

# Active Volcanoes of the Kurile Islands: A Reference Guide for Aviation Users

Open-File Report 2008–1162

U.S. Department of the Interior U.S. Geological Survey

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### **Conversion Factors**

Inch/Pound to SI

Multiply	Ву	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
mile, nautical (nmi)	1.852	kilometer (km)
yard (yd)	0.9144	meter (m)
centimeter (cm)	0.3937	inch (in.)
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)
meter (m)	1.094	yard (yd)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:  $^{\circ}F=(1.8\times^{\circ}C)+32$ .

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

°C=(°F-32)/1.8.

Altitude, as used in this report, refers to distance above sea level.

## Active Volcanoes of the Kurile Islands: A Reference Guide for Aviation Users

By Christina Neal<sup>1</sup>, Alexander Rybin<sup>2</sup>, Marina Chibisova<sup>2</sup>, and Edward Miller<sup>3</sup>

#### Introduction

The many volcanoes of the remote and mostly uninhabited Kurile Island arc (fig. 1; table 1) pose a serious hazard for air traffic in the North Pacific. Ash clouds from Kurile eruptions can impact some of the busiest air travel routes in the world and drift quickly into airspace managed by three countries: Russia, Japan, and the United States. Prevailing westerly winds throughout the region will most commonly send ash from any Kurile eruption directly across the parallel North Pacific airways between North America and Asia (Kristine A. Nelson, National Weather Service, oral commun., 2006; fig. 1). This report presents maps showing locations of the 36 most active Kurile volcanoes plotted on Operational Navigational Charts published by the Defense Mapping Agency (map sheets ONC F-10, F-11, and E-10; figs. 1, 2, 3, 4). These maps are intended to assist aviation and other users in the identification of restless Kurile volcanoes. A regional map is followed by three subsections of the Kurile volcanic arc (North, Central, South). Volcanoes and selected primary geographic features are labeled. All maps contain schematic versions of the principal air routes and selected air navigational fixes in this region.

#### **Monitoring of Kurile Volcanoes**

Currently, only one Kurile volcano, Alaid Volcano on Atlasova Island in the far northern Kuriles, is monitored by a single real-time seismic station (fig. 2). As of 2008, time-delayed seismic data from several seismic stations on Iturup and Kunashir Islands in the South Kuriles (fig. 4) are collected at scientific institutes on Sakhalin Island. The region also is examined using satellite data several times a day by volcanologic and meteorological authorities in Russia, Japan, and the U.S. Sensors and satellites used include the Moderate Resolution Imaging Spectroradiometer (MODIS), Advanced Very High Resolution Radiometer (AVHRR), Geostationary Operational Environmental Satellites (GOES), and the Japanese MTSAT. The frequent cloud cover in the area, however, severely hinders satellite surveillance and eruptions from Kurile volcanoes can go undetected for many hours.

Satellite information, along with occasional groundbased observations on the southernmost islands are used by the Sakhalin Volcanic Eruption Response Team (SVERT) to evaluate the status of active Kurile volcanoes and issue summary reports via e-mail (Rybin and others, 2004). The Kamchatka Volcanic Eruption Response Team (KVERT) is responsible for volcanoes on the island of Paramushir and Atlasova in the North Kuriles (fig. 2) and also issues status reports based on satellite and occasional groundbased observations. A single seismic station on Paramushir Island transmits data to Petropavlovsk, but is not capable of consistently detecting volcanic unrest in real-time (Neal and others, 2007).

### How the Aviation Sector is Notified of Eruptions in the Kuriles

Airlines may receive formal notification of eruptions or unrest in the Kuriles via several message types over the Aeronautical Fixed Telecommunications Network (AFTN) and the Internet. The 24-hour operation of the Tokyo Volcanic Ash Advisory Center (VAAC) issues Volcanic Ash Advisories (VAA) and sometimes Graphical Volcanic Ash Advisories for suspected or confirmed volcanic clouds in the Kuriles and Kamchatka. Meteorological Watch Offices for the region (Yuzhno-Sakhalinsk and Petropavlovsk-Kamchatsky) issue SIGMETs for ash clouds in their areas of responsibility. If ash drifts into U.S. airspace, VAAs and SIGMETs also may be issued by the Anchorage and/or Washington VAACs, the Alaska Aviation Weather Unit, or the Kansas City Aviation Weather Unit. International NOTAMs also may be issued for significant eruptive activity. Finally, KVERT, SVERT, and the Alaska Volcano Observatory issue email alerts of known volcanic activity that are then posted to their institutional web sites (table 2).

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#### **Pilot Reports of Volcanic Activity**

Flight crew observations of volcanic activity while aloft remain an important means by which the International volcanologic, meteorological, and aviation communities are alerted to volcanic activity. This is especially true for remote, seismically unmonitored volcanoes such as the Kuriles. Pilots are required to report atmospheric hazards to their controlling Air Route Traffic Control Center (ARTCC). Pilots should submit PIREPs regarding volcanic activity using the Volcanic Activity Reporting form (VAR; fig. 5) as a guide. Items 1 through 8 of the VAR are most critical and should be transmitted to air traffic control as soon as possible. If a VAR is not available, pilots should relay enough information to identify the position and type of volcanic activity. The VAR can be found in appendix 10 of the Aeronautical Information Manual.

#### **Rates of Eruption in the Kuriles**

Of the 36 active volcanoes listed here, many display ongoing thermal or fumarolic activity (Rybin and others, 2004). Since 2002, small eruptions have occurred at Chikurachki and Ebeko volcanoes on Paramushir Island (fig. 2; McGimsey and others, 2005; McGimsey and others, 2008) and at Chirinkotan in the Central Kuriles (fig. 3; Neal and others, 2005).

Sarychev Peak in the Central Kuriles (fig. 3) has been the most active volcano in the Kurile Islands in the last century producing 10 eruptions between 1923 and 1989. The next most active volcanoes include Alaid, Ebeko, and Chikurachki, all in the North Kuriles. In 1981, an eruption at Alaid Volcano distributed ash in a north-south curtain that extended more than 1,500 miles from the northern Bering Sea to the Central Kuriles. A similar eruption cloud today would severely disrupt all Russian Trans East and NOPAC air traffic. Chikurachki erupted five times between 1958 and 1986 and an additional three times between 2002 and 2005 (Siebert and Simkin, 2002-; Rybin and others, 2004). Based on the average number of recorded eruptions from the last century, an eruption has occurred about once every 1.6 years (or 0.6 eruptions per year) in the Kurile Islands. This compares to a similarly calculated Alaskan eruption rate of about two eruptions per year (Miller and others, 1998).

#### **Acknowledgments**

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Base from a scan of 1:1,000,000 Operational Navigation Charts (Defense Mapping Agency) sheets E-10, F-10, and F-11.













	Date		
	1. Aircraft Identification		
ansmit to ATC via radio	2. Position		
	3. Time (UTC)		
	4. Flight level or altitude		
	5. Position/location of volcanic activity or ash cloud		
	6. Air temperature		
- Tr	7. Wind		
ON I	8. Supplementary Information		
SECTIO	(Brief description of activity including vertical and lateral extent of the ash cloud, horizontal movement, rate of growth, etc., as available.)		
$p_{i}$	Mark t	he appropriate boxe	(s).
ecte	9. Density of ash cloud	□ wispy	moderately dense very dense
ıs dir	10. Color of plume or cloud	white black	☐ light gray ☐ dark grey
rd a	11. Eruption	Continuous	intermittent not visible
эгwа	12. Position of activity	ummit umultiple	side single
l and fo	13. Other observed features of eruption	☐ lightning ☐ ash fallout	glow large rocks mushroom cloud none
- Completed	14. Effect on aircraft	<ul> <li>communications</li> <li>pitot static</li> <li>none</li> </ul>	navigation system engines windscreen other windows
i	15. Other effects	turbulence ash deposits	St. Elmo's fire fumes

### Volcanic Activity Reporting Form (VAR)

**Figure 5.** Volcanic Activity Reporting form for air crews lists the specific observations that are most important to pass along to ATC as soon as safely possible.

#### 8 Active Volcanoes of the Kurile Islands: A Reference Guide for Aviation Users

#### Table 1. Active volcanoes of the Kurile Islands and relevant location, elevation, and eruption history.

[Data sources: (1) Alexander Rybin, IMGG (working from Russian maps at scales of 1:50,000 and 1:200,000), (2) Siebert, L., and Simkin, T., 2002-, Volcanoes of the World: an Illustrated Catalog of Holocene Volcanoes and their Eruptions; (3) the on-line database of the Global Volcanism Program of the Smithsonian Institution (http://www.volcano.si.edu/gvp/world/index.cfm). Some inconsistencies between sources remain unresolved. This list and details will change as new geological information becomes available. **Bold**: Seismically monitored volcanoes. \*\**Italics*: Last eruption date unknown or highly uncertain. These volcanoes may display thermal/fumarolic activity. ?, indicates uncertain eruption account]

Map No. ( <u>fig. 1</u> )	Name	IAVCEI Catalog No	Location	Year of last historical eruption	Elevation
		North Kuriles	3		
1	Alaid (Atlasova Is.)	0900-39	50°52'N, 155°34'E	1986	7,674'; 2,339 m
2	Ebeko (Paramushir Is.)	0900-38	50°41'N, 156°01'E	2005	3,793'; 1,156 m
3	Chikurachki (Paramushir Is.)	0900-36	50°19'N, 155°28'E	2007	5,956'; 1,816 m
4	Tatarinova (Paramushir Is.)	_	50°18'N, 155°27'E	**	5,020'; 1,530 m
5	Fuss Peak (Paramushir Is.)	0900-34	50°16'N, 155°15'E	1854	5,814'; 1,772 m
6	Karpinsky Group (Paramushir Is.)	0900-35	50°08'N, 155°22'E	1952	4,413'; 1,345 m
7	Nemo Peak (Onekotan Is.)	0900-32	49°34'N, 154°48'E	1938	3,342'; 1,019 m
8	Krenitzyn Peak (Tao-Rusyr Caldera; Onekotan Is.)	0900-31	49°21'N, 154°42'E	1952	4,344'; 1,324 m
9	Severgin (Harimkotan Is.)	0900-30	49°07'N, 154°30'E	2007?	3,796'; 1,157 m
10	Sinarka (Shiashkotan Is.)	0900-29	48°52'N, 154°11'E	2003?	3,064'; 934 m
11	Kuntomintar (Shiashkotan Is.)	0900-28	48°45'N, 154°01'E	1924	2,717'; 828 m
12	Ekarma (Ekarma Is.)	0900-27	48°57'N, 153°56'E	1980	3,842'; 1,171 m
13	Chirinkotan (Chirinkotan Is.)	0900-26	48°59'N, 153°28'E	2004	2,375'; 724 m
		Central Kurile	S		
14	Raikoke (Raikoke Is.)	0900-25	48°17'N, 153°15'E	1924	1,808'; 551 m
15	Sarychev Peak (Matua Is.)	0900-24	48°06'N, 153°12'E	1976	4,744'; 1,446 m
16	Rasshua (Rasshua Is.)	0900-22	47°45'N, 153°01'E	1957?	3,113'; 949 m
17	Ushishir (Yankich Is.)	0900-21	47°31'N, 152°48'E	**	1,276'; 389 m
18	Ketoi (Pallas Peak; Ketoi Is.)	0900-20	47°20'N, 152°29'E	1960	3,248'; 990 m
19	Prevo Peak (Simushur Is.)	0900-19	47°01'N, 152°07'E	1914	4,462'; 1360 m
20	Zavaritzii (Simushur Is.)	0900-18	46°55'N, 151°57'E	1957	2,050'; 625 m
21	Goryachaya sopka (Simushur Is.)	0900-17B	46°50'N, 151°45'E	1944?	2,923'; 891 m
		South Kuriles	3		
22	Cherny (Chirpoi Is.)	0900-15	46°31'N, 150°52'E	1857	2,047'; 624 m
23	Snow (Chirpoi Is.)	0900-15	46°31'N, 150°52'E	1982	1,296'; 395 m
24	Berga (Kolokol Group, Urup Is.)	0900-12	46°03'N, 150°04'E	2007?	3,215'; 980 m
25	Kudryavy (Medvezhii; Iturup Is.)	0900-10	45°23'N, 148°50'E	1999	3,235'; 986 m
26	Men'shiy Brat (Iturup Is.)	0900-10	45°23'N, 1484°7'E	~400 yrs BP	1,847'; 563 m
27	Chirip cluster (Bogdan Khmelnitzky; Iturup Is.)	0900-09	45°23'N, 147°55'E	1860?	5,131'; 1,564 m
28	Baransky (Iturup Is.)	0900-08	45°06'N, 148°01'E	1951	3,717'; 1,133 m
29	Ivan Grozny (Iturup Is.)	0900-07	45°01'N, 147°52'E	1989	3,802'; 1,159 m
30	Stokap (Iturup Is.)	_	44°50'N, 147°20'E	**	5,361'; 1,634 m
31	Atsonupuri (Iturup Is.)	0900-05	44°48'N, 147°08'E	1932	3,953'; 1,205 m
32	Berutarube (Iturup Is.)	0900-04	44°27'N, 146°56'E	1812	4,003'; 1,220 m
33	Ruruy (Kunashir Is.)	0900-032	44°27'N, 146°08'E	**	4,872'; 1,485 m
34	Tyatya (Kunashir Is.)	0900-03	44°27'N, 146°15'E	1973	5,968'; 1,819 m
35	Mendeleev (Kunashir Is.)	0900-02	43°59'N, 145°44'E	1977	2,910'; 887 m
36	Golovnin (Kunashir Is.)	0900-01	43°51'N, 145°30'E	~1,900 yrs BP	1,775'; 541 m

 Table 2.
 Important web sites that are sources of information about Kurile Volcanoes.

Organization	Web Site
Tokyo Volcanic Ash Advisory Center	http://ds.data.jma.go.jp/svd/vaac/data/index.html
Anchorage Volcanic Ash Advisory Center	http://vaac.arh.noaa.gov/
Washington Volcanic Ash Advisory Center	http://www.ssd.noaa.gov/VAAC/washington.html
NOAA Alaska Aviation Weather Unit Alaska FIR SIGMETs	http://aawu.arh.noaa.gov/aawuapps/sigmetgs.php
NOAA National Weather Service Aviation Weather Center	http://adds.aviationweather.gov/airmets/
Kamchatka Volcanic Eruptions Response Team	http://www.kscnet.ru/ivs/kvert/current/index_eng.php
Alaska Volcano Observatory	http://www.avo.alaska.edu/activity/

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