

2016  
SUMMARY ANNUAL REPORT  
SWEDISH  
METEOROLOGICAL  
AND  
HYDROLOGICAL  
INSTITUTE

**SMHI**

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# DIRECTOR GENERAL'S OUTLOOK

2016 may go down in history as the year of the unexpected, at least in the world political arena. The major and relatively unexpected events in the world around us may also affect SMHI and our operations. One could say that the common denominator in the outcomes of both the Brexit vote and the US presidential election is that the majority who voted wanted less focus on international cooperation and more focus on national interests. In the aftermath of the US presidential election, the country may be forging a path where the climate issue is not taken as seriously as it should be.

The trend of turning inwards and focusing on the domestic affairs is contrary to the global Sustainable Development Goals set by the UN and summarised in Agenda 2030. These goals instead highlight the need to work together to resolve major global challenges. This applies in particular to the climate area, where both emission reductions and adaptation measures are best done by countries working together. During the year, SMHI, like other Swedish authorities, reviewed how we already contribute to Agenda 2030 in Sweden and internationally. We see that our knowledge can contribute even more to achieving many of the global Sustainable Development Goals. Our knowledge and specific services can not only contribute to national climate and environmental work, but also to international development cooperation.

In 2016, SMHI worked with its vision for the future, SMHI 2025, which, among other things, resulted in us defining sustainability as our overall offering and realising that we can call ourselves a Swedish authority with a global perspective. This direction is in line with the work of Agenda 2030 and our Government's intention for Sweden to be best in implementing Agenda 2030. SMHI's operations are generally borderless, since we work with disciplines where cross-border effects are common, such as meteorology, hydrology, oceanography and climate.

The work with our vision SMHI 2025 has given us the opportunity to define the key factors that affect us, make significant choices as to how to go forward, and point to some of SMHI's most important areas to work with both today and in the future. In the spring, we gathered all of our employees on a number of occasions to present and discuss the 2025 work.

One area of major importance to SMHI is the ongoing digitalisation of society. During the year, we worked more

to find our role in the digital future. We are one of the authorities with the most experience in working with big data, and that is most dependent on continuously working to develop products and services based on our data. We have long been active in the development of digital services in our competence areas, and in conveying information and knowledge in digital channels both to the public, decision-makers and specialists. This has given us a great deal of experience and taught us important lessons. We see great opportunities for us in a digital future, although we also see great challenges in the changes that digitalisation will bring to society.

A significant portion of our data comes from satellites. In January, a rocket went up with a new European satellite called Jason-3. This satellite will, for example, measure the water level in the seas with a high degree of accuracy, which is important for SMHI's analyses of future sea levels. The information is also important for the marine service within the European cooperation Copernicus.

Each day, SMHI contributes to developing solid material for citizens, the Government, local governments, municipalities and companies. To do this, we collect 7.2 million meteorological observations per day, which equals 2.6 billion measurement values per year. We currently store about 11.4 petabytes (11,400 terabytes) of data.

We also have long time series of observations. One example is that we have 10.4 million measurement values from about 50,000 sites that describe the condition of the Swedish marine environment from 1893 to today.

During the year, the European Centre for Medium-Range Weather Forecasts (ECMWF) launched a new model with increased resolution, including improvements to several of the model's parameters. Each improvement to the ECMWF model gives SMHI greater ability to produce better weather forecasts with our own model – all with the aim of increasing safety in society and reducing vulnerability, particularly as regards to extreme weather conditions.

At the end of the year, the Nordic and Baltic meteorological institutes took further formal steps towards the possibility of combining resources to increase efficiency and quality. As our societies are vulnerable to extreme weather conditions, this cooperation makes us all better equipped to give the public, authorities and companies services of the highest quality even in the future.

SMHI's employees are the foundation for our ability of working efficiently and developing our offerings. A scientific approach and an innovative approach are factors that characterise us and enable us to deliver high quality. Being a well-functioning workplace with good communications and effective digital work tools paves the way for this. For example, during the year we conducted pilot projects related to the next generation of digital workplace and tools



that can help us in our daily work going forward. I am also proud that we were given a top ranking in the Gender Equality Index (JÄMIX) for our work with gender equality issues. During the year, the Government decided to clarify the instructions for SMHI's research activities and allowed us to hire professors in our areas of activity. This creates opportunities for us to further strengthen our scientific expertise.

Adaptation to climate change is one of the most important issues for both Swedish society and other countries. We must reduce greenhouse gas emissions while preparing and protecting ourselves and economic values from extreme weather conditions, for example. During the year, the Government decided to change SMHI's instructions to specify that SMHI is to run the Swedish National Knowledge Centre for Climate Change

Adaptation. We have also noted an increased demand for decision-making data in this area.

SMHI's financial results for 2016 were negative, and for the first time in many years we were forced to tap into our additional funding. The result is partly due to the fact that during the year the Government took SEK 6 million from SMHI's base funding grant to finance Sweden's fee for the European weather satellite cooperation Eumetsat. The accumulated results of the fee-based operations are developing positively, mainly due to a surplus in commissioned operations. Both aviation meteorology services and assignments for government authorities indicate a balanced economy. Business activities, including service exports, show a weakly negative result. Work to ensure a long-term sustainable economy for all of SMHI will continue in 2017.



Rolf Brennerfelt  
Director General

# CORE SERVICES

The core services department manages the meteorological, climatological, hydrological and oceanographic infrastructure in Sweden. Operations include everything from measuring and collecting data to calculating, storing and processing data. The data then becomes statistics and information that serves as the basis for calculations important to society, for example analyses for achieving national environmental quality goals. Delivering decision-making data that contributes to a sustainable society is the key. Forecasting and warning operations have a direct impact on the vulnerability of society. Work with climate change adaptation is important to society both now and for the future, and has taken on even greater importance in recent years. The work includes compiling and communicating information and knowledge. Cooperation with other authorities and institutes is very important, both nationally and internationally. Since 2013, SMHI has been designated as the national provider of aviation meteorology services, and its work is moving towards greater cooperation, particularly in Northern Europe. The department also manages SMHI's role in representing Sweden in international organisations, such as the European Centre for Medium-Range Weather Forecasts (ECMWF), the World Meteorological Organization (WMO) and the European weather satellite cooperation Eumetsat. SMHI's expert competence is requested in connection with referrals and also by other authorities. Within its assignment operations, SMHI develops and delivers a broad spectrum of products and services to authorities such as the Swedish Agency for Marine and Water Management (SwAM), the Swedish Environmental Protection Agency, and the Swedish Civil Contingencies Agency (MSB). This can range from the delivery of data and analyses to customised development of entire systems, including 24/7 operation and administration.

## **MODERNISATION OF STATION NETWORK AND EXPANSION OF NORDIC COOPERATION**

New data collection and data retrieval technologies, combined with improved computer capacity, contribute to an ever-increasing amount of near real-time and high-resolution data. In 2016, SMHI began modernisation of both its meteorological and hydrological stations to enable measurement and collection of more observations. Modernisation of the radar network continued in 2016, with upgrades to the facilities in Vara and Hudiksvall. The MetCoOp cooperation between SMHI and Norway's meteorological institute (MET Norway) was expanded during the year to include Finland's meteorological institute (FMI). The cooperation relates to operation and development of a common high-resolution meteorological model and common computer resources for forecast production.

## **COMMON AVIATION METEOROLOGY PORTAL**

Since 2013, the aviation meteorology service at SMHI has had an operational cooperation with the Danish Meteorological Institute, with joint production of aviation meteorology for Swedish and Danish airspace. Work is underway to expand the geographic area within Northern Europe for joint services in the new Northern Europe Aviation Meteorology Consortium (NAMCon). The aim of NAMCon is to work together to produce reliable and cost-effective aviation meteorology services.

February 2016 saw the launch of a joint web-based aviation meteorology portal, Northavimet, where data from all-weather institutes associated with NAMCon is collected. The portal presents all products that air traffic requires in a way that is easy to understand. Registered users can create customised information for each flight. The cooperation within NAMCon over the year has also resulted in a shared interpretation of regulations, forecast verification, and methodology for coordinating cross-border aviation meteorology warnings. Cooperation of this type is unique and serves as a model for other countries in Europe.

## **FOCUS ON CLIMATE CHANGE INFORMATION**

2016 was the year that the Paris Agreement came into force. In response, Sweden has launched a number of ambitious goals to contribute to the fulfilment of the global Sustainable Development Goals in Agenda 2030. During the year, SMHI has worked to disseminate information on climate changes with an emphasis on the target groups decision-makers, civil servants, and the media. SMHI's broad competence in the climate area has facilitated communication of the message that the climate has changed and will continue to change, and that this change must be addressed in various decision-making processes in society. SMHI has been active in both the national and the international area, and has invested a great deal of time and energy in staying at the forefront of the climate service field. A lot of work has also been done to develop internal processes so as to derive the greatest possible societal benefit from the authority's information.

## **ACTIVITIES WITHIN THE SWEDISH NATIONAL KNOWLEDGE CENTRE FOR CLIMATE CHANGE ADAPTATION**

The Swedish National Knowledge Centre for Climate Change Adaptation (Knowledge Centre) was established by the Government in 2012, and was made permanent in 2016. The goal of the Knowledge Centre is to make positive contribution to urban planning and a sustainable and safe society in the climate of today and the future. The work contributes to Sweden's implementation of Agenda 2030, with a primary focus on Goal 13: Combat climate change. The Knowledge Centre shall create conditions for climate



change adaptation work in society, which will ultimately lead to reduced vulnerability to climate change. The activities focus on raising awareness about climate change adaptation, offering information, a knowledge base and tools, and creating meeting places and forums for cooperation.

An important aspect of the provision of knowledge is mapping out and demonstrating the Swedish authorities' climate change adaptation work. Compilations have been made and published on the climate change adaptation portal [klimatanpassning.se](http://klimatanpassning.se). Expert support is provided to the Ministry of the Environment and Energy on a regular basis, and includes, for example, international activities such as participation in the Commission's working group for climate change adaptation and the work to develop standards for climate change adaptation work, as well as an ongoing responsibility investigation related to climate change adaptation. The climate change adaptation portal is one of the foremost communication channels in the work to accumulate knowledge within the area and make it available. During the year, the portal was supplemented with a wealth of information and descriptions of climate effects within the financial and transport sectors. It was also updated with several examples of practical climate change adaptation measures and launched in an English version.

SMHI has within the framework of a government commission continued its work to develop plans for future sea levels along Swedish coastlines. Work to develop a method for capturing extreme periods of short-term precipitation has also continued. The project aims to provide better data for short precipitation forecasts and hydrological forecasts, thereby increasing society's ability to handle heavy rainfall.

In 2016, in a new commission from the Government, SMHI was tasked with distributing SEK 5.6 million to other authorities for the development of tools and action plans for adapting the authorities' work on climate change. The societal sectors prioritised in the call for proposals were food production, human health, Sweden's environmental quality goals, as well as urban planning and society development. Eleven authorities were granted funds. The financial support has put a greater focus on climate change adaptation at the authorities that were granted funding and has led to new cooperation between and within the authorities.

## **IPCC**

SMHI is Sweden's national point of contact for the UN climate panel, IPCC. Following the IPCC Bureau election in November 2015, the IPCC's sixth evaluation cycle began. There were a number of planning elements in the initial work, which involved SMHI collecting the viewpoints of other Swedish authorities, institutes of higher education, and other actors. The planning will lead to a work process where hundreds of researchers around the world collectively review research results in order to draw well-

founded conclusions. During the year, SMHI represented Sweden at two IPCC decision-making meetings, one in Nairobi and one in Bangkok. Sweden nominated a number of experts to attend expert meetings during the year to prepare and delimit the reports. Sweden also answered questionnaires regarding the focus of the content of the various reports.

## **GROUNDWATER LEVELS WITH TEN-DAY FORECAST**

Many depend on access to groundwater for drinking water and irrigation. As an example, the unusually dry weather in south-east Sweden in 2016 led to increased demand for information on groundwater. Information about the country's groundwater situation has been improved thanks to cooperation between SMHI and Geological Survey of Sweden (SGU), who together have developed a web service that presents the current groundwater levels for all of Sweden. The groundwater levels are calculated using the hydrological model S-HYPE, and are updated daily together with a ten-day forecast. It is also possible to download historical data.

Because aquifers have different storage capacities depending on the type of soil and soil depth, levels are reported as two types: small, fast and large, slow aquifers. The small and fast aquifers can be both emptied and filled quickly in connection with changes in weather, while large and slow aquifers have greater inertia and do not respond as quickly to weather changes. The information on groundwater levels helps decision-makers to determine when to implement irrigation bans, when to use backup water supplies and when to support water supply with tanker trucks.

## **MODERN BUOY SYSTEM WITH HIGH MEASUREMENT FREQUENCY**

Marine environmental monitoring is often carried out with field sampling once a month, but other systems with higher measuring frequencies are required to understand processes on a shorter timescale. In a cooperation between SMHI and the universities of Stockholm, Gothenburg and Umeå as well as Linnaeus University, a buoy system with sensors for salinity, temperature, oxygen, current and the presence of plankton, was acquired and placed in various environments along the coast of Sweden. The buoy data series have high temporal resolution, which means that the buoys deliver collected data every hour. This generates new knowledge in basic research in relation to rapid developments in coastal waters, as well as improved forecast quality, and valuable data for physical, chemical and biological modelling. The new buoy system is an example of modern measurement instruments that contribute to more effective environmental monitoring. The buoys were funded by the Swedish Research Council, the Swedish Environmental Protection Agency, and the joint SwAM and Interreg Europe project "Hav möter Land" [Sea Meets Land]. SMHI stores collected data and makes it openly available at [smhi.se](http://smhi.se).

### **AIR ENVIRONMENT FORECAST SERVICE**

SMHI delivers air environment forecasts to EU's Copernicus Atmosphere Monitoring Service (CAMS) from a proprietary atmospheric chemistry model. The service is coordinated by the French meteorological institute. In total, various European countries deliver air environment data from ten calculation models. The air environment data is compiled and made available in the form of a forecast service on a public European website. The goal is to be able to warn the population in Europe when air quality is not good enough so that measures can be taken to reduce the risk of unhealthy exposure.

## **RESEARCH**

The research department works in an applied and problem-oriented manner to meet SMHI's and society's need for new knowledge. Research is conducted in meteorology, hydrology, oceanography and climatology. The work is largely focused on developing and applying calculation models. It includes developing analyses and products based on remote analysis from satellites and radar as well as different types of local data. Through its research activities, SMHI can provide reliable data for decision-making, apply international research results and build expertise on societal challenges in the climate and environment areas. The activities constitute an important infrastructure with their extensive model development and production of different scenarios. This infrastructure gives both Swedish and international research groups data to build on in e.g. impact studies. Both nationally and internationally, society benefits greatly from the results of SMHI's research, for example in the adaptation of society to a changing climate. SMHI's research and development is mainly project-funded, where SMHI seeks external funding in competition with other national and international research institutes and universities. More than half of SMHI's research activities are funded from national research funding programmes, EU research programmes (Horizon 2020 and 7th Framework Programme for Research and Technological Development, FP7), and Copernicus.

### **EUROPEAN REANALYSES IN FULL PRODUCTION**

SMHI coordinates an EU project that performs meteorological reanalyses. A reanalysis is new processing of existing data, often with new tools, to create a greater volume of cohesive and comprehensive data. During the year, SMHI completed the first parts of a 55-year reanalysis. A six-year analysis of cloudiness was also completed. The new data that come from reanalyses are important in order to be able to evaluate climate models or make

In order to further improve the models that deliver data to the forecast service, the different development groups follow a joint development plan to which new calculation modules are added and in which existing ones are improved. During the year, SMHI also contributed its own research, where important improvements were made in relation to how observations of particles in the air are incorporated into the model calculations.

Data from Copernicus services are open and free for all to use, for example in more specialised services developed by other actors in society.

climatological calculations, and can be used as the basis for further research in which uniform and comprehensive meteorological data is required.

### **REGIONAL CLIMATE MODELLING FOR SOUTHERN ASIA AND THE ARCTIC**

SMHI Rossby Centre has conducted a large number of detailed regional climate model simulations within the framework of the international Coordinated Regional Climate Downscaling Experiment (Cordex). During the year, SMHI completed detailed regional climate simulations for southern Asia and the Arctic – two areas facing major challenges in a changing climate. The volumes of data have been made freely available via the international cooperation Earth System Grid Federation as well as via smhi.se. The climate simulations serve as the basis for further research and studies of impact of climate change. They also form an important basis for decision-making and for adaptation of society to a changing climate. The free access to the volumes of data that SMHI has provided is valuable in areas that do not have their own capacity to perform basic calculations on future climates.

### **INTERNATIONAL CONFERENCE ON REGIONAL CLIMATE MODELLING**

In 2016, SMHI was the main organiser of the third International Conference on Regional Climate as part of the Cordex framework. More than 300 researchers from around the world gathered for 89 lectures and 300 posters that presented different aspects of regional climate research. During the conference, the benefit of detailed regional climate information produced within the network was highlighted. There's a growing demand for this type of information, e.g. from the IPCC. However, the research community needs to find even better ways to meet user needs and make them understand and use the research results effectively in order to maximise the benefit society gains from the research.

### **NEW VERSION OF GLOBAL CLOUD AND RADIATION CLIMATOLOGY**

Satellites have been used to monitor the atmosphere since the late 1970s. SMHI has compiled a global climatology of cloud, radiation and reflection from the Earth's surface (surface albedo) for the period 1982–2015 in the European weather satellite cooperation Eumetsat's climate monitoring project. It contains data from an image instrument from twelve satellites for the period 1982–2015. The climatology can be used, for example, to evaluate the results of climate models, study trends and to estimate the possibility of solar energy in high latitudes.

### **HYDROLOGIC MODEL IN WEST AFRICA**

Since 2012, SMHI has been working with a regional technical institute in West Africa to develop a hydrological calculation model with information on water resources, flow forecasts, infrastructure dimensioning, and possible effects of climate changes.

In 2016, SMHI made the model available as a cloud service, which means that users can now run the model without being hindered by local power outages and internet connection problems, which are common in West Africa. SMHI has also operationalised the model so that it produces daily forecasts for expected water supply 1–10 days forward in time. SMHI has also trained local users to use the information, tools and services on their own to produce hydrological information that benefits society. Over time, the knowledge and capacity building provided through the project will lead to increased stability in society through reduced vulnerability in extreme water situations.

### **EUTROPHICATION IN THE BALTIC SEA**

Over the years, an increased amount of nutrients from the land has made its way into the Baltic Sea, resulting in eutrophication. A clear sign of eutrophication is sea bottoms with oxygen deficiency. In a model study, SMHI has shown that the Stockholm archipelago serves as a filter for land derived nutrients. A large proportion, approximately 70 percent, of the run-off nutrients remains in the archipelago instead of continuing out into the open Baltic Sea. The model study was carried out within the framework of an international project intended to study the significance of the coastal zone to the transport of nutrients between land and sea. The knowledge is important in society's work to reduce the eutrophication of the Baltic Sea.

### **DETAILED CALCULATIONS OF AIRBORNE PARTICLES**

SMHI has calculated the amount of particles in the air to which people at different residential addresses in Gothenburg and Umeå are exposed. The total levels of airborne particles declined from 1990 to 2011. However, the amount of wear particles from road traffic and particles from small-scale combustion that are created within the respective cities have not declined. Local measures are therefore important in order to improve air quality. The calculations make it possible for epidemiologists to investigate whether the size and origin of different particles produce different health effects, such as cardiovascular diseases and impaired lung function. The study is conducted as part of a research programme funded by the Swedish Environmental Protection Agency.

## **PROFESSIONAL SERVICES**

The professional services department offers industry-oriented and customer-integrated services for society, industry and commerce. The services are based on experiences and expertise in all of SMHI's areas of competence as well as cooperation with external partners. The customer benefits are increased safety, sustainability and safer decisions, both in Sweden and internationally. During the year, activities have been developed and adapted in several areas. New steps have been taken to better match the internal organisation to the external market. The goal is to further increase the ability to increase the advantages for our customers' organisations. A number of market areas have shown good improvements in earnings, while other areas are still undergoing restructuring. An initiative is underway to further establish SMHI in international aid and relief work.

### **DEVELOPMENT OF AIR QUALITY CALCULATION TOOL**

SIMAIR is SMHI's national model system for air quality calculations. It is used to monitor airborne pollution in urban air, and is a web-based tool that includes all input data needed to calculate air quality or air pollution levels. This makes it a user-friendly and cost-effective method for evaluating air quality and, for example, comparing environmental quality standards and environmental quality goals. The model system is primarily used by municipalities, air quality management associations, and authorities. It is also used by engineering consultants who purchase short-term licences in order to perform customer assignments.

During the year, SMHI developed the web tool and launched a new version of the system with a more modern user interface that will further facilitate its use. A new feature in SIMAIR aims to discover which sources have the



greatest impact on air quality. It will be possible to allocate contributions to air pollution from urban sources into different sources, such as road traffic, small-scale wood burning and industry. Another development in SIMAIR is that a new model is being implemented for road dust and wear particles from road traffic. The model will enable users to better study the effect of various air quality measures.

### **FLOW TIME CALCULATION IN RIVER ÄTRAN**

Traditionally, Sweden has had good access to raw water (the raw material for drinking water) of good quality. To ensure a continued secure and safe supply of drinking water, Swedish water resources must be better protected. For many municipalities and water and sanitation companies, defining a water protection area can be a long process. The process involves many consultations and questions from concerned stakeholders. It is therefore crucial to be able to clearly explain the reasoning behind the scope of the protection area, which is based on the calculation of flow time in the water system. As the basis for defining the scope of a water protection area at one of the city of Falkenberg's water reservoirs, SMHI has calculated the water's flow time in the Ätran river and its tributary Högvadsån. This gave Falkenberg municipality underlying data on which to base a decision on the scope of the water protection area.

### **ADAPTATION TO DIGITAL DEVELOPMENT**

Steps have been taken to further adapt our business models and services to the digital transformation. Our focus in 2016 has been on further developing our working methods and services with the target groups and end user in mind, focusing on need and how to resolve the problem for the target groups. For example, we developed the service "Summer weather with SMHI", which presents weather forecasts and weather content linked to Swedish outdoor events, where weather is a key factor. "Summer weather with SMHI" is a radically new approach, where a close cooperation was formed between meteorologists and communication officers. In 2016, interest in SMHI's "Weather insight" service increased. With "Weather insight", SMHI's experience in calculations and large volumes of data is combined with customers' input data to facilitate planning and decision-making. The service is intended for companies that want to increase their understanding of how weather affects their customers' behaviours and their own operations. In this context, SMHI has primarily worked with companies working with consumer goods. This has resulted in both a follow-up tool and a forecast tool.

### **NEW CALCULATION METHOD FOR REGULATED FLOWS WITH A RETURN PERIOD OF 100 YEARS**

Proper dimensioning of dams in our watercourses is very important. For example, a dam needs to be able to handle high inflow without failing. SMHI carries out applied development of models and calculation methods to support

dam-owners' dimensioning work so that they can handle flows in future climates as well. Small dams are dimensioned in accordance with the guidelines to be able to handle a flow with return periods (i.e. that a specific event on average occurs once during the specified time period) of about 100 years.

Traditional statistical analysis works poorly for water supply series affected by regulation. To address this problem, SMHI was commissioned by the energy research company Energiforsk to develop a method for calculating flows with return periods of 100 years in regulated watercourses. The method developed during the project may contribute to increased quality in dimensioning calculations and thereby giving the dam owners a basis for decision-making that ultimately contributes to good urban planning.

### **ENVIRONMENTALLY ASSURED SPREAD OF PROCESS WATER**

The forest owner's association Södra Cell AB intends to introduce changes concerning the process water from the paper mill in Mönsterås. The process water from the mill is currently directed to the Kalmarsund by using a pipeline and released at the bottom approximately one kilometre from land via a spreader. SMHI was commissioned to investigate how the process water from the mill is spread and diluted in the water mass outside of the mill. A three-dimensional calculation model was used to examine what areas of the Kalmarsund may be affected and to what extent this could happen. SMHI's investigation will serve as support for achieving environmentally safe operations, which will reduce vulnerability in society while increasing the potential for achieving environmental quality goals.

### **INCREASED OPTIMISATION FOCUS OF SHIPPING SERVICES**

SMHI is one of the five largest suppliers on the global market for weather-related services in merchant shipping. SMHI's shipping customers operate in a highly competitive market where the number of vessels in different areas exceeds market needs. There is a huge demand to constantly optimise operations. Together with various partners, SMHI develops shipping services within two focus areas. One relates to optimising routes for both individual vessel and full fleets as regards to the impact of the weather on arrival times, fuel savings, and avoid load damage. The other focus area is documentation of vessel performance as regards to speed, fuel and a variety of other data that is reported manually or automatically and is evaluated with the help of SMHI's data, competence and methods.

### **INTENSIFIED CLIMATE WORK IN DEVELOPING COUNTRIES**

On behalf of Sida, SMHI carries out the training programme Climate Change – Mitigation and Adaptation. During the year, SMHI ran three international training

programmes (ITP) in Africa. The participants work on climate issues, climate change adaptation, risk management, and agriculture on a daily basis. They represent civil societal organisations, private industry, authorities, and water and environmental administrations. The training is broad and runs for more than six months. The programme covers

everything from the latest climate research to how communities can be adapted and crises be prevented. Particular focus is put on water resources and agriculture. The goal is to strengthen both individuals and their organisations, as well as contributing to the development of the regional cooperation between different parties.

## FOCUS COPERNICUS

During the year, SMHI continued to develop its operations through measures such as conducting operational services in Europe within the framework of the European Earth observation programme Copernicus. Within Copernicus, data and information are processed to give different actors in various sectors of society current and more reliable data. More and better data on safety and the environment are critical for sustainable development and can be applied throughout society, for example with in the sectors environmental protection, land use, agriculture, forestry, health, transport, climate change, rescue services, and tourism.

SMHI has been successful with its obtaining grants since the programme became operational. The authority can now offer more and better data, and some of the European services that SMHI has helped to develop in recent years are now run operationally within Copernicus. In 2016, SMHI also submitted tenders for a number of procurements related to the provisioning of new operational Copernicus services, where SMHI is one of several providers.

SMHI coordinates the cooperation of Swedish authorities in relation to Copernicus. In April, SMHI and the Swedish Environmental Protection Agency organised a work-shop on Copernicus that focused on air quality and climate. At the workshop, SMHI presented the programme, key players and the cooperation between authorities in Sweden.

### Copernicus services

Service	Area	Time period	SMHI role
Copernicus Atmosphere Monitoring Service (CAMS) – Forecasts and analyses of atmospheric composition.	Atmosphere	2015–2018	SMHI contributes with a proprietary atmosphere model in a sub-project on air quality forecasts.
Copernicus Marine Environment Monitoring Service (CMEMS) – Basic services in forecasts, observations and analysis for marine conditions.	Marine	2015–2018	SMHI contributes in part to infrastructure for data transmission and reanalyses for the Baltic Sea and in part with the collection, infrastructure and transmission of observation data for the Baltic Sea.
European Flood Awareness System (EFAS)	Emergency	2015–2021	SMHI monitors the hydrological situation in Europe daily and works with institutes in the Netherlands and Slovakia to run a European Flood Awareness System.
Service for Water Indicators in Climate Change Adaptation (SWICCA) – Service for more efficient water management in Europe.	Climate	2015–2017	SMHI leads the work of the development project with a service that provides data and guidance for climate effects and climate change adaptation studies within the water sector in Europe.
Clim4Energy – Climate information for energy system planning.	Climate	2015–2017	In the development project, SMHI is responsible for analyses of forecasts and climate scenarios for the energy sector and for climate indicators and commercial products in the hydropower industry.
Urban-SIS – Support for planning urban infrastructure and for reducing the risk of health effects in a changing climate.	Climate	2015–2017	SMHI leads a development project together with six other parties that has created a service related to health effects in cities. The service consists of climate variables and indicators for temperature, precipitation and air pollutant concentrations.

# FINANCIAL PERFORMANCE

<b>Income statement - (EUR 000)</b>	<b>2016</b>
Exchange rate - Average rate for the current year	9 4704
<b>Operating income</b>	<b>78 352</b>
Personnel expenses	-42 165
Premises expenses	-2 971
Other operating expenses	-31 544
Financial expenses and amortisation	-3 193
<b>Operating expenses</b>	<b>-79 873</b>
<b>Surplus/deficit of the year</b>	<b>-1 521</b>

<b>Balance sheet - (EUR 000)</b>	<b>2016</b>
Exchange rate - Closing rate on 31 December 2016	9 5669
<b>Non-current assets</b>	
Intangible assets	1 996
Tangible assets	7 417
<b>Total non-current assets</b>	<b>9 413</b>
<b>Current assets</b>	
Inventories	314
Receivables	26 176
Cash and cash equivalents	7 284
<b>Total current assets</b>	<b>33 774</b>
<b>Total assets</b>	<b>43 187</b>
<b>Equity and liabilities</b>	
Equity	1 448
Provisions	719
Liabilities	41 020
<b>Total equity and liabilities</b>	<b>43 187</b>
<b>Contingent liabilities</b>	<b>29</b>

SMHI, the Swedish Meteorological and Hydrological Institute, is Sweden's expert agency within meteorology, hydrology, oceanography and climatology. We contribute to good social planning and a safe and sustainable society. Communicating warnings and weather forecasts, around the clock, all year round, is an important assignment for us. We work for the entire society – for private persons, agencies and companies. The weather, water and climate are global issues. SMHI has extensive collaborations with both Swedish agencies, international organisations and researchers.

We collect data from the air, lakes, waterways and seas. The data is stored and processed in powerful computers. With advanced mathematical models and analysis methods, our experts produce forecasts, monitor the development of the climate and environment and supply the society with qualified decision data. Our customised services, products and decision data are used by agencies, municipalities and trade and industry – for example, within the energy sector, media and transport sector. SMHI conducts applied research in meteorology, hydrology, oceanography and the climate. Knowledge, models and tools which describe processes in the atmosphere, sea and on land are needed so that SMHI can produce decision data with practical social benefit for many areas in society. SMHI has an annual turnover of SEK 740 million and has just over 600 employees. The main office is located in Norrköping. SMHI also has offices in Malmö, Gothenburg, Stockholm and Sundsvall.

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