



“ Efficient services benefiting people and the environment are anchored in reliable observations and first-rate research.

At society's service around the clock



Antonin Halas

The weather and other natural events have a great impact on society – here in Finland, above all, on the smooth running and safety of all transport forms. With the unusually long period of cold weather last winter, whirling snow and snowdrifts posed challenges to both rail and road traffic. Sea traffic suffered from winds that pushed ice on the Gulf of Finland towards the Finnish coast and caused great pressures in the ice field. Later in spring, European air traffic came to a halt because of ash clouds dispersed into the atmosphere from an erupting volcano in Iceland.

Our high-tech, digitalised society is very sensitive to the weather. What makes the challenge even greater is the constantly increasing need to transport people and goods ever more quickly.

The 24/7 services of the Finnish Meteorological Institute support the work of the authorities, businesses and private individuals also when the

weather and nature pose challenges to us. For example, the ash cloud showed that, irrespective of the time of day, the Institute is able to respond quickly and to provide information for both the authorities and other bodies, including the media.

With climate change, the role of weather and climate services as a support to weather-sensitive society is emphasised on a global scale. The Finnish Meteorological Institute's expertise is also utilised internationally: FMI is playing an active role in several WMO programmes, and is offering its expertise to enhance the capabilities of the other NMHSs in all WMO Regions. This review of 2010 presents our projects in Africa and Croatia. In addition, the review highlights our services and other projects that we implement together with our cooperation partners.

Petteri Taalas

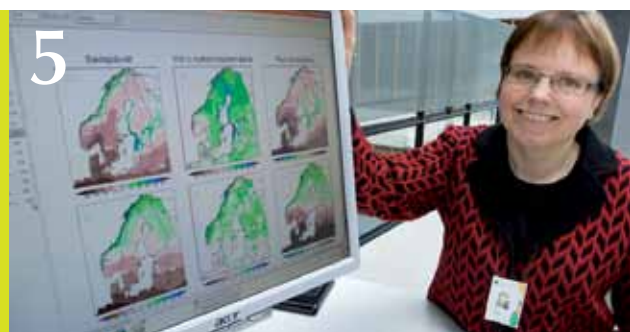
Director General

Finnish Meteorological Institute

2010

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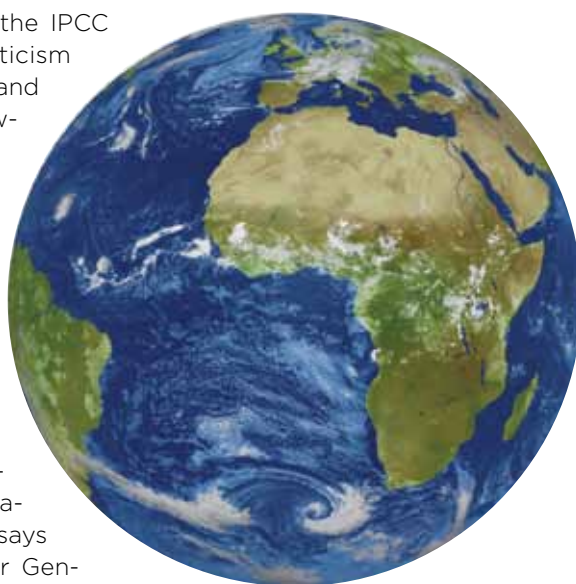
The IPCC

still a reliable information source on climate change

The reputation of the Intergovernmental Panel on Climate Change was put to the test when it was discovered that the climate reports compiled by the IPCC contained some errors concerning the impacts of climate change. However, these errors do not change the bottom line: scientific assessments of climate change.

Climate research and the IPCC were subject to criticism during autumn 2009 and early in 2010. Following the discovery of errors, climate sceptics have labelled climate research as mere politics and business.

“The errors that have entered the reports have been human slips that the IPCC’s otherwise thorough screening mechanism had not caught,” says **Petteri Taalas**, Director General of the Finnish Meteorological Institute, who chairs the Finnish IPCC working group. In his view, the errors do not undermine the value of the IPCC’s scientific work.



The estimated melting rate of the Himalayan glaciers, published in the Fourth Assessment Report, did not originate in a peer-reviewed scientific study. However, the error does not refute the conclusion that the Himalayan glaciers are receding. In the other case, the percentage of land that would be flooded by the sea in the Netherlands had been defined carelessly, as it also included land areas subject to river floods.

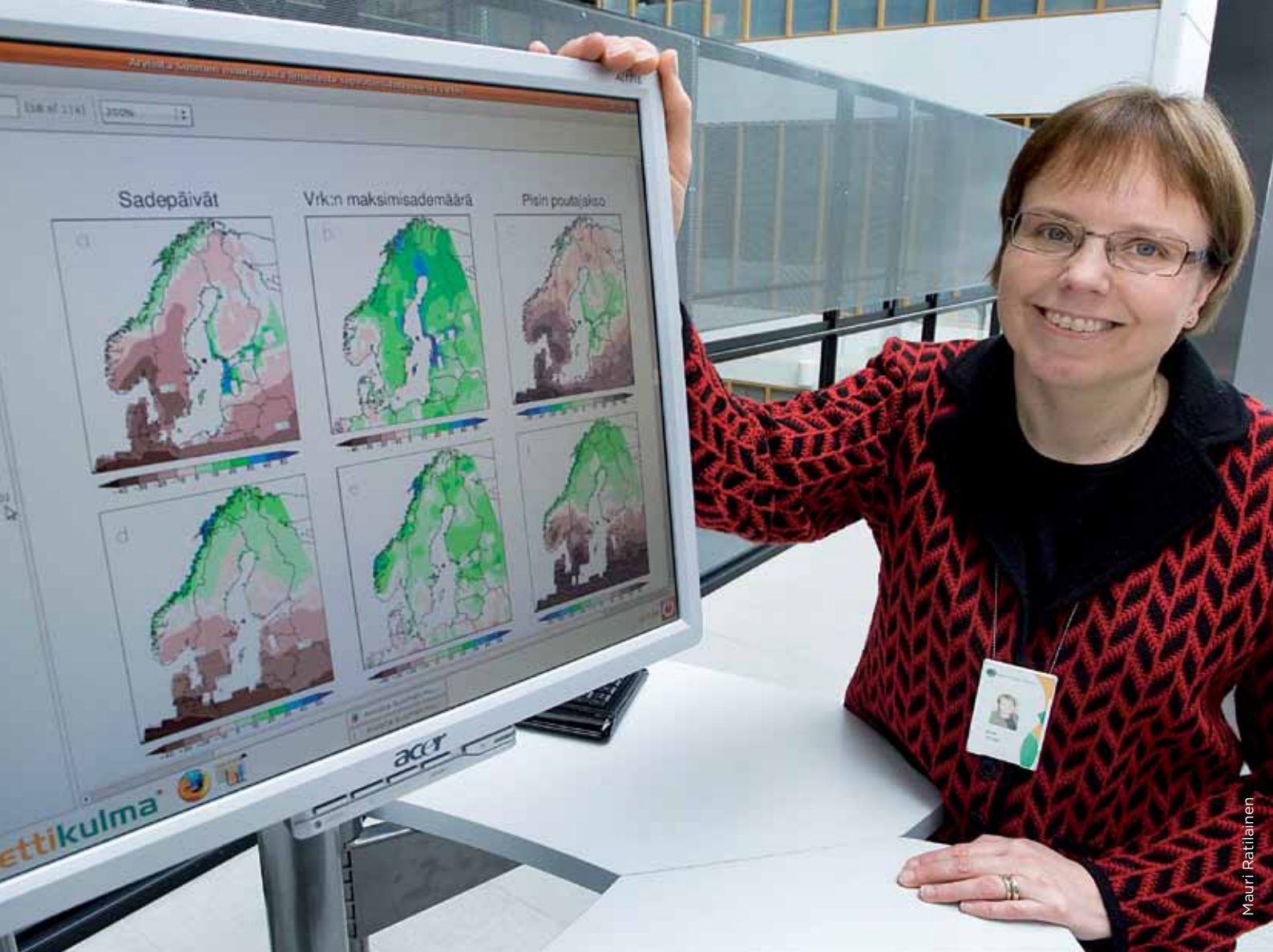
“Despite this, the IPCC reports are still the best source of information about climate change,” Taalas stresses and rebuffs suspicions that climate research would not be reliable. “To avoid further errors in its reports, the IPCC is developing its working methods.”

A seminar organised by the Finnish IPCC group in February pointed out that, according to the latest research findings, climate change is progressing even more rapidly than had been assumed. In other words, irrespective of the debate on the credibility of the IPCC, climate change is continuing. The temperature of the climate has already risen and, according to climate models, it will keep rising if carbon dioxide emissions continue.

At present, the IPCC is working on the Fifth Assessment Report, scheduled for publication in 2014. ■

The objective of the Intergovernmental Panel on Climate Change (IPCC) is to produce scientific basic data for national and international decision-making concerning climate policy. The IPCC itself does not conduct new research on the climate; instead, it analyses and compiles existing scientific data.

The InterAcademy Council (IAC), a multinational organisation of the world’s science academies, has been requested to conduct an independent review of the IPCC processes and procedures. The study comes at the invitation of the United Nations Secretary-General and the Chair of the IPCC, and will help guide the processes and procedures of the IPCC’s fifth report and future assessments of climate science.



Mauri Ratilainen

Research Scientist Kirsti Jylhä has studied the impact of climate change on the Finnish climate.

New information

about the impacts of climate change on Finland

The ACCLIM and ENSEMBLES research projects have produced new information about the impacts of climate change on the Finnish climate and on climate extremes, as well as estimates of the rate of climate change.

To provide for climate change in social and political decision-making, we need information on the past, present and future climate that is as reliable as possible.

“Aside from average values, information is needed about variations and extreme weather events and the associated prob-

abilities,” says Research Scientist **Kirsti Jylhä** of the Finnish Meteorological Institute. She leads the ACCLIM project that will continue until the end of 2010.

The project is also responsible for information service concerning the present and future climate that is needed for the Research

Programme on Adaptation to Climate Change (ISTO).

Probabilities considered better than before

“Based on probability distributions, the scenarios produced in these projects describe changes in the climate during the coming





During the projects, Research Scientist Hanna Tietäväinen has explored data on the climate in the past.

According to the results of the ACCLIM project, the average temperature in Finland will rise by 2–6 degrees Celsius by the end of the century. Winters will be 3–9 degrees and summers 1–5 degrees warmer.

decades if greenhouse gas emissions follow certain alternative trends,” says Research Scientist **Kimmo Ruosteenoja** of the Finnish Meteorological Institute.

To compile the scenarios, Ruosteenoja and **Jouni Räisänen**, Lecturer at the University of Helsinki, reviewed material produced by some 20 global climate mod-

” According to the project findings, limiting the average global warming to two degrees Celsius requires that net emissions of carbon dioxide be reduced to near zero by the end of this century.

els. For adaptation research, the results can be utilised in many different fields.

“How will changes in thermal growing seasons affect forestry? Will new cultivars be needed in agriculture? How will heavier rains and warmer winters affect floods?” Ruosteenoja asks, listing some examples.

Reducing emissions must start now

The ENSEMBLES project was one of the most extensive European climate research projects. In all, 66 research institutes from 20 European countries participated in this project, carried out in 2004–2009.

According to the project findings internationally, limiting the average global warming to two degrees Celsius requires that net emissions of carbon dioxide be reduced to near zero by the end of this century. Net emissions mean the difference between emissions and the amount of carbon dioxide absorbed from the atmosphere, for instance, by forests. ■

Greenhouse gas measurements launched in Siberia

The Finnish Meteorological Institute and Roshydromet have started to measure greenhouse gases and aerosols at a new measurement station in Northeast Siberia. The unique measurement data will help scientists to develop climate change forecasts and to gain a better view of the local and global impacts of climate change.

The concentrations of carbon dioxide, methane and fine particles, or aerosols, in the atmosphere are the factors that affect climate change the most.

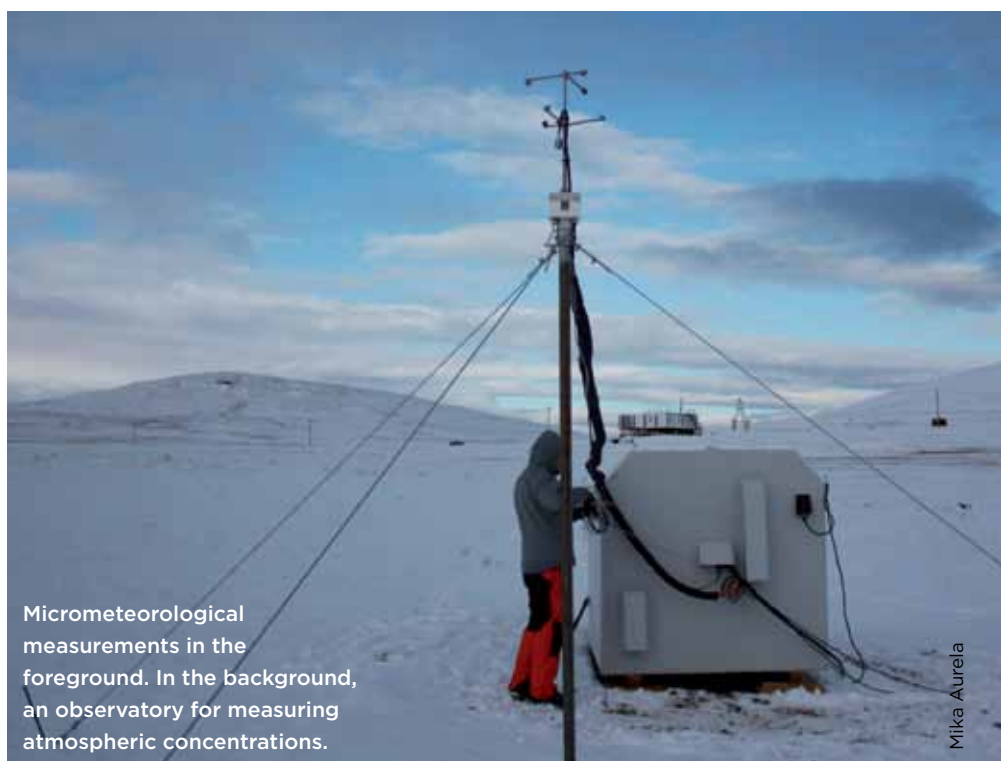
“No equally intensive observation of factors affecting the climate has been carried out in Russia before. As far as measurement data are concerned, Arctic areas in Russia have been almost unknown,” says **Tuomas Laurila**, who heads the Greenhouse Gases Group at the Finnish Meteorological Institute.

Siberia an interesting object for research

Observations of atmospheric concentrations make it possible to estimate emissions from the coldest regions in Siberia. The formation and development of aerosols and clouds can now also be studied in Arctic conditions. In addition, a separate measurement unit can measure methane and carbon dioxide emissions directly from the tundra surrounding the observatory.

The Tiksi observatory is located in an area where the impacts of climate change are already evident.

“One question intriguing scientists about climate change is whether the warming of large areas in Siberia will accelerate climate change further. The impacts and volumes of emissions from natural sources have so far been studied little.”



Micrometeorological measurements in the foreground. In the background, an observatory for measuring atmospheric concentrations.

Mika Aurela

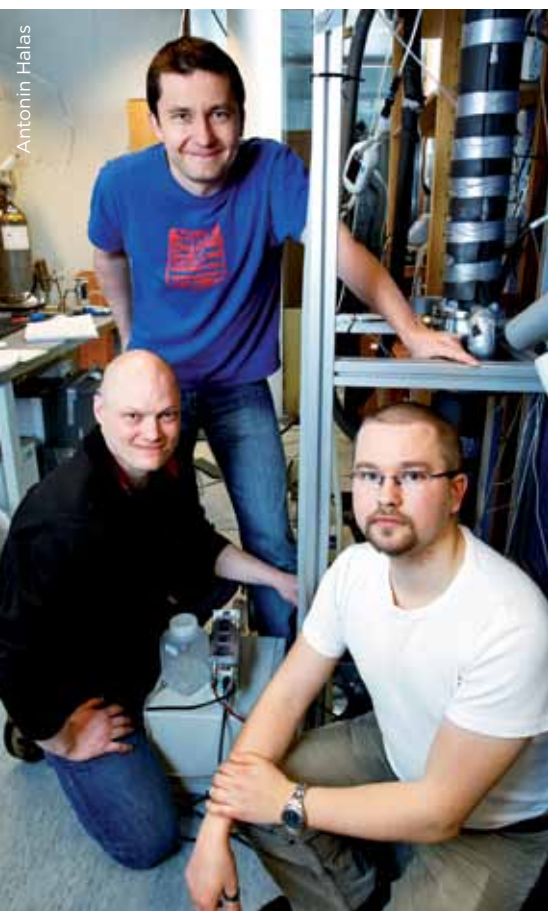
“The methane concentrations in the atmosphere have begun to rise, and it is suspected that the defrosting of Siberian bogs is one reason for this. In Arctic areas, permafrost acts as a kind of lid over methane stored deep underground. With warming, permafrost becomes thinner and methane can escape into the atmosphere. Apart from climate change, the melting of Siberian permafrost may have other dramatic consequences for the environment,” Laurila explains.

The station to join the international GAW network

The intention is to link the measurement station in Tiksi with the Global Atmosphere Watch (GAW) network. At present, the only GAW station on the Northern Eurasian continent is Pallas-Sodankylä, operated by the Finnish Meteorological Institute in Finnish Lapland. The Institute has supplied the necessary measurement equipment for the Tiksi station and will also train local operators how to use the equipment. ■

Formation of atmospheric fine particles: The sulphuric acid mystery solved

At present, the greatest uncertainty in climate change research and forecasts is associated with atmospheric fine particles and especially with the formation of aerosol particles. Scientists at the University of Helsinki, the Finnish Meteorological Institute, and Leibniz Institute for Tropospheric Research have established that the formation of fine particles in the atmosphere can be explained by means of sulphuric acid.



Heikki Lihavainen, David Brus and Antti Hyvärinen studying the development of atmospheric fine particles in a flow chamber.

“Effort has been made to solve this ‘sulphuric acid mystery’ – or the difference between laboratory tests and field measurements – in many ways. Now we have been able to show that the formation of atmospheric fine particles can be explained with sulphuric acid,” says **Heikki Lihavainen**, who heads the Aerosols and Climate Research Group of the Finnish Meteorological Institute.

Atmospheric mechanisms simulated in a flow chamber

The study was conducted by means of two flow chambers. The Meteorological Institute’s chamber has been subject to long-range development for several years.

“Decisive for the results is that the new, more advanced measuring instruments have allowed us to study very small particles, and the results have been verified in two separate flow chambers,” Heikki Lihavainen says.

The instruments have been able to measure both the number of newly formed particles and the variation in their number. This was not possible with the older instruments until the mass of the par-

ticles had grown tenfold or even more. In many older measurements, the growing time required with low sulphuric acid concentrations was too long to allow the observation of the real formation rate. Now the formation rates observed in the atmosphere could be repeated for the first time in laboratory conditions, using the sulphuric acid concentrations discovered in the atmosphere.


“This means in practice that we have been able to simulate atmospheric processes in laboratory conditions,” says **David Brus**, Senior Research Scientist at the Finnish Meteorological Institute.

Aerosols play an important role in climate change research

Aerosols affect the Earth’s radiation balance directly by reflecting and absorbing the Sun’s light and by acting as concentration nuclei for clouds. Contrary to greenhouse gases, atmospheric fine particles are assumed to have a cooling effect on the global climate. The research findings were published on 5 March in *Science*.

“Once again, the results are proof of the importance of national and international scientific cooperation in today’s world,” Heikki Lihavainen stresses. ■

One of the principal sources of fine particles in the atmosphere is gas-to-particle conversion. Sulphuric acid molecules play a role in the formation of particles, but in laboratory tests it has been impossible to prove the effect of sulphuric acid on particle formation.



Using a new Fourier spectrometer, Veikko Mylläri and Osmo Aulamo obtain measurement data on the amount of carbon dioxide in the atmosphere.

Measurements in Arctic areas concentrated in Sodankylä

The Arctic Research Centre of the Finnish Meteorological Institute uses various methods to make accurate measurements ranging from below the Earth's crust to the upper atmosphere. With the advancement of climate change, Arctic research and monitoring of the Northern environment are increasingly important.

The Arctic Research Centre of the Finnish Meteorological Institute serves as an observation and research station for various purposes. The site has already become the most important measurement site for Arctic continental areas. Unique information is produced not only about the impacts of various atmospheric strata but also about the impacts of vegetation, soil and snow, for instance, on carbon dioxide concentrations and on the carbon cycle. Reference material is produced by means of atmospheric sounding, research station measurements and ground-level observations. The measurement results are also used regularly to develop new remote sensing and modelling methods for monitoring

and predicting changes in the environment.

Ground-level and satellite measurements support each other

The Arctic Research Centre includes a Satellite Data Centre supporting several polar satellites. The research centre in Sodankylä, together with the measurement infrastructure in the Pallas area, is also a leading validation and research site for satellite material in the Arctic and Northern regions.

In practice, scientists working in Sodankylä help develop satellite instruments observing the Earth to improve their applicability, for instance, to climate change research. Accurate local measure-

ment data are needed so that the validity of remote sensing data obtained through various satellites can be verified in different climate conditions.

The latest investment in the Arctic Research Station's infrastructure is a Fourier spectrometer that can measure the amount of carbon dioxide in the atmosphere from the ground level upwards. There is now similar equipment at about ten locations worldwide.

Sodankylä a unique research site

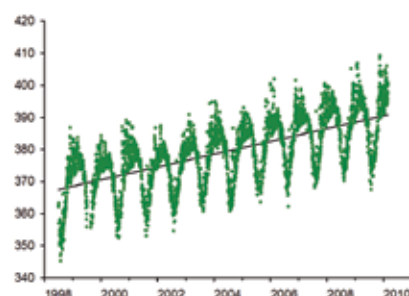
Sodankylä is the best equipped measurement and observation site in the Northern region. In that way it is unique in the whole world. "In view of the Northern Eurasian continental climate and ecosystem, Sodankylä is among the few possible research sites sufficiently far up in the north. The results obtained in Sodankylä do not apply only to Finland. The measurement data collected in the area are essential for the climate and atmospheric mechanisms of the whole world," **Jouni Pulliainen**, Director of the Arctic Research Centre, stresses. ■

Measurement results from Pallas highlight the importance of carbon sinks

The Finnish Meteorological Institute maintains a station for measuring greenhouse gases on the summit of Sammaltunturi mountain. Together with the Arctic Research Centre, it forms the Pallas-Sodankylä Global Atmosphere Watch (GAW) station monitoring the global atmosphere with high-quality satellite technology.



Carbon dioxide concentration (ppm)



Carbon dioxide concentrations at Pallas. The carbon sinks of forests reduce the concentrations during the growing season. The green dots indicate the daily mean values, while the line shows the concentration trend.

The concentrations of carbon dioxide, methane and aerosols, or fine particles, in the atmosphere are the factors that affect climate change the most. The measurement results obtained at Pallas are used to study changes in the concentrations of greenhouse gases. The other measurement points located around Sammaltunturi observe greenhouse gas fluxes, for instance, in forest and bog ecosystems. These measurements help reveal the sinks and sources of greenhouse gases.

Forests absorb less carbon

The increase in carbon dioxide concentrations is evident in the measurements conducted at Pallas

since 1996. The measurements also show the important role of carbon sinks.

“The growing season of the northern hemisphere is clearly visible in the measurement series. At Pallas, it can be seen that forests, in particular, absorb much carbon in summer. Even though the concentrations fall every summer, they reach ever higher values during the following autumn and winter,” says Head of Group **Tuomas Laurila**.

In particular, the Arctic region gives rise to concern because ecosystems cannot keep up fully with the pace of change when temperatures rise. According to research findings, the carbon sinks of ecosystems in seas and on land decline

when global warming advances. This increases the carbon dioxide content of the atmosphere even more, which in turn speeds up climate change.

By making accurate measurements of atmospheric concentrations, scientists in the GAW network try to determine the regional absorption of carbon. This helps identify the factors that affect the ability of ecosystems to absorb carbon. At present, the Pallas-Sodankylä station is the only GAW station in the Northern Eurasian continental area. The Finnish Meteorological Institute also participates in a project to build a corresponding research and observation station near Tiksi in Siberia. ■

New warnings taken into use at the Finnish Meteorological Institute

In May 2009, the Meteorological Institute took new warnings into use. These warnings for for thunderstorm wind gusts, high winds and heavy rains increase safety by making it easier to prepare for hazardous weather.

The new warnings apply to to thunderstorm wind gusts, strong winds, winds caused by severe low pressures in land areas, and rains.

“The warnings are divided into three awareness levels. This makes it easier both to assess the risks involved in weather phenomena and to prepare for hazardous situations. The change introduced in May was the first part of a more extensive revision of the Meteorological Institute’s warning system,” Meteorologist **Ari-Juhani Punkka** explains.

Two different rain warning types into use

As a completely new warning type, the Meteorological Institute has adopted rain warnings, which may be given for short-term downpours of the thunderstorm type or for longer-term heavy rains. For rains of the thunderstorm type, three warning limits are used for precipitation: 20, 30 or 45 millimetres per hour. For longer-term rain, the warning limits are 50, 70 or 120 millimetres per 24 hours.

More precise warnings for thunderstorms and for wind in land areas and inland waters

“A three-grade system of warnings for severe thunderstorm wind gusts has been in use since May in all land areas, irrespective of whether the gusts appear on land or over water areas. Previously we

used to have only one awareness level and the warning was given separately for inland waters or land areas,” Ari-Juhani Punkka says.

On the warning map, the new warnings for thunderstorm wind gusts are marked with a yellow, orange or red lightning. This means that the thunderstorms are accompanied by wind at speeds of 15, 25 or 30 metres per second. Between June and August 2009, severe thunderstorm warnings were given on 24 days. On two of them, the risk level was orange.

Wind warnings for land areas used to cover both both thunder-

storm wind gusts and high winds associated with low pressures. After the change, the warning obtained a clearer role because now the wind warning for land areas only applies to extensive low-pressure winds. Three awareness levels and colour codes were also introduced in wind warnings for land areas. In addition, the warning limits were no longer determined by average wind speeds but by wind speeds during gusts. The warning limits are 20, 25 and 30 metres per second. Most of the warnings are given during winter when low pressures are strongest. ■



The Finnish Meteorological Institute’s first official rain warning, which warned that heavy rains, over 20 mm per hour, would be possible in Uusimaa and Eastern Uusimaa. The radar image shows the situation at 9:15 p.m., when the rain had already reached the southern coast.

More accurate precipitation forecasts with dual-polarisation radars

The first new dual-polarisation radars manufactured by Vaisala Corporation have been taken into use in Kaivoksela, Vantaa and in Kaipainen, Kouvola. Among other things, the new technology helps improve traffic safety because precipitation forecasts will be more accurate.



Antonin Halas

The Finnish Meteorological Institute has begun to modernise its weather radar network. The first radar replaced was the oldest radar located in Kaivoksela, Vantaa. The new radars supplied by Vaisala Corporation of Finland apply the dual polarisation technology.

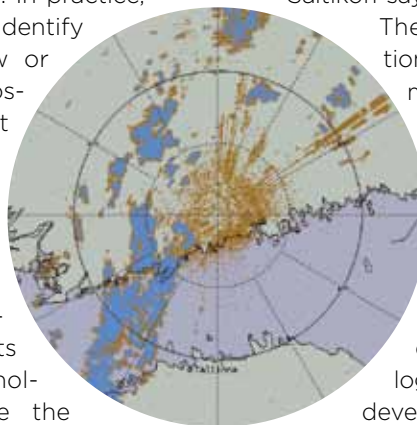
“The main technological improvement of the new radars is that they can show precipitation type more accurately than before. A dual polarisation radar sends signals at two polarisations. Combining the signals gives information of e.g. the shape of objects moving in the air. In practice, we are able to identify water, hail, snow or sleet in the atmosphere with great precision,” Senior Research Scientist **Elena Saltikoff** explains.

The Meteorological Institute also expects the new technology to improve the quality of the present measurement data because it enables increasingly accurate differentiation between precipitation echoes and other echoes on radar images. Aside from snow flakes and water droplets, echoes are

caused, for instance, by birds and insects. The additional information also makes it possible to predict the extent and intensity of precipitation in greater detail.

New technology improves safety

“Weather radars are vital for the functioning of today’s society. It is important for safety that our information about precipitation is as accurate as possible. The weather radar is an essential observation instrument when predicting quickly changing weather events,” Saltikoff says.



Radar echoes classified according to dual polarisation properties. The blue echoes are rain, the brown represent something other than rain.

The new polarisation radars give much more detailed information about precipitation and its various physical states, for instance, for road and air traffic. To utilise the radar data, the Meteorological Institute is also developing new products and services in research and development projects.

At present, the Meteorological Institute has a network of eight radars that cover almost the whole of Finland. The coverage is among the best in the world. ■



A new supercomputer enables weather forecasts on a more detailed scale

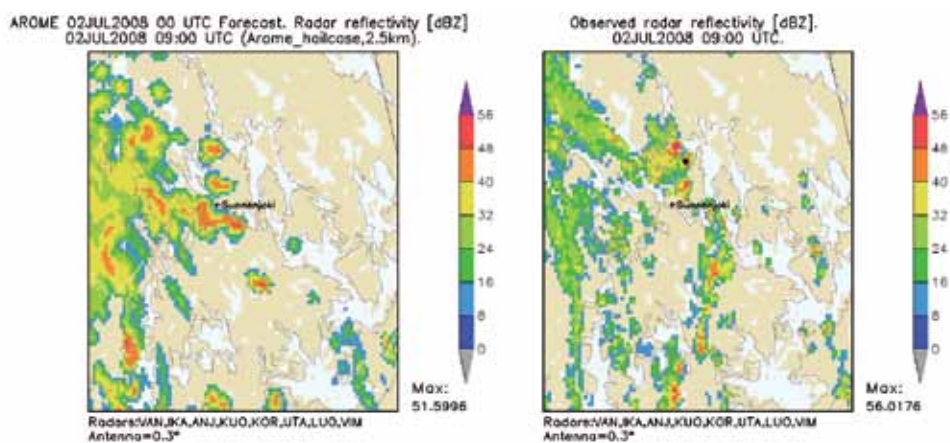
The Finnish Meteorological Institute is renewing its high-performance computing environment for weather forecasts and scientific computing. The new supercomputer solution is planned and supplied by CSC – IT Centre for Science.

The new supercomputer ensures the Meteorological Institute's production of weather forecasts and supports the Institute's research.

Computer capacity a prerequisite for further development of forecasts

Powerful supercomputers play an important role in the development of weather and climate forecasts. "Thanks to greater computing power, it will be possible to draw up 48-hour forecasts with a resolution of 7.5 kilometres for the whole of Europe, instead of the present resolution of 16.5 kilometres. In particular, the new capacity can be utilised in the high-resolution AROME model, which is computationally considerably more demanding. In particular, AROME improves the forecasts of severe weather events, such as torrential rains and thunderstorms," says Research Scientist **Sami Niemelä**.

Thanks to the more powerful equipment, the high-resolution model can be put into operation. With increasingly effective development, the model can be made



A hailstorm hit Suonenjoki on 2 July 2008. On the left is a forecast given by the high-resolution model, on the right a radar image of the situation. The model is able to describe individual intense rain cells very much like radar observations do.

into a system that is able to produce weather forecasts with the accuracy of a city district.

Apart from weather forecasts, the Finnish Meteorological Institute uses the supercomputer for studying global climate change and for computing the dispersion of radioactive and other dangerous materials. The concept also offers better opportunities for the Institute's other research projects that need computing power.

"Compared against the Institute's current capacity, the capacity of the new equipment is about 20 times greater. The peak performance of the equipment to be acquired for the Institute is over 34,000 billion calculations per second (34.6 Tflops). If needed, additional capacity is also available from CSC," says **Kimmo Aaltonen**, Head of ICT Management Services. ■

The year 2009

and the whole decade warmer than average in Finland

The past decade 2000–2009 was clearly warmer than previous decades in all of Finland. The year 2009 was also warmer than average in the whole country.



“Temperatures in 2009 did not reach the same records as in 2008. In Southern and Central Finland, the year was among the 15th to 20th warmest in history, and in the north among the 10th to 15th warmest. However, the year was still warmer than average throughout the country,” Meteorologist **Niina Niinimäki** sums up.

The annual mean temperature for 2009 was 3...7°C in Southern and Central Finland, 0...3°C in the Province of Oulu, and -1...+2°C in Lapland. In other words, the mean temperature in Southern and Cen-

tral Finland and in the Province of Oulu was about one degree and in Lapland 1...1.5 degrees higher than it usually is.

Mild winter and spring

Because December and January were mild, the winter 2008–2009 turned out to be warmer than usually. The number of winter days, or days when the mean daily temperature was under 0°C, was normal in the whole country. The lowest temperature for the year, -37.6°C, was measured in Sevettijärvi, Inari on 7 February.

Spring, too, was warmer than average throughout the country; in some places it was also drier than average. In some locations in Eastern Finland, precipitation in March–May was less than half of the normal amount. On the other hand, in Lapland and Western Finland, precipitation in spring was near average.

Varying weather later in the year

Summer started cooler than average; the weather in early June in Southern and Central Finland was unusually chilly. June ended with hot weather, whereas early July was again cooler than average, with even severe night frosts. However, the warm weather in August offset the cool early summer so that, on the whole, the summer was slightly warmer than average in almost all of Finland. The number of hot days (tem-

perature reaching at least 25.1°C) was more or less normal for Finnish summers. The highest temperature for the summer, 29.6°C, was measured in Jämsä on 28 June.

Autumn weather varied over a wide range. In some places, September was even unusually warm, while October was colder than average. In November, the weather again turned unseasonably mild, and on the whole the autumn was warmer than average in all of Finland. Colder weather set in again in December, and with the exception of Lapland, the beginning of winter 2009–2010 was colder than average.

Less rain and fewer storms than usual

Precipitation in 2009 was slightly less than average in almost all of Finland. In most parts of the country, precipitation came to 500–650 mm, while in some areas of Central and Western Finland and in Northern Lapland, the figure was 400–500 mm. In relation to long-term averages, precipitation was the lowest in Central Finland and in some areas of the southwest, where the annual precipitation amounted to 70–80 per cent of the usual volumes. The number of stormy days was clearly below the average. Storm was measured only on 11 days in 2009, while the usual number is 23. The number of stormy days had not been this low since 2002. ■



The latest delivery of supplies and fuel to Aboa was quite exceptional. Parachutes were used to drop almost 35,000 kilograms of fuel and other cargo onto the glacier near the station.

FINNARP maintains the Finnish research station in the Antarctic

Operating in connection with the Finnish Meteorological Institute, FINNARP manages the logistics for Finland's Antarctic research. The group is responsible for the arrangement of expeditions to the Antarctic and for tasks associated with the maintenance of Research Station Aboa.

FINNARP Logistics is a safety and service organisation whose clientele includes all Finnish universities and research institutes conducting research in the Antarctic. FINNARP maintains the Finnish research station Aboa and manages the planning and practical arrangements for field work carried out there. Expeditions are made every year for a couple of months between November and February.

A challenging task to maintain Aboa

Maintaining the Finnish research station in the Antarctic is a real

challenge. "For instance, the latest delivery of supplies and fuel to Aboa was quite exceptional. Almost 35,000 kilograms of fuel and other cargo was dropped onto the glacier next to the station by means of parachutes," says Development Manager **Mika Kalakoski**.

"Compared to traditional shipments by sea, parachuting is a cost-effective and safe method for delivering cargo. The operation ensured that the Aboa station has enough fuel for the next three expeditions," Kalakoski points out.

The Finnish Meteorological Institute active in the Antarctic

Finland built Research Station Aboa in 1988; it has since been renovated and expanded. Aboa provides living and working quarters for expeditions of 12 people. Diverse studies on ice and the atmosphere are conducted at the station.

Finland's Antarctic coordination group determines what type of research corresponds to Finland's Antarctic strategy. The Meteorological Institute has conducted aerosol, UV and ozone measurements and has explored meteorology and climate change in the Antarctic. "The Antarctic is like nature's own laboratory. Research findings obtained here tell us about the state of the environment in the whole world," Kalakoski sums up. ■



The Finnish Meteorological Institute helps Croatia to conduct air quality monitoring meeting today's needs.

Air quality expertise from Finland to Croatia

Through a Twinning project, the Finnish Meteorological Institute has helped Croatia develop a modern system for the monitoring and management of air quality.

The goal of the Twinning project was to make Croatia's air quality systems more compatible with the requirements of EU Directives.

"During the project, 12 observation stations were provided with new equipment. It was also ensured that the country has the necessary know-how for the operation, service and maintenance of this equipment. Moreover, air quality laboratories and information management have been modernised to meet today's needs," Project Manager **Harri Pietarila** explains. He adds that the ultimate goal of this development of air quality monitoring and management systems is to

improve air quality in the beneficiary country.

Another objective is to provide Croatians with information and real-time measurement results on air quality in their country. "Like in Finland, air quality data produced by various measurement stations will be collected into a web-based service," Pietarila continues.

In this Twinning project financed by the EU, Finnish experts have trained the personnel of the Meteorological and Hydrological Service of Croatia.

"We have shared Finnish air quality know-how with Croatia by means of practical-oriented training. In the air chemis-

try laboratory, we have already made great progress in analysis methodology and quality assurance training and in the development of a storage system for the results of analyses," says Senior Researcher **Vuokko Karlsson**, the resident Twinning advisor in Croatia. Besides her, about twenty experts from the Finnish Meteorological Institute have worked in the project for shorter periods of time.

The development project came to a close early in 2010. The Finnish Meteorological Institute carried out a similar modernisation project in the Former Yugoslav Republic of Macedonia in 2006. ■

Cooperation

with meteorological institutes in Southern Africa

According to predictions, the impacts of climate change will be felt most keenly in Sub-Saharan Africa. The Finnish Meteorological Institute exports know-how to this region.

Finland and the Southern African Development Community (SADC) have signed an agreement on the launching of regional cooperation in meteorology. A community formed by a number of Southern African countries, the SADC works towards economic integration and development.

Climate change to have major impacts in Africa

The availability of weather and climate data necessary for the functioning of society is still a great problem in many developing countries. The importance of such data increases constantly because predictions indicate that the consequences of climate change will hit Sub-Saharan Africa the hardest. For instance, climate change is expected to increase extreme weather events having serious impacts, especially in African countries where people's livelihood depends almost exclusively on agriculture and other sectors sensitive to the effects of climate change.

"For this reason, there is a great need to improve the operating conditions for meteorology and to develop more efficient early warning systems," says **Ari Venäläinen**, who manages the project in Pretoria.

Cooperation to benefit Southern Africa

The Finnish Meteorological Institute, together with the Meteorological Association of Southern

Africa (MASA), is responsible for the practical implementation of the one-year preparatory phase. The preparatory phase is carried out by the Finnish Meteorological Institute in 2009–2010, and its budget is EUR 800,000. Cooperation is conducted with 14 Southern African countries. The northernmost country is the Democratic Republic of Congo and the southernmost the Republic of South Africa.

"The goal of the preparatory phase is to plan the project proper and to provide the necessary training. We are now investigating the capacities and needs of

the host countries and regional organisations and the activities of other donors in the region. The objective is to start the project proper immediately once the preparatory phase is completed," Ari Venäläinen explains. ■

Working in Pretoria, South Africa, Project Manager Ari Venäläinen (right), Regional Expert Maurice Muchinda and Project Secretary Lindelwa Ntlangula are responsible for practical implementation during the project's preparatory phase.



Prince Mlongwana



Heikki Järvinen

to chair the ECMWF Scientific Advisory Committee

Research Professor Heikki Järvinen of the Finnish Meteorological Institute has been elected Chair of the Scientific Advisory Committee of the European Centre for Medium-Range Weather Forecasts (ECMWF).

Finland has been a member of the ECMWF since its establishment in 1975. The Finnish Meteorological Institute utilises the Centre's numerical weather forecasts widely in its own forecasting. Most of the Institute's forecasts extending over 48 hours are based on computer models calculated by the ECMWF.

The Committee reviews the scientific work and research plans of the ECMWF from the perspective of the Centre's focal points and strategy. The Committee supports decision-making by the Council, composed of representatives of the Centre's Member States. In their position of trust, the 12 members of the Committee represent their own scientific discipline and specialised competence, not the Centre's Member States.

The ECMWF is an independent international organisation that develops and produces medium-range (up to ten days) numerical weather forecasts. The forecasts are available to the Member States. The Centre also engages in scientific research, develops models, and collects and saves meteorological materials. ■

The Wind Atlas

produces accurate information about Finland's winds

The Finnish Wind Atlas, launched in November 2009, is an Internet-based map interface containing information about wind conditions in Finland. The map interface makes it possible to determine local wind conditions for the whole of Finland.

Based on numerical weather models, the Wind Atlas project has charted the Finnish wind conditions on land and at sea. "According to the models, the best wind conditions are found in the Sea of Åland and the Gulf of Finland, and on the mountains of Lapland. There are also windy areas inland, especially by large lakes, when the altitude exceeds 100 metres. Finland's wind conditions are not optimal for wind power plants, but still reasonably good when compared to those in many other countries," Development Manager **Bengt Tammelin** says.

The Wind Atlas is based on a representative sample of Finn-

ish wind conditions over the past 20 years. Wind conditions, such as wind speed, direction and turbulence up to the altitude of 400 metres, have been described with maximum accuracy. The results are presented as annual and monthly averages on a grid of squares measuring 2.5x2.5 square kilometres over the whole country. In addition, a resolution of 250x250 square meters has been used on the coast and in selected inland areas. Through the map interface, wind data can be examined together with information on individual localities and other geographical variables.

The map interface is supplemented with extensive information material on wind, wind properties and wind power. The material also includes a review of the impacts of climate change on wind conditions in Finland. The Wind Atlas project was implemented by the Finnish Meteorological Institute and funded by the Ministry of Employment and the Economy. The work was coordinated by Motiva Oy. The website has been published in Finnish (www.tuuliatlas.fi), Swedish (www.vindatlas.fi) and English (www.windatlas.fi). ■



VISION

The Finnish Meteorological Institute – cutting-edge expertise in European atmospheric and marine know-how.

Mission statement

The Finnish Meteorological Institute produces high-quality observational data and research findings on the atmosphere and seas. The Institute uses its expertise to provide services that promote public safety and enhance well-being among people and in the environment.

The Finnish Meteorological Institute

- observes the physical state, chemical composition and electromagnetic phenomena of the atmosphere
- observes the physical state of the Baltic Sea and the Arctic sea area
- produces information and services about the past, present and future states of the atmosphere and seas
- conducts high-standard research in the fields of meteorology, marine sciences, air quality, space physics and earth observation
- carries out competitive commercial activities, based on expert services, both in Finland and abroad
- takes an active part in national and international cooperation
- actively disseminates information about matters associated with the atmosphere, seas and near space
- foresees changes and responds quickly to changes in the environment and to changing expectations.

The Advisory Board of the Finnish Meteorological Institute, 15 January 2009–14 January 2012

- Chair: Paula Kankaanpää, Director, Arctic Centre
- Vice Chair: Pekka Plathan, Director-General, Ministry of Transport and Communications

Other members:

- Eeva Furman, Research Manager, Finnish Environment Institute
- Kjell Forsén, President & CEO, Vaisala
- Sirkka Haunia, Principal Negotiator, Ministry of the Environment
- Raimo Heino, Graphic Designer, Finnish Meteorological Institute (personnel representative)
- Kai Kaatra, Head of Unit, Water Resources Management, Ministry of Agriculture and Forestry
- Sakari Karjalainen, Director General, Ministry of Education
- Ritva Koukku-Ronde, Director General, Ministry for Foreign Affairs
- Markku Kulmala, Academy Professor, University of Helsinki
- Seija Paasonen, Senior Meteorologist, Finnish Broadcasting Company

- Petteri Taalas, Director General, Finnish Meteorological Institute
- Kari Takananen, Commodore, Defence Command, Finnish Defence Forces

Management Group of the Finnish Meteorological Institute 1.1.2010–31.12.2010

- Petteri Taalas, Director General
- Yrjö Viisanen, Director, Research and Development
- Juhani Damski, Director, Weather and Safety
- Marko Viljanen, Director, Administration
- Keijo Leminen, Head of Unit, Observation Services
- Ari Laaksonen, Head of Unit, Climate Change
- Markku Seppänen, Personnel representative
- Eeva-Kaisa Heikura, Communications Manager
- Joanna Saarinen, Management Group Secretary

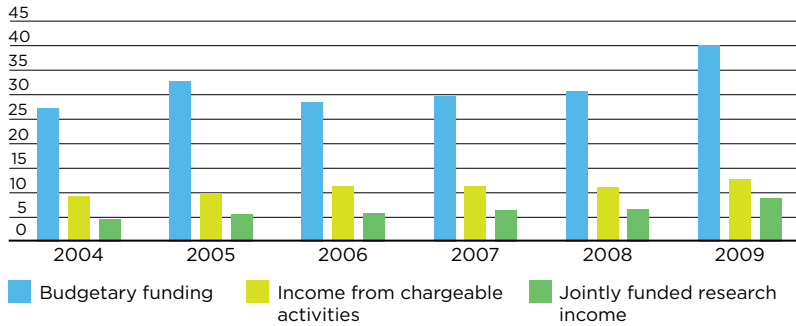
VALUES
Expertise
Courage
Fair play

DIRECTOR GENERAL AND DIRECTOR GENERAL'S OFFICE

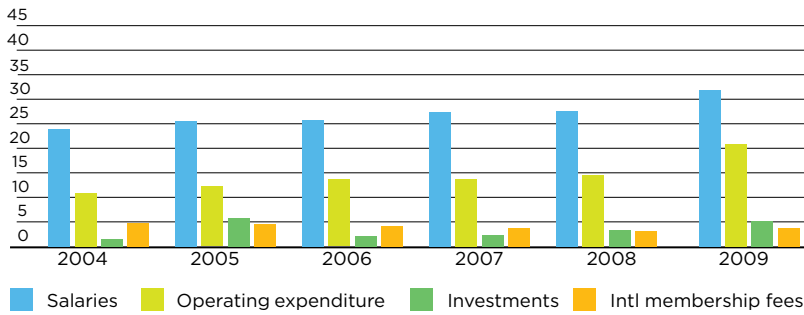
WEATHER AND SAFETY	RESEARCH AND DEVELOPMENT
Weather and Safety Centre	Climate Change
Commercial Services	Air Quality
Development of Services	Meteorology
ICT Management Services	Marine Research
Observation Services	Earth Observation
	Arctic Research
	Kuopio Unit
	Consulting Services
ADMINISTRATION	

Finances

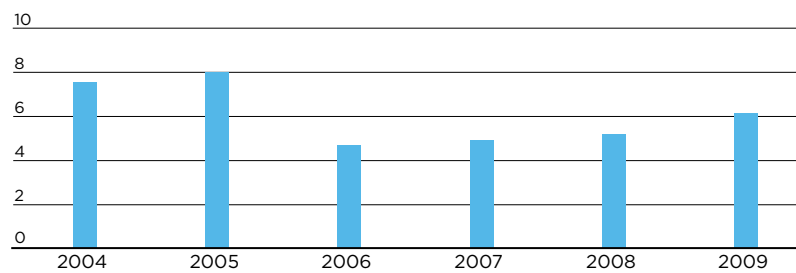
Funding Trends 2004-2009 (€ million)



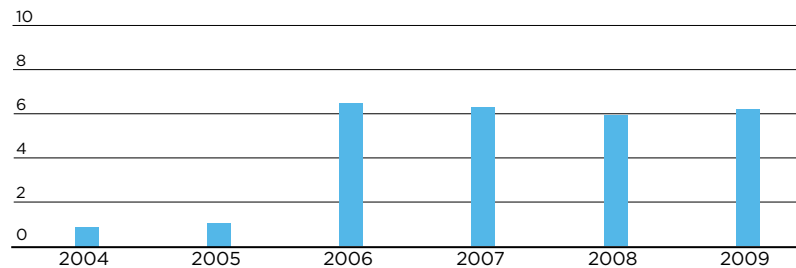
Expenditure Trends 2004-2009 (€ million)



Income Trends of Commercial Activities (€ million)



Income Trends of Activities under Public Law (€ million)



Funding 2009

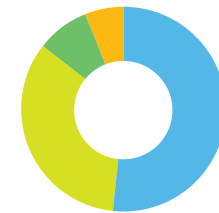
Total 61.7 € million



Budgetary funding	40.0
Income from chargeable activities	12.7
Joint research income	9.0

Expenditure 2009

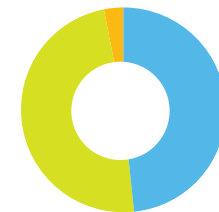
Total 61.7 € million



Salaries	31.9
Operating expenditure	20.9
Investments	5.1
Intl membership fees	3.7

Income from Chargeable Activities

Total 12.7 € million



Income from commercial activities	6.2
Income from activities under public law	6.2
Other income	0.4

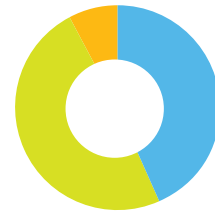
Personnel

Job Satisfaction 2009



2009 2008 2007 2006 2005

Person Years (637)



Weather and Safety	277
Research and Development	312
Administration and Director General's Office	48

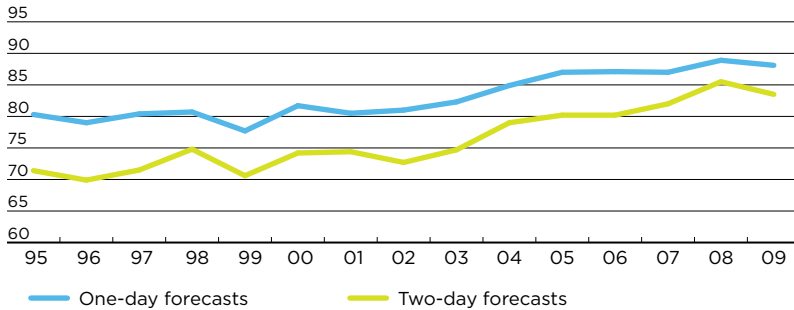
Breakdown of the Personnel's Education %



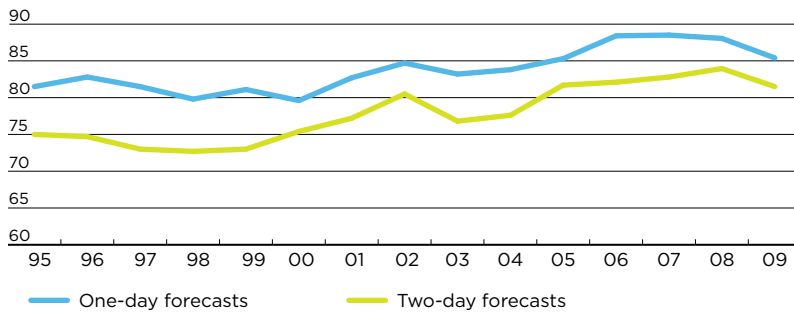
General Education	7,9
Secondary Level	28,1
Lowest Post-Secondary	6,1
Lowest Tertiary	8,8
Higher Tertiary	31,9
Doctoral and Licentiate's Degree	17,5

Result Indicators

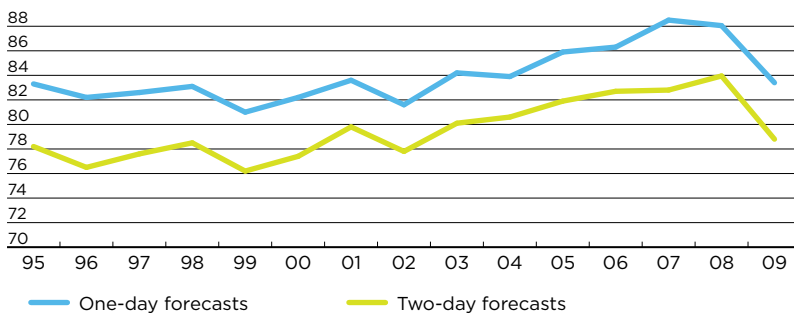
Accuracy of temperature forecasts



Accuracy of rainfall forecasts



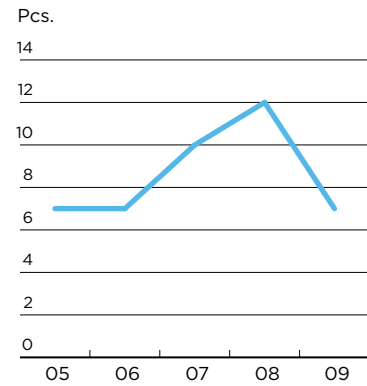
Warnings for high wind



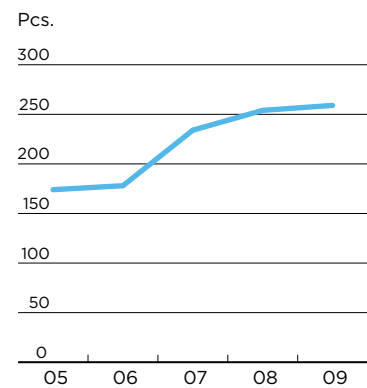
Availability of systems

	2009	2008	2007	2006	2005
Satellite systems (mean), %	98.8	98.6	98.5	98.1	98.3
Radar systems (mean), %	98.4	98.5	98.2	99.3	99.3
Information systems (mean), %	99.9	99.9	99.8	99.6	99.9

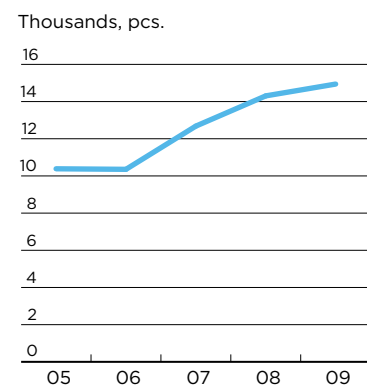
Doctoral dissertations



Publications subject to international peer review



Scientific publishing index





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