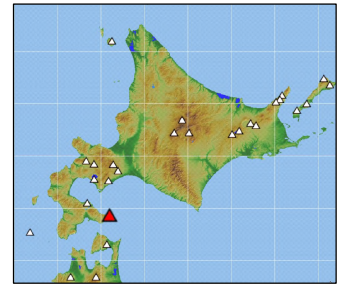


19. Esan

Continuously Monitored by JMA

Latitude: 41°48'17" N, Longitude: 141°09'58" E, Elevation: 618 m (Esan)
(Triangulation Point)



Overview of Esan, taken from east side on March 13, 2009 by the Japan Meteorological Agency

Summary

Volcanic activity at Esan began approximately 40,000 to 50,000 years ago, and lava domes such as Kaikozan, the somma, Todoyama, and Sukaizawasan, and the pyroclastic flows that accompanied their formation, occurred until approximately 10,000 years ago. After that, the Esan dome was formed, accompanied by a pyroclastic flow. Since the formation of the Esan lava dome, small scale eruption activity has occurred. Fumarolic activity exists at the explosion crater at the western foot of the Esan lava dome. Sulfur deposits are located in and around this explosion crater and the Esan lava dome. The volcano is prone to phreatic eruptions and lahars. The SiO₂ content is between 54.3 and 62.7 wt.%.

Photos



Lava Dome Explosion Crater, taken from west side on October 31, 2007 by the Japan Meteorological Agency

Topography around the Crater

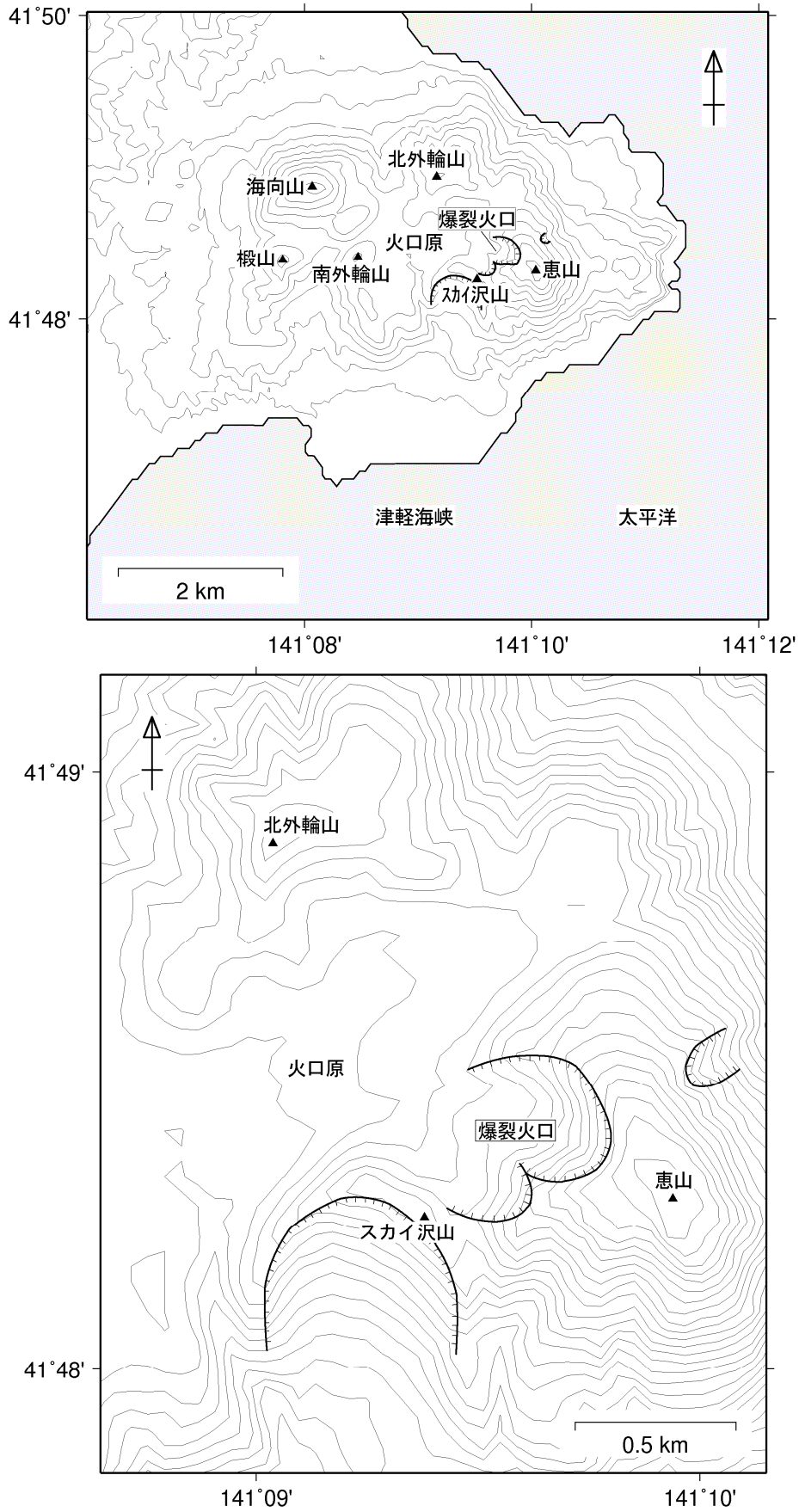


Figure 19-1 Detailed topography of the crater area.
The cliff at the south of Sukaizawasan is a collapse wall.

Red Relief Image Map



Figure 19-2 Topography of Esan.

1:50,000 scale topographic maps (Esan and Osatsube) 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

The Motomura eruption approximately 8,000 years ago produced a large pyroclastic flow, forming a plateau at the foot of the volcano, as well as forming the Esan lava dome. Volcanic activity also occurred thereafter, approximately 5,000, 3,000, 2,500, and 600 years ago. Each eruption other than the eruption of approximately 3,000 years ago included pyroclastic flows and pyroclastic surges. The activity approximately 2,500 years ago produced a debris avalanche through the collapse of the Esan dome. In recent years phreatic eruptions occurred in 1846 and 1874. The 1846 eruption produced lahar, which resulted in a large number of deaths (Arai et al., 1998; Esan Volcano Disaster Committee, 2001; Tajika, 2006).

Period	Area of Activity	Eruption Type	Main Phenomena / Volume of Magma
8.7ka	Esan summit area	Magmatic eruption	Motomura pyroclastic flow and Esan lava dome eruption (pyroclastic flow / pyroclastic surge → lava dome). Magma discharge > 0.032 km ³ DRE. (VEI 3)
6←→5.8ka	Northwest of Esan	Magmatic eruption	Es-1 eruption: Pyroclastic flow → lahar
3ka	Northwest of Esan	Phreatic eruption	Es-2 eruption: Tephra fall
2.5ka	Daijigoku crater	Phreatic eruption (collapse)	Es-3 eruption: Pyroclastic surge, debris avalanche
0.6ka	Northwest of Esan	Phreatic eruption	Es-4 eruption: 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.
1764 (Meiwa 1)	Fumarole	Increased fumarolic activity in July (lunar calendar), large number of deaths.
1845 (Koka 2)	Heat	Sulfur fire on July 15 (solar calendar).
1846 (Koka 3)	Phreatic eruption	Es-5 eruption: Small eruption from the Mizunashizawa crater on November 18 (solar calendar). Lahar was produced. Damage to homes, and a large number of deaths.
1857 (Ansei 4)	Fumarole, heat	Increased fumarolic activity and sulfur fire on May 21.
1874 (Meiji 7)	Small-scale: Phreatic eruption	Es-6 eruption: Small eruption from the Daijigoku crater on June 8. Tephra fall. Total ejecta: 0.0001 km ³ . (VEI 1)
1876 (Meiji 9)	Heat	Sulfur fire.
1962 (Showa 37)	Heat	Sulfur fire.

* 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.

Precursory Phenomena

Localized felt-earthquakes and rumbling immediately preceded the 1846 eruption.

Recent Volcanic Activity ▪ Activity Chronograms

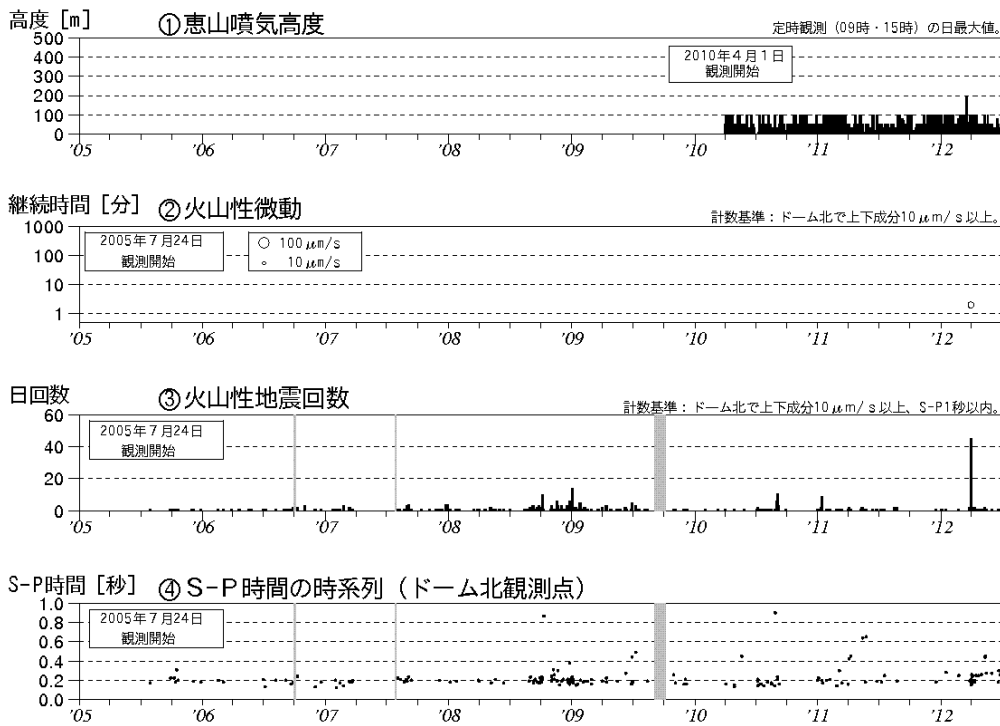


Figure 19-3 Volcano activity (January, 2005 to June, 2012).

- ① Fume heights
- ② Daily number of volcanic tremors
- ③ Daily number of volcanic earthquakes
- ④ S-P time series (Dome north observation point)

▪ Seismic Activity

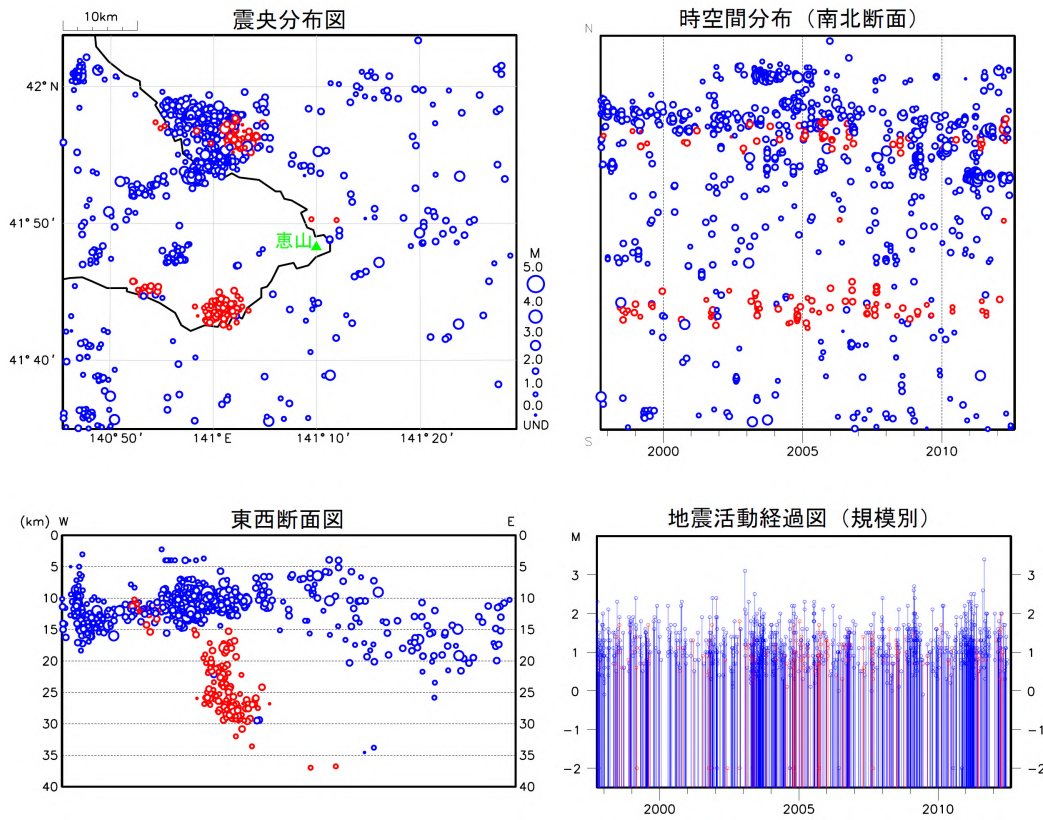


Figure 19-4 Activity of shallow VT earthquakes (blue circles) and deep low-frequency earthquakes (red circles) observed by a regional seismometer network (October 1, 1997, to June 30, 2012). Epicenter distribution (upper left), space-time plot (N-S cross-section) (upper right), E-W cross-section (lower left) and magnitude-time diagram (lower right).

▪ Volcanic Earthquake Epicenter Distribution

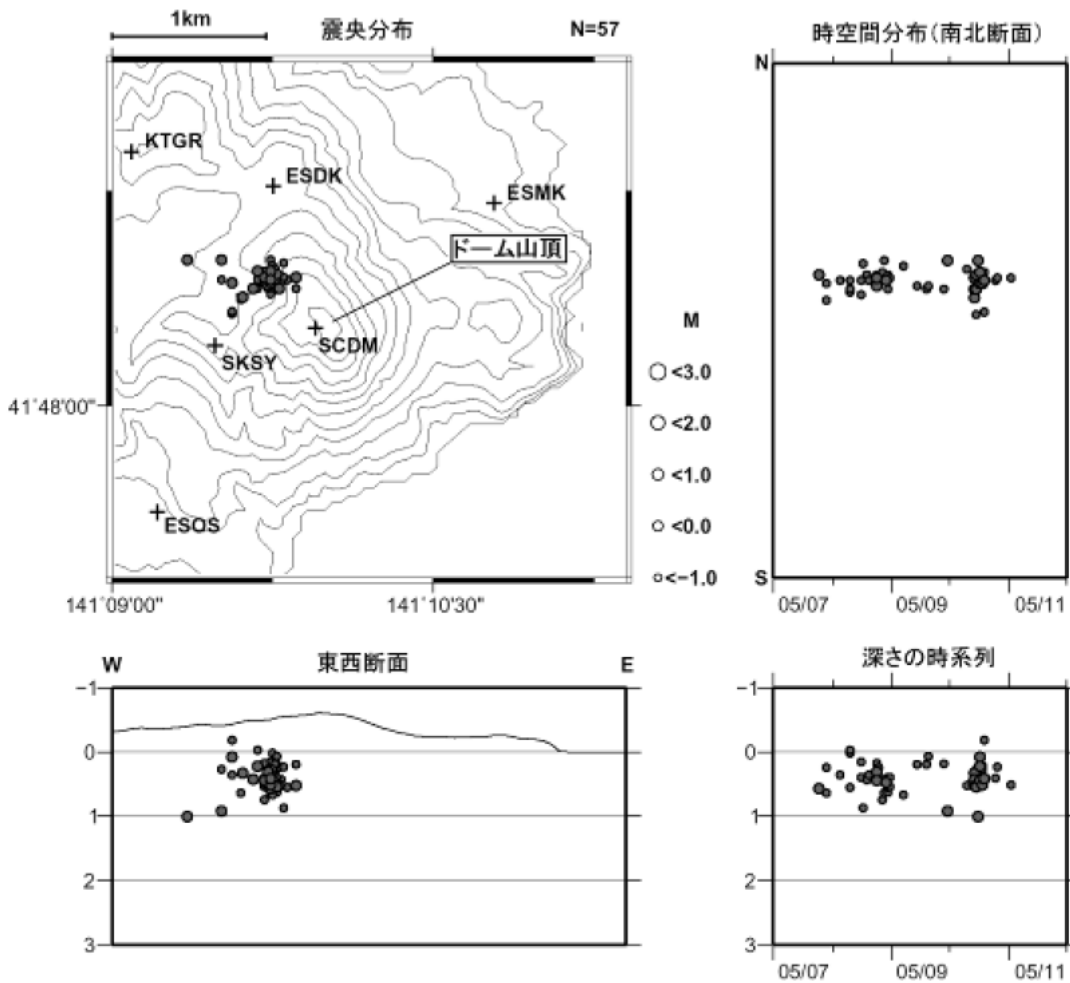


Figure 19-5 Distribution of volcanic earthquakes determined by mobile observation (July 24, 2005 to November 18, 2005) (Sapporo District Meteorological Observatory, 2006).



Camera image at Takadai on October 20, 2011 by the Japan Meteorological Agency

Information on Disaster Prevention

① Hazard Map

Esan Volcano Disaster Prevention Map (Wide Area Version)

February, 2001 (Heisei 13) - Published by the former Esan

Volcano Disaster Committee, Esan Town Hall, and Todohokkemura Town Hall, editorial supervision by Tadahide UI

<http://www.city.hakodate.hokkaido.jp/soumu/bousai/esan.html>

恵山 火山防災マップ

一人ひとりが正しい知識を身につけると 火山災害は軽減できます

もし、噴火したら・・・
 防災無線やラジオに注意し、落ちついて、役場の指示に従って下さい。
 ●噴火口の近くでは、大きな石が勢よく飛んできます(噴石・火山弾)。後方や上にも注意して避難しましょう。
 ●道路や土石が崩れかかっているときは、すぐに避難しましょう。谷底に下りてはいけません。橋の上も危険です。
 ●火砕流や火砕サージの発生が警戒されているときは、危険が予測される地区から、ただちに逃げましょう。発生してからは避難は間に合いません。

火山ガスは、かちかちと音のない成分が入っています。できる限り吸わないようにしましょう。酸の少ないときに火口や噴気孔の近くの沢や凹地に立ち入るは危険です。

マップの説明
 火山ガスは噴火の有無と関係なく、注意が必要です
 火山ガスに特に注意すべき範囲
 100年に1~2回、発生可能性がある 小規模噴火の場合
 想定火口位置と噴石が飛んでくる範囲
 ◎この範囲内別の場所が噴火する可能性もある
 噴火した時やその後の 火山泥流や土石流のとおり道
 数千年に1~2回発生可能性がある 中規模噴火の場合
 軽石や火山灰が10cm以上積る範囲
 積雪期の噴火や大きな噴火の後、噴火後の長雨の時に泥流が広がる範囲
 火砕流あるいは火砕サージの到達範囲

恵山の過去の噴火と現在の気象・地形条件をもとに噴火を想定して作成しています。

1万年に1回発生している大規模噴火で火砕流が到達する恐れがある区域 (色の濃い範囲ほど到達の可能性が高い)

近くの集合場所を覚えましょう
 わが家の集合場所は

◎集合場所 ▲避難場所 ⊗役場・警察・消防
 ※場合によっては船で避難することもあります

このような異変に気づいたら連絡ください
 ある場所だけ急に雪がとけた、など
 動物の行動の異常
 噴気の臭いや色の変化、噴気量の急激な変化など
 新しい噴気の発見
 植物の枯死・枯生の異常など
 地下水・湧水 温泉水・川の水温や色、臭いの変化など
 地鳴り・地動・地震の頻発
 地割れ・地盤の変動

情報の提供・問合せなど

連絡先	電話番号	連絡先	電話番号
恵山町役場	85-2331	檜法華村役場	86-2111
恵山駐在所	85-2110	檜法華駐在所	86-2150
恵山消防署	83-3121	檜法華消防署	86-2221
札幌管区気象台 (代表番号)	011-611-6121		

避難するときのおもな持ちもの
 火山災害では、長期間、安全のために家に居られない場合もあります。日頃から準備しておきましょう。
 携帯電話・ラジオ、貴重品・現金、ヘルメット・マスク等、食糧、衣類、寝具、懐中電灯・手回し灯、防寒着・下着、非常食・飲料水、防雨用品、下着

このほか、乳幼児用品・介護用品など、各家庭に必要なものを準備しておきましょう。

発行：恵山火山防災協議協議会：恵山町・檜法華村（平成13年2月） 監修：宇井忠英（北海道大学大学院理学研究科 教授） 制作：アジア航測株式会社 調製・印刷：株式会社旭プリント
 「この地図は、国土院院長の承認を得て、同院発行の数値地図2万5千分の1(0809商)を複製したものである。(承認番号)平7総機、第1017号」

Social Circumstances

① Populations

- Hakodate Esan population: 3,678 (as of October 31, 2011)
- Hakodate Todohokke population: 1,220 (as of October 31, 2011)

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

- Esan Prefectural National Park - Hakodate Esan
Number of sightseers per year: Approx. 278,300

(Number of entering sightseers, from 2010 Hokkaido-wide municipal study)

- Esan Prefectural National Park - Hakodate Todohokke
Number of sightseers per year: Approx. 194,400

(Number of entering sightseers, from 2010 Hokkaido-wide municipal study)

- Esan Prefectural National Park - Esan
Number of mountain-climbers per year: Approximately 129,300 (assessed by Esan branch office in 2010)

③ Facilities

- None

Monitoring Network

Wide Area

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



1:200,000 scale regional maps (Hakodate and Shiriyazaki) published by the Geospatial Information Authority of Japan were used.

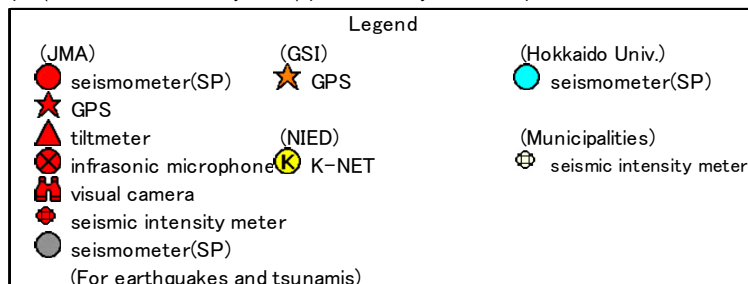


Figure 19-6 Regional monitoring network.

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(Miura, D.)