Alaska Volcano Observatory

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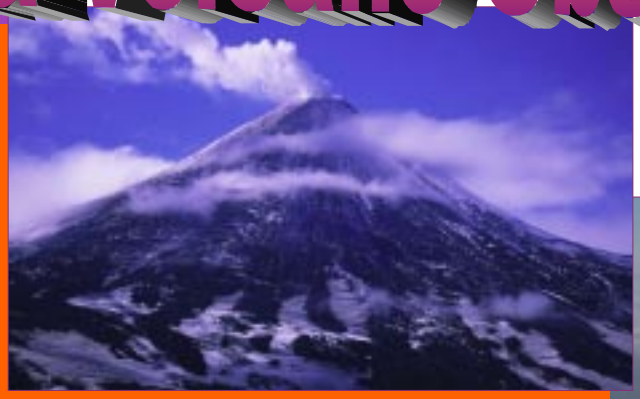

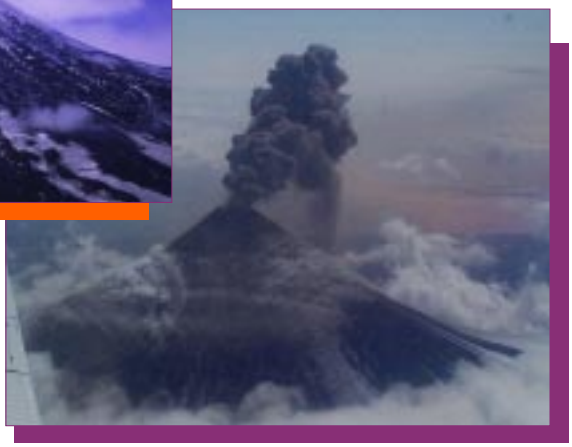

AVO is a cooperative program of the U.S. Geological Survey,[1] University of Alaska Fairbvanks, Geophysical Institute[2], and the Alaska Division of Geological and Geophysical Surveys[3].
Scientist-in-Charge: Terry Keith [1A] (907) 786-7443, email: tkeith@tundra.wr.usgs.gov
Coordinating Scientist: John C. Eichelberger[2] (907) 474-5530, email: eich@gi.alaska.edu
This report was edited by John C. Eichelberger and designed and prepared by Jean Sobolik, email: jsobolik@gi.alaska.edu
Cover photos: left, north flank of Shishaldin volcano covered with ash and debris flows following the recent eruption. Photo taken August 8, 1999; rght, Shishaldin in eruption, April, 1999. Photos taken by G. McGimsey.

In This Issue

Highlights

- Shishaldin returned to repose following April eruptions.
- Karymsky likewise quieted, but then put out a new lava flow and numerous explosions in August.
- A 14-station net was installed around Adak to monitor Kanaga and Great Sitkin volcanoes.
- A complete section of caldera-forming ignimbrite from rhyodacite through andesite, was found at Aniakchak.
- Investigation of complex variations in composition, density, and crystallinity of eruption products is underway at Augustine.
- Emmons Caldera may be the illusive source of the Old Crow tephra.
- Fisher Caldera reveals a rich and complex post-collapse history of volcanism.
- More than 200 samples were returned from an extensive field campaign at Kaguyak Caldera.
- Okmok Caldera has experienced many late Holocene, post-collapse explosive eruptions.
- Field investigations confirm that the April 19th eruption of Shishaldin was the big one.
- Shrub Mud Volcano continues to emit CO_2 and warm mud.
- Roundtop appears to have had a caldera-forming eruption in early Holocene time.

Summary

Whereas the last report period was dominated by the Shishaldin eruption, this one is dominated by the above highlights of a frenetic and productive summer. The biggest news is that AVO's seismic monitoring reach now extends to Adak, approximately 2000 km west-southwest of Anchorage.

John C. Eichelberger
Coordinating Scientist

ERUPTIONS

Summary

This was an anomalously quiet period for Alaska and Kamchatka volcanoes.

Shishaldin Volcano
54°45' N, 163°58'W
AVO brought to a close it's response to the unrest and the eruption of Shishaldin volcano that had begun in February, 1999. The last eruptive activity was minor and occurred on May 27, 1999. Therefore, seismicity remained low, and the level of concern color code was changed from YELLOW to GREEN on June 18, 1999.

Pavlof Volcano
55°25'N, 161°54'W
On July 30, 1999, pilots reported an ash plume over Pavlof. Seismicity remained at background levels and no activity was visible on satellite images. The cloud was therefore assumed to be the result of high surface winds redistributing ash from the 1996-97 eruption, which blankets the upper flanks.

Klyuchevskoi Volcano, Kamchatka
56°03' N, 160°39'E
On July 12, 1999, KVERT reported several ash and gas explosions that sent plumes up to 2 km above the volcano drifting to the east for about 5 km. The activity was not visible on satellite imagery. KVERT raised the level of concern to color code YELLOW on July 13, and downgraded to GREEN on July 26 as seismicity returned to background levels.

Karymsky Volcano, Kamchatka
54°03'N, 159°27' E
After three years of eruptive activity, the level of concern color code was downgraded to GREEN on August 2, 1999. Within a few days, seismicity abruptly increased and gas explosions resumed, prompting KVERT to upgrade the level of concern to YELLOW on August 6, 1999. As many as 300 ash-rich explosions were recorded on August 7, 1999. During the week of August 16, steam and ash plumes rising 500 to 1000 m above the volcano and extending as far as 75 km downwind were visible on satellite images. As of the end of this reporting period, the color code remains YELLOW and low level eruptive activity continues.

Game McGimsey

Figure 1(a): North flank of Shishaldin volcano covered with ash and debris flows following the recent eruption. Photograph taken August 8, 1999. and (b): Shishaldin steaming on 5/26/99, photo taken by Jim Begét.

MONITORING

Satellite Observations of Alaska and Kamchatka Volcanoes

AVO monitors volcanoes in Alaska and Kamchatka using the relatively high spatial resolution and nadir view of polar orbiting satellite data, and the high temporal resolution of geostationary satellite data. All of these systems include visible and thermal infrared wavelength data.

The Polar Orbiting system is the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-12 and -14 satellites. Images are recorded in five spectral bands at a spatial resolution of 1.1 km at nadir. Alaskan volcanoes are received by the ground station at the Geophysical Institute, University of Alaska Fairbanks, and are analyzed daily to detect volcanic eruption clouds and thermal anomalies at volcanoes in the North Pacific region. Repetitive coverage by these satellites are eight images per 24 hours for Alaskan Volcanoes and approximately four images per 24 hours for Kamchatka Volcano. The timing of satellite passes are not distributed evenly over the 24 hour time frame.

Geostationary data are received from the GMS and GOES satellites via computer networks at AVO-Anchorage, and provide off-nadir observations of the western North Pacific (GMS), and the eastern North Pacific (GOES). Hourly GMS data (~8km resolution at 60°N in the visible and TIR) are available for analysis within ~1 hour after reception by a ground station. GOES data are available at 15 minute intervals at resolutions of ~2 km at 60°N (visible band), and at 30 minute intervals at 8 km at 60°N (Vis and TIR bands), respectively within 45 minutes after reception by a ground station.

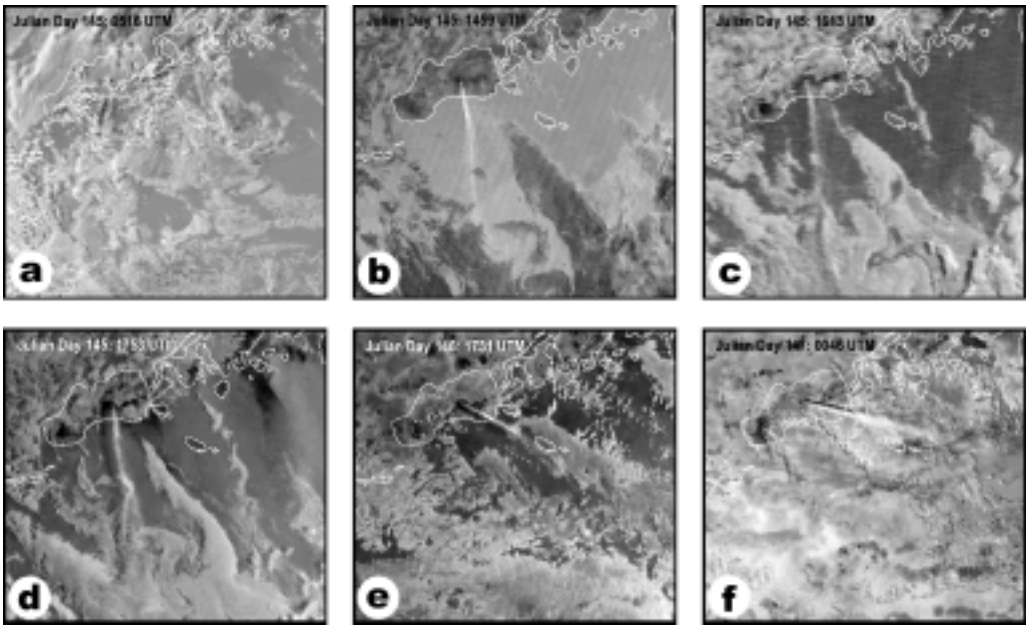

Figure 2: AVHRR images of the eruption of Shishaldin Volcano 25-27 May 1999. This time series of selected images shows a narrow plume emitted from the volcano over a three day period that blew to the south on day 145 (a, b, and c), and then to the SE on day 146 (e) and 147 (f). The data shows the plume is connected to the volcano and increases in length over time, although on day 146 at 1447 (image not shown) the plume length was shorter but increased again ass seen on later images. Plume lengths on the images shown range from 60km (a) to 450km (f). The chronology of events is shown in Table 2.

Volcanic Eruption Observations

During this period, eruption clouds and/or hot spots were observed at Shishaldin Volcano, Unimak Island and Karymsky Volcano, Kamchatka Peninsula, Russia. A thermal anomaly was also observed at Korovin Volcano and a plume-like cloud in the vicinity of Mt. Kialagvik, Alaska Peninsula and at Kliuchevskoi Volcano, Kamchatka Peninsula (Table 1). The burning of a historical lodge near Mt. Wrangell was also detected. All times are in UTC.

Shishaldin Volcano

Eruptive activity at Shishaldin Volcano continued intermittently throughout May. Initial observations consisted of elevated temperatures at the summit cone on day 127 and 133 (7 and 13 May), and included two warm pixels for each date. The warmest pixel on day 127 was approximately 6 °C above background with a near-vertical (8.5 degree) zenith viewing angle, but since this was a dawn image it may have been related to solar reflection (n14.99127.1500). The warmest pixel on day 133 was 21 °C above background (n12.99133.0336) on a night time satellite pass and thus this was very likely of volcanic origin.

A plume and hot spot were observed on day 136 (n12.99136.0410). The plume was 5 km long, blowing to the NW and had no negative values in band 4 minus 5, suggesting that it was predominantly steam. A two-pixel hot spot was also observed on this image that was 36 °C above background. Volcanic activity heightened on days 145, 146 and 147 (fig. 2) that resulted in plumes observed on multiple images (Table 2).

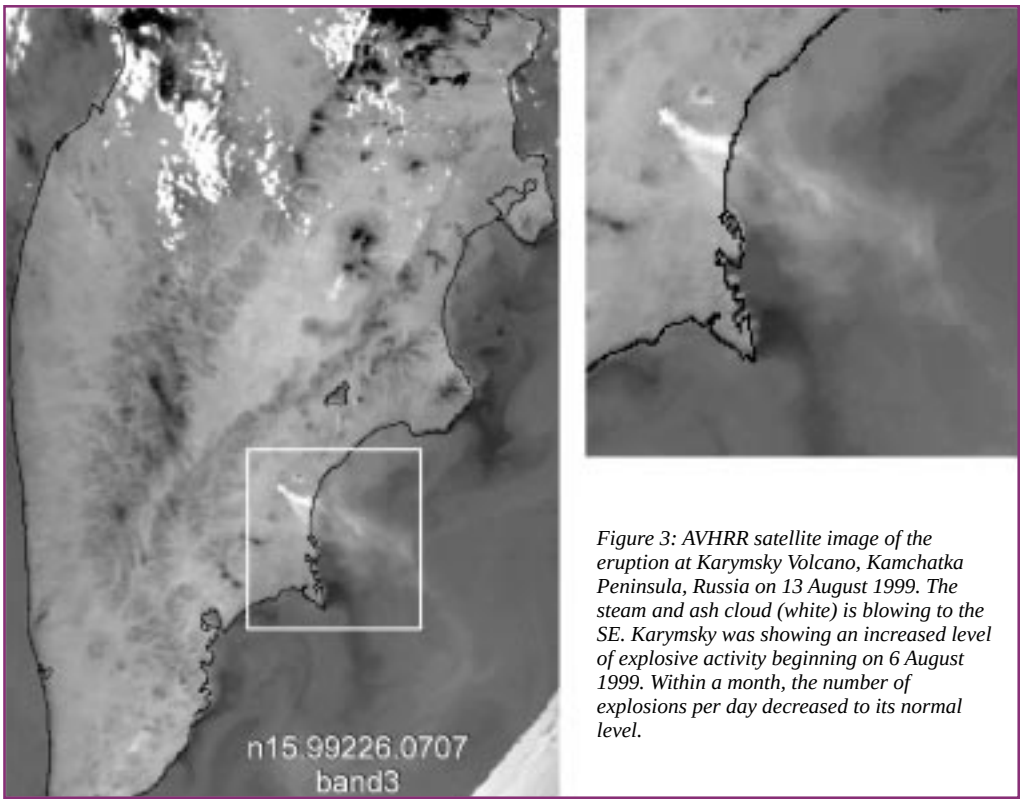

Figure 3: AVHRR satellite image of the eruption at Karymsky Volcano, Kamchatka Peninsula, Russia on 13 August 1999. The steam and ash cloud (white) is blowing to the SE. Karymsky was showing an increased level of explosive activity beginning on 6 August 1999. Within a month, the number of explosions per day decreased to its normal level.

Table 1.
Satellite Observations of Alaska and Kamchatka Volcanoes for the months of May-August, 1999

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
May																															
Shishaldin							X						X			XP									P	P	P				
June																															
Karymsky		X																											X		
Kliuchevskoi																		P													
July																															
Korovin																	X														
August																															
Karymsky								X		XP			XP	XP	XP			XP		P	XP	X		XP							
Kialagvik																									P						

X = Hot Spot
P = Plume or Suspicious Cloud

Table 2.
Satellite Observations of the 25 and 26 May Eruption at Shishaldin Volcano from AVHRR Data unless Otherwise Noted.

Julian Date	*Time*	*Plume Length*	*Direction*	*Lowest B4 - 5 value*
145	0410	30 km	SSW	-1
	0516	60 km	SSW	-2
	1459	170 km	SSE	-1.5
	1613	200 km	SSE	-1.5
	1753	214km	SSE	-3.05
	1802	214 km	S	-3.01
146	1447	40 km	SE	0
	1550	75 km	SE	0
	1628	110 km	SE	0
	1731	100 km	ESE	-1
	1837	120 km	ESE	-2.5
147	0046	450 km	ESE	-2.25
	0230	300 km	N/A	-2.2
	0325	N/A	N/A	-1.5
	0431	N/A	N/A	-2.2
	0631	700 km (GOES)	N/A	-2.2

N/A: Information not available in data base.nor observer reports

The observations show that on day 145 the plume blew to the south at a rate of approximately 13 km/hr over a 14 hour period. The plume was attached to the volcano in all of the images indicating that the activity was continuous. Subtractions of bands 4 minus 5 showed that airborne ash was present throughout day 145 but the lowest negative value (highest detected ash signal) was at 1802.

On Julian day 146, the first image was almost 21 hours after the last image from the previous day and showed that a plume was still being emitted. However, the length of the plume was 40 km, indicating that plume-producing activity had decreased during the intervening time. As the day progressed, several images over a15-hour period showed the plume again increasing in length until it was over 700 km long on day 147 at 0631 and still connected to the volcano. A strong ash signal was observed, seen as low band 4 minus 5 values, during the latter half of day 146 and on day 147. Cross correlation of plume temperature (–17°C) to atmospheric soundings indicated that the plume altitude was 4,000 m (16,000 ft) on day 147 at 0235. The explosive activity diminished to a hot spot 30°C above background on day 147 at 1708 (n12.99147.1708). This was the last volcanic activity observed at Shishaldin Volcano for this reporting period.

Karymsky Volcano

Activity was observed at Karymsky Volcano in June and August. A volcano-related, two pixel hot spot was observed on day 153 at 1650 that was 8°C above background temperatures (n14.99.153.1650) and a one pixel hot spot 15Ç above background temperatures on day 180 (n14.99180.1648). A month later, a series of hot spots and plumes were observed over a 15-day period (figs. 3 and 4). First, a three-pixel hot spot that was 27°C above background temperatures was observed on day 220 (12.99220.1825). Two days later (day 222), a plume that was 75 km long and blowing to the SE, and a four-pixel hot spot < 41°C were observed (n15.99222.0655) and on day 224 a four-pixel hot spot with 38°C above background temperatures and a 75 km long plume blowing to the SE were observed (n12.99224.1836). The following day (225) three images showed hot spots that ranged in size from 1 to 6 pixels with temperatures up to 31°C above background, and a plume that was from 30 to 130 km long blowing to the SE (n14.00225.0256; n12.99225.0432;

Figure 4: Ground-based photograph of a fresh lava flow and small plume from Karymsky Volcano on 22 August 1999. The lava flow was the source of some of the hot spots observed on AVHRR data.

n15.99225.0730; n12.99225.1814). This activity continued on day 226 seen as 2 to 3 warm pixels at temperatures ≤ 31°C above background. Later in the day at 1632 a plume 90-km-long blowing to the SE was observed (n14.99226.0245, n12.99226.0554, n15.99226.0707, n14.99226.1632).

Another period of activity started on day 230(n14.99230.0343) seen as a one-pixel thermal anomaly 30°C above background temperatures and a 20-km-long plume blowing to the ESE. Later that evening a three-pixel thermal anomaly, 28°C above background temperatures was again observed (n15.99230.0719) but this may have been solar in origin. The following day (231) a faint plume was observed that was 100-km long at 0542 and over 200-km long at 0656, both blowing ESE (n12.99.231.0542, n15.99.231.0656). No ash was detected in these plumes in the band 4 minus 5 data. The following day (232), a 3-pixel hot spot was observed at 0319 that was 28°C above background. Two hours later (0518), a single-pixel hot spot that was 26°C above background temperatures and a 70-km-long plume blowing to the ESE were observed (n15.99232.0632). No ash signal in the band 4 minus 5 data was detected. Activity declined to a two-pixel hot spot that was 37°C above background temperatures at 1705 (n14.99232.1705). On day 233, a hot spot 23°C above background temperatures was observed (n14.99233.1653). The final day of activity (day 234) included a hot spot 28°C above background temperatures and a plume 150-km-long blowing to the SE. No ash was detected in this plume in the band 4 minus 5 data (n14.99234.0731).

Korovin

A single-pixel thermal anomaly was observed through clouds at Korovin volcano on July 17, 1999 (n15.99198.0544). The thermal anomaly was 33°C above background in band 3.

The anomaly was not detected in succeeding images. This was a daytime image and thus the anomaly may have been solar in origin.

Kialagvik

A plume-shaped cloud was seen in the vicinity of Mt. Kialagvik on the Alaska Peninsula August 25, 1999 (n14.99237.0220 and n12.99237.0323). The plume-like cloud trails off at 130 km to east-southeast. Subtraction of bands 4 from 5 did not detect any ash. Subsequent analysis of the geostationary images suggests a jet contrail. This cloud (elongated east-west) was observed in the visible images drifting from north to south for an hour prior to the AVHRR pass, at which time it was in the vicinity of Kialagvik. It continued to drift to the south after the AVHRR passes were collected, and was visible until darkness fell.

Kliuchevskoi

A possible steam plume was observed at Kliuchevskoi Volcano that was 33.5 km long and blowing south June 18, 1999 (n15.99169.0627). Volcanic activity was not observed on subsequent images.

Wrangell (General Interest)

A thermal anomaly was detected on the SW flank of Wrangell Volcano August 18, 1999 (n14.99230.1406). The anomaly was 19°C above background temperatures. The hot spot was caused by a fire that burned the Chistochina Lodge, a National Historic Site.

Ken Dean, Jon Dehn, Dave Schneider, Kevin Engle, Matt Patrick, and Ken Papp