

An aerial photograph of Mount Fuji, a large snow-capped volcano, dominating the center of the frame. The mountain's conical shape is clearly visible, with snow covering its upper slopes and a band of white clouds at its base. Below the mountain, a vast, densely populated urban area stretches across the foreground, showing a mix of residential buildings, roads, and green spaces. In the far distance, other mountain ranges are visible under a clear blue sky. The wing of an aircraft is visible in the upper left corner, suggesting the photo was taken from an airplane.

*JGCA*

# Mt. Fuji

World Cultural Heritage  
-Objects of faith and sources of art-

Japan Geotechnical Consultants Association

# INTRODUCTION.

The word “Mt. Fuji” has special resonance for Japanese. Mt. Fuji is Japan’s highest mountain, standing 3,776 meters above sea level and locating in both Yamanashi and Shizuoka prefectures. Its

graceful appearance is known both in Japan and abroad as a symbol of Japan, and it has been the subject of numerous works of art and has had a great influence on Japanese culture.

How much do we know about such Mt. Fuji?

Let’s learn together through this booklet.



## ● Mt. Fuji is a cultural heritage

On June 22, 2013, Mt. Fuji was registered as a World Heritage Site by UNESCO’s World Heritage Committee under the title, “Mt. Fuji - Object of Faith and Source of Art”.

In addition to its scenic beauty as a famous mountain, its value has been recognized around the world as an object of worship since ancient times and as a source of numerous works of art. The 25 sites recognized as cultural heritage include not only the mountain itself, but also surrounding shrines, mountain trails, caves, lakes, and marshes. Mt. Fuji viewed



Fuji from Miho- no- Matsubara  
(Yamanashi Tourism Promotion  
Organization HP)

from Miho-no-Matsubara creates a wonderful sight in harmony with the pine forest.

Why is Mt. Fuji a cultural heritage site rather than a natural heritage site? It is said that it is because of the following reasons:

- (1) Several independent peaks with similar conical shapes are already registered.
- (2) More active mountains are registered as active volcanoes.
- (3) The original nature has not been preserved because it has been used too much by humans.
- (4) There is a lot of garbage and the toilets on the trail are not well maintained.

## ● Mt. Fuji and Faith

Mt. Fuji has been an object of faith and worship since ancient times, as the Japanese considered its repeated eruptions to be a terrifying and mysterious mountain. Around Mt. Fuji, ruins as a result of the Fuji worship have been found that are thought to have been created during the Jomon Period (710-794). In the early Heian period (794-1185), Sengen Shrine was built to calm the repeated eruptions, and in the



the inner sanctuary of Mt Fuji  
(Fuji Hongu Sengen Taisha HP)

late Heian period (794-1185), it became the center of Shugendo, a unique Japanese religion that combined mountain worship with Buddhism and other religions. In the Muromachi period (1333-1573), a mountain trail was opened and the mountain became known



to the general public as a place to climb for worship. During Edo period (1603-1868) people began to gather to pay homage to Mt. Fuji.

## ● Fuji Radar

Learning from the Typhoon Isewan in 1959, a plan was made to install weather radar at the top of Mt. Fuji for early detection of typhoons. The construction was difficult due to the lack of roads to transport materials and the severe weather conditions in the area where the radar was to be installed. But it was completed in 1964 and has served as a fortress for typhoon monitoring. In recent years, it has become possible to observe typhoons using meteorological satellites, and in 1999, after 35 years of operation, it came to an end. The radar was dismantled from the top of Mt. Fuji and is now open to the public in Fujiyoshida City as the Fuji Radar Dome Museum.

Jiro Nitta, an official of the Japan Meteorological Agency at the time who was in charge of radar construction, depicted the construction of the radar in his novel “Fuji Summit. Later, it was made into a movie by Ishihara Promotions, and in 2000, it was featured in NHK’s “Project X”.



Fuji Radar (JMA HP)

## ● Fuji is an active volcano

In the past, volcanoes that were still smoking were called “active volcanoes,” dormant volcanoes were those that had erupted in historical times but were not currently smoking, such as Mt. Fuji, and volcanoes which has no records of eruption in historical times were called “extinct volcanoes.” However, since the eruptions of Meakan-dake in Hokkaido and Kiso Ontake, which were considered extinct volcanoes, and Akita Komagatake, which was considered dormant, it became common to consider all volcanoes that have a record of eruption or have the potential to erupt in the future as active volcanoes. Mt. Fuji was changed from a dormant volcano to an active volcano, and the terms dormant volcano and extinct volcano are no longer used.

The definition of an active volcano has changed little by little over time, but in 2003, the Volcano Prediction Association defined an active volcano as “a volcano that has erupted within the past 10,000 years or has active fumarolic activity at present. As of May 2014, there are 110 active volcanoes in Japan.

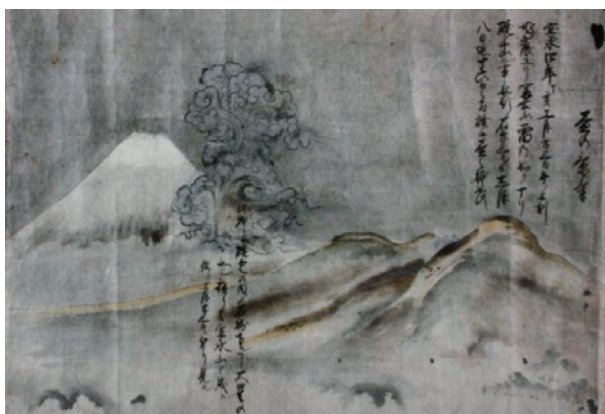


Illustration of the Hōei Eruption, October 4, Hōei 4  
(Shizuoka Prefectural Library)

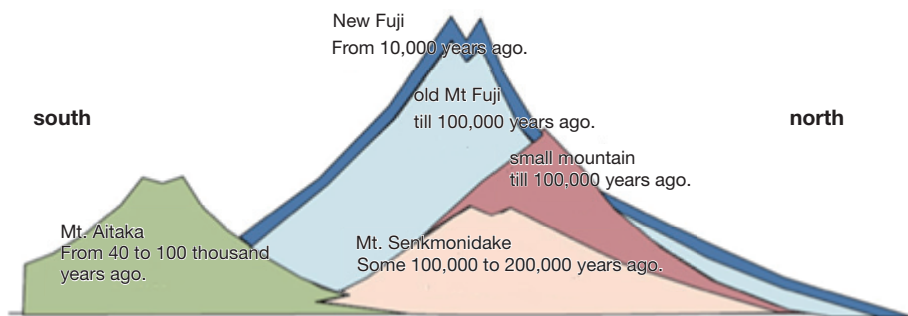
# 1. HISTORY OF THE BIRTH OF MT. FUJI

Mt. Fuji is a “stratovolcano” formed by conical layers of lava, volcanic ash, and scoria (black pumice). With a volume five times that of a typical stratovolcano, it is the largest volcano on land in the Japanese islands.

## ● Foundation of Mt. Fuji

What is the interior of Mt. Fuji (Shin-Fuji Volcano)? It is believed that Old Fuji Volcano and Komitake Volcano are buried within Mt. Fuji. Recent research suggests that an even older pre-Komitake Volcano is buried beneath the Komitake Volcano. There is Ashitaka Volcano to the south of Mt. Fuji. Mt. Fuji is a multi-story volcano based on these older volcanoes.

Let’s take a look at the history of the volcanoes that formed the foundation of Mt. Fuji. About 200,000 years ago, Mt. Ashitaka and Mt. Komitake volcanoes erupted repeatedly. About 100,000 years ago, these volcanoes ceased their activities and were replaced by Old-



Fuji's interior (Fujii, 2013)  
Illustration of the Hoei Eruption, October 4, 1704  
(Shizuoka Prefectural Library)

Fuji volcanoes. The Old-Fuji volcano repeatedly erupted explosively, spewing large amounts of ash and scoria into the air and forming the foundation of Mt. Fuji.

## ● Eruption of New-Fuji Volcano

Around 10,000 years ago, the New Fuji Volcano began its activity on the slightly western side of the summit of the Old Fuji Volcano. New Fuji Volcano repeatedly erupted in relatively quiet eruptions, with lava flowing from both the summit and flank craters, and explosive eruptions, spewing a lot of ash and scoria from the craters. Lava at the beginning of the New Fuji volcano is flowable, and some lava has been found to have flowed down as far as 40 km.

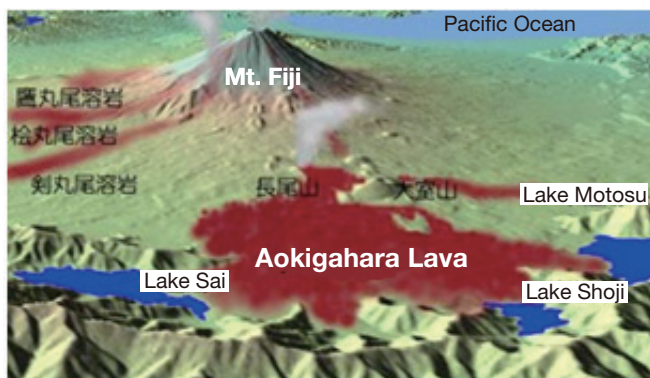
After the last eruption 2,200 years ago, eruptions from the summit crater of New-Fuji Volcano ceased, and only eruptions from the flank craters have been occurring.

Fuji is known to have erupted about 10 times in the historical record, with the Jogan eruption of 864-866 during the Heian period and the Hoei eruption of 1707 during the Edo period being the most significant.

In the Jogan eruption, 1.3 billion cubic meters of magma overflowed from two lines of fissure craters



Eruption of Mt. Fuji in the historical period  
(Fujii, 2013, drawn from Koyama 1998)



Aokigahara Lava (Fuji Five Lakes TV HP)

at the northwestern foot of the volcano, and lava flowed down the foot-slopes of the volcano. This is the Aokigahara Lava. The Aokigahara lava flowed into Motosuko and then large lake called Senoumi, and filled up Lake Senoumi, dividing it into the current smaller lakes of Shojiko and Saiko. This eruption continued for about two years.

The Hoei Eruption was an explosive eruption that spewed out 1.7 billion m<sup>3</sup> of volcanic ash and scoria (700 million m<sup>3</sup> of magma) in only 16 days, creating a crater larger than the summit crater on the southeast flank. The volcanic fumes reached a height of 10 to 20 km, and ash was carried eastward by the prevailing westerly winds, accumulating several centimeters in the city of Edo at the time, which was about 100 km away from the volcano.



Hoei Crater (photo by Shigeru Sudo)

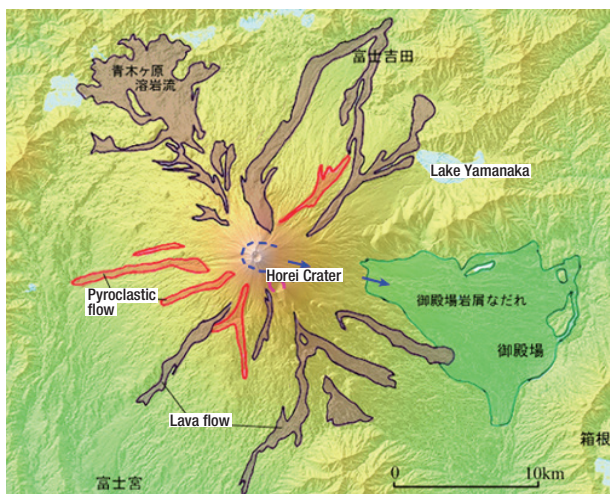


In areas where more than several tens of centimeters of volcanic ash fell, fields were completely wiped out, and the ash left behind caused mudslides and floods whenever it rained, making life difficult for people for several decades after the eruption.

Forty-nine days before the Hoei eruption, the Hoei Earthquake, which is believed to have been triggered by a series of three earthquakes (Tokai, Tonankai, and Nankai) that occurred in conjunction, is said to have triggered the eruption.

## ● Collapse and erosion of Mt. Fuji

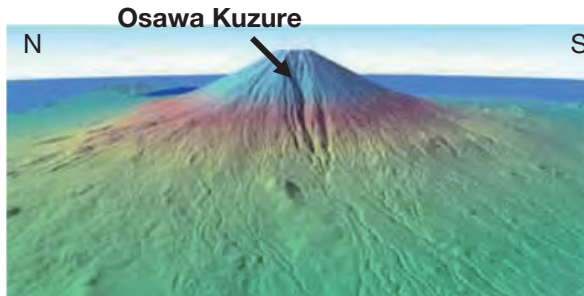
Mt. Fuji has not always grown while erupting repeatedly. Fuji has experienced a number of major and transformative collapses. The most recent collapse occurred on the eastern slope about 2,900 years ago. The sediments from this event are called “Gotemba debris avalanche sediments” and are thickly distributed over a wide area in Gotemba City.



Distribution of Gotemba debris avalanche deposits  
(National Research Institute for Earth Science and Disaster Prevention HP)

This collapse is said to have been caused by an earthquake on the Fuji River Estuary Fault Zone southwest of Mt. Fuji.

On Mt. Fuji, there are numerous radial valleys that are gradually eroding the mountain body. On the western slope, there is a large erosion valley that looks like a gaping wound. It is called the “Osawa Kuzure,” and its width and depth extend up to 500 m and 150 m, respectively. Downstream of the Osawa Kuzure, sediments accumulated due to erosion, creating a vast fan-shaped area.



Osawa Kuzure

(National Institute of Land and Geography, 2003, with additional text)

## ● Living Mt. Fuji

Mt. Fuji has repeatedly erupted and collapsed over the course of its history and becomes present shape. A stratovolcano such as Mt. Fuji is said to have a life span of several hundred thousand to one million years. Mt. Fuji is a young volcano, only 100,000 years old, or about 10 years old if compared to a human being.

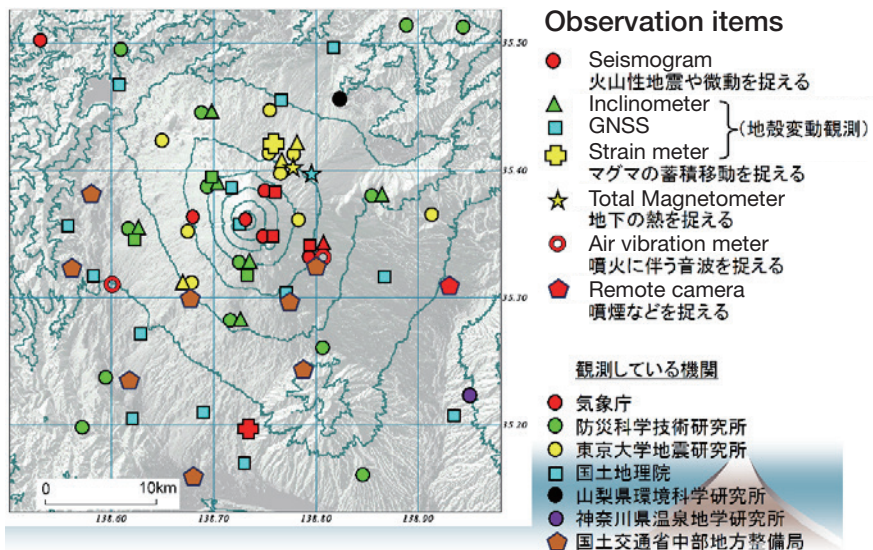
Mt. Fuji has not erupted for about 300 years since the Hoei eruption, but small earthquakes, believed to be caused by magma movement, have occurred 15 to 20 km underground. As mentioned in the introduction, Mt. Fuji is an active volcano, and it is alive. For the life of a volcano,

300 years is just a moment, a fleeting sleep. We need to be prepared for eruptions.

## 2. PREDICTION OF ERUPTION AND DISASTER PREVENTION OF MT. FUJI

### ● Mt. Fuji Volcano Monitoring System

It is known that before a volcano erupts, magma rises from underground, causing the mountain to swell and earthquakes to occur. Various systems are in place, including seismographs to monitor earthquakes, tiltmeters, GPS, and strain gauges to monitor ground deformation, air vibration gauges to monitor the sound waves that accompany an eruption, and long-range cameras to capture volcanic fumes.

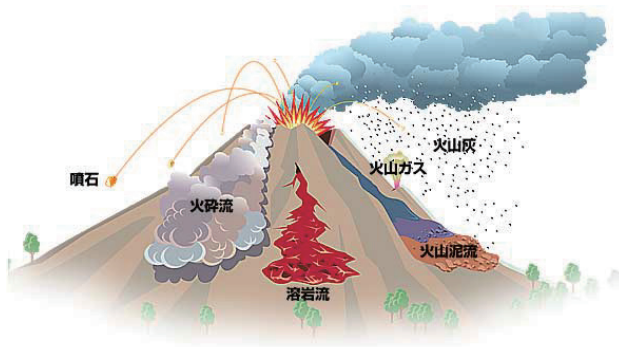


Mt. Fuji Volcano Observation System (Courtesy of JMA)

Mt. Fuji has not erupted for more than 300 years, and no eruption has ever been monitored by instruments. Currently, the government and universities have placed more than 50 monitored instruments around Mt. Fuji to predict eruptions, and the data is monitored (Kanshi) 24 hours a day by the Japan Meteorological Agency (JMA).

## ● Various phenomena caused by the eruption of Mt. Fuji

Mt. Fuji has been called a “department store of eruptions” and has caused various eruptions and disasters, ranging from small eruptions to large eruptions. The Japanese government is studying countermeasures against pyroclastic flows, volcanic mudflows, lava flows, ash fall, and other eruptions that may occur at Mt. Fuji.



Volcanic Eruption Phenomena (Kagoshima Prefecture HP)

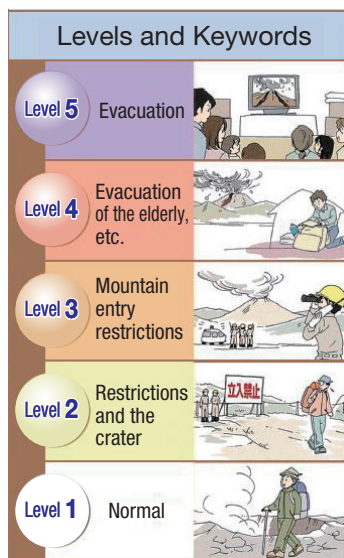
## ● Eruption Alert Level of Mt. Fuji

When an eruption is about to start, the JMA sets eruption warning levels to determine whether to prepare for evacuation or whether to evacuate. When the possibility of an eruption increases, the JMA issues a warning and notifies the public through television and other media.

Level 4 of the eruption warning requires evacuation preparations and evacuation of the elderly and other persons requiring special care. Level 5 requires evacuation of dangerous residential areas.

## ● Disaster Prevention Measures at Mt. Fuji

Around Mt. Fuji, disaster prevention measures are being promoted through various instruments and facilities such as weather observation stations, wire sensors, and erosion control weirs to reduce disasters caused by eruptions, etc. When something unusual happens, residents are notified through disaster prevention radio, television, and radio.



Volcanic Alert Levels  
(Japan Meteorological Agency Website)

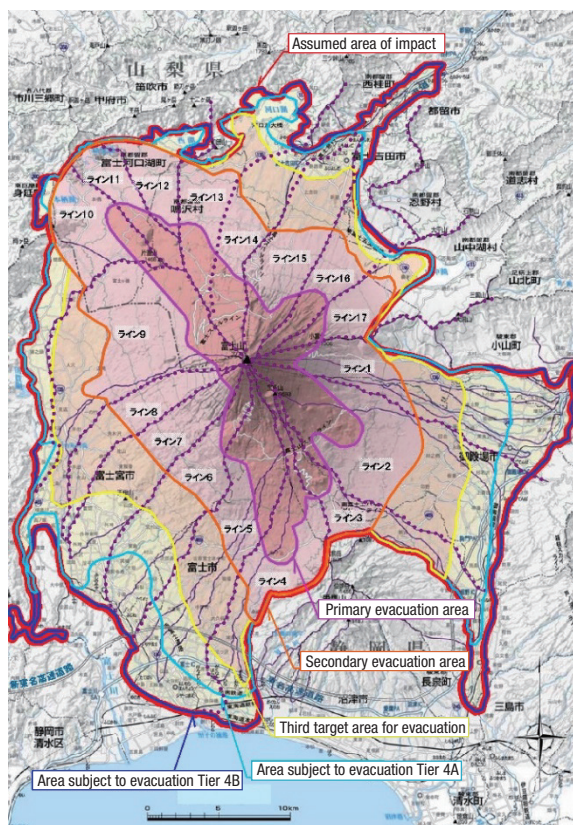
## ● Impact of the Eruption of Mt. Fuji

If Mt. Fuji erupts, it will affect a wide area. If lava flows, up to 750,000 people in Yamanashi and Shizuoka prefectures are expected to evacuate.

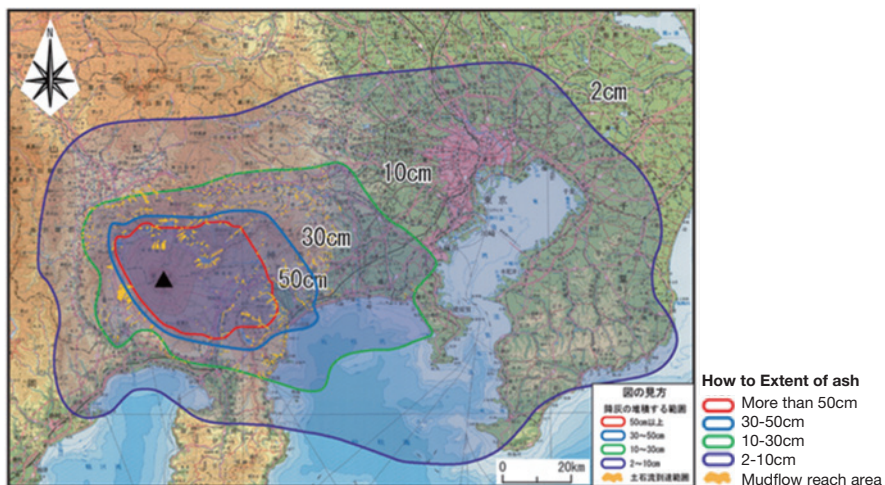
“Hazard Map (Mt. Fuji Volcano Disaster Prevention Map)” has been made to summarize possible future disasters. The map is based on research into the history of past eruptions and summarizes areas where the next disaster is likely to occur. The map includes a forecast of ash fall caused by eruptions. If a major eruption were to occur at Mt. Fuji,



ash fall is thought to affect areas as far away as Chiba Prefecture, more than 100 km from Mt. Fuji. When we think of the effects of volcanic eruptions, we tend to associate them with bright red lava flowing near the mouth of an estuary. However, since volcanic ash does not melt like snow, once it falls, it will have a significant impact on people's lives for a long period of time over a wide area. For example, there is damage to vehicles, crops, and drinking water.



Fuji eruption (Crisis Management Department, Shizuoka Prefecture HP)



Ash fall forecast map (Cabinet Office HP)



Damage to automobiles



Volcanic ash cleanup on road

### 3. BLESSINGS OF MT. FUJI

#### ● A popular landscape from the past

Mt. Fuji is a beautiful conical shape that can be seen from any direction, from east, west, south and north. This figure was also featured as the subject of ukiyoe paintings from the late Edo period. Representative ukiyoe include Katsushika Hokusai's "Thirty-six Views of Mount Fugaku" and Utagawa Hiroshige's "Fifty-three Stages of the

Tokaido. Hokusai's particularly famous 'Red Fuji' depicts Mount Fuji on an early summer morning from the direction of Lake Kawaguchi. It is a masterpiece that depicts the oxidized iron in the lava looks red on the surface of Mt. Fuji in the morning sun.

In recent years, many resort facilities have been built to take advantage of the scenery around Mt. Fuji. When you visit these resort facilities, think back to the time when Hokusai and Hiroshige lived.



53 Stations of the Tokaido Highway  
"Yuijuku" by Hiroshige Utagawa



"Kappu Kasei" or "Red Fuji" by  
Hokusai Katsushika

## ● Abundant groundwater

There is usually no water flowing in the rivers on the mountainside of Mt. Fuji. Since the ejecta of the new Fuji volcano, which is distributed on the surface of Mt Fuji, is extremely water permeable, rain and snowmelt soak into the ground and flow toward the foot of the mountain as groundwater. For this reason, there are many springs around Mt. Fuji. The famous spring on the north side of Mt. Fuji in Yamanashi Prefecture is the Oshinohakkai Spring. On the Shizuoka Prefecture side, the Kakita River, Shiraito Falls, and the spring at Wakutama Pond are famous.

The figure on the right shows that most of these springs are located near the ends of the lava. For example, at Shiraito Falls, groundwater

flows through the boundary between the crumbly Shiraito lava and less permeable layer below, gushing out from the cliff at the end of the lava and cascading down like a cascading thread.

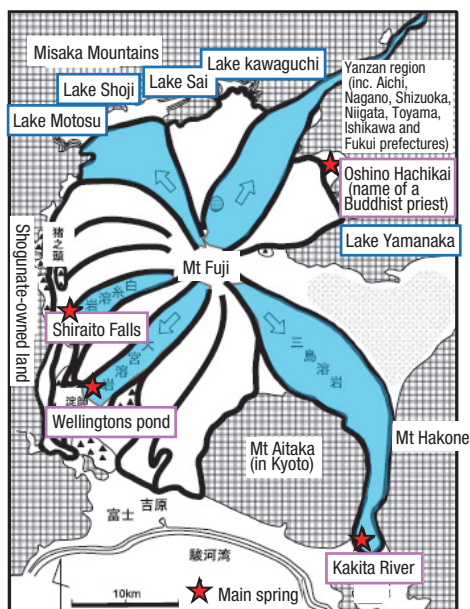
The Fuji Five Lakes“Fuji Goko” on the Yamanashi Prefecture side have no large rivers flowing into them, but they are always full of water. The reason for this is thought to be that rain that falls on the northern foot of Mt. Fuji seeps underground and gushes out at the lower elevations of the Fuji Five Lakes.

Many mineral waters are produced around Mt. Fuji. Mineral water is groundwater that has flowed from lava and

other sources from the New Fuji volcano. Most of the mineral water is pumped up from wells about 100 m deep. In terms of annual mineral water production by prefecture in 2012, Yamanashi and Shizuoka prefectures ranked first and second in the country, respectively. Both prefectures are located around Mt. Fuji. This includes the amount of



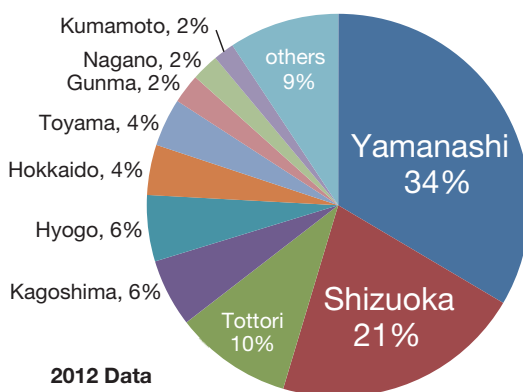
Shiraito Falls (Fujinomiya City HP)



Major springs around Mt.Fuji

mineral water produced outside Mt. Fuji area, but these two prefectures account for more than half of the national production.

Mineral water produced around Mt. Fuji contains more vanadium than mineral water produced in other regions. This is because vanadium is contained in high concentrations in the basaltic lava that erupts from Mt. Fuji.



Comparison of Mineral Water Production by Prefecture  
(Created from the Japan Mineral Water Association website)

## ● Hot springs to heal the soul

Currently, there are a number of hot spring facilities in various locations around Mt. Fuji. However, the hot springs at these facilities are not naturally gushing hot springs. They are dug in wells about 1,500 meters underground and pumped up to the surface in a temperature of 30 to 40 degrees Celsius. On the other hand, Hakone, near Mt. Fuji, is also a volcano, but it has hot springs that gush out naturally. Why do these differences occur? Mt. Fuji is because the magma reservoirs that heat the hot springs are located deep underground, making it more difficult for



the heat to be transmitted to the groundwater, while Hakone's magma reservoirs are located shallow.

Mt. Fuji is painted on the walls of many public bathhouses. It is likely that people had a strong desire to soak in hot water while viewing Mt. Fuji. These thoughts have been made a reality by digging wells deep underground, and hot spring facilities have been built in various locations at the foot of Mt. Fuji. Take a relaxing soak in a hot spring and enjoy the bounty of the earth.



Fuji on the wall of a public bathhouse. (Michikusa Society HP)

## 4. MT. FUJI TRIVIA

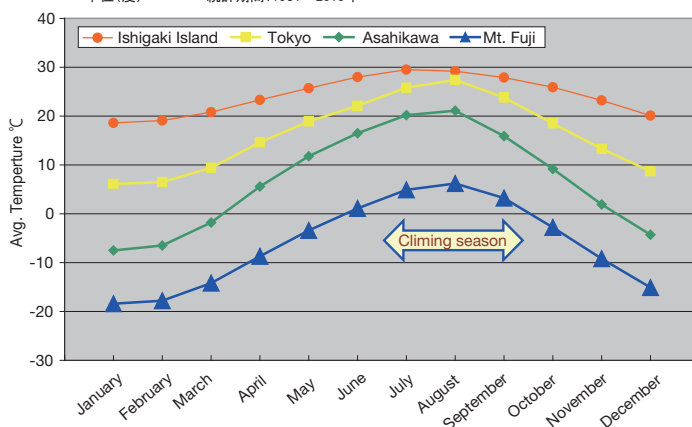
### ● Temperature at the top of Mt. Fuji

Temperature of Mt. Fuji is observed at the Mt. Fuji Special Area Weather Station located at the summit of Mt. Fuji. The average annual temperature is -6.2 degrees Celsius. That of Asahikawa in Hokkaido is 6.9 degrees Celsius, that of Tokyo is 16.3 degrees Celsius, and that of Ishigaki Island in Okinawa Prefecture is 24.3 degrees Celsius.

Thus, the temperature at the top of Mt Fuji is outstandingly low, and if you look for an area of this coldness on the plains, it corresponds to the area around the Arctic Circle in Siberia. Mt. Fuji and the average temperatures in other parts of Japan, the differences can be clearly seen. Duration of climbing Mt. Fuji is limited to about two months during the summer season due to the severe weather conditions. When you climb Mt. Fuji, please make sure you are fully equipped and safe.

point	January	February	March	April	May	June	July	August	September	October	November	December	yearly
Ishigaki Island	18.6	19.1	20.8	23.3	25.7	28.0	29.5	29.2	27.9	25.9	23.2	20.1	24.3
Tokyo	6.1	6.5	9.4	14.6	18.9	22.1	25.8	27.4	23.8	18.5	13.3	8.7	16.3
Asahikawa	-7.5	-6.5	-1.8	5.6	11.8	16.5	20.2	21.1	15.9	9.2	1.9	-4.3	6.9
Mt. Fuji	-18.4	-17.8	-14.2	-8.7	-3.4	1.1	4.9	6.2	3.2	-2.8	-9.2	-15.1	-6.2

\*単位(度) \*統計期間: 1981~2010年

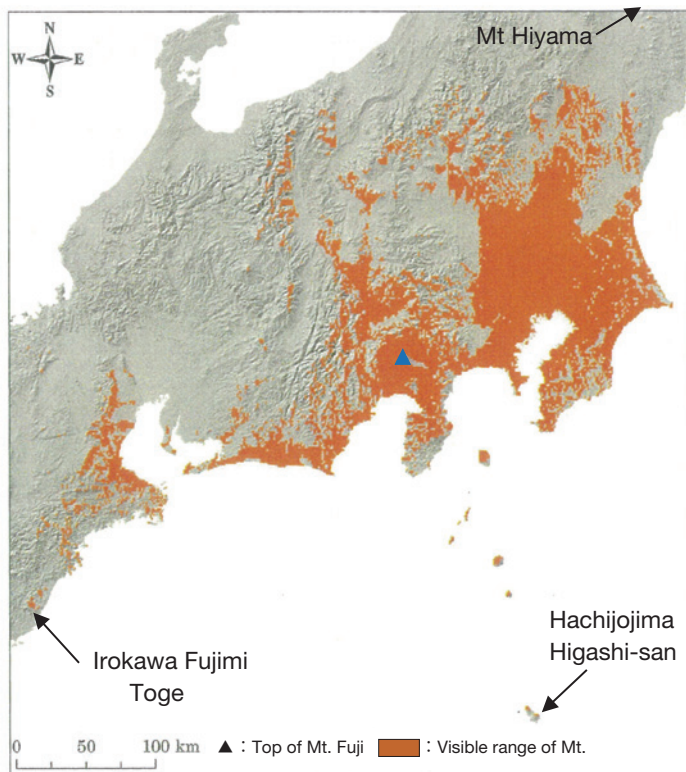


Temperatures in each area (plotted from JMA website)

## ● Places where you can see Mt. Fuji

Mt. Fuji, the tallest mountain in Japan, can be seen from some places far away and cannot be seen some places close by, due to the complex topography of Japan. Fuji is visible from the northernmost point, Mt. Hanazuka (elevation 919 m) on the border between Kawamata Town

and Iitate Village in Fukushima Prefecture, which is 308 km away from Mt. Fuji. The southern limit is Hachijo-jima Higashi-san (elevation 701 m) in Hachijo Town, Tokyo, a distance of 271 km. The western limit is Irokawa Fujimi Toge in Nachikatsuura Town, Wakayama Prefecture, a distance of 323 km. It is not easy to see Mt. Fuji from those mountains unless the weather conditions and other factors are right. Mt. Fuji is becoming less and less visible from Tokyo due to buildings and other factors.



Fuji (Sano, 2008, added)

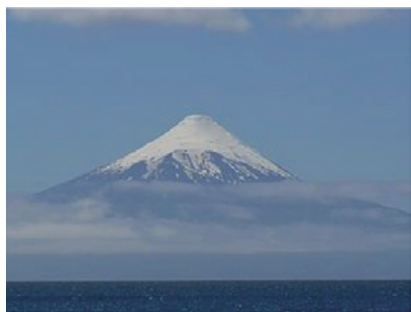
## ● Mt. Fuji in various locations

There are many mountains in Japan and around the world named “Mt. Fuji.” The lowest mountain named Mt. Fuji in Japan is Mt. Myoden Fuji in Akita Prefecture. At 35 meters above sea level, it is recognized by the Japan Alpine Club as “the lowest Mt. Fuji in Japan. Yotei in Hokkaido is called “Ezo Fuji,” and Mount Kaimon in Kagoshima Prefecture is called “Satsuma Fuji.”

Fuji is named after a mountain in the world that resembles Mt. Fuji. For example, Mount Osorno in south-central Chile is called “Chile Fuji,” and Mount Taranaki on the west coast of New Zealand’s North Island is called “South Sea Fuji.”



Mt. Myoden Fuji (blog)  
<http://blog.goo.ne.jp/taic02/e/bfc2a6b34e63aacca028aa170baf44a2>



Mount Osorno  
(Sarah and Iain, 2007)



Mount Taranaki  
(Phillip Capper, 2008)

## ● Banknotes and stamps

Mt. Fuji design is often used on banknotes. Old example is Mt. Fuji on a 50 sen banknote issued in 1913. This banknote shows Mt Fuji from Mt Ashitaka. Mt. Fuji from Sasago-Kaigaharayama is shown on on the old 500-yen bill issued in 1951 and 1969. Mt. Fuji from the shores of Lake Motosu is shown on the old 5,000-yen bill issued in 1984 and the 1,000-yen bill issued in 2004.

Mt. Fuji has been used on many postage stamps. The oldest known examples are those issued in the Taisho era (1912-1926). Mt. Fuji is shown on the stamp issued from Fuji Summit Post Office. Mt. Fuji is also shown on commemorative postage stamps for Fuji Radar and the completion of the Tomei Expressway.



Fuji depicted on the 50 sen banknote (Eclipse2009, 2011)



It became the design of the old 5,000 yen bill.

Upside-down Fuji at Motosu-ko Lake (Captain76, 2010)



Stamps with Mt. Fuji (blog)  
Issued 1922, 8.00 on the left, 20.00 on the right

<http://suzu22rann.web.fc2.com/hujisann.html#hujisikakitte>



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Front cover: New Year Fuji 4 January 2013 (Asia Air Survey Co., Ltd.)

Back cover: Tomei-Shin-Tomei Expressway and Mt Fuji (photo by  
Yukito Yamashima)