

SMHI 110

SWEDISH METEOROLOGICAL AND HYDROLOGICAL INSTITUTE



DIRECTOR GENERAL'S OUTLOOK



“ SMHI's mandate is to produce decision support to promote good planning, reduce societal vulnerability, and help achieve the Swedish Environmental Objectives.

Key agreements were confirmed in 2011. A consortium for aviation weather forecasts was approved by SMHI and the Danish Meteorological Institute, and its efforts will start in 2012. Another important agreement, signed with the Norwegian Meteorological Institute, concerns financing the future's costly, more-detailed meteorological forecasting using high-performance computer systems. The goal is to run a shared operational numerical weather prediction model by 2014 at the latest.

The work depends on well-functioning and practical international cooperation.

At the end of 2011, SMHI was commissioned by the EU to lead efforts to build a pre-warning system for the flooding of large rivers in Europe.

SMHI is also active in international research. One example is the European research project EMBRACE, coupling models of various parts of the climate system, to make better calculations of future climate change as a basis for mitigation and adaptation decisions. SMHI is also one of the main actors in the CORDEX regional climate modelling research programme, which covers most of the populated land areas around the world. Another example is the now completed three-year project BONUS/ECOSUPPORT. In it, researchers from eleven institutions around the Baltic Sea area have studied how a changed climate will affect the Sea's nutrition cycles.

SMHI seeks new ways to visualize results and communicate with stakeholders.

The Baltic Vision presentation visualizes future scenarios for the Baltic Sea. It was declared the winner for best public engagement activity at an EU meeting in Gdansk. The presentation was produced in cooperation with the Centre for Climate Science and Policy Research and at the Norrköping Visualization Centre.

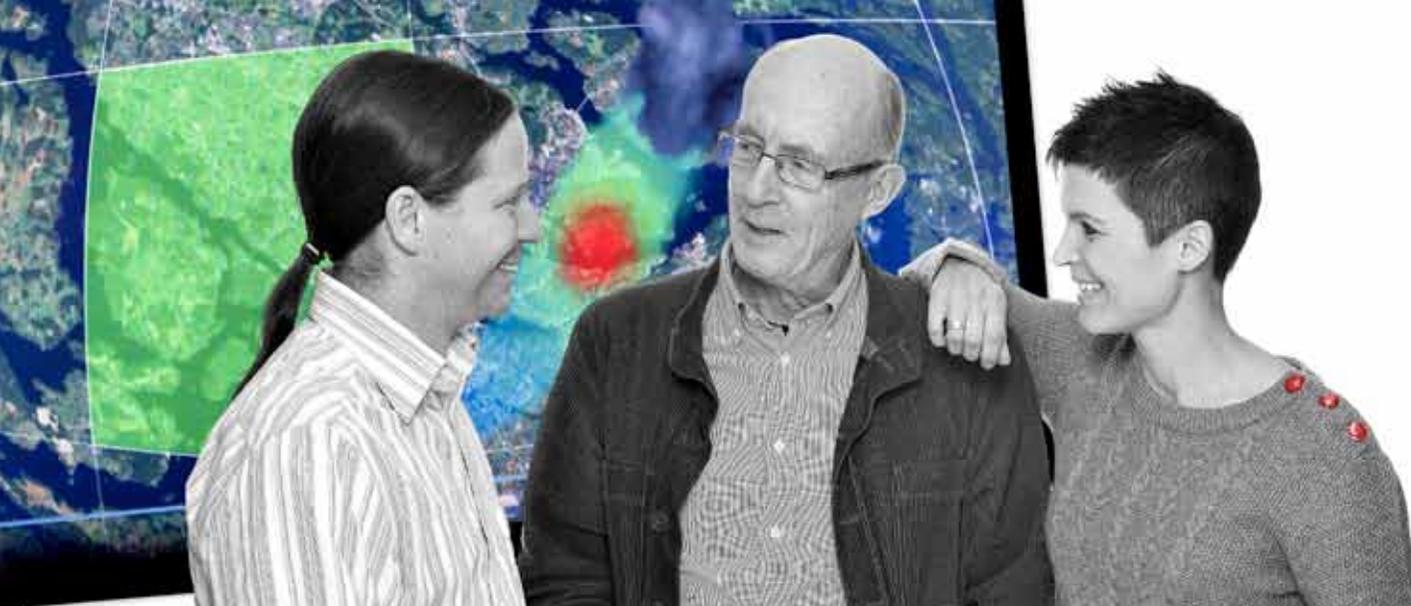
SMHI has developed solutions for outreach via new media. A weather app for the iPhone and Android phones was launched in spring 2011. SMHI is active on Facebook as well as Twitter.

Fulfilling our mandate and offering knowledge and services to users' calls for a range of competences.

Together with other authorities, SMHI is actively helping build a sustainable society. Our mandate in the climate adaptation area has now been expanded. Establishment of a new Centre has started, which will serve as a Swedish node for knowledge of adaptation to a climate in change.

Work at SMHI is based on expert competence and a lean production system. New employees are recruited to bring skills and experiences that support efforts to build a safe and sustainable society. ”

Lena Häll Eriksson
Lena Häll Eriksson / Director General



Ludvig, Sten, and Anna discuss how SMHI can best present climate information.

CLIMATE

Urban Water Vision

More intense rains in future will increase the demands placed on urban planning. The film *Urban Water Vision*, which shows how rain intensity may change and highlights the importance of high-resolution climate scenarios, has been shown in various settings both nationally and internationally.

Climate is an area of SMHI expertise that is becoming increasingly important to stakeholders and that affects many areas. The need for climate adaptation support in Sweden and internationally has resulted in greater cooperation and joint action among authorities and researchers.

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. SMHI also manages the national climate adaptation portal, supported by twelve Swedish authorities, publishing weekly news and information in the field of climate adaptation.

INTERNATIONAL COOPERATION

Nordic cooperation has started between national meteorological institutions to increase the accessibility of climate information. SMHI is contributing in various ways to realize the EU strategy for the Baltic Sea Region. For example, the EU-supported Baltadapt project is developing a climate adaptation strategy for the Baltic Sea region. An evaluation report has been

delivered covering the knowledge gaps in research and adaptation strategies. The project has also produced information sheets on air temperature, precipitation, wind, sea level, oxygen content, salinity, water temperature, runoff, and nutrient status.

In the network Climate Impact Research and Coordination for a Larger Europe (CIRCLE-2), SMHI is involved in disseminating research results on climate change effects, vulnerability, and adaptation.

SCIENTIFIC EXPERTISE AND RESOURCES

SMHI supports the Swedish government by providing expertise on scientific questions connected with planning for the future as well as when UN climate negotiations are at hand.

Calculations made using the EC-EARTH global climate model will form part of the basis of the next IPCC evaluation. The model's resolution is almost twice that of the models serving as the basis of the previous evaluation. Concise documentation of SMHI's regional climate model has been presented in the scientific journal *Tellus*. The published articles describe the formulation and functioning of the model as well as its results and uncertainties.

The climate research programme MISTRA-SWECIA continues with a focus on climate adaptation and land use in Sweden. Interaction with users will also be enhanced. SMHI is hosting the programme and cooperates with the Stockholm Environment Institute and universities in Stockholm and Lund.

DATA SERVICES

Environment Climate Data Sweden (ECDS) is a national resource for environment and climate data as well as an infrastructure for research. SMHI was commissioned to develop and manage the service by the Swedish Research Council. Since 2011, SMHI has also been tasked with coordinating efforts to reduce emissions of short-lived climate forcers.

FORUM FOR KNOWLEDGE AND EXCHANGE

SMHI has been involved in arranging various seminars and forums on climate issues. Every year, a Rossby Centre Day is held focusing on various subjects, but featuring climate modelling research.

ENVIRONMENT



Best communication effort
The ECOSUPPORT project won the award for best public engagement activity of the BONUS sea environment programme, pointing out new ways of engaging and communicating with stakeholders.

Researchers Patrik and Helén work together for the Baltic Sea environment.

SMHI supports Sweden's water management by creating web-accessible and quality-assured information that is operationally reliable. SMHI is also active in national and international cooperation for a better marine environment. Decision support tools are being developed to support attainment of the national clean air environment objective.

Technical systems for data provision and reporting are linked to produce efficient water management tools. The information guides the management of lakes, rivers, and coastal areas and provides strong support for the EU Water Framework and Marine Strategy Framework directives. SMHI is responsible for the main part of the national environmental survey in the open sea around the country, with a focus on overfeed and climate effects.

OBSERVATIONS

Fifty temporary hydrological stations reporting in real time complement the national network of hydrological stations. Some of the temporary stations will be

relocated in 2012 according to the needs of the national water management programme.

The national observation network for monitoring sea level consists of nineteen stations, a number insufficient for local conditions in some areas. In cooperation with local actors, SMHI is testing three mobile stations for two–three years; after evaluation, they will be moved to other places of interest.

Many processes in the sea occur on short time scales, making frequent observations important. The cargo ship Transpaper, the ferries Silja Serenade and Baltic Princess, and the ice breakers Atle, Frej, and Oden automatically report water and weather data. This automatic reporting system provides better support for current, water temperature, and ice growth forecasts and complements algae monitoring. The meteorological data so obtained support weather forecasting.

MODELLING

The hydrological model for calculating water flow and water quality in Sweden, S-HYPE, has been further refined regarding transition times and denitrification in rivers. Local deviations can be better described since

regional and local parameters can be combined. Efforts have been made to adapt S-HYPE to the high spatial resolution of water occurrences as determined by Sweden's water management programme. The extensive calibration effort has focused on the sources of small rivers and on river estuaries as the main runoff areas.

FUTURE SEA ENVIRONMENT

The three-year sea environment research project, Bonus+/ECOSUPPORT, was completed in 2011. The project, coordinated by SMHI, aimed to determine how a changing climate is affecting ecosystems. Researchers from seven countries around the Baltic Sea joined in studying entire nutrient cycles in the Baltic. Models of the future climate were used to study water flow and nutrient transport from land to the sea as well as airborne substances affecting the sea. The models are coupled with calculations concerning marine biochemistry and nutrient chains.

Baltic Sea conditions have been projected up to the next century, assuming both current emission levels and the decreased emissions called for by the Baltic Sea Action Plan.



Hydrologist Lena discusses data availability on the web with system developer Tomas.

SMHI WaterWeb, both fresh and salt

This web-based map interface for downloading monthly and yearly water flow and nutrient transport values gives access to data describing both land and coastal waters.

WEB SERVICES

Two web services, allowing users to freely download water information, were launched in 2011. Decision makers, water administrators, researchers, and other interested parties are supported in analysing river conditions or in studying flows to the sea. E-HypeWeb, which offers highly resolved information on flows for all of Europe, was complemented with a visualization tool in 2011. Balt-HypeWeb presents information on inflows to the Baltic Sea. These services give unique opportunities to download data for both hydrological and oceanographic analyses, based on river catchment areas. The work is the result of several EU initiatives, including Global Monitoring for Environment and Security.

Using the HYPE Open Source Community virtual platform, water actors can share and develop source codes for calculation models. The platform offers free access to the HYPE model. The expectation is that, with many people examining and developing it, the model will rapidly improve. The goal is to increase international cooperation and transparency around SMHI's models.

BUILDING COMPETENCE AND AWARENESS

Together with other authorities, SMHI is striving to increase hydrological competence in the water management area. Training has been offered to local actors in the use of web services for water-related information. In the EU project BalticSea.now, around 50 people were equipped with instruments and training for observing the Baltic Sea. These people can now report visibility depth, water temperature, ice thickness, algae occurrence, and sea level. The main goal is to create concern and awareness regarding the Baltic Sea environment. Finland, Estonia, and Latvia are also involved in the project.

AIR POLLUTION GLOBALLY, REGIONALLY, AND IN THE FUTURE

Studies suggest that the situation regarding long-distance-transported air pollutants in Sweden is expected to improve up to 2020 – assuming that targets for decreased emissions are achieved.

Atmospheric dispersion models are combined with data from regional climate models to estimate the future chemical composition of the air. These

calculations are extremely comprehensive and are only possible because of access to climate model data and powerful computers.

Results indicate that decreased emissions in Europe will reduce air pollution and the fallout of airborne substances. The climate affects the formation and destruction of many air pollutants. In southern Europe, climate change will result in increasing air pollution, partly counteracting the effect of decreased emissions.

FORECASTING



Emma, Henrik and Sofia represent SMHI forecasting services.

SMHI launched a weather app
This application, presenting forecasts for up to ten days and for approximately 60,000 places, was well received by users. It was downloaded almost 700,000 times over its first four months.

SMHI offers forecasting services for meteorology, hydrology, and oceanography, presenting information that helps in protecting life and property. More detailed forecasts are required, which calls for model development and intense computer capacity. As a result, Nordic cooperation in the forecasting area has been enhanced. Both national and international cooperation are vital for SMHI work.

United action in meteorology, hydrology, and oceanography provide society with planning and decision support for activities depending on weather and water. Forecasting model development is permitting more detailed temporal and spatial resolution, letting researchers describe smaller-scale weather phenomena. For more turbulent, small-scale weather activity, research is focusing on probability forecasts and on combining several model calculations. Another issue is formulating detailed starting conditions for model calculations. This can be achieved by using more observations.

DATA IS THE BASIS

Enormous quantities of meteorological data must be handled and stored. Accordingly, development of a

more efficient database – now underway – is a prerequisite for SMHI's meeting the demands of the EU INSPIRE directive.

SMHI is cooperating with a number of national authorities. For example, it is exchanging observations as well as production development and educational information with the Swedish Armed Forces.

Weather satellites are important data sources. SMHI is engaged as an expert organization by EUMETSAT to improve satellite-derived information on clouds and climate. A new five-year project has been started to develop the application of satellite data on cloud height, which is important for both forecasting and climate monitoring.

EMERGENCY SUPPORT

SMHI's forecasting competence provides crucial support in the event of various emergencies. In 2011, a volcanic ash event in Iceland brought aviation to a stop at many European airports. SMHI supported actors by providing specific calculations and expertise. After the tsunami and ensuing breakdown of a nuclear plant in Japan, SMHI supported the Swedish Radiation Safety Authority by providing weather forecasts and calculations of the dispersion and fallout of the nuclear release over the surrounding area. Another example is an oil spill event

in 2011, when SMHI's oceanographic service provided special forecasts to the Swedish Coast Guard for several weeks, to support remediation work.

Since 2011, SMHI has been Sweden's Tsunami Warning Focal Point, receiving warnings from all over the world.

INTERNATIONAL COOPERATION

SMHI coordinates national cooperation for the Global Monitoring for Environment and Security programme, the European contribution to the Group on Earth Observations initiative. The target is to collect, process, and disseminate data and information services. SMHI is the Swedish representative to WMO, EUMETSAT, and ECMWF.

ECMWF = European Centre for Medium-Range Weather Forecasts

EUMETSAT = European Organisation for the Exploitation of Meteorological Satellites

WMO = World Meteorological Organization

BUSINESS SERVICES



Marina and Henrik support each other when developing products and services for the wind energy market.

SMHI services
wind power all the way
The energy sector is displaying increasing interest in wind power. SMHI has strengthened its position as a distributor of strategic decision support for the wind energy market. Services are available encompassing the whole process from location and set up to network connection, production optimization, and finally phase-out.

SMHI business services include everything from dam safety calculations for Swedish water power and climate regulation of buildings to advanced training programmes in several parts of the world. Deliverables consist of single tasks as well as complicated decision support for large infrastructure projects. SMHI also builds competence to ensure better future decisions. Everything is based on solid knowledge in the areas of climate, energy, and the environment.

CALCULATING FOR THE FUTURE

The goal is to develop products and services that support the individual, region, and country to achieve a promising future. As part of the Baltic Sea Action Plan, SMHI provides crucial support with calculations to promote better water quality. SMHI also handles calculations to support adaptation to climate change. The 2011 focus was on analysing how climate change may affect river flow and thus dam safety in Sweden.

MODERN APPLICATIONS

A graphical web-based system for monitoring winter-time road status presents observations and forecasts regarding, for example, surface temperature, frost cover, and slipperiness. The tool also recommends maintenance actions.

New mobile applications were developed in 2011: a weather app for the general public and a special farmer's app describing critical weather conditions for sowing and harvest.

PARTNERSHIP FOR MARKET SERVICE

To meet the demand for specialized business services, SMHI is working with several actors in complementary areas. A tool for optimizing sea transport has been internationally recognized, and SMHI Energy web products are now included in the market programme for energy dealers, Montel Online.

EDUCATION AND TRAINING

Demand has increased for education targeting various professional groups and activities in Sweden. In 2011,

SMHI provided training in how weather influences business for professionals working in the areas of roads, energy, shipping, and wind power.

The five-year international programme Air Pollution Management was completed in 2011 in India and Vietnam. An evaluation demonstrated that the participants succeeded in putting their knowledge into practice to promote better air quality in their home countries. In 2011, another 170 people started training in the Climate Change Mitigation and Adaptation programme; participants came from, for example, West Africa and the Middle East.

The four-year project with the Botswana Weather Service ended in 2011. Both parties expressed satisfaction with the results achieved in the areas of observation, information, and forecast production and presentation. Such international competence building is funded by the Swedish International Development Cooperation Agency (Sida).

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 650 million, of which approximately SEK 210 million is in the business services area.

SMHI

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