

Meteorology

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Introduction

The history of scientific meteorology in Finland originates from the first half of the 18th century. The oldest meteorological observations were made in the 1730s in Turku by some interested professors of Turku University. Those observations were started at the proposal of Dr. James Jurin, a student of Sir Isaac Newton, as part of an international programme supervised by the Royal Society. Although observations at eight other sites in Finland were also made during the second half of the 1700s, their scientific value remains somewhat questionable, due to interruptions or unspecified observation sites, methods and measuring instruments. The period of continuous meteorological observations at several stations started in the 1850s, after the establishment in 1838 of the Magnetic Observatory of the University of Helsinki, the predecessor of the Finnish Meteorological Institute.

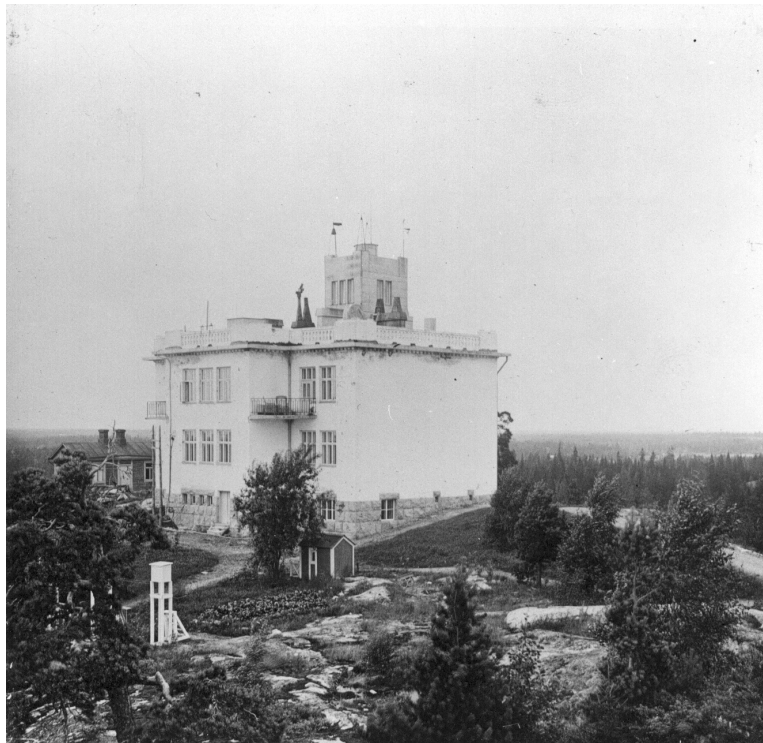
Scientific research in the field of meteorology was also rather sporadic in Finland before the last decades of the 1800s. No university vacancies were available solely for meteorological purposes, but certain principles of basic meteorology were probably included in the lessons of some of the professors of physics in the University of Helsinki, who also published their own studies on meteorology and related geophysics. Studies on frost formation by A.F. Hällström, on micrometeorology by Th. Homen and on normal barometers by A.F. Sundell may be mentioned as prominent examples. Finland also participated in the International Polar Year 1881–1882 by founding an observation site in Sodankylä for magnetic and meteorological observations.

More details of meteorological research and observations in Finland in the 1700s and 1800s have been published by e.g. Johansson (1913), Simojoki (1978), Seppinen (1988) and Heino (1994). Those publications also contain exhaustive lists of references to other papers on meteorological activities in Finland during that period.

Situation at the turn of the 20th century

The organization of meteorological services in Finland was still rather weak during the first years of the last century. In 1874 the Magnetic Observatory of the University of Helsinki was subordinated to the Finnish Society of Sciences and Letters, and in 1881 the Observatory was renamed the Finnish Meteorological Institute. Although the network of climatological stations was becoming considerably denser at the end of the 19th century and the Institute started to issue a monthly bulletin of the Finnish climate in 1881 and weather reports in 1885, the Institute still suffered from lack of competent manpower and other resources. Only one or two academic scientists were employed: their job was to run the organization, to prepare forecasts and to produce scientific papers and general information.

Some essential changes to the scientific organization were carried out during the first years of the 20th century. Research on inland and sea waters, a very important but laborious branch of natural science, had also been allocated to the Meteorological Institute, but now special bureaus were established, for oceanography in 1902, and for hydrology in 1907. The Meteorological Institute was now able to reorganise its branches, following the recent international advances in the study of atmosphere. Improvement of weather forecasts and the awakening needs of aviation called for more information about the upper atmosphere. This led to the foundation in 1910 of the aerological observatory at Ilmala, near Helsinki, as part of the Finnish Meteorological Insitute. Here upper-air soundings were carried out, initially using kites, later with radiosondes.



Ilmala observatory. (Courtesy of the Department of Meteorology, University of Helsinki.)

Declaration of independence and its impacts on meteorology

Finland declared its independence in 1917, and a full reorganization of public administration was started soon thereafter. In the new system the Finnish Meteorological Institute was transferred in 1919 from the Society of Sciences and Letters to the Ministry of Agriculture, and the organization of the Institute was also reconstituted to include three divisions. A need for more highly-educated meteorologists and for their education to take place in Finland was herewith increasing, and attention was turned to university education.

In those days meteorology was not yet an official university subject in Finland, although separate courses on meteorological subjects were occasionally organized in Helsinki by professors of physics. They also required students to read certain meteorological textbooks as part of the examinations. Lectures in agrometeorology were already given at the University of Helsinki from the 1910s onwards. More status was gained for meteorology in 1921 when Oscar V. Johansson was appointed as the first extraordinary professor in meteorology to the University of Helsinki. The professor was assisted by some lecturers (docents), but the first premises for meteorology within the Department of Physics remained very modest until 1957, when the Department of Meteorology moved into brand-new quarters in the Porthania building of the University of Helsinki.

Progress in meteorology between the First and Second World War

The development of meteorology in Finland in the years following the declaration of independence was clearly evident. The number of employees in the Finnish Meteorological Institute grew from 19 in 1919 to 75 in 1939: new branches, especially the aviation weather service from 1924 onward and a round-the-clock weather watch, demanded more specialized manpower both at the headquarters and the airports. The opening of new airports in Helsinki and Turku in 1936 led to a considerable increase in air traffic and also in real-time meteorological services. When regular radio broadcasting was started in Finland in 1926, the Meteorological Institute was involved in the preparation and transmission of weather reports from the very beginning.

The role of meteorological research was also gaining strength: talented Finnish scientists, Erik Palmén and Vilho Väisälä in particular, gained international reputations, the former from his synoptic and diagnostic studies and the latter with new technical inventions. Several meteorologists were elected members of leading scientific societies, and the role of meteorologists was also prominent when the Geophysical Society of Finland was established in 1926. Seven doctoral theses in meteorology were accepted by the University of Helsinki during the period 1926–1940.



Weather station. (Courtesy of the Finnish Meteorological Institute.)

Wartime meteorology in Finland

In 1939–1944 Finland was involved in the Second World War, and various military operations required intensified meteorological observations and weather forecasts. The number of educated meteorologists was insufficient, so substitutes with backgrounds in technical subjects or physics were recruited. For the most part the weather service was subordinated to the military command due to its importance in military operations.

More observations were needed from the upper atmosphere to facilitate air force operations in bad weather. Several temporary radiosonde stations were set up for this purpose, and the use of radiosondes increased considerably. Distribution of meteorological messages was mostly carried out in cipher code in order to keep them secret from enemies; the publication of weather forecasts for civil use was also limited.

New challenges after the Second World War

Some new tools were developed for meteorological services before or during the Second World War. Instruments and methods of observation had been earlier based on mechanical or electromechanical devices, but now more automated electronic instruments started to gain ground. This tendency accelerated more and more towards the end of the 20th century. Radiosondes were rather rare before the war, but their

importance in the meteorology of the free atmosphere was demonstrated in wartime military operations. Professor Vilho Väisälä had developed a Finnish radiosonde instrument at Ilmala Observatory in the 1930s, and this device turned out to be a success both scientifically and commercially. In 1936 Väisälä established a commercial company to manufacture radiosondes and their accessories. Radiosondes were thoroughly tested during scientific expeditions in polar and tropical conditions. About 95 per cent of the company's production has been exported. Since the end of the 1950s regular radiosonde observations have been made at three stations in Finland (Rossi, 1973).



Vaisala Weather Station in a tropical environment. Vaisala is the main worldwide producer of e.g. meteorological surface instrumentation and radiosondes. Clients exist in 110 countries and company offices are found in 20 countries. (Courtesy of Vaisala Ltd.)

Radar was another invention that was improved in wartime conditions. Soon after the war radar systems were modified for civil weather observations. Weather radars were used to observe rain, cloudiness and violent weather phenomena, whereas windfinding radars measured wind speed and direction in the free atmosphere. Radars have been used at the Department of Meteorology of the University of Helsinki since 1965 for scientific research and at the Finnish Meteorological Institute for aviation meteorology and weather surveillance since 1961. The number of radar stations was increased considerably by the FMI towards the end of the century. Three conventional weather radars were purchased in 1972–1980 and eight automated radars in the period 1985–1999.



Radio sounding. (Courtesy of the Department of Meteorology, University of Helsinki.)



Work in a radar station in the Department of Meteorology, University of Helsinki. (Courtesy of the Department of Meteorology, University of Helsinki.)

Until the 1970s the development of automatic weather stations was rather slow, but the introduction of microprocessors dramatically increased the capacity, versatility and reliability of automated meteorological systems. The Finnish Meteorological Institute and the Board of Navigation supported the installation of several automatic weather stations at lighthouses and other remote sites in the 1980s and 1990s in order to improve the safety of navigation. This action also considerably increased the availability of marine meteorological data from Finland.

After the war many more weather services were needed to satisfy expanding civil aviation and other demands from Finnish society and the economy. More meteorologists and technicians were taken on to run meteorological services at new airports and aerological stations. In 1959 the number of employees at the Finnish Meteorological Institute was 193, or tenfold compared to the situation in 1919.

The general expansion of meteorological services also entailed intensified training in meteorology at the University of Helsinki. More lecturers and assistants were employed, and an associate professorship in meteorology was created in 1969.

Meteorology and the environment

The relationship between meteorology and the environment is self-evident in agriculture, forestry, fishery, navigation and other lines of trade which depend on weather and climate. Many earlier meteorological studies in Finland and elsewhere deal, therefore, with the application of meteorological and climatological statistics to these subjects. The influence of man on the local climate was first observed in large cities, e.g. in London, as air pollution, whereas large-scale environmental problems such as nuclear fallout and harmful industrial emissions only came to light in the 1950s and 1960s as a result of the cold war and burgeoning industries.

In the 1960s the Finnish Meteorological Institute developed methods and practices for measuring and estimating the propagation of radioactive fallout from nearby or distant sources. At the end of the 1960s and in the 1970s some industrial companies or larger cities requested the help of the Institute in obtaining information about the propagation of harmful gases and airborne particles in their environment. Such activities soon expanded, and the FMI opened, in cooperation with other institutes and authorities, several measuring and monitoring stations for the versatile monitoring of environmental pollution. This work gained further impetus when new laws for air protection came into force. International research programs have been organized to monitor the propagation of harmful gases and particles and to propose ways and means to counteract global threats such as the enlarging ozone holes and the enhancement of the atmospheric greenhouse effect. Finnish meteorologists have participated very actively in such programmes and as scientific experts have helped national authorities to improve environmental legislation.



Finnish Meteorological Institute. (Courtesy of the Finnish Meteorological Institute.)

International cooperation

International cooperation in the field of meteorology has been traditional in Finland. Finland was under the rule of Sweden until 1809 and then under that of Russia until 1917; Finnish scientists were thus able to become familiar with scientific organizations and outstanding scientists in those countries. Although international travelling was rather rare in those days, leading Finnish scientists were also allowed to make study tours abroad or participate in important meetings in other countries. In the 1830s the first director of the Finnish Meteorological Institute, J.J. Nervander, made a study tour lasting three and half years in several countries of Central Europe to become acquainted with scientific ideas and operations in those countries in preparation for the founding of magnetic and meteorological observation and research facilities in Finland. In 1873 his successor, N.K. Nordenskiöld, participated in the first international meteorological conference in Vienna, at which meeting the International Meteorological Organization was founded. Oscar Johansson, the first Finnish professor in meteorology, studied meteorology in Austria and Germany in 1902–03.

International scientific cooperation increased considerably when Finland became independent. All directors of the Finnish Meteorological Institute and all professors in meteorology appointed after 1917 have studied or occupied a scientific post abroad for a time before taking up their high-level domestic posts. The study tours in the 1920s and 1930s were mostly made to Scandinavian countries or Germany, but after the Second World War these also took place in Great Britain and North America. Finnish

meteorologists have also actively participated in the relevant programs of the Second Polar Year 1932–1933 and of the International Geophysical Year 1957–1958, as well as in numerous international meteorological programs later on.

For financial reasons participation in the meetings of the International Meteorological Organization (IMO) and in other international meteorological events was at first limited to the most important occasions only. When the World Meteorological Organization (WMO) was founded in 1951 to replace the IMO, the role of the WMO as a sub-organization of the United Nations considerably increased the number of international conferences, workshops, working groups and other meetings in the field of meteorology. More government funds were thereafter allocated in Finland to international cooperation; later on, several other international organizations initiated and also financed multilateral study programs with a meteorological content. Many Finnish meteorologists have worked in the management of working groups of such projects.

The role Finland has played in international meteorological programmes in developing countries has been outstanding, in particular in the 1980s and 1990s. In 1987–1991, major Finnish development cooperation programmes were launched in coordination with the World Meteorological Organization. These programmes were financed by the Ministry of Foreign Affairs of Finland, while the Finnish Meteorological Institute acted as the main expert authority in watching over the planning and realization of the various sub-programmes. The first large-scale meteorological cooperation programme was implemented in the SADC countries in Southern Africa in 1987–1993 and the second in Central America 1991–1997. The financing provided by Finland for these two programmes was of an order of 25 million U.S. dollars, which is a very significant sum in the overall context of international meteorological cooperation. In addition, Finland has supported several other developing countries since the late 1960s by donating meteorological measuring equipment as well as technical and scientific expertise.

Arrival of the Computer Age in meteorology

At the beginning of the 20th century, theoretical studies on the behaviour of the atmosphere already indicated a great discrepancy between the generation and development of weather phenomena on the one hand and the available methods to analyze and forecast them in real time on the other. Developments in the atmosphere were obviously so intricate and influenced by so many variables that medium or long-range weather forecasts based on analyses of manually-drawn charts for a limited region were impossible by traditional methods. The percentage of correct forecasts decreased rapidly with forecast length.

In 1922 L.F. Richardson, a British mathematician, made a pioneering effort in the pursuit of numerical weather prediction. His attempt was a failure, due to at the time unknown physical and numerical relationships that would have led to important

simplifications in the governing equations and their solutions. Another limiting factor in those days was the very low capacity of calculators. The rapid and continuous evolution of electronic computers, which started soon after the Second World War, was step by step able to produce new computer models with astonishing performance. Meteorologists have been continuously in the forefront in using the latest developments in computer technology.

Attempts to use computers for weather forecasts and meteorological modelling in Finland were started in the early 1960s both at the Department of Meteorology of the University of Helsinki and at the FMI. In 1969 the FMI purchased its first central computer. Finland was also actively involved in the COST project of the European Union for establishing a European Centre for Medium Range Weather Forecasts (ECMWF). This centre was opened in England, in 1979; since then several Finnish meteorologists have contributed to its work.

Besides weather forecasting and modelling, meteorological telecommunication systems and many meteorological measuring devices today also need considerable computer support. In addition, almost all meteorologists are nowadays connected to various sources of information, communication and data through their personal computers.



Forecast meteorologist at work in the Finnish Meteorological Institute. (Courtesy of the Finnish Meteorological Institute.)

Scientific papers and other publications

The number of scientific, technical and educational papers published by Finnish meteorologists during the 20th century is rather large considering the small number of experts. To give an example, a bibliography on the climate of Finland that was published in 1988 contains references to about 900 publications. Scientific

meteorological papers, such as academic theses and other important studies, have customarily been published in the journals of the Finnish Society of Sciences and Letters and the Finnish Academy of Science and Letters, as well as in several university publication series, those of the Finnish Meteorological Institute and in the *Geophysica* journal of the Geophysical Society of Finland. Numerous papers have also been accepted by authoritative international meteorological journals that use the peer review system. The majority of papers have been published during the last decades of the century.

The proceedings of international meteorological conferences also contain a large number of papers written by Finnish participants. Shorter domestic scientific contributions, technical papers and lecture notes for limited distribution have often been published as photocopies. Information on meteorology has been published in many professional journals and newspapers and recently also on the Internet.

The small number of Finnish-speaking meteorologists coupled with high editing and printing costs has seriously limited the publication of advanced meteorological textbooks in Finnish. On the other hand, several extensive textbooks on popular meteorology and meteorological applications have been written in Finnish during the course of the 20th century.



Opening of the Erik Palmén Memorial Symposium on Extratropical Cyclones in Helsinki, August 1988. (Courtesy of the Department of Meteorology, University of Helsinki.)

Noted Finnish meteorologists of the 20th century

The number of distinguished Finnish meteorologists during the last century is rather small, for obvious reason. In the early 1900s the role of meteorology was very modest, and the only notable vacancy throughout the century was the post of the director of the Finnish Meteorological Institute. The holders of this post have therefore played a most important role in the organization and direction of meteorological services and information, but their role as scientists has sometimes been less remarkable due to the work load inherent in the organization and general management of the Institute. Since the 1980s the FMI has appointed research professors in order to strengthen its scientific expertise, and several FMI staff members have also worked as lecturers or training assistants at universities or educational establishments.

Professors of meteorology at the University of Helsinki, on the other hand, have been more able to devote themselves to teaching and scientific work. The number of students has also been rather small thus providing an opportunity for personal guidance during their studies. Most advanced students have customarily been later appointed to vacancies which rather well correspond to their area of interest, although the very low number of top meteorological vacancies has sometimes made their filling more or less casual.

Some Finnish meteorologists have also earned credit by working effectively abroad in the service of famous universities or renowned international organizations. These merits have mostly been gained since the Second World War when more foreign scientists or specialists have been employed by such research centres and organizations.

The following list first contains the names of high-ranking meteorological officials and distinguished meteorological scientists or specialists in Finland during the 20th century; thereafter, more information is given on a selected group of them.

Directors of the Finnish Meteorological Institute (see *Seppinen*, 1988)

Ernst Biese	1890–1907
Gustaf Melander	1907–1931
Jaakko Keränen	1931–1953
Matti Franssila	1953–1970
Lauri Vuorela	1971–1979
Erkki Jatila	1980–

Professors in meteorology at the University of Helsinki (see *Holopainen and Leskinen*, 1996)

Oscar Johansson	1921–1947
Vilho Väisälä	1948–1958
Lauri Vuorela	1958–1971
Eero Holopainen	1971–1997
Hannu Savijärvi	1997–

Distinguished scientists

Erik Palmén

Other specialists

Climatology: Ville Korhonen, Juho Angervo, Raino Heino, Reijo Solantie

Aerology: Veikko Rossi

Air quality: Antti Kulmala

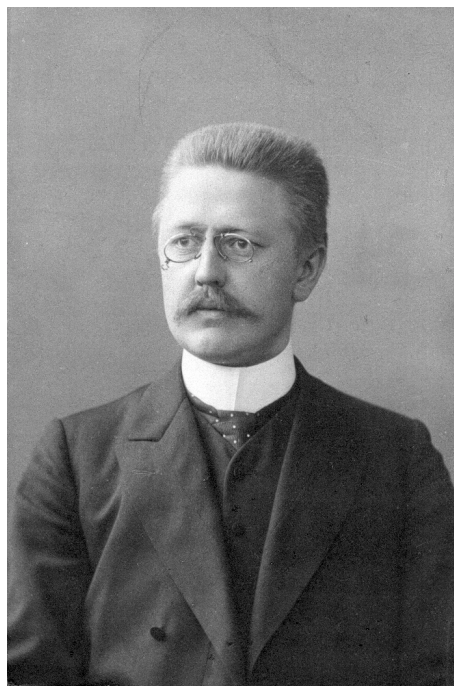
Instruments and measurements: Seppo Huovila, Timo Puhakka

Forecasts and other services: Sulo Venho, Jorma Riissanen

Numerical meteorology: Daniel Söderman, Juhani Rinne

Boundary layer: Sylvain Joffre, Martti Heikinheimo

Oscar V. Johansson (1878–1956), the first extraordinary professor in meteorology at the University of Helsinki, held this office from 1921 to 1947. His main subject was climatology; most of his more than 140 scientific papers deal with different features of the climate of Finland. Johansson also participated wholeheartedly in the work of several scientific societies, and started the publication of the scientific series “Mitteilungen-Papers” in his institute. In his younger days he worked from 1901 to 1921 at the Finnish Meteorological Institute as a meteorologist and in 1919 was appointed director of a division.



Oscar Johansson (1878–1956). (Courtesy of the Department of Meteorology, University of Helsinki.)



Jaakko Keränen (1883–1979) worked at the Finnish Meteorological Institute from 1911 to 1919 as a magnetist, from 1921 to 1931 as director of a division, and finally as the director of the Institute in the period 1931–1953. Keränen was not famed as a scientist but he is perhaps the best-known meteorologist of all in Finland due to his long and versatile official career, his good relationship with higher officials and his popularity with the Finnish people.

Jaakko Keränen (1883–1956). (Courtesy of the Finnish Meteorological Institute.)

Vilho Väisälä (1889–1969) was a famous inventor, and the developer of modern and advanced meteorological instruments. His most successful inventions were the Finnish radiosonde in the 1930s and the Finnish radiotheodolite in the 1950s. In 1936 he founded a company, Vaisala Oy (*Pitkänen, 1986*), which is today one of the world's leading manufacturers of meteorological instruments. Väisälä worked from 1912 to



1948 at the Finnish Meteorological Institute, for the most part as director of the aerological division, and from 1948 to 1958 he served as extraordinary professor in meteorology at the University of Helsinki. Väisälä received several scientific honours, and the Geophysical Society of Finland struck a medal in 1959 to commemorate his scientific achievements.

Vilho Väisälä (1889–1969). (Courtesy of Vaisala Ltd.)

Erik Palmén (1898–1985) was famous throughout the meteorological community for his work on atmospheric circulation, tropical meteorology and jet streams. In the 1920s and 1930s he studied the structure and behaviour of mid-latitude cyclones in close association with the famous “Bergen school”. In 1939–1947 he was director of the



Finnish Institute of Marine Research and in 1948 he was elected to the Academy of Finland as one of its twelve distinguished members. After the Second World War, Palmén visited the United States several times. In the 1940s he worked at the University of Chicago, and in 1953–1954 was a visiting professor at the University of California (UCLA). Palmén received several international honours from scientific societies and organizations. In 1968 the Geophysical Society of Finland struck a medal to mark his distinguished career.

Erik Palmén (1898–1985). (Courtesy of the Department of Meteorology, University of Helsinki.)

Matti Franssila (1905–1976) was director of the Finnish Meteorological Institute in 1953–1970 and lecturer in meteorology at the University of Helsinki and at several technical institutions of higher education. He was well-known as an expert in micrometeorology, and wrote a university textbook on this subject. He also made significant contributions to the study of agrometeorology in Finland.



Matti Franssila (1905–1976). (Courtesy of the Finnish Meteorological Institute.)

Lauri Vuorela (1913–1999) distinguished himself as professor of meteorology at the University of Helsinki in 1958–1971 and as director of the Finnish Meteorological Institute from 1971 to 1979. He was first and foremost a good scientific organizer and



was able to develop the image and operations of both institutions significantly. Vuorela also fostered the role of Finland in the World Meteorological Organization and other international efforts. He also held or chaired several important posts in their administration. In Finland he was known as a very energetic and influential person in several scientific societies and foundations.

Lauri A. Vuorela (1913–1999). (Courtesy of the Finnish Meteorological Institute.)

Eero Holopainen (1937–) held the chair in meteorology at the University of Helsinki over a period of more than a quarter of the 20th century. He also worked several times as a visiting scientist in the United States and several other countries. In 1984–1989 Holopainen was appointed as a research professor of the Academy of Finland. Holopainen, together with Palmén and Väisälä, makes up the trio of the best meteorological scientists in Finland during the 20th century. He has been frequently invited to review scientific programs and to give lectures at prestigious meteorological meetings.



Eero Holopainen (1937–). (Courtesy of the Department of Meteorology, University of Helsinki.)

Erkki Jatila (1939–) has been the director of the Finnish Meteorological Institute since 1980. In 1971–1976 he worked as associate professor in meteorology at the University of Helsinki and in 1976–1980 and 1990–1992 in the headquarters of the World Meteorological Organization in Geneva. His wide international experience has fostered the participation of the FMI and its staff in many international research and development programmes in the field of meteorology and its applications. Jatila himself has held many high posts within these programmes or in important domestic projects related to meteorology.



Erkki Jatila (1939–). (Courtesy of the Finnish Meteorological Institute.)

Chronological list of memorable meteorological events

The following list recalls memorable events of interest or importance to meteorological science or its application in Finland during the 20th century:

- 1903 Oscar V. Johansson participates in a meteorological balloon flight which starts in Vienna, reaches an altitude of 3600 metres and lands in Hungary.
- 1909 The senate accepts the foundation plan of the Ilmala observatory.
- 1911 Kite soundings started at Ilmala.
- 1920 First observations for aeronautical meteorology.
- 1923 The Finnish airline Aero opens business, starting flights to Stockholm in 1924. The company requests special forecasts from the FMI.
- 1925 First FMI weather reports broadcast by radio.
- 1926 Erik Palmén defends his doctoral thesis at the University of Helsinki. The Geophysical Society of Finland is founded (*Johansson, 1935*).
- 1931 Vilho Väisälä successfully launches the first prototype of his radiosonde at Ilmala and in 1936 founds a company to manufacture them.
- 1939 Vilho Väisälä makes an expedition on board a ship to South America to test his radiosondes in oceanic and tropical conditions.
- 1948 Erik Palmén is elected member of the Academy of Finland.
- 1949 New aerological observatory of the FMI opened at Sodankylä.

- 1950 Finland ratifies its joining of the World Meteorological Organization (WMO) which replaces the International Meteorological Organization (IMO) in 1951.
- 1957 Ilmala observatory moved to Jokioinen.
- 1958 First weather forecasts on Finnish TV.
- 1959 The local telephone company in Helsinki starts an automatic telephone reply service to disseminate weather forecasts prepared by the FMI.
- 1962 Seppo Huovila works in Jordan as the first Finnish WMO technical expert.
- 1965 The first Finnish numerical weather forecast is made at the Department of Meteorology of the University of Helsinki.
- 1965 Department of Meteorology of the University of Helsinki purchase its first weather radar, which is replaced in the 1984 by a Doppler radar. Over the period 1973–1999 the FMI purchases eleven weather radars.
- 1966 New main building of the FMI inaugurated to replace the old building completed in 1844.
- 1969 First central computer of FMI brought into operation.
- 1969 Erik Palmén and Chester Newton write a comprehensive meteorological textbook “Atmospheric Circulation Systems”.
- 1973 Sixth session of the WMO Commission for Instruments and Methods of Observations, the first major WMO meeting in Finland, assembles in Helsinki. In 1973–1981 Seppo Huovila serves as vice-president and in 1981–1989 as president of the Commission.
- 1973 Finland joins the European Centre for Medium-Range Weather Forecasts (ECMWF) which starts its operations in England in 1979. Daniel Söderman works in 1980–1989 as head of the operations department and in 1982–1989 as deputy director of the Centre.
- 1976 Erkki Jatila works under the Secretary-General of the WMO in Geneva as scientific expert, from 1976 to 1980 and as director of technical cooperation department from 1990 to 1992. In 1980–1989 he serves as a member of the Executive Council of the WMO.
- 1980 Eero Holopainen serves, in a personal capacity, as a member of the ICSU/WMO Joint Scientific Committee on the World Climate Research Programme.
- 1986 Finland joins the EUMETSAT organization. Jorma Riissanen serves as chairman of the EUMETSAT council in the period 1994–1996.
- 1988 The Geophysical Society of Finland and the American Meteorological Society organize the Erik Palmén Memorial Symposium on Extratropical Cyclones in Helsinki.
- 1988 First supercomputer installed in Finland. FMI uses 20 per cent of its capacity.

- 1994 Extraordinary session of the WMO Commission for Basic Systems is held in Helsinki.
- 1995 International Conference on Past, Present and Future Climate, organized by the Finnish Research Programme on Climate Change, is held in Helsinki.
- 1996 Weather Service Finland, a private company established by Pirkko Saarikivi, begins to deliver weather forecasts and other meteorological services to customers.
- 1999 The number of full-time employees at the FMI is about 570 and at Vaisala Oy about 970. At the turn of the century Vaisala Oy has manufactured about six million radiosondes, of which about 95 per cent have been exported.

Doctoral theses of Finnish meteorologists accepted by the University of Helsinki or by foreign universities in the 20th century

- 1926 Kallio, Niilo: Über die Windverhältnisse der oberen Luftschichten am aerologischen Observatorium Ilmala nebst Übersichten für andere Gegenden.
Palmén, Erik: Über die Bewegung der aussertropischen Zyklonen.
- 1928 Angervo, Juho, M.: Einige Formeln für die numerische Vorausbestimmung der Lage und Tiefe der Hoch- und Tiefdruckzentra.
- 1936 Franssila, Matti: Mikroklimatische Untersuchungen des Wärmehaushalts.
Kuuskoski, Urpo: Kaakkois-Suomen tuulisuhteet.
Meinander, Runar: Studien über den täglichen Temperaturgang in Europa.
- 1940 Rossi, Veikko: Aerologische Untersuchungen über die Feuchtlabilität der Luft in Finnland besonders in Gewitter- und Schauerwetterlagen.
- 1944 Hela, Ilmo: Über die Schwankungen des Wasserstandes in der Ostsee.
- 1949 Venho, Sulo, N.: A study of meteorological phenomena connected with the outflow of polar air masses over western Europe.
- 1950 Vuorela, Lauri, A.: Synoptic aspects of tropical regions of Atlantic Ocean, West Africa and South America.
- 1955 Nurminen, Aili: Some aspects of fog, with special reference to South Finland.
Similä, Artturi: Über Gewitterbildung und Gewittervorhersage besonders in Skandinavien.
- 1956 Tommila, Mauri: A variable-radio-frequency radiosonde system with graphical transfer of the recording to the aerological diagram.
- 1961 Huovila, Seppo: Contributions to the measurement and interpretation of small-scale temperature fluctuations.

- 1964 Helimäki, Ilmari: On the annual and diurnal distribution of temperature, humidity and wind above Murchison Bay, Spitzbergen, during the International Geophysical Year 1957–1958.
Holopainen, Eero: Investigation of friction and diabatic processes in the atmosphere.
- 1969 Laitinen, Erkki: On the warming of the troposphere in spring in North Finland.
- 1970 Kulmala, Antti: Heat balance of the earth's surface at Jokioinen, summer 1968.
- 1971 Rinne, Juhani: Investigation of the forecasting error of a simple barotropic model with the aid of empirical orthogonal functions.
- 1973 Jatila, Erkki: Measurement of precipitation by RADAR.
- 1974 Puhakka, Timo: Studies on the quantitative measurement of precipitation by RADAR.
- 1976 Riissanen, Jorma: Mesometeorological structure of the lower atmosphere near Helsinki.
- 1980 Savijärvi, Hannu: Diagnostic studies on the balance requirements of the atmospheric large-scale flow.
- 1981 Alestalo, Mikko: On the energy and water balance of the earth-atmosphere system in Europe.
- 1982 Joffre, Sylvain: A theoretical and empirical study of the atmospheric boundary layer dynamics over a frozen sea.
Nordlund, Göran: On the dispersion of airborne pollutants with particular emphasis on sulphur in the air over Finland.
- 1985 Makkonen, Lasse: Atmospheric accretion of ice loads.
- 1989 Ruosteenoja, Kimmo: Simulating the effect of the critical latitude on the extra-tropical response of a linear stationary wave model.
- 1990 Saarikivi, Pirkko: Observational studies on the subsynoptic structures in extra-tropical cyclones.
Solantie, Reijo: The climate of Finland in relation to its hydrology, ecology and culture.
- 1992 Lönnberg, Peter: Optimization of statistical interpolation.
- 1993 Fortelius, Carl: The sources and sinks of energy and water in the atmosphere.
Taalas, Petteri: Factors affecting the behaviour of tropospheric and stratospheric ozone in the European arctic and in Antarctica.
- 1994 Heino, Raino: Climate in Finland during the period of meteorological observations.
- 1995 Järvinen, Heikki: Meteorological data assimilation as a variational problem.

- 1996 Kaurola, Jussi: Diagnostics of the present and future climate in the ECHAM3 model: Storm tracks and wave propagation during the boreal winter.
- 1997 Rummukainen, Markku: Modeling stratospheric chemistry in a global three-dimensional chemical transport model. Model development.
- 1998 Venäläinen, Ari: Aspects of the surface energy balance in the boreal zone.
Räisänen, Jouni: Intercomparison studies of general circulation model simulations of anthropogenic climate change.
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Problems and challenges at the end of the 20th century

During the 20th century the development of meteorology has been outstanding in Finland and over the whole world. On the one hand this progress has been achieved through intensive theoretical research into the properties and behaviour of the atmosphere and on the other hand through the general development and new discoveries in technology. The rate of progress has accelerated continuously towards the end of the century, and many recent inventions and applications offer promising challenges. Theoretical and experimental studies on the atmospheres of neighbouring planets and the versatile real-time distribution of weather information to the mass media can be mentioned as two typical examples. Finnish meteorologists are nowadays working in the front line of scientists in these fields.

This rapid, even breathtaking, development has also generated some serious problems that may distort or retard the development of meteorology in coming years. Increasing needs for more research, development and applications have up to the present been solved by employing more manpower, but the increasing cost of manpower versus automation is nowadays leading towards ever more automation of meteorological operations and services. The decreasing number of brain workers and technicians at research institutes and the vulnerability of fully-automated system to atmospheric extremities or other disturbances may be mentioned as likely problems in meteorology and other atmospheric sciences in the foreseeable future.

Meteorological institutes and weather services have traditionally been government agencies, but the tendency towards replacing part of them with private enterprises, together with the associated problems and challenges, is already clearly evident.

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