



# ANNUAL REPORT 2006

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## Information about the atmosphere to promote people's safety

The Finnish Meteorological Institute's principal task is to produce information about the weather for various actors in society, such as operators of air, road, sea and rail traffic, the Defence Forces, businesses and private individuals. As experts on the atmosphere, we also provide information about phenomena such as air quality and climate change for use by decision-makers. Atmospheric models are used to calculate and predict the drifting of oil spills or the dispersion of air pollution.

Climate change was a particularly widely discussed topic in Finland in 2006. Exceptional weather conditions gave humankind examples of how the climate may look and feel in the future. Without substantial restrictions in greenhouse gas emissions, mild, snowless winters won't be an exception in Finland, either.

According to a study published in January 2007, most Finns believe that climate change is a real phenomenon caused by human activity. People are also ready to prevent undesirable effects and expect decision-makers and businesses to take measures to improve the situation. The survey also revealed that people trust the Finnish Meteorological Institute's information and expertise in climate change issues.

The international researcher community agrees on climate change and on people's role in it. This was also indicated by the Fourth Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC) in February 2007. However, there are still many phenomena whose impact on climate change is not known: fine particles, cloudiness, possible thaw-



ing of the Siberian permafrost, and so on.

For Finland to be able to adapt to climate change and to abate it, we need Finnish research and modelling skills. For adaptation, it is vital to know, for example, how many degrees the global mean temperature will rise if the concentration of carbon dioxide in the atmosphere doubles.

The worst scenarios of climate change can still be avoided and adaptation is possible through cooperation between research institutes, universities, industry and decision-makers. The returns gained by investing in Finnish research are far greater than the sums spent.

International calculations show that investments in meteorological institutes yield social benefits that are seven times greater than the original investments. Within a project called EVASERVE, the Finnish Meteorological Institute and VTT Technical Research Centre of

Finland are currently developing a method for measuring this effectiveness.

The Finnish Meteorological Institute is responding to the challenges posed by the Central Government Productivity Programme. We have already taken measures to improve our productivity: the level of automation has been raised constantly and procedures have been revised; we have systematically met the performance targets set for us. We are ready to pull our weight.

The Finnish Meteorological Institute wants to be a forerunner in European atmospheric expertise. Relying on the high professional skills of its personnel, and together with its cooperation partners, the Institute increases people's safety in their environment.

**Pekka Plathan**  
Director General

# The Finnish Meteorological Institute builds awareness of climate change

AS AN EXPERT ON THE ATMOSPHERE, THE FINNISH METEOROLOGICAL INSTITUTE IS RESPONSIBLE FOR PROVIDING SOCIETY WITH INFORMATION ON CLIMATE VARIABILITY AND CHANGE. BESIDES CONDUCTING RESEARCH ASSOCIATED WITH CLIMATE CHANGE, IN 2006 THE INSTITUTE WAS INCREASINGLY ACTIVE IN DISSEMINATING INFORMATION ABOUT CLIMATE CHANGE.

## Information about the climate for decision-making

The climate system is changing, and climatic risk factors cause increasing problems for various activities in society. These problems can be mitigated if climate information is taken into account efficiently when decisions are made within society and industry. This was the idea underlying the WMO Conference “Living with Climate Variability and Change: Understanding the Uncertainties and Managing the Risks”, held in Espoo in July 2006.

About 250 experts and decision-makers from 60 countries met to discuss how best to support decision-makers who have to solve issues pertaining to climate variability and change in various sectors of society.

“Agriculture and food safety, water supply, health and disease control, and energy generation are sectors that are particularly sensitive to climatic factors,” lists Senior Meteorologist Jaakko Helminen, who was the conference coordinator.

The final document of the conference indicated that climate information could be utilised much more efficiently than before.

“The best way to achieve this would be to pay more attention to the special needs of various sectors of society in the management of risks associated with the weather and the climate. In addition, we should select meteorological and other methods and materials that are the best suited to decision-making in each sector and put them



About 250 experts and decision-makers from 60 countries attended the conference “Living with Climate Variability and Change” held in Finland.

to use globally. Likewise, we should utilise the expertise of institutes and persons who master the subject well. This would require more efficient networking among experts and decision-makers in various sectors,” says Jaakko Helminen, summing up the statement drawn up at the conference.

“The conference reminded us that when people need certain information for risk management, the availability of this information must be ensured. Research, tools and procedures associated with the subject must also be promoted,” Jaakko Helminen lists.

The conference presented a unanimous request that its recommendations be considered by UN organisations and by other organisations, decision-makers and industry at national, regional and international levels.

The conference was part of the World Meteorological Organization’s activities concentrating on the needs of society for handling climate issues at all levels. Hosted by Finland, the conference was arranged by the Finnish Meteorological Institute, the WMO and the International Research Institute for Climate and Society (IRI) working in conjunction with Columbia University.

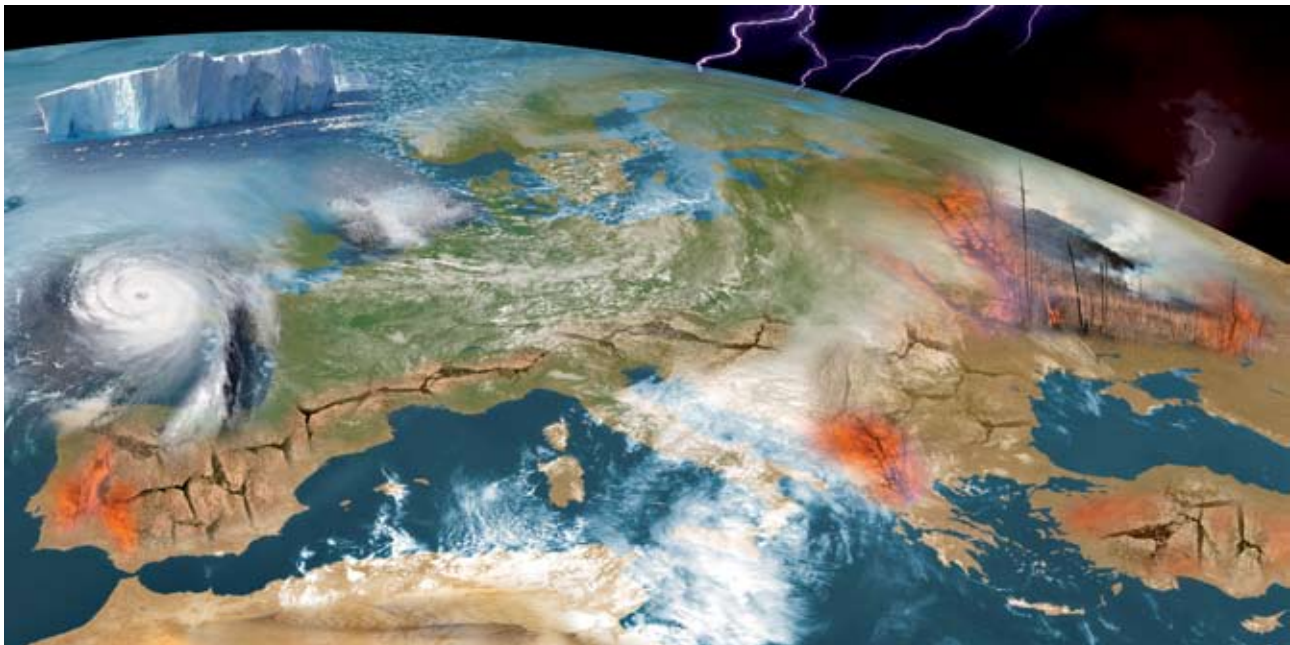
## Messengers for change and material for schools

A number of meteorologists and other experts from the Finnish Meteorological Institute have been trained to serve as messengers for climate change issues. They have participated in numerous events of different types, including the Climate Change Communications Programme of the Finnish Ministry of Trade and Industry, and The EU's Climate Change Awareness Campaign targeted at private individuals. Material for the group was prepared by the Climate Research team of the Finnish Meteorological Institute.

"During the autumn, our experts attended over 50 events to talk about climate change and its consequences. Audiences have represented various sectors, such as nature conservation, transport, energy and waste management, as well as schools," says Project Manager Reija Ruuhela. "The reception was positive and enthusiastic, and the journalists who took part in the events spread the word even wider."

As a partner in the Climate Change Awareness Campaign, the Finnish Meteorological Institute also remembered young people. The

Institute produced a short film that gives concise answers to questions concerning climate change. At the same time, the Institute translated and printed Finnish and Swedish versions of the booklet "We care for our climate", originally produced by the WMO in English. The booklet uses cartoon format to discuss this difficult issue in a language young people and children can understand. The DVD and the cartoon can be used freely by schools.



## Training for journalists

Led by Reija Ruuhela and partly funded by the Climate Change Communications Programme of the Ministry of Trade and Industry, the Finnish Meteorological Institute arranged its first training event on climate change for journalists. The two-day course "The climate is changing - whose fault" not only talked about climate change as a phenomenon, but also dealt with climate policy and other climate issues from the perspectives of emissions trading and technology. The journalists' organisations - the Union of Journalists in Finland as well as sci-

ence, environment and economic journalists - were involved in planning the training right from the start.

"Since climate change has been a recurring theme in the media for some time already, there was a distinct need to provide training that would strengthen journalists' readiness to write about topics pertaining to climate change," Reija Ruuhela explains.

"Besides developing the level of articles written on climate change, we also wanted to facilitate cooperation between journalists and experts by clarifying the concepts

and studies associated with the field. With time, the training is certain to have an effect on the general public's awareness of climate change as well," Reija Ruuhela predicts.

According to the feedback received, the training was useful and needed. In consequence, the Finnish Meteorological Institute will continue to hold training events on climate change for journalists. Otherwise, too, there is need for training tailored for various user groups. In addition to the training targeted at journalists, events were arranged, for instance, for community planners in 2006.

# A record mild December ended an unusually warm year

THE EXCEPTIONAL YEAR SHOWED US AN EXAMPLE OF HOW THE FUTURE CLIMATE IN FINLAND MAY LOOK UNLESS WE ARE ABLE TO CURB CLIMATE CHANGE. THE SUMMER WAS EXCEPTIONALLY HOT AND DRY. ROUNDING OFF THE WARM YEAR, THE WEATHER IN DECEMBER WAS RECORD MILD. THE LAST MONTHS OF THE YEAR BROUGHT HEAVY RAINS THAT LED TO FLOODS.

“In 2006, the mean temperature in the whole of Finland was about one degree higher than the average for the period 1971–2000,” says Senior Meteorologist Anneli Nordlund. “The mean temperature ranged from just under 7°C on the southern coast to -0.7°C in Northern Lapland. The year was among the 15 warmest years during a period extending over a century, from the early 1900s to the present,” Anneli Nordlund clarifies.

## **EXCEPTIONALLY WARM FROM JUNE ONWARDS**

“The mild beginning of the year was followed by fiercely cold but sunny weather in all of Finland from the end of January to late March,” Anneli Nordlund describes.

“Even in early April, it didn’t feel like spring in Southern Finland, because the cloudy weather kept temperatures close to the freezing point. Spring weather didn’t arrive in the whole country until late April.”

The first hot days were already experienced in early May. The 7th of May, when the temperature reached 25.8°C in Salo, was the warmest day during the whole month. Temperatures exceeding 25°C were measured on 59 days during the summer throughout the country, and there were days in June, July and August when temperatures exceeded 31°C. “This is very unusual. 30 degrees is reached in each of the three sum-





mer months on average only once in ten years," Anneli Nordlund comments the temperatures.

Summer weather faded slowly during September. However, temperatures approaching 25°C were still measured in Western Finland in late September. The unseasonably warm weather continued in early October. Night frosts arrived in Lapland soon after mid-October.

According to the Finnish Meteorological Institute's measurements, the thermal growing season was slightly longer than usual, but the temperatures were record high. The sums of effective temperature reached new records everywhere. The lengths of the thermal seasons were far from typical: the spring was short and the summer long in Southern Finland.

Thermal winter (daily mean temperature below 0°C) prevailed in almost all of the country for over two weeks at the turn of October–November. "After that, the rest of the year was unusually mild. Thermal winter did not start again on the southern coast until after mid-January 2007."

Records were broken in December: Throughout Finland, the mean temperature for the month was as much as 7–8 degrees higher than the average for the normal period 1971–2000. "According to extreme value calculations, such mean temperatures occur in the current climate a couple of times in a millennium. The temperatures of December 2006 will become quite common by the year 2100 unless climate warming can be halted," Anneli Nordlund stresses.

#### **EXCEPTIONALLY DRY SUMMER, WET AUTUMN**

A steady high pressure made the summer of 2006 the driest ever experienced in Southern and Western Finland and on the northern shores of the Gulf of Bothnia. The number of sunny days was one-third higher than the average in many parts of the country.

Dryness left its marks on nature, and groundwater levels were low. The longest uninterrupted rainless period, over four and a half weeks, was measured, for instance, in Kauhava in Southern Ostrobothnia.

At the end of September, the sum of precipitation for the thermal growing season ranged from 160 millimetres to over 300 millimetres in easternmost Finland. Thus, in the driest areas, precipitation was only about half of the average value.

Heavy rains in October soaked the soil, and rivers and lakes were filled even in the dry regions. October was the rainiest month of the year. Precipitation in Southern Finland was 2.5 times the average.

The first snow in Lapland fell in late October. It snowed many times around the turn of October–November, and almost the whole country was covered with snow. The snow cover of 20 to 50 centimetres that had accumulated on both sides of the Salpausselkä ridge in Southern and Central Finland was unusually thick considering the time of the year. However, the very mild weather during the latter half of November melted all of the snow everywhere except in Lapland.

"Even at the end of the year, there was no snow on the ground south of the line extending from Lappeenranta to Kokkola, and the snow cover was almost nonexistent in Eastern Finland as well," Anneli Nordlund explains. "Only in Northern Lapland was the snow cover nearly half a metre thick."

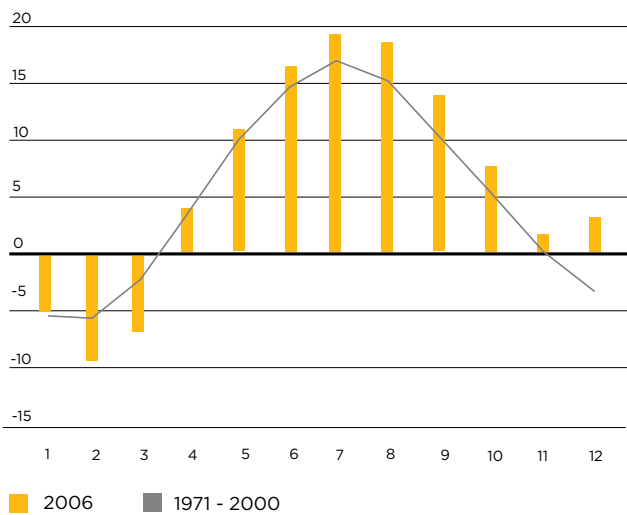
There were only 14 stormy days at sea during 2006, whereas the annual average is 24. There were also few thunderstorms, lightning strokes and whirlwinds during the year.

The strong thunderstorms on 10 July were accompanied by exceptionally large hailstones, up to 6.5 centimetres in diameter. Such large hailstones are seen anywhere in Finland on average once in a decade.

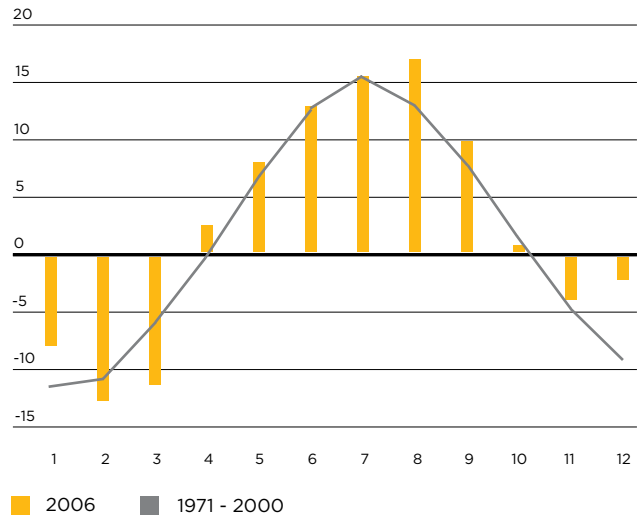
## Figures for 2006

Lowest temperature	-43.6 °C	20 January Kittilä, Pokka
Highest temperature	32.1 °C	8 July Lammi, Evo
Highest number of hot days	37	Suomusjärvi, Taipale
The last hot day of the summer season	25.6 °C	27 August Kauhava
New record for thermal summer duration during 1961-2006	160 days	Helsinki-Vantaa
New record for October precipitation in Finland	228 mm	Vihti, Hiiskula
Minimum precipitation in June-August	24 mm	Simo Maksniemi, Ii Yli-Olhava

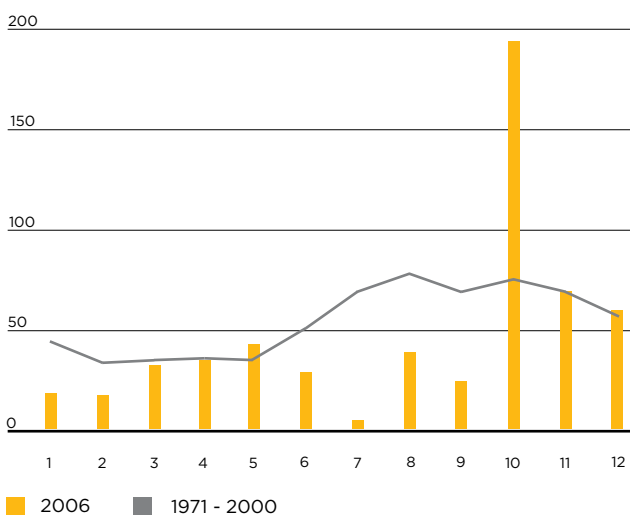
Helsinki-Vantaa Airport (Monthly mean temperature, °C)



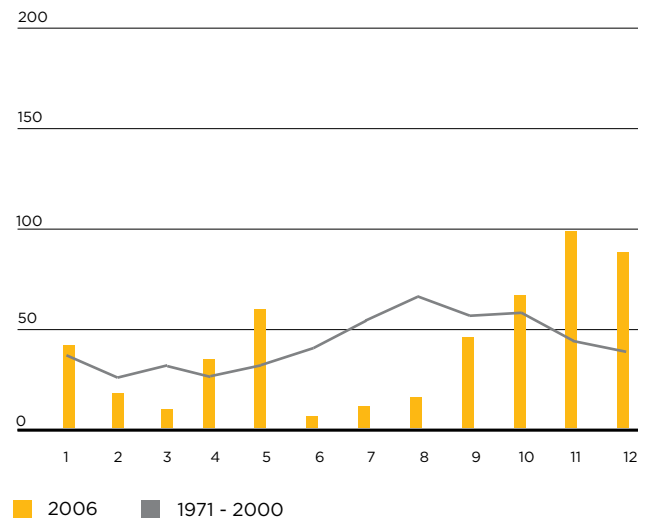
Kemi-Tornio Airport (Monthly mean temperature, °C)



Helsinki-Vantaa Airport (Annual precipitation, mm)



Kemi-Tornio Airport (Annual precipitation, mm)



# The Weather Service draws attention to hazardous weather conditions

THE WEATHER SERVICE OF THE FINNISH METEOROLOGICAL INSTITUTE PRODUCES NATIONWIDE WEATHER FORECASTS FOR LAND AND MARINE AREAS AND GIVES WARNINGS NEEDED TO ENSURE THE SAFE FUNCTIONING OF SOCIETY AND THE SAFETY OF PEOPLE. THE INSTITUTE ALSO PROVIDES WEATHER SERVICES FOR THE AUTHORITIES, FOR CIVIL AVIATION AND THE DEFENCE FORCES, AND MAINTAINS PREPAREDNESS FOR EXCEPTIONAL SITUATIONS AND DISTURBANCES AT ALL TIMES.

The Finnish Meteorological Institute's weather services are based on high-quality research and tested methods. The quality targets set for forecasts were exceeded in 2006. Customers are also satisfied with the services they receive. On a scale of 1-5, the customer satisfaction index for services to the authorities was 3.9, or the same as in 2005.

The Weather Warning Service operated its readiness service for hazardous weather conditions on a

regular basis in 2006. In the event of hazardous weather conditions, the readiness staff will intensify the flow of information to the rescue and other authorities. The Finnish Meteorological Institute is also involved in the system created within the State administration for rapid exchange of information between the authorities in special situations.

In accordance with the relevant Regulations of the European Parliament and Council, the Finnish Civil Aviation Authority granted the

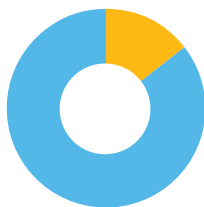
Aviation and Military Weather Service a licence for the provision of aviation weather services needed for air navigation. All providers of services for civil aviation need such a licence as of the beginning of 2007. The licence is valid throughout the EU. The Finnish Meteorological Institute provides all aviation weather forecast and warning services needed by international air traffic in the Finnish air space.

## Accuracy of weather forecasts, %

	% in 2006	% in 2005	% in 2004
One-day temperature forecasts	87.1	87.1	84.7
Two-day temperature forecasts	80.2	80.2	78.9
One-day forecasts for the probability of rain	88.4	85.3	84.4
Two-day forecasts for the probability of rain	82.1	81.7	77.9
Wind warnings in one-day forecasts	84.0	84.0	82.0
Wind warnings in two-day forecasts	80.6	80.3	78

### Weather Service

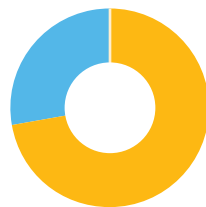
Total Expenditure €6.6 Million



Weather Service 6.6  
Other Divisions 39.0

### Weather Service

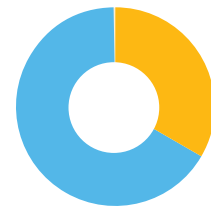
94 Person-years



Budgetary Funding 68  
Earned Revenue 26  
External Funding 0

### Weather Service

Funding €6.6 Million



Budgetary Funding 2.2  
Earned Revenue 4.4  
External Funding 0

# Weather forecast quality closely monitored

FINLAND HAS A LONG HISTORY IN APPLYING ADVANCED METHODS TO VERIFY THE QUALITY OF WEATHER FORECASTS. ALL QUALITY MEASURES APPLIED SHOW A RISING TREND IN FORECAST QUALITY.

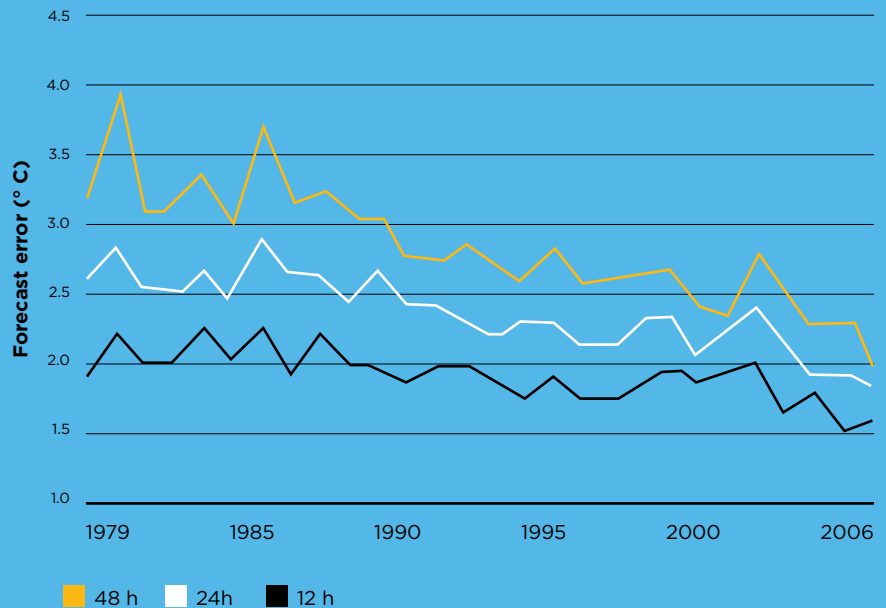
“The Finnish Meteorological Institute has met nearly all official quality targets set for public weather forecasting during the past years. Forecast accuracy for temperature, rain and wind has exceeded 80 per cent in the 24-hour and 48-hour forecast ranges. The targets were met particularly well in 2006, even though the quality criteria were tightened again,” says Marianne Sångbom, Head of the Weather Warning Service.

Predicting weather is challenging in Finland, and due to the nature of our climate, the accuracy of forecasts fluctuates from year to year and from season to season. However, the trend has been continuously rising.

“The predictive limits of today’s weather forecasts extend beyond a week, whereas 25 years ago predictability was around five days. Hence, predictability has improved approximately by one day over a ten-year period. This is also the official target of the European Centre for Medium-Range Weather Forecasts (ECMWF), the world leader in numerical weather forecasting,” explains Pertti Nurmi, Head of Meteorological Applications.

The Finnish Meteorological Institute has archived weather forecasts extensively for decades. This makes it possible to assess (verify) the quality of forecasts using diverse methods. The quality of forecasts has been monitored at the Institute systematically for more than 25 years.

“Assessment of forecast quality is extremely important for the



Differences between temperature forecasts and observed temperatures in Northern Finland from 1979 to 2006. The black curve represents a 12-hour forecast, the white curve a 24-hour forecast, and the orange curve a 48-hour forecast. The marked improvement in forecasts is seen as a pronounced reduction in errors. For instance, the average error in today’s 48-hour forecasts is roughly the same (about 2°C) as that for 12-hour forecasts in the 1980’s.

scientific development of new forecasting methods. By applying comprehensive diagnostic verification measures, we have been able to show constant development in numerical weather forecast models. The information obtained in this way helps guide development forward,” Pertti Nurmi explains.

New verification methodologies are under constant development, for instance in working groups appointed by the World Meteorological Organization. The Finnish

Meteorological Institute is an active partner in this development work. “At present, new types of verification methods are being developed for weather forecasts expressed in probabilistic terms. A probabilistic forecasting approach is generally considered to be the only sensible way to express the inherent uncertainty of extreme weather events, which have become more common in recent years and which are also closely associated with issues governing climate change.”

# Improving aviation weather know-how

THE QUALITY SYSTEM ADOPTED IN THE FINNISH METEOROLOGICAL INSTITUTE HELPS RAISE THE AVIATION AND MILITARY WEATHER SERVICE TO A NEW STANDARD THROUGH A PERSONNEL CERTIFICATION PROCESS.

Aviation weather forecasting is one of the most demanding jobs for the meteorologist. During 2006, the Finnish Meteorological Institute developed a new systematic way of monitoring the personnel's competence. The need to determine and develop the personnel's competence level further was noticed when the ISO 9001:2000 quality management system was taken into use in the Aviation and Military Weather Service. During the certification process, the competence required for the aviation weather meteorologist's duties is measured, and a plan for professional development is also monitored.

The system ensures methodically that new meteorologists have sufficient competence required by their

tasks before they are assigned independent duties in the weather service. At the same time, the information collected makes up a comprehensive register, which can be used to target training according to demand and at the most important areas of competence that might be needed in future.

"Aviation weather forecasts are subject to various international regulations more than other weather services. That's why aviation weather meteorologists are forerunners in the certification of competence," says Heikki Juntti, Production Manager at the Aviation and Military Weather Service of the Finnish Meteorological Institute.

"People play the greatest role in forecasting aviation weather. Weather forecast models are still fairly inade-

quate for predicting developments in aviation weather, and the weather has a significant impact on the safety and economy of air traffic," Heikki Juntti stresses.

At the same time, the Aviation and Military Weather Service of the Finnish Meteorological Institute is preparing for the Single European Sky Regulations of the EU. The common requirements set by the Commission also apply to aviation weather services. "According to the Regulations, providers of aviation weather services must show that their know-how meets the requirements laid down by the World Meteorological Organization," Heikki Juntti states.



Predicting the weather for the needs of air traffic is among the most demanding tasks for meteorologists. The picture shows Matti Heinonen (left) and Kari Österberg.

## Weather service for pedestrians – a useful newcomer among weather warnings

DURING 2006, NOTICES TO PEDESTRIANS ACQUIRED THE STATUS OF OFFICIAL WEATHER WARNINGS. THE SERVICE ALSO BECAME AVAILABLE IN THE SWEDISH LANGUAGE AND ITS SCOPE WAS EXTENDED TO INCLUDE ÅLAND.

**A**longside climate change, hazardous weather conditions for pedestrians may become more frequent in most areas of Finland. “The more temperatures fluctuate around the freezing point, the more accidents are caused by slippery conditions. Prevention of slipping accidents and improving pedestrian safety are also important since people should be encouraged to walk instead of driving, to help combat climate change,” says Senior Meteorologist Sari Hartonen.

Pedestrians and motorists have accidents in different weather conditions. The worst conditions for walking arise when a little dry snow or rain falls on an icy surface.

“Each winter about 50,000 pedestrians slip so badly that they need medical attention. Most injuries occur among middle-aged people, but elderly people have the most serious accidents. About 10–20 cases a year are fatal,” Project Manager Reija Ruuhela stresses.

In 2006, the pedestrian weather service of the Finnish Meteorological Institute participated in the campaign *Miten pysyisin pystyssä?* (How to remain standing). The goal of the campaign is to tell people how they can influence their own accident risk. A working group set up by the Ministry of Transport and Communications has calculated that money spent to prevent slipping yields tenfold savings in medical costs.

Pedestrian weather warnings are available at the Finnish Meteorological Institute’s website in Finnish and in Swedish. The notices are also issued in the Finnish Broadcasting Company’s regional radio and television broadcasts and on the weather pages of the YLE Teletext service.

The Finnish Meteorological Institute issues a warning to pedestrians when walking conditions are expected to be very slippery. Drawn up in the morning and afternoon, the warnings are given separately for each province. Pedestrians should be prepared for highly slippery conditions on average 5–15 times per year.



*Sari Hartonen (left) and Reija Ruuhela (right) say that the most dangerous conditions for pedestrians arise when fresh dry snow or rain falls on icy pavements. Heavy, wet snowfall may also be very slippery underfoot.*

## Commercial weather services keep expanding

THE FINNISH METEOROLOGICAL INSTITUTE'S CUSTOMER SERVICES OPERATE ON COMMERCIAL GROUNDS. THE UNIT PROCESSES WEATHER PRODUCTS FOR TRAFFIC, THE MEDIA, TRADE AND INDUSTRY, AND FOR THE GENERAL PUBLIC.

In 2006, the Customer Services focused on internationalisation and succeeded in acquiring customers in several sectors in Finland's neighbouring areas. Mobile services continued to be a popular product. In the

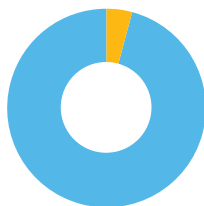
Best Mobile Service 2006 competition, the Weatherman service was selected as the best utility service.

Income from commercially priced services rose and the market share of the Customer Services

remained steady in 2006. The commercial operations yielded a surplus of 3.3 per cent.

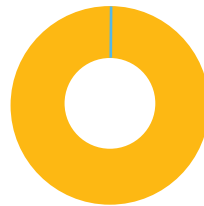
The customer satisfaction index continued to rise. On a scale of 0-5, it was now 4.0 (3.9 in 2005).

**Customer Services**  
Total Expenditure €2.0 Million



Customer Services 2.0  
Other Divisions 43.7

**Customer Services**  
33 Person-years



Earned Revenue 33  
Budgetary Funding 0

**Customer Services**  
Funding €2.0 Million



Earned Revenue 2.0  
Budgetary Funding 0

# A meteorologist's tools in demand around the world

METEOROLOGISTS IN JAMAICA AND IN TRINIDAD AND TOBAGO PREDICT WEATHER WITH THE HELP OF SMARTMET, A METEOROLOGICAL PRODUCTION SYSTEM DEVELOPED IN THE FINNISH METEOROLOGICAL INSTITUTE.

“With Smartmet, a meteorologist first processes data from weather models, radars, satellites and observations and synthesizes them into a forecast. Then the automatic production system uses the forecast to generate products, for instance, for the Internet, for mobile devices and for the media,” says Mikko Rauhala, Head of Product Development at the Customer Services, describing the process.

The system produces text automatically from numerical data. The text can also be converted into speech through a speech synthesizer. When a customer calls the service and defines the location by means of the post code, edited data becomes text. From the text, Smartmet can generate intelligible speech, which is transmitted auto-



matically to the operator and to the customer's phone.

The Finnish meteorologist's tool has also been exported to other countries. The workstation and the web production component are in use at the weather services of Jamaica and Trinidad and Tobago. They were delivered as part of a SIDS follow-up project funded by the Finnish Ministry for Foreign Affairs. The workstation has been sold, for instance, to Austria.

“The product can't just be packaged and dispatched. It needs tailoring to suit the customer's needs and system,” Mikko Rauhala points out.

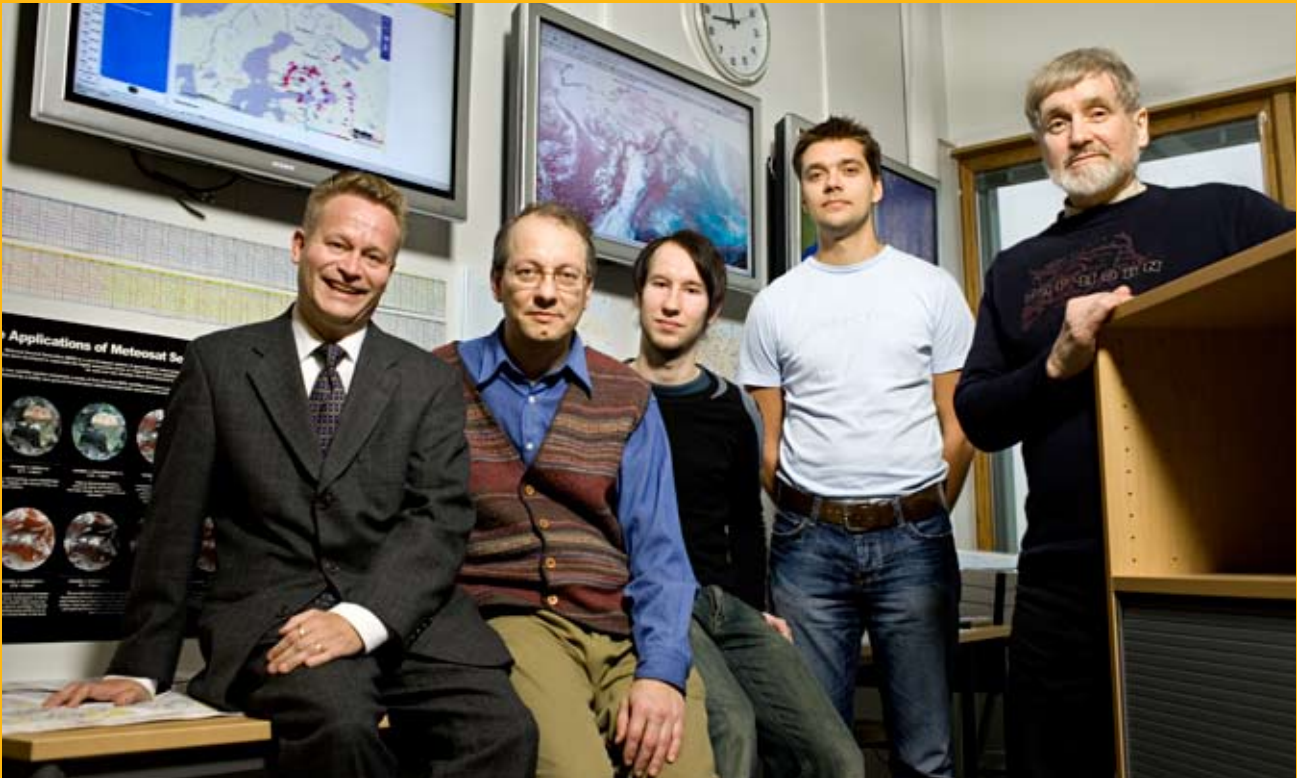
Smartmet is the result of cooperation and professional input from many of the Finnish Meteorological Institute's units. The first part of the system, the meteorologist's editor, has been in use at the Institute since 1998. At present, a production system of a completely new generation, known as SISU, is under design.

*The personnel of the Finnish Meteorological Institute trained colleagues in Trinidad and Tobago. The picture on the top shows Marko Pietarinen (left) and Mikko Parviainen. Below Mikko Rauhala on the left and Natalia Pimenoff in the centre on the right.*



# The Flash Service is being developed together with customers

BY CONSULTING THE FLASH SERVICE, THE CUSTOMER KNOWS WHERE LIGHTNING HAS STRUCK AND CAN CALL THE REPAIR TEAM TO THE RIGHT PLACE.



*The Flash Service has been developed in cooperation by the customers and product developers of the Finnish Meteorological Institute's Customer Services and by lightning experts working in the Institute's Research and Observation Services units. From the left, Timo Laine, Jussi Haapalainen, Antti Westerberg, Antti Mäkelä and Tapio Tuomi.*

Imanet is the Internet channel for various weather services provided by the Customer Services of the Finnish Meteorological Institute. One of the services supplied during the summer months is the Flash Service, which utilises the lightning sensor network to locate strokes of lightning in real time, shows them on zoomable maps and gives information about the time, place and intensity of each lightning stroke. The package also includes other weather services, such as various forecast animations made by a meteorologist.

The Flash Service is a tool for any network control room. Utilising the service, customers can pre-

dict thunderstorms and can locate a fault caused by lightning within a range of only a few hundred metres. This makes it quicker to start repair work.

"Because the lightning data are saved, the Flash Service can also be utilised afterwards if there's a need to investigate earlier fault situations," says Account Manager Timo Laine of the Customer Services. He emphasises that the Flash Service is under constant development in cooperation with customers, to meet their needs and wishes.

Based on Nordic cooperation for lightning observation, the Flash Service receives data from a total of

30 lightning sensors, eight of which are located in Finland.

"The Flash Service wouldn't exist without good and close cooperation within the various units of the Finnish Meteorological Institute and between the Institute and its international partners. The service is based on scientific lightning research, which dates back a long time in our Institute. For instance, the research has helped us acquire the right kind of observation equipment in step with advancements made in lightning observation technology. We're buying all this know-how and data from the Institute's experts so that we can serve our customers well," Timo Laine states.

# Atmospheric research benefits society and the individual

ATMOSPHERIC RESEARCH ENABLES INCREASINGLY BETTER FORECASTS OF THE WEATHER AND VARIOUS WEATHER PHENOMENA. DECISION-MAKERS AND INDUSTRY RECEIVE INFORMATION, FOR INSTANCE, TO SUPPORT THEM IN QUESTIONS CONCERNING CLIMATE CHANGE AND AIR QUALITY.

The Finnish Meteorological Institute works in close cooperation with universities and research institutes in Finland and abroad. The Institute's air quality and climate change researchers are included in the centres of excellence of the Academy of Finland, the EU and the Nordic countries.

A framework agreement on cooperation with the University of Kuopio was drawn up in autumn 2006. The Kumpula Space Centre, founded jointly by the Finnish Meteorological Institute and the Department of Physical Sciences of the University of Helsinki, began operations at the start of the year. The Centre carries out long-range space equipment projects and develops Finnish-Russian cooperation projects for charting the atmospheres of the Earth and Mars.

**The Institute's Research Unit** is working on seven fixed-term research programmes:

**The Unit of Meteorological Research** conducts research supporting weather services. Included in an international network, the unit is developing, among other things, the HIRLAM system based on the modelling of atmospheric phenomena. The unit provides expert services on the atmosphere and air quality both in Finland and abroad.

**The Climate and Global Change Unit** produces Finnish climate statistics. The unit is also responsible for creating models for climate systems and for studying the climate, greenhouse gases and the interaction between fine particles and the climate.

**The Air Quality Research Unit** monitors air quality in Finland by carrying out measurements in background areas. These measurements

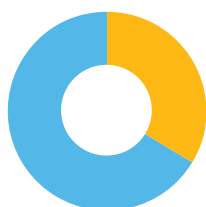
are included in several international monitoring programmes. The unit's accredited chemical laboratory serves as a national reference laboratory.

**The Space and the Upper Atmosphere Unit** studies space weather phenomena, near-Earth space, auroras, and the space environments of other planets and comets. The unit operates on a wide range, from the design and construction of equipment to the utilisation of observation findings.

**The Earth Observation Unit** investigates the atmosphere by means of remote-sensing methods: utilising measurement data from satellites, radar stations and ozone probes. The unit is involved in remote-sensing development, from the design of equipment to the development of end-products.

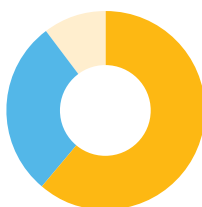
Year	2006	2005	2004
New doctoral dissertations	7	7	5
Publications subject to international peer review	178	173	133
Scientific publishing index	10 355	10 384	8 549

**Research and Development**  
Total Expenditure €15.4 Million



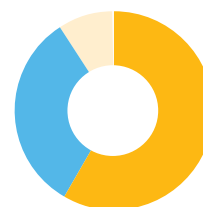
Research and Development 15.4  
Other Divisions 30.2

**Research and Development**  
256 Person-years



Budgetary Funding 157  
Earned Revenue 73  
External Funding 26

**Research and Development**  
Funding €15.4 Million



Budgetary Funding 9.0  
Earned Revenue 5.0  
External Funding 1.4

**The Arctic Research Centre** conducts atmospheric research and makes observations pertaining to arctic global change. The Sodankylä satellite service centre offers extensive data reception, processing and filing services for both Finnish and international customers.

**The Kuopio Unit** focuses on the study of fine particles and clouds. The applications concern prediction of climate change and air quality.

#### **THE FOCAL AREAS OF RESEARCH AT THE FINNISH METEOROLOGICAL INSTITUTE ARE:**

- the weather and safety
- climate change and adaptation to it
- the impact of the atmosphere on the environment and on people
- space and atmospheres.

#### **EXAMPLES OF PROJECTS OF DIFFERENT SIZES IN VARIOUS FOCAL AREAS**

##### **THE WEATHER AND SAFETY**

- The accuracy, quality and timeliness of forecasts made in the flood warning system for urban areas are developed in a project funded by the Ministry of Agriculture and Forestry.
- The amounts of fine particles transported from Central Europe to Finland are predicted by means of a model developed at the Institute. The model monitors the concentrations of the most important fine particles in the whole of Europe.
- The joint Testbed project monitors mesoscale weather phenomena in the Helsinki area by means of a weather radar, lightning observations and meteorological satellites.
- Methods for predicting conditions that cause icing are studied and developed to meet the needs of air traffic.

##### **THE IMPACT OF THE ATMOSPHERE ON THE ENVIRONMENT AND ON PEOPLE**

- Preparations are made for measuring the concentrations of mercury, heavy metals and polycy-

clitic aromatic hydrocarbons (PAH compounds), as required by the relevant EU Directive.

- The Internet portal on air quality will be completed during spring 2007. Bringing together air quality information compiled by various actors, the portal is a definite improvement in air quality communications.
- Air quality measurements are carried out in Northern Lapland as part of a project led by the Ministry of the Environment. The results are utilised not only by the scientific community but also by the local environmental authorities and by enterprises making use of nature and natural products.
- The impacts of small-scale burning of wood on air quality are investigated.
- Attenuation of radiation because of atmospheric fine particles is studied, for instance, to determine the passage of a laser ray in the atmosphere and the atmospheric corrections required by satellite-based imaging methods.

##### **CLIMATE CHANGE AND ADAPTATION TO IT**

- The Finnish climate change scenarios are updated by means of the climate model material in the Fourth Assessment Report of the IPCC.
- Studies are conducted on the regional distribution of rain in Finland and on the recurrence times observed for the extreme values of weather quantities in the current climate.
- A more detailed description of size distributions among aerosol particles has been incorporated into the climate model.
- Methane and nitrogen cycles and the occurrence of hydrogen in the atmosphere are measured at the Pallas GAW station.
- The health effects of the weather and the climate, e.g. the temperature and the intensity of sunshine, are investigated together with health sector researchers.

- The effects of UV radiation and ground-level ozone on the ageing of various materials are analysed in a joint project carried out with several enterprises.
- The Institute contributes to the International Polar Year with a project studying global change in the middle layers of the atmosphere above polar areas.
- Mechanisms associated with the formation of clouds, especially the impact of urban atmospheric pollutants, are studied by comparing the results of measurements made in Kuopio and in Pallastunturi.

##### **SPACE AND ATMOSPHERES**

- Research associated with the Earth's radiation balance is carried out in order to monitor changes in the ice and snow cover and the impacts of these changes on the atmosphere.
- The interference caused by the upper atmosphere in GPS signals is studied in view of new applications that need accurate positioning data.
- The revised network of cameras for photographing auroras produces observation material for the research of the climate and the weather in space.
- The reports of international projects pertaining to gas and power networks were completed, and cooperation projects were implemented with Finnish and Canadian industrial enterprises operating in the sector.
- The electric sail is a new invention which uses solar wind as "fuel" for spacecraft. Development will continue in cooperation with research institutes and industry.
- A project supported by EUMETSAT is developing satellite products that can be used to monitor global variations in the ozone level, aerosols, chemical concentrations and in UV levels over a long term. A time series of the products is also collected and archived for subsequent analyses.

# The Indo-Asian pollution cloud poses a challenge to aerosol researchers

AN ENORMOUS POLLUTION CLOUD MADE UP OF FINE PARTICLES FORMS OVER INDO-ASIA DURING THE DRY SEASON EVERY YEAR. OVER 50 PER CENT OF THE WORLD'S POPULATION LIVES IN THE GEOGRAPHICAL AREA AFFECTED BY THE CLOUD. THE FINNISH METEOROLOGICAL INSTITUTE STRIVES TO DETERMINE THE COMPOSITION OF THE CLOUD AND ITS IMPACT, FOR INSTANCE, ON HUMAN HEALTH.

India is one of the countries where the Finnish Meteorological Institute is engaged in development cooperation. Financed by the Finnish Ministry for Foreign Affairs and the European Union, the Institute measures the composition of the Indo-Asian pollution cloud. The goal is to create a unique time series of the cloud's physical and chemical properties.

Fossil fuels are a major problem in India. "Two-stroke engines and small-scale combustion are really common, and attitudes still need to improve. When the origin of the pollution cloud is known, problems in air quality can also be tackled through attitude change," says Heikki Lihavainen, Senior Research Scientist at the Finnish Meteorological Institute.

Through cooperation with the TERI Institute of India, opportunities are created for local experts to make aerosol measurements independently and to produce research that can be used, for instance, to support local decision-making. The Finnish Meteorological Institute has had a weather station and equipment transported to India; these can be used, for example, to measure particle masses and the size distributions and optical properties of particles. Data are monitored continuously, and about three service visits to India are made each year.

The station in the Himalayas, inaugurated in 2006, is located far from any major sources of emissions. "Air quality in background areas, such as this, must also be known so that we can determine the

role of human activity in the cloud formation," Lihavainen explains.

Measurements will be conducted in the Himalayas at least until 2009. In 2007, the Finnish Meteorological Institute will also establish a measurement station in Delhi. The station forms a part of the EUCAARI aerosol research project financed by the EU. Within the project's extensive measurement programme, the Finnish Meteorological Institute is responsible, among other things, for operations in India. The main goal of the EUCAARI project is to reduce uncertainty concerning the atmospheric impact of aerosols and to investigate the link between anthropogenic aerosols and air quality in the region. Research institutes from 25 countries participate in the project, which will continue until 2010.



*The FMI cooperates with India's leading climate research institute, TERI. The picture shows Dr. Panwar, the FMI's contact person; Yrjö Viisanen, Director of Research at the FMI; Heikki Lihavainen, Project Manager; Petteri Taalas, Head of the WMO Regional and Technical Co-operation; and Leena Srivastava, Executive Director at TERI.*

# Satellite data in real time

STARTED AS AN INTERNATIONAL PROJECT FOR INSTRUMENT DESIGN, THE OMI PROJECT HAS EVOLVED INTO AN IMPRESSIVE DEMONSTRATION OF OPPORTUNITIES OFFERED BY EARTH OBSERVATION FOR MONITORING THE ATMOSPHERE AND THE ENVIRONMENT.

**O**MI (Ozone Monitoring Instrument) measures the chemical composition of the atmosphere. It is a joint contribution of Finland and the Netherlands to the EOS Aura satellite of NASA. The Arctic Research Centre receives real-time measurement data from OMI every time the satellite passes over the Centre. The data are processed immediately and the findings are publicised as maps on the Internet.

“The OMI project was launched in the late 1990s, funded by Tekes. The Finnish Meteorological Institute joined the instrument design and science project as a coordinator in 1998. The other participants were research institutes and industrial

enterprises from Finland, the Netherlands and the United States,” says Senior Researcher Aapo Tanskanen.

The Aura spacecraft carrying OMI was launched into orbit in summer 2004. OMI’s measurements have proved to be accurate and reliable: OMI is now regarded as the most important instrument measuring the state of the ozone layer.

In spring 2006, the Finnish Meteorological Institute published a real-time application that makes it possible, within 15 minutes of the satellite overpass, to give out a map illustrating the thickness of the ozone layer over Northern Europe and to give an estimate of UV radiation reaching the Earth surface. The real-time data can be utilised in research

and in model calculations made for weather forecasts. The images also indicate whether UV protection is recommended.

“The successful instrument project also turned out to be an impressive technological demonstration: satellite observations form the base of a real-time application in which each step is controlled from start to finish,” says Aapo Tanskanen in describing the process.

“It would also be possible to devise a corresponding system for the real-time monitoring of, say, air quality, forest fires, floods or natural disasters. Satellites will play an increasingly important role in monitoring of the environment,” Tanskanen predicts.



*The Finnish Meteorological Institute’s representatives in the OMI project have included Anssi Mälkki, Anu Määttä, Seppo Hassinen, Aapo Tanskanen and Johanna Tamminen.*



*Timo Pirttijärvi is following the reception of material from satellites. The correctness of remote sensing data can be verified using, for instance, atmospheric soundings.*

## The Arctic Research Centre – important for comparing satellite data

THE ARCTIC RESEARCH CENTRE IS BECOMING A LEADING SITE IN THE NORTHERN REGION FOR CALIBRATING, VALIDATING AND STUDYING SATELLITE DATA.

The Arctic Research Centre of the Finnish Meteorological Institute produces diverse and accurate information about the atmosphere, the climate and the environment. The local measurement data need to be as accurate as possible so that the validity of remote sensing data transmitted by satellites in different climate conditions can be verified. Lack of reference material of sufficiently high quality has so far impeded the efficient utilisation of remote sensing data.

In Sodankylä, reference material is produced by means of various on-site atmospheric soundings, specialised research station measurements and surface observations. For

instance, the data transmitted by MetOp, the polar-orbiting meteorological satellite launched in October 2006, are validated in Sodankylä. For the validation and calibration of MetOp data, the Research Centre will conduct a wide range of measurements during spring 2007. For instance, atmospheric soundings will be synchronised with the orbiting of MetOp.

“For studying the continental climate and ecosystem of Northern Eurasia, Sodankylä is one the few possible research sites far enough to the North,” says Jouni Pulliainen, Director of the Arctic Research Centre.

“Sodankylä is the best equipped measurement and observation site

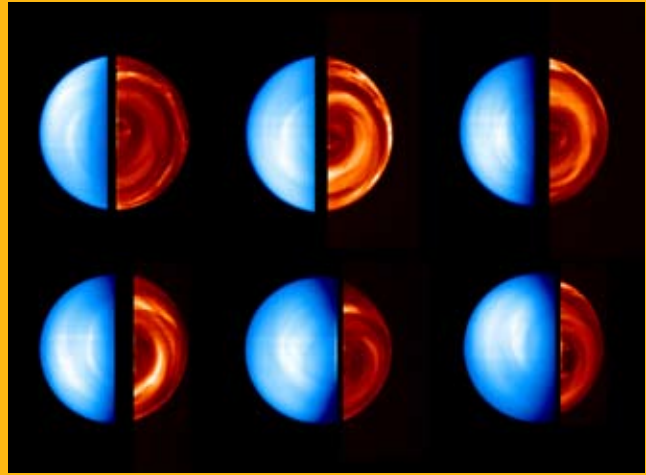
in the Northern region, and in this sense, it is unique in the world. Among other things, we study aerosols, ozone and UV radiation, we monitor the carbon dioxide cycle and we measure the effect of snow cover on the climate.”

The results obtained in Sodankylä apply not only to Finland. The measurement data collected in the area are important for the climate and atmospheric activities the world over.

“Northern Finland plays a crucial role in global climate research. For this reason, we want to make both historical and new measurement data openly available to researchers through the website designed for this purpose,” Jouni Pulliainen summarises.



*Venus Express explores the planet for two Venus days, which correspond to 486 Earth days.*



## Venus Express brings information about the atmosphere of Venus

RESEARCH INTO THE VENUSIAN ATMOSPHERE GIVES INFORMATION OF HOW THE ATMOSPHERE OF A PLANET RESEMBLING THE EARTH CAN DEVELOP OVER MILLIONS OF YEARS.

The Venus Express spacecraft that studies the atmosphere and near space of Venus, reached the planet on 11 April 2006. The Finnish Meteorological Institute has participated in the planning and construction of the ASPERA-4 particle analyser and is responsible for the operation of the analyser's main computer and operating system. The device measures the erosion of the Venusian atmosphere, i.e. the escape of particles into space.

ASPERA-4 is the fourth member of the ASPERA instrument family. The three first instruments were designed for studying phenomena in the upper atmosphere and near space of Mars. The ASPERA-3 instrument on Mars Express is currently measuring Mars; results of the escape of particles from the upper atmospheres of two of the Earth's neighbouring planets are thus being obtained simultaneously.

"The measurements add to our knowledge of the atmospheres of Venus and other Earth-like planets and how they have developed. Since Venus is hot and Mars is cold, the results can be compared against the Earth's circumstances," says Esa Kallio, Academy Researcher at the Space Research Unit of the Finnish Meteorological Institute.

"It is assumed that, a long time ago, the atmosphere and other environmental conditions on Venus were almost like those we have on the Earth. However, on Venus the greenhouse effect has raised the temperature by nearly 500 degrees, and the prerequisites for life have been destroyed. Venus and Mars thus offer extreme examples of how the atmospheres of planets can develop," Esa Kallio explains.

Kallio says that the Finnish Meteorological Institute is particularly interested to learn how the Sun

affects the upper atmospheres and atmospheric development on Earth-like planets. "By studying Venus, we also try to gain a better understanding of the greenhouse effect on the Earth."

The Finnish Meteorological Institute also participates in the global computer simulations developed for interpreting ASPERA-4 measurements. The numerical computer model developed at the Institute helps create a three-dimensional image of plasma processes in the near space of Venus. The first results were submitted to international scientific publications in February 2007.

ESA's Venus Express is the first European planet probe that has studied Venus. The ASPERA measurement device is the result of work done by an extensive international consortium, comprised of 11 countries and 16 research institutes.

# Smoke from forest fires identified rapidly

THE FINNISH METEOROLOGICAL INSTITUTE WAS QUICK TO IDENTIFY THE SMOKES THAT EMANATED FROM RUSSIA AND RAISED THE CONCENTRATIONS OF FINE PARTICLES TO RECORD-HIGH LEVELS. SPREADING OF SMOKE COULD BE PREDICTED IN ALMOST REAL TIME WITH AN ACCURACY OF SOME TENS OF KILOMETRES.

**S**outheastern and eastern winds carried smoke from forest fires in Russia and Estonia to Finland on several occasions in August 2006. According to measurements carried out by the Finnish Meteorological Institute, concentrations of fine particles reached record-high levels during the smoke episode. The highest concentration ( $PM_{2.5}$ ) was measured in Virolahti, close to the border with Russia, where the reading was nearly 150 micrograms in one cubic metre of air ( $\mu\text{g}/\text{m}^3$ ). The limit recommended by the World Health Organization is  $25 \mu\text{g}/\text{m}^3$ . The smokes gave rise to various irritation symptoms and other health effects among sensitive population groups and probably also induced a number of premature deaths.

The Finnish Meteorological Institute was quickly able to recognise and give information about the origin and composition of the smokes. The Institute also predicted the movements of the smokes. Geographically the accuracy of these predictions was some tens of kilometres and temporally about an hour.

A variety of skills and know-how is needed to obtain a reliable picture of the sources of smoke emissions and of the development of the situation. One of the first links in a successful chain of cooperation is the weather service meteorologist who monitors concentrations and alerts other experts if an air quality episode is imminent. Cooperation among researchers was close:

“The initial data for assessing the smoke emissions were obtained from satellite images. The data were

then fed into a dispersion model that utilises weather forecast data and supplements them with an estimate of the dispersion of the pollutants. That’s how we were able to estimate the amount of particles produced by a forest fire at a certain temperature, and we could predict where the smoke cloud would be moving during the next few days,” says team leader Ari Karppinen in describing the process.

“The measurement station for urban air in Kumpula produces almost real-time data on the chemical and physical properties of fine particles. The composition of particles revealed immediately that the smoke originated in forest fires,” says Research Professor Risto Hillamo.

“Experts in technical services joined the team towards the end of the chain by processing the data for the Internet. The air quality portal on the Internet is an effective tool for analysing the dispersion of smokes. Through the portal, trends in concentrations can be monitored almost in real time,” comments team leader Virpi Tarvainen.

“In addition, we can use the SILAM model, which is the only available method in Europe for calculating the dispersion of smokes from forest fires,” says Jaakko Kukkonen, Manager of Air Quality Research, adding another element to the success story.

The future goal is to deepen research and to develop the model so that it would enable reliable advance warnings of smokes. However, additional resources are still needed for the construction of an operative advance warning system.





*Above, Ljupco Grozdanovski of the Macedonian Ministry of the Environment and Tiina Harju of the FMI pictured at the measurement station.*

*Below, Johannes Roine, an expert at VTT, checking and repairing a vehicle developed for monitoring air quality in Macedonia.*



## The Finnish Meteorological Institute helps monitor air quality in Macedonia

THE FINNISH METEOROLOGICAL INSTITUTE PARTICIPATES IN A PROJECT WHERE MACEDONIAN AIR QUALITY MONITORING AND MANAGEMENT SYSTEMS ARE DEVELOPED TO MEET EU REQUIREMENTS.

“A Twinning project is a cooperation project between an EU Member State and a candidate country – in this case Finland and Macedonia. During the project, the Member State’s experience is transferred for use by the beneficiary country. The Finnish Meteorological Institute acts as Finland’s representative in the project,” Tiina Harju, an air quality expert, explains. She works as an adviser for the 18-month project that started in September 2006 in Macedonia.

Besides Tiina Harju, 24 advisers from the Finnish Meteorological Institute, the Finnish Environment Institute, VTT Technical Research Centre of Finland, the Western Finland Environmental Permit Authority, and from the Federal Environmental Agency of Austria are working for the project on a fixed-term basis. The project is headed by Harri Pietarila of the Finnish Meteorological Institute.

The goal of the EU-funded project is to develop the air quality systems of the host country, to make them more compatible

with the requirements laid down in the relevant EU Directives. This improves the country’s potential for acceding to the Union. The ultimate purpose of the project is to improve air quality in the host country by developing systems for the monitoring and management of air quality.

Once the project is completed, Macedonia will have the facilities for assessing emissions and air quality and for reporting on them. Much of the project consists of practical training where the principle is learning by doing.

“We’re developing equipment and practices for measurements and we’re training technical staff on how to carry out, for instance, air quality and emission measurements and chemical analyses of the atmosphere,” says Tiina Harju, listing practical examples.

“In addition, we’ll make plans for developing a system for air quality data collection and we’ll acquire dispersion models for the assessment of air quality. The Macedonian legislation on air quality will also be updated, to make it compatible with EU law.”

# Technical Services create preconditions for first-rate weather services

THE TECHNICAL SERVICES UNIT OF THE FINNISH METEOROLOGICAL INSTITUTE PROVIDES RELIABLE OBSERVATION MATERIAL, WELL-FUNCTIONING INFORMATION SYSTEMS AND ITC INFRASTRUCTURE. BY DOING THIS, TECHNICAL SERVICES CREATES THE PREREQUISITES FOR THE INSTITUTE'S HIGH-QUALITY WEATHER SERVICES AND RESEARCH.

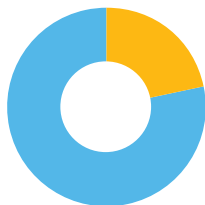
In 2006, the Technical Services launched almost complete automation of observation activities. This is an answer to the growing needs of both internal and external customers to receive more real-time services and to cut costs.

The most important development project was the revision of the weather data production system. Programming of the information system was started in 2006 and the first prototypes for tools were under testing.

The Technical Services exceeded all availability and automation targets set for the unit.

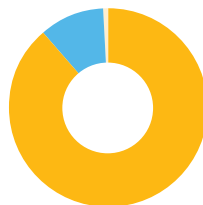
	% in 2006	% in 2005	% in 2004
Reliability of basic weather observation stations	99.2	98.0	98.8
Mean availability of radar systems	99.3	99.3	99.2
Mean availability of satellite systems	98.1	98.0	98.0
Mean availability of information systems	99.6	99.9	99.9

**Technical Services**  
Total Expenditure €10.0 Million



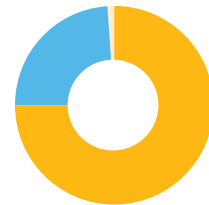
■ Technical Services 10.0  
■ Other Divisions 35.6

**Technical Services**  
150 Person-years



■ Budgetary Funding 133  
■ Earned Revenue 16  
■ External Funding 1

**Technical Services**  
Funding €10.0 Million



■ Budgetary Funding 7.5  
■ Earned Revenue 2.4  
■ External Funding 0.001

## Modernised stations give up-to-date information about rain

THANKS TO ADVANCED TECHNOLOGY, THE FINNISH METEOROLOGICAL INSTITUTE CAN OFFER ITS CUSTOMERS INCREASINGLY ACCURATE OBSERVATIONAL DATA ON RAIN THAT HELP THEM PREPARE, FOR INSTANCE, FOR FLOODS. THE INSTITUTE WILL MODERNISE MANY OF ITS RAIN STATIONS BY THE END OF 2010.

**T**he new, automatic precipitation sensors measure the amount of rain by weighing and express the result in millimeters. The gauges can be used to measure both rain and snow. Besides the amount of rain, the new gauges also reveal the intensity of rain, which could not be defined as accurately before.

“When data from rain stations are combined with information from the radar network, the customer can see how much rain has come better than before,” says Keijo Leminen, Head of Unit, Observation Services.

However, the greatest advantage of automation is probably the real-time transmission of rain data from the automatic station. So far, information has been received only once in 24 hours. In addition, intensity data can be

obtained once a minute, if necessary.

“Our customers use rain data for planning road maintenance, for predicting floods, for community planning and so on. Our task is to convert the customer’s need into practical measures. We accomplish this by using all possible means of observation: rain stations, weather radars and satellites,” Keijo Leminen explains.

Observation stations are serviced once a year. Remote access is also utilised for servicing and for monitoring the condition of equipment. The operation of the new rain sensors must be checked periodically and their water containers must be emptied at least once a year. Automation reduces manual observation work appreciably but increases the need for development and maintenance resources.



*Keijo Leminen presenting an automatic precipitation sensor. Behind, a rain gauge of an old model.*

# A new system to evaluate the accuracy of terminal area forecasts

USING AN APPLICATION PROGRAMMED AT THE INFORMATION SYSTEMS UNIT, AVIATION WEATHER METEOROLOGISTS GET AN EVALUATION OF THE ACCURACY OF THEIR TERMINAL AREA FORECASTS.

A terminal area forecast (TAF) is a standard product of the Aviation Weather Service. It is a weather forecast for the airport of destination and an indispensable help for the pilot when planning the flight.

The evaluation systems in use before were not able to give an evaluation of the accuracy of each individual meteorologist's TAF. In other respects, too, the feedback was considerably more concise.

The software ordered by the Aviation and Military Weather Service from the Information Systems Unit makes it possible to verify each

individual TAF and to give personal feedback to the meteorologist.

"We're now verifying terminal area forecasts made for all Finnish airports and for the largest airports of the Nordic capitals," says Mikael Jokimäki, who works as a designer in the Information Systems Unit.

Verification has also become faster:

"TAFs made for Finnish airports are now verified every day. A meteorologist gets feedback by e-mail on the following day. Before, feedback was received once a month," Mikael Jokimäki explains.

The quantities that are verified are visibility, cloud height, wind

direction and the weather, which refers to weather categories containing certain weather phenomena (e.g. rain, snow, icing and thunder).

"The new verification system gives more understandable and fairer feedback than the previous systems. It improves forecasting practices, thus developing the end product. Verifications can be used to plan training needed by a meteorologist, and they are also a good instrument for communicating with the customer," commends Kari Österberg, team leader of LEN-Vantaa.

*The men behind the programming of TAF verification were Mikael Jokimäki, Viljo Kangasniemi and Klaus Haikarainen of the Information Systems Unit. The idea was conceived and the verification system was planned in the Aviation and Military Weather Service.*



# Thin clients reduce electronic waste

DURING 2006, THE FINNISH METEOROLOGICAL INSTITUTE REPLACED A NUMBER OF ITS CONVENTIONAL WORKSTATIONS WITH THIN CLIENTS. THE REPLACEMENT IS THE INSTITUTE'S ANSWER TO THE STATE ADMINISTRATION'S GOAL OF IMPROVING THE EFFICIENCY OF IT OPERATIONS. OTHER ADVANTAGES INCLUDE BETTER INFORMATION SECURITY AND A REDUCED ENVIRONMENTAL LOAD.

**T**hin clients differ from conventional workstations in that they have no local hard disk. The central processing units are not located on users' desks but on servers. The only thing left on the individual user's desk is a connection point for linking the display, the keyboard and the mouse. The client terminal is small and completely silent. The user notices hardly any difference in normal daily computing.

Because all files are saved in the secure system of the computer room, the users of thin clients need not worry about losing files in the event of equipment failure. Thin clients cost less than normal PCs and also improve information security since all traffic between the server and the terminal is encrypted.

"Computer maintenance has become easier and faster. For instance, program updates only need to be installed on the server instead of numerous workstations," says Ari Pantsar, who works as a planner.

Apart from a smaller workload, the thin client environment reduces waste, power consumption, maintenance and acquisition costs, and noise. "Thin clients are small in size and have a long service life. This means that there's less electronic waste than before," Manager Johan Silén explains, pointing out that thin clients are one concrete way to conserve nature.



*"The introduction of thin clients improves information security and reduces waste," Kimmo Aaltonen, Ari Pantsar, Seppo Tuhkio and Johan Silén point out.*

# International competence in many directions

THE FINNISH METEOROLOGICAL INSTITUTE WANTS TO BE AN ACTIVE PLAYER IN INTERNATIONAL ORGANISATIONS AND RESEARCH COOPERATION, AS WELL AS A WANTED PARTNER AND CONSULTANT IN COOPERATION PROJECTS. THE INSTITUTE ALSO RECRUITS INTERNATIONAL EXPERTS.

## CLOSE COOPERATION IN EUROPE

Cooperation in atmospheric issues is becoming increasingly close in Europe. EUMETNET has started to prepare a joint strategy and wants to define a common policy for advancing European meteorology.

EUMETNET, WMO and ECMWF have hired a joint representative in Brussels to monitor and carry forward issues pertaining to the field of meteorological institutes within the EU. Alongside enlargement of the European Union, the cooperation and financial bases of the meteorological organisations, EUMETNET, EUMETSAT and ECMWF, are expanding.

The Finnish Meteorological Institute takes an active part in work done in international organisations. For instance, the FMI is involved in almost all of EUMETNET's programmes and is responsible for leading the training programme EUMETCAL until 2011. Responsibility for leading the radar programme OPERA ended in 2006. Within EUMETSAT, the FMI has representatives, for instance, as Vice chairperson of the Scientific and Technical Working Group and as Coordinator of the Centre of Excellence for Atmospheric Chemistry. Within ECMWF, the FMI has a representative serving as Chairperson of the Technical Advisory Committee, and an FMI representative was elected, on personal merits, into the Scientific Advisory Commit-

tee in autumn. Within WMO, the FMI has an expert in every commission, and two Finns are working at the WMO Secretariat in Geneva.

## CONSULTANCY AND COOPERATION

The Finnish Meteorological Institute has several cooperation projects with its sister organisations, for instance, in Estonia, Poland, Russia, Romania and Croatia. The Institute is engaged in research cooperation with several countries, including Argentina, China, India, Russia and the USA. With Argentinians, the Institute has conducted ozone soundings at the Marambio station on the Antarctica since 1988. The long time series obtained of the sounding results are valuable, for instance, when studying the impact of climate change on the development of ozone.

The Finnish Meteorological Institute has carried out development and consultancy projects for over 20 years in about 50 countries. The projects under way at present include meteorological consulting, air quality surveys and training services, for example, in Lithuania, Macedonia, Russia and Uruguay.

## INTERNATIONAL ORGANISATIONS IN THE ATMOSPHERIC SECTOR

Weather services, warning methods and observation practices are examples of the topics developed in international cooperation. The World Meteorological Organization (WMO) is a specialised agency of the United Nations in issues concerning the weather, the climate and water. EUMETNET serves as a cooperation network between national meteorological services in Europe. Nordic cooperation is carried out, for instance, within NORDMET. Representatives of the Baltic and Nordic countries have formed the BALTMET cooperation network, which held its annual meeting at the Finnish Meteorological Institute in autumn 2006. EUMETSAT, or the European Organisation for the Exploitation of Meteorological Satellites, is an intergovernmental organisation that designs and operates meteorological satellite systems. The European Centre for Medium-Range Weather Forecasts (ECMWF) develops and produces numerical weather forecasts covering a period up to 30 days.



*The Finnish Meteorological Institute serves as a consultant when air quality monitoring is started at the Bothnia pulp mill in Uruguay. The Institute's experts have assisted in the acquisition of equipment for air quality and sounding measurements, have drawn up plans for measurements and quality assurance, and have trained local experts.*

# MetOp improves weather forecasts

THE FIRST EUROPEAN POLAR-ORBITING METEOROLOGICAL SATELLITE, METOP, WAS LAUNCHED INTO SPACE IN OCTOBER 2006. METOP IS EXPECTED TO RENEW THE WAYS IN WHICH THE WEATHER, THE CLIMATE AND THE ENVIRONMENT ARE OBSERVED ESPECIALLY AT THE HIGHEST LATITUDES AND ABOVE SEAS.

**M**etOp sends data to the Earth from an altitude of about 850 kilometres. The accuracy of the images is considerably better than that of images obtained from satellites observing the Earth from an altitude of 36,000 kilometres above the equator.

MetOp provides new observational data for weather prediction models from areas that are generally not covered very well by weather observation systems, such as polar areas and oceans. A clear improvement is promised for weather observations in the marine areas of the southern hemisphere, but forecasts concerning the northern hemisphere will also gain more accuracy.

The instruments on MetOp provide information, for instance, on

atmospheric chemistry and make it possible both to continue and to develop the monitoring of the ozone hole over polar areas. In addition, meteorological satellites are used in many practical applications, such as interpreting snowy regions and locating forest fires.

The MetOp satellite was developed in cooperation by EUMETSAT and the European Space Agency ESA. The satellite carries altogether 11 instruments. Besides EUMETSAT and ESA, instruments were provided by the French Space Agency (CNES) and the National Oceanic and Atmospheric Administration (NOAA) of the USA.

With the MetOp programme, Europe shoulders some of the

responsibility for the operation of polar-orbiting meteorological satellites, which so far have been operated by the USA alone.

## **EXPERTS ON METEOROLOGICAL SATELLITES MET IN HELSINKI**

The Finnish Meteorological Institute and EUMETSAT arranged a conference on meteorological satellites in Helsinki in June 2006. Owing to the new MetOp satellite, special attention was paid to meteorology in polar regions.

The operators of all meteorological satellites assembled in Helsinki to report on their own satellite programmes. In all, about 240 participants from 34 countries attended the conference.



*The first European polar-orbiting meteorological satellite, MetOp, was launched into space in October 2006 from the Baikonur Cosmodrome in Kazakhstan.*

## Know-how from abroad

IN LINE WITH ITS STRATEGIC GOALS, THE FINNISH METEOROLOGICAL INSTITUTE RECRUITS LEADING INTERNATIONAL EXPERTS. DAVID SCHULTZ'S SPECIAL FIELD IS MESOSCALE METEOROLOGY.

**D**avid Schultz came to Finland from the University of Oklahoma and the NOAA National Severe Storms Laboratory (NSSL) to the post of Research Professor shared by the University of Helsinki, the Finnish Meteorological Institute, and Vaisala. While at NSSL, Schultz helped develop methods to improve understanding and prediction of severe weather conditions.

Schultz says that he is in Finland primarily for two reasons: snow storms and radars. Snow storms are more common in Finland than in Oklahoma, and the roof of the university building in Kumpula has a polarimetric radar for studying the physics of clouds carrying snow and sleet. The radar is an excellent tool for doing research on the micro-physics of clouds.

"In the end, my job is to support the development of forecasts and the associated basic research," Schultz explains. Concentrating on weather fronts and working with forecasters, he leads these research efforts to improve forecasting methods for extreme events in Finland.



*Besides David Schultz pictured here, the Finnish Meteorological Institute has three other research professors from abroad. They are boundary layer physicist Sergey S. Zilitinkevich, aerosol researcher Douglas Worsnop, and earth observation researcher Gerrit DeLeeuw. In all, about 15 people from abroad are working at the Institute.*

# Administration meets challenges posed by the operating environment

THE ADMINISTRATION OF THE FINNISH METEOROLOGICAL INSTITUTE IS RESPONSIBLE FOR PROVIDING SERVICES IN THE SECTORS OF FINANCES, HUMAN RESOURCES, PERSONNEL DEVELOPMENT AND PROPERTY. ADMINISTRATION WORKS TO MEET THE CHALLENGES POSED BY THE INSTITUTE'S STRATEGY, BY CHANGES IN THE OPERATING ENVIRONMENT AND BY THE DIVERSITY OF OPERATIONS.

## TRAINING AND SUPPORT FOR WELLBEING

The Finnish Meteorological Institute uses different types of programmes to support personnel development. The Supervisor Academy arranged for new group supervisors in 2006 was already the third of its kind, whereas a Secretary Academy was arranged now for the first time.

A similar programme for experts will be launched in spring 2007. Training is also provided in the Institute's own substance field: the two-year HydMet programme on hydrology and meteorology was completed in 2006, while the meteorological PD programme continued.

Well being at work is promoted by means of services provided by an occupational psychologist. Apart

from counselling at work, the services are used to solve and prevent problems in advance.

A results-based bonus scheme is currently under testing at the Finnish Meteorological Institute. The first bonuses by virtue of the scheme were paid in 2006. Altogether 31 applications were received, of which 11 were approved. Bonuses were paid to a total of 126 persons.

The contents of the Institute's current jobs and the needs to develop the wage system are being reviewed in a working group.

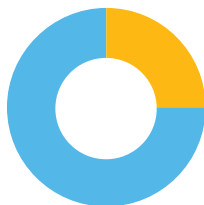
Electronic systems have been developed in both human resources and financial administration. For instance, all bookkeeping processes and the filing of financial material have been transferred to an

electronic system. The cost accounting system built on activity-based accounting also underwent a complete revision, the purpose being to serve the Institute's expanding information needs even better. The adoption of electronic processes has raised the cost-effectiveness of financial administration to an excellent level.

The Finnish Meteorological Institute and the Finnish Institute of Marine Research moved to the new Dynamicum office building in autumn 2005. The Property Services Group of the Finnish Meteorological Institute is responsible for property-related services for both institutes. In 2006, the group's operations focused on the adoption of new property engineering systems and on the development of operating routines.

### Administration and Director's General Office

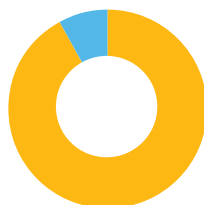
Total Expenditure €11.5 Million \*



Administration 11.5  
Other Divisions 34.0

### Administration and Director's General Office

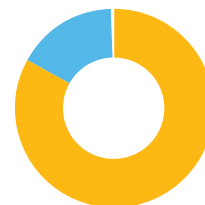
50 Person-years



Budgetary Funding 46  
Earned Revenue 4

### Administration and Director's General Office

Funding €11.5 Million



Budgetary Funding 9.6  
Earned Revenue 1.9  
External Funding 0.05

\* Share of the international membership fees €4.1 Million

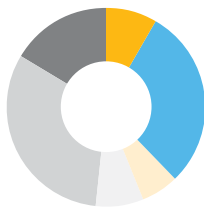
# The Finnish Meteorological Institute is a community of experts

At the end of 2006, the Finnish Meteorological Institute had 610 employees (599 in 2005). This figure includes part-time employees and the employees hired with the help of outside funding. Budgeted funding cov-

ered the expenses of a full-time equivalent staff of 404 (404), while revenues from commercial operations and other outside funding covered the expenses of a full-time equivalent staff of 179 (167).

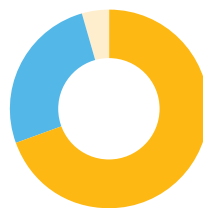
In 2006, altogether 310 Institute employees worked in the capacity of experts (311 in 2005). In all, 56 per cent (55) of the personnel have an academic degree; of them, 16.2 per cent (15) have a postgraduate degree.

## Breakdown of the Personnel's Education



## Staffing in Person-years

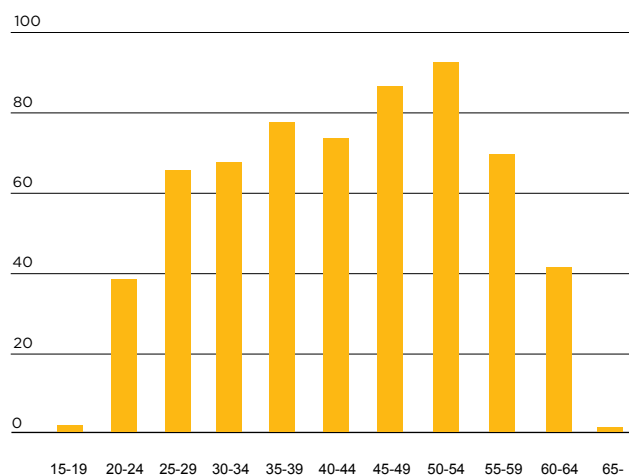
The Whole Institute 583



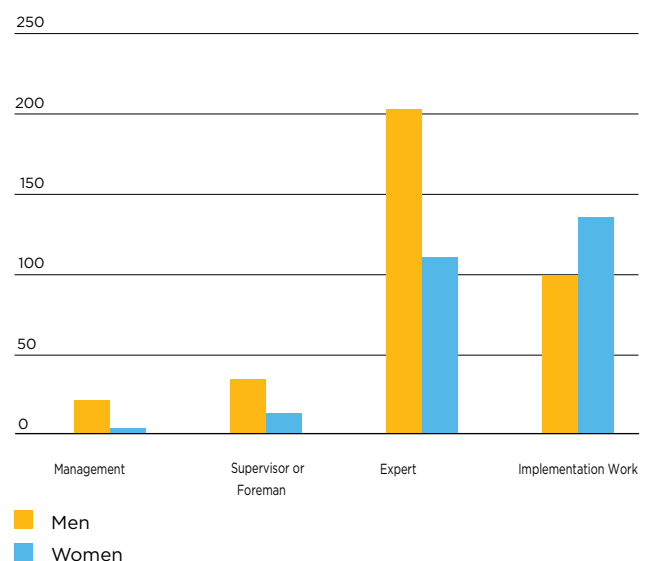
General Education	8.5
Secondary Level	29.3
Lowest Post-Secondary	6.2
Lowest Tertiary	7.9
Higher Tertiary	31.9
Doctoral and Licentiate's Degree	16.2

Budgetary Funding	404
Earned Revenue	152
External Funding	25

## Breakdown of the Personnel by Age Brackets (Number of Persons)



## Gender Breakdown by Personnel Groups (Number of Persons)



# Positive trend in job satisfaction continued

THE FINNISH METEOROLOGICAL INSTITUTE FOLLOWS TRENDS IN THE PERSONNEL'S JOB SATISFACTION BY MEANS OF ANNUAL SURVEYS. THE RESULTS ARE USED IN DEVELOPMENT OF THE WORK ORGANISATION AND ITS PRACTICES. THE INSTITUTE'S AVERAGE LEVEL OF JOB SATISFACTION CONTINUED TO RISE IN 2006. ON A SCALE OF 1-5, THE INDEX DESCRIBING OVERALL SATISFACTION WAS 3.55 (3.46 IN 2005).

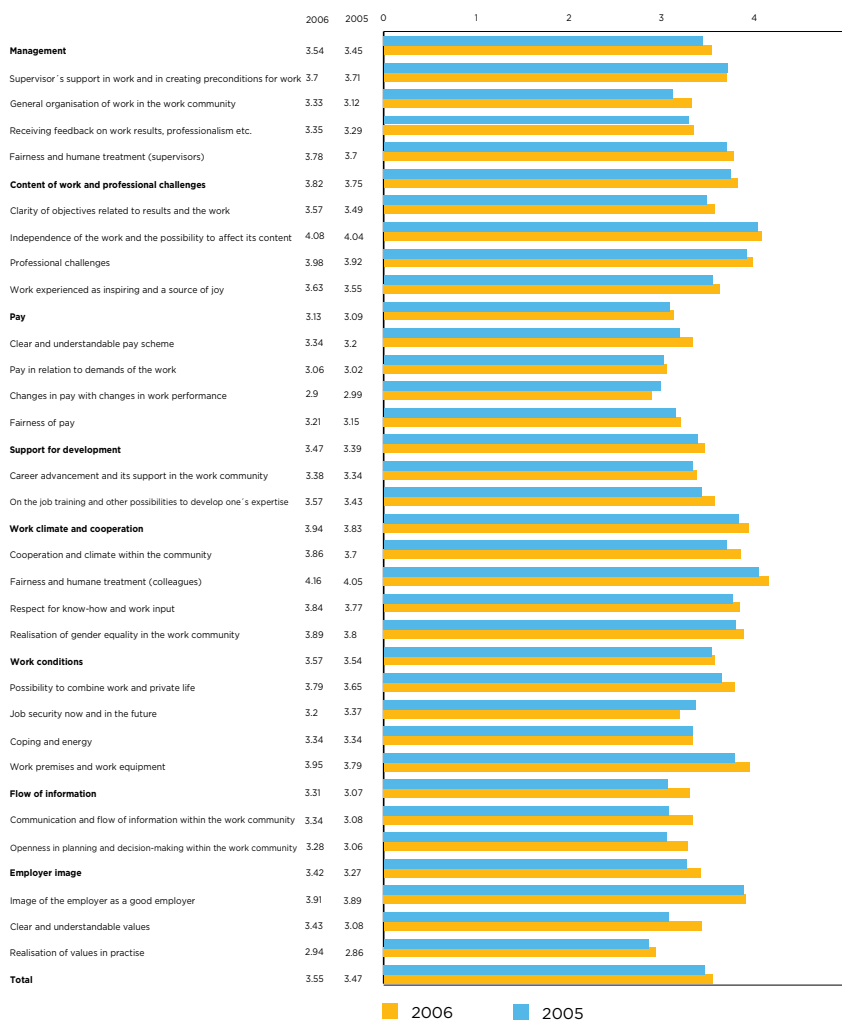
When compared against the previous year, job satisfaction increased in nearly all areas measured. The highest grades were given for content of work and challenges. Within this group, respondents were particularly satisfied with the independence of work and with professional challenges. The strongest positive trends were measured in the areas of management, flow of information and employer image. The grades given for the organization of work and for clear and understandable values improved the most.

Job security and changes in pay with changes in work performance received somewhat lower grades than the year before.

"The main underlying factors are probably the measures taken generally in state administration for improving efficiency, and the concern that this has aroused," comments Jaana Palmunoksa, Administration Manager. "Fixed-term contracts and the changes and efficiency improvement pressures that affected respondents' own work also caused apprehension," explains Palmunoksa, summing up targets for development.

The Finnish Meteorological Institute also participated in the survey "Great place to work". In the series of public, non-profit organisations, the Institute ranked second among roughly ten contestants.

## Job Satisfaction 2006



## Secretaries – experts in their own fields

THE SECRETARY ACADEMY OF THE FINNISH METEOROLOGICAL INSTITUTE DISTRIBUTES IN-HOUSE INFORMATION. ANOTHER OBJECTIVE FOR THE ACADEMY IS TO DEVELOP SECRETARIES' EXPERTISE SO THAT THEY CAN MEET THE CHANGING NEEDS OF THE ORGANISATION MORE EFFICIENTLY.

"People working in secretarial duties are a heterogeneous group. The Institute's new office premises gave us an excellent opportunity to develop secretaries' job descriptions and cooperation practices further," says Niia Fortelius, Secretary of the Research and Development Unit. Together with Executive Assistant Joanna Saarinen, she was largely responsible for planning and implementing the content of the Secretary Academy.

"Technological advances and automation bring changes to secretaries' work. They also open up new challenges for steering and developing the work. Challenges in the operating environment and their impact on activities should be seen as an opportunity for creating new practices and for upgrading professional skills," Joanna Saarinen explains.

"Sharing knowledge and best practices requires that people are

aware of the secretary's various roles and the fields of expertise they require. This also means the distribution of information so that people know who to approach when looking for particular skills. Skills cannot be shared without the necessary interaction channels and a common will and motivation," Joanna Saarinen stresses.

"We believe that a joint discussion forum is the best positive answer to development needs. In other words, we also needed a tool for promoting change," Niia Fortelius adds.

The Finnish Meteorological Institute had already arranged an academy for supervisors, and so the training organisation had a more or less finished concept to offer. There were also similarities between the contents of the programmes; after all, secretarial services are an important tool in the management process. The topics discussed

during the course included personnel issues, communications, internationalisation, the importance of networking, and project economy. The concept was designed to provide targeted training that would be tailored to the needs of the FMI organisation.

In future, half-day training sessions on topical themes will be arranged for secretaries once every few months. The purpose is also to motivate everyone to develop their own work actively.

The programme leaders think that the Secretary Academy has clearly improved interaction among secretaries.

"The atmosphere is freer than before, and there is more interaction. We have competence, valuable special skills, that should be shared. We can get much from one another," Niia Fortelius believes.



*Joanna Saarinen, Niia Fortelius and Carola Sundius were responsible for the planning and implementation of Secretary Academy's contents.*

# Expertise. Courage. Fair play.

## New values put into practice

THE FINNISH METEOROLOGICAL INSTITUTE'S OPERATIONS ARE BASED ON EXPERTISE, COURAGE AND FAIR PLAY. THE NEW VALUES HAVE BEEN DEFINED SO AS TO HAVE A CLEAR PRACTICAL LINK TO DAILY WORK.

**T**he new values were created in interaction with the personnel. The process started already in November 2005.

Each employee had the opportunity to take part in a value group that discussed what kind of values the Institute wants to promote. In all, about 100 staff members participated in value discussions," says Hanna Wasara, the planner who led the project.

After the discussions, the values were determined at a value seminar where each discussion group was

represented. In the final stage, the values were polished to obtain their final form.

The goal of the value process was to produce a broad view of the values guiding the Finnish Meteorological Institute's operations. It is hoped that the values reflect the type of work appreciated at the Institute. The purpose was to have an explicit link to activities and results.

"The values assist us in both strategic and everyday choices, and provide answers to the question of

how we all should respond to the constant challenges we face in our work," Hanna Wasara explains.

The Finnish Meteorological Institute's value atmosphere is summarised as a forecast:

"The prevailing strong expertise will gain even more strength throughout the Institute. New winds are expected to gather with brave and frank attitudes to work. High pressure on demand and gusts of creativity give rise to frequent scientific breakthroughs and services that meet people's wishes."

# Finances

## OPERATING ENVIRONMENT

The Finnish Meteorological Institute's stakeholders include the authorities, industry, universities and research institutes, cooperation partners abroad, international organisations and private individuals. Allocations from the State Budget cover 63 per cent of the Institute's expenses. Revenues from commercial operations and outside research funding account for an ever increasing share of total funding. Close cooperation with the University of Helsinki and the Finnish Institute of Marine Research provides good opportunities for effective work.

Business operations were separated from the Institute's other functions and were carried out by the Customer Services profit centre, which purchased services from the Institute's basic functions at cost price. In addition, expert services were produced on commercial grounds within the Research unit.

A good amount of project financing from both Finland and abroad was secured for research in the Institute's focal areas, which are the weather and safety, climate change and adaptation to it, the impact of the atmosphere on the environment and on people, and space and atmospheres. The principal sources of external funding were the Academy of Finland, Tekes, the European Commission, the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), and the European Space Agency.

## FINANCING AND COSTS

The Institute's total expenditure amounted to EUR 45.54 million, or EUR 2.6 million less than the year before. The difference is explained by the investments made in the Institute's new premises and by the moving costs incurred in 2005. The expenditure was covered as follows:

income from operations, EUR 15.52 million (34%); direct outside funding, EUR 1.52 million (3%); and allocations from the State Budget, EUR 28.50 million (63%).

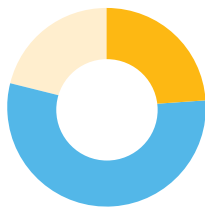
Revenues from commercial operations increased by EUR 2.26 million on the previous year. The income proper from commercial services came to EUR 11.16 million, while income from jointly funded research totalled EUR 4.27 million.

The Institute's expenses were monitored by means of an activity-based costing system. In the cost structure, the share of payroll costs fell to 56 per cent of total expenses. The share of operating costs rose to 38 per cent and the share of capital costs to six per cent of total expenses. In all, the Institute's expenses rose by six per cent on the previous year.

Commercial services yielded a deficit of 1.2 per cent. The expenditure recovery of cost-priced public services improved on the figure in 2005.

### Total Revenue by Sector

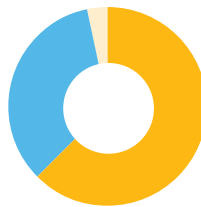
€15.5 Million



Public Sector	€3.7 Million	24%
Business	€8.5 Million	55%
Other	€3.3 Million	21%

### Funding

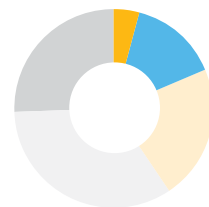
€45.6 Million



Budgetary Funding	€28.5 Million	62%
Earned Revenue	€15.6 Million	34%
External Funding	€1.5 Million	3%

### Total Revenue from Fee-based Operations by Sector

€45.6 Million



Customer Services	€2.0 Million	4%
Weather Service	€6.6 Million	14%
Technical Services	€10.0 Million	22%
Research	€15.4 Million	34%
Administration	€11.6 Million	25%

## REVIEW OF THE FINANCIAL STATEMENTS

The Income and Expense Account describes the structure of the Institute's revenues and expenses, excluding the allocations from the State Budget. Revenues from operations increased by EUR 2.12 million on the previous year; increases were recorded in revenues from both commercial and other operations.

Expenditure arising from activities rose by EUR 2.49 million on the previous year. The greatest increases were recorded in personnel expenses, rents and in purchase of supplies.

Total depreciation increased slightly on 2005. The depreciation method used by the Institute was straight-line depreciation according to economic service life; the write-off periods ranged from 3 to 10 years. The balance sheet value of fixed assets and other long-term investments fell from EUR 9.72 million to EUR 8.63 million. The balance sheet value of current assets and inventories decreased to EUR 2.67 million. The balance sheet total fell from EUR 12.972 million in 2005 to EUR 11.299 million.

Revenue, € Thousand	2005	2006	Share, 2006
Commercial Services	9 063	11 156	72%
Jointly Funded Research	4 216	4 266	27%
Other	1 250	98	1%
<b>TOTAL</b>	<b>14 529</b>	<b>15 520</b>	<b>100%</b>

Expenditure, € Thousand	2005	2006	Share, 2006
Salaries	25 848	25 762	57%
Operating Expenditure	16 995	17 742	39%
Investment	5 824	2 049	4%
<b>TOTAL</b>	<b>48 667</b>	<b>45 553</b>	<b>100%</b>

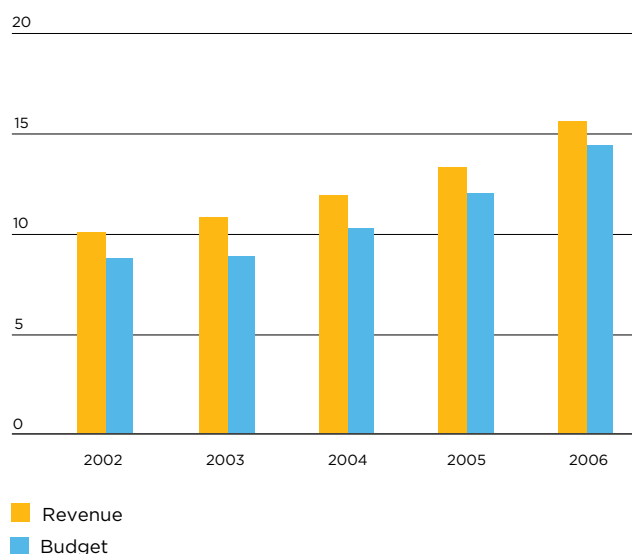
Costs, € Thousand	2005	2006	Share, 2006
Salaries	25 493	25 981	56%
Operating Costs	16 249	17 905	38%
Capital Costs	2 610	3 004	6%
<b>TOTAL</b>	<b>44 352</b>	<b>46 890</b>	<b>100%</b>

Extraordinary income decreased by EUR 0.131 million. The change was mainly caused by a decrease in the share of Russia's debt conversion.

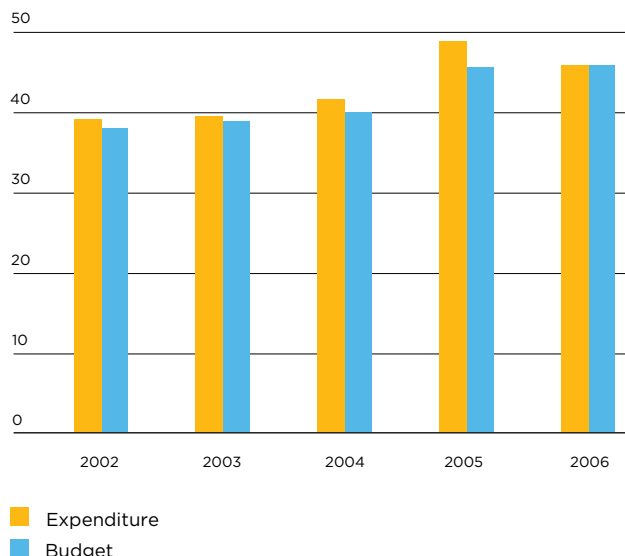
Overall, the deficit for the financial period increased by EUR 0.122 million on 2005. The change stemmed from the above-mentioned factors: increase in revenues

from operations (effect on the deficit EUR +2.12 million); increase in expenses (effect EUR -2.49 million); decrease in extraordinary income (effect EUR -0.13 million); decrease in transferred income (effect EUR -0.5 million); and VAT adjustments (effect EUR -0.88 million).

Revenue Trends (€ Million)



Expenditure Trends (€ Million)



# Income and expense account 2006

	1.1.2006 - 31.12.2006		1.1.2005 - 31.12.2005	
<b>Operating income</b>				
Income from fee-based operations	11 122 306.72		9 040 185.60	
Rents and compensation for use	43 500.06		15 728.60	
Other income from operations	4 750 819.50	15 916 626.28	4 740 360.60	13 796 274.80
<b>Operating expenses</b>				
Materials, supplies and goods				
Purchases during the year	2 979 066.98		1 748 162.86	
Personnel costs	25 991 991.84		25 536 256.02	
Rents	3 171 157.34		2 599 617.31	
Purchased services	6 222 096.66		6 251 611.05	
Other expenses	5 802 363.32		6 088 081.60	
Depreciation	2 793 326.85		2 417 589.00	
Adjustement to internal expenses	318 906.72	-47 278 909.71	144 384.32	-44 785 702.16
<b>Surplus I</b>		-31 362 283.43		-30 989 427.36
<b>Financial income and expenses</b>				
Financial income	2 212.73		1 506.54	
Financial expenses	-3 501.22	-1 288.49	-2 404.88	-898.34
<b>Extraordinary income and expenses</b>				
Extraordinary income	272 276.65		403 125.49	
Extraordinary expenses	0.00	272 276.65	-1 511.41	401 614.08
<b>Surplus II</b>		-31 091 295.27		-30 588 711.62
<b>Income and expenses from payment transfers</b>				
Income				
Other foreign income	0.00	0.00	500 000.00	500 000.00
Expenses				
Other foreign expenses	0.00	0.00	-4 647.31	-4 647.31
<b>Surplus III</b>		-31 091 295.27		-30 093 358.93
<b>Income from taxes and obligatory expenses</b>				
Value added tax collected	2 037 316.52		1 701 499.97	
Value added tax paid	-2 718 611.07	-681 294.55	-3 258 676.71	-1 557 176.74
<b>Surplus for the financial period</b>		-31 772 589.82		-31 650 535.67

# Assets 2006

	31.12.2006		31.12.2005	
<b>ASSETS</b>				
<b>FIXED ASSETS AND OTHER NON-CURRENT INVESTMENTS</b>				
<b>IMMATERIAL ASSETS</b>				
Immaterial rights	92 153.91		161 837.86	
Other non-current expenditure	3 528.95		58 676.95	
Prepayments and acquisitions in progress	29 406.00	125 088.86	0.00	220 514.81
<b>MATERIAL ASSETS</b>				
Structures	107 740.83		125 821.83	
Machinery and equipment	7 106 655.88		8 084 043.58	
Fixtures and furnishings	1 172 658.67		1 250 992.47	
Other material assets	3 385.90		4 589.90	
Prepayments and acquisitions in progress	99 439.31	8 489 880.59	0.00	9 465 447.78
<b>SECURITIES HELD IN FIXED ASSETS AND OTHER NON-CURRENT INVESTMENTS</b>				
Securities held in fixed assets	15 467.00	15 467.00	29 441.00	29 441.00
<b>TOTAL</b>	<b>8 630 436.45</b>		<b>9 715 403.59</b>	
<b>STOCK AND FINANCIAL ASSETS</b>				
<b>CURRENT RECEIVABLES</b>				
Trade receivables	2 248 954.55		2 618 623.44	
Prepaid expenses and other accrued income	295 452.90		598 585.97	
Other current receivables	112 445.92		29 705.28	
Prepayments	11 685.82	2 668 539.19	7 854.04	3 254 768.73
<b>CASH, BANK RECEIVABLES AND OTHER MONIES</b>				
Cash accounts	517.95	517.95	1 880.60	1 880.60
<b>TOTAL</b>	<b>2 669 057.14</b>		<b>3 256 649.33</b>	
<b>TOTAL ASSETS</b>	<b>11 299 493.59</b>		<b>12 972 052.92</b>	
<b>LIABILITIES</b>				
<b>EQUITY CAPITAL</b>				
<b>STATE CAPITAL</b>				
State capital 1.1.1998	5 439 282.69		5 439 282.69	
Change in capital for previous financial periods	-1 222 584.85		-4 500 548.65	
Transfer of capital	30 416 003.56		34 928 499.47	
Surplus/deficit for the financial period	-31 772 589.82	2 860 111.58	-31 650 535.67	4 216 697.84
<b>CREDITORS</b>				
<b>CURRENT</b>				
Advanced received	1 519 327.16		1 224 908.33	
Trade payables	1 272 230.15		1 937 018.82	
Transactions between accounting offices	546 784.21		580 931.69	
Items to be forwarded for payment	399 482.36		406 209.59	
Accrued liabilities	4 349 397.68		4 139 353.08	
Other current liabilities	352 160.45	8 439 382.01	466 933.57	8 755 355.08
<b>TOTAL</b>	<b>8 439 382.01</b>		<b>8 755 355.08</b>	
<b>TOTAL LIABILITIES</b>	<b>11 299 493.59</b>		<b>12 972 052.92</b>	

# Vision

**The Finnish Meteorological Institute  
- Cutting-edge expertise in European atmospheric  
know-how**

# Mission Statement

**The Finnish Meteorological Institute produces high-quality observational data and research findings on the atmosphere. The institute uses its expertise effectively to provide first-rate services benefiting people and the environment.**

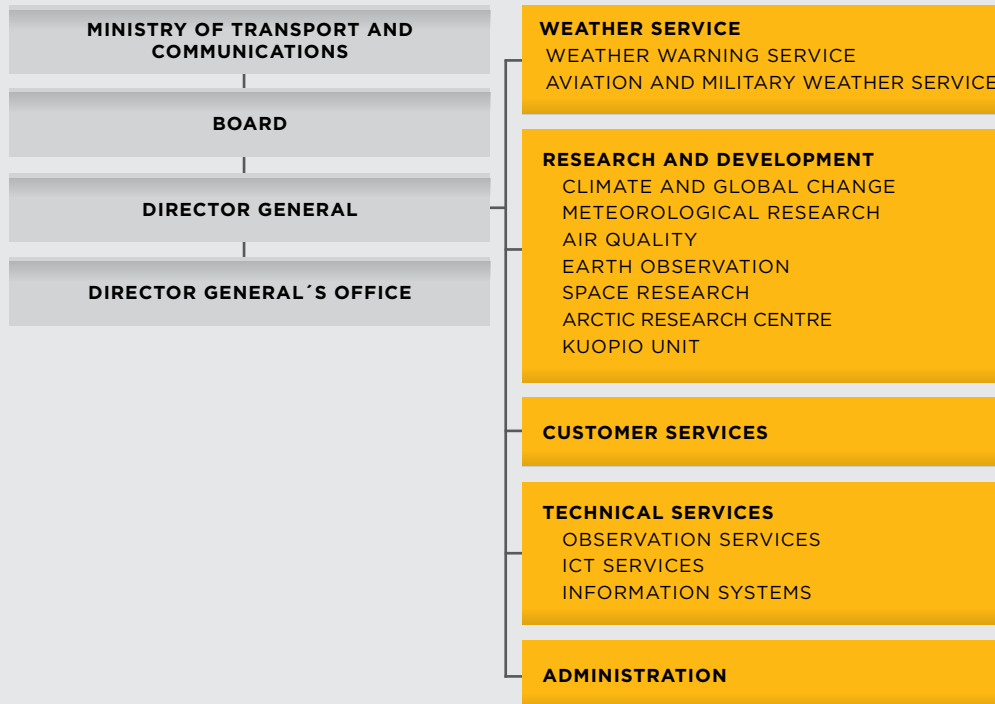
## **The Finnish Meteorological Institute**

- observes the physical state, chemical composition and electromagnetic phenomena of the atmosphere
- produces information about the past, present and future states of the atmosphere
- conducts high-standard research in the fields of meteorology, air quality, space physics, earth observation and geomagnetism
- 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
- foresees changes and responds quickly to changes in the environment and to changing expectations.

## **Strategic Goals 2008–2011**

- 1) Overall productivity will have increased 10% by the end of the period.
- 2) By means of partnerships, the Institute will become an important player in Europe.
- 3) New methods and services will be put to use to assess and minimise the harmful effects of natural phenomena.
- 4) The importance of the Finnish Meteorological Institute will continue to rise, aided by constantly developing and motivated personnel.

# Organisation 1.1.2007



## Board 1.1.2007



*Back row, from the left: Marko Viljanen, Joanna Saarinen, Veijo Mäkelä, Pekka Plathan, Sakari Karjalainen and Markku Kulmala. Sitting in the front, from the left: Outi Berghäll, Marja Happonen, Pentti Partanen, Reetta Meriläinen and Sabina Lindström.*

Director-General

**Pentti Partanen**  
Ministry of Interior  
Department for Rescue Services  
Chairman

Director

**Sabina Lindström**  
Ministry of Transport and  
Communications  
Vice Chairman

Director

**Outi Berghäll**  
Ministry of the Environment

Director

**Sakari Karjalainen**  
Ministry of Education

Academy Professor

**Markku Kulmala**  
University of Helsinki  
Department of Physical Sciences

Editor-in-Chief

**Reetta Meriläinen**  
Helsingin Sanomat, News

Director, Human Resources

**Marja Happonen**  
Vaisala Oyj

Senior System Analyst

**Veijo Mäkelä**  
Finnish Meteorological  
Institute  
Representative of the  
personnel

# Management Group 1.1.2007



Back row, from the left: Marko Viljanen, Mikko Alestalo, Veijo Mäkelä, Vesa Kurki and Martti Heikinheimo. Front row, from the left: Joanna Saarinen, Kristiina Soini, Pekka Plathan, Eeva-Kaisa Heikura and Jaana Palmunoksa.

Director General  
**Pekka Plathan**

Director General Petteri Taalas  
on leave of absence 1.1.2006 - 31.10.2007

Deputy Director General  
**Mikko Alestalo**

Director  
**Martti Heikinheimo**  
Weather Service

Director  
**Yrjö Viisanen**  
Research

Director  
**Kristiina Soini**  
Technical Services

Director  
**Marko Viljanen**  
Administration

Director  
**Vesa Kurki**  
(Invited expert)  
Customer Service

Administration Manager  
**Jaana Palmunoksa**  
(Invited expert)  
Administration

Communications Manager  
**Eeva-Kaisa Heikura**  
Communications

Senior System Analyst  
**Veijo Mäkelä**  
Representative of the  
personnel

Executive Assistant  
**Joanna Saarinen**  
Secretary

