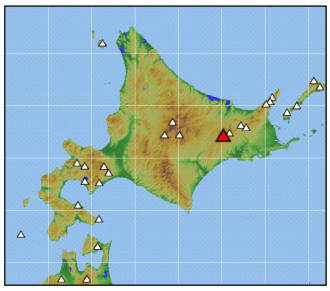
7.Meakandake



Continuously Monitored by JMA

Latitude: 43°23'11" N, Longitude: 144°00'31" E, Elevation: 1,499 m
(Meakandake) (Elevation Point)
Latitude: 43°22'27" N, Longitude: 144°00'23" E, Elevation: 1,476 m
(Akan-Fuji) (Triangulation Point)

Overview of Meakandake taken from east side on July 3, 2007 by the Japan Meteorological Agency

Summary

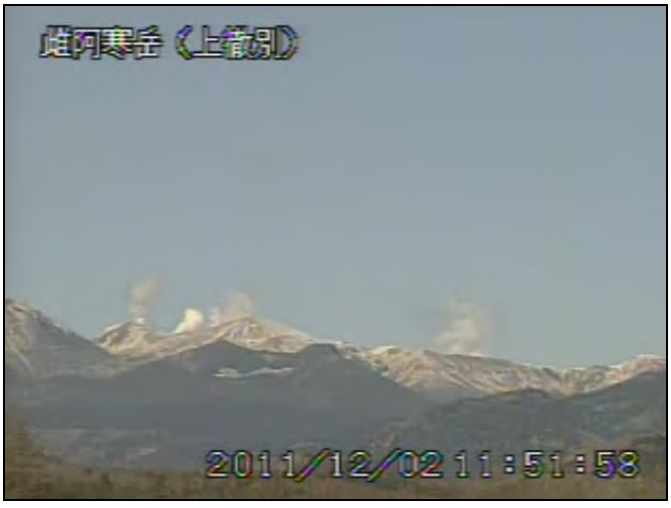
Meakandake, which was formed on the southwest wall of the Akan caldera, is a stratovolcano group composed of 8 small volcanoes, including Ponmachineshiri and Akan-Fuji (Yokoyama et al., 1976). It is composed of a variety of types of ejecta: basalt, andesite, and dacite (The SiO_2 content is between 50.2 and 65.5 wt %) (Wada et al., 1988; Wada, 1991). Nakamachineshiri crater exists at the center of the volcano group (1.1km in diameter), formed by a pyroclastic flow approximately 13,000 years ago. After the formation of Ponmachineshiri, Nishiyama, Kitayama, and Akan-Fuji, a middle scale of scoria eruption occurred at the summit of Ponmachineshiri approximately 1,000 years ago. Frequent explosions (mainly phreatic ones), then the Ponmachineshiri craters were formed on the summit of Ponmachineshiri (the old crater and the Akanuma crater). Also, in recent years, small-scale eruptions have occurred every several years (Yokoyama et al., 1976; Wada et al., 1997; Wada, 1998).

Photos

Ponmachineshiri Crater Chain (96-1 Crater), taken from south side on September 30, 2008 by the Japan Meteorological Agency

Akanuma Crater taken from southeast side on September 30, 2008 by the Japan Meteorological Agency

Nakamachineshiri Crater taken from southeast side on September 30, 2008 by the Japan Meteorological Agency



Kamiteshibetsu by the camera image on December 2, 2011 by the Japan Meteorological Agency

Ponmachineshiri No. 1 crater, after the eruption
,taken from east side on November 20, 1955
- Courtesy of the Hokkaido Shimbun Press

Eruption at Ponmachineshiri No. 1 crater
, taken from southeast side on January 7, 1988 by the Japan Meteorological Agency

Ponmachineshiri crater after eruption
, taken from west side on March 22, 2006
- Courtesy of Terada, A.

After eruption at Ponmachineshiri crater
, taken from southeast side on November 28, 2008 by the Japan Meteorological Agency

Topography around the Crater

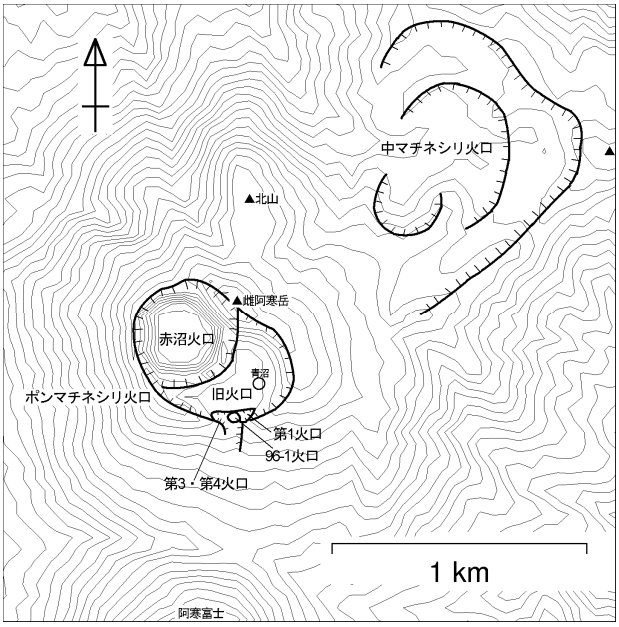


Figure 7-1 Detailed topography of the crater area.

Red Relief Image Map

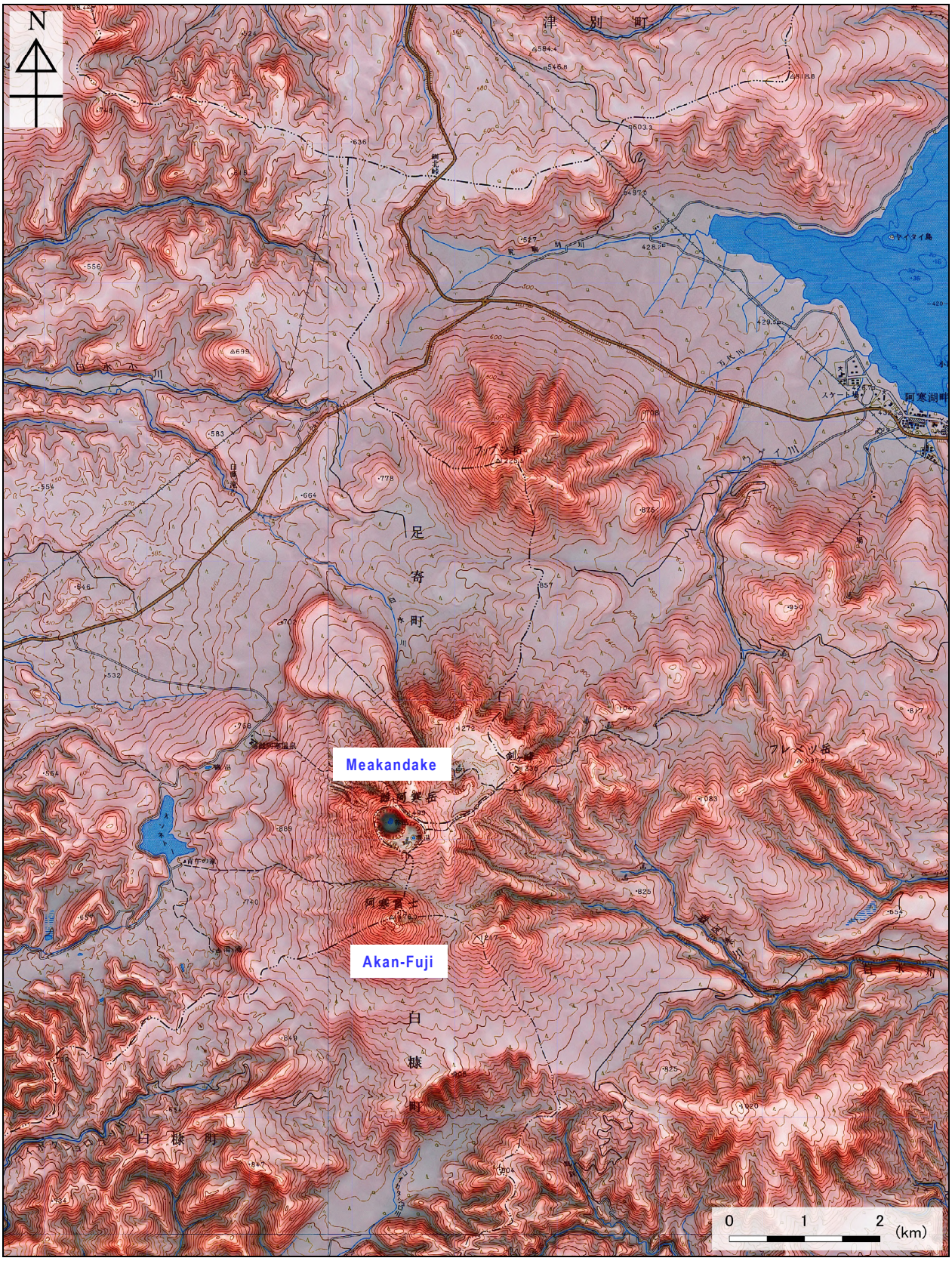


Figure 7-2 Topography of Meakandake.

1:50,000 scale topographic maps (Ukotakinupuri, Kamiashoro, Teshibetsu and Akan Ko) and digital map 50 m grid (elevation) published by the Geospatial Information Authority of Japan were used.

Chronology of Eruptions

・Volcanic Activity in the Past 10,000 Years

Pyroclastic flows occurred at the Nakamachineshiri crater during three periods, with the interval of 3,000 to 4,000 years, since approximately 13,000 years ago. The greatest activity was approximately 13,000 years ago, with pyroclastic flows in all directions, and plinian eruptions causing air-fall pumice and scoria to accumulate over a wide area to the southeast. Lava flows also occurred. Approximately 9,000 years ago a pyroclastic flow occurred along the Rawan River, and 5,000 to 6,000 years ago, a pyroclastic flow along the Moashoro River. Approximately 3,000 to 7,000 years ago the volcanic edifices of Nishiyama, Kitayama, and Ponmachineshiri were mainly formed by lava, and approximately 1,000 to 2,500 years ago Akan-Fuji was formed out of basalt lava and scoria fall deposits (Wada et al., 1997, Wada, 1998).

Over the past 1,000 years, eruptive activity is inferred to be consisted of scoria eruptions at the summit of Ponmachineshiri, each of which was followed by phreatic eruptions. Approximately 700 years ago Ponmachineshiri's old crater was formed. Approximately 400 years ago a phreatomagmatic explosion opened the Akanuma crater, resulting in the sedimentation of volcanic ash at the foot of the mountain, as well as lahar. During the approximately 100 years leading up to the 1955 eruption, at least 10 small phreatic explosions occurred. This activity is estimated to have occurred within the old crater and/or Nakamachineshiri crater. (Wada et al., 1997; Wada, 1998). Since the 1955 eruption, small-scale phreatic explosions have intermittently occurred at the Ponmachineshiri summit crater.

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
9ka	Nakamachineshiri	Magmatic eruption	Nakamachineshiri II eruption: Pyroclastic flow, tephra fall. Magma eruption volume = 0.04 km^3 DRE. (VEI 4)
7←→6ka	Ponmachineshiri	Magmatic eruption	Ponmachineshiri lower lava eruption: Lava flow.
6←→5ka	Nakamachineshiri	Magmatic eruption (producing lahar)	Nakamachineshiri III eruption: Pyroclastic flow, lahar. Magma eruption volume = 0.02 km^3 DRE. (VEI 3)
5ka?	Nishiyama	Magmatic eruption	Nishiyama eruption: Tephra fall, lava flow.
5←→4ka	Ponmachineshiri (Meakandake)	Magmatic eruption (producing lahar)	Ponmachineshiri mid-slope air-fall pyroclastic material eruption: Tephra fall, lahar.
4ka?	Ponmachineshiri (Meakandake)	Magmatic eruption	Ponmachineshiri upper lava and pyroclastic flow eruption: Lava flow, pyroclastic rock.
	Kitayama	Magmatic eruption	Kitayama lava eruption: Lava flow.
3←→2.5ka	Ponmachineshiri (Meakandake)	Magmatic eruption (producing lahar)	Akan-Fuji AS-1 eruption: Tephra fall, lahar.
2.5ka?	Akan-Fuji	Magmatic eruption	Akan-Fuji AS-1 eruption: Pyroclastic fall.
2.5←→2ka	Akan-Fuji	Magmatic eruption	Akan-Fuji AS-1 to 6 eruptions: Pyroclastic fall.
			Pyroclastic fall.
			Tephra fall, lava flow.
2ka	Akan-Fuji	Magmatic eruption	Akan-Fuji AS-7 eruption: Pyroclastic fall.
2←→1.7ka	Akan-Fuji	Magmatic eruption	Akan-Fuji AS-8 to 9 eruptions: Pyroclastic fall. [7]
1.7	Akan-Fuji	Magmatic eruption	Akan-Fuji AS-10 eruption: Tephra fall, lava flow.
1.7←→1ka	Akan-Fuji	Magmatic eruption	Akan-Fuji AS-11 to 17 eruptions: Pyroclastic fall.
1ka	Ponmachineshiri (Meakandake)	Magmatic eruption	Ponmachineshiri air-fall scoria eruption: Tephra fall?

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
1←→0.4ka	Ponmachineshiri or Nakamachineshiri	Phreatic eruption	Po-15 to 29 eruptions: Tephra fall?
0.4ka	Akanuma crater (Ponmachineshiri)	Phreatic eruption (producing lahar)	Po-14 eruption: Tephra fall? Lahar.
0.4←→0.306ka	Ponmachineshiri or Nakamachineshiri	Phreatic eruption	Po-12 to 13 eruptions: Tephra fall?
0.306←→0.144ka	Ponmachineshiri or Nakamachineshiri	Phreatic eruption	Po-11 eruption: Tephra fall?
0.144←→0.045ka	Ponmachineshiri or Nakamachineshiri	Phreatic eruption	Po-1 to 10 eruptions: Tephra fall?

* Reference documents have been appended with reference to the catalog of eruptive events during the last 10,000 years in Japan, database of Japanese active volcanoes, and AIST (Kudo and Hoshizumi, 2006) for eruptive period, area of activity and eruption type. All years are noted in calendar years. "ka" within the table indicates "1000 years ago", with the year 2000 set as 0 ka.
A←→B: Eruption events taking place at some point between year A and year B

・Historical Activity

Year	Phenomenon	Activity Sequence, Damages, etc.
1927 (Showa 2)	Rumbling	Rumbling from April to May.
1938 (Showa 13)	Rumbling	Rumbling on May 29 (accompanied by earthquake near Lake Kussharo).
1951(Showa 26) to 1952 (Showa 27)	Earthquake, rumbling	Felt-earthquakes and rumbling from July, 1951 to March, 1952 (activity increased immediately after the March 4, 1952, Tokachi Oki Earthquake).
1954 (Showa 29)	Earthquake, rumbling	Felt-earthquakes and rumbling from January to March. Emission of a volcanic plume containing ash from the Nakamachineshiri crater from April 8 to 13?
1955 (Showa 30)	Small-scale: Phreatic eruption	Small eruption at Ponmachineshiri crater on November 19: Pyroclastic fall. Created craters No. 1 through 4, and the north and south trenches. Total ejecta: $3.2x10^4$ m^3 (60,000 tons). (VEI 1)
1956 (Showa 31)	Small-scale: Phreatic eruption	Small eruptions at Ponmachineshiri craters (craters No. 1 through 4): Pyroclastic fall. (VEI 1) Small eruption on March 18. Small eruption on May 19: Explosion sound, a volcanic plume rose 2000 m above crater. Total ejecta: $4x10^4$ m^3. Small eruption on May 29: Small explosion sounds. Total ejecta: $0.2x10^4$ m^3. Colored volcanic plume on June 10. Small eruption on June 15: Explosion sound, created crater No. 6. Total ejecta: $7x10^4$ m^3. Small eruption on June 20. Very small eruption on June 29. Small eruption on June 30. Colored volcanic plume on July 8. Small eruption on October 31: Explosion sound.
1957 (Showa 32)	Phreatic eruption	Colored volcanic plume on February 24. Colored volcanic plume and rumbling on February 26. Very small eruption at Ponmachineshiri crater (one of the craters No. 1 through 4) on May 29: Pyroclastic fall. Colored volcanic plume in July. Very small eruption between August 31 and September 5 at Nakamachineshiri (Dai-Fun): Pyroclastic fall. Rumbling and felt-earthquakes from September to October.
1958 (Showa 33)	Phreatic eruption	Small eruption at Ponmachineshiri crater (one of the craters No. 1 through 4) on February 23: Pyroclastic fall.

Year	Phenomenon	Activity Sequence, Damages, etc.
1959 (Showa 34)	Phreatic eruption	Very small eruptions between May 15 and 21, and on July 28, at Nakamachineshiri (Dai-Fun): Pyroclastic fall. Small eruptions between August 2 and October 3 at Ponmachineshiri No. 1 crater (craters No. 3 and No. 4 also active?): Pyroclastic fall. Small eruption on August 2: A volcanic plume rose 800 to 1,000 m above crater. Small eruption on August 6: A volcanic plume rose 1,000 to 1,200 m above crater. Very small eruption between August 12 and 13. Small eruptions on August 15 and October 3. A volcanic plume appeared on October 10 and 30.
1960 (Showa 35)	Phreatic eruption	Colored volcanic plume on January 28. Very small eruption between September 7 and 9 at Nakamachineshiri (Dai-Fun): Pyroclastic fall. Small amount of tephra fall near Ponmachineshiri crater (No. 1 crater) on September 7 to 8.
1962 (Showa 37)	Phreatic eruption	Very small eruption on April 28 at Nakamachineshiri (Dai-Fun): Pyroclastic fall.
1964 (Showa 39)	Phreatic eruption	Very small eruption between June 20 and 27 at Nakamachineshiri (new crater southeast of Dai-Fun): Pyroclastic fall. [12,25]
1965 (Showa 40)	Phreatic eruption	Small eruption at Nakamachineshiri (65-I crater) between May 13 and 19: Pyroclastic fall.
1966 (Showa 41)	Phreatic eruption	Very small eruption in early June at Nakamachineshiri (65-I crater): Pyroclastic fall.
1973 (Showa 48)	Earthquake	Increase in earthquakes from March to June.
1975 (Showa 50)	Earthquake	Increase in earthquakes from March 21 to 24 and on April 15.
1976 (Showa 51)	Earthquake	Felt-earthquake on July 7: Earthquake north of Meakandake (details unknown): seismic intensity of 3 in JMA scale at Lake Akan, seismic intensity of 2 to 3 in JMA scale at Kitami Aioi and Meakan Onsen. Increase in earthquakes from July 7 to 11.
1979 (Showa 54)	Earthquake	Increase in earthquakes from July 15 to 19.
1980 (Showa 55)	Earthquake	Felt-earthquake on March 28. M2.5 earthquake approximately 10 km northeast of Meakandake. Maximum seismic intensity of 3 to 4 in JMA scale, measured at Oakan Hotel.
1982 (Showa 57)	Earthquake	Increase in earthquakes from March 19 to early April. Earthquakes rapidly increased after March 21 Urakawa Oki Earthquake, continuing until the start of April.
1983 (Showa 58)	Volcanic plume	Increase in volcanic plume volume in May. Active volcanic plume emission from Ponmachineshiri No. 1 crater, visible from Kushiro Local Meteorological Observatory (approximately 50 km from Meakandake).
1984 (Showa 59)	Volcanic tremors	7 volcanic tremors occurred on May 1. Evidence of tephra fall confirmed near Ponmachineshiri crater by field observation on May 29.
1985 (Showa 60)	Earthquake	Increase in earthquakes from June to July.
1987 (Showa 62)	Heat / earthquakes	August temperature increase: Ponmachineshiri No. 1 crater fumarole temperature 395 °C (measured via infrared radiation thermometer). October temperature increase: Ponmachineshiri No. 1 crater fumarole temperature 510 °C (measured via infrared radiation thermometer). Increase in earthquakes in December.
1988 (Showa 63)	Small-scale: Phreatic eruption	Small eruptions at Ponmachineshiri craters (craters No. 1 and 4?) from January 5 to 6, on January 8, from February 7 to 8, and on February 18: Pyroclastic fall. Total ejecta: 1×10^5 m^3. (VEI 1) Intermittent volcanic tremors from January 4 to February 26. Increased earthquakes from January to April and July to August. September temperature increase: Ponmachineshiri No. 1 crater fumarole temperature 306 °C. Increase in earthquakes and tremors from October to November. Approximately 2 minutes of tremors on October 27. Approximately 5 minutes of tremors on November 14.

Year	Phenomenon	Activity Sequence, Damages, etc.
1989 (Heisei 1)	Earthquake	Increase in earthquakes from September to November.
1990 (Heisei 2)	Earthquake	Increase in earthquakes from January to December.
1991 (Heisei 3)	Earthquake	Increase in earthquakes from January to February.
1992 (Heisei 4)	Earthquake	Increase in earthquakes from September to November.
1993 (Heisei 5)	Earthquake	Increase in earthquakes from April to June.
1995 (Heisei 7)	Earthquakes, volcanic tremors	Increase in earthquakes from August to November. Tremors in September and November.
1996 (Heisei 8)	Small-scale: Phreatic eruption	Increase in earthquakes from August 22 to September 2 and from September 28 to October 3. Small eruption at Ponmachineshiri crater on November 21: Pyroclastic fall. 96-1, 96-2, and 96-3 craters formed. Total ejecta: 36,000 tons. (VEI 1)
1997 (Heisei 9)	Earthquake	Felt-earthquake on May 22. M2.0 earthquake with hypocenter near Meakandake. Seismic intensity of 1 in JMA scale in Meakan Onsen, at foot of volcano.
1998 (Heisei 10)	Very small-scale: Phreatomagmatic eruption?	Increase in earthquakes from April 4 to 5. Hypocenter in Teshibedake area. Very small eruption at Ponmachineshiri 96-1 crater on November 9: Pyroclastic fall. Total ejecta: 1,100 tons. (VEI 0)
1999 (Heisei 11)	Bright crater appearance, heat, earthquakes	On May 12, high-sensitivity cameras observed that the area around the Ponmachineshiri 96-1 crater appeared bright at night. This was occasionally observed until late June. Temperature increase from June 4 to 6: High temperature of 651 °C recorded at 96-1 crater by infrared radiation thermometer. Temperature remained at 600° C or above until October. Temperature increase on July 7: High temperature of 671 °C recorded at 96-1 crater by infrared radiation thermometer. Fumarolic activity resumed at Shibukawa mud volcano at northeast foot of mountain. Increase in earthquakes from October 25 to November 1.
2000 (Heisei 12)	Earthquake	Felt-earthquakes from January 24 to 25. Relatively clustered shallow earthquakes with hypocenter approximately 11 km north of Meakandake (5 earthquakes in 2 days). The largest earthquake was a M2.3 earthquake at 18:38 on January 25. Interviews indicated a maximum seismic intensity of 2 in JMA scale at Lake Akan. Increase in earthquakes on February 13. Hypocenter in Teshibedake area. Increase in earthquakes from April 4 to 30. Hypocenter in Teshibedake area.
2002 (Heisei 12)	Earthquakes, volcanic tremors	Increase in earthquakes from January to February: Hypocenters in Teshibedake area. Increase in earthquakes and volcanic tremors on March 29: Approximately 3 minutes of volcanic tremors were observed. These were immediately followed by an increase in earthquakes. 139 earthquakes on March 29, and 19 on March 30. No anomalies such as a volcanic plume.
2006 (Heisei 18)	Very small-scale: Phreatomagmatic eruption	Increase in earthquakes and volcanic tremors from February 18 to 20. Felt-earthquake on March 7. The earthquake's hypocenter was approximately 18 km east-southeast of Meakandake. The maximum seismic intensity of 1 in JMA scale, measured at Tsurui. Increase in earthquakes from March 11 to 12. Volcanic tremors on March 19. Very small eruptions on northwest slope of Ponmachineshiri and at Akanuma crater on March 21: Tephra fall, lahar. Lahar occurred on northwest slope of Ponmachineshiri. Total ejecta: 9,000 tons. (VEI 0) Increase in earthquakes and volcanic tremors from May 9 to 10. Felt-earthquake on July 5: The earthquake's hypocenter was approximately 12 km north of Meakandake. Maximum seismic intensity of 3 in JMA scale, measured at Lake Akan Onsen.

Year	Phenomenon	Activity Sequence, Damages, etc.
2008 (Heisei 20)	Small-scale: Phreatic eruption	Increase in earthquakes from January 9 to 10. Volcanic tremors on September 16 and 29. Increase in earthquakes from September 26 to 30. Slight temperature increases observed by field observation in mid-October at Ponmachineshiri 96-1 crater and Ponmachineshiri No. 4 crater. Increase in earthquakes from November 9 to 12. Volcanic tremors on November 16-19, November 21, 26, 27, and November 28 to 29. Small eruptions at Ponmachineshiri 96-1 crater and No. 4 crater on November 18 and from November 28 to 29. Pyroclastic fall. Total ejecta: 1,200 tons. (VEI 1) Increase in earthquakes and volcanic tremors in December.
2009 (Heisei 21)	Earthquake	Increase in earthquakes from January to April, and in July and September.
2010 (Heisei 22)	Earthquakes, volcanic tremors	4 volcanic tremors on December 17. Increase in earthquakes from December 17 to 19.
2011 (Heisei 23)	Earthquakes, volcanic tremors	Volcanic tremors in July and November. Increase in earthquakes in October.

* Reference documents have been appended with reference to the catalog of eruptive events during the last 10,000 years in Japan, database of Japanese active volcanoes, and AIST (Kudo and Hoshizumi, 2006) for eruptive period, area of activity and eruption type.

Whole Rock Chemical Composition

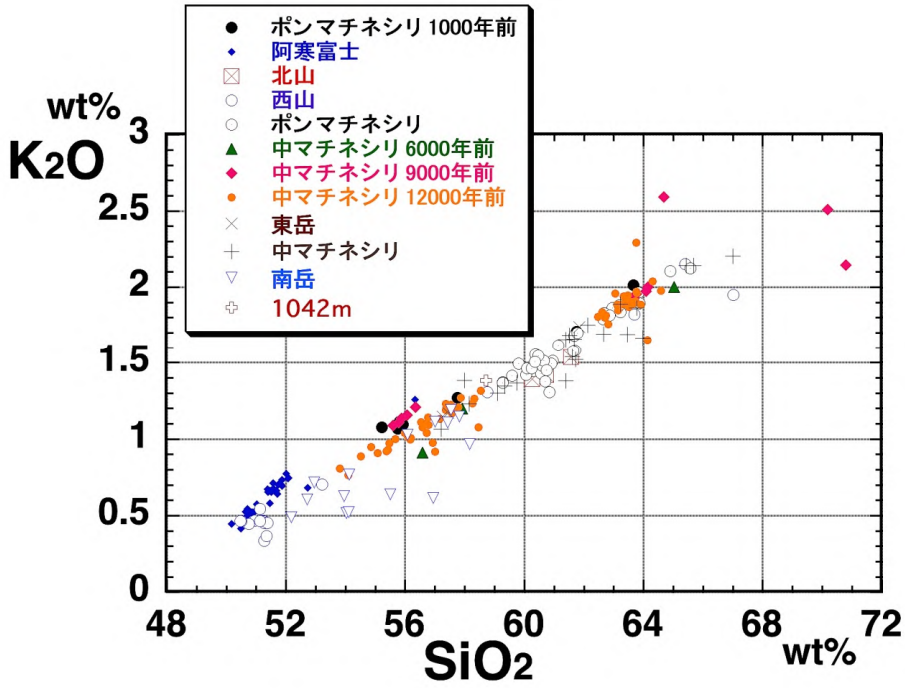


Figure 7-3 Whole rock chemical composition by SiO_2-K_2O diagram (Wada et al., 1998).

Major Volcanic Activities

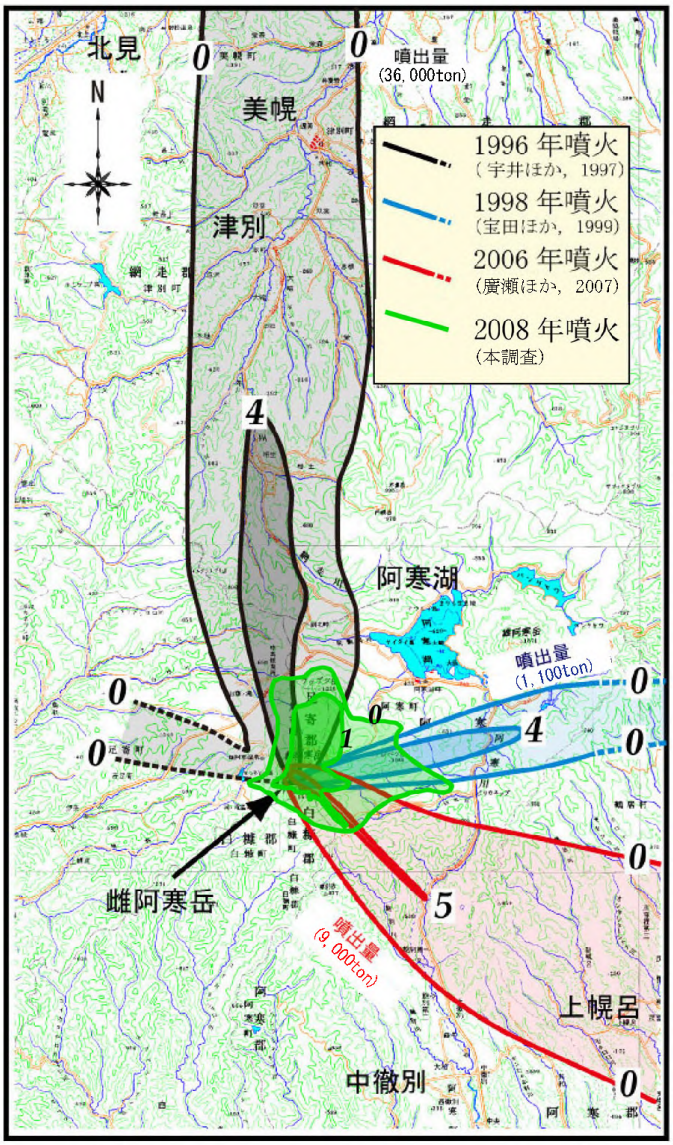
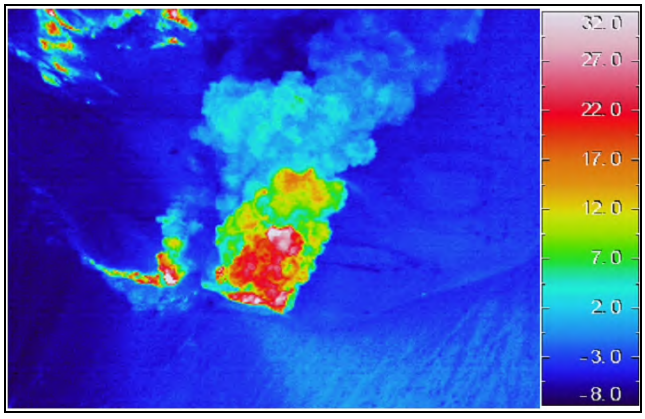


Figure 7-4 Distribution of ash fall for the eruption since 1996 (Ishimaru et al., 2009).

Visible image - Ponmachineshiri 96-1 crater after the eruption at
No. 4 Crater, taken from southeast side at 11:50, November 28, 2008 by the Japan Meteorological Agency



Infrared image - Ponmachineshiri 96-1 No. 4crater after the eruption, taken from southeast side at 11:50 on November 28, 2008 by the Japan Meteorological Agency

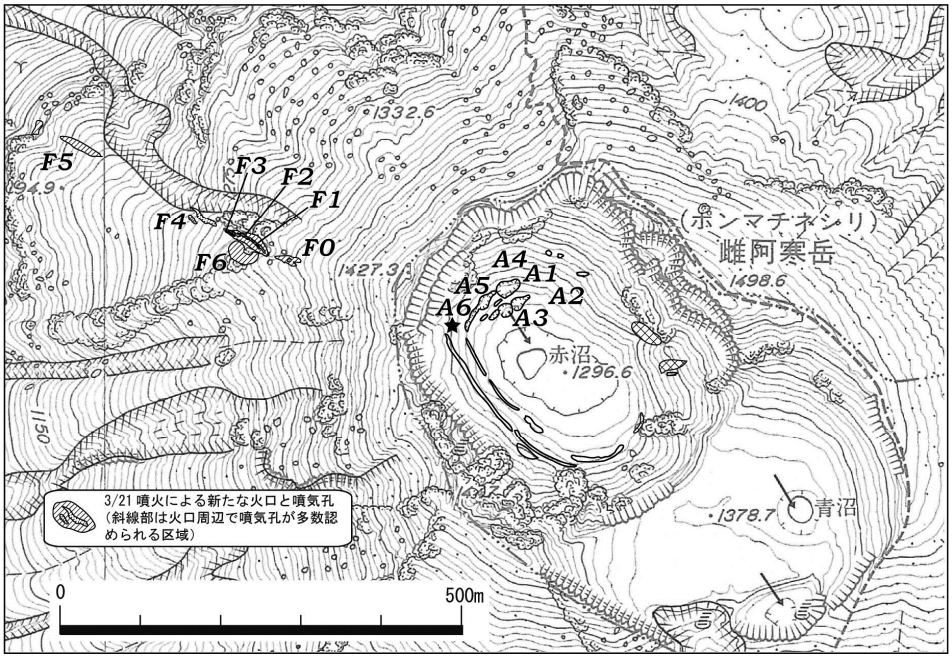


Figure 7-5 Distribution of craters and fumaroles formed by the 2006 eruption (Hirose et al., 2007a).

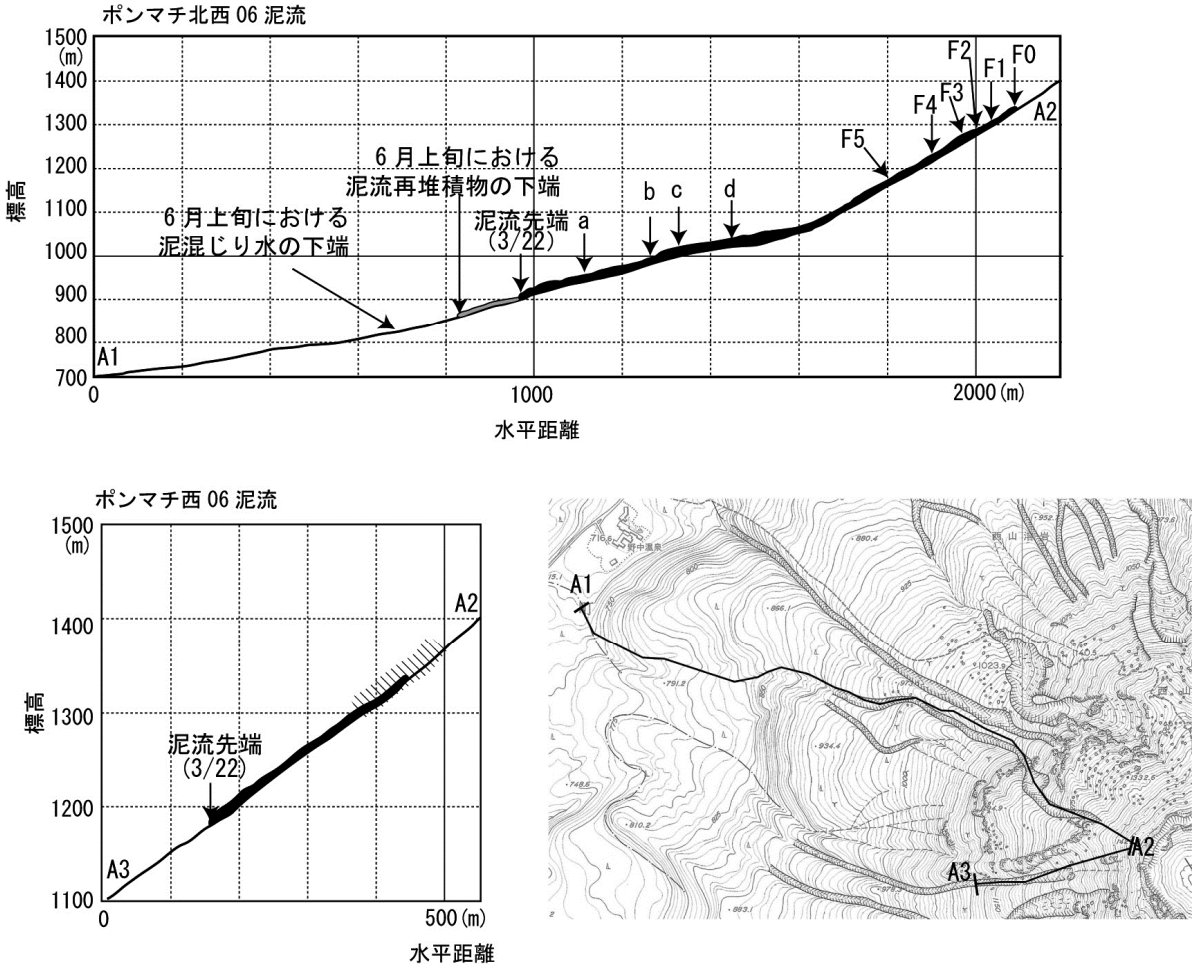


Figure 7-6 Flow routes of lahar produced by the 2006 eruption (Hirose et al., 2007b).

Precursory Phenomena

The phreatic eruptions of recent years was preceded by increases in seismic activity, volcanic tremors, increased crater temperatures, and thermal demagnetization in the shallow areas from 1 to several months in advance of the eruption.

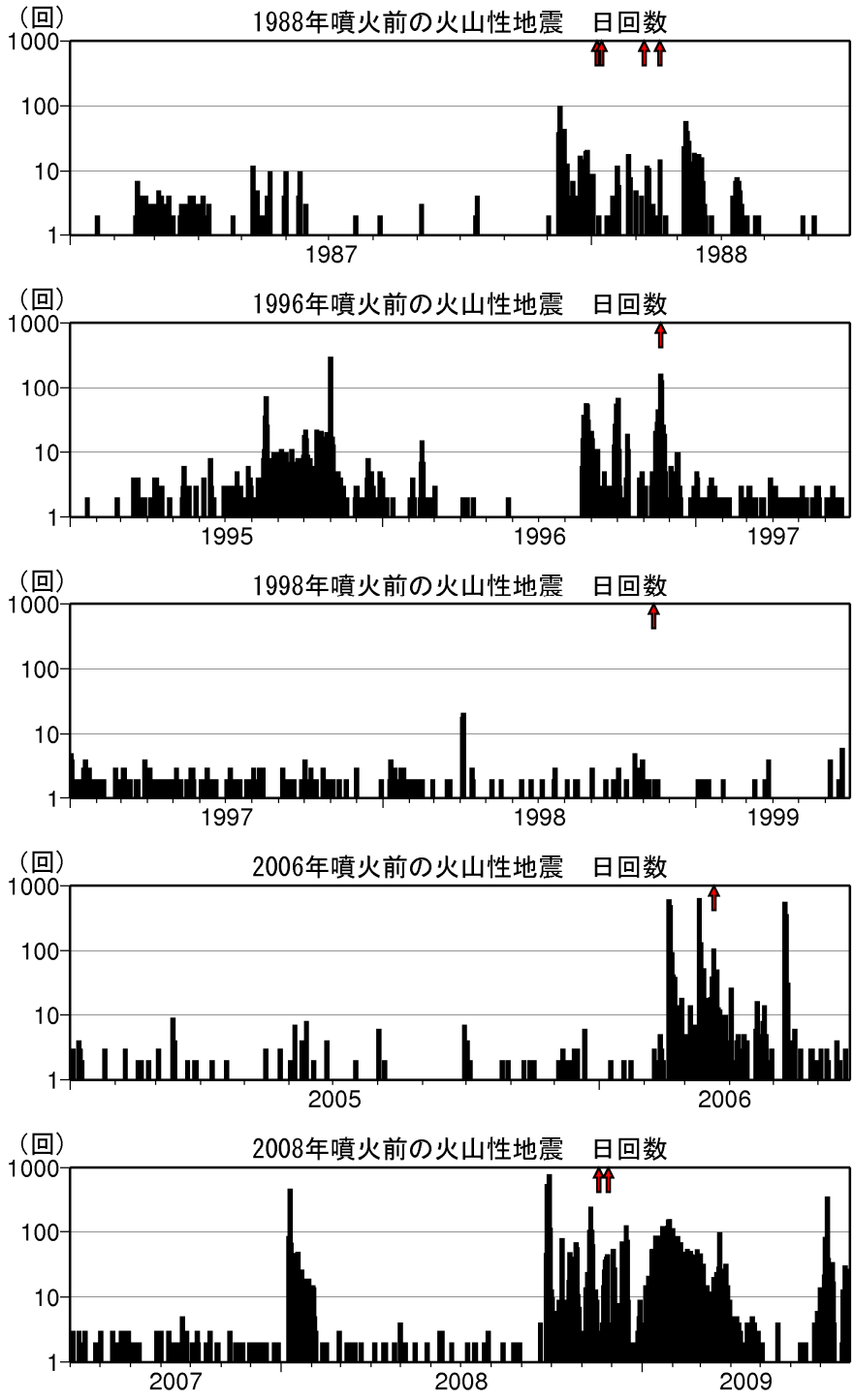


Figure 7-7 Changes in numbers of volcanic earthquakes before and after eruptions.

①Number of volcanic earthquakes per day before 1988 eruption

②Number of volcanic earthquakes per day before 1996 eruption

③Number of volcanic earthquakes per day before 1998 eruption

④Number of volcanic earthquakes per day before 2006 eruption

⑤Number of volcanic earthquakes per day before 2008 eruption

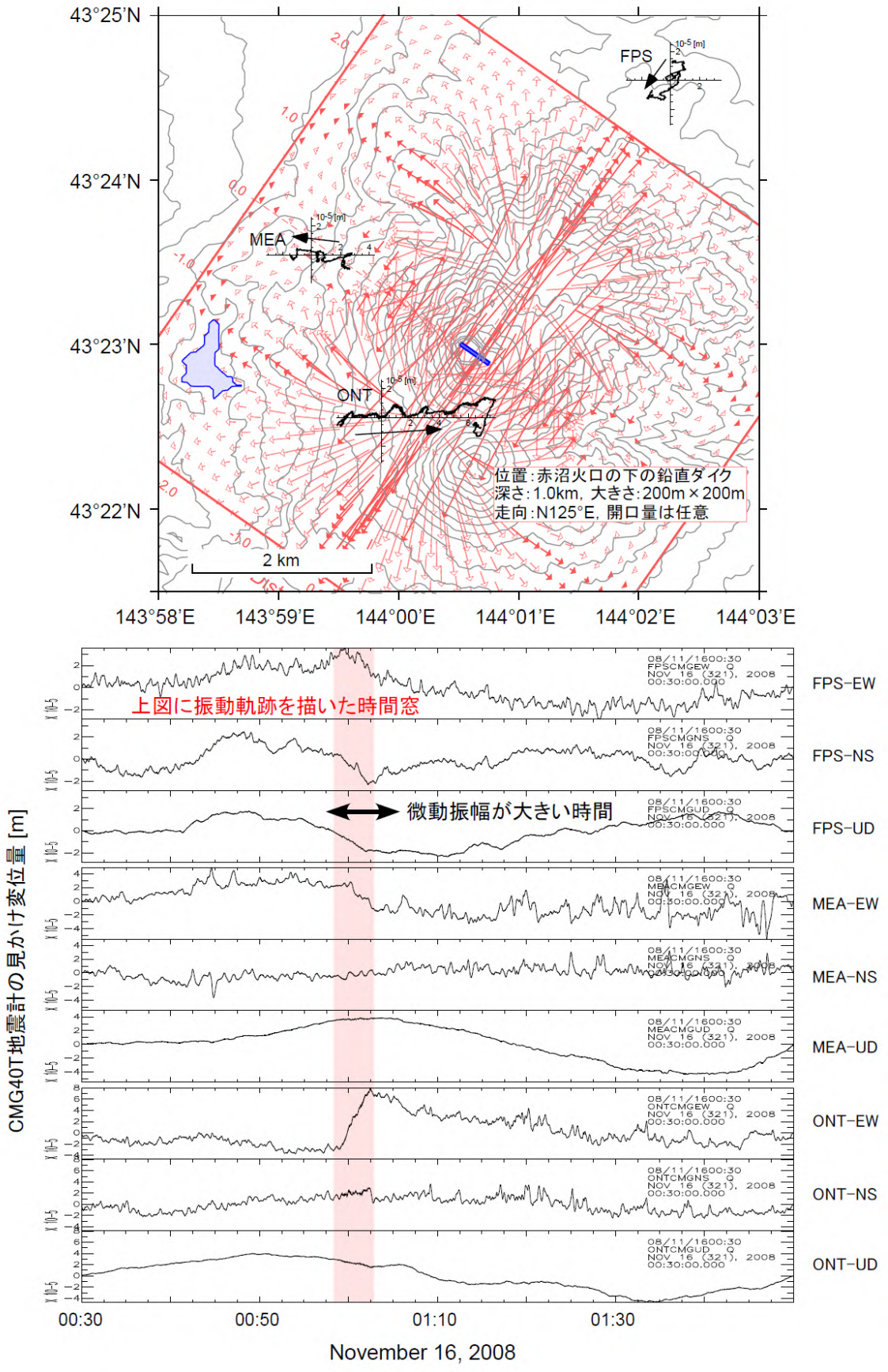


Figure 7-8 Example of tilt-change which accompanied volcanic tremors observed by broadband seismometers before the 2008 eruption (Hokkaido University, 2009).

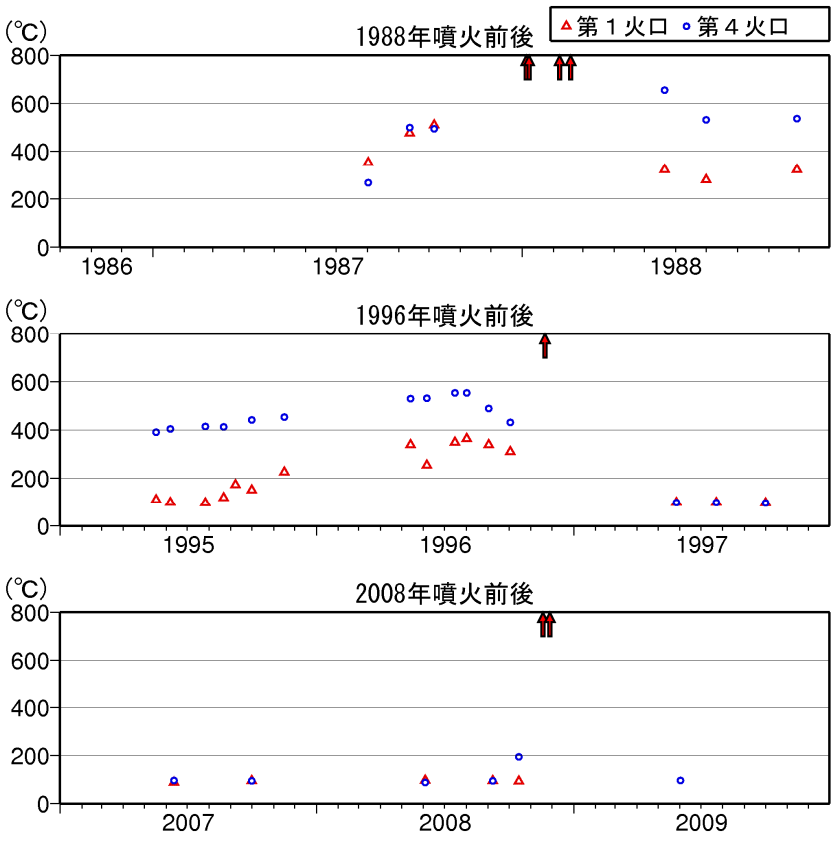


Figure 7-9 Time serried of temperature inside the crater before and after eruptions (↑ symbols represent eruptions).

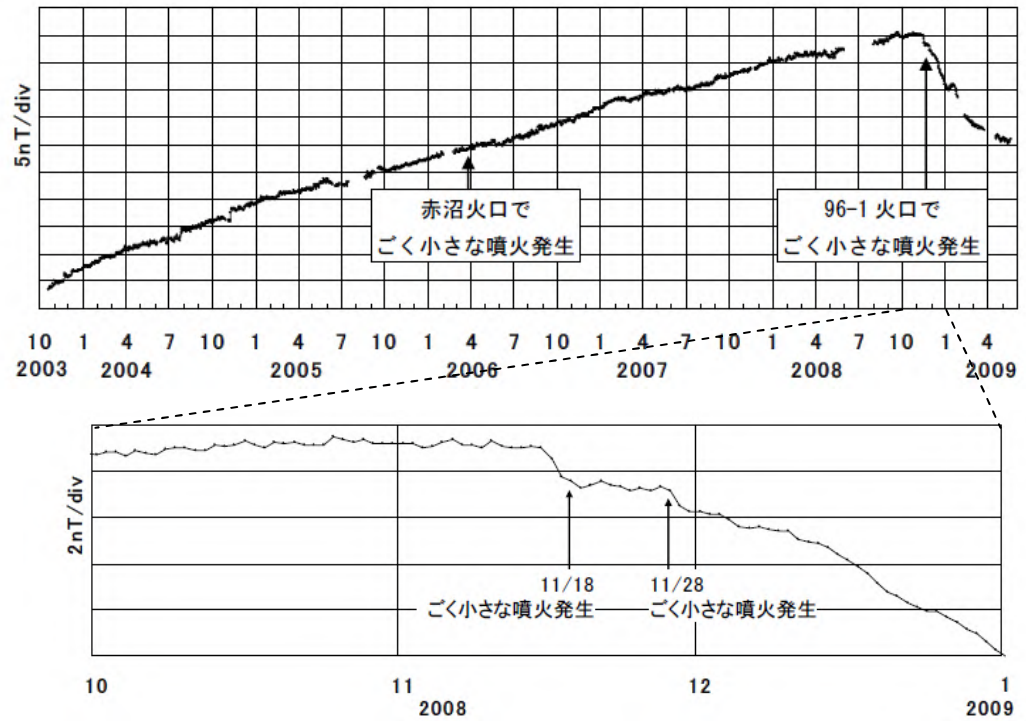


Figure 7-10 Changes in geomagnetic total force observed on south side of 96-1 crater in the 2008 eruption (Kakioka Magnetic Observatory, JMA, 2009).

Recent Volcanic Activity

・Activity Chronograms

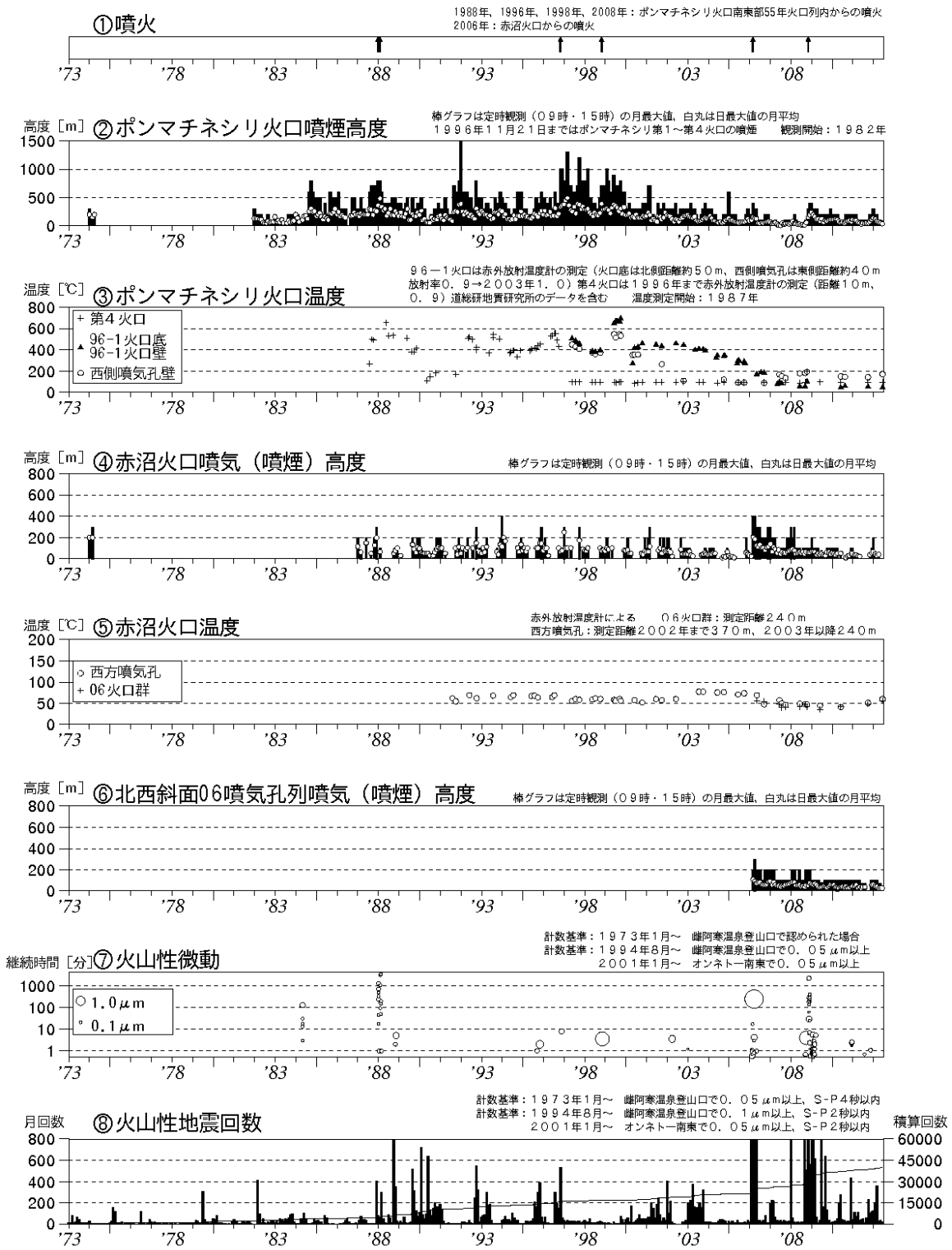


Figure 7-11 Meakandake volcano activity (1973 to June, 2012).

①Eruptions, ②Plume heights at Ponmachineshiri, ③Temperatures inside Ponmachineshiri crater,

④Plume heights at Akanuma crater, ⑤Temperatures inside Akanuma crater,

⑥Plume heights at the northwest flank 06 fumaroles, ⑦Duration and maximum amplitudes of volcanic tremors

⑧Monthly number of volcanic earthquakes

・Volcanic Earthquake Epicenter Distribution

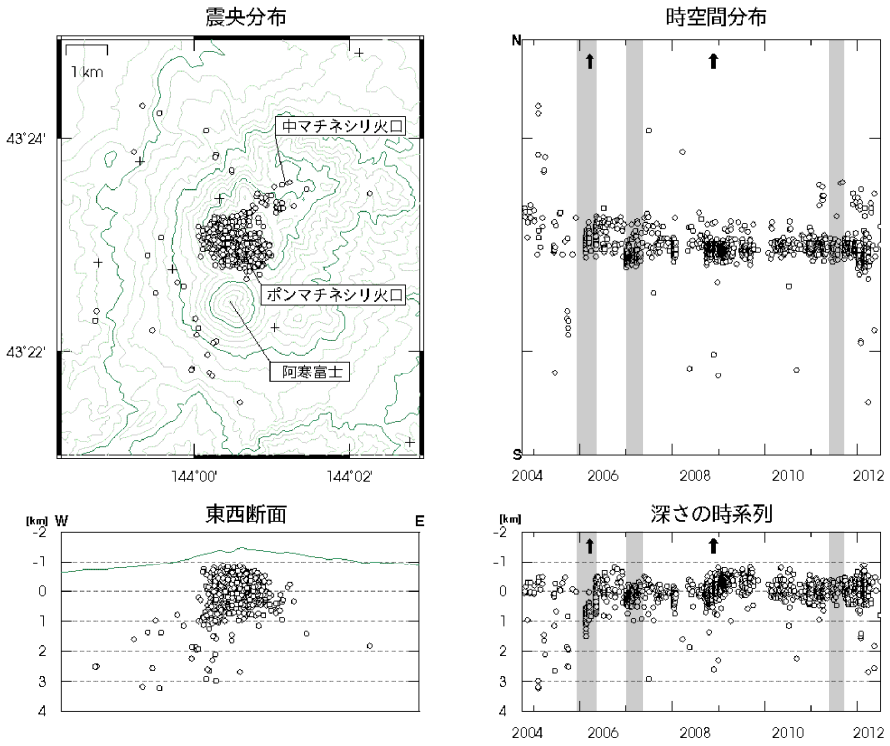


Figure 7-12 Distribution of volcanic earthquakes (October, 2004, to June 30, 2012).
+ symbols indicate observation points, ↑ symbols represent eruptions
* Periods indicated in gray represent periods where data are partly lacking, resulting in a decrease in number of identified hypocenters and resulting reduction in accuracy.
①Epicenter distribution
②Space-time plot
③E-W cross-section
④Depth time series

・Seismic Activity

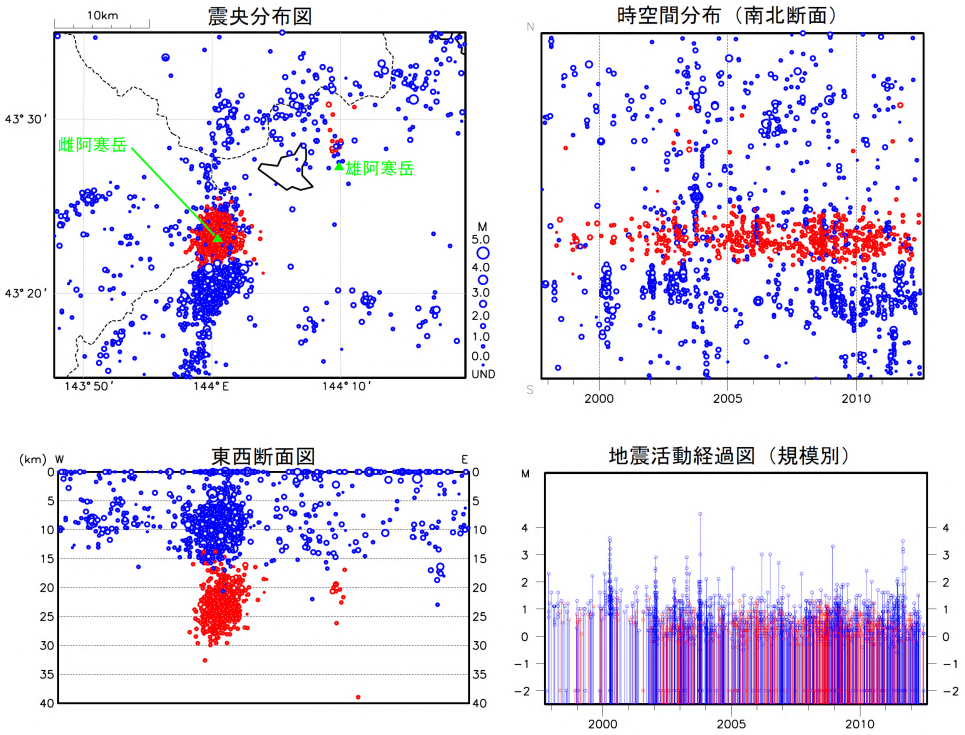


Figure 7-13 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to June 30, 2012). Epicenter distribution (upper left), space-time plot (N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (lower right).

・Recent Crustal Deformation (GPS Baseline Length Changes)

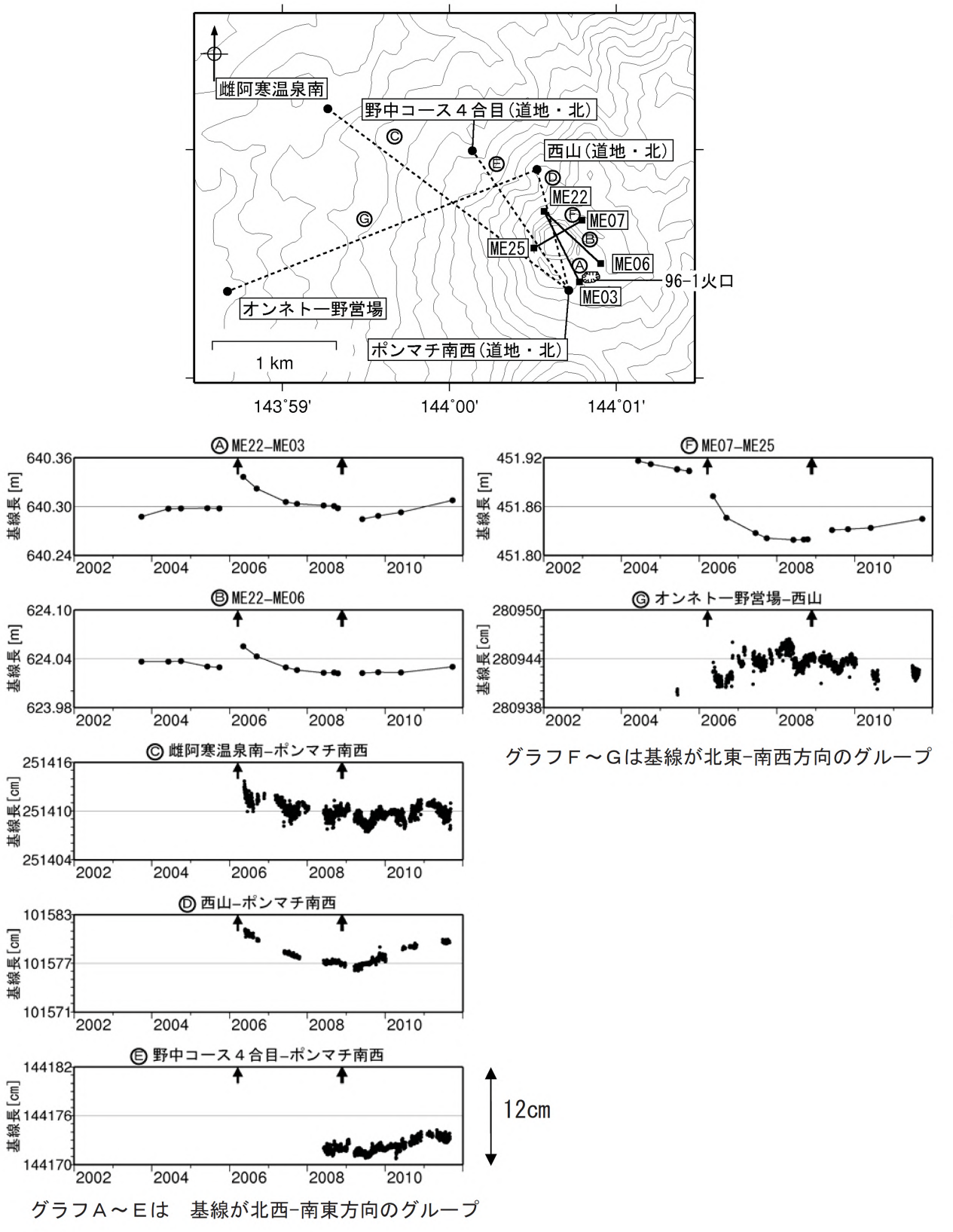


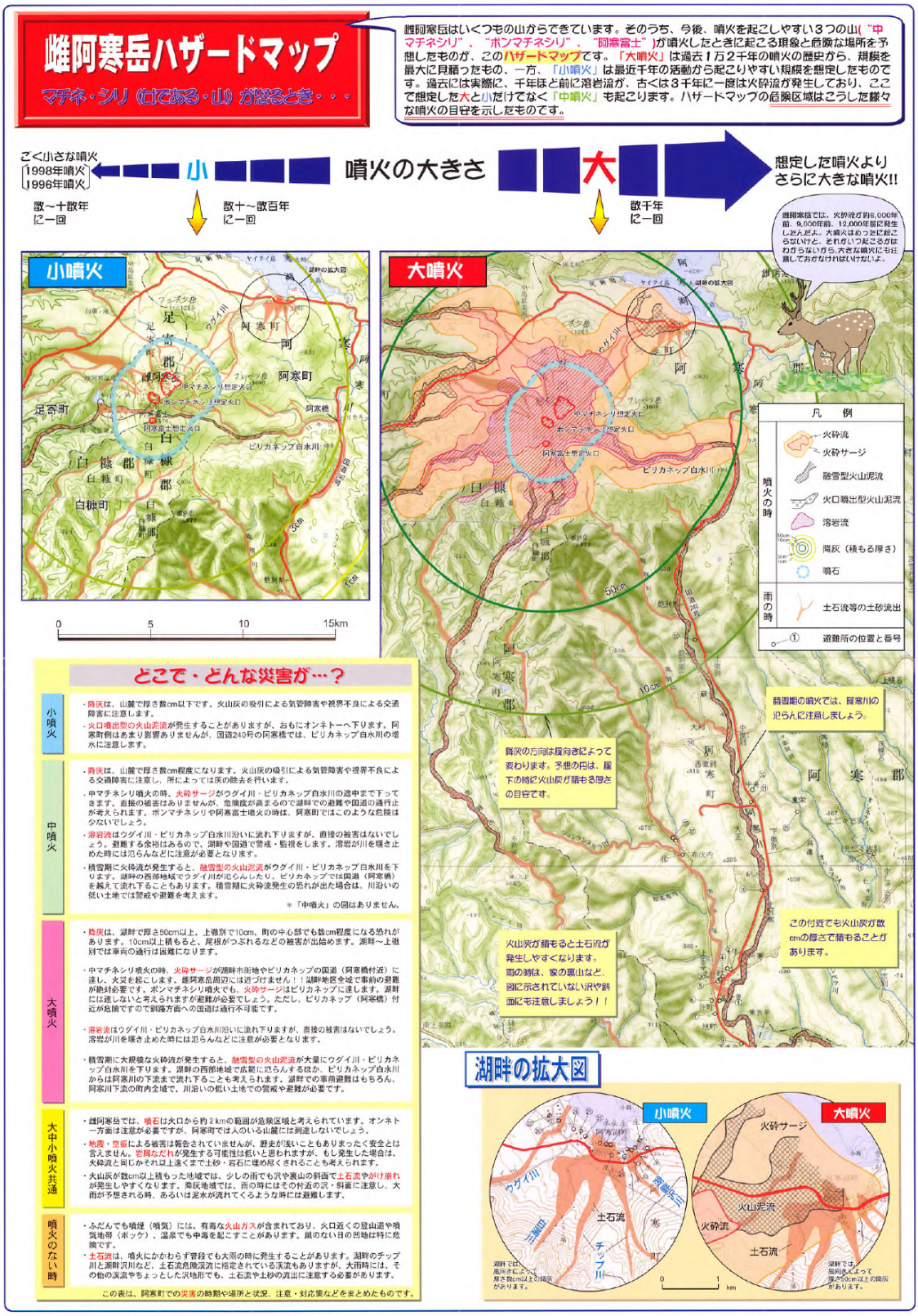
Figure 7-14 Changes of the GPS baselines (2003 to 2011, ↑ symbols represent eruptions) and observation points (Japan Meteorological Agency, 2011).
The digital map 50m grid (elevation) published by the Geospatial Information Authority of Japan was used to create this map.
Graphs A to E (left) are for northwest-southeast baselines.
Graphs F to G (right) are for northeast-southwest baselines.

Information on Disaster Prevention

①Hazard Map

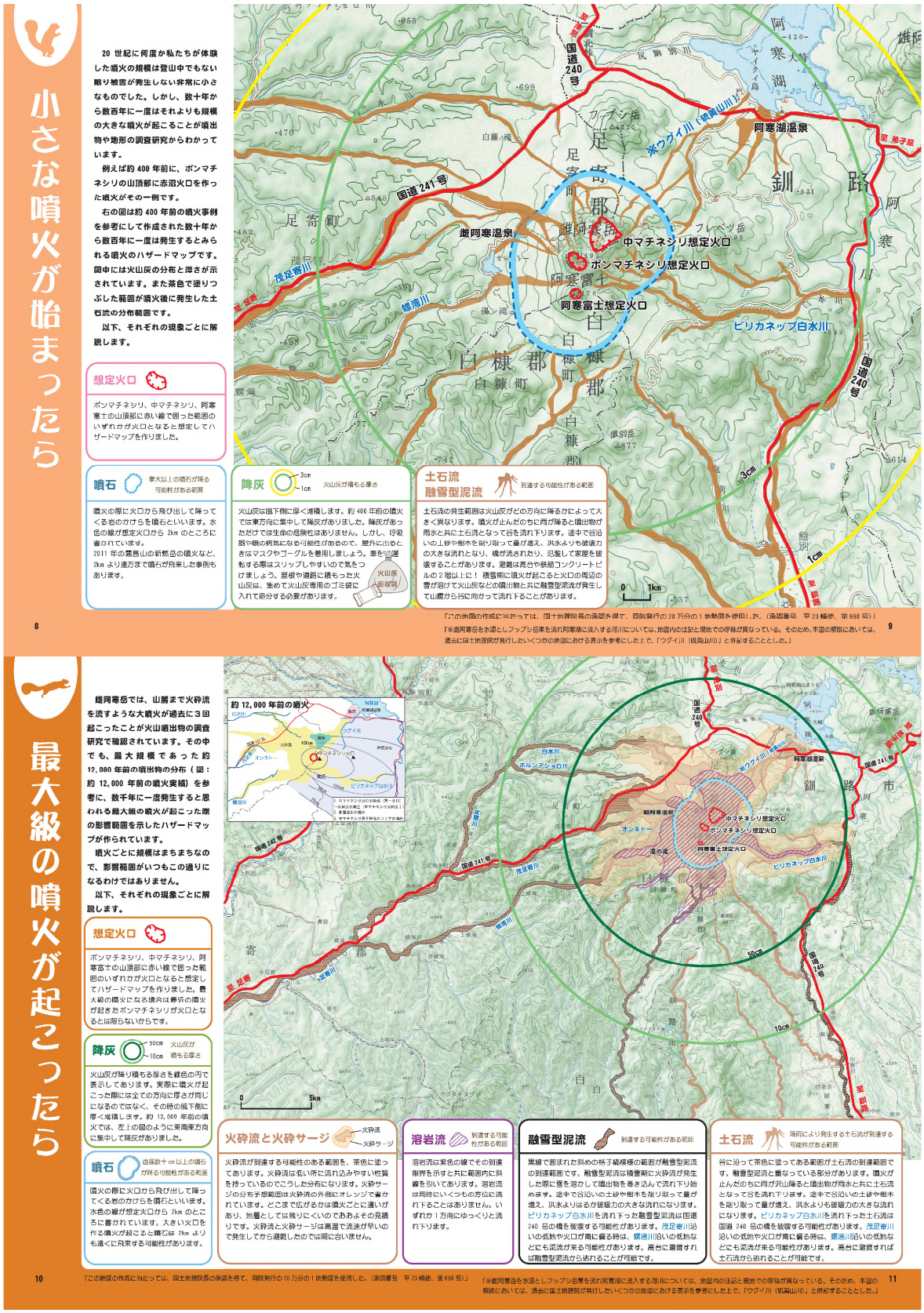
Akandake Disaster Special Edition (Akan Edition) August, 1999 - Published by the General Affairs Manager of the Akan General Affairs Division - Editorial supervision by Katsui and Ui

http://www.city.kushiro.lg.jp/common/000008838.pdf

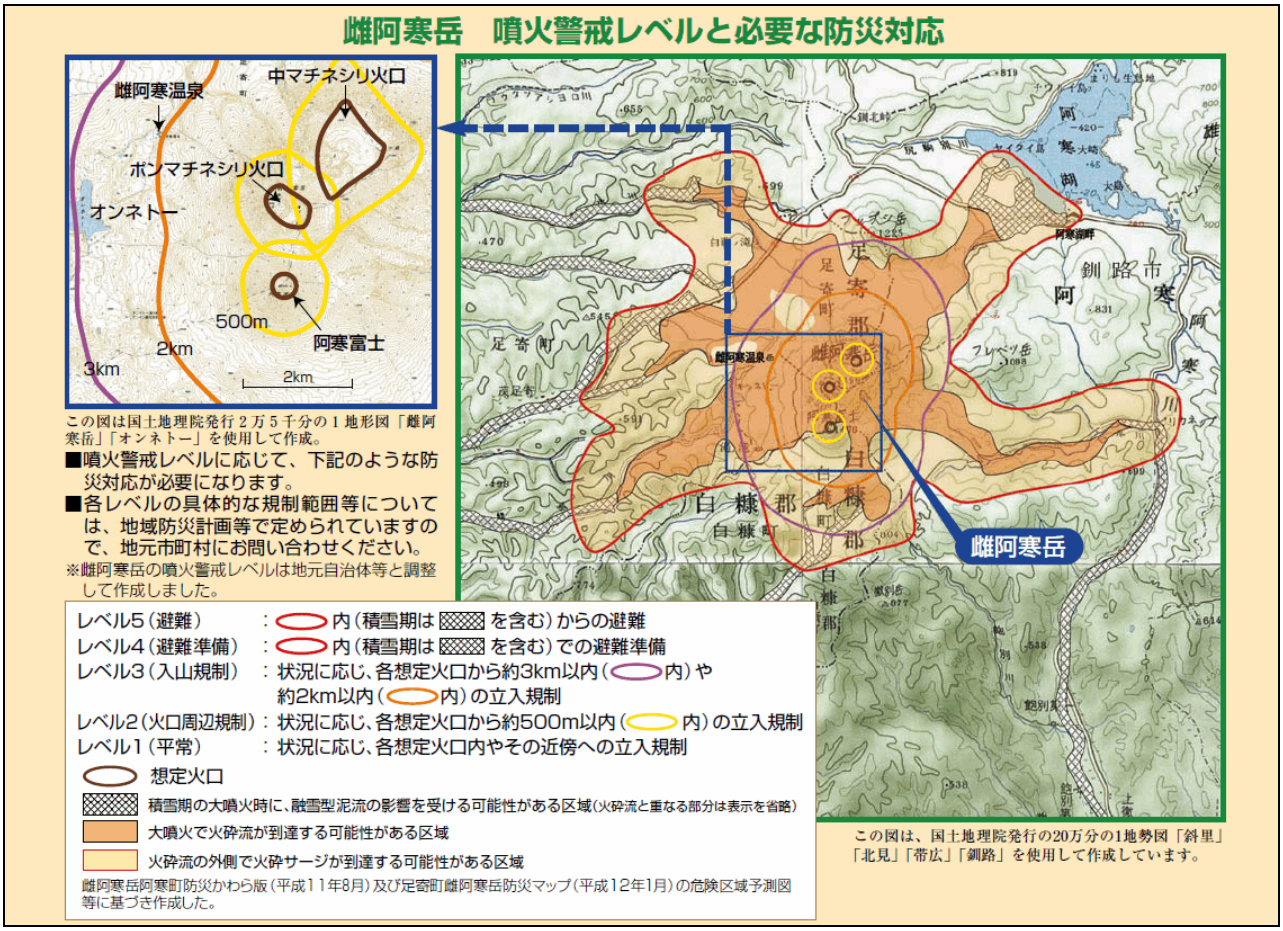


Meakandake Volcano Disaster Guidebook - Living With Meakandake - September, 2012 - Published by the Meakandake Volcano Disaster Committee - Editorial supervision by Ui, T. et al.

http://www.city.kushiro.lg.jp/common/000033664.pdf



②Volcanic Alert Levels (Used since December 16, 2008)



Volcanic Alert Levels for the Meakandake Volcano (Valid as of December, 2008)

Warning and Forecast	Target Area	Levels & Keywords	Expected Volcanic Activity	Actions to be Taken by Residents and Climbers	Expected Phenomena and Previous Cases
Eruption Warning	**Residential areas and areas closer to the crater**	**5 Evacuate**	Eruption or imminent eruption causing significant damage to residential areas	Evacuate from the danger zone	●Large eruption or imminent large eruption, with pyroclastic flow and/or melted snow lahar (during periods when snow has accumulated) reaching residential areas, and large volume of pumice and volcanic ash sedimentation over wide area downwind. Past Examples Approx. 12,000 years ago
		4 Prepare to evacuate	Forecast of eruption causing significant damage to residential areas (increased probability).	Those within the alert area should prepare for evacuation. Those requiring protection in the event of an disaster must be evacuated.	●Large eruption is expected to result in pyroclastic flow and/or melted snow lahar (during periods when snow has accumulated) reaching residential areas. Past Examples No observed examples (when medium sized eruptions such as those approximately 6,000 and 9,000 years ago, and there are indicators that the magnitude of the eruptions will reach large eruptions, or when there is a possibility that pyroclastic flows or melted snow lahar will reach residential areas)
Crater Area Warning	**Non-residential areas near the volcano**	**3 Do not approach the volcano**	Eruption or prediction of eruption causing significant damage to areas near residential areas (entering area is life threatening).	Residents can go about daily activities as normal (paying close attention to volcanic activity). When necessary, evacuation preparations should be performed for those requiring protection in the event of a disaster. Access restrictions for dangerous areas, including mountain climbing and mountain access prohibitions, etc.	●Medium sized eruption, scattering volcanic blocks 2 to 3km away, pyroclastic flows several km long in some valley areas, melted snow lahar during periods when snow has accumulated, sedimentation of pumice and volcanic ash downwind of the volcano at its foot, and/or lava flows. Past Examples Approx. 6,000 and 9,000 years ago ●Small eruption scattering volcanic blocks 2 to 3km away and sedimentation of volcanic ash, etc. downwind of the volcano at its foot. Past Examples Approx. 400 and 700 years ago ●Very small eruption (relatively strong) scattering volcanic blocks 1 to 2km away and sedimentation of volcanic ash, etc. downwind of the volcano at its foot and on its slope. Past Examples August, 1959, and May to June, 1956 ●Increase in earthquakes and crustal deformations results in forecasts of medium eruptions, small eruptions, and very small eruptions (relatively strong). Past Examples No observed examples
	Crater area	**2 Do not approach the crater**	Eruption or prediction of eruption affecting area around crater (entering area is life threatening).	Residents can go about daily activities as normal (paying close attention to volcanic activity). Access to crater area restricted, etc.	●Very small eruption scattering volcanic blocks around the crater (approximately 500m). Past Examples Majority of very small eruptions in mid-20th century, such as eruptions of March 21, 2006, November, 1998, November, 1996, and January to February, 1988 ●Increase in seismic activity and thermal activity, etc. results in forecasts of very small eruptions. Past Examples February 18 to February 20, 2006, March 11 to March 12: Many minor earthquakes and tremors 1999: Rapid temperature increase at Ponmachineshiri 96-1 crater August to September, 1996: Many minor earthquakes December, 1987: Increase in earthquakes
Eruption Forecast	**Inside the crater**	**1 Normal**	Little or no volcanic activity. Volcanic ash may be emitted within the crater as a result of volcanic activity (entering area is life threatening).	Access to interior of and area around crater restricted as necessary, etc.	●Little or no volcanic activity. Possibility of emission of volcanic ash, etc. which may affect summit crater interior and nearby area.

Note 1) The volcanic blocks mentioned in this table refer mainly to blocks large enough that their trajectories are not affected by wind.

Note 2) Large eruptions refer to eruptions with volcanic plumes extending 10,000m or more directly above the crater rim, with pyroclastic flows over a wide area, and whose pyroclastic flows are accompanied by large melted snow lahars in periods when snow has accumulated.

Note 3) Moderate eruptions refer to eruptions with volcanic plumes extending 3,000 to 10,000m directly above the crater rim, scattering volcanic blocks between 2 and 3km away from the crater, which in some cases are accompanied by pyroclastic flows or lava flows down valleys, and which produce melted snow lahars when pyroclastic flows occur during periods when snow has accumulated.

Note 4) Small eruptions refer to eruptions with volcanic plumes extending 2,000 to 5,000m directly above the crater rim, and which scatter volcanic blocks between 2 and 3km away from the crater.

Note 5) Very small eruptions refer to eruptions with volcanic plumes extending several hundred to 2,000m directly above the crater rim, and which scatter volcanic blocks between several hundred meters and 2km away from the crater.

Social Circumstances

①Populations

- Lake Akan Onsen area population: 1,402 (from statistics current as of end of October 2011)
- Meakan Onsen area population: 5 (from statistics current as of end of October 2011)

* Population of other area (Moashoro area): 41

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

- Akan National Park, Lake Akan Onsen area

  Number of sightseers per year: Approx. 924,000

  (Number of sightseers entering Lake Akan Onsen area, from 2010 Hokkaido-wide municipal study)
- Akan National Park, Meakan Onsen area (Onneto area)

  Number of sightseers per year: Approx. 452,000

  (Number of sightseers entering Meakan Onsen area, from 2010 Hokkaido-wide municipal study)
- Akan National Park Meakandake

  Number of mountain-climbers per year: Approx. 10,100 (June 1 to October 31, 2010)

  Akanko Ranger Office for Nature Conservation mountain-climber counter

③Facilities

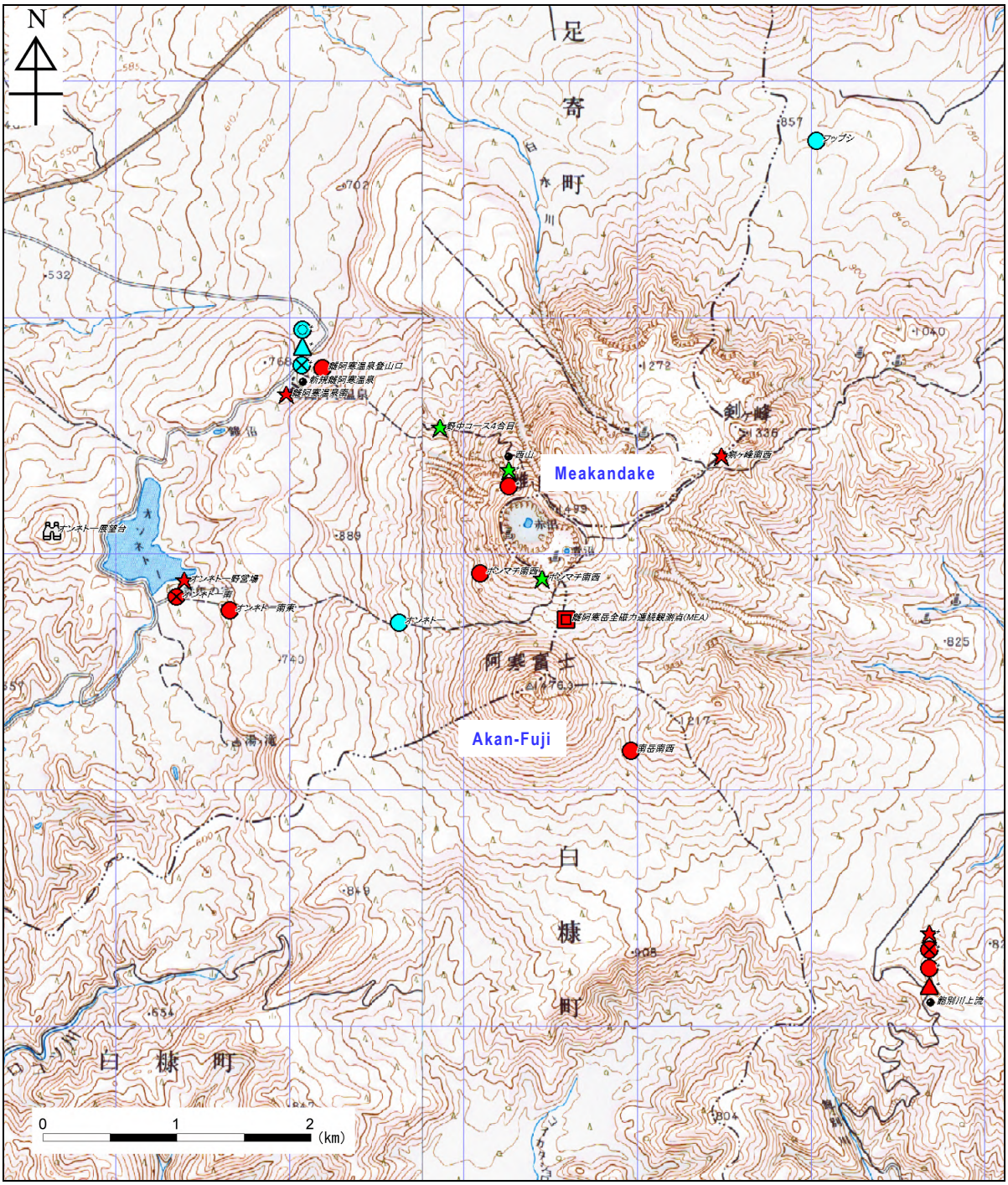
- Kushiro City Akan-cho Akanko Onsen

  Akankohan Eco-Museum Center

Monitoring Network * See Oakandake for wide area map

In and Around the Summit

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



1:50,000 scale topographical maps (Ukotakinupuri, Kamiashoro, Teshibe and Akan Ko) published by the Geospatial Information Authority of Japan were used.

Legend

(JMA)	(GSI)	(Hokkaido Univ.)	(Hokkaido Govt.)
seismometer(SP)	GPS	seismometer(SP)	visual camera
GPS		seismometer (broadband)	
tiltmeter	(NIED)	tiltmeter	(GSH)
infrasonic microphone	Hi-net	infrasonic microphone	GPS
visual camera	K-NET		
scalar magnetometer	KiK-net		

Figure 7-15 Local monitoring network.

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(Nakagawa, M., and Wada, K.)