Appendix B – Region 9

Country and regional profiles of volcanic hazard and risk:

Kuril Islands

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This download comprises the profiles for Region 9: Kuril Islands only. For the full report and all regions see Appendix B Full Download. Page numbers reflect position in the full report. The following countries are profiled here:

Brown, S.K., Sparks, R.S.J., Mee, K., Vye-Brown, C., Ilyinskaya, E., Jenkins, S.F., and Loughlin, S.C. (2015) Country and regional profiles of volcanic hazard and risk. In: S.C. Loughlin, R.S.J. Sparks, S.K. Brown, S.F. Jenkins & C. Vye-Brown (eds) *Global Volcanic Hazards and Risk,* Cambridge: Cambridge University Press.

Region 9: Kuril Islands

Description

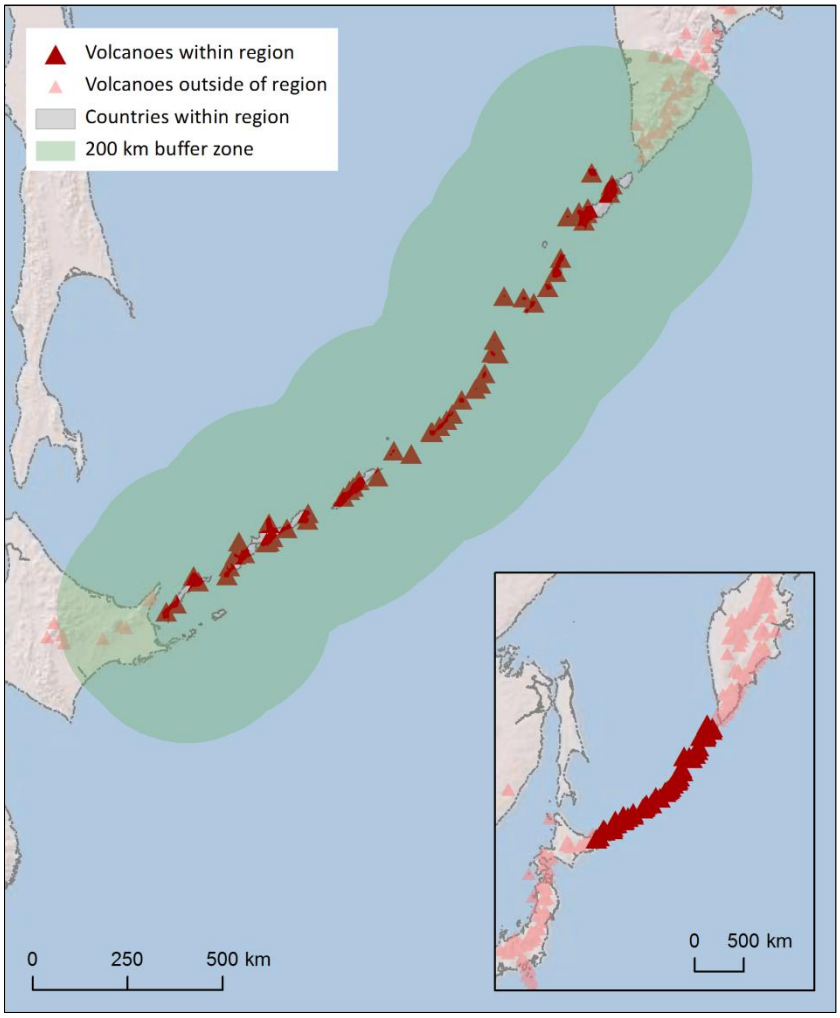

Figure 9.1 The distribution of Holocene volcanoes through the Kuril Islands region.

Forty-eight Holocene volcanoes are located in the Kuril Islands, stretching from Hokkaido, Japan in the south, to Kamchatka, Russia in the north. Volcanism in this arc is due to the subduction of the Pacific Plate beneath the Eurasian Plate. Most volcanoes here are of dominantly andesitic composition, and most are volcano types typically associated with explosive activity including stratovolcanoes and calderas.

Thirty-one of these volcanoes have Holocene records of 165 eruptions, of these, 148 of the eruptions are recorded post-1500 AD at thirty volcanoes, indicating the geological eruption record is sparse. Historical eruptions have ranged in size from VEI 0 to 5, indicating a range of eruption styles from mild events to large explosive eruptions. Two VEI 6 eruptions are recorded in the Holocene record and there are Pleistocene records of larger events, with the largest Quaternary eruption

recorded in the Kuril Islands being the M7.3 eruption of Nemo Peak at 45 ka. Moderate eruptions dominate the record, however twelve large explosive historical eruptions of VEI ≥4 are recorded.

The size of a large number of eruptions in the Kuril Islands is unknown, and the dominance of the historical record indicates that further research is required to more fully understand the eruptive histories in this region and to better understand the hazard. However, the Kuril Islands are sparsely populated with only four volcanoes having over 10,000 people located within 100 km radii, reducing the risk substantially.

Both Japan and Russia are very familiar with responding to and monitoring eruptions and unrest (see Japan, region 8; and Russia, region 10). The northernmost volcanoes in the Kuril Islands are monitored by the Kamchatka Volcanic Eruption Response Team (KVERT) who primarily monitor these volcanoes by satellite observations with a few seismometers located on two historically active volcanoes.

Volcano facts

Number of Holocene volcanoes	48
Number of Pleistocene volcanoes with M≥4 eruptions	6
Number of volcanoes generating pyroclastic flows	8
Number of volcanoes generating lahars	6
Number of volcanoes generating lava flows	13
Number of eruptions with fatalities	3
Number of fatalities attributed to eruptions	32
Largest recorded Pleistocene eruption	The largest recorded Quaternary eruption occurred at Nemo Peak with the M7.3 K3 (Nemo 1) eruption at 45 ka.
Largest recorded Holocene eruption	The 8290 BP M7 caldera formation at Tao-Rusyr Caldera is the largest recorded Holocene eruption in LaMEVE in this region.
Number of Holocene eruptions	165 confirmed Holocene eruptions.
Recorded Holocene VEI range	0 – 6 and unknown
Number of historically active volcanoes	30
Number of historical eruptions	148

Number of volcanoes	Primary volcano type	Dominant rock type
5	Caldera(s)	Andesitic (5)
34	Large Cone(s)	Andesitic (26), Basaltic (6), Unknown (2)
4	Small Cone(s)	Andesitic (3), Unknown (1)
5	Submarine	Unknown (5)

Table 9.1 The volcano types and dominant rock types of the volcanoes of this region according to VOTW4.0.

Note that the stratovolcano Chikurachki comprises the sub-features of the Lomonosov Group and stratovolcano Tatarinov.

Eruption Frequency

VEI	Recurrence Interval (Years)
Small (< VEI 4)	2
Large (> VEI 3)	30

Table 9.2 Average recurrence interval (years between eruptions) for small and large eruptions in the Kuril Islands.

The eruption record indicates that on average small to moderate sized eruptions of VEI <4 occur in this region with an average recurrence interval (ARI) of about 2 years, whilst the ARI for large eruptions is longer, at about 30 years.

Eruption Size

Eruptions are recorded through the Kuril Islands of VEI 0 to 6, representing a range of eruption styles from gentle effusive events to large explosive eruptions. VEI 2 events dominate the record, with over 50% of all Holocene eruptions classed as such.

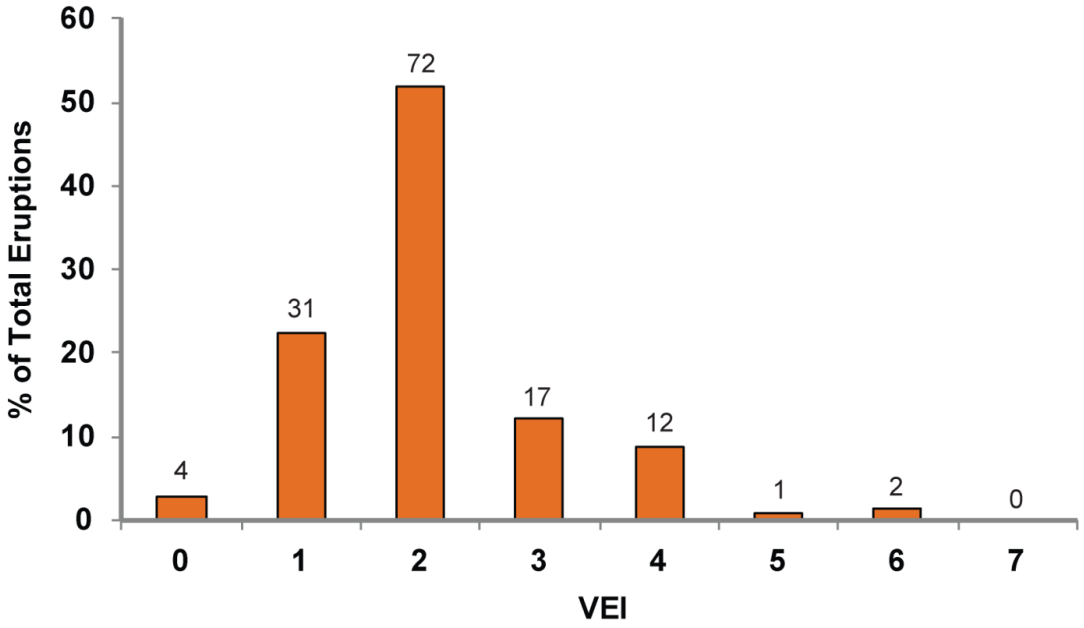

Figure 9.2 Percentage of eruptions in this region recorded at each VEI level; the number of eruptions is also shown. The percentage is of total eruptions with recorded VEI. A further 26 eruptions were recorded with unknown VEI.

Infrastructure Exposure

The volcanoes of the Kuril Islands are distributed between Hokkaido, Japan in the south and Kamchatka in the north. The entirety of the Kuril Island chain is volcanic and thus lies within 100 km of volcanoes, and the 100 km radii extend into Hokkaido and Kamchatka, exposing infrastructure here, including ports and airports. Whilst no infrastructure is described in the Kurile Islands here, there are settlements on some of the islands and all critical infrastructure is exposed.

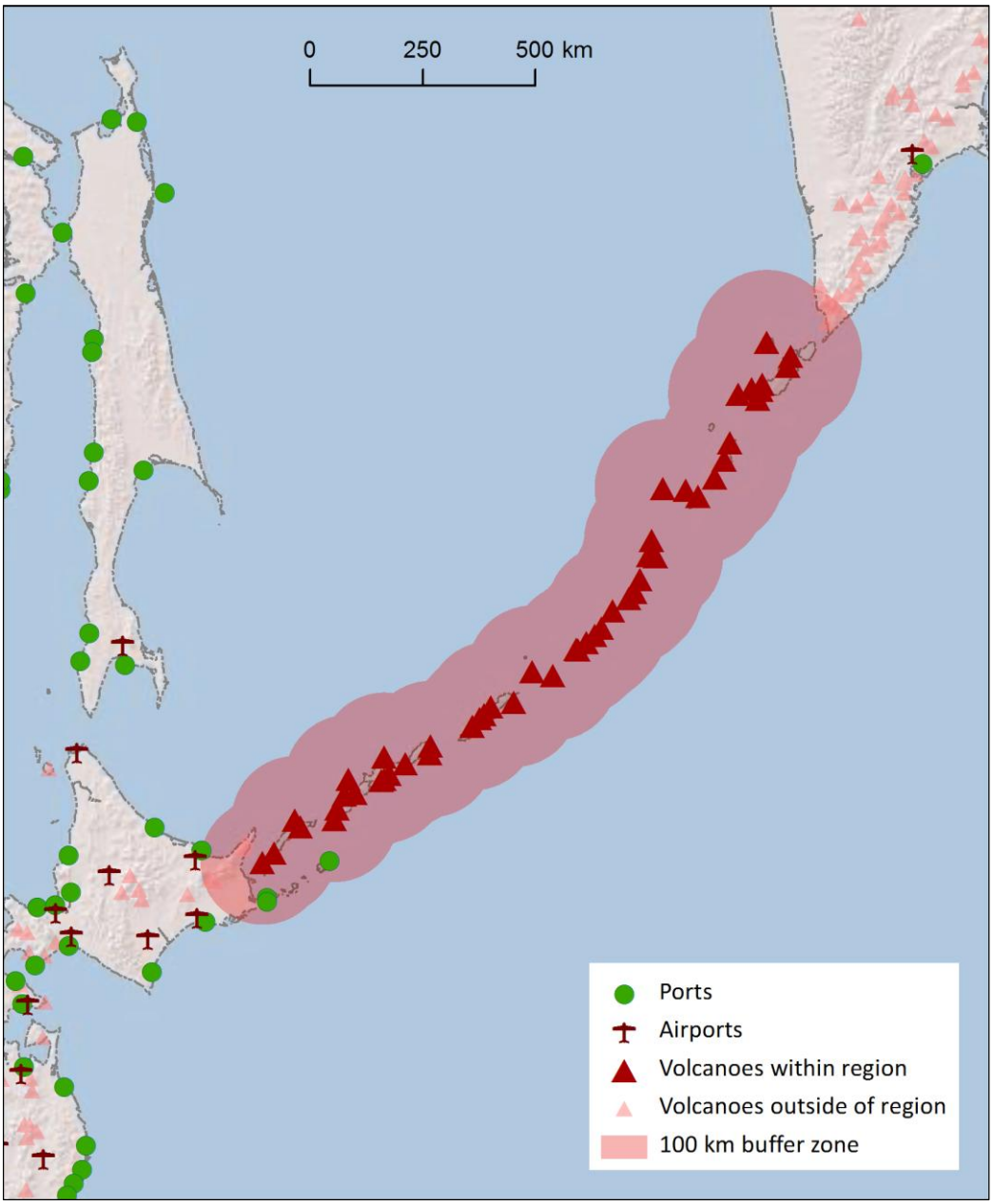

Figure 9.3 The location of the volcanoes in the Kuril Islands and the extent of the 100 km zone surrounding them. Ports, airports and the major cities are just some of the infrastructure that may be exposed to volcanic hazards.

Hazard, Uncertainty and Exposure Assessments

Of the 48 volcanoes in the Kuril Islands just 13 have a sufficient eruption record for hazard assessment. These volcanoes are classified into all three hazard levels, with Sarychev Peak, Sinarka and Kharimkotan being classed at the highest hazard here, Level III all with Holocene records of large explosive eruptions and pyroclastic flows recorded in more than 10% of their eruptions.

The 35 unclassified volcanoes have varying degrees of information in their records. 16 of these have no confirmed Holocene eruptions. One, Moekeshiwan [Lvinaya Past], has a Holocene record but no

historical eruptions, and 18 have confirmed historical events including 12 with eruptions since 1900. Three volcanoes, Fuss Peak, Raususan [Mendeleev] and Ushishur, have records of increased fumarolic emissions in the 1980s suggesting unrest above background levels.

The population in the Kuril Islands is low, and all volcanoes are classed with a low PEI of 1 and 2, with all but four volcanoes having fewer than 10,000 inhabitants located within 100 km (Tomariyama [Golovnin], Raususan [Mendeleev], Ruruidake [Smirnov], and Chachadake [Tiatia]). This low PEI coupled with the dominant distribution of the volcanoes across Hazard Levels I and II makes the majority of the classified volcanoes of the Kuril Islands Risk Level I volcanoes. Just three volcanoes, Kharimkotan, Sarychev Peak and Sinarka, are classed at Risk Level II.

CLASSIFIED	**Hazard III**		Sarychev Peak; Sinarka; Kharimkotan					
	Hazard II		Chachadake [Tiatia]; Etorofu-Yakeyama [Grozny Group]; Chirpoi; Chikurachki; Ebeko; Alaid					
	Hazard I	Chirinkotan	Moyorodake [Medvezhia]; Kolokol Group; Goriaschaia Sopka					
UNCLASSIFIED	**U – HHR**	**Ekarma**	Tomariyama [Golovnin]; **Raususan [Mendeleev]; Etorofu-Atosanupuri [Atosanupuri]; Sashiusudake [Baransky];** Chirippusan [Chirip]; **Unnamed (290160); Zavaritzki Caldera**; Prevo Peak; **Ketoi**; **Ushishur**; **Rasshua**; **Unnamed (290230); Raikoke**; **Tao-Rusyr Caldera**; **Nemo Peak; Fuss Peak**; **Karpinsky Group**					
	U- HR		Moekeshiwan [Lvinaya Past]					
	U-NHHR	Odamoisan [Tebenkov]	Ruruidake [Smirnov]; Berutarubesan [Berutarube]; Nishihitokappuyama [Bogatyr Ridge]; Unnamed; Rucharuyama [Golets-Tornyi Group]; Rakkibetsudake [Demon]; Ivao Group; Rudakov; Tri Sestry; Unnamed; Milne; Urataman; Srednii; Shirinki; Vernadskii Ridge					
		PEI 1	**PEI 2**	**PEI 3**	**PEI 4**	**PEI 5**	**PEI 6**	**PEI 7**

*Table 9.3 Identity of the Kuril Islands' volcanoes in each Hazard-PEI group. Those volcanoes with a sufficient record for determining a hazard score are deemed 'Classified (top). Those without sufficient data are Unclassified (bottom). The unclassified volcanoes are divided into groups: U-NHHR is Unclassified No Historic or Holocene Record: that is there are no confirmed eruptions recorded in the Holocene. U-HR is Unclassified with Holocene Record: that is there are confirmed eruptions recorded during the Holocene, but no historical (post-1500) events. U-HHR is Unclassified with Historic and Holocene record. The unclassified volcanoes in **bold** have experienced unrest or eruptions since 1900 AD, and those in red have records of at least one Holocene VEI ≥4 eruption.*

Population Exposure Index

Number of Volcanoes	Population Exposure Index
0	7
0	6
0	5
0	4
0	3
45	2
3	1

Table 9.4 The number of volcanoes in the Kuril Islands classed in each PEI category.

Volcano	Population Exposure Index	Risk Level
Sarychev Peak	2	II
Sinarka	2	II
Kharimkotan	2	II
Chachadake [Tiatia]	2	I
Etorofu-Yakeyama[Grozny Group]	2	I
Moyorodake [Medvezhia]	2	I
Kolokol Group	2	I
Chirpoi	2	I
Goriaschaia Sopka	2	I
Chikurachki	2	I
Ebeko	2	I
Alaid	2	I
Chirinkotan	1	I

Table 9.5 Classified volcanoes of the Kuril Islands ordered by descending Population Exposure Index (PEI). Risk levels determined through the combination of the Hazard Level and PEI are given.

Risk Levels

Number of Volcanoes	Risk Level
0	III
3	II
10	I
35	Unclassified

Table 9.6 The number of volcanoes in the Kuril Islands classified at each Risk Level.

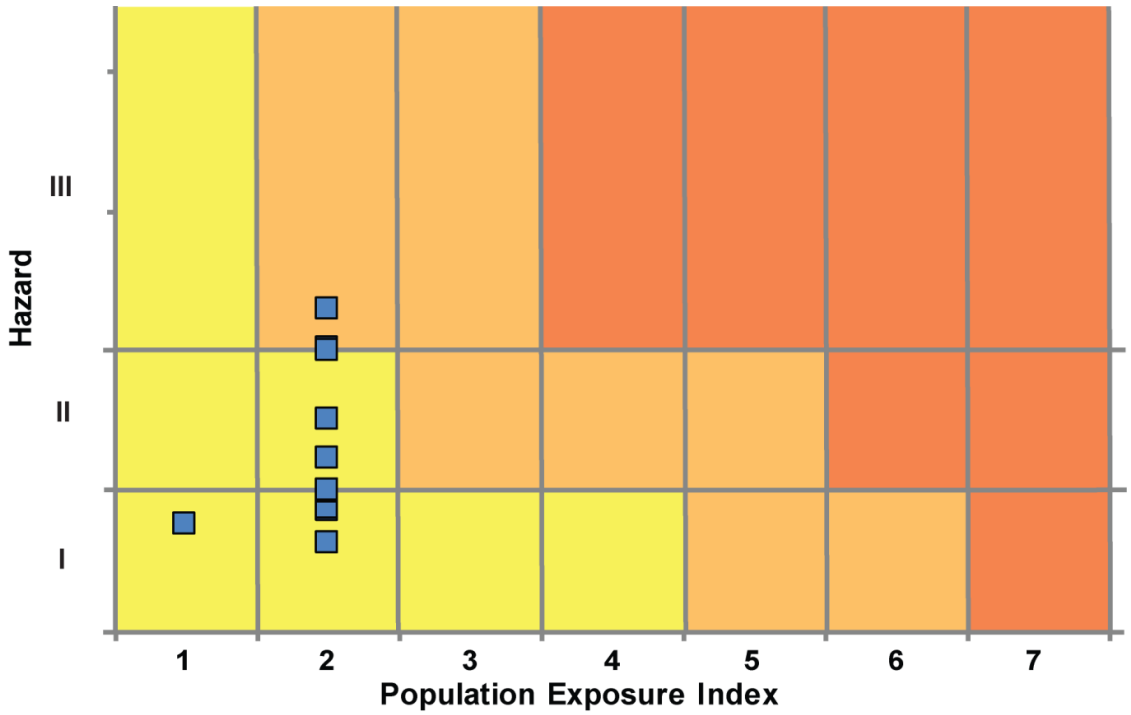

Figure 9.4 Distribution of the classified volcanoes of this region across Hazard and Population Exposure Index levels. The warming of the background colours illustrates increasing Risk levels from Risk Level I - III.

Regional Capacity for Coping with Volcanic Risk

Thirty-one volcanoes in the Kuril Islands have records of historical activity. The Kamchatka Volcanic Eruption Response Team (KVERT) monitors six volcanoes in the northern Kuriles, five of which have had historical activity. Of these, seismic stations are located at two volcanoes. At the time of the writing of this report, no information is available to suggest that there is dedicated ground-based monitoring throughout the remaining Kuril Island volcanoes.

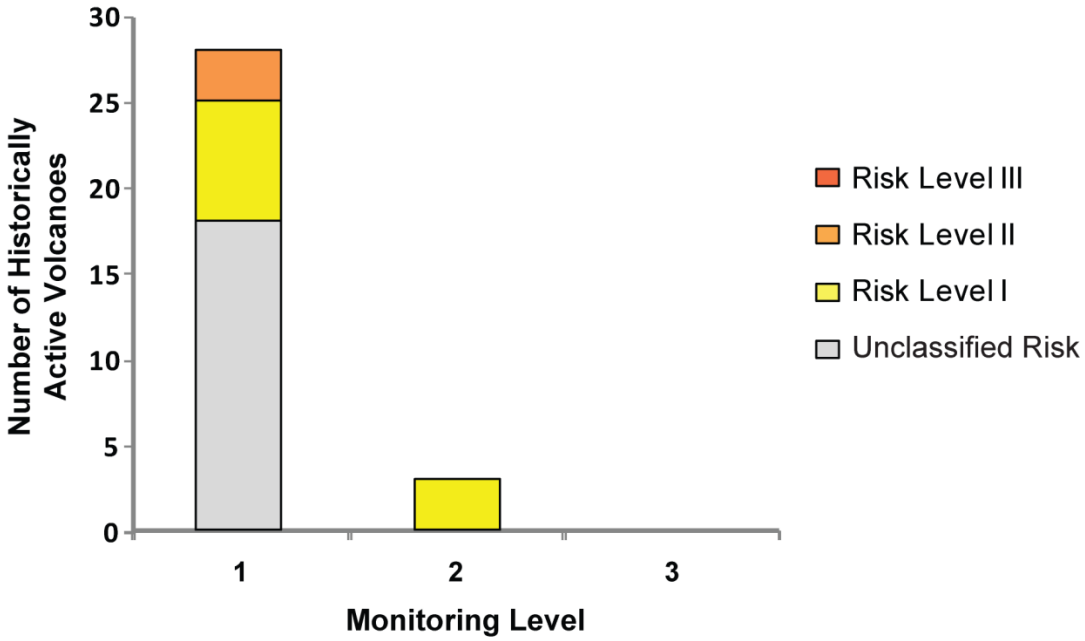

Figure 9.5 The monitoring and risk levels of the historically active volcanoes in the Kuril Islands. Monitoring Level 1 indicates no known dedicated ground-based monitoring; Monitoring Level 2 indicates that some ground-based monitoring systems are in place including ≤3 seismic stations; Monitoring Level 3 indicates the presence of a dedicated ground-based monitoring network, including ≥4 seismometers.