



**Korea
Meteorological
Administration**



Korea Meteorological
Administration

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**KOREA
METEOROLOGICAL
ADMINISTRATION**

What Information Does the KMA Provide?

The information helping us secure our lives and property

Like a doctor diagnosing patients and protecting their health, the KMA protects the public from severe weather by observing and analyzing the atmosphere and weather conditions.

The information helping us make important decisions

We often need weather information – when we go out, plan a trip, manufacture and ship products, or even when we stay at home. Meteorological information plays a crucial role in making an important decision in our lives.

The information helping us prepare for the future

Weather forecasts for the next 10 to 30 years are closely connected to our future life. The KMA is making every effort to provide information necessary to plan for a better future in all areas, including economy, welfare and national security.

HISTORY

Meteorology in Korea Past & Present

Meteorology has a long history in Korea. Korea invented a rain gauge in the 15th century. Today, the COMS (Communication, Ocean & Meteorological Satellite) and meteorologists at the KMA continue the proud tradition.

BC 35 -

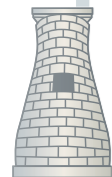
THREE KINGDOMS PERIOD

BC 35

The first meteorological record was made in Samguk sagi (History of the Three Kingdoms).

633

Cheomseongdae, the oldest astronomical observatory in Asia, was built. (2nd year of Queen Seondeok of Silla)



1023-

GORYEO DYNASTY

Early Goryeo

At the beginning of the dynasty, Goryeo established two organizations, Taebokgam and Taesaguk, to observe meteorological and astronomical phenomena.

1023-1275

Taebokgam changed its name to Sacheondae, then to Sacheongam, then to Gwanhuseo, and again to Sacheongam.

1308

Sacheongam and Taesaguk were merged to become Seoungwan. (34th year of King Chungnyeol)

1441-

JOSEON DYNASTY

1441

The world's first rain gauge was invented. (23rd year of King Sejong)

1442

A nationwide precipitation observation network was established. (24th year of King Sejong)

1466

Seoungwan changed its name to Gwansanggam. (12th year of King Sejo)

1818

Seoungwan ji (Treatise of the Astronomical and Meteorological Observatory) was published. (18th year of King Sunjo)



1883-

MODERN PERIOD

1883

The Korean Maritime Customs Service was established in Incheon, Wonsan and Busan and modern meteorological observation began. (20th year of King Gojong)

1894-1895

Gwansanggam changed its name to Gwansangguk and then to Gwansangso.

1904

The temporary observatory of Japan's Central Meteorological Observatory was set up in Busan, Mokpo, Incheon, Wonsan and Yongampo (in Yongcheon).

1907

The Japanese Residency-General Observatory was established in Incheon and its substations were set up in Busan, Mokpo, Wonsan, Yongampo (in Yongcheon) and Seongjin. The Korean Empire established a weather station in Pyongyang, Daegu and Gyeongseong (Seoul).

1910

The meteorological service of the Korean Empire was taken over to the meteorological observatories and weather stations of the Japanese Government-General of Korea.

1945

The Japanese Government-General of Korea Observatory was taken over by the Meteorological Observation Bureau of the Ministry of Education under the US Army Military Government in Korea.



1949-

PRESENT

- 1949** The Central Meteorological Office (CMO) was established under the Ministry of Education.
- 1956** Korea joined the World Meteorological Organization (WMO) as the 68th member.
- 1961** The Weather Service Act was enacted and proclaimed.
- 1962** The weather radar started operation.
- 1967** The CMO became an organization under the Ministry of Science & Technology.
- 1969** Observations begin with weather radars.
- 1978** The National Institute of Meteorological Research was established.
- 1982** The CMO changed its Korean name from "Jungang Gwansangdae" to "Jungang Gisangdae."
- 1989** The Antarctic King Sejong Station of Korea started meteorological observations.
- 1990** The CMO was promoted as the Korea Meteorological Administration.
- 1991** Numerical weather prediction service began.
- 1998** The KMA relocated its headquarters from Songwol-dong, Jongno-gu, Seoul, to Sindaebang-dong, Dongjak-gu, Seoul.
- 1999** Meteorological Supercomputer 1 was introduced.
- 2005** The KMA was elevated to a vice-minister-level organization. The Weather Service Act was completely revised as the Weather Act.
- 2007** Korea became a member of the WMO Executive Council.
- 2008** The KMA was transferred to the Ministry of Environment as an affiliate. The National Typhoon Center was established. The Digital Weather Forecast Services began.
- 2009** The Weather Industry Promotion Act was enacted. The National Meteorological Satellite Center and the National Center for Meteorological Supercomputer were established. The KMA was approved by the WMO to establish the WMO Lead Center for Long-Range Forecast Multi-Model Ensemble in Korea.
- 2010** The COMS was launched. The Weather Radar Center was set up.
- 2011** The Gisang 1, Korea's first weather ship, was launched.
- 2012** The KMA was approved by the WMO to establish the Global Information System Center (GISC) in Korea.
- 2014** The Act on the Monitoring and Warning of Earthquakes, Tsunami and Volcanic Activities was enacted.
- 2015** Seoul Metropolitan Office of Meteorology and the Daegu, the Jeonju & the Cheongju Branch Offices of Meteorology were newly established.
- 2017** Earthquake and Volcano Center, Numerical Modeling Center and Meteorological Human Resources Development Institute were newly established.



ORGANIZATION

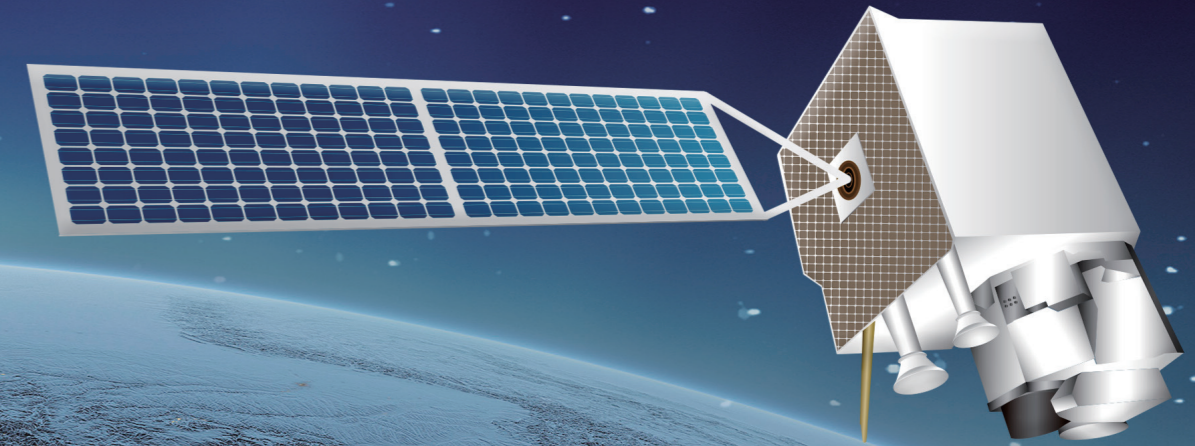
KMA - a Group of Experts Communicating and Cooperating Together for the Best Meteorological Services

From Baengnyeongdo to Ulleungdo across the country and from Sokcho down to Jeju, the KMA's experts are fully committed to the Best Meteorological Services Available

The KMA is a central administrative agency responsible for managing, supervising, and supporting the meteorological observation and forecasting services. As the top-notch network of meteorological experts, the KMA not only produces reliable meteorological information based on the atmospheric observations and weather forecasting, it also helps protect the Korean public and develop the meteorological industry.



KMA - Going Beyond Weather Forecasts



Weather prediction is not all that the KMA does; this is just the tip of the iceberg. Being firmly based on the meteorological observation and prediction, the KMA is also involved in a wide variety of matters, from research into earthquakes, volcanic activities, climate change, the meteorological industry, hydrometeorology, and space weather to international cooperation. The meteorological services that the KMA offers relate to a wide array of areas, including the agriculture, fisheries and livestock industries; the environment; national security; healthcare; sports; and tourism. The KMA also provides developing countries with meteorological technology and promotes exchanges and cooperation with many countries in the world. It is fully devoted to helping mitigate meteorological disasters not only in Korea but also in the global village. In this era of climate change, the KMA is committed to protecting the public and maximizing Korea's national competitiveness, thereby bringing Korea's international standing to higher tier-activities that the KMA calls collectively the "National Meteorological Services (NMS)."

The National Meteorological Services at a Glance

● OBSERVATION

The KMA carries out three-dimensional meteorological observations of the atmospheric and oceanic conditions, from the sky, the land, and space.



● METEOROLOGICAL TELECOMMUNICATION

The KMA collects, processes, and shares in real-time the observational and meteorological data produced at home and abroad.



● NUMERICAL PREDICTION

Making the best use of its supercomputer, the KMA analyzes the huge amount of observational data fast and accurately to produce numerical prediction data.



● WEATHER FORECAST

The KMA produces weather forecasts based on all of the observational data collected from home and abroad, the current weather conditions, and the results from the numerical weather prediction models, combined with the expertise and experience of the weather forecasters at the KMA.



● DISSEMINATION

The KMA provides weather forecasts for the public through multiple media channels, including broadcasting networks, newspapers, and the Internet.



● BIG DATA

The KMA opens and offers big data on climate and weather information to government organizations, public institutions, research institutes and universities. It creates new value out of the meteorological and climate information.

● SERVICES

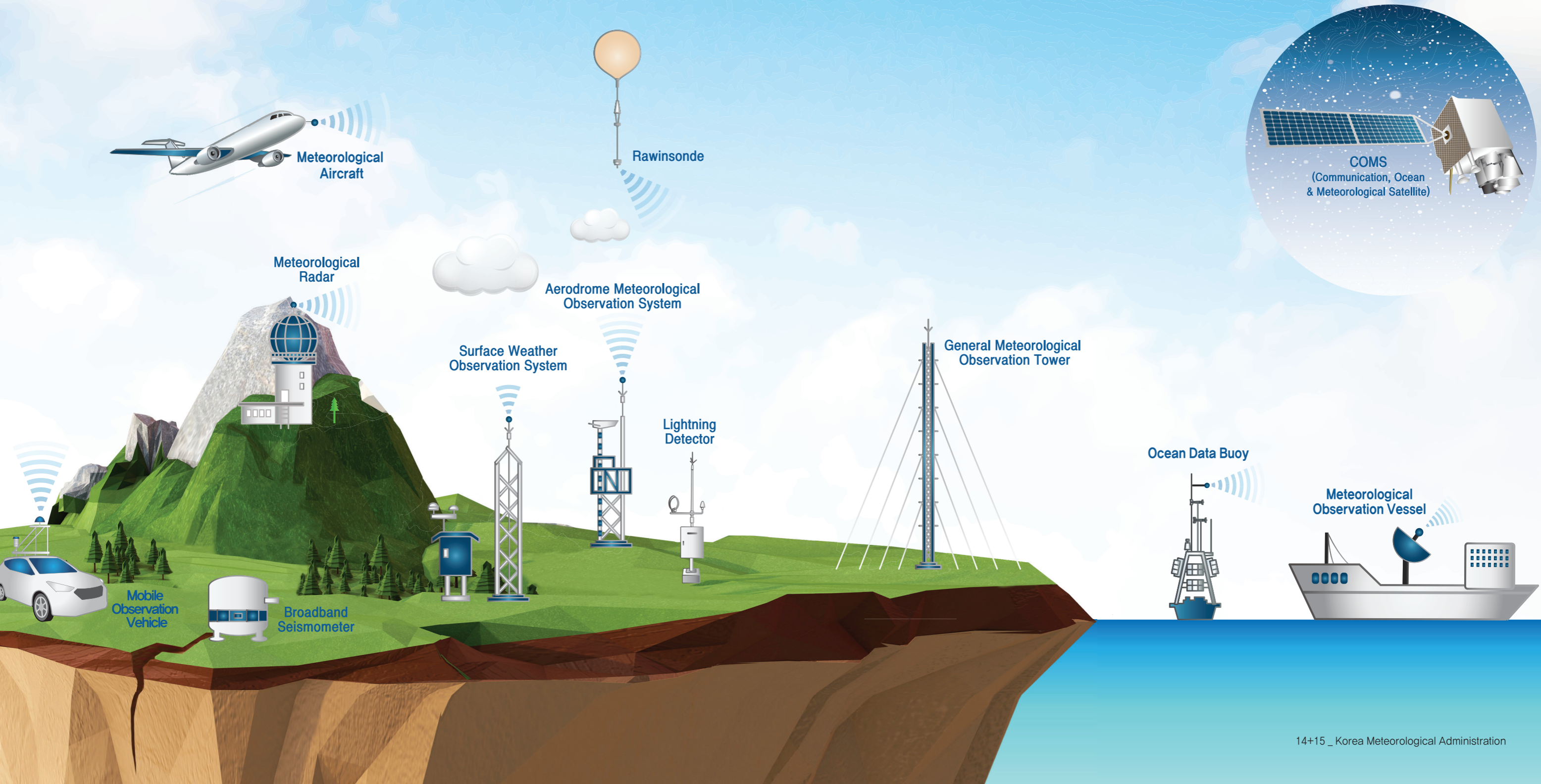
The KMA's meteorological and climate services are widely applicable and impact public health, everyday life and industry.

OBSERVATIONS



The National Meteorological Services starts with observation.

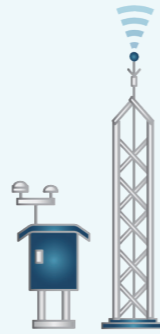
The KMA observes atmospheric and oceanic conditions three-dimensionally from the sky, the land and the sea.



OBSERVATIONS

Surface Weather Observations on Land

More than 590 surface weather observation systems across the country automatically measure the atmospheric pressure, temperature, humidity, wind direction, wind speed, and precipitation at locations that represent their respective areas. The systems are located at an average of 13 km apart from each other nationwide. In fact, the observation density is even higher than in Japan (approx. 15 km) and the USA (approx. 20km).



Observation site



General Meteorological Observation Tower of the Boseong Global Standard Meteorological Observatory



Upper-Air Observations in the Sky

Information about the upper atmosphere is essential to analyze atmospheric conditions in every respect. For this purpose, rawinsondes are carried aloft by large balloons to an altitude of 35 km to measure atmospheric conditions. Vertical wind profilers and radiometers are used for more detailed observation. The former measures the wind direction and wind speed up to 5 km above the ground; the latter measures the temperature and humidity up to 10 km above the ground.



Upper-air observation



Rawinsonde

Tip on Weather

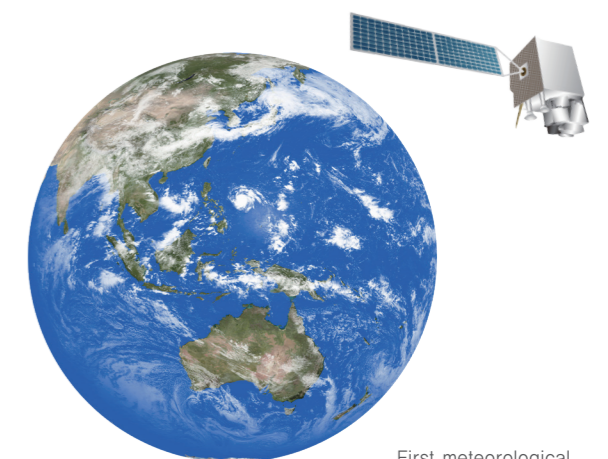
Is the weather also observed by human eyes?

Many automated systems are used in the meteorological observations, but meteorologists at the KMA still observe meteorological elements with their naked eyes. They observe the sky, current weather conditions, and other factors at the interval of one hour during the day and three hours during the night under regular weather conditions and at intervals of thirty minutes to one hour day and night under precipitation or other bad weather conditions.



Meteorological Satellite Observations from the Space

A meteorological satellite is a highly sophisticated apparatus and can detect a wide range of meteorological phenomena, from very localized, fast-developing ones to global ones. Following on from Korea's first geostationary meteorological satellite Chollian No. 1 launched in 2010, next-generation meteorological satellite Chollian No. 2 provides more variety of weather information by observing the vicinity of the Korean peninsula every two minutes.



First meteorological image by the COMS

OBSERVATIONS

Marine Weather Observations in the Sea

Atmosphere conditions are susceptible to change while the air passes over the ocean. For Korea, marine weather observations are especially important to ascertain the conditions of the atmosphere approaching land as the nation is surrounded by sea on three sides. The observations are also necessary to produce meteorological information for industries, including the fishing industry, passenger ship service, and marine leisure. For marine weather observations, many types of equipment and systems are used, including ocean data buoys, coastal wave buoys, drifting buoys, the coastal long wave monitoring system, the port weather monitoring system, light house AWSs, and wave radars. Korea launched its first meteorological observation vessel "Gisang 1" in May 2011 and ARGO floats have been deployed in the waters around the Korean peninsula and in the Pacific Ocean to monitor salinity and water temperature.



Meteorological observation vessel "Gisang 1"



Ocean data buoy

Weather Radar Observations from the Mountaintop

A weather radar is a remote sensing instrument that detects precipitation and its velocity by projecting electronic waves onto water droplets of clouds and analyzing their reflected waves. Weather radars are especially useful for monitoring and tracing typhoons and unexpected weather events, including localized heavy rain and hail. The era of remote-sensing observation in Korea began with the installment of the first weather radar on Mt. Gwanak in 1969. Eleven weather radars, including Terminal doppler weather radar(TDWR), are now in operation across the country.



Gangneung Weather Radar

Lightning Observations from the Earth and Clouds

Lightning is a meteorological phenomenon in which electricity accumulated in the cloud is suddenly discharged to the ground. The recent rise in the number of people doing outdoor activities has led to a greater loss of life and property damage due to lightning. The KMA has installed 21 lightning detectors across the country and used them to provide real-time lightning information to the public.



"A Localized Heavy Rain with Thunder and Lightning" by Shin Min-Cheol, a winner of the Weather Photo Contest 2010.



Lightning Detector



Tip on Weather

Many people say "thunder and lightning" more often than "lightning and thunder." Which occurs first?

Lightning and thunder occur almost simultaneously, but we see the lightning before we hear the thunder. That is because a bolt of lightning is light and thunder is sound caused by the lightning and light travels faster than sound.



OBSERVATIONS

Aviation Weather Observations at the Airports

Aviation Weather observation is essential for the safety of flight. The KMA operates the automated Aerodrome Meteorological Observation System (AMOS) at all airports across the country to measure wind, the Runway Visual Range (RVR), temperature, pressure, and the amount of precipitation-information necessary for aircraft landing and take-off. The LLWAS (Low Level Wind Shear Alert System), the TDWR (Terminal Doppler Weather Radar) and the vertical wind profiler are used to make routine observations every hour on the hour. Special observations are also made when any meteorological changes are likely to affect flight safety, or when organizations responsible for air transportation and airport operation request them. The observation data is distributed to relevant aviation administrations and commercial airliners.

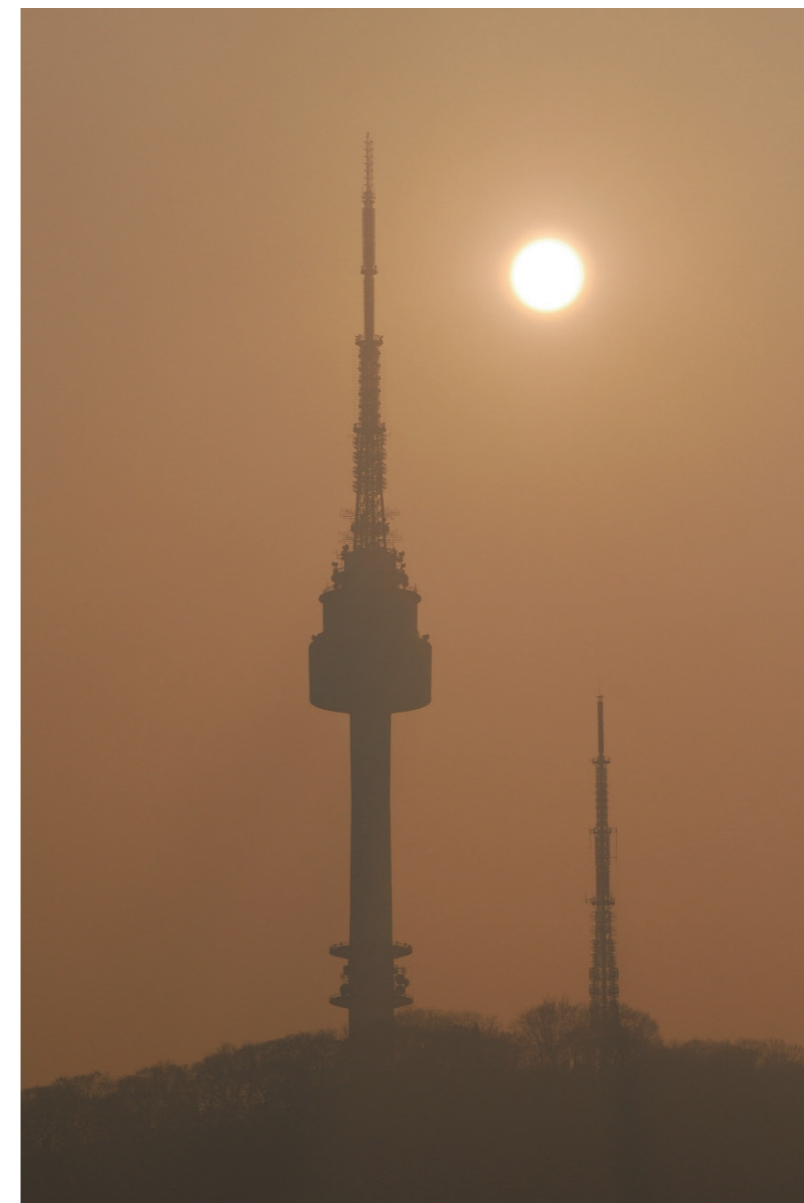


Runway Visual Range (RVR)

Asian Dust Observations in Korea and China



Due to the increasing desertification in China, Asian Dust is affecting the Korean Peninsula more frequently than before and at higher concentrations. This dust is very fine and can cause a number of health problems, such as respiratory diseases and eye diseases. This renders observations of Asian Dust more critical than ever. The KMA has been operating the BAMS (Beta Attenuation Monitors/PM10) designed to make real-time observations of fine, airborne particles of less than 10 μ m. The KMA also monitors Asian Dust in the source regions in China through the 10 Korea-China Joint SDS (Sand and Dust Storm) Monitoring Network Stations. It has installed two Asian Dust monitoring towers in Mongolia to ensure more effective Asian Dust monitoring.



"At the Mere Sight of It" by Choi Young-Jin, a winner of the Weather Photo Contest 2009.



Korea-China joint monitoring network of SDS (Sand & Dust Storm)



Beta Attenuation Monitor PM10

WEATHER FORECASTS



Weather forecasts are a synthesis of the accuracy of observation data, numerical prediction technology and the capabilities of forecasters.

From very short-term predictions to climate outlook, the KMA provides information necessary for public safety and planning for the nation's future.

The process in which weather forecasts are produced is a series of communications. The weather observation data are shared with other countries of the world. Numerical prediction data are produced by means of the supercomputer. Weather forecasters with expertise and experience across the nation share opinions and make decisions. All these factors go into producing weather forecasts. In a sense, weather forecasts are a product of communication among the sky, the technology, and people.



WEATHER FORECASTS

Things You Know Through Weather Forecasts

Humidity

The amount of moisture in the air (Usually it refers to the relative humidity.)

On low humidity days, the laundry dries quickly. During the seasons with low humidity, you should take care not to start a forest fire.

State of the Sky

The meteorological conditions of the sky, indicated by the amount of clouds

When it's very sunny, prepare sunglasses.

Snow Cover

The blanket of snow covering the ground

You're advised to use public transportation, if possible. Use the snow chains for your car when you drive. Clear the snow on the road in front of your house. When you walk along the snow-covered sidewalks, keep your hands out of the pockets and refrain from using a mobile phone.

Thunder & Lightning

Thunder & Lightning

When thunder and lightning are expected, refrain from going out and unplug electrical appliances when they are not in use.

Precipitation

Amount of any form of water that falls from the sky

When a heavy rain is expected, stay away from manholes, streetlights and high-voltage electricity cables. Prepare for flood damage

Probability of Precipitation

Percent chance of rain or snow fall

If a high probability of precipitation is expected, carry an umbrella when you go out.

Asian Dust

Dust and fine sand particles, thrown up into the sky by the strong wind, spreading through the atmosphere and falling down slowly

Carry a mask when you go out.

Fog

Liquid water droplets or ice crystals suspended in the air, giving a visibility of less than 1km, often in the form of clouds close to the ground

Be very careful when you drive.

Temperature

Temperature of the atmosphere

Wear thick clothes to keep warm when the temperature is low.

Wind Direction

Where the wind is coming from

Usually, a warm wind blows from the south and a cold wind from the north.

Wind Speed

How fast the air flow is

When the wind is strong, be careful with possible falling objects.

Wave Height

Height of waves

When the waves are high, the passenger ship service may be closed - you need check beforehand.

WEATHER FORECASTS

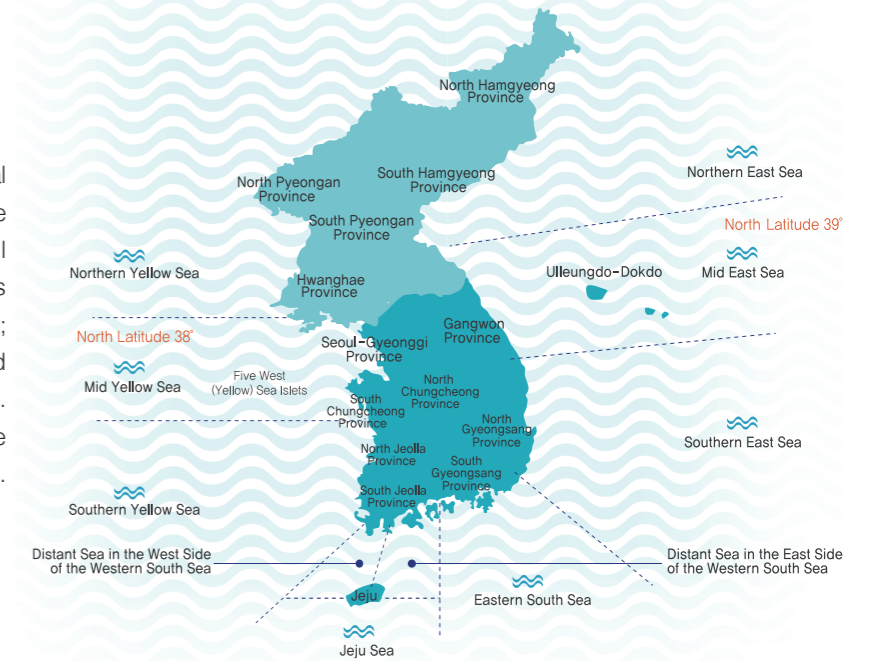
Numerical Weather Prediction & Supercomputer

The numerical weather prediction is made by way of putting into the supercomputer a physical equation for the transition of the meteorological elements, such as temperature, wind and humidity. The earth's atmosphere is divided into the grids of a certain size like a cubic checkerboard and the values at the grid points represent the atmospheric conditions. The numeric weather prediction models use very complicated equations and huge amounts of data, requiring a supercomputer. The more elaborate the model, the faster the supercomputer that is needed.

The atmosphere is subject to constant change. The uncertainty of atmospheric phenomena may be best explained by the so-called "butterfly effect." A small change like the flutter of a butterfly in one state, the idea goes, can result in large differences in a later state like a typhoon halfway around the world. As it involves such fundamental uncertainty from the beginning, numerical weather prediction can never be one-hundred percent accurate even with the aid of the most sophisticated technology-and this is where weather forecasters step in. With meteorological expertise and experience, they effectively analyze and modify the output of numerical prediction before providing a final forecast for the public.

Forecast Zones

The KMA's forecast zones consist of the digital forecast zones of some 3,500 administrative units of eup, myeon and dong; regional forecast zones comprising 17 land zones and 19 marine zones including North Korea; 170 local land forecast zones for cities and counties; and 25 local marine forecast zones. In addition to these, five ocean zones are also designated for marine weather forecasts.



Tip on Weather

Can weather forecasts be made accurate only with a supercomputer?

The three most important factors in determining the accuracy of weather predictions are the accuracy of the observation data, the performance of the numerical weather prediction models, and the ability of weather forecasters. A supercomputer is essential for the numerical weather prediction models for both their practical use and improvement. It is also indispensable for faster and more accurate analysis of the gigantic amount of observation data. However, weather forecasting also requires the ability of forecasters with expertise and experience to analyze the output of the supercomputer. The best weather forecasting requires accurate observation data, well designed numerical weather prediction models, and competent forecasters.

Korea's numerical weather prediction technology ranks 5th in the world

Only 13 countries in the world carry out global Numerical Weather Prediction (NWP). The KMA has used numerical weather prediction models for weather prediction since 1991. Countries using the NWP system share the errors of the NWP models on a monthly basis. Korea ranks 6th in the world after Europe, the UK, Japan, the USA and France, in terms of the accuracy of NWP. In 2011, the KMA launched a project to develop Korea's own global NWP model, and its NWP technology should be greatly improved by 2019 when the project is completed.

Is the KMA the only organization that can forecast the weather?

According to Article 17 of the Weather Act, only the KMA administrator can provide the weather forecasts and special reports. However, weather forecasts may be permitted for the purpose of national defense and to the proprietor of a weather business registered as a weather forecasting business in accordance with Article 6 of the Weather Industry Promotion Act.

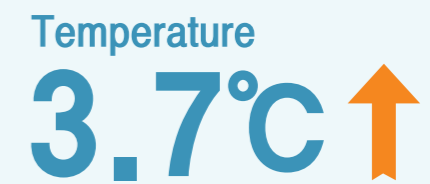
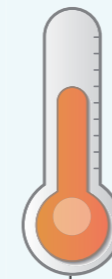
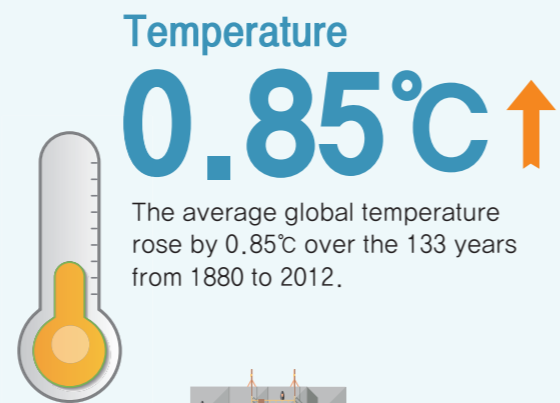


CLIMATE CHANGE

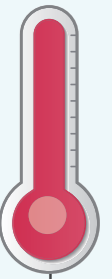


Through the observations of climate change and the production of scientific information, the KMA helps establish policy on climate change and support industrial activities.

The KMA monitors climate change and produces scientific information required to deal with it. Through weather predictions, it also supports policy-making and industrial activity. Sharing its information on climate change with the rest of the world and actively participating in international initiatives, the KMA stands in the forefront of the world's response to climate change.



If the use of fossil fuels, the major cause of the global warming, continues at the current rate, the average global temperature is projected to rise by 3.7°C compared to temperatures from 1986 to 2005, and the sea level is expected to rise by 63cm by the end of the 21st century.



1880



2012



End of the **21st** Century

CLIMATE CHANGE

Monitoring the global atmosphere from the east, west, and south

The KMA runs the climate change Monitoring stations to observe and analyze changes in the atmospheric environment on the Korean Peninsula and actively respond to the changing global environment in the future. The climate change Monitoring station was first established on Anmyeondo Island in 1996, followed by Gosan, Jeju, in 2008 and Ulleungdo/Dokdo in 2014.

Anmyeondo
Climate Change
Monitoring Station

Ulleungdo/Dokdo
Climate Change
Monitoring Station

Gosan
Climate Change
Monitoring Station

Climate Change Scenarios that Project 10 Years and 100 Years Ahead

“What will the climate be like by 2100, if the current trend of greenhouse gas emissions continues?” “How much would temperature and precipitation change, and how much impact would it have?” The KMA produces forecasting data to answer these questions - what is dubbed “climate change scenarios.” We have four climate change scenarios based on different projections of the increase in greenhouse gas emissions. According to the RCP (Representative Concentration Pathway) 8.5, one of the four scenarios which assumes the continuation of the current trend of greenhouse gas emissions, the global temperature is projected to rise by 3.7°C by the end of the 21st century (2081-2100) from the 1986-2005 period, with the amount of precipitation varying greatly from region to region. By the end of the 21st century (2071-2100), the temperature on the Korean Peninsula is expected to rise by 5.9°C from the 1981-2010 period and the amount of precipitation, by 18%. These scenarios are used effectively to minimize anticipated damage stemming from climate changes in different areas, including food production, pest control, water resource management, changes in forest ecosystem and natural disasters, and to be prepared for future challenges



CLIMATE CHANGE

New & More Detailed Climate Change Scenarios

The climate change scenarios currently used (RCP) are up to 100 times more specific than the existing ones (SRES). Now three types of scenarios have been produced and made available: Scenarios for the globe, the Korean Peninsula and South Korea. The climate change scenario for South Korea represents how temperature and precipitation would change in each 1km x 1km grid square. Using these scenarios, we can take a closer look at the impacts of climate change on the administrative units of not only city/county/district but eup/myeon/dong as well.

* RCP : Representative Concentration Pathways
** SRES : Special Report on Emission Scenario

STEP 1



Global Scenario
135km

STEP 2

Korean Peninsula Scenario
12.5km



STEP 3



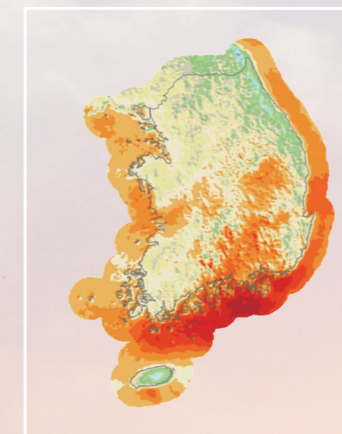
Detailed South Korea Scenario
1km

Carbon Tracking System Supports the Policy to Reduce Greenhouse Gas Emissions

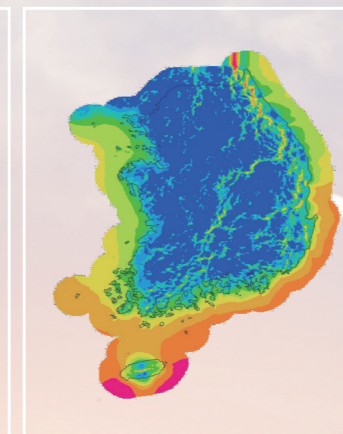
Carbon dioxide (CO₂) is one of the main causes of climate change. The carbon tracking system is used to find out where and how much CO₂ is being produced and absorbed. It also helps provide the ground from which to verify carbon dioxide reduction activities in the international community.

Virtual Resource Map Tells Us the Distribution of the Wind and Solar Energy

The wind/solar power resource map shows which areas are more sunny and windy than others. It is an important map that exhibits the distribution of our natural resources. The map also gives information about the best place to build wind and solar power plants and serves as basic data to determine the type of generator to establish. In other words, it provides us with important information for the generation of new renewable energy to replace fossil fuels.



Solar-Meteorological Resources Map



Wind-Meteorological Resources Map

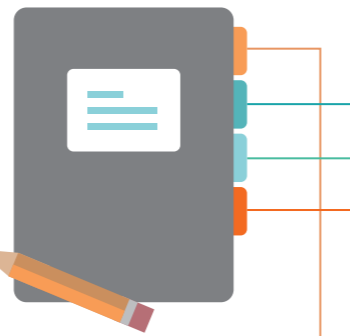
METEOROLOGICAL INDUSTRY



The KMA stands in the forefront to help invigorate the meteorological industry, creating high added value and leading the national economy in the future.

The size of the meteorological industry has been steadily increasing, reaching at KRW 400 billion in 2016. Many advanced countries see the industry as a new driver of economic growth. The KMA is promoting various policies for the activation of the meteorological industry by establishing a full-cycle support system in order to strengthen the capability of the meteorological companies, expanding domestic and overseas markets, and expanding the practical use of market-oriented weather service research and development.

4 strategies to be 3 most powerful nation in global meteorological-industries



Maximizing creation of demand for weather services

- Strengthening competitiveness of private weather services of "Weather Management"
- Expansion of demand for weather services through the spread of weather management
- Improved understanding of the value of weather information



Expanding application of weather services to R&D

- Creating an infrastructure for advanced R&D technology business
- Promotion of R&D business development by activating technical transactions
- Expanded market-oriented R&D support



Establishment of full-cycle support system for meteorological companies

- Support for the promotion of business start-ups by meteorological companies
- Expansion of the weather company support program
- Establishment of global support system for overseas market expansion



Expansion of infrastructure to develop a sustainable weather industry

- Training of experts in the meteorological industry
- Establishment of coordination system for development of meteorological industry
- Improvement of business-friendly weather industry promotion system

METEOROLOGICAL INDUSTRY

The KMA has laid an institutional foundation to promote the weather industry.

The Weather Industry Promotion Act has provisions for the support and promotion of the meteorological industry. It was designed to lay the foundation for the industry's development and enhance its competitiveness, thereby contributing to the national economy. To achieve the goal of the Act systematically and efficiently, the KMA has established and implemented the Basic Plans for the Advancement of Weather Industry every five years. Since the first Basic Plan (2011-2015), Korea has entered the growth period of the industry through supporting the industry and establishing the foundation for its further development. The second Basic Plan (2016-2020) has concentrated on improving capabilities and spreading the value of the meteorological industry in an effort for Korea to become a global meteorological industry powerhouse.

The KMA selects “Excellent Business Management Based-on Weather Information” for promoting weather information utilization

“Weather management” is a business area in which a company uses meteorological information to create profit and increase efficiency in various fields. The KMA selects companies that excel in weather management every year for companies that effectively utilize weather information and conducts various support projects. With this support, the KMA helps reduce weather disasters and provides new market opportunities.



날씨경영 우수기업
Excellent Business Management Based-on Weather Information

The Korea Meteorological Industry Awards were introduced to help expand the base of the weather industry

The annual Awards are intended to reward those individuals and organizations which have utilized weather information in corporate management or furthered the development of the meteorological industry. The individuals and organizations eligible for the Awards include those which have contributed to more profit-making and improved corporate management through customized weather information or those which have made great contributions to the development of the weather industry and national competitiveness. Individuals can also propose ideas to vitalize the meteorological industry. Nominations for the Awards can be made for utilization of meteorological information, promotion of the meteorological industry, and idea proposals.



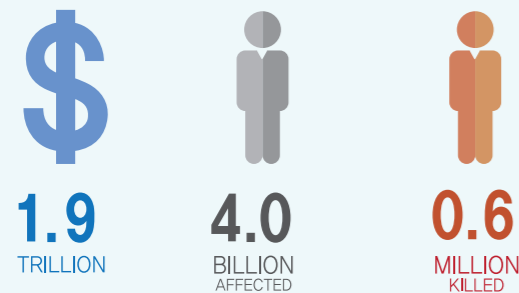
METEOROLOGICAL INDUSTRY

The KMA supports the Korean meteorological industry to advance into the global market.

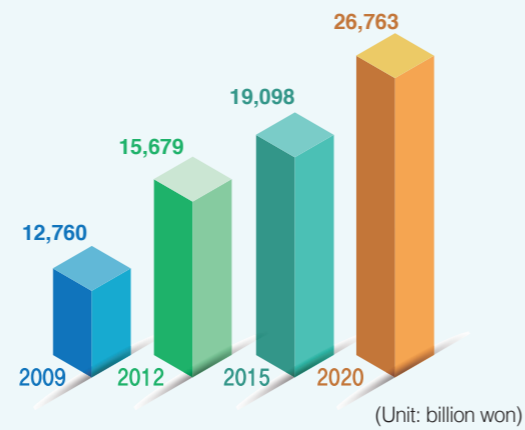
In the wake of the increase in the meteorological disasters, there has been a growing demand for the meteorological and climate industry globally. The KMA seeks to establish a new growth driver for Korea's stagnant meteorological industry and expand it internationally. To this end, it has made an effort to support Korean meteorological companies expanding overseas and exporting their products.

Increase in the demand for the global meteorological industry following growing meteorological disasters

< Damage from Natural Disasters 1995-2015 >



< Changing Market Size of the Global Meteorological Industry >



Major Programs for the Promotion of the Meteorological Industry Advancing Overseas

Support to Exports by the Meteorological & Climate Industry

< Support Areas >

Export marketing expenses (invitation of buyers, participation in exhibits, etc.) and export consulting expenses (review of trade contracts, preliminary survey of overseas tariffs and customs clearance, etc.)

Private & Public Joint Overseas Trade Mission of the Meteorological & Climate Industry

< Major Activities >

1. High-level bilateral meetings of delegations from the meteorological administration
2. Forums of meteorological & climate policy and technology
3. Building a support system by the relevant local Korean organizations (diplomatic offices, etc.) for exports of the meteorological & climate industry

Support to International Exhibitions of the Meteorological and Climate Industry

< Eligible Candidates >

Meteorological companies

< Areas of support > :

Expenses for participation, including exhibition booths, rents for supplies and interpretation costs

The KMA supports the development of the meteorological and climate industry.

< Support to Young Entrepreneurs in the Meteorological & Climate Industry >

Classification	Content
Support provided to	Individuals or a team of people aged 34 or younger who wish to start a business
Application areas	New weather and climate business projects which can lead to actual startups, including information service utilizing meteorological big data (apps, Web, SWs); new development and/or improvement of meteorological equipment; and fusion solution developments with other areas of the meteorological technology
Support programs	Startup grants; training on starting a new business and one-to-one mentoring; startup camps and startup contests (Minister of Environment Awards, etc.)

< Meteorological Business Growth Support Center >

Classification	Content
Support provided to	Companies which are classified as a micro business and those wishing to start a business in the meteorological industry
Tenant period	2 years after contract (up to 3 years if the tenancy contract is extended)
Support Programs	Support for the growth infrastructure to help businesses stand on their own - Full amount of the rents for infrastructure (office space, business space, business facility support) - Management and/or technology consulting and/or technology development

< Business Support Center for the Meteorological & Climate Industry >

Classification	Content
Support provided to	Small- and medium-sized weather business operators and those who wish to start a business in the meteorological industry
Support programs	Regular counseling Regular counseling is supported by internal experts at the Korea Meteorological Institute (management, starting a business, finance, accounting, etc.)
	In-depth counseling In-depth counseling is provided by advisors or contracted specialized organizations (patent, law, tariff, etc.) on matters that are not covered by regular counseling

BIG DATA

The Power to Create Synergy Beyond Your Imagination
The value of meteorology has been increased even more by fusion with other fields.

The weather is closely related to our daily life. When used in other fields, meteorological data enables a wider range of services with higher value. For example, a big data analysis can be performed on data of the areas of heavy rain and of actual damage, and this enables us to provide information on the possibility of damage stemming from severe weather hazards in advance. Fusion services that are currently available include agricultural meteorological information service for major production areas of garlic, onion, and other agricultural products, which are sensitive to weather, and weather service for popular tourist attractions that provides not only weather information by tourist destination, but also recommends alternative spots to visit if rain or snow is expected.

The fusion services which are currently under development include the service, together with Korea Electric Power Corp., to predict solar power generation by estimating solar radiation, and to provide a service for the prediction of frost occurrence by studying the weather variables that affect frost generation. In cooperation with experts from various fields and relevant organizations, the KMA will continue to develop services that utilize meteorological and climate big data. Thus, it will create the value of meteorological information that benefits the public and spread the value to both the public and private sectors.

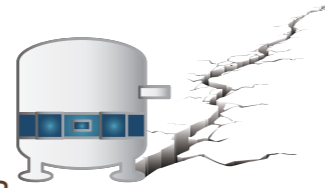


The KMA has been operating the Climate Big Data Forum since 2014 to promote the utilization of climate Big Data and to develop collaborative services, and is joined by public, academic, and private organizations. The forum is composed of specialists from various fields, ranging from Agriculture, Fisheries & Livestock, Energy, Water Resources, Healthcare, Disaster Prevention and Transportation. The KMA is developing a variety of ideas through this forum.

EARTHQUAKE AND VOLCANO



From earthquakes, tsunami and volcanic observation to broadcasting alerts from the Sky, the Land and the Sea

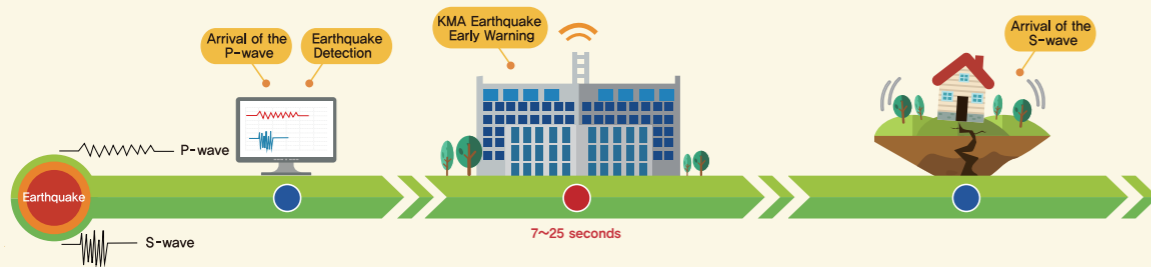


The KMA closely observes earthquakes occurring not only in Korea but around the world 24 hours a day throughout the year. It provides information so that people may quickly evacuate when necessary. Since 1998, The KMA has been strengthening our rapid earthquake alert system through the sequential expansion and analysis of digital seismic observation networks.

The KMA provides the Earthquake Early Warning (EEW) Service to minimize the damage from earthquakes that are hard to predict. The EEW service aims to provide rapid information and provides early warning within 7-25 seconds after observing an earthquake with a magnitude 5 or more. (Less than 5 inland magnitude earthquakes are alerted to through earthquake early information). The KMA also observes not only natural earthquakes but also artificial vibrations caused by nuclear tests and large-scale explosions.

As it is surrounded by the sea on three sides, Korea must be ready to counter damage caused by tsunamis. The East Sea is especially susceptible to tsunami since two oceanic tectonic plates meet the continental plate along the west coast of Japan. The KMA is using its own observation network and the KMA has installed wave gauges and exchanges observation data and tsunami information with Japan, and it encourages international cooperation with Southeast Asian countries, China, and Japan for the monitoring of possible earthquakes and tsunami. The KMA is also monitoring volcanic activity through a variety of instruments, including satellites and sensors that carry out observation of the atmosphere.

Earthquake Early Warning Service



What is the Earthquake Early Warning (EEW)?

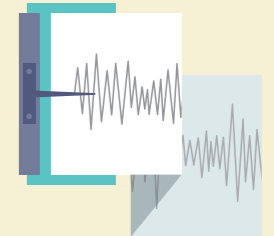
EEW provides quick and automatic analysis of the P-wave detected before the arrival of the S-wave with slow movement and damage.



Tip on Weather

Do earthquakes of the same magnitude cause the same level of damage?

The KMA announces an alert for any earthquake with a magnitude of 2.0 or above on the Richter scale. Many people are confused about the magnitude and intensity of an earthquake. The magnitude of an earthquake refers to the absolute amount of energy released. An earthquake is measured at the same magnitude wherever it is detected. The seismic intensity varies depending on the location where it is detected: the farther from the epicenter, the lesser the intensity. Intensity can also differ depending on the underlying strata and the conditions of the structure where the measurements are made, even at points equidistant from the epicenter. The magnitude and the intensity of an earthquake, therefore, do not correspond with each other proportionally. An earthquake has one magnitude but varying intensity depending on a number of factors.



Is Korea at risk of a great earthquake?

On September 12, 2016, a magnitude 5.8 earthquake struck Gyeongju, a city in North Gyeongsang Province. The earthquake was the most powerful seismic activity since 1978 when the nation started measuring tremors. On November 15, 2017, a 5.4-magnitude earthquake occurred in Po-hang City, North Gyeongsang Province, and a great shock was felt throughout the country. As major earthquakes occurred consecutively in 2016 and 2017, the perception is spreading that Korea is no longer a safe zone from earthquakes. Historical records such as the Samguksagi (History of the Three Kingdoms) and Chosun Wangjo Sillok (Annals of the Chosun Dynasty) contain records of loss of human life and property caused by earthquakes. We must always suppose that there is a chance of an earthquake and tsunami occurring and causing damage.

Are we prepared for volcanic activity by Mt. Baekdusan?

In answer to the growing concern about a possible eruption of Mt. Baekdusan, in March 2011 the KMA came up with the "General Countermeasures against Volcanic Activities for Proactive Prevention and Mitigation of a Volcanic Disaster." The KMA put forward the "Mt. Baekdusan's Volcanic Eruption Scenario," showing the types of disasters that could occur in the event of an eruption by Mt. Baekdusan, the range of volcanic ash dispersal, and the level of impact. The KMA is also stepping up cooperation with East Asian countries to build a network for collecting information on volcanic activity in respective countries.

Where can we find the information about earthquakes?

Since earthquakes are unpredictable, it is important to check information quickly. When a large-magnitude earthquake is about to occur, information can be found in emergency messages, on TV, on websites, in tweets, and in instant messaging services.

METEOROLOGICAL RESEARCH



Overcoming Today's Limitations and Opening Tomorrow

The KMA has been developing world-class meteorological research capabilities based on new meteorological and climate technologies.

The global weather is becoming increasingly erratic, and we still have a long way to go to cope with it properly. This is what the National Institute of Meteorological Sciences (NIMS) and Numerical Model Development Center have been working hard to achieve.

Observation and Forecast Research

- Research on weather observations and forecasts
- Research on target observation of high-impact weather and improvement of its predictive accuracy
- Operation of the Global Standard Observatory and Monitoring Equipment Effect Analysis Research
- Research on Operation and Application of Weather Aircraft
- A Study on the Anthropogenic and Mechanical Structure of Air Quality



Climate Research

- Research on climate variability and change
- Development of a Global System Model for the Prospect of Climate Change
- Development of global and regional climate change scenarios
- Research on the Causes and Mechanisms of Climate Change
- Research on the Development of Carbon Cycle Monitoring and Technology



Global Environment System Research

- Research on the Observation, Analysis, and Prediction of Sea Weather
- Research on the Operation and Development of a Long-Term Prediction System
- Research on the Production and Application of Hydrological Weather Information and the Water Circulation System
- Management and operation of marine meteorological observation ships
- Operation of WMO S2S International Coordination Office (ICO)



Environmental Meteorology Research

- Research on the Asian Dust and haze
- Research on the environmental meteorology, atmospheric radiation, and atmospheric chemistry
- Observations and analysis of the earth's atmosphere
- Observation, analysis and research required for the monitoring of climate change

Applied Meteorology Research

- Research on the development of life and healthcare models and services
- Research on the industrial meteorology (agriculture, weather resource map, aviation weather)
- Research on the development of weather modification technology (artificial rainfall/snow, fog dissipation)
- Research on the urban meteorology (heat island, changes in precipitation, wind corridor)
- Research on cloud physics observation and analysis



Future Strategy Research

- Studies on Future Strategic Technologies
- Research on Weather-based Converged Technologies
- Establishment and evaluation of R&D promotion strategies
- Establishment of mid- and long-term research plans



Research on the Numerical Models

- Development and improvement of numerical weather prediction models for weather predictions
- Development and improvement of the production and application processes of numerical weather prediction data
- Research on the numerical weather prediction technology



INTERNATIONAL COOPERATION

Enhancing the International Standing

The KMA has become a role model for the national meteorological services of developing countries and a partner of those in advanced countries.

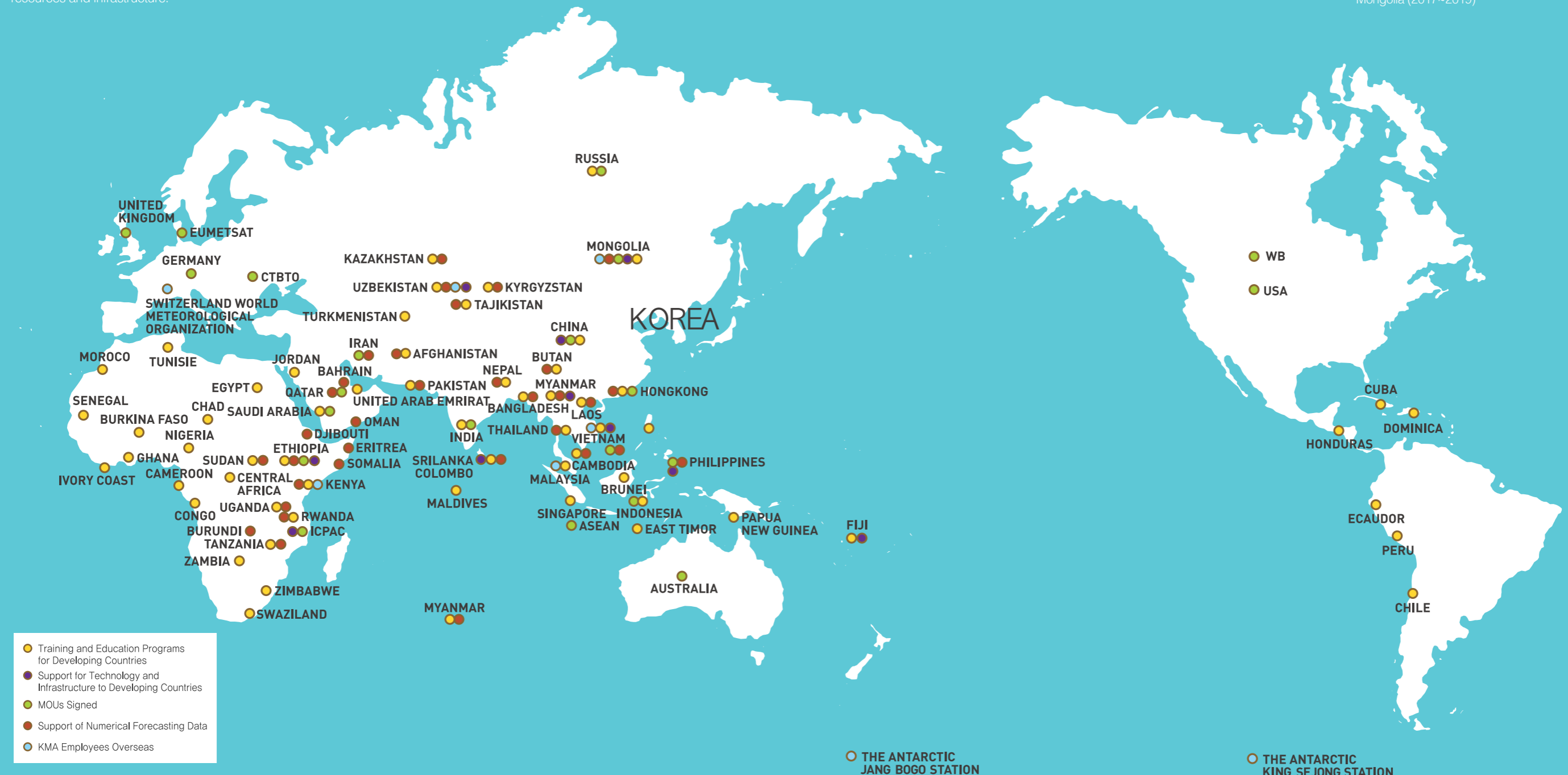
Meteorology transcends national borders. The member countries of the WMO are cooperating with one another in a concerted effort to reduce meteorological disasters around the world. Korea had to receive assistance from the Overseas Economic Cooperation Fund to modernize its meteorological equipment until 1980. It is now a meteorological giver, transferring its meteorological technology to developing countries and supporting development of human resources and infrastructure.

Establishing Global Leadership

- Korean candidate elected member of the WMO Executive Council
- KMA approved by the WMO to establish the WMO Lead Center for Long-Range Forecast Multi-Model Ensemble in Korea
- KMA approved by the WMO to establish the Global Information System Center (GISC) in Seoul
- KMA appointed government department representing Korea for the Intergovernmental Panel on Climate Change (IPCC)
- KMA approved by the WMO to establish the Global Atmosphere Watch (GAW) World Calibration Center for SF6 (sulfur hexafluoride)
- Korean candidate elected to the vice-presidency of the WMO Commission for Atmospheric Sciences (CAS)
- KMA has implemented joint research projects with the international community.

Supporting Developing Countries Projects and Invitation & Training Programs

- Education program for foreign forecasters (1998~2005, 2014~)
- Education program for the operation of the weather radar and data utilization (2012~)
- KMA built the Korea-China Joint SDS (Sand & Dust Storm) Monitoring Network (2003~2006, 2006~2008, 2014~2018)
- KMA worked out the master plan for the advancement of the national meteorological system in Myanmar (2015~2016)
- KMA modernized the meteorological disaster monitoring system of Myanmar (2017~2019)
- KMA modernized the meteorological disaster monitoring system of Vietnam (2014~2016)
- KMA established the automatic weather observation system of Mongolia (2017~2019)



- Training and Education Programs for Developing Countries
- Support for Technology and Infrastructure to Developing Countries
- MOUs Signed
- Support of Numerical Forecasting Data
- KMA Employees Overseas

○ THE ANTARCTIC JANG BOGO STATION

○ THE ANTARCTIC KING SEJONG STATION

CENTERS

Working with the KMA for Better Meteorological Services

Attesting to Korea's advanced meteorological technology, they are world-class specialized institutions.

Numerical Modeling Center (NMC)

The Numerical Modeling Center focuses on developing numerical weather prediction (NWP) models that are used to calculate atmospheric conditions to predict the future weather. The NWP data obtained from the models is provided to weather forecasters to generate meteorological information ranging from weather forecasts for medium-Range forecast information. The data is also used as a base data for a variety of fields, including daily life, agriculture, transportation, aviation, and logistics. Thus, the Center makes efforts to improve the accuracy of predictions.

(61, Yeouidaebang-ro, 16-gil, Dongjak-gu, Seoul)

Meteorological Human Resources Development Institute (MHRDI)

The MHRDI focuses on training the employees of the KMA and providing educational programs on meteorology for the general public and those working in the meteorological industry. The institute concentrates on improving the professional capacity of the employees and developing and training specialists in meteorology.

(61, Yeouidaebang-ro, 16-gil, Dongjak-gu, Seoul)

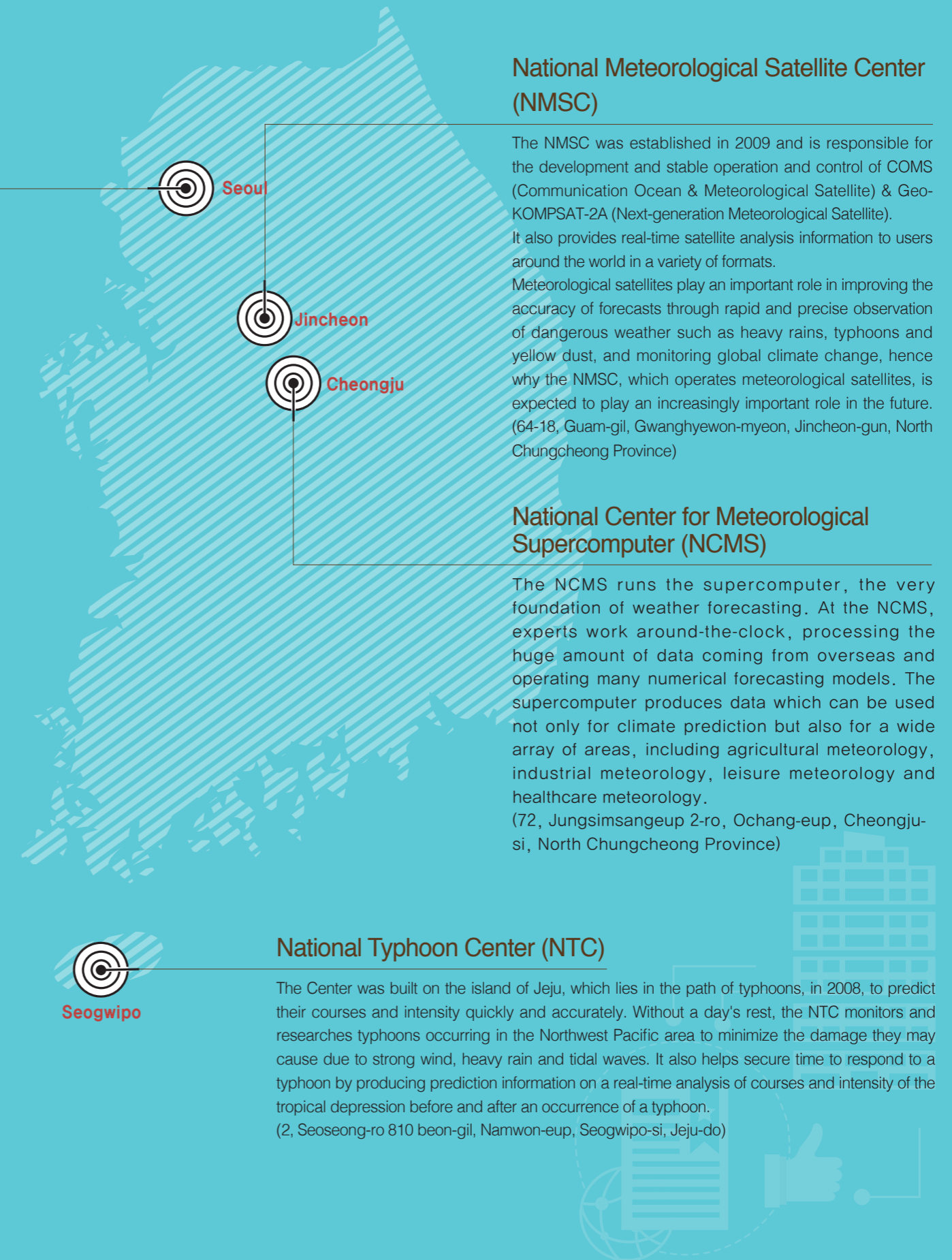
Weather Radar Center (WRC)

The WRC was set up in 2010 by consolidating radar staff and business which had been distributed across the nation. The weather radar sweeps the entire Korean Peninsula and nearby sea areas at 5-minute intervals to detect precipitation. As an exemplar of the collaborative administration, the WRC also makes use of the radars of the KMA, the Mistry of Land, Infrastructure and Transport, and the Ministry of National Defense in an effort to minimize the blind spots of observation and reduce cost. (61, Yeouidaebang-ro 16-gil, Dongjak-gu, Seoul)

National Climate Data Service System (NCDSS)

The NCDSS was newly established in 2015 to enable consolidated management of national climate data and advancement of its services. It manages the data in a comprehensive way, including those on the surface, marine and upper-air weather observations that the KMA produces or acquires. It then produces high-quality climate data through quality control of the data it controls. It also produces many useful climate data, including the climatological normals, for statistical treatment of climate data. The NCDSS serves as a national archive of Korea's climate data as it maintains databases and periodicals of climate data. As a unitary channel of the national climate data, it aims to continue to develop its services, which are convenient for anybody to access and easy to understand.

(61, Yeouidaebang-ro 16-gil, Dongjak-gu, Seoul)



National Meteorological Satellite Center (NMSC)

The NMSC was established in 2009 and is responsible for the development and stable operation and control of COMS (Communication Ocean & Meteorological Satellite) & Geo-KOMPSAT-2A (Next-generation Meteorological Satellite).

It also provides real-time satellite analysis information to users around the world in a variety of formats.

Meteorological satellites play an important role in improving the accuracy of forecasts through rapid and precise observation of dangerous weather such as heavy rains, typhoons and yellow dust, and monitoring global climate change, hence why the NMSC, which operates meteorological satellites, is expected to play an increasingly important role in the future. (64-18, Guam-gil, Gwanghyewon-myeon, Jincheon-gun, North Chungcheong Province)

National Center for Meteorological Supercomputer (NCMS)

The NCMS runs the supercomputer, the very foundation of weather forecasting. At the NCMS, experts work around-the-clock, processing the huge amount of data coming from overseas and operating many numerical forecasting models. The supercomputer produces data which can be used not only for climate prediction but also for a wide array of areas, including agricultural meteorology, industrial meteorology, leisure meteorology and healthcare meteorology.

(72, Jungsimsangeup 2-ro, Ochang-eup, Cheongju-si, North Chungcheong Province)

National Typhoon Center (NTC)

The Center was built on the island of Jeju, which lies in the path of typhoons, in 2008, to predict their courses and intensity quickly and accurately. Without a day's rest, the NTC monitors and researches typhoons occurring in the Northwest Pacific area to minimize the damage they may cause due to strong wind, heavy rain and tidal waves. It also helps secure time to respond to a typhoon by producing prediction information on a real-time analysis of courses and intensity of the tropical depression before and after an occurrence of a typhoon.

(2, Seoseong-ro 810 beon-gil, Namwon-eup, Seogwipo-si, Jeju-do)

Useful KMA Services You Might Not Know

Some of us use weather forecasting when we decide whether to carry an umbrella or what to wear for the day. Others use meteorological information for marketing purposes. Still others adjust the production volume for the next season based on the weather forecasts and enjoy increased sales as a result. Utilizing the climate change information, some determine when to fertilize their fruit trees and others decide when to plant the seed clams of short-necked clams, thus contributing to local economies. The meteorological information can be combined with information from other areas, which then can be developed into a mobile app with high added value.

The weather has increasing influence on society and the economy, and meteorological and climate information is naturally becoming more and more valuable. When you actively use various pieces of information that the KMA provides, they will certainly afford you greater convenience and make your business more competitive.



SERVICES

Meteorological Services for All the People

KMA Public Data Service & Open Weather data portal

Since July 2015, the KMA has operated a web-based open weather data portal that allows users to view and download weather data anytime, anywhere for free. This portal allows you to view data such as Meteorological observations, weather forecasts, radar and numerical models and download them in an open standard format. Also you can download weather statistics content such as temperature, precipitation, days of weather phenomena, and weather analysis tools.



(KMA Electronic Civil Service homepage)

Meteorological Data Certificate and Meteorological Data Provision Service

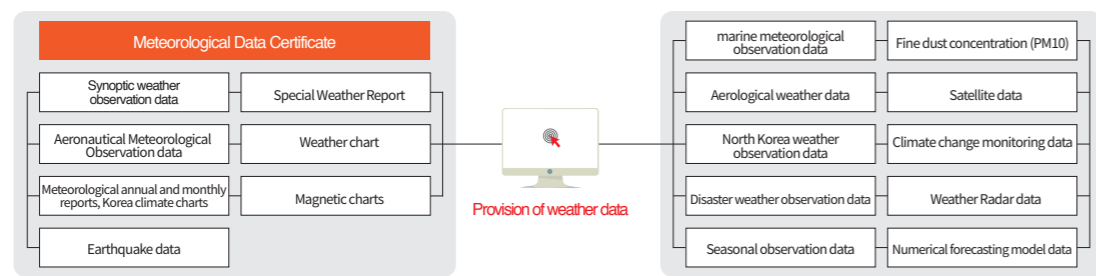
The field of use of meteorological data required for use as legal grounds for making decisions in courts, police stations, insurance companies, etc. and academic research is increasing.

In response to this, KMA issues Meteorological Data Certificates and provides meteorological data services for past weather data to be used in a variety of areas.

Meteorological data can be conveniently accessed online (Electronic Civil Service : <http://minwon.kma.go.kr>) and offline at local meteorological offices.



(KMA Electronic Civil Service homepage)



(List of weather data provided)



Life Weather Information (Life & Health Weather Indices)

The KMA has developed many weather indices that can help people every day using various weather data. It provides life weather information that can be used for everyday purposes and healthcare through the KMA's website and the Open API for public data.

Menu	Information	Available Period	Content
Life Weather Index	Ultraviolet Index	March-November	The index of ultraviolet radiation reaching the surface at times of maximum solar radiation.
	Food Poisoning Index	Throughout the year	The index indicates the probability of food poisoning according to different weather conditions.
	Discomfort Index	June-September	A combination of temperature and humidity indicates the degree of discomfort that people feel.
	Sensible Temperature	November-March	It is an indication of how people actually feel the temperature when they are exposed to the wind and cold outdoor.
	Water Pipe Freeze Probability Index	December-February	The index indicates the probability of water pipes and water gauge becoming frozen and bursting due to cold snaps during the winter.
	Air Pollution Dissipation Index	November-May	The index of the possibility of contaminants being changed(dispersed) by the atmospheric conditions.
	Heat Sensitivity Index	May - September	Developed based on the Heat Index (WBGT), this is a customized index that provides differentiated heat information according to the target and environment.
Health Weather Index	Flu Infection Index	September-April	The index indicates the probability of people getting the flu according to different weather conditions.
	Asthma & Lung Disease Probability Index	Throughout the year	The probability of asthma and lung disease is indexed according to different weather conditions.
	Stroke Probability Index	Throughout the year	The index indicates the probability of stroke according to different weather conditions.
	Skin disease potential index	Throughout the year	The index of occurrence of skin disease (dry dermatitis, athlete's foot and rash) according to weather conditions.
	Pollen Concentration Risk Index	April-May for Oak & Pine Trees September-October for Weeds	The index indicates the probability of allergies by predicting the concentration of pollen according to different weather conditions.

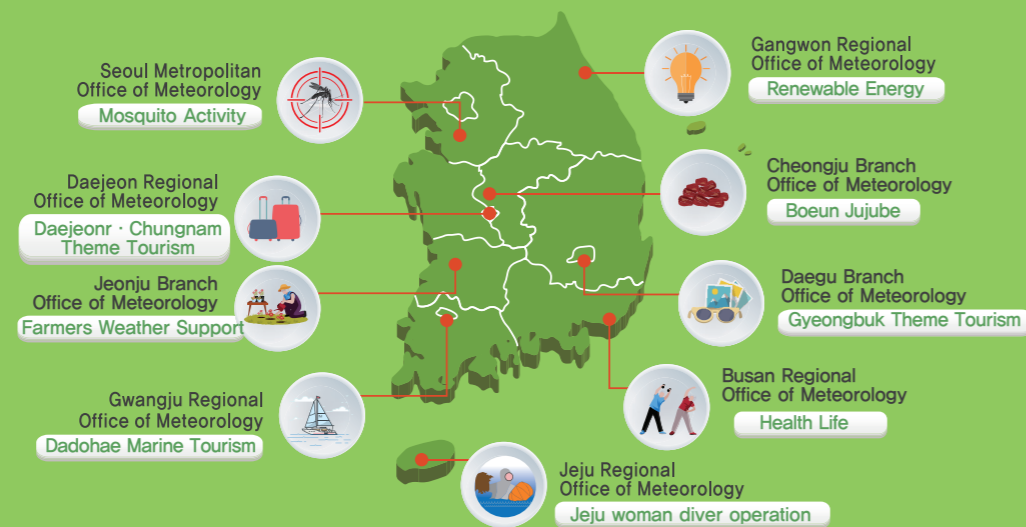
SERVICES

Where Do You Live?

Localized Services

Region-specific Weather Fusion Services

Regional Office of Meteorology and Branch Office of Meteorology provide regional specialized information as follows



Local Climate Service

You can receive information on climate change, which will impact each region differently, and customized climate information. Under the topic of Campaign for Expanding Understanding of Climate Change Science, there are a variety of climate change awareness activities and local participation programs held for college students across the country. The beneficiaries of this service can also have a better understanding of climate change through forums, workshops, and discussions with experts in local industries and research institutes.

Are You Interested in Social Issues?

Various Weather and Climate Services

Space Weather Forecast/Special Report System

Space weather refers to physical phenomena in outer space which can affect human activities in space and on earth.

The main causes of space weather are light and energy particles emitted from the Sun and space radiation. This can cause effects such as satellite operation disturbance, communication disturbance, power grid failure, cosmic radiation exposure, low reliability of ground observers, and climate change.

As the threat of cosmic disaster caused by sunspot explosions increases, KMA provided the legal basis for the implementation of space weather forecasts on September 30, 2011.

Since April 1, 2012, NMSC has been monitoring space weather conditions that could affect weather satellite operations, arctic flight operations etc. And we announce Special Weather Report for Space of 6 different levels of dangerous situations caused by space weather to public institutions and media organizations related to space weather.)

Also NMSC has serviced space weather forecasts at 16:00 everyday. You can find various information such as space weather reports, space weather forecasts, and overseas weather information trends on the NMSC website.

(<http://spaceweather.kma.go.kr>)

KMA Public Data Service

The Service works as a one-stop service channel of the various data that the KMA produces. It provides the data in a comprehensive way through the portal for the meteorological data at <http://data.kma.go.kr>. Along with the supply of the data, it also provides the meta-data, which contain sufficient comments on the data to enable the users to understand the data better. As the data are provided in the open standard format for easy and convenient use, the users can make use of the data in any software without conversion.

Are You a Foreign Visitor to Korea?

Multi-language Service

Multi-language Smart Weather Information Service

In the era of multi-culture and 10 million foreign tourists, the KMA provides meteorological information in English, Japanese, and Chinese through the mobile web. As a result of this service, eight out of ten foreign tourists in Korea now have access to weather information in their native language. Regardless of the types of the smartphones and tablets, they can get weather information and forecasts real-time by logging onto the mobile webpage (<http://m.kma.go.kr>) or reading the QR code.



KMA Website

- <http://www.kma.go.kr>
- <http://www.weather.go.kr>

Weather ON

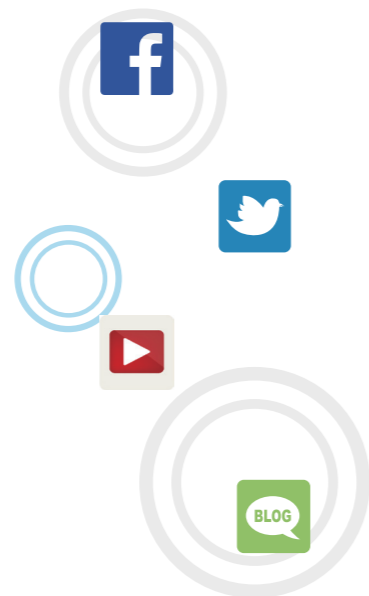
"Weather On" is an internet broadcast of weather forecasts and a variety of weather information. KMA weather forecasters provide you with weather briefing to help you easily understand weather.

- <http://www.weather.kr>



Social Networking Service (SNS)

- <https://www.facebook.com/kmaskylove>(Facebook)
- https://twitter.com/kma_skylove(Twitter)
- <https://www.youtube.com/user/KMA0365best>(YouTube)
- http://blog.naver.com/kma_131(Blog)
- http://twitter.com/kma_earthquake
(Earthquake Information Service)



KMA Mobile Web

Using KMA's mobile website on your smartphone, you can check out various weather information, such as special weather reports, current weather, digital forecasts, weather videos, and weather-related information for your daily life.

- <http://m.kma.go.kr>

Marine Weather Mobile Web

On your smartphone, you can use voice service of marine weather forecasts, satellite images, weather charts, and real-time marine observation data.

- <http://marine.kma.go.kr>

Open Weather Data Portal

You can access to various data and information produced by KMA and its interpretation on this Portal.

- <https://data.kma.go.kr>



Weather Reporting App

This app allows anyone to obtain weather and earthquake information wherever you are to share them with the public.

131 Weather Call Center

For more detailed weather and earthquake-related information, you can directly call 131 without an area code to contact the Weather Call Center.

Dial 131(without area code)





Korea Meteorological Administration

61, Yeouidaebang-ro 16-gil, Dongjak-gu, Seoul, 07062, Republic of Korea
(<http://www.kma.go.kr>) (<http://m.kma.go.kr>)

Call 131 for weather information

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