



Certified Nonprofit Organization
MFRS
MOUNT FUJI RESEARCH STATION



LERMF

Laboratory for Environmental Research
at Mount Fuji

The Mount Fuji Weather Station, which had a 72-year history of manned observation, was unmanned in 2004.

What has happened to it since then? We have lented this valuable facility from the Japan Meteorological Agency and are using it for research and education.

LERMF(Laboratory for Environmental Research at Mount Fuji) which has received a grant from the Japan Society for the Promotion of Science in 2024 is steadily achieving results.



Facilities of former Mt. Fuji Weather Station

The four buildings are connected by a corridor and have a site area of more than 600 m². Buildings 2 and 3 are constructed of an aluminum alloy, the same style to that used for the Shinkansen, bullet train in Japan, because of its lightness and strength.

The JMA continues meteorological observations of atmospheric pressure, temperature, and humidity in Building 2, using batteries. We now use most of the rest of the station for various research and educational projects since 2007.

1. Building 1

Used for the Mt. Fuji Radar built in 1964 and has a huge radar dome above. The radar dome was removed in 2001. This 88 m² two-story building is used for atmospheric chemistry and physics.

2. Building 2

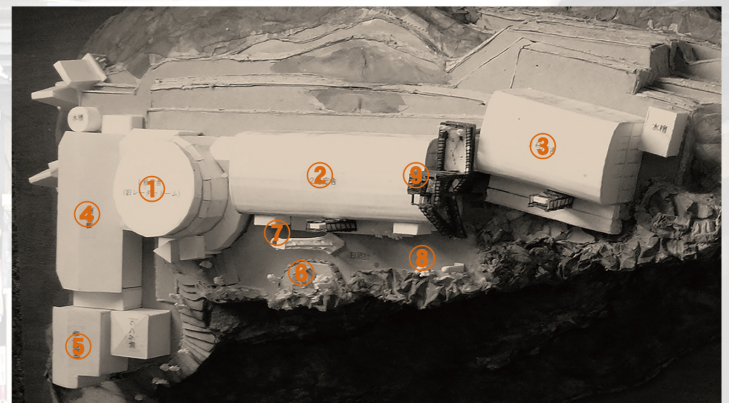
Built in 1973, 134 m². The first floor has a dining room and traditional living rooms, which are used for medical research.

3. Building 3

Built in 1973, 76 m². We constructed a new air inlet in 2012 that is used during the summer.

4. Building 4

Built in 1964, 99 m². Mainly contains the battery system for the Mt. Fuji Radar and is disused. Houses a simple toilet during the summer.



5. Temporary Building

Built for the construction workers of Buildings 2 and 3 in 1971, 42 m². It also served as an experimental building for new buildings. Mt. Fuji summit support team stay in here during the summer.

6. Point of triangulation

7. Sunlight tower

8. GPS electron threshold

9. Wind measurement tower



Research Activities

The summit of Mt. Fuji (35.21°N, 138.43°E, 3776 m a.s.l.) is located in the path of the East Asian upper air mass, which is transported from the Asian Continent through the free troposphere. Mt. Fuji therefore provides an ideal observation site for atmospheric chemistry and physics research, such as monitoring fine particulate matter, sulfate aerosols, and mercury.

Since the summer of 2007, Mt. Fuji Weather Station has been operated by the non-profit organization "Mount Fuji Research Station (former Valid Utilization of Mt. Fuji Weather Station)", renting part of the station from the Japan Meteorological Agency.

For 2 months during the summer research campaigns, the organization runs an open research station for the interdisciplinary science and education.



Permafrost and Ecology

At the summit of Mount Fuji, the only location in Honshu where permafrost has been reported, ecological studies have been conducted on mosses and other organisms that use it as a water source. Since 2010, a ground temperature observation borehole 10 meters deep has been drilled near the summit, and temperature sensors have been installed to begin continuous monitoring of ground temperatures. By directly observing the ground temperature profile to significant



depths along with meteorological elements, researchers aim to clarify the factors controlling ground temperature changes and to evaluate the dynamics and distribution of permafrost.

(National Institute of Polar Research, Shizuoka University, University of Tsukuba, The University of Tokyo)



Mount Fuji Volcanic Monitoring

The last eruption of Mount Fuji occurred about 300 years ago, in 1707, during which the Hiei Crater was formed. Mount Fuji is an extremely young volcano, comparable to a human around the age of 20, and future eruptions are considered highly likely. In volcanic eruption prediction, accurately detecting the ascent of magma is crucial. For this purpose, in addition to monitoring mountain inflation and volcanic earthquakes, geomagnetic observations, which can directly detect



magma ascent, have been recognized as effective. In 2020, the NPO established the first observation point on the Shizuoka side at Tarobo. Currently, a second observation point near the summit is planned, and ongoing monitoring of Mount Fuji is scheduled to continue in the future.

(Tokai University, Shizuoka Prefectural University, Tokyo Metropolitan University)



High-Altitude Mountain Medicine and Training

At the summit of Mount Fuji, the air pressure is about two-thirds that at sea level, which reduces the amount of oxygen in the air, creating a low-pressure, low-oxygen environment. Acute mountain sickness (AMS) is said to occur at altitudes around 2,500 meters, causing symptoms such as headaches, loss of appetite and nausea, fatigue and weakness, dizziness and unsteadiness, and sleep disturbances, and in severe cases, it can be fatal. Approximately half of the mountain accidents on Mount Fuji are due to AMS. For safe climbing, it is important to prevent and treat AMS and to clarify the related pathophysiology.

Additionally, the number of tours traveling to high-altitude locations and overseas climbs has been increasing. Generally, the first major challenge for high-altitude

acclimatization is said to be at 4,000 meters, which corresponds to the elevation of Mount Fuji in Japan. Recently, private hypoxic rooms have been increasingly used before overseas climbs; performing high-altitude acclimatization training beforehand, which closely simulates actual climbing conditions, can enable efficient acclimatization on site, thereby contributing to safer climbing and shorter climbing periods.

(Tokyo Metropolitan Otsuka Hospital, Jichi Medical University, Kanoya Sports University)

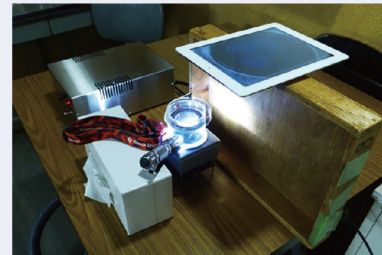


Development of Scientific Educational Tools

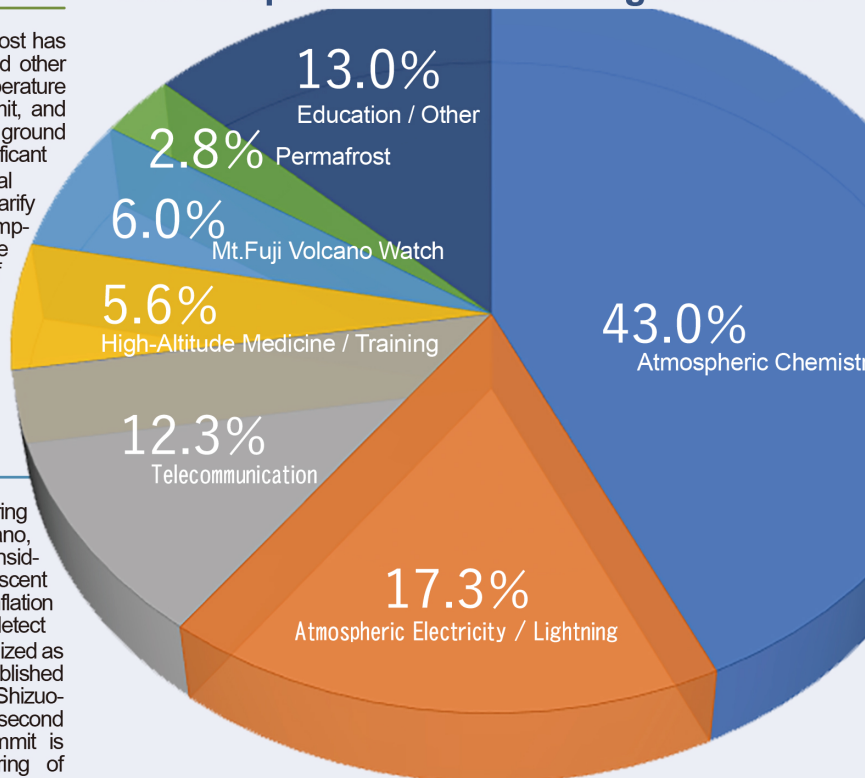
New and unique scientific education tools for junior high and high school students are being developed by utilizing Mt. Fuji's environment. For example, a high-school

science teacher has been developing an experimental method intended for classroom use to teach students how to investigate low pressure, severe wind and rain, sunshine, high UV light, and natural radioactivity.

(Rikkyo Niiza Junior & Senior High School, Jumonji Junior & Senior High School, NPO Galileo studio)



User composition ratio according to the field

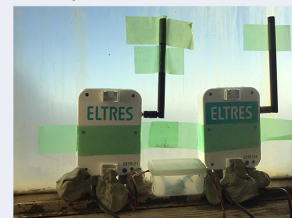


Telecommunication

Mount Fuji, which can be considered an observation tower of about 4 km, is an ideal place for research on communication technology. Various studies have been conducted so far, but recently, experiments on ultra-low power, long-distance stable communication called LPWA (Low Power Wide Area) have become active (SONY, Shizuoka Prefectural University, Tokyo Metropolitan University). In addition, the use of mobile phones at the extreme environment of the summit of Mount Fuji is an important research topic from the perspective of the safety of climbers.

The four major mobile phone companies (KDDI, NTT Docomo, SoftBank, Rakuten Mobile) are conducting demonstration experiments on not only 4G but also 5G mobile communications, studying whether stable communication can be provided to users.

(SONY, Shizuoka Prefectural University, Tokyo Metropolitan University, KDDI, NTT, Docomo, SoftBank, Rakuten Mobile)



History of Mt. Fuji Weather Station

In 1895, a meteorologist, Itaru Nonaka accompanied with his wife Chiyoko, spent days at the summit of Mt. Fuji for the meteorological observation in a little by himself.

In 1932, JMA established weather station at the summit, in which Mount Fuji was built in 1964 which saved many people from the typhoon disaster, but in 2001, the RADAR was removed, the mission of which was replaced by Meteorological Satellite.

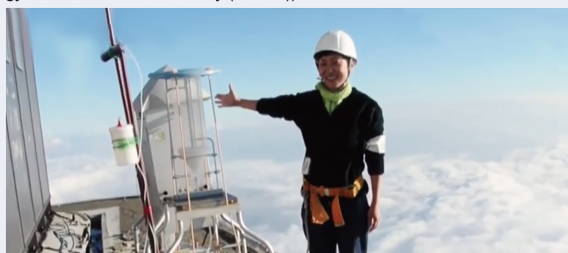


Atmospheric Chemistry

Observational tower for climate change and transboundary air pollution.

Mount Fuji is an independent peak with a high elevation, and its summit is located in the free troposphere. For this reason, it is possible to observe the effects of aerosols (fine particles) and cloud particles related to climate change, as well as long-range transport of air pollutants arriving from the Eurasian continent. In the past, smoke from Sakurajima and air pollutants from the Chinese continent have been observed, and the Fuji Weather Station has begun to function as a sensor for global atmospheric movements. In climate change studies, there are many substances that should be the focus of research, including aerosols, cloud droplets, and greenhouse gases, while in transboundary air pollution, acid substances, heavy metals, harmful organic compounds, and mercury as an indicator of coal combustion are important. The importance of direct field observations is therefore high. Since air pollution is a concern for spreading far across the Pacific Ocean to the rest of the world, researchers from Taiwan, France, and Germany, in addition to domestic research institutions, also use the site. Collaborative research on PM2.5 with China and South Korea has already begun. Furthermore, there are plans to strengthen the observation network through cooperation with high-altitude observatories worldwide, such as Mauna Loa in Hawaii and Jungfraujoch in the European Alps. In November 2017, the international symposium ACPM2017 was held, and since 2023, microplastic research at the summit of Mount Fuji has become a topic of global interest.

(National Institute of Advanced Industrial Science and Technology, Japan Agency for Marine-Earth Science and Technology, Saitama Prefectural Environmental Science International Center/Hokkaido University, Tokyo University of Agriculture and Technology, Yamanashi University, Kyoto University, Kanazawa University, Tokushima University, Kumamoto University, Fukui University, Tokyo Metropolitan University, Ishikawa Prefectural University, Shiga Prefectural University, Shizuoka Prefectural University, Waseda University, Tokyo University of Science, Teikyo University of Science, Shizuoka Institute of Science and Technology/National Central University (Taiwan))



Atmospheric Electricity, Lightning, and Cosmic Ray Studies

Research on lightning activity: Measuring discharge phenomena in the upper atmosphere and continuous monitoring of cosmic rays

The summit of Mount Fuji is frequently covered by thunderclouds. To investigate the relationship between the radiation behavior from thunderclouds and the electric field structure, detectors for measuring radiation from thunderclouds are installed inside the weather station, and electric field measurement devices (field mills) are installed on the roof of the station for observation.

In addition, during the summer, the active lightning discharges that develop over the Kanto Plain generate high-altitude luminous discharge phenomena above thunderclouds (discharge luminous phenomena occurring between thunderclouds and space). These phenomena are observed to attempt to clarify their fine structures and the characteristics of the parent thunderclouds and lightning discharges that cause them. In particular, discharges occurring in the lower stratosphere, which are difficult to capture from ground-based observations, are being observed. In August 2014, it was possible to capture on camera "Gigantic Jets," considered extremely difficult to photograph even worldwide, on two occasions.

The construction of a continuous cosmic ray measurement system at the summit of Mount Fuji also contributes to radiation exposure management for airline crew members.

(Japan Atomic Energy Agency, National Institute of Radiological Sciences/The University of Tokyo, Tokyo Gakugei University, National Defense Academy, Shizuoka Prefectural University, Tokyo University of Science, Tokai University, Hiroaki University, Seikei University, Ibaraki National College of Technology/Otowa Electric Industry, Docomo CS Tokai, Weathernews)



Organization's History

In 2004, Mt. Fuji Weather Station was shifted to be under unmanned operation. 50 researchers gathered and organized a workshop, and it shifted to the NPO to prevent that the Station was demolished. In 2007, summer campaigns started receiving permission to use the facilities from the JMA in the summer 2 months. Now, the MFRS is regarded as a unique research facility with interdisciplinary scientific fields. The number of researchers has increased to be 260.

2005	November 27, Valid Utilization of Mt. Fuji Weather Station (present: MFRS) founded. (re-organization from Mt. Fuji High Altitude Group)
2006	First International Workshop / Symposium in Tokyo, on International Valid Utilization of Mt. Fuji Weather Station. November 22-23: Second International Workshop / Symposium at the University of Tokyo, funded by the MEXT grant for the Mt. Fuji Project for establishing a high mountain observation platform in an extreme environment.
2007	July 10 - September 5: First Summer Campaign at the Mt. Fuji Weather Station, 212 researchers participated over 58 days. July 17: World Eco-Science Network Meeting sponsored by Dentsu Ltd.
2008	July 10 - August 31: Second Summer Campaign. 379 researchers participated over 53 days.
2009	July 12 - August 30: 4th Summer Campaign. 467 researchers participated over 50 days. NIRS started year-round observation of cosmic rays. AIST and Tokyo Metropolitan University started using wireless LAN for data communication and semi-real-time data publication.
2010	July 12 - September 1: 5th Summer Campaign. 373 researchers participated over 53 days. Radioactivity was measured on the climbing route, live camera images of cloud were broadcast by wireless LAN to the organization members.
2011	March 11, East Japan Earthquake and Fukushima Daiichi Nuclear Disaster. July 12 - September 1: 5th Summer Campaign. 373 researchers participated over 53 days. Radioactivity was measured on the climbing route, live camera images of cloud were broadcast by wireless LAN to the organization members.
2012	July 1 - August 29: 8th Summer Campaign. 434 researchers participated over 60 days. September 27, 2014: Eruption of Mt. Ontake 3067-m volcano on the west side of Kiso Valley.
2013	July 1 - September 1: 10th Summer Campaign. 456 researchers participated over 63 days. A Taiwan-Japan project on atmospheric mercury and VOCs was carried out by the National Central University, Taiwan and Tokyo University of Agriculture and Technology.
2014	November 6 - 10: ACPM2017 was held at Gotemba, Japan, successfully with 101 participants from 11 countries and one region, 41 oral presentations and 34(-1) poster presentations.
2015	July 8 - August 28: 9th Summer Campaign. 530 researchers participated over 22 projects in 52 days. New student programs have started.
2016	July 1 - September 1: 10th Summer Campaign. 456 researchers participated over 63 days. A Taiwan-Japan project on atmospheric mercury and VOCs was carried out by the National Central University, Taiwan and Tokyo University of Agriculture and Technology. The English name of the NPO is changed to be NPO Mount Fuji Research Station.
2017	July 1 - September 1: 11th Summer Campaign. November 6 - 10: ACPM2017 was held at Gotemba, Japan, successfully with 101 participants from 11 countries and one region, 41 oral presentations and 34(-1) poster presentations.
2018	Another 5 year lease contract was made between JMA (from September, 2018- September, 2023)
2019	Laboratory for Environmental Research at Mount Fuji has started as an inner organization of NPO. (January, 5, 2019) July 26, Total number of participants reaches 5,000 since the first summer campaign, 2007.
2020	July 1, because of COVID-19, summer campaign 2020 was cancelled. June 26 - Aug. 15, Crowdfunding call for applications, 424 supporters received.
2021	May 31, Tokyo Metropolitan Government renews the validity period of the authorization of specified nonprofit corporations (until January 7, 2026).
2022	Summer campaign during July 1-Sept.9 was performed with care against COVID-19 infection.
2023	Another 5 year lease contract was made between JMA (from September, 2023-September, 2028)
2024	June 12: First Grant-in-Aid for Scientific Research Project (Volcanic Eruption Monitoring) has started.
2025	Summer campaign during July 1-Sept. 6 was performed. The 7000th researcher at the summit was Prof. Sorimachi.

Mount Fuji Research Station

環境省
公衆トイレ
馬の背
ハット
NTT
ハット

ニッ山
永山

富士山

7.8合ハット

5.5合ハット

宝永第一火口

富士宮口

宝永山

地中ケーブル
(7.2km)

2.8合ハット
73号柱
71号柱

Tarobo Base

御殿火口

赤塚

馬ノ頭

Power Transmission Lineion

(Length: 10,903 m)

An advantage of Mt. Fuji Research Station is that its electricity supply comes from a commercial electric source through 3.8 km of over-head wires and 7.2 km of underground cables. Power is also supplied to a public toilet on the summit and to a parking area at the foot of the mountain. The over-head cables can be damaged by lightning, snow, wind, and fallen trees. Repair and maintenance are difficult at high altitudes.



地中ケーブル
(2.5km)

架空線
(3.8km)



1号柱
責任分界点
東京電力
送電線網
(エネット)

Logistics and Power Supply

Mount Fuji Research Station (Elevation: 3,776 m)

Professional climbers are employed as Mt. Fuji summit supporting staffs during the summer season. They take care of the researchers and students who are susceptible to high-altitude sickness, which can be fatal. The climbers also install monitoring equipment and repair the power supply for the aging buildings.



Tarobo Base(Elevation: 1,300 m)

Tarobo at the southeast foot of Mt. Fuji is the base camp for Bulldozers which are used to carry large loads of equipment, food, and water. Tarobo is also used as one of the observation sites for atmospheric sciences as well as the base for researchers who climb to the top of mountain.



Gotemba Base (Elevation: 446 m)

A two-story house was rented with the whole year contract in the quiet residential area of Gotemba city as the Gotemba Base of NPO, which also can be utilized as an observation site.



Gotemba Base

Mount Fuji Research Station

3,776 m

Tarobo Base

1,300 m

446 m



Certified Nonprofit Organization
Mount Fuji Research Station

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Laboratory for Environmental
Research at Mount Fuji

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