

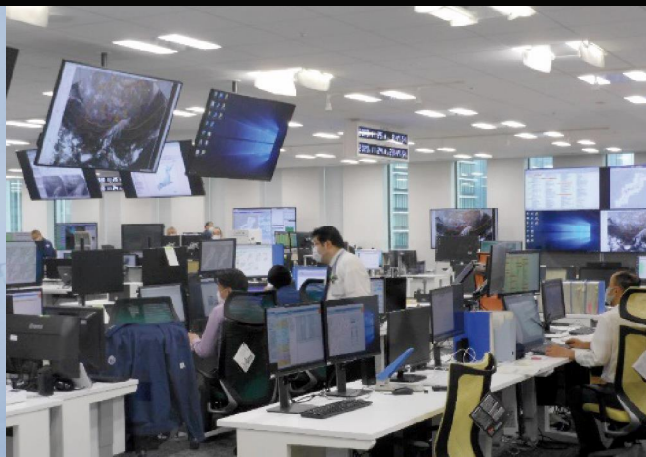


Japan Meteorological Agency





Enhancement of Local Disaster Mitigation	•••••	1
Enhanced Application of Weather Information	•••••	2
Meteorological Observation Networks	•••••	3
Weather Analysis and Prediction	•••••	5
Monitoring of the Global Environment	•••••	7
Monitoring of Earthquake/Tsunami	•••••	9
Monitoring of Volcanic Activity	•••••	11
Meteorological Information for Aviation and Maritime Safety	•••••	13
International Cooperation	•••••	15
JMA Information Services	•••••	21
Organizational Structure	•••••	27
History	•••••	28



Protecting people, nature and the earth

The Japan Meteorological Agency (JMA) has provided services to protect people and their property from disasters by monitoring and predicting natural events for over a century since it was established in 1875.

JMA is committed to its activities for the protection of life and property as well as support for resilient and productive everyday living based on the mission and vision outlined below.

Mission:

To contribute to the promotion of public welfare by preventing disasters, securing traffic safety, and promoting the prosperity of industries, and to offer international cooperation concerning meteorological services, by ensuring the sound development of meteorological services.

Vision:

To provide meteorological services supporting safe, resilient and productive everyday living.

- Enhance technological development under public-private-academic partnerships and international coordination incorporating state-of-the-art science and technology.
- Promote the application of meteorological information and data as part of the soft infrastructure necessary for various aspects of everyday living.



Enhancement of Local Disaster Mitigation

JMA supports disaster mitigation activities of local governments and local branches of relevant Ministries as outlined here.

JETT(JMA Emergency Task Team)



▲ JETT staff at a disaster scene

In the event of a large-scale disaster, JMA dispatches JETT staff to provide weather commentary based on local needs and to support local governments and related organizations.

～ Dispatches for 2018 – 2020 ～

Year	Dispatches	Number of staff dispatched
2018	9	1154
2019	23	1775
2020	22	840

As of November 30, 2020

Forecaster in your town

All local meteorological offices in Japan have support teams based on regional disaster characteristics, and efforts are made to build close cooperative relations with local governments.

If large-scale disaster conditions are expected, the head of the local meteorological office contacts the head of the local government to communicate the sense of crisis.

Weather Disaster Mitigation Advisors (WDMAs)



▲ A WDMA outlining weather conditions to local government staff

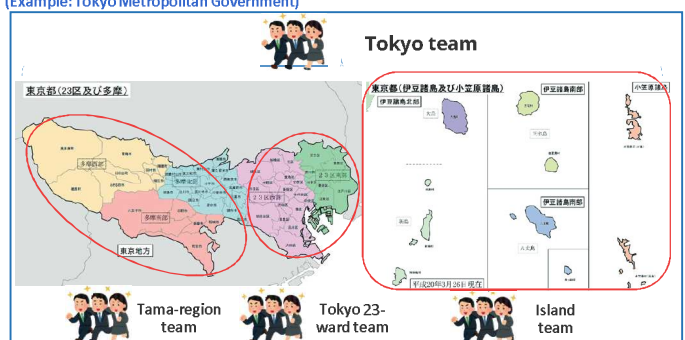
In December 2020, JMA assigned several WDMAs specializing in local weather conditions to work at local governments. The local government support system will be expanded to enhance local disaster mitigation efforts.



A WDMA receiving a letter of commission

12.17.2020

(Example: Tokyo Metropolitan Government)

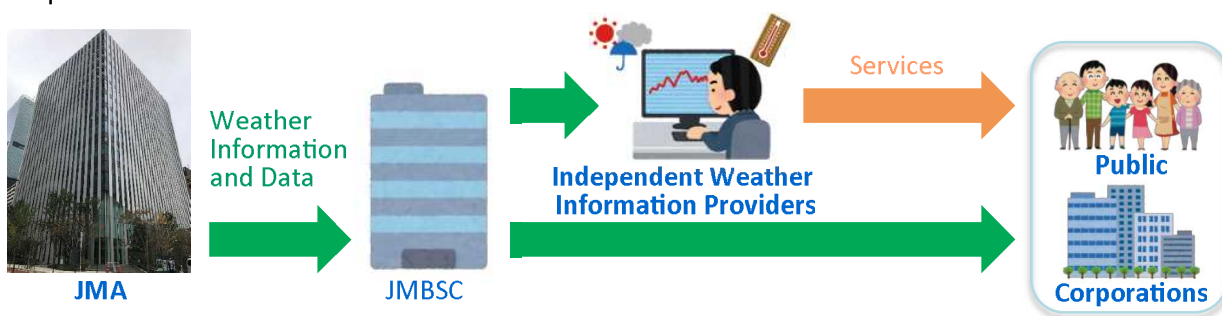


Enhanced Application of Weather Information

JMA provides weather information to support socio-economic productivity in Japan.

Data Provision to the Private Sector & Licensing for Forecast Services

Japan's private sector plays a vital role in providing individual and commercial weather information services. In this context, JMA supplies a wealth of related information via the Japan Meteorological Business Support Center (JMBSC; a general incorporated foundation designated by the JMA Director-General) and manages licensing to control the quality of independent forecast services.



Commercial Weather Information Development

Enhanced Application of Weather Information

- ✓ Analysis of big data and meteorological information for commercial insight
- ✓ **Inter-sector dialogue**
- ✓ Efforts toward **provision of fit-for-purpose weather data**

Specific Activities

Weather Business Consortium (WXBC) of public, private and academic operators (established March 2017)

- Seminars and other events to promote expertise on weather data and related commercial application
- Provision of opportunities for service providers to engage with users



Weather Business Forum



Weather data analysis training



Weather business matching events

Public-Private-Academic Collaboration

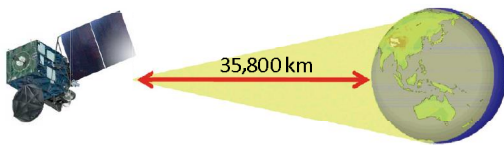
Service upgrades and productivity improvement with weather data in various sectors

Meteorological Observation Networks

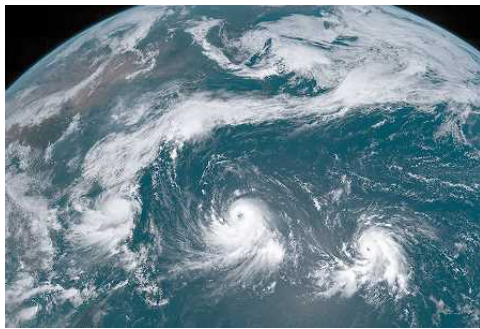
For Better Monitoring of Atmospheric Phenomena

Satellite Observation

Satellite observation is indispensable for obtaining a clear picture of typhoons over ocean areas and other global atmospheric conditions. The Eastern Asia, Western Pacific and Oceania regions are covered by JMA's Himawari geostationary meteorological satellites (*himawari* is the Japanese word for sunflower), whose 10-minute interval observations from 35,800 km above the equator produce data on the distributions of clouds, moisture and volcanic ash, upper-air winds and sea surface temperatures. JMA and a variety of National Meteorological and Hydrological Services (NMHSs) make extensive use of Himawari data in daily operations.

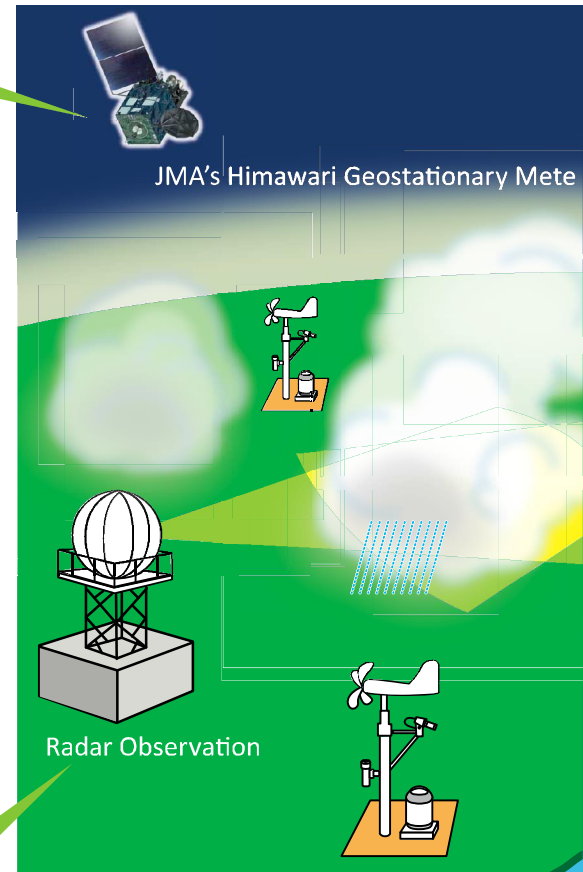


▲ Observation from space



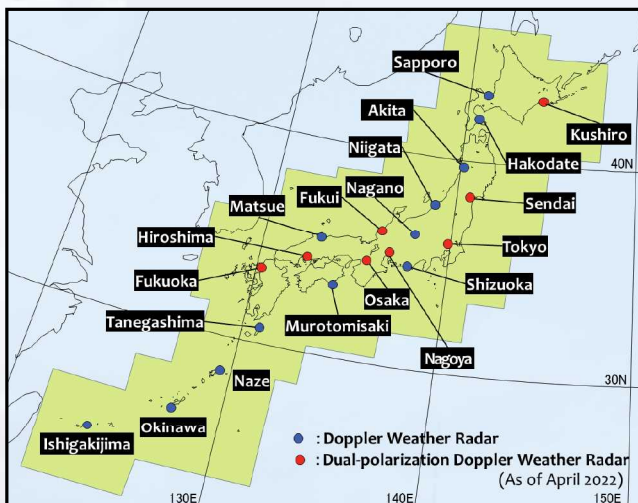
▲ Cloud distribution as observed by Himawari

Observation networks for atmosphere

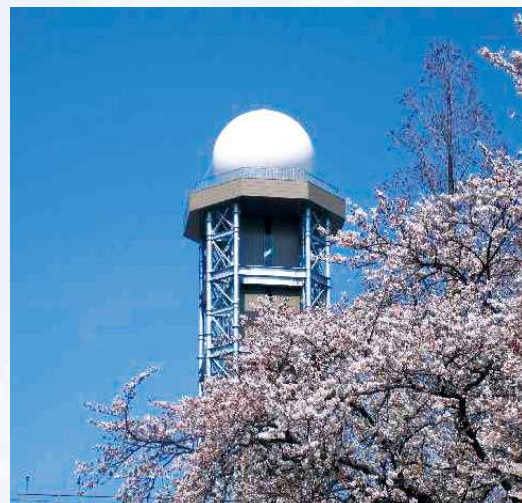


Radar Observation

JMA operates 20 Doppler weather radars for observation of precipitation intensity and upper-air wind fields. Starting with the Tokyo radar in 2020, Doppler weather radars have gradually been replaced with dual-polarization Doppler weather radars for more accurate precipitation monitoring.



▲ JMA's radars and observation areas



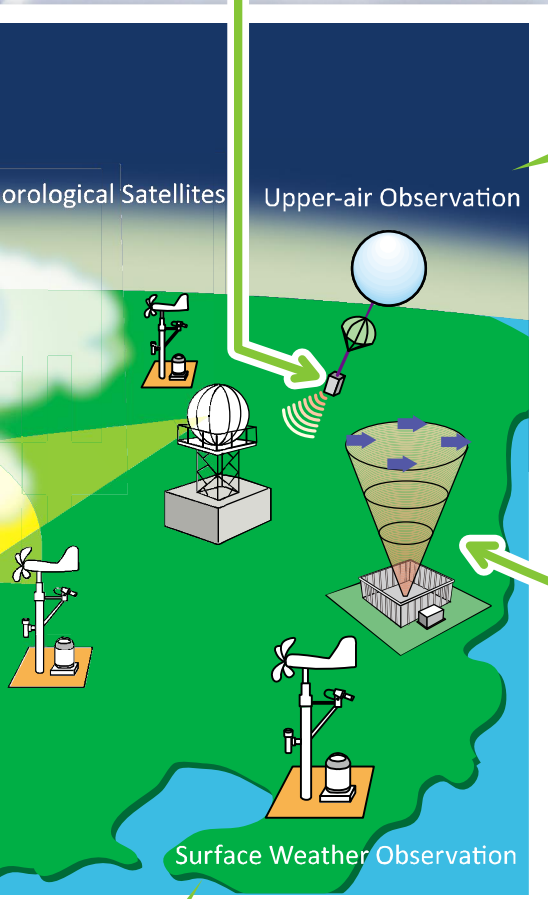
▲ Tokyo Radar

JMA operates an array of networks involving surface-based observation and the use of meteorological satellites to monitor the atmosphere around the clock. After a process of stringent quality control, the results are made available to the public and related users. The data produced are essential in clarifying atmospheric conditions, and are used for daily weather forecasts, severe weather monitoring, typhoon analysis and climate change monitoring.

Radiosonde

Radiosondes measure pressure, temperature, humidity and wind in the atmosphere at altitudes of up to 30 km from the surface twice daily.

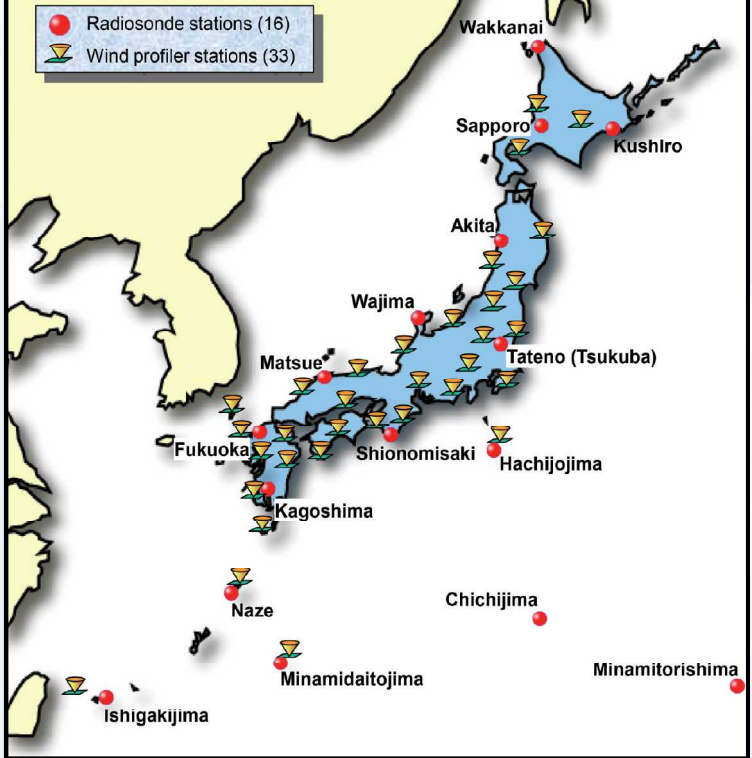
Surface weather monitoring



Upper-air Observation

To clarify meteorological conditions and three-dimensional atmospheric activity, upper-air monitoring is performed via radiosonde and wind profiler observation networks.

Upper-Air Observation Network



Surface Weather Observation

A total of 160 JMA weather stations, including Local Meteorological Offices, across the country routinely collect data on variables such as surface pressure, temperature, humidity, wind, precipitation, sunshine duration, snow depth, visibility and current weather conditions. As many as 1,300 AMeDAS (Automated Meteorological Data Acquisition System) stations automatically observe precipitation, temperature, wind and sunshine duration. Around 320 of these also observe snow depth.

Wind profiler

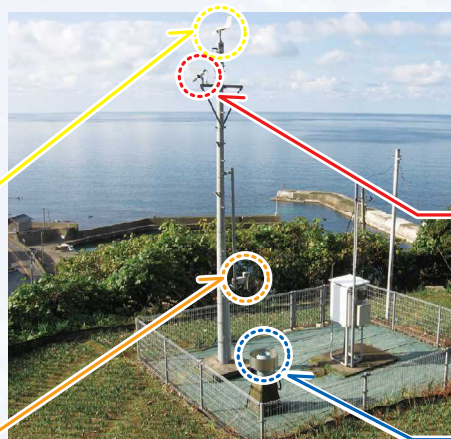
Wind profilers measure wind in the upper atmosphere at altitudes of up to about 12 km every 10 minutes.



Anemometer



Thermometer



Sunshine recorder

Raingauge



Weather Analysis and Prediction

For Appropriate Forecasts and Warnings

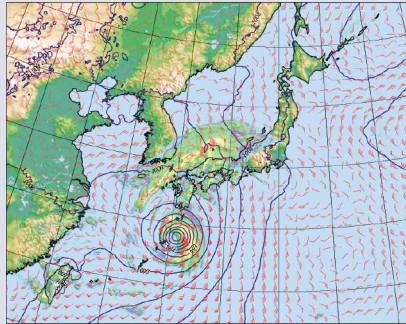
Numerical Weather Prediction (NWP)

Weather prediction is numerically conducted on a supercomputer using models initialized with observation data.

▼ Typhoon forecast example

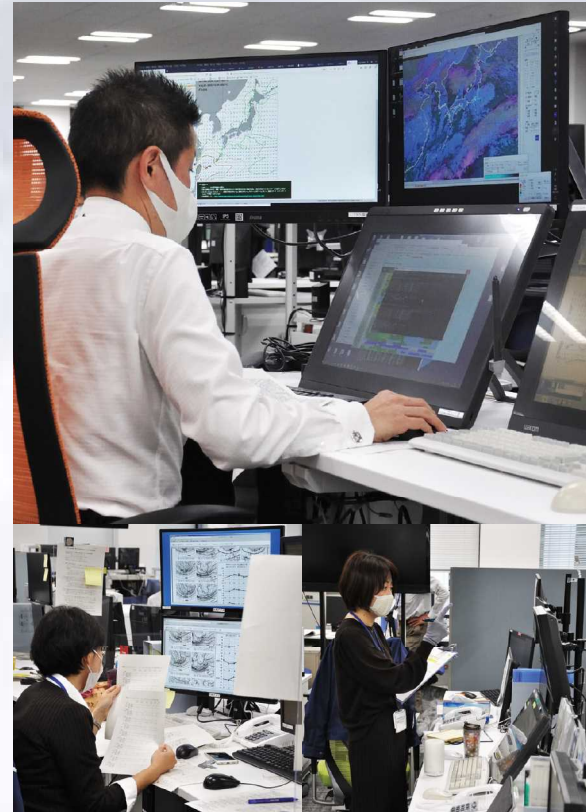


▲ Supercomputer system



Weather Forecasting

Weather forecasts, Emergency Warnings, Warnings and preparedness and mitigation based on observation data. The service's accuracy, reliability and level of detail have expertise and the progress of NWP.



Weather Maps

Weather maps showing isobars, center positions/intensities of highs and lows and locations of fronts are made using a variety of weather observation data.

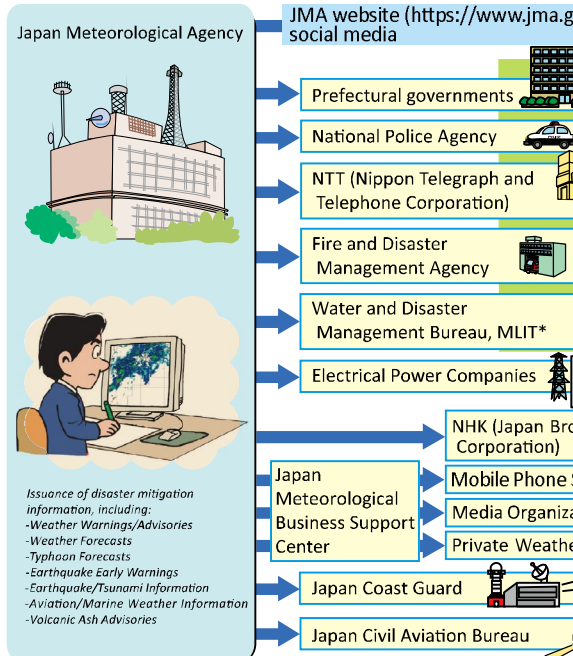
Forecasters use various weather maps to determine future weather conditions.



Provision of Disaster Mitigation Information

JMA issues disaster mitigation information to residents, via TV, radio and other media, and directly to disaster management authorities and local governments to help mitigate disaster-related damage.

Prefectural governments, NTT (Nippon Telegrams and Telephone Corporation) and J-ALERT ensure the provision of information to municipal governments directly involved in local disaster mitigation. Alerts are provided online and through other channels.



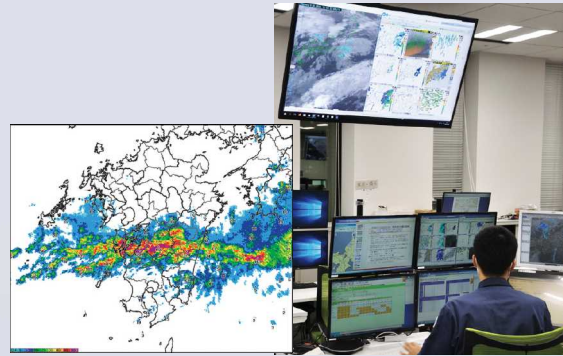
JMA monitors weather conditions 24 hours a day and issues Emergency Warnings, Warnings and Advisories to mitigate the effects of possible natural disasters and allow preparations for other disasters they may trigger. The Agency also issues weather forecasts based on observation and numerical weather prediction (NWP) for the general benefit of society.

Advisories are issued mainly for natural disaster from around the world and NWP products. been improved over the years based on forecaster



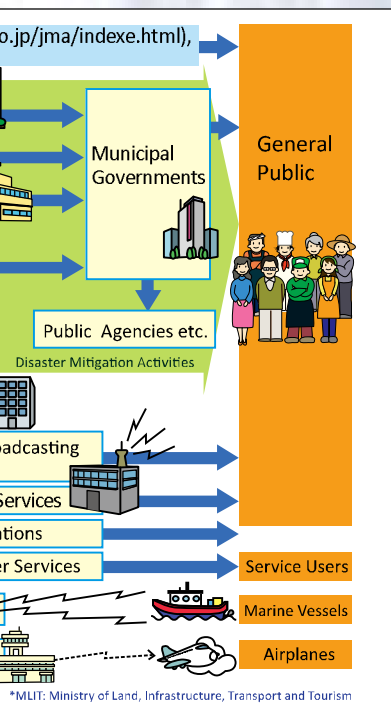
Monitoring

Forecasters monitor changes in weather conditions such as torrential rain, tornadoes and thunderstorms to enable the issuance of appropriate weather information that will help mitigate the effects of natural disasters.

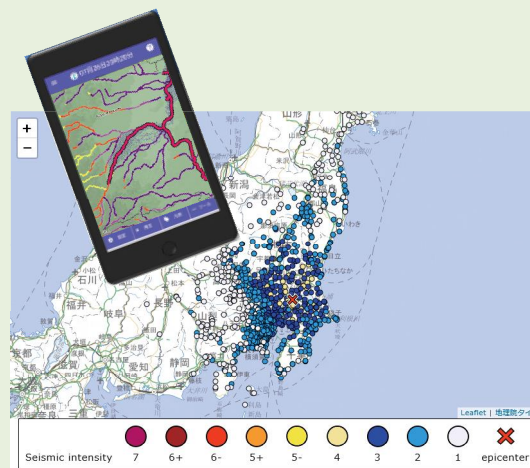


Utilization of Data from Other Organizations

JMA also collects data gathered by other national and local organizations in Japan as well as National Meteorological and Hydrological Services (NMHSs) and relevant organizations around the world.



▼ Typical channels for notification



https://twitter.com/JMA_bousai

Monitoring of the Global Environment

For a Better Understanding of Our Earth

Monitoring of the Global Environment

Observation

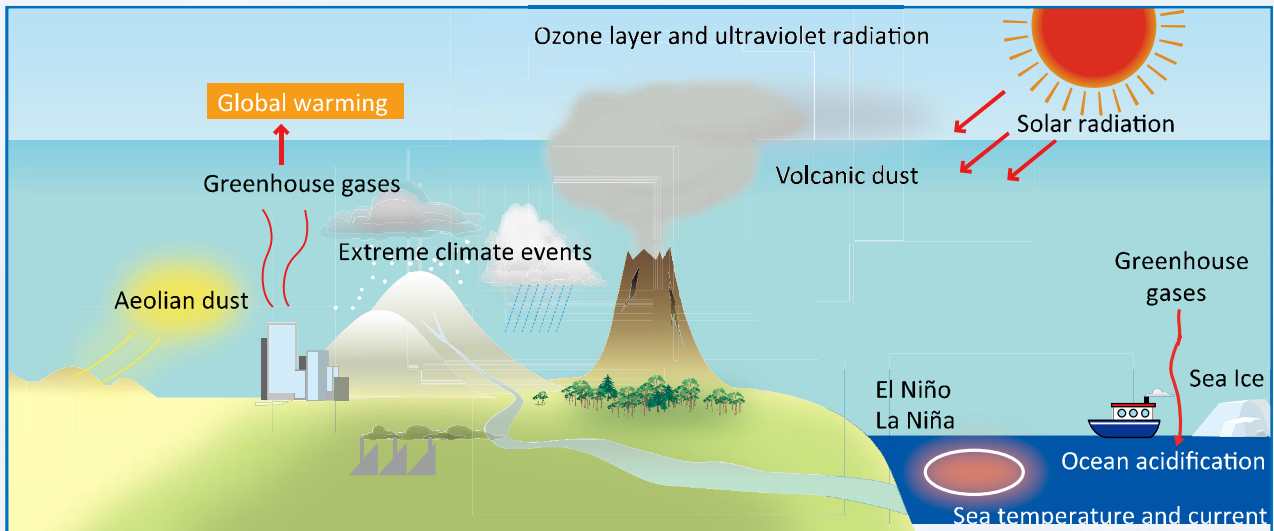
- Weather conditions/phenomena
- Greenhouse gases
- Ozone layer and ultraviolet radiation
- Oceanographic conditions/phenomena
- Aerosol and solar radiation

Analysis and Prediction

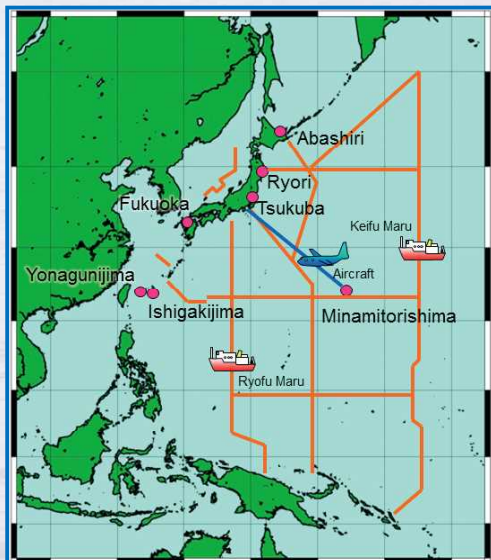
Information

- Global warming projection
- Extreme climate events
- Ozone layer and ultraviolet radiation
- Marine Diagnosis Reports
- Global analysis of greenhouse gases

Monitoring of Phenomena



Observation Network for the Global Environment



▲ Global environment observation network

JMA monitors greenhouse gases, ozone, solar radiation and other atmospheric components at several ground observation stations.

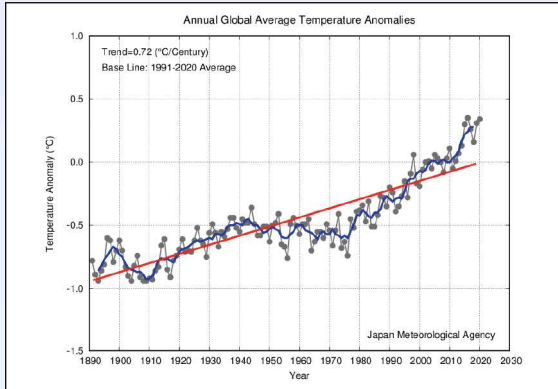
The Agency also observes greenhouse gases in seawater using research vessels and carries out greenhouse gas observation in the upper air using aircraft in collaboration with Japan's Ministry of Defense.

- (●) Global environment observation station)
- (—) Research vessel observation route)
- (—) Aircraft observation route)

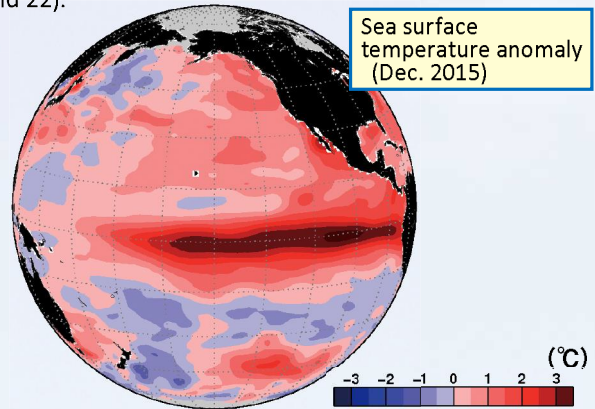
JMA carries out observation and monitoring related to environmental issues such as global warming and ozone layer depletion as well as prediction of global warming, and makes the results public. The Agency also provides information on oceanic phenomena such as El Niño, which significantly affects extreme climate events around the world.

Monitoring of the Climate

JMA monitors extreme climate events around the world and related phenomena such as El Niño and La Niña. The Agency also runs and develops a global general circulation model to calculate variables such as wind and sea currents for seasonal climate outlooks and future climate projection (see pages 21 and 22).



▲Monitoring of global warming



▲An El Niño event

Monitoring of the Atmospheric Environment

JMA observes elements of the atmospheric environment such as greenhouse gases at several stations. Its Minamitorishima location is one of the most important monitoring spots in the world because it is located more than 2,000 km from the continent and is therefore relatively unaffected by local anthropogenic emissions.



▲ Overview of Minamitorishima



▲ Greenhouse gas observation at Minamitorishima

Monitoring of Oceans

JMA conducts oceanographic observation (water temperature, salinity, carbon dioxide, etc.) using two research vessels and operates profiling floats to monitor the long-term variability of the marine environment and global warming.



Keifu Maru (1,483 tons)

▲ JMA's two research vessels are named the Ryofu Maru (1,380 tons) and the Keifu Maru.



▲ Oceanographic observation

Seawater collection and carbon dioxide analysis



▲ On-board analysis

Monitoring of Earthquake/Tsunami

Public safety based on prompt issuance of related information



Earthquake

Several to tens of seconds

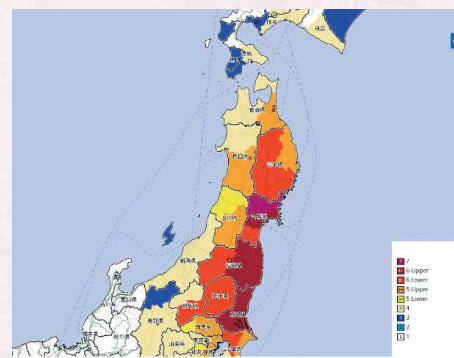
Around 1.5 minutes

Earthquake Early Warning



Automatically issued in the event of a large earthquake → p.21

Seismic Intensity Information



→ p.21

Monitoring of Earthquakes

JMA collects real-time data from around 1,800 seismometers and 4,400 seismic intensity meters deployed throughout Japan to support the monitoring of earthquakes around the clock.



Collection of Data

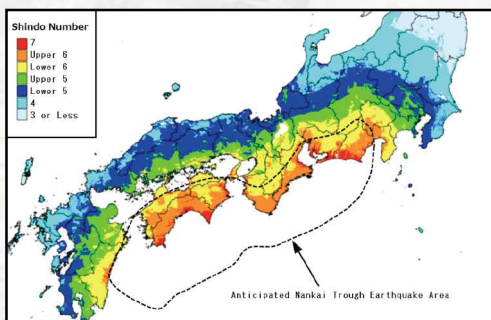
← Seismometer and Seismic Intensity Meter

Earthquake Analysis, Forecasts and Monitoring of Tsunamis

JMA analyzes earthquakes and issues warnings/advisories if there is a threat of a tsunami. The Agency also monitors tsunami situations using sea level data gathered from 410 coastal tide gauges and offshore tsunami meters. Values observed at seismic intensity sites throughout Japan are also issued as earthquake information to support initial urgent action for disaster mitigation by disaster management authorities.

Monitoring of Nankai Trough Earthquakes

In line with increasing expectations of a megathrust earthquake along the Nankai Trough, JMA observes seismic activity over the whole area and crustal deformation around the trough in conjunction with related organizations to enable 24-hour monitoring. In the event of anomalies, JMA convenes the Nankai Trough Earthquake Assessment Committee for discussions on the expected potential for an earthquake and issues Nankai Trough Earthquake Extra Information.



▲ Map of Maximum Seismic Intensity Distribution for Nankai Trough earthquakes

Results from multiple cases are combined here to show the maximum intensity in a given area.

Source: Committee for Nankai Trough Megaquake Modeling, Cabinet Office



▲ Nankai Trough Earthquake Assessment Committee

This Committee is convened to provide expert advice in evaluating the potential for earthquakes across the whole of the Nankai Trough.

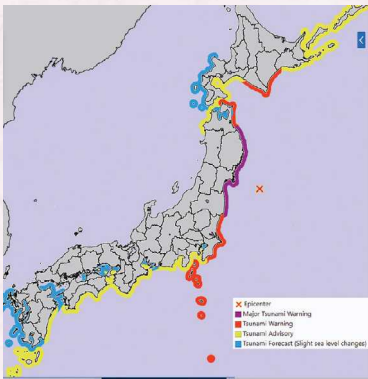
Around 10% of all the world's earthquakes occur in and around Japan, making it one of the world's most tremor-prone areas. The country has suffered repeated damage from seismic activity and resulting tsunami waves.

To mitigate related damage and to protect life and property, JMA monitors real-time data from land-based/seabed seismometers and tsunami observation facilities and issues a range of associated disaster mitigation information.

Around 3 minutes

Around 5 minutes onward

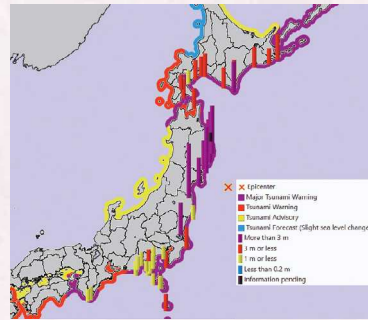
Tsunami Warning/Advisory



→ p.21

Example of a Tsunami Warning/Advisory

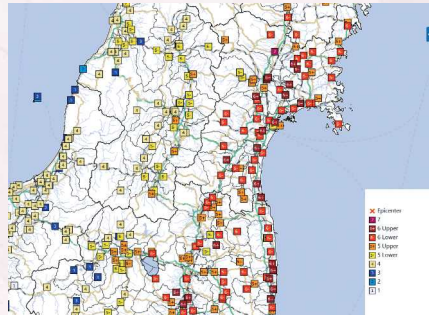
Tsunami Information, Earthquake and Seismic Intensity Information, and others



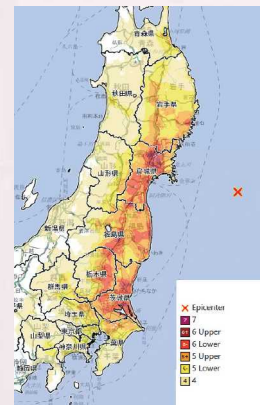
→ p.21

Examples

- Above: Tsunami Information (Tsunami Observations)
- Bottom left: Information on Seismic Intensity at individual sites
- Bottom right: Estimated Seismic Intensity Distribution Map



→ p.21



→ p.21

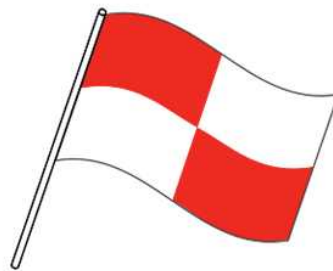


Operation Room – earthquake analysis work

Focus Tsunami flags

Tsunami warnings are issued via TV, radio, mobile phones, disaster management radio, sirens, local alarms and other means. Visual notification using flags in coastal areas was also started in summer 2020 to help hearing-impaired people and swimmers, who may have difficulty hearing due to waves and wind. Immediate evacuation should follow any display of tsunami flags in coastal areas.

The flags feature a red and white checkered pattern, with a design similar to that of the U-flag used internationally as a marine warning.



▲ Tsunami flag



▲ Tsunami flag display

(Credit: Japan Lifesaving Association)

*Tsunami flags may also be displayed from buildings.

Monitoring of Volcanic Activity

Public safety based on prompt issuance of related information

Active volcanoes in Japan and Volcanic Observation and Warning Centers

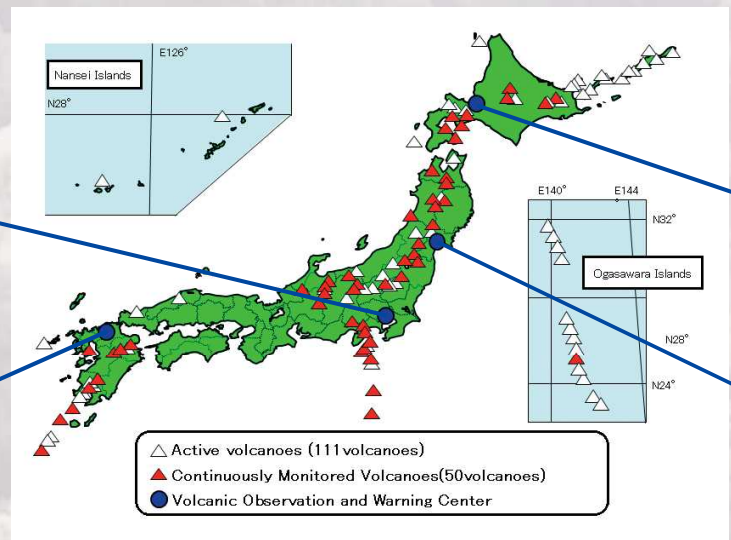
JMA operates the Volcanic Observation and Warning Center in Tokyo and Regional Volcanic Observation and Warning Centers (VOWCs) for active volcanoes within their areas of responsibility.



Tokyo



Fukuoka



- △ Active volcanoes (111 volcanoes)
- ▲ Continuously Monitored Volcanoes(50volcanoes)
- Volcanic Observation and Warning Center

JMA conducts intensive observation of 50 of Japan's 111 active volcanoes chosen by the Coordinating Committee for Prediction of Volcanic Eruptions (Continuously Monitored Volcanoes).

When abnormal phenomena are observed, JMA reinforces its monitoring efforts and implements mobile observation as necessary in a

Volcano observation facilities

Intensive observation for Continuously Monitored Volcanoes

JMA continuously monitors volcanoes using surveillance cameras, seismometers, GNSS observation instruments and other equipment, and also collects observation data from research institutes such as universities and local governments.



Surveillance cameras (top)
Low-frequency microphones (top right)
Seismometers (bottom right)



Tilt meters



GNSS observation instruments

Japan's 111 active volcanoes make it one of the world's most volcanic countries. JMA monitors volcanic activity 24 hours a day and issues various types of information for disaster mitigation.

) in Sapporo, Sendai and Fukuoka. VOWCs monitor



Sapporo



Sendai

canic Eruption for special attention toward disaster
addition to regular plans during normal times.



Issuance of Volcanic Forecasts/Warnings

JMA also issues Volcanic Warnings based on the results of observation, monitoring and evaluation (p. 26). Updates are posted on the Volcanic Information for Mountaineers section of the JMA website, including current volcanic warnings, images from surveillance cameras and volcano observation data.



▲ Kuchierabujima – volcano camera monitoring

Mobile observation

Regular surveying and time-sensitive observation of volcanic activity

Mobile observation includes land-based monitoring of thermal activity, volcanic gas and other variables, as well as aerial monitoring using helicopters and drones in collaboration with related organizations. Aerial observation is performed to determine conditions inside craters that cannot be approached from the ground and distribution of volcanic ejecta.



▲ Kusatsu-Shiranesan – volcano observation via mobile surveying



▲ Asosan – dronebased volcano observation

Meteorological Information for Aviation and Maritime Safety

For Aviation Safety

Aircraft are affected by weather conditions from take-off to landing. To support safe and efficient aviation, JMA provides meteorological information on aerodromes and airspace to aeronautical operators, including airlines and air traffic service units of the Japan Civil Aviation Bureau (JCAB) under the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

Monitoring at Airports



Issuance of forecasts and warnings



Observation (wind direction, wind speed, etc.)

JMA provides meteorological reports to support decisions on take-off and landing, and also issues the aerodrome forecasts required for flight planning.

Monitoring of Airspace



Monitoring and forecasting of turbulence and thunderstorms



Monitoring and forecasting of volcanic ash clouds

JMA issues information to warn aircraft operators of thunderstorms, typhoons, turbulence, icing, volcanic ash clouds and other phenomena that may have significant impacts during the flight.

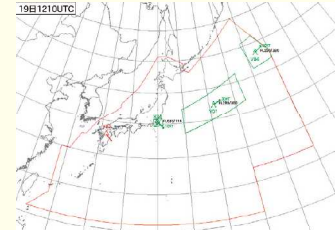
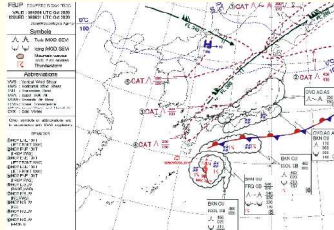
Provision to JCAB and Airlines

RJNS AERODROME SEQUENTIAL FORECAST Part1

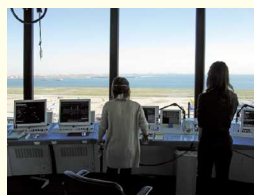
ISSUED TIME 08:50:00 11 OCT 2019

TOYO AIRPORT WEATHER SERVICE CENTER

Time	01	02	03	04	05	06	07	08	09	10	11	12
Cloud	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
Wind	08/12	08/12	08/12	08/12	08/12	08/12	08/12	08/12	08/12	08/12	08/12	08/12
Temp	16	16	16	16	16	16	16	16	16	16	16	16
Humidity	80	80	80	80	80	80	80	80	80	80	80	80
Visib	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Sea	0	0	0	0	0	0	0	0	0	0	0	0
Pressure	1013	1013	1013	1013	1013	1013	1013	1013	1013	1013	1013	1013
Prob	0	0	0	0	0	0	0	0	0	0	0	0



Pilots and dispatchers



Air traffic controllers (airport control tower)



Air traffic controllers (area control center)



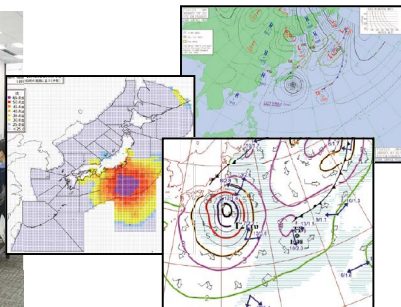
Air traffic management officers (Air Traffic Management Center)

For Maritime Safety

Maritime navigation must be safe even when typhoons or developing low-pressure systems approach, and this must be balanced with punctuality and economic effectiveness.

To support safety and efficiency, JMA issues marine warnings, forecasts and other information including sea surface temperature and currents for ships in waters around Japan and the high seas.

Forecast weather maps and forecast wave height maps



Meteorological Information is imperative for the safe operation of aircraft and marine vessels. JMA provides aviation stakeholders and maritime operators with specialized information to meet their specific needs.

Research Observation with Cutting-edge Weather Radar

JMA's Meteorological Research Institute conducts research and development using phased-array radar as a next-generation remote sensing technology. Figure 1 shows related results from observation of a well-developed thunderstorm system that caused significant hail in Tokyo on July 18 2017. This innovative radar (Figure 2) is expected to support improved prediction of severe weather events.

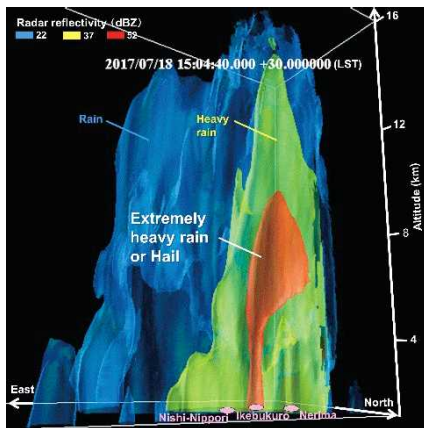


Figure1 Three-dimensional hailstorm structure

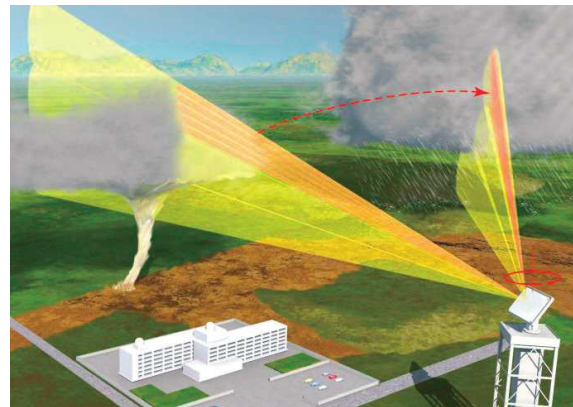


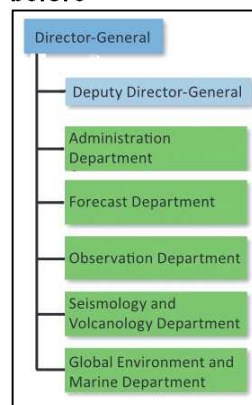
Figure2 Rapid volume scanning using phased-array radar

Focus JMA Headquarters re-organization

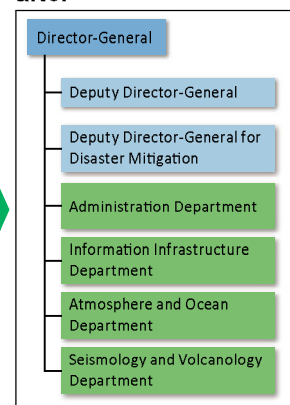
JMA reorganized its headquarters on October 1st, 2020, in response to intensification in the scale and frequency of natural disasters and social changes such as IoT development. The shuffle was based on the three concepts of promotion for disaster mitigation/support, utilization of weather information/data, and technological development related to improving observation and prediction accuracy.

Specifically, JMA created a position for a Deputy Director-General for Disaster Mitigation to coordinate with the Prime Minister's Office and related ministries. The new Information Infrastructure Department promotes technological development in areas such as numerical modeling for weather prediction and provision/utilization of meteorological information/data, and the new Atmosphere and Ocean Department conducts atmosphere/ocean observation and forecasting in relation to phenomena such as extreme rain or heat with a long-term perspective on global warming and other factors. Divisions and offices in the Seismology and Volcanology Department were also re-organized for unified implementation of observation, system maintenance and technological development.

before



after



▲Organizational structure of JMA Headquarters

Focus JMA relocation to Toranomon

In autumn 2020, JMA's headquarters were relocated for the first time since 1964 from the Otemachi area of Tokyo to the city's Toranomon area, where the Tokyo Meteorological Office (JMA's predecessor) began operations around 140 years previously.

The new building features a seismic isolation structure and contingency fuel/water tanks enabling ongoing operation in the event of a disaster.

The complex is shared with the Minato Educational Research and Training Center, with Minato Science Museum occupying the first and second floors and the new JMA Meteorological Science Museum on the 2nd floor. The facility provides an interesting visit for all generations.



▲JMA Headquarters



▲Meteorological Science Museum

International Cooperation

Radar Observation

Radar observation is an indispensable part of weather monitoring and forecasting, and capacity development for National Meteorological and Hydrological Services (NMHSs) is important in maximizing radar performance. Against this background, JMA held the Weather Radar Workshop in November 2021 as a platform for discussions on dual polarization solid-state weather radar and common issues in radar observation among participating countries.

The Agency also works to promote further use of weather radar in Southeast Asia under the UNESCAP/WMO Typhoon Committee project. Member countries exchange domestic radar composite data and provide regional radar composite imagery to the Typhoon Committee.

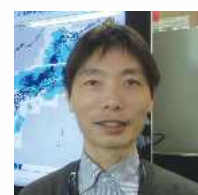


Weather Radar Workshop 2021

Collaboration in the radar field among NMHSs is expected to support risk reduction for weather-related disasters.



https://www.jma.go.jp/jma/en/photogallery/Radarworkshop_202111.html



YAMAUCHI Hiroshi
Senior Coordinator for Observation Planning
Observation Division
Atmosphere and Ocean Department

WMO Integrated Global Observing System

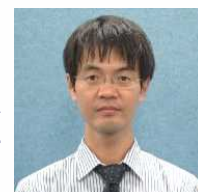
WMO Regional WIGOS Centre (RWC) Tokyo

The WMO Integrated Global Observing System (WIGOS) covers various WMO observing systems for efficient observation and data usage, with Regional WIGOS Centres (RWCs) providing WMO Members with support and assistance in related implementation efforts. JMA (designated as RWC Tokyo in September 2021) supports Members in Asia on observational metadata management and performance monitoring. The RWC also engages in capacity development in regional WIGOS projects and other areas.

RWC Tokyo works with Members to improve observation and develop WIGOS-related activities in Asia.



<https://www.jma.go.jp/jma/jma-eng/jma-center/rwc/index.html>



MINEMATSU Hiroaki
International Strategy Officer for
Meteorological Observations
Observation Division
Atmosphere and Ocean Department

Instrument Maintenance and Calibration

WMO Regional Instrument Centre (RIC) Tsukuba

JMA established the Regional Instrument Centre (RIC) Tsukuba in 1998 in accordance with a WMO recommendation. Against this background, the Agency developed the RIC Tsukuba Package as a comprehensive support approach to assist WMO Members in calibrating their national meteorological standards and to provide advice on instrument performance, maintenance, availability of relevant guidance materials, and other matters.



Training on barometer calibration in Mauritius

RIC Tsukuba Package

- (a) Preliminary Survey on calibration capacity
- (b) Preparation of standard instruments and/or inspection equipment
- (c) Training (in Japan and on site)
- (d) Follow up activities

NMHS Technical cooperation in a manner both efficient and effective

Ensuring traceability of meteorological instruments, quality improvement of surface observation

These RIC activities help Members to improve their meteorological observation data.



https://www.jma.go.jp/jma/jma-eng/jma-center/ric/ric_HP.html



SHIGEOKA Hiroumi
Meteorological Instrument Centre

Since the atmosphere has no national borders, international cooperation and coordination is essential for the development of worldwide meteorological activities. JMA devotes consistent efforts to international cooperation through multilateral and bilateral channels alike, and has established procedures to engage in cooperative activities with many National Meteorological and Hydrological Services (NMHSs) and international organizations.

Satellite

Himawari-series geostationary satellites

The latest Himawari-8/9 satellites in the series are capable of frequent and versatile observation with 16 spectral bands, providing full-disk Earth images every 10 minutes and regional imagery even more regularly. The data produced are utilized by countries across the Asia-Pacific region and elsewhere.

HimawariRequest

The HimawariRequest service, which allows National Meteorological and Hydrological Services (NMHSs) to request 1,000 x 1,000 km regional observation every 2.5 minutes by Himawari-8/9, supports intensive monitoring of extreme events such as tropical cyclones. As of November 2021, 22 NMHSs had joined the service.

RSMC Tokyo for Nowcasting

Himawari-8/9 also supports the Regional Specialized Meteorological Centre (RSMC) Tokyo for Nowcasting, which JMA launched in December 2018. The Centre's website provides NMHSs in the Asia-Pacific region with graphical nowcasting products to support disaster risk reduction. The service offers a number of Himawari-8/9 products.

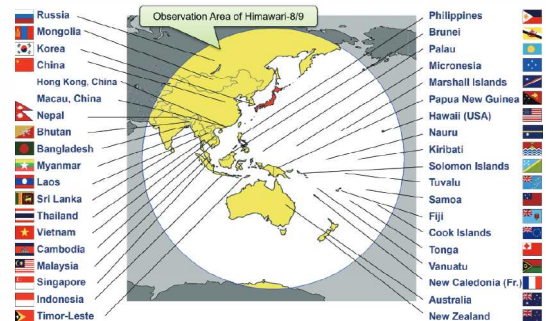


YAMAMOTO Mikito, SAKASHITA Takuya, ABE Miki
Satellite Program Division
Information Infrastructure Department

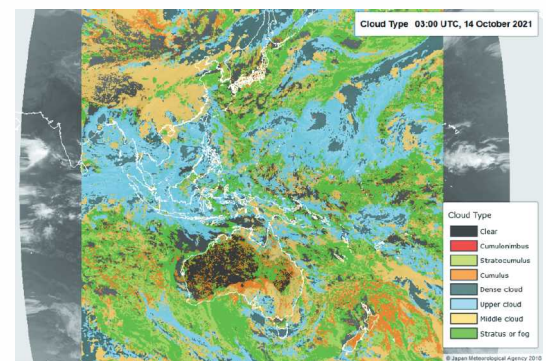


<https://www.jma.go.jp/jma/jma-eng/satellite/index.html>

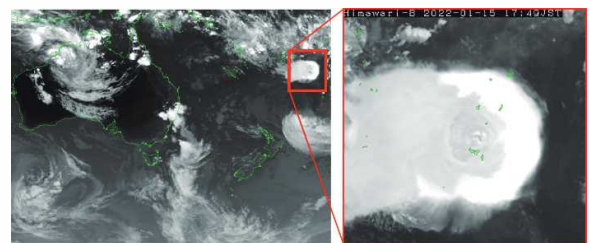
Himawari data are very useful for disaster risk reduction in Asia-Pacific nations.



Himawari user countries in the Asia-Pacific region



HCAI (High-resolution Cloud Analysis Information) product on the RSMC Tokyo for Nowcasting website



HimawariRequest observation for the large volcanic eruption in Tonga requested by Australia.

Technical collaboration with the Japan International Cooperation Agency (JICA)

JMA provides various forms of technical support to NMHSs with JICA. In particular, more than 350 officers from NMHSs worldwide have attended the three-month training course since 1973, in which JMA experts share broad knowledge and techniques and dedicated JICA coordinators support participants to promote their understanding.

https://www.jma.go.jp/jma/en/Activities/jica_training.html



SONE Eri
Coordinator for JICA training course
"Reinforcement of Meteorological Services"



Taking the course is a privilege, which makes trainees all the more responsible for winning public trust and providing vital and accurate meteorological information. They must think how to proactively use the expertise they gain from the course to benefit society.

International Cooperation

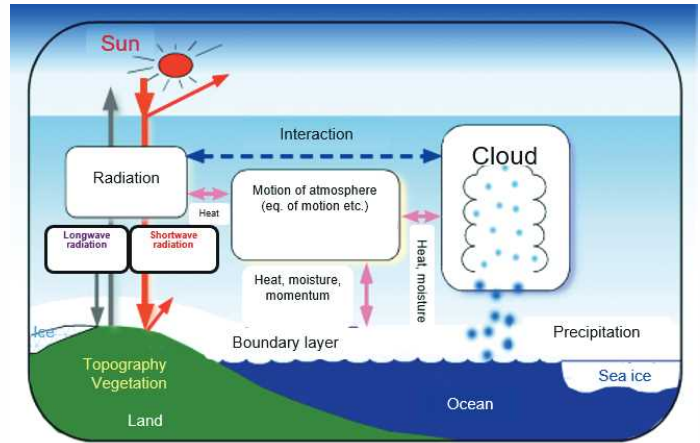
Global Data-processing and Forecasting System

World Meteorological Centre (WMC) Tokyo / RSMC Tokyo

The standards of JMA's numerical weather, climate and ocean wave prediction have advanced significantly, and the Agency is now designated as a World Meteorological Centre (WMC) and a Regional Specialized Meteorological Centre (RSMC) for global numerical prediction. To help Members enhance forecasting, warning and climate services, JMA provides various products based on operational global numerical weather/climate prediction models as well as various types of training.

RSMC Tokyo - Nuclear Environmental Emergency Response

JMA is also designated as an RSMC for nuclear Environmental Emergency Response (EER), providing dispersion prediction information in line with requests from IAEA.



Processes in numerical weather/climate model

We are committed to helping save life and property in developing countries by sharing advanced numerical prediction data.

SATO Yoshiaki

Head, Office of Numerical Prediction Modeling Fundamental Technology



Coordinator for Engagement and Partnership (C-ENG), INFCOM
World Meteorological Organization (WMO)

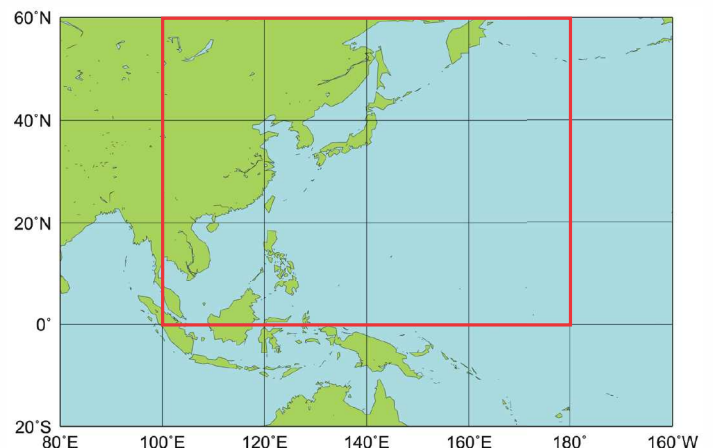


https://www.jma.go.jp/jma/en/NMHS/JMA_RSMC.html

Disaster Mitigation

RSMC Tokyo – Typhoon Center

JMA's Tokyo – Typhoon Center analyzes and forecasts tropical cyclones (TCs) over the western North Pacific (0 – 60°N, 100 – 180°E) in its role as a Regional Specialized Meteorological Center (RSMC) - one of six such facilities tasked with TC forecasting within the framework of the WMO World Weather Watch Programme. The Center issues vital information on TCs, such as analysis results and forecast advisories, to support disaster risk reduction activities conducted by NMHSs of ESCAP/WMO Typhoon Committee Members. The Center's work includes providing real-time online information for TC forecasters in the region, running various courses such as on-the-job training at JMA Headquarters, dispatching experts to other NMHSs, giving virtual training, and issuing publications such as annual reports and technical reviews.



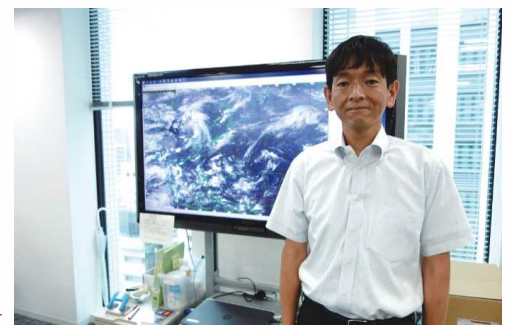
RSMC Tokyo – Typhoon Center Area of Responsibility

We deliver high-quality, useful information based on the latest technology to support the activities of NMHSs and other parties engaged in disaster-risk reduction in the region.



https://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.htm

HOSOMI Takuya
Head, RSMC Tokyo – Typhoon Center

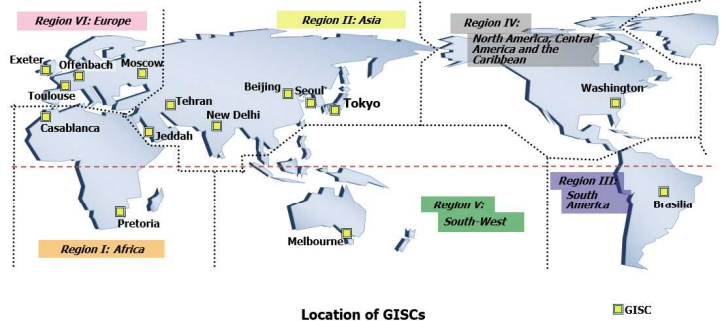


The World Meteorological Organization (WMO) facilitates international cooperation in the meteorological field to coordinate, standardize and improve world meteorological activities. JMA is a core member in the implementation of a number of scientific and technical WMO programs, with many experts contributing to Technical Commissions and associated working bodies of the organization. JMA also operates a number of WMO regional and global centers for the WWW (World Weather Watch) Programme and others.

Information and Communications

WMO Information System (WIS)/Global Information System Centre (GISC) Tokyo

JMA operates GISC Tokyo as part of the WIS (WMO's coordinated global telecommunication/data management infrastructure) and plays major roles in stable data communication using the WIS core network (which builds on the Global Telecommunication System (GTS)), coordination for efficient data exchange and management for data catalogue. GISC Tokyo is actively involved in all aspects of WIS operation/development, and also creates opportunities such as training workshops and collaboration events. These efforts to provide WIS benefits to NMHSs worldwide undoubtedly help to make a difference in the WMO community.

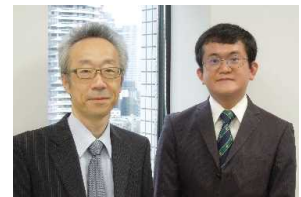


We're committed to the development of telecommunication services for faster and more reliable global sharing of meteorological information, with dedication to the creation of new technologies and reliable services based on our experience.



<https://www.wis-jma.go.jp/cms/>

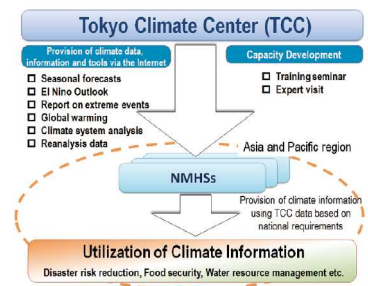
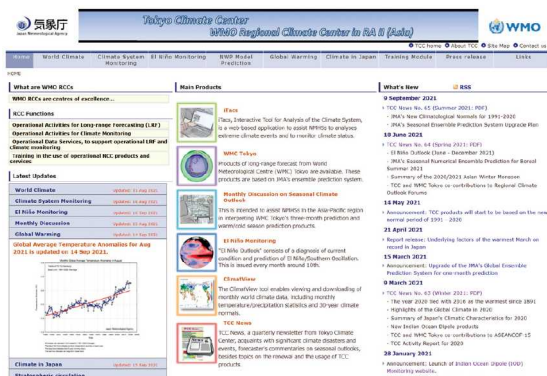
TSUNODA Kenji & EGAWA Takumu
Information and Communications Technology Division
Global Information System Centre (GISC) Tokyo



Climate

Tokyo Climate Center (TCC)

The Tokyo Climate Center (TCC), a WMO Regional Climate Centre (RCC) for Regional Association II (RA II; Asia) (RCC Tokyo) and a Global Producing Centre for Long-range Forecasts (GPC-LRF Tokyo) contribute to operational climate services provided by NMHSs in the Asia Pacific region. Major activities include online provision of climate data, products and tools to NMHSs and assistance with related capacity development. Recent activities are detailed online at <https://ds.data.jma.go.jp/tcc/tcc/index.html>.



▲ TCC website providing climate data, information/tools and information on capacity development activities



<https://ds.data.jma.go.jp/tcc/tcc/index.html>

TCC's RCC roles include the provision of data products and training activities. Online TCC products are constantly improved, and training involving attendees from various countries has been conducted in Japan since 2008. The Center has also dispatched experts to NMHSs to discuss collaboration, technical transfer and training since 2006. We remain committed to assisting and improving climate services in the region.

KAKIHARA Koichiro, Senior Scientific officer
WAKAMATSU Shunya, Scientific Officer
Tokyo Climate Center



International Cooperation

Atmospheric Environment

Under the WMO Global Atmosphere Watch (GAW) programme, JMA provides international center services as described below.

World Data Centre for Greenhouse Gases (WDCGG)

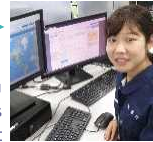
WDCGG collects, archives and provides information on atmospheric greenhouse gases, and contributes to worldwide monitoring of the global environment.

We're very grateful to the many data providers worldwide, and hope this important information will be used by more and more people worldwide.



<https://gaw.kishou.go.jp>

OWAKI Mika
World Data Centre for Greenhouse Gases
Atmosphere and Ocean Department



Reported stations to the WDCGG

World Calibration Centre (WCC) for methane in Asia and the South-West Pacific

The WCC for methane in Asia and the South-West Pacific conducts reference-gas inter-comparison activities in the area to ensure the adherence of GAW network monitoring to the WMO primary standard.

Reference-gas inter-comparison is essential in unifying observation standards, and is conducted in collaboration with the relevant institutions.



<https://ds.data.jma.go.jp/wcc/>

TAKATSUJI Shinya
World Calibration Centre for methane
in Asia and the South-West Pacific
Atmosphere and Ocean Department



International Program on Ocean Data

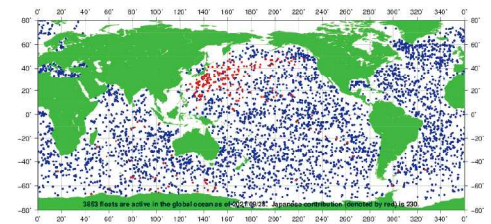
Argo

The Argo international program involves collection of ocean data using floats. In this program, JMA takes a role of the Japan Data Assembly Center (DAC) for international exchange of Argo float data and is operating the Japan Argo Real-time Data Base. The Delayed-mode Data Base is operated by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC).



<https://www.data.jma.go.jp/argo/data/index.html>

We're dedicated to supporting faster and more accurate Argo data delivery.



Argo float map

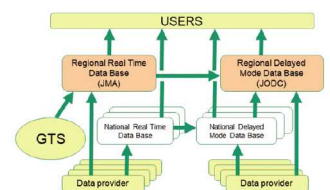
NEAR-GOOS

The North-East Asian Regional GOOS (NEAR-GOOS) is a regional pilot project conducted under the Global Ocean Observing System (GOOS) by China, Japan, the Republic of Korea and the Russian Federation, with JMA operating the NEAR-GOOS Regional Real-time Database in Japan. The associated Delayed-Mode Database resource is operated by the Japan Oceanographic Data Center (JODC) within the Japan Coast Guard.



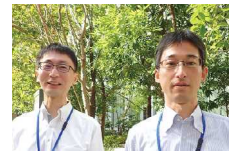
<https://www.data.jma.go.jp/goos/data/database.html>

The real-time database is made easily accessible to support the use of oceanographic data.



Data flow in the NEAR-GOOS Data Exchange System

TSUJI Kentaro & KAWAMURA Chihiro
Office of Marine Prediction
Atmosphere and Ocean Department



Volcanic Ash

ICAO Volcanic Ash Advisory Center (VAAC) Tokyo

Within the framework of the International Airways Volcano Watch (established by the International Civil Aviation Organization (ICAO) in conjunction with WMO), nine Volcanic Ash Advisory Centers (VAACs) monitor volcanic activity and provide information to support aviation safety.

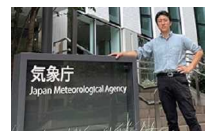
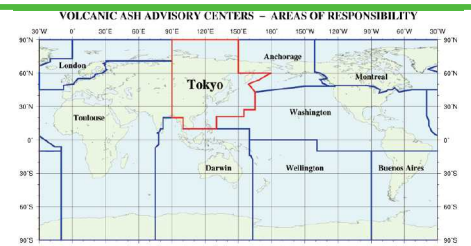
JMA operates VAAC Tokyo, which covers the area of responsibility (AoR) shown below. The expected movement of volcanic ash is calculated, and Volcanic Ash Advisories are issued to aviation-related organizations.



<https://www.data.jma.go.jp/vaac/data/index.html>

From my involvement in VAAC activities, I really understand the importance of global harmonization based on international cooperation in providing the information that users need.

KANNO Yo
Assistant Scientific Officer, Volcanic Observation Division
Seismology and Volcanology Department

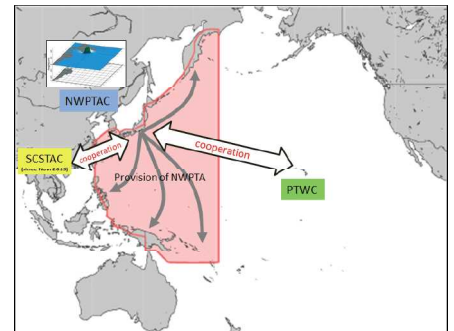


JMA staff are committed to supporting WMO regional and global centers in fields such as international communications, weather forecasting and the global environment. The Agency is also actively involved in international programs organized by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Civil Aviation Organization (ICAO) and other bodies.

Tsunamis

Northwest Pacific Tsunami Advisory Center (NWPTAC)

JMA's Northwest Pacific Tsunami Advisory Center (NWPTAC) forecasts tsunami heights and coastal arrival times when an earthquake with a magnitude of 6.5 or greater occurs in or around the Northwest Pacific region. Northwest Pacific Tsunami Advisories are provided to support individual nations' decisions on local domestic tsunami warnings and evacuation advice.



NWPTAC Area of Service

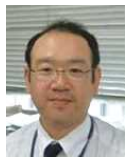
The information is intended to support tsunami disaster mitigation in the Northwest Pacific region. I'm very proud of our work when other countries express respect for JMA's highly advanced tsunami forecast service.



<https://www.data.jma.go.jp/eqev/data/nwptac/index.html>

Senior Coordinator for International Earthquake and Tsunami Information Seismology and Volcanology Department

TAIRA Yutaro



Aviation Weather

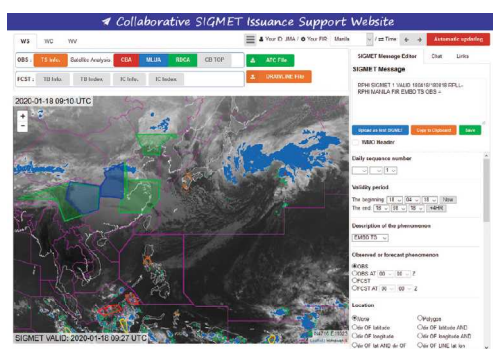
The CSI scheme— joint efforts for harmonized en-route weather services

As the volume of global air traffic increases, inconsistencies in en-route hazardous-weather information among multiple Flight Information Regions (FIRs) have become a significant concern within the aviation community. Against such a background, JMA collaborates with aeronautical meteorological service providers in Lao PDR, Myanmar, the Philippines, Thailand and Vietnam on the Collaborative SIGMET Issuance (CSI) scheme to help enhance aviation safety, efficiency and sustainability via the provision of harmonized weather information.

This multilateral arrangement enables forecasters to interact via a JMA-hosted web platform providing Himawari-8 real-time imagery and a wide range of supporting weather information from JMA.



Expert visits



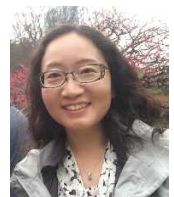
Web platform

The CSI scheme is an advanced global example of international collaboration for en-route hazardous-weather information.

Senior Coordinator for International Aeronautical Meteorology Planning Division

KOMATSU Naoko

Planning Division



JMA closely collaborates with CSI members and supports related activities in member-adjacent countries for further contribution to aviation safety.

Office of Aviation Weather Forecasting

KATO Yuki & IKEDA Michiko



https://www.jma.go.jp/jma/en/photogallery/CSI_Tokyo_2018.html



JMA Information Services

For Weather Disaster Mitigation

Information for Severe Weather Preparedness

JMA issues a variety of messages as detailed below in response to current and forecast weather conditions so that appropriate measures can be taken to mitigate possible issues such as damage from storms/flooding and damage brought by such hazards as debris flow and slope failure caused by tropical or extra-tropical cyclones and fronts.

Emergency Warnings/Warnings/Advisories

JMA issues Emergency Warnings, Warnings and Advisories in line with the significance of possible disasters associated with meteorological phenomena so that disaster management authorities and residents can take appropriate mitigation measures.

Emergency Warnings	Storm, Snow-storm, Heavy rain, Heavy snow, Storm surge and High waves	Issued if there is significant likelihood that a serious disaster will be caused by a natural phenomenon of a scale far exceeding the warning criteria.
Warnings	Storm, Snow-storm, Heavy rain, Heavy snow, Storm surge, High waves and Flood	Issued if there is a chance of a serious disaster caused by weather conditions that meet the relevant warning criteria.
Advisories	Gale and snow, Gale, Heavy rain, Heavy snow, Dense fog, Thunderstorm, Dry air, Avalanche, Ice/snow accretion, Frost, Low temperature, Snow-melting, Storm surge, High waves and Flood	Issued if there is potential for the development of serious adverse conditions that meet the advisory criteria but remain below the warning criteria.

Real-time Risk Maps show where the risk of disasters is rising in association with heavy rain to supplement meteorological information such as Heavy rain/Flood Warnings.

Bulletins

Bulletins are issued to alert public to weather conditions before Warnings and Advisories are issued and to supplement the Warnings.

Probability of Warnings

JMA provides probability information on the risk of severe weather phenomena expected to exceed the warning criteria within the next five days. Probability is expressed as "High" or "Mid."

Bulletins on Exceptionally Heavy Downpours

Bulletins on Exceptionally Heavy Downpours are issued when a downpour with a scale seen only once every few years has been observed or analyzed in the last hour.

Landslide Alert Information

In association with the issuance of Heavy Rain Warnings, information on debris flow, slope failure and other hazards is issued jointly by LMOs and civil engineering bureaus of prefectural governments when damage from such hazards caused by heavy rain is considered likely within the next few hours.

Flood Warnings and Advisories for designated rivers

JMA issues Flood Warnings and Advisories for designated rivers with information on water levels or flow rates in collaboration with national and prefectural river authorities for rivers deemed prone to flood disasters by these organizations.

Hazardous Wind Watch

Hazardous Wind Watch alerts supplement Thunderstorm Advisories to warn of a high probability of hazardous winds such as tornados and downbursts.

Nowcasts (Precipitation, Thunder and Tornadoes)

Nowcasts provide forecasts of precipitation intensity, thunder and the probability of hazardous winds such as tornadoes and downbursts up to an hour ahead.

Radar/Raingauge-Analyzed Precipitation, Very Short-range Forecasts of Precipitation, Analysis and Very Short-range Forecasts of Snow

Radar/Raingauge-Analyzed Precipitation data show the distribution of one-hour precipitation. Very Short-range Forecasts of Precipitation predict hourly precipitation amounts for the next fifteen hours. Snow Depth and Snowfall Amount Analysis data show the distribution of snow depths and snowfall amounts. Very Short-range Forecasts of Snow predict snow depths and amounts for the next six hours.

Precipitation Nowcasts

Updated every 5 minutes
Lead time: next hour



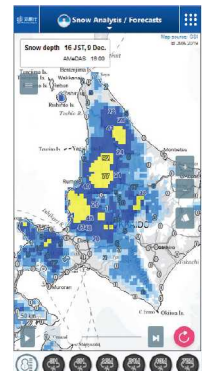
Precipitation Analysis/Forecasts

Updated every 10 minutes
Lead time: next 15 hours



Snow Analysis/Forecasts

Updated every hour



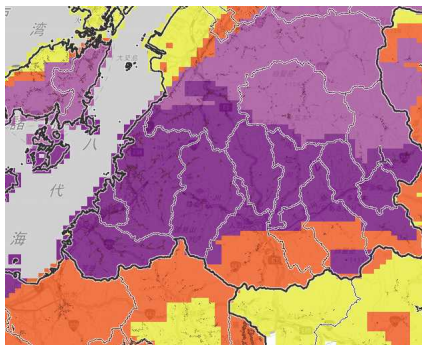
To limit the extent of damage caused by natural disasters and support the prompt execution of related activities, JMA provides disaster mitigation information via various channels to government disaster management agencies, local governments, the media and the public.

Real-time Risk Maps

These show landslide, inundation and flood risk for individual kilometer grids on an ascending five-level color scale (white to dark purple) every ten minutes. High-risk (light-purple) areas are equivalent to Alert Level 4 requiring prompt evacuation from hazardous locations.

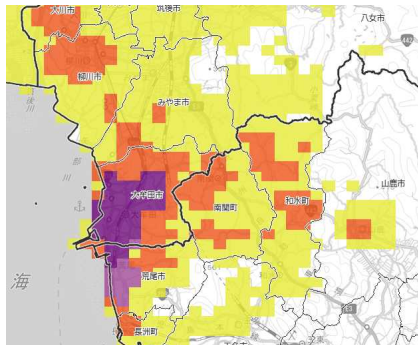
Corporate operators provide push-type services notifying of increased risk.

Landslide



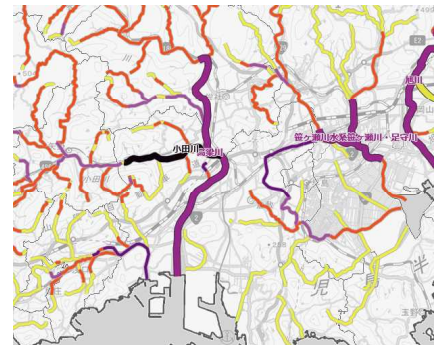
(JMA staff photography)

Inundation



(Omuta City offer)

Flood

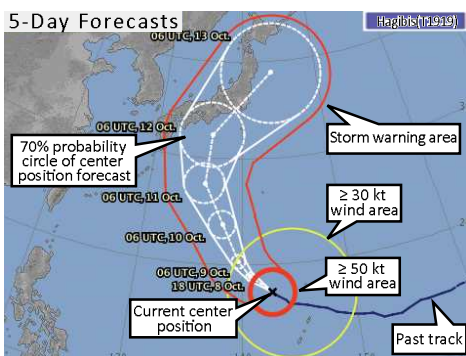


(JMA staff photography)

Tropical Cyclone Information

JMA monitors tropical cyclone (TC) activity over the western North Pacific and issues TC advisories every three hours to provide relevant information, including the results of analysis and forecasts regarding location, intensity and movement up to 24 hours ahead. The Agency also issues five-day forecasts every six hours.

If damage is expected from TCs approaching Japan, analysis data are provided every hour and 50-kt wind probability data are issued every six hours.



Terms used in the tropical cyclone information

Probability circle	A circular range into which a TC is expected to move with a probability of 70% at a particular time
≥ 30 kt wind area	An area with wind speeds exceeding/expected to exceed 30 kt (10-min. average)
≥ 50 kt wind area	An area with wind speeds exceeding/expected to exceed 50 kt (10-min. average)
Storm warning area	An area with wind speeds exceeding/expected to exceed 50 kt (10-min. average) when a TC center moves into a probability circle

Daily Forecasts

Daily forecasts provide information on weather, winds, coastal ocean waves, maximum/minimum temperatures and probabilities of precipitation covering periods up to two days ahead. They include Distribution Forecasts and Three-hourly Forecasts.

One-week Forecasts

One-week Forecasts provide information on weather, precipitation probability, maximum/minimum temperatures and reliability, and cover the period up to seven days ahead.

Daily forecasts: Tokyo											
Updated at 11:00 JST, 13 Oct., 2021											
Date		Today 13(Wed)				Tomorrow 14(Thu)				The day after tomorrow 15(Fri)	
Tokyo Region	Weather										
	Probability of precipitation(%)	00-06	06-12	12-18	18-24	00-06	06-12	12-18	18-24		
		-	-	70	50	20	10	10	10		
	Temp. (°C)	Morning minimum		Daytime maximum		Morning minimum		Daytime maximum			
	Tokyo	-		19		17		23			

▲Example of a forecast covering the period up to two days ahead

One-week forecasts: Tokyo									
Updated at 11:00 JST, 21 Oct., 2021									
Date		Today 21(Thu)	Tomorrow 22(Fri)	23(Sat)	24(Sun)	25(Mon)	26(Tue)	27(Wed)	28(Thu)
Tokyo Region									
Probability of precipitation (%)		- / -10/20	30/50/50/50	10	10	40	40	30	40
Reliability		-	-	-	A	C	B	C	B
Tokyo Temp. (°C)	Max.	19	14	20 (17~21)	20 (17~22)	19 (17~22)	21 (17~23)	22 (20~24)	22 (19~27)
	Min.	-	12	11 (10~13)	9 (8~11)	10 (8~12)	11 (9~13)	13 (11~15)	16 (11~18)

▲Example of an forecast covering the period up to seven days ahead

Two-week Temperature Forecasts and Early Warning Information on Extreme Weather

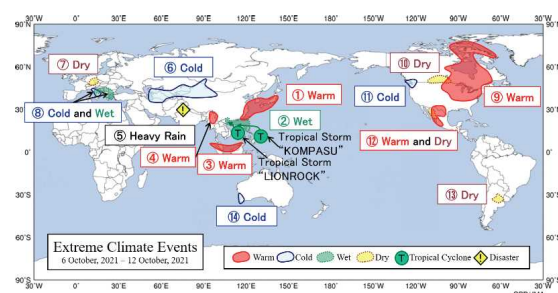
Two-week Temperature Forecasts provide information on five-day averaged maximum and minimum temperatures for the second week ahead. If very high/low temperatures or very heavy snowfall on the Sea of Japan side of Japan are expected during this period, Early Warning Information on Extreme Weather is issued.

Seasonal Forecasts

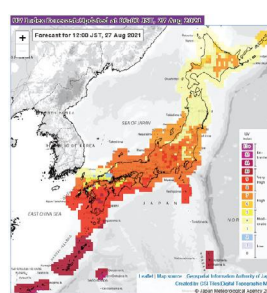
Seasonal Forecasts provide climate outlooks on variables such as average temperature, precipitation amounts, sunshine duration and snowfall for the next one-to-six months. These are expressed in general terms of above-normal, normal or below-normal probability due to the scientific difficulty of deterministic prediction for the forecast period.

Information on climate, atmospheric environment and ocean conditions

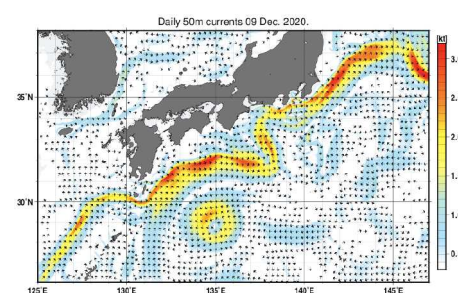
JMA issues information on climate, atmospheric environment and ocean conditions. This includes data on extreme climate events worldwide, ultraviolet radiation, Aeolian dust (Kosa), the ozone hole and ocean currents/temperatures.



▲Map of extreme climate events



▲UV Index Forecast



▲Ocean current map

JMA provides daily forecasts for wide range users, seasonal forecasts for operators in agriculture and other commercial fields, as well as basic monitoring information and projections to support climate change adaptation.

Focus Heat Stroke Alert

"Heat Stroke Alert" is information that calls attention to dangerous heat and encourages people to take actions to prevent heat illness. The Heat Stroke Alert is issued by the Ministry of the Environment (MoE) and the Japan Meteorological Agency (JMA) when the risk of heat illness is predicted to be extremely high based on the WBGT heat stress index forecast. Japan is divided into 58 regions, and the Heat Stroke Alert will be announced by each region. The Heat Stroke Alert will be announced when the WBGT index is 33 or higher.

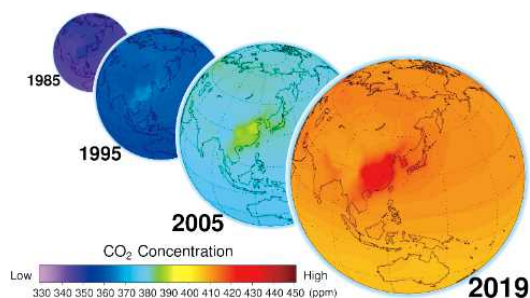
When the Heat Stroke Alert is issued:
 •Avoid going out as much as possible and keep the room cool with an air conditioner and the like.
 •Check the heat index in your immediate surroundings and take action to prevent heat illness. Before you get thirsty, be proactive and set fixed times for taking frequent breaks and stay hydrated.

WBGT	Risk of Heat illness	Activity guide in daily life	Guide to how much exercise can be safely performed
≥ 31 °C		Risk of occurrence is high in elderly people even at rest. Avoid staying outdoors as much as possible, and move to a cool place.	Danger (exercise should be avoided). The environmental temperature is higher than the skin temperature, so the body heat cannot escape. Except in special cases, all exercises should be avoided.
28 - 31 °C	May occur during any daily activities	Avoid staying under the sun. Keep an eye on the rise of indoor temperature.	Severe warning (heavy exercise should be avoided) Activities that require heavy exercise should be avoided. When exercising, frequent breaks and plenty of fluids should be provided. People who are at high risk should avoid exercise.
25 - 28 °C	May occur during moderate activities	Take breaks regularly during exercise or strenuous activity	Warning (rests should be provided often) Frequent breaks and plenty of fluids should be provided. Breaks should be provided every 30 min for activities requiring heavy exercise.
21 - 25 °C	May occur during heavy activities	Risk of occurrence is low in general. Caution is advised during heavy exercise or strenuous work.	Caution is advised since there is still a risk of heat illness. Drinking plenty of water during exercise is advised.

Reference:
 Japanese Society of Biometeorology, "The guideline of heat disorders prevention in daily life ver.3_1", 2021.
 Japan Sports Association, "A Guidebook for the Prevention of Heat Disorder During Sports Activities", 2019.

Information on Climate Change

JMA evaluates current atmospheric concentrations of greenhouse gases as well as observational evidence and projections of climate system variables (e.g., air temperature, precipitation, sea level, sea surface temperature). This provides essential information for planning and decision-making in climate-change mitigation/adaptation for impact assessment by national and local government bodies, and for consideration of mid- and long-term strategies in the commercial sector.



▲ Analysis-based data on distribution of atmospheric carbon dioxide concentration



▲ "Climate Change in Japan 2020"

Information on Earthquakes, Tsunami and Volcanoes

Tsunami Warnings/Advisories and Tsunami Information

■ Tsunami Warnings/Advisories

JMA estimates the potential for tsunami generation in the wake of earthquakes. If disastrous waves are expected in coastal regions, Tsunami Warnings/Advisories are issued.

■ Tsunami Information

When a Tsunami Warning/Advisory is issued, JMA also issues Tsunami Information with details such as estimated arrival times/heights and the recorded tsunami date.

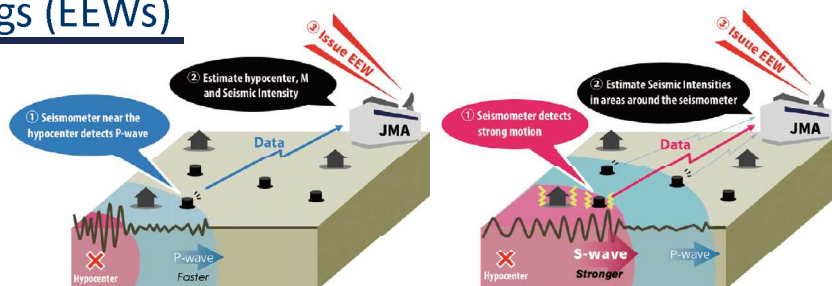
Category	Indication	Actions to be taken
Major Tsunami Warning*	Tsunami height is estimated to exceed 3 meters.	Evacuate from coastal regions and riversided areas to a safer place such as high ground or a tsunami evacuation building.
Tsunami Warning	Tsunami height is estimated to be 1 - 3 meters.	
Tsunami Advisory	Tsunami height is estimated to be 0.2 - 1 meter.	Get out of the water and leave coastal regions immediately.

Important points to notice

- * Major Tsunami Warnings with the term **"HUGE"** indicate a state of emergency. *For when a tsunami as large as that of the 2011 Great East Japan Disaster is expected*
- * **"Currently Observing"** announcements are made while observed tsunamis remain small. *Used to maintain awareness that higher waves may still approach*

Earthquake Early Warnings (EEWs)

These provide advance notice of estimated seismic intensities and expected arrival times of principal motion just after an earthquake occurs. If the estimated maximum seismic intensity is 5-lower or more, EEWs (warnings) are issued for regions with estimated seismic intensities of 4 or more.



Earthquake Information

When an earthquake occurs, JMA promptly issues this information based on seismic intensity observations and determines the time of occurrence, hypocenter and magnitude.

Seismic Intensity Information

This specifies the time of earthquake occurrence and identifies regions where seismic intensities of 3 or greater have been observed.

Information on Seismic Intensity at Individual Locations

This specifies hypocenters/magnitudes and identifies individual locations where seismic intensities of 1 or greater have been observed.

Estimated Seismic Intensity Distribution Map

These specify areas where intensities of 4 or greater have been estimated using seismic intensity observation data. The Map is issued when maximum seismic intensity is 5-lower or more.

Nankai Trough Earthquake Extra Information

If anomalies are detected along the Nankai Trough, Nankai Trough Earthquake Extra Information is issued with a keyword below in the line with the relationship with a major seismic event.

Keywords	Condition
Under analysis	When analysis is underway to determine whether anomalies relate to a Nankai Trough Earthquake
Megathrust earthquake alert	When an earthquake with a magnitude of 8.0 or more is considered to have occurred at the plate boundary in the hypocenter area along the Nankai Trough
Megathrust earthquake attention	When an earthquake with a magnitude of M7.0 or more or an anomalous slow slip is considered to have occurred along the Nankai Trough (except in correspondence with a megathrust earthquake alert)
Analysis complete	When the results of analysis indicate that the anomalies are not classified into either megathrust earthquake alerts or megathrust earthquake attention output

After the above announcements, Nankai Trough Earthquake Information may also be issued to supplement Nankai Trough Earthquake Extra Information.

JMA is responsible for issuing warnings and information on earthquakes, tsunamis and volcanoes. As such bulletins are critical for the protection of life, a standard operating procedure and warning categories are set in advance to ensure prompt issuance.

Volcanic Warnings and Alert Levels

JMA issues Volcanic Warnings when extremely hazardous volcanic phenomena or expansion of affected areas is expected. The information includes Volcanic Alert Levels highlighting target areas and action to be taken in five categories.

Classification	Abbreviated Term	Target area	Volcanic Alert Levels & Keywords		
Emergency Warning	Volcanic Warning (Residential area) a.k.a. (Residential area Warning)	Residential areas and non-residential areas nearer the crater	Level 5	Evacuation	
			Level 4	Evacuation of the elderly, etc.	
Warning	Volcanic Warning (Near the crater) a.k.a. (Near-crater Warning)	Non-residential areas near the crater Around the crater	Level 3	Restriction on proximity to the volcano	
			Level 2	Restriction on proximity to the crater	
Forecast	Forecast	Inside the crater	Level 1	Potential for increased activity	

Details of Volcanic Activity

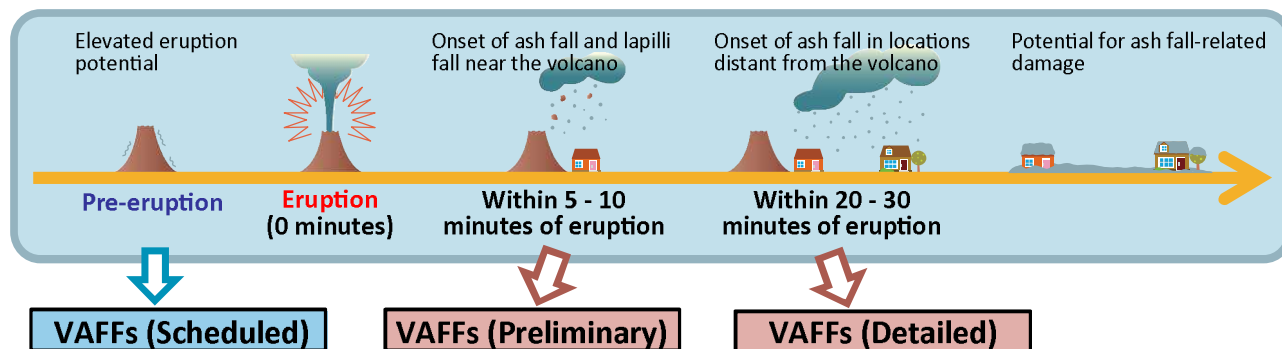
JMA issues Details of Volcanic Activity information to highlight the current status of volcanic activity. JMA also issues Details of Volcanic Activity (Extra) information when volcanic activity is elevated and the Volcanic Alert Level may need to be raised, although there is no need to do so at the time.

Eruption Notice

JMA issues Eruption Notice to provide immediate brief information on volcanic eruptions for climbers, residents and other people nearby to allow appropriate protective action. The Notice is issued when a volcano for which no Volcanic Warning is in effect erupts and in the event of an eruption that may affect locations outside the current target area.

Volcanic Ash Fall Forecasts (VAFFs)

JMA issues Scheduled, Preliminary and Detailed Volcanic Ash Fall Forecasts to provide information on ash fall amounts and potential areas of lapilli fall. Ash fall thickness is expressed as heavy (≥ 1 mm), moderate (0.1 - 1 mm) or low (< 0.1 mm).



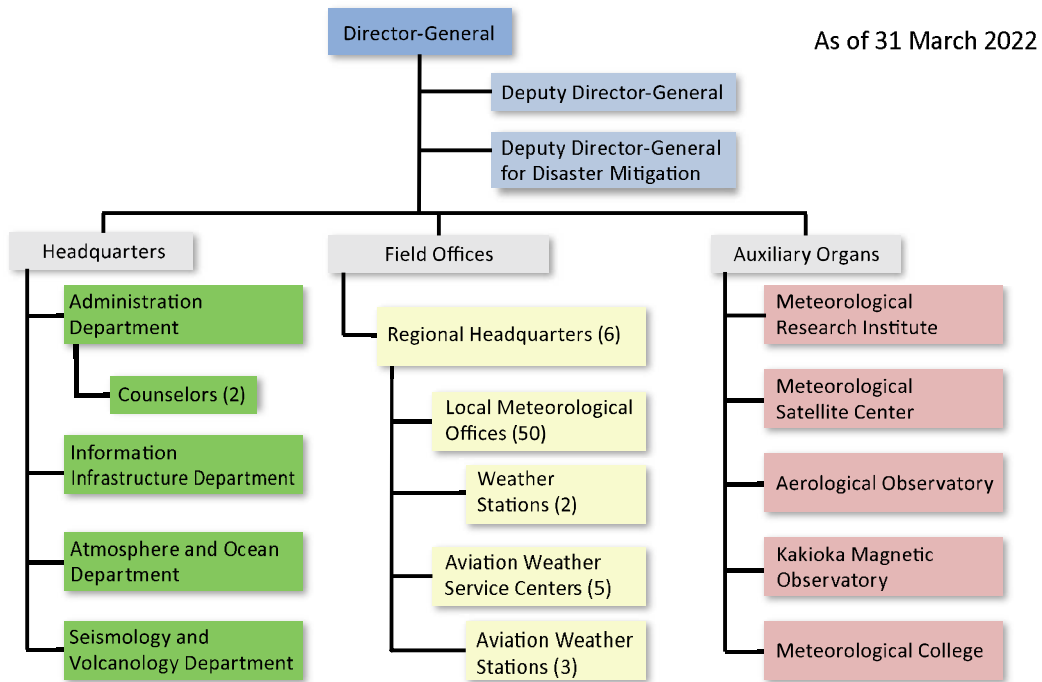
Focus Long-Period Ground Motion (LPGM) and related classes

Long-Period Ground Motion (or LPGM, where "period" refers to the duration of one back-and-forth shake cycle) associated with large earthquakes can cause strong shaking lasting 10 minutes or more in high-rise buildings. The phenomenon propagates over great distances, potentially resulting in persistent shaking hundreds of kilometers from the epicenter. It may cause furniture and fixtures to topple, fall or shift significantly.

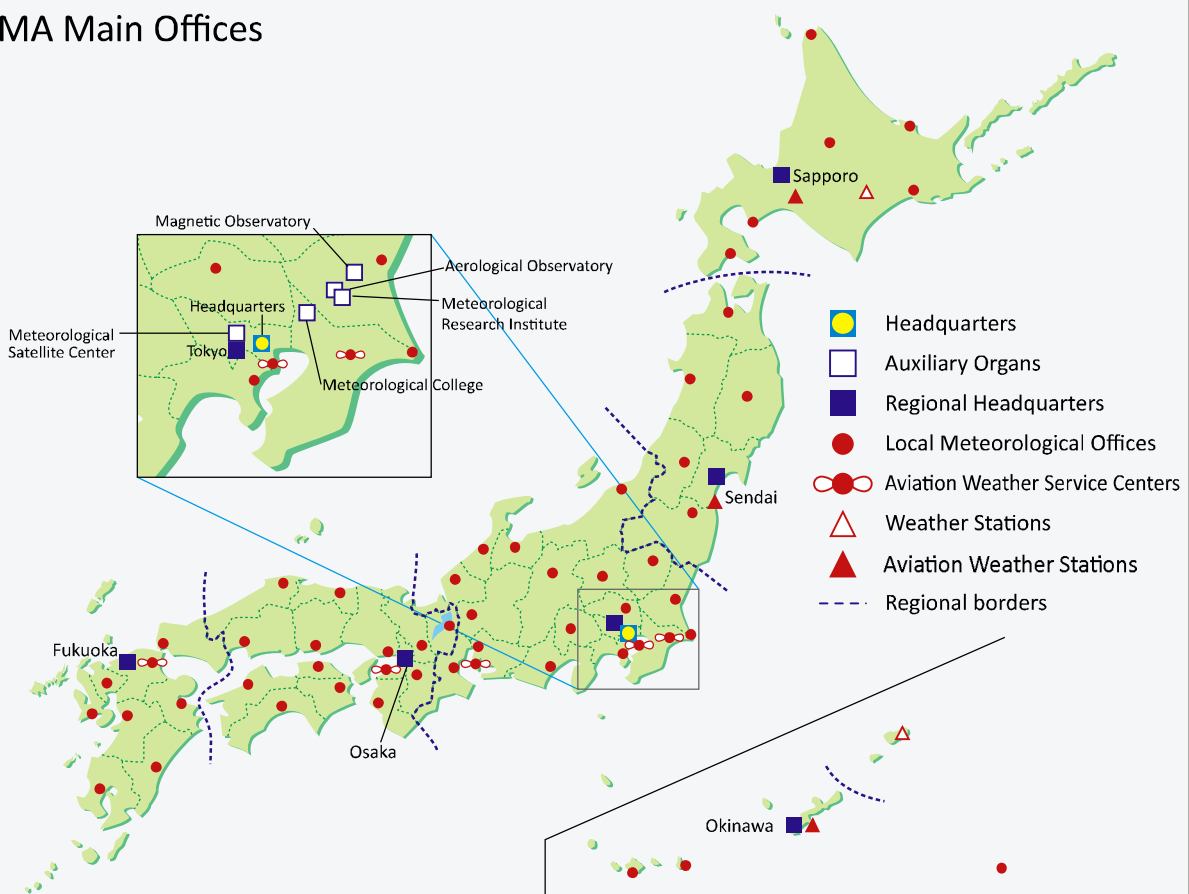
The JMA Intensity Scale for Long-Period Ground Motion (a four-category metric indicating the strength of shaking in high-rise buildings) provides much more focused information for this purpose than regular seismic intensity data. JMA also publishes online data on observed long-period ground motion and information such as related classes and seismic waveforms.

Long-Period Ground Motion (LPGM) class	Human perception	Indoor situation
class1	 • Felt by most people in buildings. Some people are startled.	• Hanging items such as lamps and blinds swing significantly.
class2	 • Many people find it difficult to walk without holding onto something stable.	• Furniture on casters moves slightly. • Items in cupboards and bookshelves may fall. • Some of unsecured moves and may topple over.
class3	 • It's difficult to remain standing.	• Furniture on casters moves significantly. • Some of unsecured moves and may topple over. • Partition walls may crack
class4	 • It's impossible to remain standing or move without crawling. People are at the mercy of shaking.	• Furniture on casters moves significantly and may topple over. • Unsecured furniture moves and may topple over. • Partition walls are likely to crack.

Organizational Structure



JMA Main Offices



JMA operates the Sapporo, Sendai, Tokyo, Osaka, Fukuoka and Okinawa Regional Headquarters to observe and monitor weather and earthquakes and to issue forecasts, warnings and bulletins for these regions. The Regional Headquarters give direction to Local Meteorological Offices for the issuance and provision of information and comments on prefectural and sub-prefectural levels. The Agency operates Aviation Weather Service Centers at major airports to support the safe flow of air traffic.

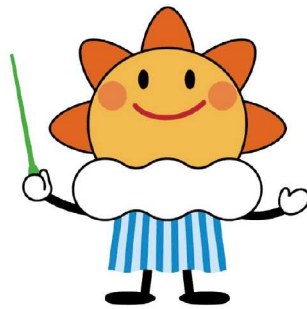
JMA also operates the Meteorological Research Institute, the Meteorological Satellite Center, the Aerological Observatory, the Magnetic Observatory and the Meteorological College as locations for research and training to support meteorological services.

History

Year	Events
1872	First observation station established in Hakodate.
1875	Tokyo Meteorological Observatory (TMO; the predecessor of JMA) established within the Ministry of the Interior.
1883	First weather map issued.
1884	First national weather forecast issued.
1884	Nationwide seismic intensity observation begun.
1887	TMO renamed as the Central Meteorological Observatory (CMO).
1921	Oceanographic and marine meteorological observation begun.
1930	Aviation weather service begun.
1935	Storm Warnings divided into Storm Warnings and Weather Advisories.
1941	Tsunami warning organization for the Sanriku coast established.
1942	Long-range Forecast Service begun.
1952	Meteorological Service Act brought into force.
1953	Japan joins the World Meteorological Organization (WMO).
1956	CMO becomes JMA (an affiliate agency of the Ministry of Transport).
1957	Observation in Antarctica begun.
1959	Numerical weather prediction begun.
1965	Provision of Volcanic Information begun.
1974	Automated Meteorological Data Acquisition System (AMeDAS) established.
1977	GMS (JMA's first geostationary meteorological satellite) launched.
1978	Act on Special Measures for Large-scale Earthquakes brought into force.
1980	Forecast for Probability of Precipitation begun.
1988	Very Short-range Forecast of Precipitation begun.
1991	Seismic intensity meter observation begun.
1996	Distribution Forecasts and Three-hourly Forecasts begun.
1999	Tsunami Forecast Regions segmentalized and Quantitative Tsunami Forecasts begun.
2001	JMA placed under the Ministry of Land, Infrastructure and Transport (MLIT*).
2004	Provision of Precipitation Nowcasts begun.
2005	Issuance of information on debris flow, slope failure and other hazards begun.
2007	Provision of Earthquake Early Warning for the public begun.
2007	Earthquake Early Warnings and Volcanic Warnings placed as Warnings under the Meteorological Service Act.
2008	Provision of Early Warning Information on Extreme Weather begun.
2010	Issuance of Weather Warnings targeting municipalities begun.
2010	Issuance of Hazardous Wind Potential Nowcasts and Thunder Nowcasts begun.
2013	New Tsunami Warning System operation begun.
2013	Issuance of Emergency Warnings begun.
2014	Provision of High-resolution Precipitation Nowcasts begun.
2015	Himawari-8 geostationary meteorological satellite operation begun.
2015	Issuance of Eruption notice begun.
2017	Issuance of Probability of Warnings begun.
2017	Provision of Real-time Risk Maps on inundation and flooding begun.
2017	Issuance of Nankai Trough Earthquake Information begun.
2018	JMA Emergency Task Team (JETT) created.
2019	Issuance of Two-week Temperature forecasts and Early Warning Information on Extreme Weather begun.
2020	Deputy Director-General for Disaster Mitigation position, Information Infrastructure Department and Atmosphere and Ocean Department established.
2020	Tokyo headquarters transferred from Otemachi to Toranomon.

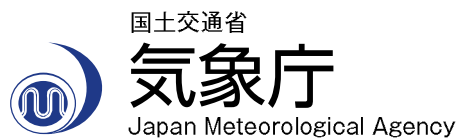
*MLIT became the Ministry of Land, Infrastructure, Transport and Tourism in January 2008.

The JMA Mascot



Harerun

Harerun is designed with elements of sun, cloud and rainfall. It holds a green baton in prayer for a disaster-free, peaceful world.



English website

<https://www.jma.go.jp/jma/indexe.html>



Multilingual Information on Disaster Mitigation

<https://www.jma.go.jp/jma/kokusai/multi.html>