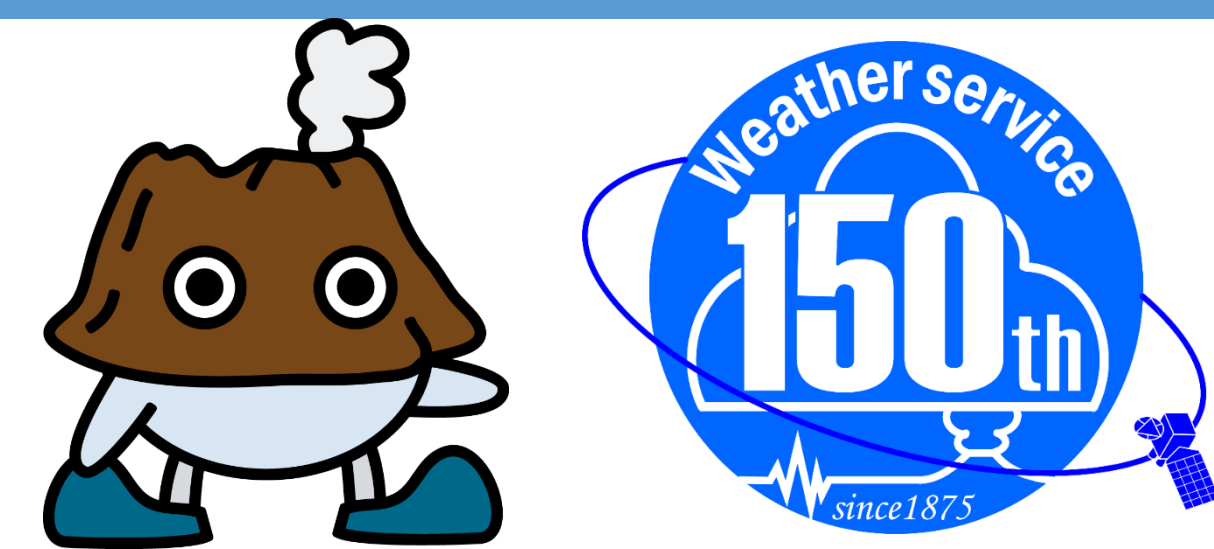


Volcanic observation and warnings in JMA

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Abstract: Japan Meteorological Agency (JMA) continuously monitors 50 active volcanos, using several kinds of equipment. Mobile observation teams also observe the state of volcanic activity on the field. Based on the above observation, JMA issues information depending on the volcanic activity status. When hazardous volcanic phenomena are expected, JMA issues Volcanic Warning. For the most of continuously monitored volcanos, Volcanic Alert Levels are introduced. JMA also has other several information, such as Details of Volcanic Activity (Extra) and Eruption Notices.

Volcanic observation

JMA monitors 111 active volcanoes in four (Sapporo, Sendai, Tokyo and Fukuoka) Volcanic Observation and Warning Centers (VOWC) and one (Kagoshima) local meteorological office. 50 volcanoes are selected from 111 volcanoes based on activity level and JMA continuously monitors them using seismometers, tiltmeters, GNSS, cameras (visible/infrared) and so on. In some volcanoes, JMA uses geochemical monitoring method. Mobile observation team also observe the state of volcanic activity on the field and maintain the installed equipment.

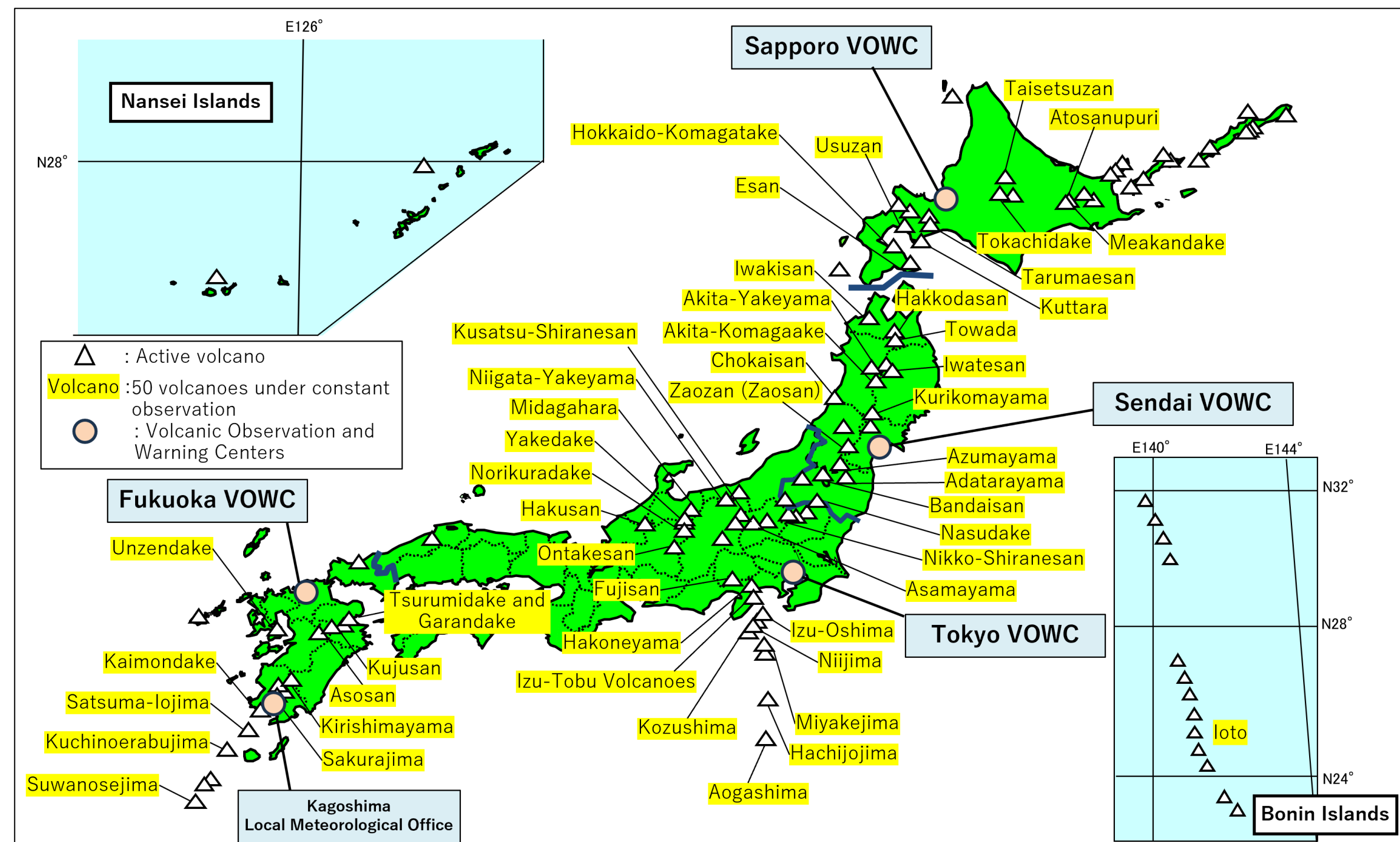


Figure 1. 111 active volcanoes in Japan and five observation spots

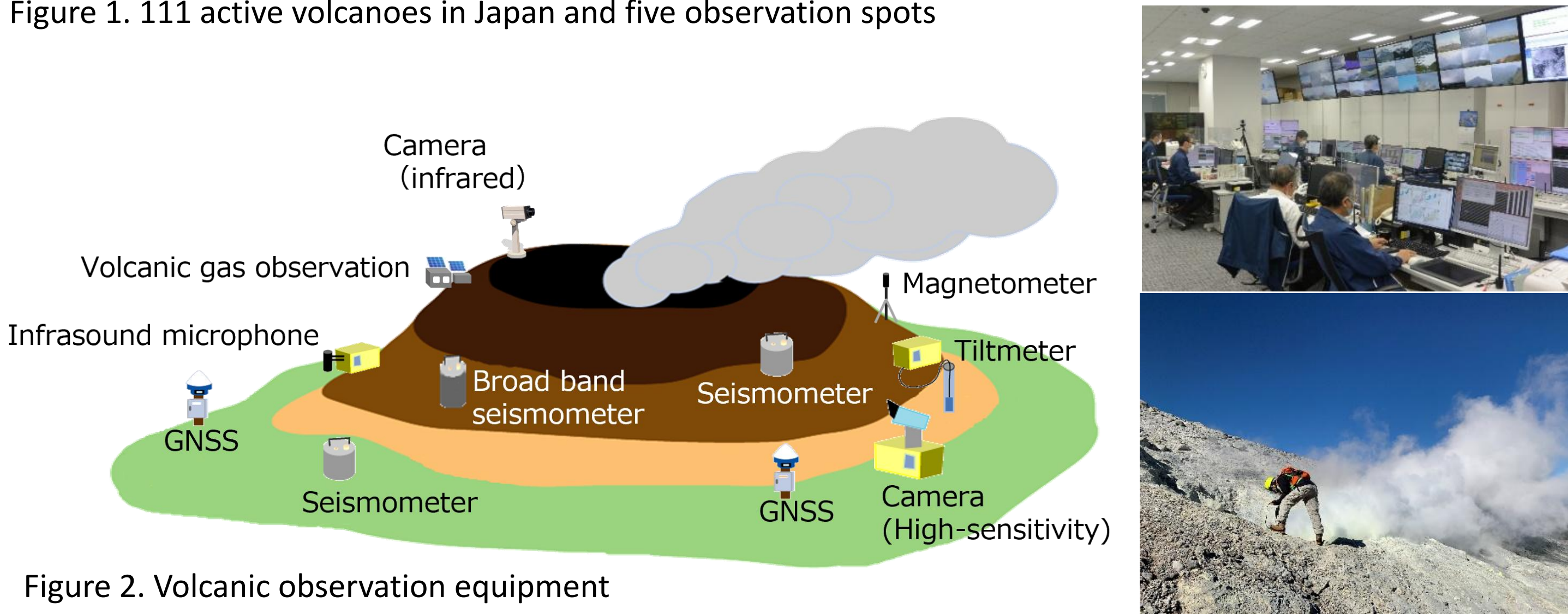


Figure 2. Volcanic observation equipment

Volcanic Warnings

There are many types of volcanic phenomena such as volcanic ash and lava flow. In particular, ballistic projectile, pyroclastic flow and snowmelt lahar are positioned as important by JMA because the lead time for evacuation is little. Therefore, when these phenomena are expected based on the results of observation, JMA issues Volcanic Warnings for 111 volcanoes.



Figure 5. Ballistic projectile (Asamayama)
Figure 6. Pyroclastic flow (Unzendake)
Figure 7. Snowmelt lahar (Tokachidake)

Volcanic Warnings are issued specifying the target area (Near the Crater or Residential area) where the hazardous volcanic phenomena may be affected. The warnings are issued to residents through the media, prefectural office and local municipalities.

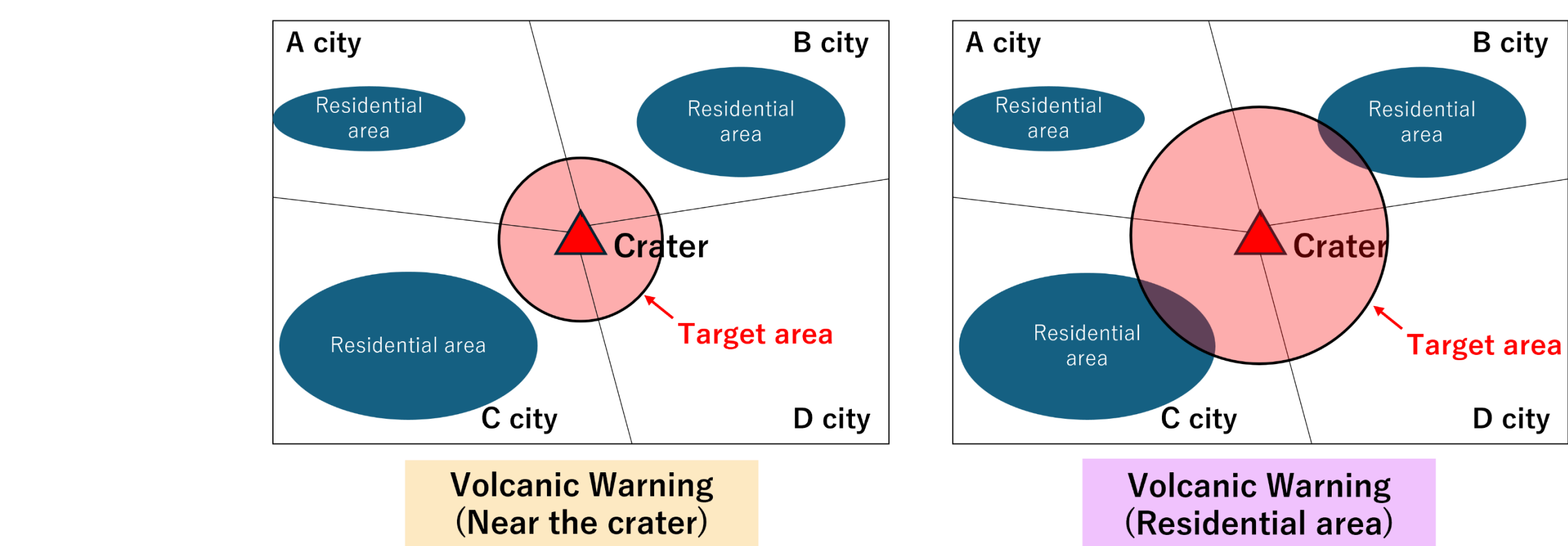


Figure 8. Volcanic Warnings and target area

Volcanic Alert Levels

JMA operates **Volcanic Alert Levels** (VALs) in 49 active volcanoes. This levels describe target areas and recommended action to be taken by disaster management organizations and residents in five levels depending on volcanic activity. Current level is evaluated based on criteria such as number of earthquakes, and the level is set mainly based on past activity. This system is not common in other countries and allows local government to react quickly for disaster prevention even if sudden eruption occurs.

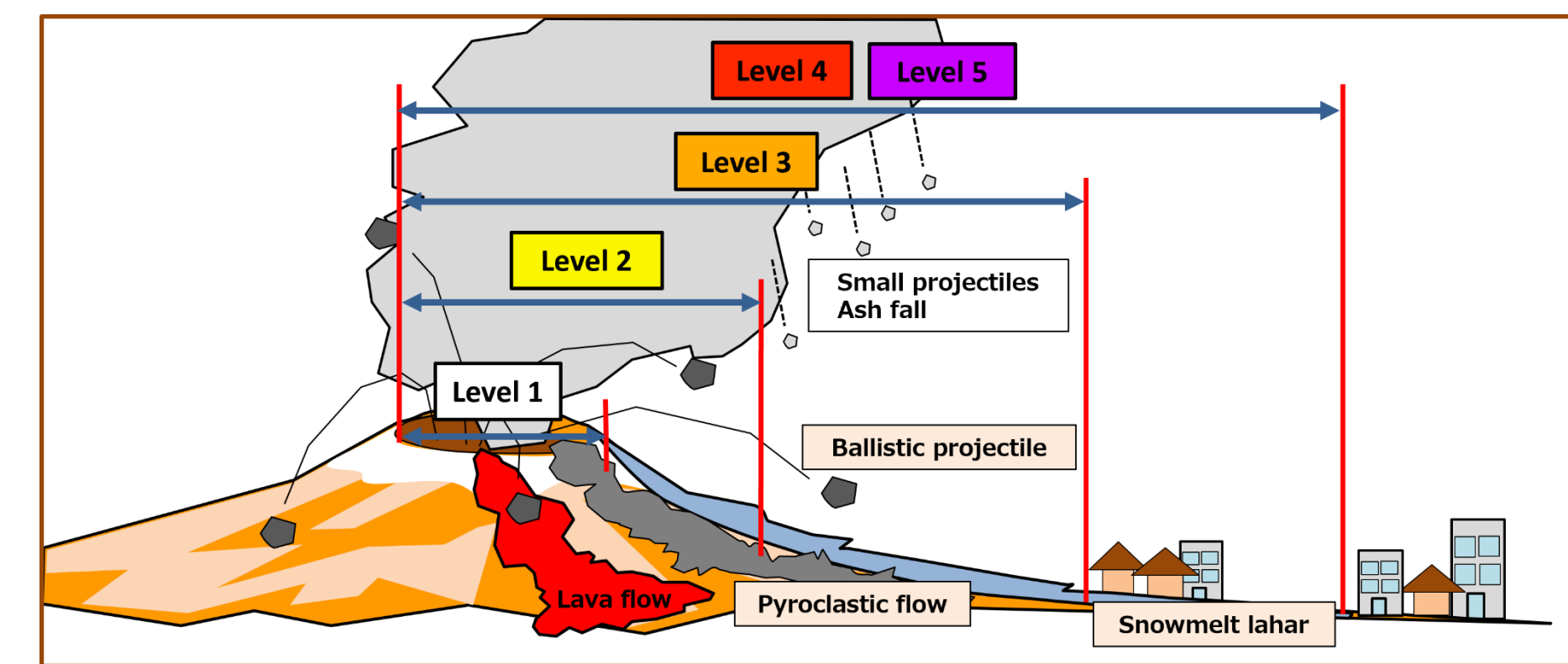


Figure 9. Volcanic hazards and Volcanic Alert Levels

Figure 10. Volcanic Alert Levels (Lower left)
Figure 11. VALs Leaflet of Mt. Fuji (Lower right, in Japanese)

Classification	Abbreviated Term	Target area	Volcanic Alert Levels & Keywords	Expected volcanic activity	Explanation	Action to be taken by residents	Action to be taken by climbers
Emergency Warning	Volcanic Warning (Residential area and non-residential area Warning)	Residential area and non-residential area nearer the crater	Level 5	Evacuation	Eruption or imminent eruption that may cause serious damage in residential areas and non-residential areas near the crater.	Evacuation from residential areas at risk is necessary.	
			Level 4	Evacuation of the elderly, etc.	Possibility or increasing possibility of eruption that may cause serious damage in residential areas and non-residential areas near the crater.	Evacuation of the elderly and other persons requiring special care, and preparation for evacuation of residents in residential areas at risk is necessary.	
Warning	Volcanic Warning (Near the crater)	Non-residential areas near the crater	Level 3	Restriction on proximity to the volcano	Eruption or possibility of eruption that may severely affect places near residential areas (possible threat to life in such areas).	Stand by and pay attention to changes in volcanic activity. Preparation for the evacuation of the elderly and other persons requiring special care, depending on the situation.	Restrictions on entry to areas at risk, such as prohibition of climbing and restrictions on mountain entry.
			Level 2	Restriction on proximity to the crater	Eruption or possibility of eruption that may affect areas near the crater (possible threat to life in such areas).	Stand by and pay attention to changes in volcanic activity. Preparation for the evacuation of the elderly and other persons requiring special care, depending on the situation.	Restrictions on entry to areas near and around the crater.
Forecast	Forecast	Inside the crater	Level 1	Potential for increased activity	Calm. Possibility of volcanic ash emissions or other related phenomena may occur in the crater (possible threat to life in the crater).	No action required.	No restrictions. Restrictions on entry to the crater, depending on the situation.

Volcanic Disaster Management Councils are in charge of setting VALs and they are required to be established for each active volcano by law. The councils consist of JMA, prefectures, municipalities, police, fire department, volcanologists and others. In normal times, the councils create eruption scenario(showing when is dangerous) and volcanic hazard map (showing where is dangerous). Based on the above scenario and map, the councils set VALs which is linked with evacuation planning.

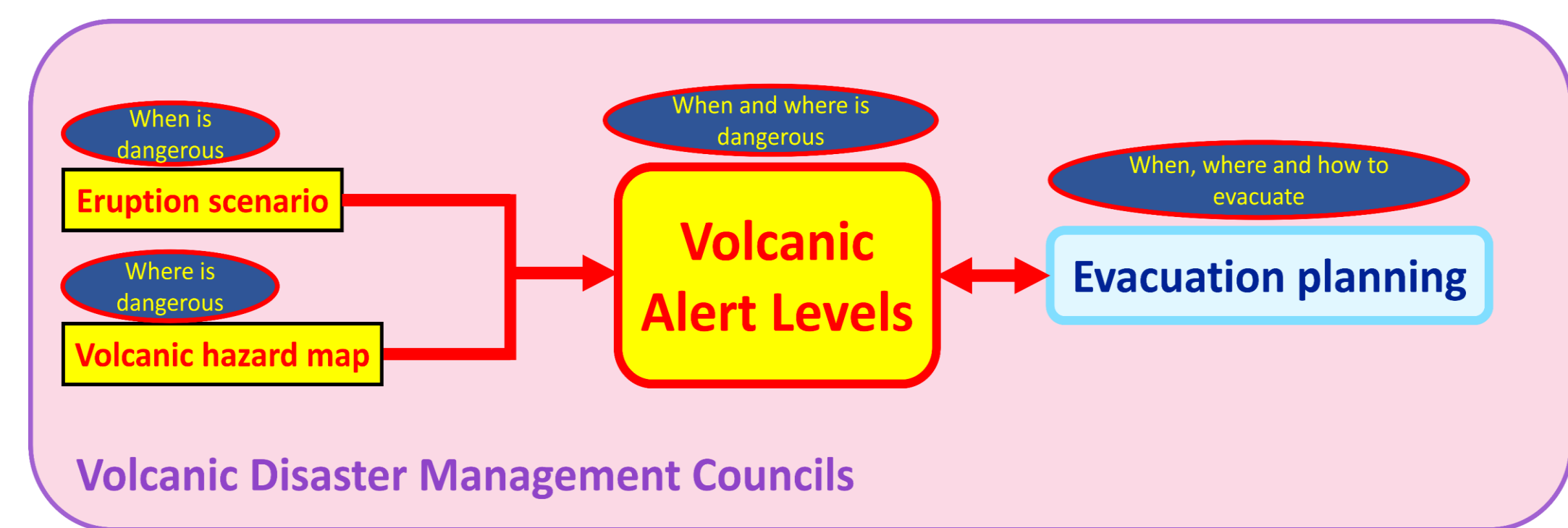


Figure 12. Volcanic Disaster Management Councils

Other information

Eruption Notices

This provides brief information about the eruption (location and time) especially for climbers. When an eruption occurs and ballistic projectiles reached over the restricted area in Volcanic Warnings, JMA issues Eruption Notices in order to allow protective action.

Details of Volcanic Activity

This information is issued when change in volcanic activity such as increase of volcanic earthquakes is detected. If volcanic activity changes and VALs may be raised, Details of Volcanic Activity (Extra) is issued. This information includes current status of activity and advises special attention to volcanic hazards.

※Volcanic Warnings, Eruption Notices, and Details of Volcanic Activity are required by law to be communicated to prefectures.