04; Imura, 1992).

This report notes that seismic and thermal unrest also occurred in 2003-2004. Four years later (in August 2008) Kirishima had a sudden, short-lived eruption. Although the plume seemingly did not rise above 1 km altitude, observers chronicled a thin airfall ash deposit highly elongate to the NE.

Late 2003 and early 2004 unrest. Seismicity increased from "normal" levels on 13 December 2003, and the same day observers saw new fumarole pits at the Ohachi crater. A video camera showed steam rising above that crater's rim. Observers saw two new pits that formed in the middle of that crater's southern inner wall and steam rising to ~ 100 m. Within ~ 10 m of these pits, observers saw freshly ejected mud and cognate pebbles 2-3 cm across. The seismicity peaked in mid-December, then declined somewhat, continuing at a relatively high level through at least mid-January 2004.

Multi-year seismic overview. Seismicity rose substantially starting on 19 August 2008 (figure 3), several days prior to the 22 August eruption. Japan Meteorological Agency (JMA) reported 1,005 earthquakes during August 2008. In contrast, the monthly number of earthquakes recorded during the previous 13 months ranged between 2 and 118, with only four earthquakes seen during each of the two months prior to the eruption.

Tremor was rare during 2003-2008. There had been tremor during early 2006, and briefly in 2007, but the 2008 tremor included three episodes. During 2008 the longest tremor episode, in August, continued for 350 minutes (the full circle goes off the scale of the plot).

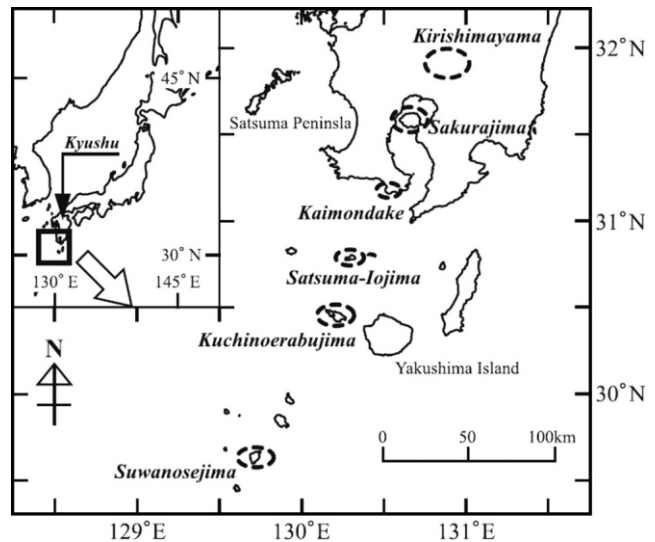


Figure 2. Maps of the South Kyushu region showing recently active volcanoes. The Kirishima volcanic group ("Kirishimayama") lies near the map's N edge. Taken from Matsumoto and others (2007).

Eruption on 22 August 2008. The eruption began at 1634 on 22 August 2008 from Shinmoe-dake, a stratovolcano with a summit rim around 1,400 m elevation and a main 750-m-diameter crater containing a lake (figure 4). JMA noted that the tallest plume only reached ~ 850 m altitude. Post-eruption inspection found that fissures at Shinmoe-dake had recently opened both in the crater and on its W flank (figures 4 and 5). Also, observers found abundant ballistic lithics near the fissures.

Ash fell at Kobayashi City (10 km NE) and reached up to 25 km from the source (figure 6). According to Nobuo Geshi (Geological Survey of Japan), ~ 200,000 metric tons of ash was erupted. Under the microscope, the ash was composed mostly of non-juvenile materials, although some juvenile glass fragments were found (University of Tokyo - Earthquake Research Institute and Kagoshima University, 2008). As of early November 2008, authorities had not issued further reports, implying quiet conditions. Because of low seismicity and lack of ash plumes, JMA lowered the Alert Level from 2 to 1 on 29 October 2008.

Partial list of resources discussing Shinmoe-dake. Two informative reports in Japanese helped describe the



Figure 1. Wide-angle view of Shinmoe-dake crater at Kirishima looking NW. Prominent are both the crater wall and the aqua-blue lake. The flat-topped cone in the background is Karakuni-dake (summit elevation 1,700 m) the tallest peak in the Kirishima complex. The rubbly material draping the the lower half of the crater wall represents remnants of a lava lake formed during the 1716-17 eruption. Copyrighted photo by Keizo Morita (used with permission).

eruption. The first was the report by JMA (2008), from which figures 3-5 were extracted. That report discussed pre- and post-eruption monitoring, including geophysics, geodetics, behavior of fumaroles, the development of new fissures and fumaroles (including photos and thermal anomalies). The second report, University of Tokyo - Earthquake Research Institute and Kagoshima University (2008), discussed erupted ash.

Fukui and others (2008) discussed Shinmoe-dake's deformation. Their studies employed deformation monitoring by Global Positioning System (GPS) during 2001-2007. Their data disclosed uplift starting in mid-2004.

A website mentioned Kirishima in regard to engineering approaches (sabo dams and related structures) to manage rivers and basins confronting mass wasting at volcanoes (Sakurajima International Sabo Center, 2008). The same site also shows a monitoring camera for Shinmoe-dake and posts a disaster prevention map for Kirishima (in Japanese).

In 1992, geophysicists completed a self-potential survey at Shinmoe-dake (Hashimoto and others, 1994) finding a negative anomaly over the crater basin, a result interpreted as due to streaming potential due to the crater lake and the motion of ions through porous rock. Positive anomalies

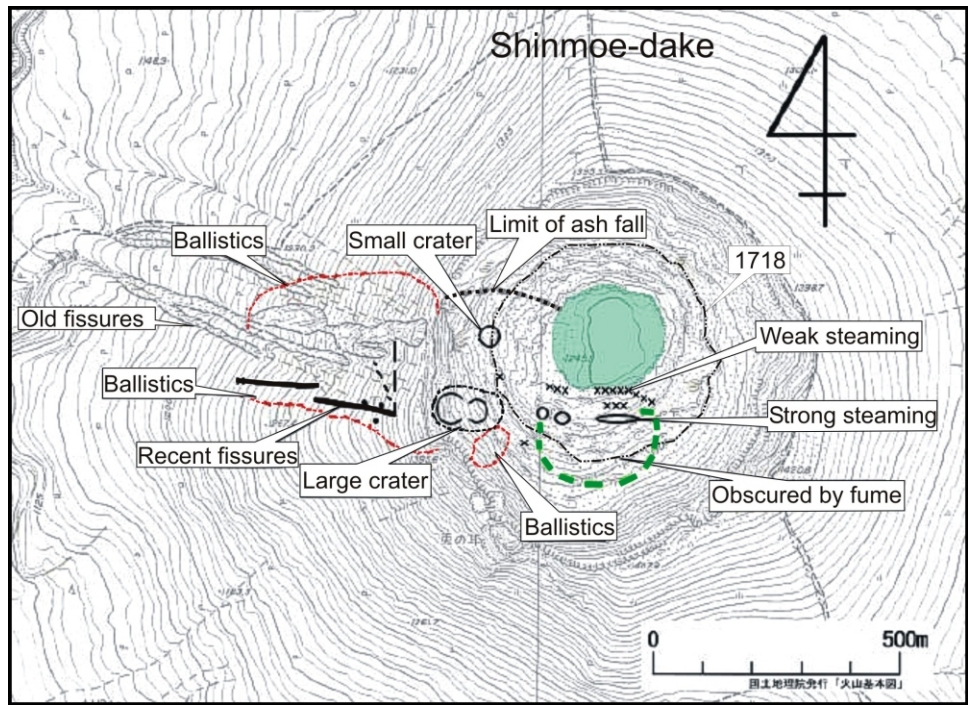


Figure 4. Diagram showing key surface features found at Kirishima's Shinmoe-dake associated with the 22 August 2008 eruption. Also labeled is the upper margin of a lava lake that formed in the crater during the 1716-1717 eruption. Adapted from the August 2008 monthly report by Japan Meteorological Agency (JMA, 2008).

were small and local and corresponded to fumaroles. Continuous self-potential monitoring during December 1991 to 1993 indicated few changes.

References: Fukui, K., Torisu, K., Tomoyuki, K., Sakai, T., and Takagi, A., 2008, Volcano deformation detected by GPS observation around Shinmoe-dake crater of Kirishima and pressure source estimation by FEM: Meeting Proceedings of the Japan Geoscience Union, Makuhari, Japan, 26 May 2008, v. 151, p. 20.

Imura, R., 1992, Minor phreatic activity of Shinmoe-dake, Kirishima volcano, in 1991-92: Bull Volc Soc Japan (Kazan), v. 37, p. 281-283 (in Japanese).

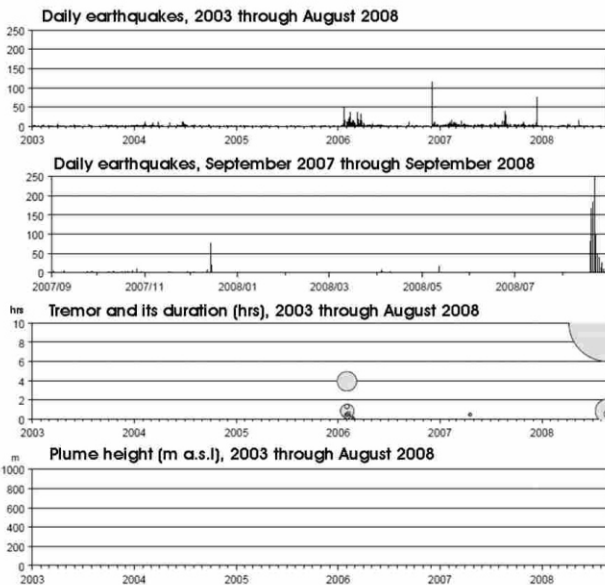


Figure 3. Earthquakes and tremor duration measured at station A (1.7 km SW of the Shinmoe-dake's summit) during 2003 to end of August 2008. The top two panels show daily earthquakes. The third panel down shows tremor, with circle size scaled to duration. The lowermost panel shows plume height, which was absent until the 22 August 2008 eruption. Taken from JMA (2008).



Figure 5. Aerial photo of the W flank of Shinmoe-dake at Kirishima showing fissures as seen on 24 August 2008. Some of these features were present prior to the eruption. An enlarged view shows numerous light colored ballistic blocks thrown out by the 2008 eruption. Some are apparently over a meter in diameter. Photo taken from JMA (2008).

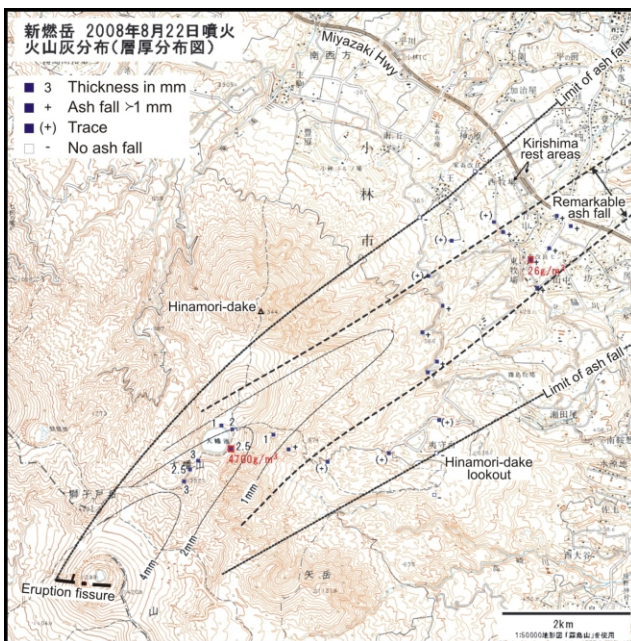


Figure 6. Preliminary near-source isopach map describing ash fall from Kirishima's 22 August 2008 eruption. The map extends out to ~ 10 km from the vent (horizontal scale, bottom right) although ash also fell much farther away. On the key and enlarged views of this map one can see the sites where ash thickness data were collected, providing insight into the map's construction. Some of these points indicate the absence of detectable ash, and at two sites, density data. Field work supporting the map was conducted during 1-2 September 2008. Map was created by Nobuo Geshi (Geological Survey of Japan; original in Japanese).

Hashimoto, T., Kagiya, T., and Masutani, F., Self-potential measurements on Shinmoe-Dake, Kirishima Volcanic Group: *Bull. Earthq. Res. Inst. Univ. of Tokyo*, v. 69, p. 257-266.

Japan Meteorological Agency, 2008, August 2008 Monthly Report on Kirishima: Japan Meteorological Agency (URL: http://www.seisvol.kishou.go.jp/tokyo/STOCK/monthly_v-act_doc/fukuoka/08m08/505_08m08.pdf).

Matsumoto, T., Ueno, H., and Kobayashi, T., 2007, A new secular variation curve for South Kyushu, Japan, and its application to the dating of some lava flows: *Rep. Fac. Sci., Kagoshima Univ.*, no. 40, p. 35-49.

University of Tokyo - Earthquake Research Institute and Kagoshima University, 2008, About ejecta of eruption of 22 August 2008 from Shinmoe-dake (Kirishima): University of Tokyo (Earthquake Research Institute) and Kagoshima University (in Japanese; published 30 August 2008) (URL: www.eri.u-tokyo.ac.jp/topics/Kirishima2008/Figure/kazanbai080830.pdf).

Sakurajima International Sabo Center, 2008, Volcanic Sabo in Japan: Sakurajima International Sabo Center (URL: <http://www.qsr.mlit.go.jp/osumi/sivsc/home/english/j038.html>).

Geologic Summary. Kirishima is a large group of more than 20 Quaternary volcanoes located N of Kagoshima Bay. The late-Pleistocene to Holocene dominantly andesitic volcano group consists of stratovolcanoes, pyroclastic cones, maars, and underlying shield volcanoes located over an area of 20 x 30 km. The larger stratovolcanoes are scattered throughout the field, with the centrally located, 1,700-m-high Katakuni-dake being the highest. Onami-ike and Mi-ike, the two largest maars, are located SW of

Katakuni-dake and at its far eastern end, respectively. Holocene eruptions have been concentrated along an E-W line of vents from Mi-ike to Ohachi, and at Shinmoe-dake to the NE. Frequent small-to-moderate explosive eruptions have been recorded since the 8th century.

Information Contacts: *Volcanological Division*, Seismological and Volcanological Department, Japan Meteorological Agency (JMA), 1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100 Japan; *Nobuo Geshi*, Geological Survey of Japan (GSJ), AIST, (Volcanic activity research group), Building No. 7, 1-1-1 Higashi, Tsukuba, Ibaraki, 305-8567 Japan (Email: geshi-nob@aist.go.jp); *Volcano Research Center (VRC-ERI)*, Earthquake Research Institute, University of Tokyo, Yayoi 1-1-1, Bunkyo-ku, Tokyo 113, Japan (URL: <http://hakone.eri.u-tokyo.ac.jp/vrc/erup/erup.html>); *Keizo Morita* (URL: <http://www.pmiyazaki.com/kirishima/tz/sinmoe/pano01.htm>).

Kuchinoerabu-jima

Ryukyu Islands, Japan

30.440°N, 130.219°E; summit elev. 657 m

Anomalous seismicity and inflation was noted at Kuchinoerabu-jima in late 2008. Seismic unrest was also reported during mid-1999 (*BGVN* 24:08). The island of the same name is home to ~ 140 residents and lies ~ 130 km S of the city of Kagoshima (Kyushu Island, Japan). The 19-km-diameter Kikai caldera, which is mainly submarine, sits a few tens of kilometers to the N, and is renowned for its massive eruption ~ 6,300 years ago. Kuchinoerabu Island contains a composite elongate cone made up of three closely spaced Holocene volcanoes supporting the island's S-central zone (figure 7; Geshi and Nakano, 2007; Geshi and Kobayashi, 2007).

Increased seismicity prompted the Japan Meteorological Agency (JMA) to raise the Alert Level from 1 to 2 (on a scale of 1-5) on 4 September 2008, and to level 3 on 27 October 2008. According to JMA, GPS measurements indicated inflation just below the summit crater that had started

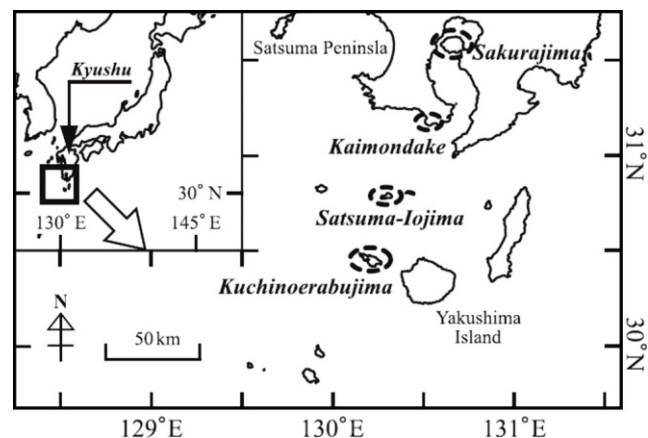


Figure 7. Map showing the location and geography of Kuchinoerabu-jima Island (Ryukyu Islands) south of Kyushu, Japan. The island is located ~ 15 km W of the larger circular Yaku-shima Island. The map also indicates recently active volcanoes of the region. Modified from Matsumoto and others (2007).

in September was continuing in October. Fumarolic activity near the summit had also increased.

Reference: Matsumoto, T., Ueno, H., and Kobayashi, T., 2007, A new secular variation curve for South Kyushu, Japan, and its application to the dating of some lava flows: Rep. Fac. Sci., Kagoshima Univ., no. 40, p. 35-49.

Geologic Summary. A group of young stratovolcanoes forms the eastern end of the irregularly shaped island of Kuchinoerabu-jima in the northern Ryukyus, 15 km W of Yaku-shima. Furu-take, Shin-take, and Noike were erupted from S to N, respectively, to form a composite cone that is parallel to the trend of the Ryukyu Islands. The highest peak, Furu-take, reaches only 657 m above sea level. The youngest cone, 640-m-high Shin-take, was formed after the NW side of Furu-take was breached by an explosion. All historical eruptions have occurred from Shin-take, although a lava flow from the S flank of Furu-take that reached the coast has a very fresh morphology. Frequent explosive eruptions have taken place from Shin-take since 1840; the largest of these was in December 1933. Several villages on

the 4 x 12 km island are located within a few km of the active crater of Shin-take and have suffered damage from eruptions.

Information Contacts: *Volcanological Division*, Seismological and Volcanological Department, Japan Meteorological Agency (JMA), 1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100 Japan; *Volcano Research Center (VRC-ERI)*, Earthquake Research Institute, University of Tokyo, Yayoi 1-1-1, Bunkyo-ku, Tokyo 113, Japan (URL: <http://hakone.eri.u-tokyo.ac.jp/vrc/erup/erup.html>).

Suwanose-jima

Ryukyu Islands, Japan

29.635°N, 129.716°E; summit elev. 799 m

All times are local (= UTC + 9 hours)

Historically, Suwanose-jima (figure 8) has been one of

Japan's most frequently active volcanoes. Our last report on Suwanose-jima, (BVGN 33:02) listed ash plumes between 9 December 2007 and 21 March 2008. This report continues the list through 26 October 2008.

According to a 2008 International Civil Aviation Organization (ICAO) report, the Tokyo VAAC issued 70 volcanic ash advisories for Suwanose-jima during the 17-month period of January 2007-May 2008. This included seven from January through May 2008 (ICAO, 2008). Table 1 summarizes reports of explosive events and plumes for January-October 2008.

MODIS/MODVOLC thermal alerts were measured by satellite-borne radiospectroradiometer during 2008 through 6 November (table 2). The island is often covered by clouds, preventing consistent detections.

NASA satellite observation of 19 October 2008. According to the NASA MODIS Rapid Response team and the NASA Earth Observatory, the volcano released a continuous plume of ash and steam in late October 2008. They noted that a Moderate Resolution Imaging Spectroradiometer (MODIS) captured an image of an ash plume on 19 October 2008. In this image, the plume formed a rippling pattern as it blew WSW. The plume differed from the nearby clouds in both its slightly darker color and more diffuse shape. Near the summit, the plume appeared beige.

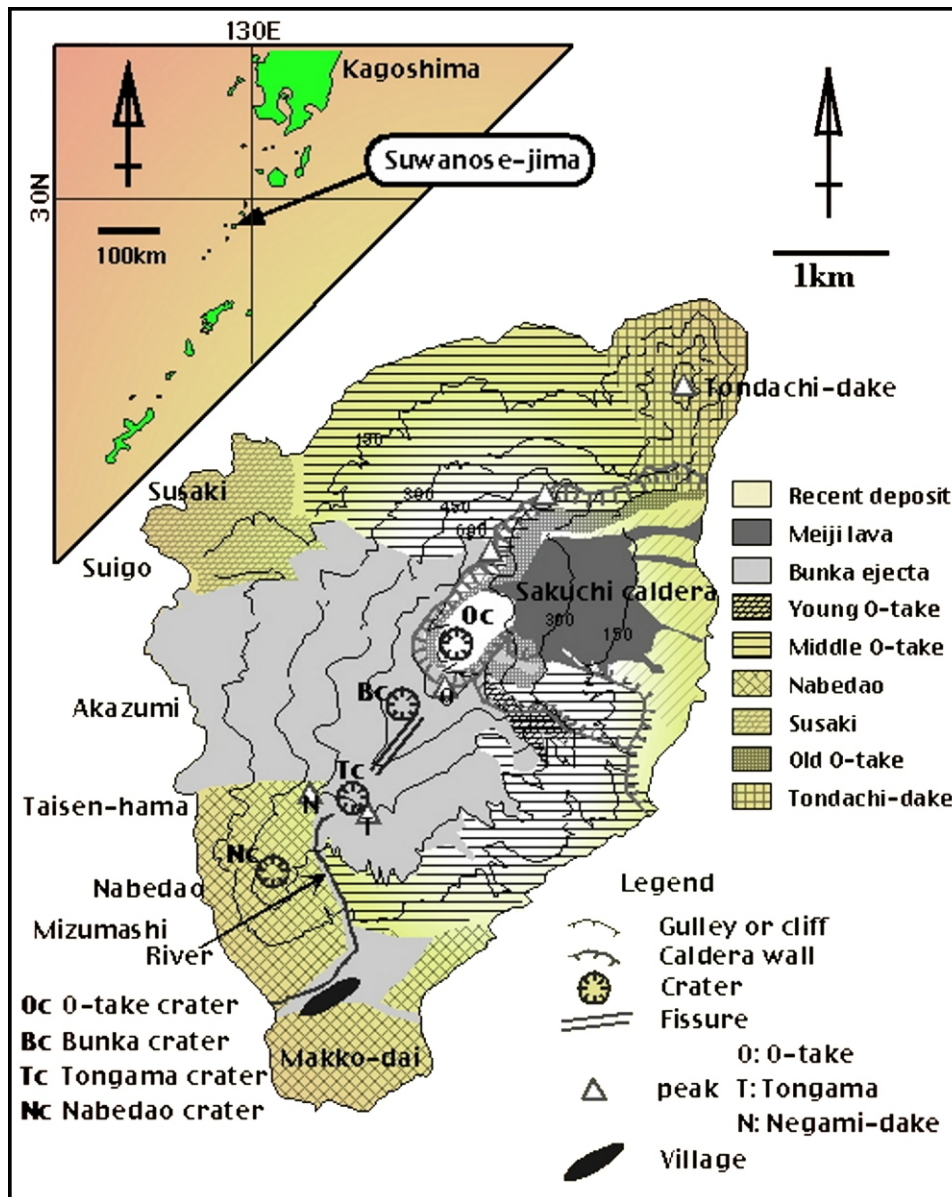


Figure 8. Simplified map of the geology of Suwanose-jima. The active crater, O-take (Oc), appears at the southern end of the small, sparsely populated island. Courtesy of Taketo Shimano.

Date (UTC)	Plume Altitude	Drift direction
16 Apr 2008	not observed	not observed
16 Jun 2008	not observed	not observed
29 Jul 2008	0.6 km	S
07 Aug 2008	1.2 km	not observed
24-26 Aug 2008	1.8-2.4 km	not observed
04-06 Sep 2008	1.5-1.8 km	E (5 September)
24-29 Sep 2008	1.5-3 km	NE, E, and SW
01-02 Oct 2008	not observed	not observed
07-10 Oct 2008	2.1 km	not observed
16, 18-20 Oct 2008	1.2-2.5 km	W
21, 23, and 25-26 Oct 2008	1.5-3.0 km	W and E

Table 1. A summary of Tokyo VAAC reports on explosive events and resulting ash plumes from Suwanose-jima from April through October 2008 (continued from table in *BGVN* 33:02). For some events, observers detected an explosion but were unable to observe a resulting plume. Courtesy of Tokyo VAAC, based on information from the Japanese Meteorological Agency (JMA) or pilot reports.

Date	Time (UTC)	Pixels	Satellite
30 Jul 2008	1710	1	Aqua
31 Jul 2008	1335	1	Terra
22 Sep 2008	1350	1	Terra

Table 2. Thermal anomalies measured by MODIS satellite analyzed by the MODVOLC algorithm for Suwanose-jima volcano in 2008 through 6 November. Courtesy of Hawai'i Institute of Geophysics and Planetology (HIGP) Thermal Alerts System.

References: International Civil Aviation Organization (ICAO), 2008, Fourth Meeting of the International Airways Volcano Watch Operations Group (IAVWOPSG), Paris, France, 15-19 September 2008: Working Paper 34, VAAC Tokyo Management Report, 6 p. (URL: <http://www.icao.int/anb/iavwopsg/meetings/iavwopsg4/wp>).

Geologic Summary. The 8-km-long, spindle-shaped island of Suwanose-jima in the northern Ryukyu Islands consists of an andesitic stratovolcano with two historically active summit craters. Only about 50 persons live on the sparsely populated island. The summit of the volcano is truncated by a large breached crater extending to the sea on the E flank that was formed by edifice collapse. Suwanose-jima, one of Japan's most frequently active volcanoes, was in a state of intermittent strombolian activity from On-take (Otake), the NE summit crater, that began in 1949 and lasted until 1996, after which periods of inactivity lengthened. The largest historical eruption took place in 1813-14, when thick scoria deposits blanketed residential areas, and the SW crater produced two lava flows that reached the western coast. At the end of the eruption the summit of On-take collapsed forming a large debris avalanche and creating the horseshoe-shaped Sakuchi caldera, which extends to the eastern coast. The island remained uninhabited for about 70 years after the 1813-1814 eruption. Lava flows reached the eastern coast of the island in 1884.

Information Contacts: Taketo Shimano, College of Environment and Disaster Research, Fuji-Tokoha University, 325 Obuchi, Fuji-shi, Sizuoka 417-0801, Japan (URL: <http://www.eri.u-tokyo.ac.jp/shimano/>); International Airway Volcanic Watch Operations Group of the International

Civil Aviation Organization (URL: <http://www.icao.int/anb/iavwopsg>); Tokyo Volcanic Ash Advisory Center (VAAC) (URL: <http://ds.data.jma.go.jp/svd/vaac/data/index.html>; <http://www.ssd.noaa.gov/VAAC/OTH/JP/messages.html>); NASA MODIS Rapid Response team, NASA Goddard Space Flight Center NASA; NASA Earth Observatory (URL: <http://earthobservatory.nasa.gov/NaturalHazards>); Hawai'i Institute of Geophysics and Planetology (HIGP) Thermal Alerts System, School of Ocean and Earth Science and Technology (SOEST), Univ. of Hawai'i, 2525 Correa Road, Honolulu, HI 96822, USA (URL: <http://hotspot.higp.hawaii.edu/>).

Ibu

Halmahera, Indonesia

1.48°N, 127.63°E; summit elev. 1,325 m

During late March through late April 2008, the Center of Volcanology and Geological Hazard Mitigation (CVGHM) described mainly white plumes emitted from Ibu. On at least five days, however, the plumes were gray. During 17-31 March, frequent white plumes rose to an altitude of 1.5 km. On 31 March the plume altitudes increased to 1.6 km.

During 4-5 April 2008, seismicity increased in amplitude and plume altitude increased to 1.8-2.0 km. On 5 April, the eruption plume was gray and material fell around the crater. Residents of nearby communities were not permitted to climb or approach the crater.

Plumes that were possibly gray rose to altitudes between 1.6 and 1.9 km during 6-17 April. Gray plumes rose to altitudes of 2-2.1 km during 18-21 April. On 21 April, CVGHM warned that residents and tourists were not permitted within 2 km of the crater.

Steam plumes rose above the crater during late May to late August 2004 (*BGVN* 30:03). Thermal anomalies detected by the MODIS instruments triggered MODVOLC thermal alerts (table 3) during that interval and the last quarter of 2004; alerts were also noted during February 2005, but not in 2006 and 2007. Thermal anomalies were again measured by the MODIS instrument in mid-May 2008 and continued to be detected through late October.

Geologic Summary. The truncated summit of Gunung Ibu stratovolcano along the NW coast of Halmahera Island has large nested summit craters. The inner crater, 1 km wide and 400 m deep, contained several small crater lakes through much of historical time. The outer crater, 1.2 km wide, is breached on the N side, creating a steep-walled valley. A large parasitic cone is located ENE of the summit. A smaller one to the WSW has fed a lava flow down the western flank. A group of maars is located below the northern and western flanks of the volcano. Only a few eruptions have been recorded from Ibu in historical time, the first a small explosive eruption from the summit crater in 1911. An eruption producing a lava dome that eventually covered much of the floor of the inner summit crater began in December 1998.

Information Contacts: Center of Volcanology and Geological Hazard Mitigation (CVGHM), Saut Simatupang, 57, Bandung 40122, Indonesia (URL: <http://portal.vsi.esdm.go.id/joomla/>); Hawai'i Institute of Geo-

Date	Time (UTC)	Pixels	Satellite
24 Aug 2004	1355	1	Terra
31 Aug 2004	1655	1	Aqua
30 Sep 2004	1710	1	Aqua
02 Oct 2004	1655	1	Aqua
04 Oct 2004	1350	1	Terra
09 Oct 2004	0440	1	Aqua
18 Oct 2004	1655	1	Aqua
20 Oct 2004	1350	1	Terra
25 Oct 2004	1705	1	Aqua
29 Oct 2004	1345	1	Terra
03 Nov 2004	1655	1	Aqua
10 Nov 2004	1700	1	Aqua
12 Dec 2004	1700	1	Aqua
21 Dec 2004	1400	1	Terra
21 Dec 2004	1655	1	Aqua
30 Dec 2004	1355	1	Terra
16 Feb 2005	1355	1	Terra
21 Feb 2005	1710	1	Aqua
15 May 2008	1355	1	Terra
20 May 2008	1710	1	Aqua
07 Jul 2008	1405	1	Terra
07 Jul 2008	1700	1	Aqua
06 Sep 2008	1345	1	Terra
11 Sep 2008	1700	1	Aqua
13 Sep 2008	1350	1	Terra
20 Sep 2008	1355	1	Terra
25 Sep 2008	1710	1	Aqua
04 Oct 2008	1705	1	Aqua
06 Oct 2008	1355	1	Terra
20 Oct 2008	1705	1	Aqua

Table 3. MODVOLC thermal anomalies over Ibu from late August 2004 to 20 October 2008. Courtesy of the HIGP Thermal Alerts System.

physics and Planetology (HIGP) Thermal Alerts System, School of Ocean and Earth Science and Technology (SOEST), Univ. of Hawai'i, 2525 Correa Road, Honolulu, HI 96822, USA (URL: <http://hotspot.higp.hawaii.edu/>).

Soputan

Sulawesi, Indonesia

1.108°N, 124.73°E; summit elev. 1,784 m

All times are local (= UTC + 8 hours)

Activity at Soputan stratovolcano was characterized in an October 2008 report by the Centre of Volcanology and Geological Hazard Mitigation (CVGHM) as ongoing growth of a lava dome since 1991. This growth has often been accompanied by ash eruptions.

Activity through 23 November 2007 included an eruption in August 2007 and several ash plumes, a lava flow, and rock avalanches (*BGVN* 32:11). Ash from an event in October remained in the area for about two days, affecting important flight routes. No further information was available until CVGHM reported deformation in May 2008.

According to the CVVHM, seismicity increased during 1-6 June. On 6 June, the volcano erupted, causing part of the crater wall to collapse, creating an opening to the W and

increasing the diameter of the crater. A pyroclastic flow, possibly generated by a rockfall avalanche, traveled down the E flank about 1.5 km; a number of nearby villages were covered with tephra. Based on observations of satellite imagery, the Darwin Volcanic Ash Advisory Centre (VAAC) reported that an ash plume rose to an altitude of 13.7 km on 6 June and drifted SW. Ash deposits were about 4 cm thick in an area 5 km NW, and a nearby coconut plantation reported damage to trees. The Alert Level was raised to 3 (on a scale of 1-4). Residents and tourists were advised not go within a 6 km radius of the summit.

During 7-18 June, seismicity decreased and white plumes at altitudes at or less than 1.8 km were spotted when clouds did not inhibit observations. On 18 June, the Alert Level was decreased to 2.

The next episode of seismic activity was on 6 October. Loud noises were heard and observers noted Strombolian activity that ejected incandescent material 100-150 m from the crater. CVGHM noted that a thick gray ash plume rose 2.8 km in altitude. (According to the Darwin VAAC, analysis of satellite imagery suggested that the ash plume rose to the much greater altitude of 7.6 km and drifted W.)

Based on these visual observations and on earthquake and tiltmeter deformation data, the volcano alert level was raised from 2 to 3. Residents and tourists were again advised not go within a 6 km radius of the summit.

On 7 October 2008, CVGHM reported that white plumes rose to altitudes of 2.3-3.3 km. Incandescent material was ejected 50-150 m from the crater, and incandescent rockfalls traveled 500 m W. The following day, plumes rose to an altitude of 2 km.

After 9 October, seismic activity decreased. On 20 October 2008, white and gray smoke rose from the crater to a height of 200 m above the peak. On 21 October, the Alert level was lowered from 3 to 2.

Thermal anomalies. Coinciding with the observed eruptions, MODVOLC thermal alerts were measured during 6-20 October 2008 (table 4). The set begins with 24 pixels measured at 1355 UTC (2155 local) on 6 October 2008. (If each pixel represented an area of 1-2 km², the resulting area of thermal sources, including lava flows or other material ejected from the volcano, and possible fires, would be on the order of 25-50 km².) After a second set of 11 alerts measured 3 hours later on 6 October, the alerts dropped to 1-2 on several days through 20 October.

Reference: International Civil Aviation Organization (ICAO), 2008, Twelfth Meeting of the Communications/Navigation/Surveillance and Meteorology Sub-Group of

Date	Time (UTC)	Pixels	Satellite
06 Oct 2008	1355	24	Terra
06 Oct 2008	1655	11	Aqua
13 Oct 2008	1405	1	Terra
13 Oct 2008	1700	1	Aqua
16 Oct 2008	1435	1	Terra
16 Oct 2008	1730	2	Aqua
20 Oct 2008	1410	1	Terra
20 Oct 2008	1705	1	Aqua

Table 4. MODIS/MODVOLC satellite thermal anomalies measured at Soputan during October 2008. No anomalies were measured from the beginning of the year 2008 to 5 October. Courtesy of HIGP Thermal Alerts System.

APANPIRG (CNS/MET/SG/12): VAAC Darwin Report July 2007-June 2008, Bangkok, Indonesia, 21-25 July 2008.

Geologic Summary. The small Sopotan stratovolcano on the southern rim of the Quaternary Tondano caldera on the northern arm of Sulawesi Island is one of Sulawesi's most active volcanoes. The youthful, largely unvegetated volcano rises to 1,784 m and is located SW of Sempu volcano. It was constructed at the S end of a SSW-NNE trending line of vents. During historical time the locus of eruptions has included both the summit crater and Aesepu, a prominent NE-flank vent that formed in 1906 and was the source of intermittent major lava flows until 1924.

Information Contacts: *Hawai'i Institute of Geophysics and Planetology (HIGP) Thermal Alerts System*, School of Ocean and Earth Science and Technology (SOEST), Univ. of Hawai'i, 2525 Correa Road, Honolulu, HI 96822, USA (URL: <http://hotspot.higp.hawaii.edu/>); *Centre of Volcanology and Geological Hazard Mitigation (CVGHM)*, Diponegoro 57, Bandung, Jawa Barat 40122, Indonesia (URL: <http://portal.vsi.esdm.go.id/joomla/>); *Darwin Volcanic Ash Advisory Center (VAAC)*, Bureau of Meteorology, Northern Territory Regional Office, PO Box 40050, Casuarina, Northern Territory 0811, Australia (URL: <http://www.bom.gov.au/info/vaac/>; <http://www.ssd.noaa.gov/VAAC/OTH/AU/messages.html>).

Manam

Papua New Guinea, Northeast of New Guinea
4.080°S, 145.037°E; summit elev. 1,807 m
All times are local (= UTC +10 hours)

Table 5 characterizes plumes from Manam during 2 April 2008 to 7 October 2008 (*BGVN* 33:04 listed plume activity through mid-May 2008). The International Civil Aviation Organization (2008) noted that during July 2007-June 2008, the Darwin Volcanic Ash Advisory Centre issued 23 Volcanic Ash Advisories resulting from 10 Manam eruptions.

According to the Rabaul Volcano Observatory, people watching Manam described it as generally quiet from April through October 2008. Occasional ash plumes in this period resulted in aviation ash advisories (table 5). Both craters released variable amounts of white vapor. No audible noises were heard during this period and no glow was visible at night except for a weak steady glow visible at night during 18-22 May.

Seismic activity was low to moderate, dominated by low frequency volcanic earthquakes (numbers fluctuated daily between 650 and 1,000). No high frequency earthquakes were recorded during the period and no significant movement was recorded by the tiltmeter.

The only MODIS/MODVOLC satellite thermal anomaly for Manam during 2008 as late as 6 November was a 1-pixel anomaly measured 28 July at 1555 UTC from the Aqua satellite system.

Reference: International Civil Aviation Organization, 2008, Twelfth Meeting of the Communications/Navigation/Surveillance and Meteorology Sub-Group of APANPIRG (CNS/MET/SG/12), Bangkok, Thailand, 21-25 July 2008: Information Paper 10, VAAC Darwin Report July

Date	Observation
02 Apr 2008	Low-level plume drifted SW.
14-15 Apr 2008	Low-level ash-and-steam plume drifted WNW.
23-29 Apr 2008	Diffuse plume below 3 km altitude; drifted NW.
11-12 May 2008	Plumes to 3 km altitude; drifted SE.
29 Jul 2008	Plumes to 2.4 km altitude; drifted WNW.
30 Jul 2008	Plume to 2.4 km altitude; drifted NW.
16-17 Aug 2008	Ash plumes to 1.5 km altitude; drifted NW.
19 Sep 2008	Ash plumes to 1.8 km altitude; drifted NW.
07 Oct 2008	Ash plumes to 2.4 km altitude; drifted NW.

Table 5. Plumes from Manam from 2 April to 7 October 2008. Courtesy of Darwin Volcanic Ash Advisory Centre.

2007-June 2008, 12 p. (URL: http://www.icao.or.th/2008/cnsmet_sg12/index.html).

Geologic Summary. The 10-km-wide island of Manam, lying 13 km off the northern coast of mainland Papua New Guinea, is one of the country's most active volcanoes. Four large radial valleys extend from the unvegetated summit of the conical 1,807-m-high basaltic-andesitic stratovolcano to its lower flanks. These "avalanche valleys," regularly spaced 90 degrees apart, channel lava flows and pyroclastic avalanches that have sometimes reached the coast. Five small satellitic centers are located near the island's shoreline on the northern, southern and western sides. Two summit craters are present; both are active, although most historical eruptions have originated from the southern crater, concentrating eruptive products during much of the past century into the SE avalanche valley. Frequent historical eruptions, typically of mild-to-moderate scale, have been recorded at Manam since 1616. Occasional larger eruptions have produced pyroclastic flows and lava flows that reached flat-lying coastal areas and entered the sea, sometimes impacting populated areas.

Information Contacts: *Herman Patia and Steve Saunders*, Rabaul Volcano Observatory (RVO), P.O. Box 386, Rabaul, Papua New Guinea; *Darwin Volcanic Ash Advisory Centre (VAAC)*, Bureau of Meteorology, Northern Territory Regional Office, PO Box 40050, Casuarina, Northern Territory 0811, Australia (URL: <http://www.bom.gov.au/info/vaac/>; <http://www.ssd.noaa.gov/VAAC/OTH/AU/messages.html>).

Bezymianny

Kamchatka Peninsula, Russia
55.978°N, 160.587°E; summit elev. 2,882 m

Between May and December 2007 there was increased seismic activity with ash plumes and lava emission (*BGVN* 32:11) at Bezymianny (figure 9). No further reports were available about this volcano until July 2008.

On 12 July 2008, the Kamchatkan Volcanic Eruption Response Team (KVERT) reported increased seismicity, with shallow earthquakes, and raised the Level of Concern Color Code to Orange. According to KVERT, intermittent volcanic tremor at Bezymianny was detected on 11 July, along with hot avalanches and strong fumarolic activity. On 11 and 15 July, satellite imagery detected weak thermal



Figure 9. Bezymianny as seen on 20 July 2008 from the SE side. Note the prominent avalanche scarp ("crater rim") on either side of the actively growing dome and its mantling talus apron. Hummocks in the foreground terrain are signatures of the debris avalanche deposit there. Upslope of the zone of hummocks lies a delta- or fan-shaped deposit eroded from the growing dome. Courtesy of Olga Girina (KVERT).

anomalies over the lava dome. On 15 July, local observers reported hot avalanches.

Seismic activity remained above background levels through 17 July (table 6), but then declined to background levels (except for a one-day increase on 20 July). Weak to moderate fumarolic activity was observed during 18-22 July. Volcanologists saw the growing dome extruding a viscous lava flow. Weak thermal anomalies over the lava dome were detected in satellite imagery on 18, 19, and 20 July. KVERT lowered the level of Concern Color Code to Yellow.

Reference. Fedotov, S.A., Chernisheva, G.V., and Shumilina, L.S., 1993, The estimation of the seismic danger of the earthquakes of M 6, which accompany the strong (M 8) Pacific Ocean earthquakes: *Volcanology and Seismology*, no. 6, p. 3-12 (in Russian).

Geologic Summary. Prior to its noted 1955-56 eruption, Bezymianny volcano had been considered extinct. The modern Bezymianny volcano, much smaller in size than its massive neighbors Kamen and Kliuchevskoi, was formed about 4,700 years ago over a late-Pleistocene lava-dome complex and an ancestral volcano that was built between about 11,000-7000 years ago. Three periods of intensified activity have occurred during the past 3,000 years. The latest period, which was preceded by a 1,000-year quiescence,

began with the dramatic 1955-56 eruption. This eruption, similar to that of Mount St. Helens in 1980, produced a large horse-shoe-shaped crater that was formed by collapse of the summit and an associated lateral blast. Subsequent episodic but ongoing lava-dome growth, accompanied by intermittent explosive activity and pyroclastic flows, has largely filled the 1956 crater.

Information Contacts: *Kamchatka Volcanic Eruptions Response Team (KVERT)*, Institute of Volcanology and Seismology (IVS), Far East Division, Russian Academy of Sciences, Piip Ave. 9, Petropavlovsk-Kamchatskii 683006, Russia (Email: kvert@kscnet.ru, URL: <http://www.kscnet.ru/ivs/>); *Olga Girina*, KVERT, IV&S.

Date	Earthquakes, Ks	Comments
06 Jun 2008	4.0	Obscured by clouds
10 Jun 2008	4.3	Obscured by clouds
13 Jun 2008	4.2	Obscured by clouds
17 Jun 2008	4.3	Obscured by clouds
08 Jul 2008	4.0	Obscured by clouds
09 Jul 2008	4.7	Obscured by clouds
11 Jul 2008	tremor	Hot avalanches, strong fumarolic activity, thermal anomaly
12 Jul 2008	Over 4.0 and one over 5.0	Obscured by clouds
13 Jul 2008	4.0-5.0	Obscured by clouds
14 Jul 2008	4.0-5.0	Obscured by clouds
15 Jul 2008	4.0-5.0	Hot avalanches, thermal anomaly
16 Jul 2008	4.0-5.0	Obscured by clouds
17 Jul 2008	4.0	Explosive activity of the volcano and new pyroclastic flows, thermal anomaly
20 Jul 2008	4.0	An effusion of viscous lava flow at the lava dome and a moderate fumarolic activity, thermal anomaly
27 Jul 2008	4.5	Fumarolic activity, thermal anomaly

Table 6. Seismicity at Bezymianny and visual observations for the interval from 6 June to July 2008. Ks refers to a magnitude classification determined from S-wave amplitude (as defined by Sergei Fedotov). Courtesy of KVERT and Kamchatka Branch of the Geophysical Service of the Russian Academy of Sciences (KB GS RAS).