SUMMARY ANNUAL REPORT 2012

DIRECTOR GENERAL'S OUTLOOK

» SMHI's mandate is to produce support for decision making to promote good planning, reduce societal vulnerability, and help achieve the Swedish Environmental Objectives. During 2012 the Swedish government has put increased focus on making the authorities' data available for business development and planning. SMHI continues working, in accordance with the EU Inspire and PSI directives, with making data easily available via the Web.

Interest in the climate issue is increasing steadily. Need for research about the future climate is thus greater than ever before.

The National Knowledge Centre for Climate Change Adaptation has been established at SMHI, commissioned by the Swedish government. The work is performed in broad cooperation with other Swedish authorities and other actors within the adaptation area. One issue in focus during 2012 was the future sea level. For all planning close to the sea such knowledge is crucial, and SMHI experts play an important role in, for instance, pre-studies for the new lock in Stockholm city.

There are many interesting opportunities to integrate and visualize information on climate and environment.

Integrated support for decisions is needed for the more and more specific questions asked by society. In recent years SMHI has experimented with new visualization tools, both for the Internet and for geodome format, in cooperation with the Norrköping Visualization Centre and Linköping University.

SMHI focuses on developing forecast and warning services. The processes involved when making forecasts and warnings are refined to better foresee serious weather events and to increase the quality of forecasts.

One part in enhancing the quality of forecasts is to increase resolution in calculations.

This calls for further development of forecasting models and investment in more powerful computers than we have today. For this development more resources are needed than we can gain access to ourselves. Therefore, cooperation with the Norwegian Meteorological Institute is ongoing, with the goal of making forecast calculations together.
European air traffic control is going through a process to increase aviation capacity and security. The demands on aviation weather services are rapidly changing. SMHI and the Danish Meteorological Institute are together creating aviation weather forecasts to meet the new demands of the customers.

Clients want continued improvements in both content and quality of products and services.

Competition in the weather market is increasing, and the prices in several areas are decreasing. To meet the demands, SMHI is spending resources for product development and developing cooperation with complementary partners.
The EU initiates services within our expert fields to give information on the European scale. One example is that SMHI, together with colleagues from Slovakia and the Netherlands, produces hydrological flood forecasts for a number of rivers in Europe.

We can see a clear trend towards achieving weather information via mobile equipment.

Weather services on the Web are developing quickly, and SMHI is further enhancing weather apps for smart phones. The number of visitors on SMHI's weather apps as well as on our website continues to increase. More than 15 million unique visitors were counted on smhi.se during the year. We also meet interested users in social media. Their responses are important for making knowledge of weather, water and climate available in new and good ways. «

Lena Häll Eriksson
Director General

CLIMATE

SMHI collects climate data continuously, not only for weather forecasting, but also for climate analyses. A study on extreme precipitation, based on 15 million observations from around thousand measurement stations, shows that cloudbursts have become more frequent during the last forty years.

The work with climate adaptation is increasing both nationally and internationally, requiring additional knowledge and support. At SMHI we have established a National Knowledge Centre for Climate Change Adaptation this year. International climate cooperation is growing, and research is contributing better models, methods and joint actions among users.

SMHI provides a wide range of data and knowledge to the County Administration Boards in Sweden, including climate scenarios, climate indicators and various training programmes. The National Knowledge Centre for Climate Change Adaptation develops and supplies knowledge of climate change effects on different sectors. One important task is to create a forum for meeting and to act in broad cooperation with other actors within the climate adaptation area. The main channel is the climate adaptation portal, a joint effort of thirteen Swedish authorities, hosted by SMHI.

SCIENTIFIC EXPERTISE AND RESOURCES

SMHI supports the Swedish government by providing expertise on scientific questions concerning planning for the future as well as preparing for UN climate negotiations. SMHI represented Sweden at the World Meteorological Organisation congress in October, arranged to decide on a Global Framework for Climate Services. Nordic cooperation is also ongoing to increase access to climate services and communication among users. SMHI has been designated as a national reference centre for the European Environment Agency regarding work with effects of climate change, vulnerability and adaptation.

The hydrologists at SMHI have calculated effects of a changed climate on different water indices, such as high flows, soil water content, drought and groundwater. The calculations are made on a national scale, and the results are freely available on the Web for planning, control of the environment and water power. An article on the method used, developed at SMHI, was recognized with a prize for best article in the peer-reviewed journal *Hydrology Research.*

CLIMATE ADAPTATION IN EUROPE

As one of the authorities responsible for implementing the EU strategy for development of the Baltic area, SMHI is actively involved in revision of the strategy. Within the EU project Baltadapt, a strategy for climate adaptation within the area is the focus of work undertaken together with sectors like tourism and agriculture. On a European scale SMHI conducts reanalyses of weather during the past 20 years with a resolution of 20 km. SMHI acted as lead partner for the EU project SUD-PLAN (Sustainable Urban Development Planner for Climate Change Adaptation). A planning tool for European cities and regions was developed that includes intensive precipitation, hydrological conditions and air quality between 1960 and 2100 for different climate scenarios. The tool also comprises functions for visualization and possibilities for coupling with local models.

PROGRESS IN CLIMATE MODELLING

The Rossby Centre at SMHI participates in several projects of the EU Seventh Framework Programme to develop global earth system models as well as infrastructure for resources demanding high-resolution model calculations. During the year, results from the global EC Earth model have been delivered to an international archive, whose data is freely available to researchers. The results will be part of the next IPCC evaluation. SMHI is one of the main actors in the coordinated regional climate calculations for different land areas, with a focus on developing countries. Detailed climate information for Africa has been produced as well as a large number of simulations for Europe, the Middle East and the Arctic. The Arctic shows an observed temperature increase double the global mean value, and the sea ice is melting faster than most projections foresee. Thus, the area holds a special interest for process studies to better understand the climate changes and their effects.

ENVIRONMENT

SMHI works to meet demands for information on water and air environment. Both nationally and internationally, SMHI plays an active role for better water environment, both on land and at sea. Tools are being developed to support Sweden's water management as well as attainment of the national environment objectives.

SMHI is responsible for the national database SVAR, linking catchment areas to the report areas for Sweden's water management. The national dam register has been updated to include 11,000 dams, and the dam locations are linked to the hydrological network in SVAR. Creation of a national database on wetlands, constructed for reduction of nutrients, is in progress, and a database on effects and loads has been set up.

MODELLING WATER

The hydrological model HYPE has been further developed based on suggestions from the international open source community. As an example, the programmed code has been divided into modules. The model version calculating water flow and water quality in Sweden, S-HYPE, now has more accurate descriptions of water balance and storage in lakes and rivers. A function for corrections, made by incorporating station measurements, gives better results, especially for regulated rivers. A new flow statistics method for the 38,000 sub-basins has also been introduced.

The coastal zone model describes water quality along Sweden's coast and can now be used to estimate reactions to changed conditions and planned actions.

FROM EUROPEAN LAND TO THE SEAS

A new operational system has been developed that delivers information on runoff from all rivers running to the European coasts. The system is based on a European-scale hydrological model, integrating simulation of flows and turnover of water and nutrients. The system presents information on flows and nutrients across Europe over the latest 30-year period and runoff from rivers into the seas, both in real time and as support for forecasts.

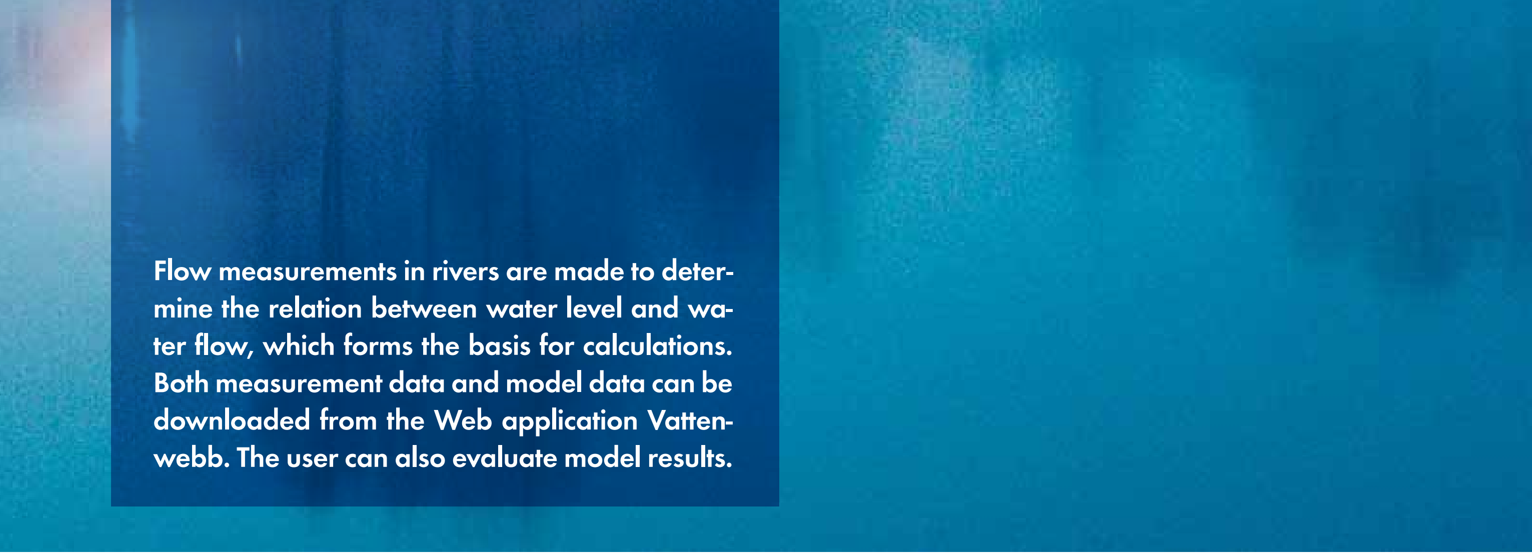
THE BALTIC SEA

Calculation models are tools for recreating historical conditions and simulating possible future scenarios. During 2012 SMHI performed a reanalysis of the Baltic Sea, and the calculated values have been corrected by help of observations. The study was made for, among other factors, salt concentration, temperature, oxygen content and nutrient load. It gives longer continuous time-series of data and better descriptions of the variations. The results are being used in climate simulations and to improve models for circulation and for nutrients and algae.

To decrease the eutrophication of the Baltic Sea, the surrounding countries have agreed on decreased emissions. A hydrological model has been set up at SMHI for the Baltic Sea to calculate water and nutrient flows to the sea. Analyses show that it is possible to reach the targets for decreased transport of nutrients by the end of the century, but there is large uncertainty in the climate scenarios.

OCEANOGRAPHIC DATA

More oceanographic measurements are needed. Cooperation in recent years with commercial transports at sea, with observational equipment installed, has provided information on the sea's natural variations and added value to the monthly environment survey performed by SMHI.



Flow measurements in rivers are made to determine the relation between water level and water flow, which forms the basis for calculations. Both measurement data and model data can be downloaded from the Web application Vattenwebb. The user can also evaluate model results.

In cooperation with the Swedish Maritime Administration, marine meteorological equipment has been installed on the icebreakers Atle, Frej and Ymer to improve the forecasts for the Gulf of Bothnia. With better forecasts, the planning of icebreaking becomes more efficient and thus makes cargo traffic more environmentally friendly. The Swedish Polar Research Secretariat arranged expeditions to the Arctic with the Swedish icebreaker Oden.

SMHI meteorologists were on board to provide weather and ice forecasts. In this area, very few observations are available. The Secretariat, together with SMHI and the Swedish Maritime Administration, thus installed marine meteorological equipment on Oden, making it one of the best-equipped ships for real-time weather observations.

SMHI is part of the EU project SeaDataNet, the leading network aiming to build up infrastructure for archived oceanographic information and data management. The goal is to make all data available according to the EU Inspire directive. As regional coordinator for the Baltic Sea, SMHI contributes monthly climate statistics on salt content and temperature.

The work on the environment for Sweden's maritime regions is regulated in the conventions HELCOM (for the Baltic Sea) and OSPAR (for the North Sea). The EU Water Framework Directive and the Sea Environment Directive are also important. To get information on the status of the seas, indicators are used. SMHI is an active partner in several national and international groups working with sea environment indicators and contributes information on hydrography, oxygen, nutrient loads, algae bloom and runoff.

AIR QUALITY

The composition of air plays a great role for both the climate and our health. SMHI supports efforts towards achieving clean air, by developing tools and knowledge. During 2012 the Swedish government focused on the work of decreasing short-lived climate pollutants (SLCP): particles, ozone, methane and HFCs. SMHI offers expertise and run a national SLCP website. The air dispersion model can now be used for studying the effects of SLCP on climate as well as future European concentrations of surface ozone.

European cooperation for air chemical forecasts is becoming operational, and SMHI is one of six main actors presenting calculations.

Air pollution levels in traffic environments will remain high in 2020, despite reduced emissions. This is shown in a study of 40 Swedish cities, that includes projections of the concentrations of atmospheric particles, nitrogen dioxide and benzene. Forceful actions are needed to reach the national clean air environment objective.

FORECASTING

During the summer of 2012 there were 58 million visits to the SMHI weather apps. The peak was July 7, with 1.3 million visits. A blog was started in July, where meteorologists write about actual weather and water events, and where during the autumn, SMHI meteorologists reported from an Arctic expedition.

SMHI offers forecasting services for meteorology, hydrology and oceanography, delivering information that helps in protecting life and property. Both national and international cooperation are vital for SMHI. Areas of collaboration include the development of forecasting models and High Performance Computing. Other examples are emergency response, the European flood warnings, radar network, satellites and global observing systems.

Collaboration between meteorology, hydrology and oceanography provide the society with planning and decision support for activities dependent on both weather and water. SMHI provides a 24/7 service to support users with information when crises occur. A new type of weather warning, for heat, is under development. The system was tested during summer and continued tests will follow next year.

MODEL DEVELOPMENT

Forecasting model development is concentrated on providing more detailed temporal and spatial resolution. Together with 25 European countries, SMHI contributes to the HIRLAM-ALADIN model cooperation. To run the models, more detailed observations as well as intense computer capacity are needed. Observations from weather satellites together with GPS satellites and radar have become more and more important, and a lot of efforts have been made to manage data and to prepare the models for using these data.

SMHI is working with the Norwegian Meteorological Institute toward a joint technical production, using the same detailed numerical weather prediction model. During spring 2014 the model will become operational.

INTERNATIONAL COOPERATION

SMHI is the Swedish representative to the WMO, EUMETSAT and ECMWF. EUMETSAT launched two new weather satellites in 2012, giving access to continued data for better weather forecasts. SMHI coordinates national User forum for the European Earth monitoring programme Copernicus (previously known as Global Monitoring for Environment, GMES), with the aim to collect, process and disseminate data and information services. One operational service developed within the programme is the European Flood Awareness System, EFAS. SMHI is one of the actors analysing model results, and when needed, providing flood warnings for some rivers in Europe.

In May 2012 SMHI hosted some 50 representatives from 29 national weather services in a EUMETNET meeting discussing enhanced cost-sharing and effectiveness. Prioritised areas are e.g. drifting buoys, observations from ships and aviation observations, and development of a system for presenting warnings for extreme weather. ECOMET also had a meeting in Norrköping in May, and its 25 members are working towards the widest availability of basic meteorological data for re-use applications.

WMO = World Meteorological Organization
EUMETSAT = European Organisation for the Exploitation of Meteorological Satellites
ECMWF = European Centre for Medium-Range Weather Forecasts
EUMETNET = European Meteorological Services Network
ECOMET = The Economic Interest Group of the National Meteorological Services of the European Economic Area

BUSINESS SERVICES

Economic and environmental considerations increase the need for energy-efficient transport by sea. Weather and currents affect the ship's speed and consumption of fuel. Advanced visualization techniques show factors that can be altered to reduce consumption of fuel and still achieve swift transport. The supervision of ships also includes information on recent pirate attacks.

SMHI business services offer a broad range of branch and consultancy services, including recently added mobile applications, virtual measurement masts and tools for the shipping market. Our consultancy service has provided, for example, calculations to support dredging work in Lake Mälaren and for a new regulation regime.

The whole of SMHI is engaged in important and continuously ongoing work to increase the perceived forecast quality. To this end we are looking at all stages of product development and improving the methods used. Our focus for business services is to find new ways of post-processing data.

COOPERATION WITHIN WEATHER AVIATION

SMHI is working with the Danish Meteorological Institute to offer joint aviation weather services. Our goal is to deliver cost-efficient aviation weather services to the Swedish-Danish air territory and to ensure mutual support.

ENERGY EFFICIENCY

Because SMHI is working towards a sustainable society, we offer services to assist customers in reducing their environmental load within their areas of work. One important aspect is to reduce the use of energy. SMHI offers products and tools for achieving these goals to various markets, like shipping and property.

For the wind energy market, our virtual measurement masts facilitate finding the best location for a wind power plant. A quick check of wind speed, wind direction and wind energy content at a chosen site makes planning faster and more cost effective.

MOBILE APPLICATIONS

Modern technologies–such as smart phones and tablet computers–offer possibilities for better service to professionals on the go. We make a range of applications for mobile devices designed to help those responsible for maintaining Sweden's roads throughout the winter, as well as software to benefit builders and constructors. Painting, high crane lifts and coating are all easier to plan and execute with these innovative applications.

MEDIA MARKET

A radical change has occurred within the media market in recent years. Development for Web, mobile and social media is occurring extremely fast. To fully serve our customers, SMHI has embraced digital media. Together with an external partner, we have developed a website and mobile applications for discussions with a focus on weather.

About SMHI

The Swedish Meteorological and Hydrological Institute (SMHI) is a government agency operating under the auspices of the Ministry of the Environment. An expert organisation in the fields of meteorology, hydrology, oceanography, and climatology, SMHI aims to provide social benefits by increasing safety, and fostering a more sustainable society.

Air and water are crucial to life on earth and to the environment. Knowledge and advanced information let us meet the challenges presented by our climate, weather, and air and water conditions.

SMHI manages and develops information that provides knowledge and advanced decision-making information for public services, the private sector, and the public. General forecasts and weather warnings, industry-specific services, simulations and analyses, statistics, climate studies, and contracted research are just a few of its many services. SMHI's national and international cooperation is extensive as well.

SMHI operations are funded in various ways, by government subsidy, on contract for other government agencies, by research funding, and on commercial terms through its business services. SMHI has about 660 employees and a turnover of approximately SEK 670 million, of which approximately SEK 200 million is in the business services area.

SMHI

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