



SMHI SUMMARY ANNUAL REPORT
2014

DIRECTOR GENERAL'S OUTLOOK

» In September 2014, I took over as Director General of SMHI, and I look forward to leading our operations for several years to come. The climate issue is a central and growing part of the agency's work. SMHI emphasize on extensive collaboration within all disciplines, not least in Europe.

The summer of 2014 brought several weather-related challenges for Sweden – heat, a devastating forest fire and great torrential rains with subsequent flooding. According to future climate scenarios, both heatwaves and torrential rains will become increasingly common. Climate change adaptation will be necessary for society to be able to handle these challenges better.

Increased collaboration for climate change adaptation

The Swedish National Knowledge Centre for Climate Change Adaptation has been established at SMHI and continues to play an important role in Sweden's climate change adaptation. The work is largely based on collaboration between authorities and other community stakeholders.

Global challenges

The climate changes constitute a global challenge, in which Sweden and SMHI contribute to knowledge development, both nationally and in other parts of the world. The research and development conducted at SMHI is largely focused on climate and climate effects. Measures to reduce emissions and adapt to climate change are required, and international collaboration will be necessary. The world's climate researchers combine their results within the framework of the UN Intergovernmental Panel on Climate Change (IPCC), in which SMHI assumed responsibility as the Swedish focal point in 2014.

Increased collaboration in the Nordic countries and internationally

The international collaboration within meteorology continues to expand. The fact that an increasing number of countries are developing weather forecasts together allows for more resources, which results in even better forecasts. I and my Director General colleagues from the other Nordic meteorological institutes have come to an agreement to expand the collaboration on forecast models that currently exists between Sweden and Norway to include all the Nordic countries in 2020. The collaboration with regard to aviation weather services and the collaboration with Danish DMI have also continued to develop over the year. The collaboration on oceanography and marine environment in the Baltic Sea continues to improve.

Services for wise decisions

In response to the challenge of climate changes and global security, a European programme for earth observation, Copernicus, has been established. Within this programme, large investments are being made to increase the capacity within the EU to supply services that meets society's needs. Since 2013, SMHI has had a role within the European Flood Awareness System (EFAS) for hydrological warnings. This is an example of the rapid development of common services in Europe, which will be intensified in 2015 within Copernicus. SMHI actively participates in several socially important areas.


Open data within all areas

Investments into new services, information and data continue. The introduction of open data has been completed and, as of January 2014, sought-after data from all of our disciplines can be downloaded from the SMHI website and used, free of charge. Thanks to generous licensing terms, the user can refine and distribute data, even for

commercial purposes. Fully open data contributes to increased use and social benefit, and an increasing number of services are emerging where SMHI's data is combined with the open data of others.

Great challenges in coming years

The operation can look back on an intense year, with improved results within several areas. We have also had an opportunity to contribute sought-after knowledge, not only in Sweden but also as support in international relationships, not least within the climate area. However, all over Europe, our operational area is facing great investment needs. Resources are required for both expanded calculations and new technology, and for the development of expertise and capacity for new services. Increased collaboration on both financial resources and development ability is therefore necessary. <<


Rolf Brennerfelt
Director General



CLIMATE

SMHI is an important player within the area of climate change and climate change adaptation in Sweden. SMHI runs the Swedish National Knowledge Centre for Climate Change Adaptation, and is responsible for the Swedish focal point for the Intergovernmental Panel on Climate Change (IPCC), established by UN and WMO. SMHI has also taken over the chairmanship of the Nordic network for climate services.

During the year, SMHI has disseminated information on the academic knowledge situation with regard to the climate issue, not least based on the IPCC reports on climate change. Supplementary climate analyses and regional climate scenarios have been developed that illustrate how Sweden's climate would change in the event of different global scenarios. Furthermore, SMHI is the Swedish contact point within the global framework for climate services that is operated by the World Meteorological Organization.

MAJOR RESPONSIBILITY AS THE NATIONAL IPCC FOCAL POINT

The responsibility as the national IPCC focal point is very important. During 2014, SMHI has led the Swedish representation at the consensus meetings for the fifth assessment report on future climate change from the IPCC. SMHI participates in the ongoing planning of IPCC's future processes. The link to the work at the National Knowledge Centre for Climate Change Adaptation is important in order to reach as many stakeholders as possible.

CONTINUED EFFORTS FOR CLIMATE CHANGE ADAPTATION

The National Knowledge Centre for Climate Change Adaptation provides support to Sweden's adaptation efforts. In 2014, the knowledge centre organised and participated in several important seminars to highlight the adaptation to a warmer climate, with in-depth discussions on potable water

supply, sustainable cities, public health and disaster management. In an international context, the knowledge centre has monitored the development of the EU Adaptation Strategy Package, and worked on the evaluation of the adaptation situation of Sweden.

GREAT ADVANCES IN CLIMATE RESEARCH

The Rossby Centre at SMHI develops climate prediction methods, together with European partners, for a close future in line with natural climate fluctuations, through a method similar to the one used for weather forecasts. The results indicate the possibility of making 10-year forecasts for the average climate in north-western Europe, something that can be useful both in terms of research and climate adaptation.

SMHI participates in the international efforts to develop the Earth System Model EC-Earth, based on the forecasting model from the European Centre for Medium-Range Weather Forecasts. The results will provide information for coming IPCC reports.

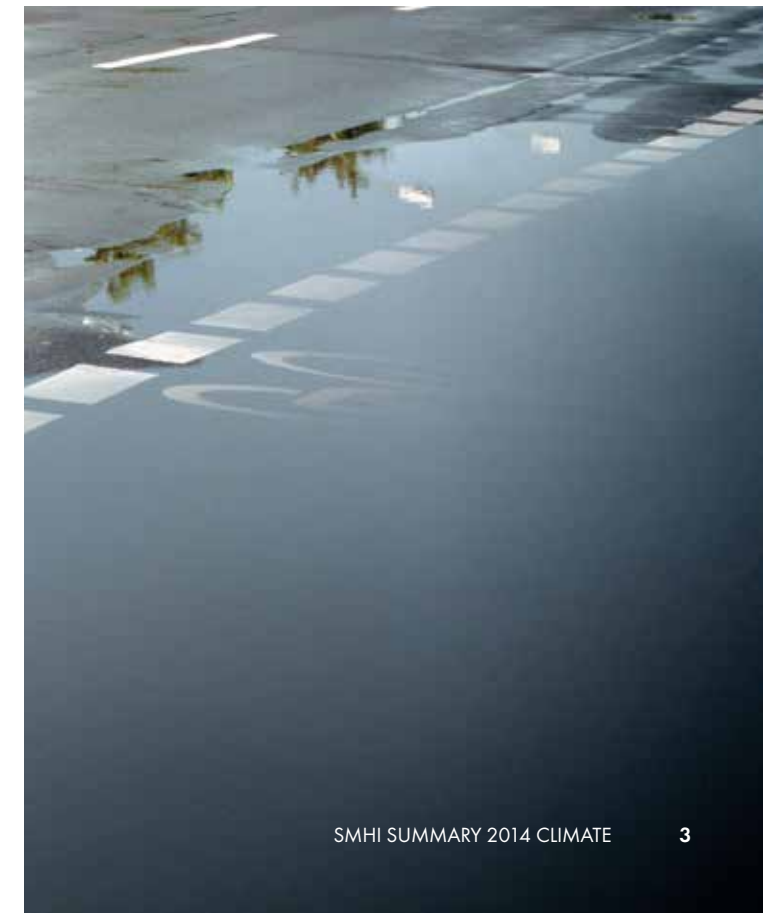
NEW OFFICE FOR CLIMATE MODELLING

CORDEX is a global collaboration initiative that is to develop knowledge on the regional downscaling of global climate scenarios. SMHI hosts a project office for regional climate modelling within CORDEX. This office supports the development of climate models and estimations of future climate. It is also important for the collaboration between different regions and countries, and particularly with regard to developing countries. Within CORDEX, SMHI has produced several regional climate scenarios. Data is shared openly and has been widely disseminated among more than 900 registered users around the world.

EXTREME CLIMATE IS EXPECTED

Future climate will be more extreme, and the temperature increase in Europe will be greater than the global average, particularly in northern Scandinavia and southern Europe.

Precipitation will increase in central and northern Europe during the winter, but in the summer, only northern Europe will have increased amounts of precipitation. Studies of particularly vulnerable areas have been conducted, in which SMHI has looked at the area around the Niger River. In this area, there will probably be higher flows during floods, while the dry periods will be longer and more intense. A historical weather archive has been created as part of an EU project. By analysing historical data using a modern high-resolution computation model, a historical archive has been created with descriptions of the weather over the last 30 years at four points per day. This can be used for climate change adaptation, evaluation of climate models and commercial product development.



FORECASTING

The accuracy of SMHI's forecasts remains on the same level as in the last few years. The new high-resolution forecast model, which has been further developed by researchers, meteorologists and IT specialists in Sweden and Norway since 2011, provides the basis for the joint production that was initiated in 2014 with the aim of being able to describe local weather variations more accurately.

Sweden and Norway are now using a common forecasting model, as well as joint computer resources. The results lead to more details that capture local weather, for example in case of torrential rain and strong winds, with a greater consideration of topography. This gives the Institute's warning services a better basis for assessment of extreme weather situations.

CONDITIONS FOR HIGHER FORECAST QUALITY

Since March, the high-resolution model has been used for forecasts and warnings. It gives a good indication of heavy rain, for example, even if there is also a high degree of uncertainty. However, the model's capacity to reproduce strong winds is a valuable basis for the warning efforts.

The development of the SMHI high-resolution forecasting model takes place within an international consortium. SMHI is leading the work on the next version of the model, and has improved the methods to describe clouds consisting of ice crystals and water droplets, which has resulted in a higher accuracy when it comes to surface temperatures.

Together with their European colleagues, researchers at SMHI have developed a new way of assessing ensemble forecasts.

WARNING SYSTEM FOR EUROPEAN RIVERS

The European Flood Awareness System is a European Commission initiative to increase preparedness for riverine floods across Europe that is coordinated by SMHI. During 2014, SMHI issued 5 warnings, 7 flood warnings and 3 high-flow warnings. SMHI has also conducted contract negotiations with both old and new partners.

ARCTIC COLLABORATION

SMHI has followed up on the conclusions and recommendations adopted at the Arctic Environment Ministers' Meeting of February 2013, and at the Arctic Council Ministerial Meeting of May 2013. SMHI participates in the Swedish SAON (Sustaining Arctic Observing Networks). SMHI has also contributed to the Arctic activities of the WMO, for example through calculations of the inflow to the Arctic Basin. Within the Arctic Council, the agency has also participated in the AACA (Adaptation Actions for a Changing Arctic) project.

SPACE WEATHER OPERATIONAL FROM 2015

Space weather depends on entirely different mechanisms than the weather on earth, and is used to describe the shifting conditions outside of the atmosphere. The term 'space weather' is used to describe conditions in space that affect the earth and the technical systems here, such as satellites, aircraft and energy provision. The northern lights are the only effects of space weather visible from earth.

In 2014, a decision was made for SMHI to develop space weather forecasts. The basis for such forecasts comes from the UK MetOffice, and space weather services will be operational from the new year.

ENVIRONMENT

In national and international collaboration, SMHI plays an active part in promoting better water environments, on land and in the sea. Clean air is a prerequisite for good health, and for animals, plants and cultural values to remain unharmed. Increased knowledge of the processes that influence the spread of air pollutants is important if we are to understand them.

Air environment is a priority on the EU agenda, and the member countries have agreed on a number of environmental quality norms that regulate permissible levels of air pollution. The demand for tools is great, and SMHI is working on a local and national level to estimate the contribution of various sources using coupled models.

PREDOMINANT TRANSPORT SECTOR

The transport sector is responsible for a large part of the air pollutants, such as nitrogen oxides and particles. Even if the total emissions have been reduced, the transport sector proportion has not fallen at all. When it comes to greenhouse gases, the energy sector is responsible for almost as much of the emissions as the transport sector. Other contributions come from the agricultural sector, and from aviation and shipping.

THE WEATHER CONTROLS POLLUTION

Researchers at SMHI study how wind, high and low pressure as well as natural fluctuations may alter the pollution levels in Sweden. Measurements using satellite data make it possible to test aviation models for future projections that guide norms and climate agreements.

The concentration of aerosols has increased by 50–80% across Europe, compared with the pre-industrial era. SMHI has investigated how these aerosols affect the climate. Higher concentrations lead to greater cloud coverage, which cools down the earth's surface.

OPEN DATA FOR LARGE PARTS OF THE WORLD

The supply of open data is growing within the hydrology sector, and SMHI is leading a EU project together with 15 European partners. The aim is to evaluate how open databases may lead to new products. In 2014, SMHI also contributed a virtual water laboratory, with up-to-date flow information for the whole European continent.

Data from the hydrological model of SMHI is openly accessible. At hypeweb.smhi.se, there is simulated hydrological data for Sweden, Europe, India, La Plata in South America and the Niger River in Africa. For each area there is information on water flow, water supply and climate effects.

SOLID COLLABORATION ON THE BALTIC SEA

SMHI is responsible for a large part of Sweden's monitoring of the conditions in the seas, and has initiated a close collaboration with Finland on the research vessel Aranda. The countries are thus better able to coordinate their work to more efficiently gather more and better data.

SMHI has created a model for the North Sea and the Baltic Sea, the first that can be used for climate studies in both seas. This has been used to study how the exchange between the salty water of the North Sea and the brackish water of the Baltic influences the eutrophication of the Baltic Sea.

In collaboration with Germany, SMHI has developed a high-resolution model for the Baltic countries, which supplies them with a basis for maritime safety, search and rescue and environmental protection. The collaboration, which is headed by SMHI, also includes Denmark, Latvia, Estonia, Russia, Finland, Poland and Lithuania.

Seatrack Web is a model developed by SMHI for oil spill, which is used by most countries around the Baltic Sea. SMHI is heading a project to develop new and improved oil spill observation methods, which will be included in Seatrack Web.





AUTHORITY COMMISSIONS

The broad expertise of SMHI makes it possible to support other authorities within a number of areas, in order to use tax funds more effectively. The emphasis of several measures is placed on the responsibilities of other authorities within the areas of water, marine and air environments, hydrology and climate.

As an expert agency, SMHI has a long history of assisting other authorities in their work. A dialogue is used to identify needs in which SMHI can assist and contribute to increased benefit.

AGRICULTURE IN A CHANGING CLIMATE

The county administrative board of Östergötland is looking at options to increase agricultural production without impairing the water environment. SMHI supplies temperature and precipitation analyses founded on documentation from international institutes, based on two of the IPCC emission scenarios. As climate models have different properties, the results may differ, but by placing several scenarios within an ensemble, it is possible to deliver more definitive results.

PHYTOPLANKTON DATA FROM THE BALTIC SEA, KATTEGAT AND SKAGERRAK

Phytoplankton is the foundation of the marine food chain, which is why requirements have been set out in international conventions and EU directives on monitoring measures to assess the environmental status of specific marine areas. SMHI has evaluated data to provide a basis for future environmental monitoring.

ESTIMATING DRAIN OUTFLOW FROM AGRICULTURAL FIELDS

The Swedish Board of Agriculture has analysed the costs accrued by the agricultural sector in the event of a flood. One example involves measures to lower the retaining dikes around water courses, allowing the fields to be flooded. SMHI has delivered computed data for different combina-

tions of dike heights and flows. The effects of lowered dikes depends on the surrounding fields' capacity to absorb water.

MODEL DEVELOPMENT FOR AN IMPROVED AIR ENVIRONMENT

The shipping sector is a major source of soot particle emissions, which reduces air quality and increases the greenhouse effect. SMHI has improved its modelling capacity for ship emissions. The results make it possible to estimate the influence of these emissions in relation to other sources.

FORECAST SERVICE DESIGNED FOR THE AIRSPACE

SMHI has exclusive rights as the supplier of forecast and warning services for Swedish airspace. SMHI is therefore affected by the long-term plans of the EU, which make strict demands on cost-effectiveness. The compensation received by SMHI is linked to the Swedish inflation rate, in relation to the European average. Nordic collaboration is a way to reduce costs, and the airspace collaboration between Sweden and Denmark is one of the first in Europe.

HOSTING DATA FOR INCREASED ACCESSIBILITY

SMHI provides a data centre for several authorities for the collection of measurements and data. These are then easily accessible via thematic sites. The access to SMHI's data systems and processes allows other authorities to streamline their operations without constructing their own resources.

PROFESSIONAL SERVICES

SMHI's professional services offer a wide range of forecasting and consulting services, for both the private and public sectors, based on all its areas of expertise. These services contribute to an increased level of certainty and better decisions, both in Sweden and internationally.

The market is changing, and SMHI is looking for new synergies and working methods. This will free up time to support clients with expert assistance, but also to support changes in society. One of these changes is digitalisation, where consumer behaviours and the media market have been driving forces.

SHIPPING IS BECOMING SAFER AND MORE EFFICIENT

The shipping sector is being forced to streamline activities, where fuel consumption currently constitutes 40–70 per cent of costs. Data with regard to winds, waves and currents, combined with data on the ship's route, make it possible to render transports more effective. This is the foundation of the SMHI's services for energy-optimised maritime transports, and market interest is growing steadily. The marine meteorologists at SMHI provide guidance for ships all over the world around the clock. They deliver data to select the most suitable route, based on the ship's properties, its cargo, winds, waves and currents.

MONITORING EMISSIONS IN TURKEY

With large parts of the population living along the coasts, and more than 50,000 ships passing through its narrow straits each year, Turkey is highly exposed to air pollution from the shipping sector. An EU project is under way to provide data for international reports on emissions from the shipping sector, which is to be used for analysing their influence on air quality, health and ecosystems. SMHI delivers systems for emission inventory, dispersion modelling and air quality monitoring.

ESTIMATING AIR QUALITY ALONG SWEDISH ROADS

SMHI is observing the Swedish road network. Simulations have been conducted for 150 densely populated areas, and the roads in between them. The estimations are carried out using a national air quality model developed by SMHI on behalf of the Swedish Transport Administration and the Swedish Environmental Protection Agency.

CUSTOMISED SERVICES FOR SKANSKA

SMHI delivers customised weather services to the construction company Skanska, with the possibility of consulting a meteorologist in the event of difficult weather situations. SMHI provides tools to schedule weather-sensitive components for their building and civil engineering activities. Skanska is also a contractor involved in snow clearance and de-icing, where weather information is a central factor to ensure they take the appropriate measures.

EXTREME WEATHER ANALYSIS FOR ESS IN LUND

The international research centre ESS is currently under construction. The facility is based on a particle accelerator, in which radioactive particles are formed, which places particularly high demands on the planning. SMHI has long collaborated with the nuclear sector in Sweden, for instance in respect of meteorology and investigations of extreme weather. For this reason, SMHI is a natural partner when it comes to investigating possible risks associated with future weather events that could occur in Lund.

NEW NORMAL PERIOD 1981-2010 – ENABLES CORRECT ENERGY CONSUMPTION STATISTICS

SMHI provides climate correction factors for Sweden, enabling true energy consumption statistics. Precise energy statistics is essential to reduce consumption, costs and climate impact related to heating and cooling in buildings. At the turn of 2014-2015 SMHI decided to replace the normal period for the products that are monitoring energy statistics. The development of these tools reflects the climate better.

IMPROVED FORECAST AND WARNING SERVICE IN BOTSWANA

The Department of Water Affairs in Botswana needs to develop its knowledge of hydrological monitoring, in order to improve its forecast and warning service. For two years, SMHI has been working on this assignment with support from Sida, and the Department of Water Affairs is now seeking its own funding to continue the collaboration. With the support of SMHI, there is also a closer collaboration with the Department of Meteorological Services in Botswana.

ADAPTATION IN THE MEDIA SECTOR

The media sector continues to convert to digital media, hence the printed editions becomes fewer and profitability falls. For SMHI as a supplier, this has a great impact on its activities. A major effort has been made in recent years to meet the new needs of clients, whilst maintaining a high quality of services and products.

UNDERSTANDING THE WEATHER IS BECOMING INCREASINGLY IMPORTANT TO BUSINESS

Insights about the effects of weather and consumption are becoming an increasingly important factor in the business strategies of consumer-oriented companies. Large amounts of sales data can now be stored, and combined with weather data it can streamline the flow of goods, stock levels and ordering processes. SMHI has therefore initiated a consultancy operation for consumer-oriented companies such as Coop.

CONTINUED COLLABORATION WITH RADIO SWEDEN

SMHI continues its long-established collaboration with Radio Sweden, with around 80 broadcasts per day. The participation of SMHI meteorologists is an important feature, and Radio Sweden is a central channel which SMHI reaches the public with its forecasts and warnings.

About SMHI

SMHI is an expert agency under the Ministry of the Environment and Energy, which works for the benefit of society, the public, authorities and companies. This places great demands on our handling of a complex reality in constant change.

Weather and water crosses all borders, and SMHI is involved in extensive collaboration with both Swedish and foreign authorities, as well as with international organisations and researchers. SMHI also provides professional services to support the business sector with customised services, for example within the mass media, energy and transport sectors. SMHI often acts as a consultative body for other authorities, and disseminates knowledge through media, lectures and training programmes.

Advanced mathematical models and analysis methods are central tools in producing forecasts, monitoring the development of the climate and environment and to supply the society with qualified decision data. By developing and administrating information on weather, water and climate, SMHI contributes to good community planning, reduced vulnerability and to environmental efforts.

SMHI has an annual turnover of more than SEK 640 million and has approximately 600 employees. The main office is located in Norrköping. There are also offices in Malmö, Göteborg, Stockholm and Sundsvall.

SMHI

SMHI – SWEDISH METEOROLOGICAL AND HYDROLOGICAL INSTITUTE

SE-601 76 Norrköping, Sweden

Telephone +46 11 495 80 00 Fax +46 11 495 80 01

Customer services +46 11 495 82 00

www.smhi.se