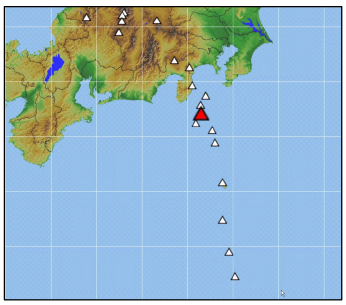


60. Niijima

Continuously Monitored by JMA

Latitude: 34°23'49" N, Longitude: 139°16'13" E, Elevation: 432 m
(Miyatsukayama)
(Spot elevation measured by JMA)

Overview of Niijima taken from southeast side on October 2, 2000. Courtesy of the Japan Coast Guard.

Summary

Niijima is an island that measures 11.5 km north-south and 3 km east-west. It has groups of rhyolite lava domes, such as Mukaiyama, Miyatsukayama, and Atchiyama, in the north and south, and the depression in the center, which contains the village, is a plateau built up from pyroclastic material deposits from eruptions in the 9th century. Small basalt explosion breccia and base surge deposits from submarine eruptions are the north, around Wakago. Mukaiyama (301 m) erupted at the end of the 9th century eruption. The intervals between eruptions are long, but the eruptions themselves are explosive, and often result in pyroclastic surges and pyroclastic flows. It is important to note that pyroclastic flows and pyroclastic surges can travel over the surface of the watery for some distances, and that small tsunamis may result from eruptions in shallow areas. Kogaseki rock (pumiceous rhyolite) is mined from Mukaiyama. Lines of evidence exist of multiple secondary explosions caused by thick rhyolite lava flows entering shallow sea areas at the nearby Shikinejima (Ito and Taniguchi, 1996). The SiO_2 content of basalt - rhyolite is between 49.5 and 78.3 wt %.

Photos

Overview of Niijima taken from Shikinejima on November 2, 2004 by the Japan Meteorological Agency

Shikinejima and southern Part of Niijima (Kozushima in the distance) taken from Fujimi Pass on May 27, 2006 by the Japan Meteorological Agency

Northern Part of Niijima taken at the sea from northwest side on November 9, 2006 by the Japan Meteorological Agency

Red Relief Image Map

Figure 60-1 Topographic map of Niijima.

1:50,000 scale topographic maps (Kozushima and Niijima) and digital map 50 m grid (elevation) published by the Geospatial Information Authority of Japan were used.

Submarine Topographic Map

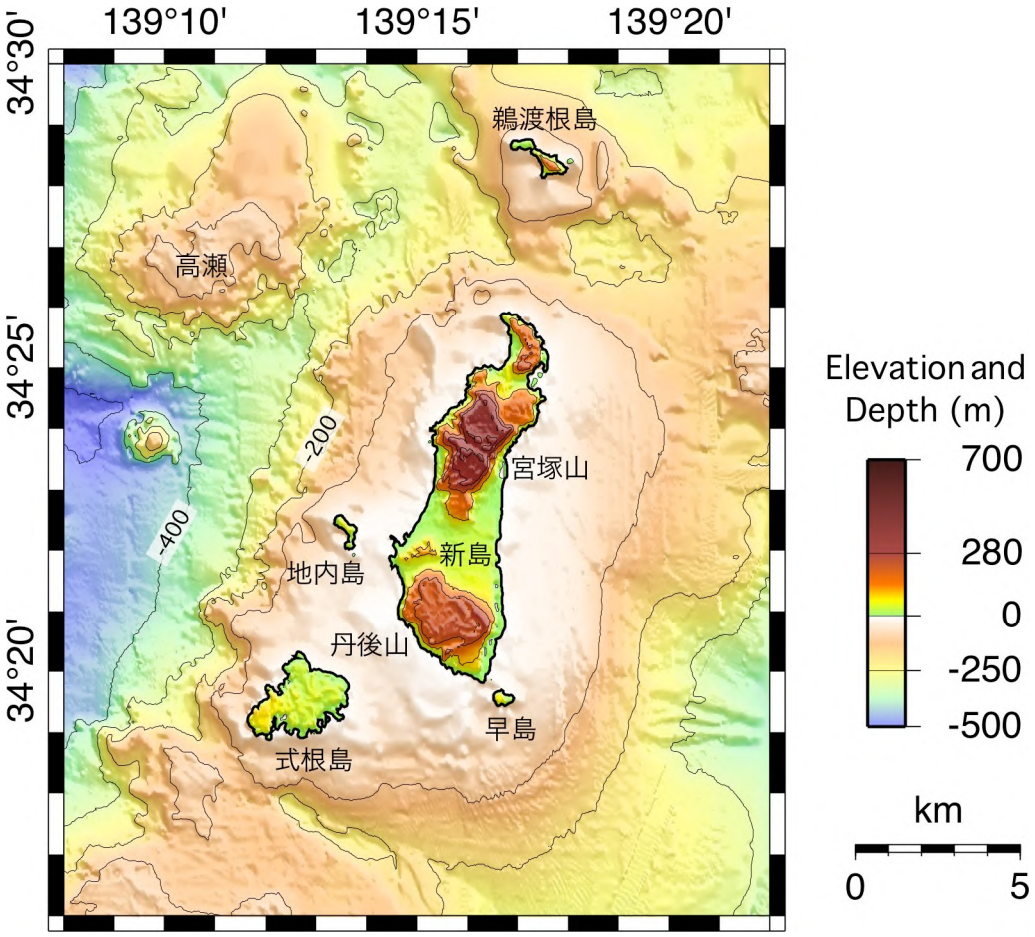


Figure 60-2 Submarine topographic map of the Niijima area (Japan Coast Guard).

Chronology of Eruptions

・Volcanic Activity in the Past 10,000 Years

The Wakago volcano is located in the north of Niijima, and erupted either 3,200 years ago (radiocarbon dating) or slightly over 2,000 years ago (based on archaeological remains). The eruption was a phreatomagmatic explosion caused by basalt magma, discharging a base surge. The Atchiyama volcano erupted between 838 and 886 (Yoshida, 1992). This eruption was caused by magma composed of major rhyolite and subordinate mixedbasalt. It began with a phreatomagmatic explosion, and formed a pyroclastic cone and lava dome. The Mukaiyama volcano then erupted in 886. This eruption began with a phreatomagmatic explosion of rhyolite magma in the shallows to the south of Niijima. It then went on to discharge a pyroclastic flow and pyroclastic surge, form a pyroclastic cone, and then form a lava dome (Yokoyama and Tokunaga, 1978; Isshiki, 1987; Ito, 1993, 1999).

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
14 ka	Shikinejima	Magmatic eruption (secondary explosion)	Lava dome, pyroclastic flow, pyroclastic surge, tephra fall. Magma eruption volume = 0.44 km^3 DRE.
7.6 ka	Hanshima	Magmatic eruption	Lava dome and tephra fall?
6.3 ka	Niijimayama	Magmatic eruption	Lava dome and tephra fall?
3.2 ka	Wakago volcano (shallow sea floor volcano several hundred meters off western coast of Niijimayama)	Phreatomagmatic eruption	Pyroclastic surge, tephra fall.

* Volcanic periods, areas of activity, and eruption types taken from the Active Volcano Database of Japan, AIST (Kudo and Hoshizumi, 2006). All years are noted in Western date notation. "ka" within the table indicates "1000 years ago", with the year 2000 set as 0 ka.

・Historical Activity

Year	Phenomenon	Activity Sequence, Damages, etc.
838 ←→ 886 (Jowa 5 to Ninna 2)	Phreatomagmatic eruption	Tephra fall? The eruption occurred near Kudumaki and Awaiura.
838 ←→ 886 (Jowa 5 to Ninna 2)	Large: Phreatomagmatic eruption → magmatic eruption	Pyroclastic surge, tephra fall → lava dome. The eruption occurred at Atchiyama. Magma eruption volume = 0.085 km^3 DRE. (VEI 3)
886 → 887 (Ninna 2 to 3)	Large: Magmatic eruption → phreatomagmatic eruption → magmatic eruption, phreatic eruption → magmatic eruption	Mukaiyama eruption: Started June 29. Pyroclastic flow → pyroclastic surge → tephra fall, pyroclastic surge → lava dome, tephra fall → pyroclastic flow, tephra fall. The eruption occurred at the Mukaiyama volcano. The Mukaiyama volcano was formed (according to ancient records, a new island was formed). A black volcanic plume was emitted, rumbling, lightning, and earthquake swarms occurred, a large amount of ash fell, and many livestock were killed on the Boso Peninsula. Magma eruption volume = 0.73 km^3 DRE. (VEI 4)
1936 (Showa 11)	Earthquake	December 27 to 29. Large number of aftershocks. Damage on the island (maximum magnitude of M6.3).
1957 (Showa 32)	Earthquake	November 6 to late November. Earthquake swarm (approximately 10 km off south coast of Niijima, maximum magnitude of M6.0).
1965 (Showa 40)	Earthquake	August 3 to September. Earthquake swarm (near Niijima and Kozushima, maximum magnitude of M5.0).
1966 (Showa 41)	Earthquake	May 15. Earthquake swarm (approximately 10 km off west coast of Niijima, maximum magnitude of M5.5).
1968 (Showa 43)	Earthquake	February 24 to 27. Earthquake swarm (approximately 10 km off south coast of Niijima, maximum magnitude of M5.0).
1983 (Showa 58)	Earthquake	August. Earthquake swarm (approximately 15 km off northeast coast of Niijima, maximum magnitude of M4.3).
1985 (Showa 60)	Earthquake	September 21 to 22. Earthquake swarm (several km off north coast of Niijima, maximum magnitude of M3.4).
1991 (Heisei 3)	Earthquake	January to February. Earthquake swarm (several km off west coast of Niijima, maximum magnitude of M3.3).
1991 to 1995 (Heisei 3 to 7)	Earthquake	Occasional earthquake swarms in area (seismic activity near Niijima and Kozushima).
2000 (Heisei 12)	Earthquake	June to August. Earthquake swarm activity near Niijima, Kozushima, and Miyakejima
March to April, 2011 (Heisei 23)	Earthquake	After the 2011 off the Pacific coast of Tohoku Earthquake (March 11, 2011) a large amount of seismic activity occurred in the Niijima area. High number of felt-earthquakes. March 11, 14:50 - M4.7 (JMA scale seismic intensity: 4).

* Reference documents have been appended with reference to the Active Volcano Database of Japan, AIST (Kudo and Hoshizumi, 2006) for volcanic periods, areas of activity, eruption types, and eruption events.

A←→B: Eruption events taking place at some point between year A and year B

A→B: Indicates a continuous chain of eruption events beginning in year A and ending in year B.

* For details regarding earthquake swarms, see Miyakejima entry.

Precursory Phenomena

Although eruptions have not occurred recently, crustal deformation imples magma supply below Niijima.

Major Volcanic Activity

・Eruptive Activity between 886 and 887 (Ninna 2 and 3)

The Mukaiyama volcano's eruptive activity began in the shallows to the south of Niijima. It began with a phreatomagmatic explosion of rhyolite magma, forming a pyroclastic cone and emitting a lava flow. According to records in the 9th century, the period of activity lasted from 1 to several years. The pyroclastic surge deposits and pyroclastic flow deposits from the initial eruptive activity filled in the sea area to the south of Niijima, and covered Miyatsukayama (elevation 432 m) in the north of Niijima. Some of it also reached as far as Shikinejima, Jinajima, and Hanshima. During this period of activity ash also fell in the south of the Boso Peninsula (6 to 9cm in depth) (Isshiki, 1987; Ito, 1993).

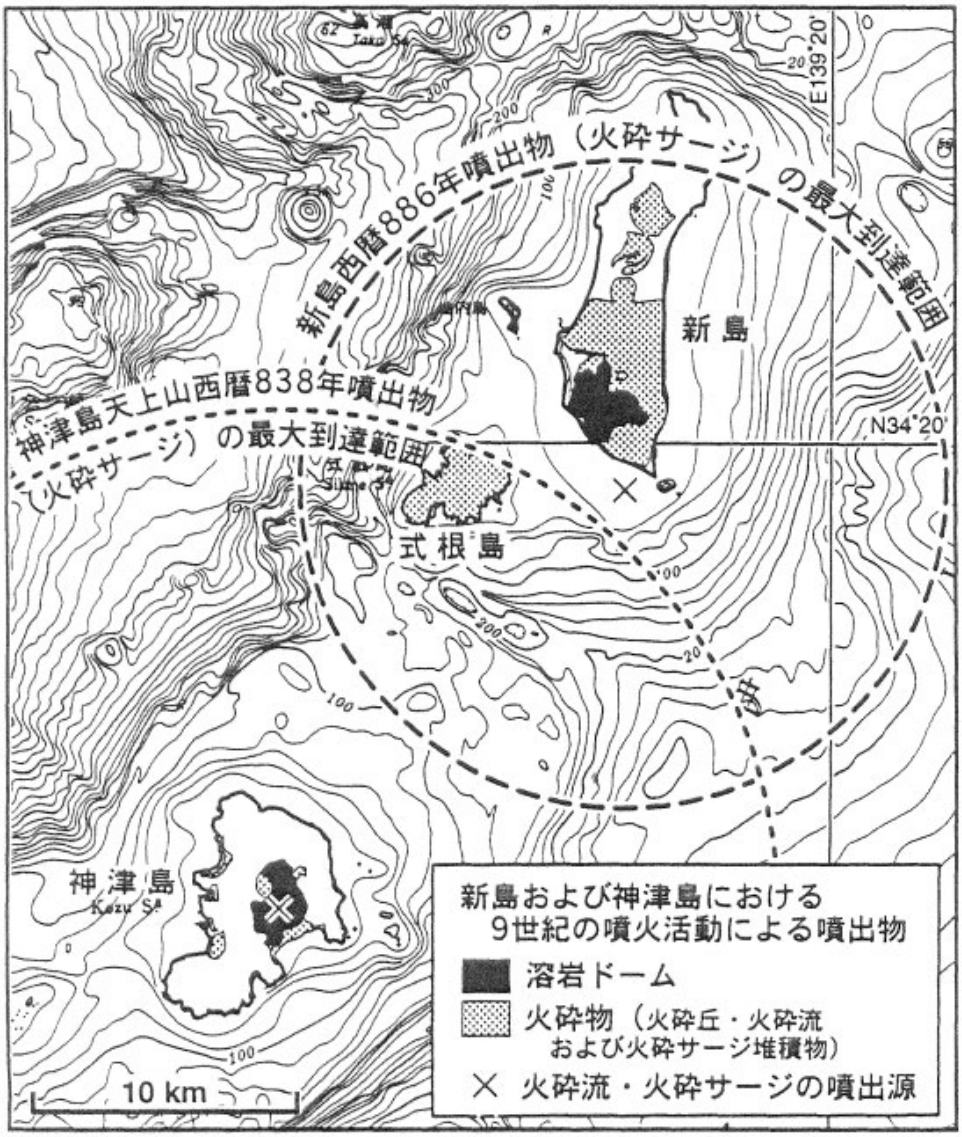


Figure 60-3 Areas of Niijima and Kozushima reached by pyroclastic surge from eruptive activity in 9th century.
The maximum travel distance of pyroclastic surges produced by the Niijima Mukaiyama volcano eruption of 886 and the Kozushima Tenjosan volcano eruption of 838 are indicated (Ito (1999)).

Recent Volcanic Activity

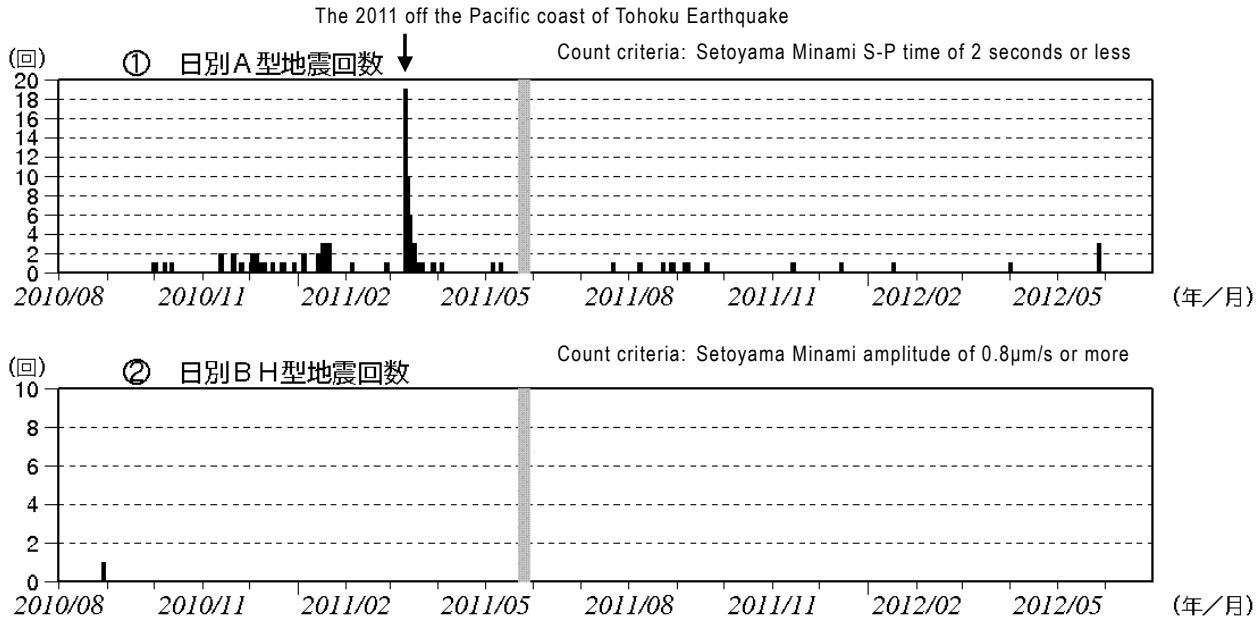


Figure 60-4 Number of earthquakes per day (August, 2010, to June 30, 2012)

Figures are missing for areas in gray due to equipment failures.

① Number of A-type earthquakes per day

② Number of BH-type earthquakes per day

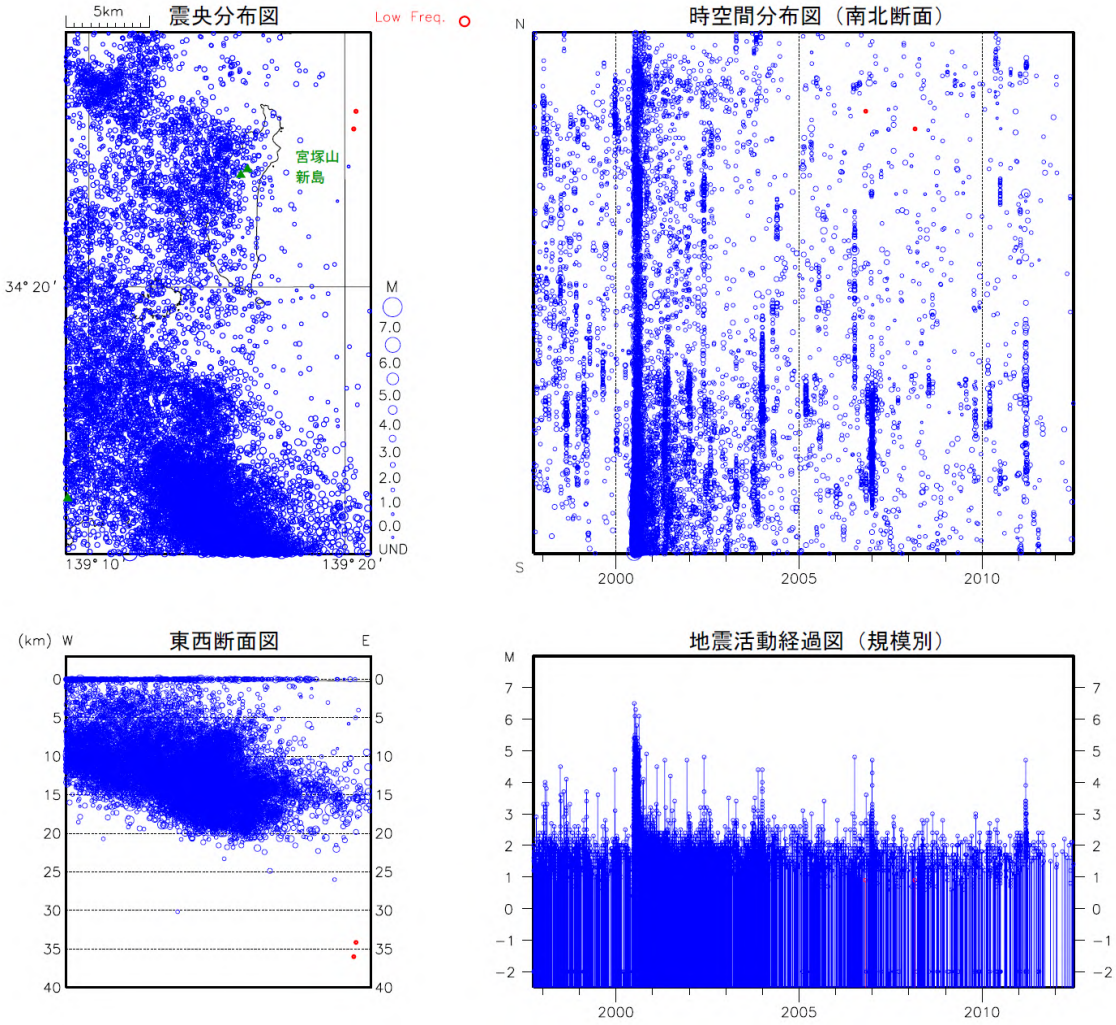
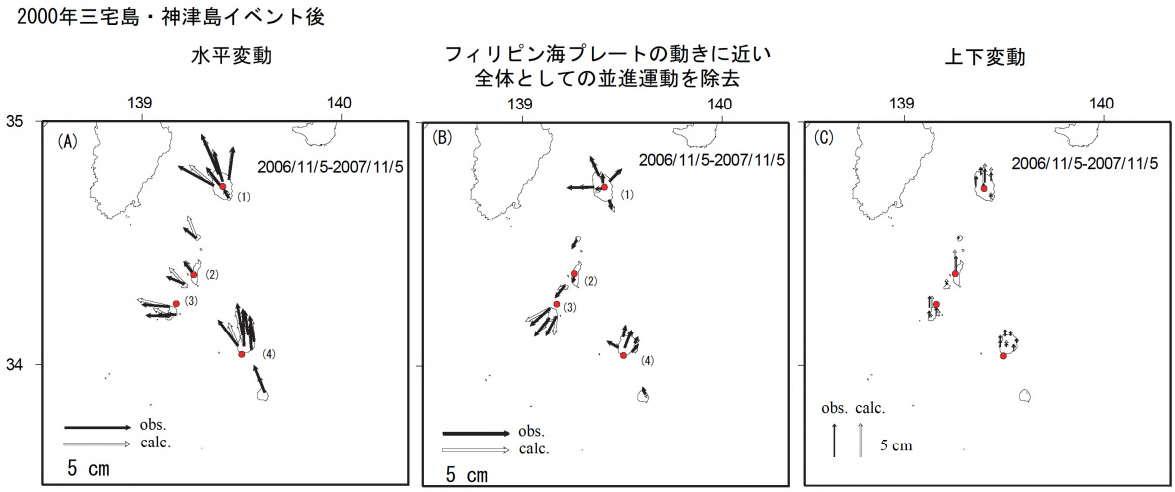


Figure 60-5 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to June 30, 2012). Epicenter distribution (upper left), space-time plot (N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (by scale) (lower right).



固定局：秩父

伊豆諸島の2006/11/5～2007/11/5間の変動を４つの点圧力源（●）でモデル化（茂木モデル）した。
黒矢印は観測値、白矢印は計算値で、比較的よく観測結果が再現されている。

圧力源		緯度	経度	深さ	貫入量
(1)	伊豆大島	34.739	139.407	5.8 km	$5x10^6$ m^3
(2)	新島	34.379	139.259	4.5 km	$3x10^6$ m^3
(3)	神津島	34.254	139.172	3.1 km	$2x10^6$ m^3
(4)	三宅島	34.038	139.499	10.0 km	$6x10^6$ m^3

Figure 60-6 Results of analysis using Mogi model for Niijima / Kozushima area (Geographical Survey Institute, 2009). GPS measurements indicate an uplift of several centimeters in and around Niijima and Kozushima even after the 2000 Miyakejima eruption.

Information on Disaster Prevention

①Hazard Map

None

Social Circumstances

①Populations

・Island population: 3,059 (according to Tokyo statistics as of January 1, 2011)

・Residential area at the foot of the volcano, etc.: 1.0 km from Atchiyama

②National Parks, Quasi-National Parks, Number of Climbers

・Fuji-Hakone-Izu National Park Niijima

Number of sightseers per year: Approximately 50,000 (according to 2010 Tokyo Oshima Branch Office Jurisdiction Overview)

Number of mountain-climbers per year: Unknown

③Facilities

Niijima Museum

Monitoring Network

* Monitoring sites with multiple observation instruments are indicated by small black dots, and other symbols indicate types of monitoring.

1:50,000 scale topographic maps (Kozushima and Niijima) published by the Geospatial Information Authority of Japan were used.

Legend

(JMA)
seismometer(SP)
GPS
tiltmeter
infrasonic microphone
visual camera
seismic intensity meter
seismometer(SP)
(For earthquakes and tsunamis)

(GSI)
GPS

(NIED)
Hi-net
K-NET

(Nagoya Univ.)
GPS

(Tokyo Metropolitan Govt.)
seismometer(SP)

Figure 60-7 Monitoring network.

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