

# Appendix A

## Structure, Organization and History of the Bolin Centre

### 1. STRUCTURE AND ORGANIZATION OF THE BOLIN CENTRE

The overall organization of the Bolin Centre is summarized in the figure below. The Bolin Centre is led by a Board with representation from SU and its partners, as decided on by the President of Stockholm University. The operational activities of the Bolin Centre are led by a Directorate, which is also responsible for coordination and communication activities. The directorate is comprised of a Director, a vice-director and a Coordinator. The Directorate also oversees the scientific support functions of the Bolin Centre: the Climate Research School, Climate Model Coordination and the Bolin Centre Database. These science support functions are designed to provide broad support across the range of climate research carried out at the Bolin Centre. This climate research is organized into four Research Themes (RTs): (RT1) The physical-chemical climate system, (RT2) Water, biogeochemistry and climate, (RT3) Past climates and (RT4) Climate, ecosystems and biodiversity. Each RT is led by two senior researchers employed at, or affiliated to, a Bolin Centre institution (SU, KTH or SMHI). The RTs can choose to have additional RT co-leads that support specific functions or research directions within the RT. Together, these RT leads comprise the Science Advisory Group (SAG), which guides the scientific direction of the Bolin Centre and provides leadership and support within their specific themes. See Appendix B for in-depth descriptions of the scientific direction and expertise of each RT. The External Science Advisory Group is comprised of internationally recognized experts in climate science. They provide support, advice and feedback on all aspects of the Centre, including both management and its scientific direction.

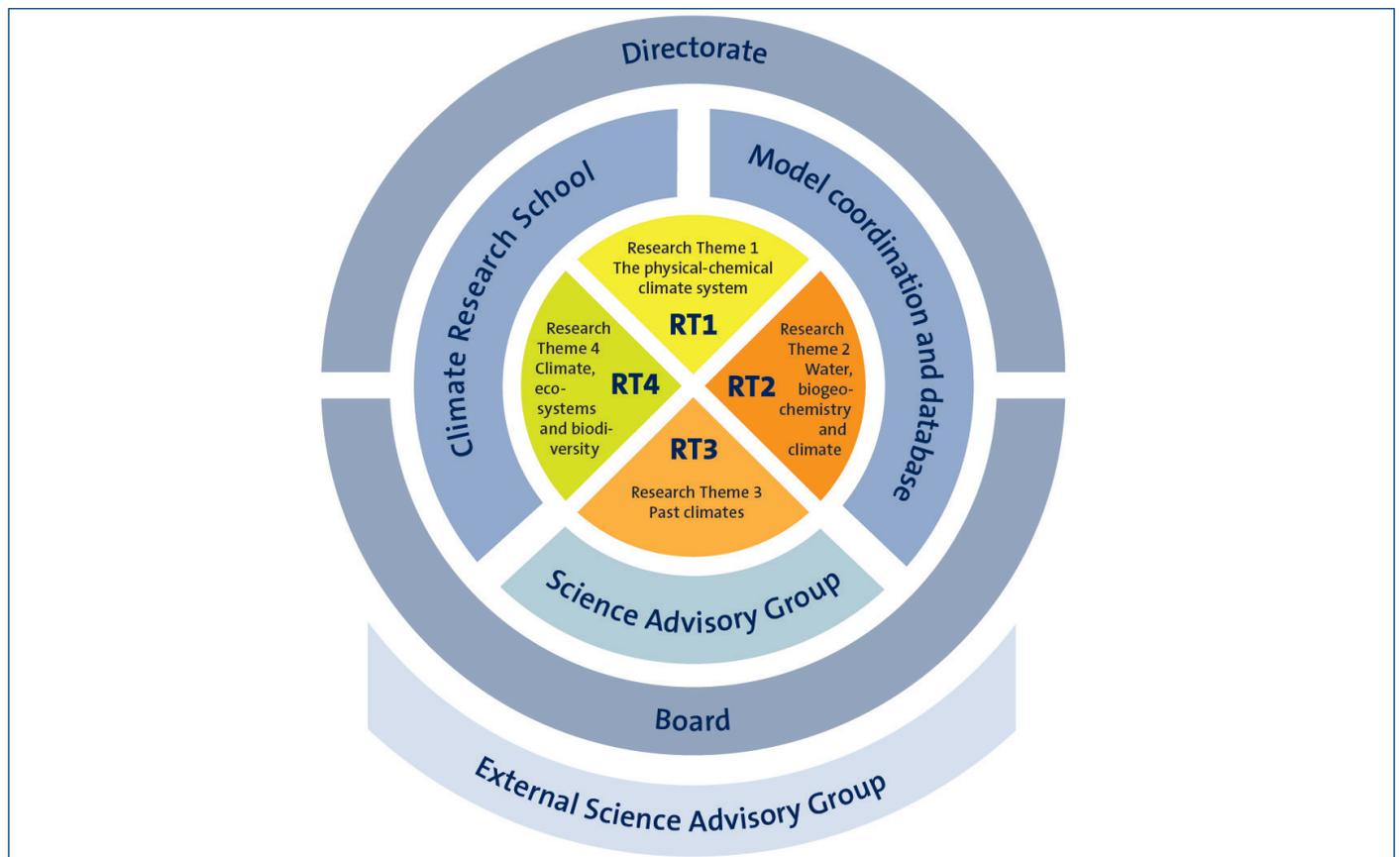


Illustration of the organizational structure of the Bolin Centre.

## 2. OVERARCHING SCIENCE SUPPORT ACTIVITIES

### 2.1 Modelling Coordination

The modelling coordination team's primary task at the Bolin Centre is to ensure that researchers at the Bolin Centre have access to computing resources adequate for performing simulations with numerical models required for climate research, the most prominent type being climate and Earth system models. The centre also arranges large scale data storage resources to provide an efficient data analysis platform. Storage resources include both storage facilities for climate model output as well as for large data sets being widely used, such as reanalysis and CMIP datasets. Apart from the core activities of securing computing and storage for Bolin Centre scientists, the modelling coordination team also provides general support for using climate models. This includes helping users e.g. install and run codes and handle data. The centre regularly organizes workshops and training events related to high performance computing and climate modelling, and user meetings for the modelling communities within the Bolin Centre. In the coming five-year period of the Bolin Centre, the modeling coordination team will look into taking an even stronger national role in organizing and coordinating climate-related numerical modeling and assess the possibilities to expand to new types of climate-related numerical modeling tools and techniques.

### 2.2 Bolin Centre Database

The Bolin Centre Database is a modern repository for research data and source code. It provides open access to climate and other Earth system data and source code from scientists at the centre and their collaborators, following the Stockholm University policy for Open Science and the FAIR principles for data sharing. The Bolin Centre Database is, since 2022, a part of the central research data management team at Stockholm University. In 2023, the Bolin Centre database became a flagship project within the Swedish National Data Service.

The Bolin Centre Database assigns DOIs, manages large datasets, creates interactive data visualizations, provides data collections for research groups and has secure storage with backup in Sweden provided by SUNET. The latter ensures that we meet requirements from the Swedish Government that data from Swedish universities shall be stored securely, within the borders of our country. According to an extensive assessment by the European Open Science Cloud (EOSC) the Bolin Centre Database has a very high FAIR level, among the best data repositories in Europe.

The need of the climate research community for support from the Bolin Centre Database is expected to increase further in the coming years. The Bolin Centre Database will hence continue to support the Bolin researchers in all essential aspects of data management issues, and work towards improving the workflow from research to publication of the data even further. The director of the Stockholm University research data management team and the Bolin Centre Database will develop a common strategy of how to strengthen the sustainability of our repository and to integrate it more in the university's infrastructure for research data support.

### 2.3 Climate Research School

The Bolin Centre Climate Research School (CRS) organizes climate-related courses, summer schools and activities for early career researchers within the Bolin Centre. The focus has long been on PhD-students, but since 2022, activities coordinated by the CRS are extended to also include post-doctoral researchers. We this we hope to ensure a broad support network for early career researchers within the Bolin Centre. The CRS has long been an important part of the Centre, and vital to its growth (see History of the Bolin Centre below). In addition to activities within the Bolin Centre, the CRS also offers funding to support early

career researcher participation in external international conferences, courses and workshops. The CRS also organizes an annual meeting and other social events only for early career researchers to meet and network.

The climate research spans over several institutions and research areas in the Bolin Centre. Since 2020 CRS cooperate with and ClimBEco Graduate School at the Centre for Environmental and Climate Science (CEC), Lund University. This widens the possibility for Climate Research School students to participate in courses and workshops offered by the ClimBEco program, and for students enrolled in ClimBEco to participate in courses and activities offered by the Bolin Centre Climate Research School. The courses offered are based on student feedback and demand, in other words, there is an active effort by the CRS to provide courses that students deem valuable to their future career as researchers. In the future, the CRS will look into opportunities for future deepening the collaboration of Bolin partner organizations, particularly the Stockholm Trio network.

### 3. HISTORY OF THE BOLIN CENTRE

*This text is adapted from a text published on January 4, 2018 by Jan Backman, Johan Kleman and Henning Rodhe. Translation from original text in Swedish by Alasdair Skelton.*

See full text here: <https://bolin.su.se/about-us/bolin-centre-s-history>

In the years leading up to the turn of the millennium, publication of the first reports by the Intergovernmental Panel on Climate Change (IPCC) awakened interest both among researchers and society at large about the question of anthropogenic climate change. The first few years of the new millennium was a time of active work towards creating a joint platform for climate research in the Natural Sciences, both within and across institutions. This work led to a cross-disciplinary climate research school being established in 2005 and, shortly thereafter (2006), the founding of the climate research program SUCLIM (Stockholm University Climate Research Centre), which later grew and changed into the Bolin Centre for Climate Research. This work was led by the Dean of the Science Faculty, Henning Rodhe, together with the leaders of the Section for Earth and Environmental Sciences, Jan Backman and Johan Kleman. From 2010, the Swedish Hydrological and Meteorological Institute (SMHI) and the KTH Royal Institute of Technology joined the Bolin Centre in a collaboration aimed at strengthening climate modelling within the centre. This initiative was funded as a strategic research area (SFO) by the Swedish government. In June 2016, the Bolin Centre merged with another strategic research area at Stockholm University: EkoKlim. This merger widened the scope of the Bolin Centre to include the impacts of climate change on landscape processes and biodiversity. The text below outlines the early history of how the Centre became established at Stockholm University.

A century ago, Svante Arrhenius had already undertaken research at Stockholm University on the importance of atmospheric CO<sub>2</sub> to Earth's climate. In the 1950s, Bert Bolin re-established research on this fundamental question. His outstanding scientific expertise on CO<sub>2</sub> and Earth's climate as well as his organisational and diplomatic skills ultimately led to his founding roll in the IPCC, an organisation which he led during its first ten years (1988–1998). In 2007, IPCC was awarded the Nobel Peace prize. Bolin experienced the Nobel prize ceremony, but only at a distance before he passed away, a few weeks afterwards. In 2008, the name *Bolin Centre* was proposed by the Science Faculty, with approval of Bert Bolin's family in honor of his contribution to climate research. A longer biography of Bert Bolin is found in section 4 below.

#### 3.1 The start of the Climate Research School

At the start of 2005, the Faculty of Science published a call for cross-disciplinary research schools. Climate researchers from several different departments prepared an application which was awarded funding by the Faculty Board in September, 2005. A steering committee with representation from MISU, NG, IGV and

ACES was founded to lead the research school. A key goal of this group was to create PhD level courses which were of interest to PhD students from several of the four host departments. Another goal aimed at stimulating cross-disciplinary research was for all PhD students to be co-supervised from at least two participating departments.

### 3.2 The Linnaeus Grant, SUCLIM and the Bolin Centre

In June 2005, the Swedish Research Council (VR) published a call for cross-disciplinary research within a framework of their so called *Linnaeus program*. An application was submitted to VR for a Linnaeus grant for climate research (*Climate evolution, variability and sensitivity*) by the Rector of Stockholm university and was granted funding in June 2006. The total funds awarded were 120 MSEK over 10 years, of which 20 MSEK was allocated to the Climate Research School, which was called SUCLIM. A steering group was established with Johan Kleman as chairperson. Its members included the chairperson of the Climate Research School and representatives from the four participating departments (IGV, NG, ACES, MISU).

In October 2008, the government submitted a research proposition in which the need for climate modelling in Sweden was highlighted. An application for strategic funds to climate modelling research was submitted from SU to the Swedish Research Council for Sustainable Development (FORMAS). FORMAS awarded 18.3 MSEK annually for five years, which were to become permanent university funds after five years, half of which were guaranteed by the Rector to climate research. At this time, the name Bolin Centre was established and the activities were broadened to include the Swedish Hydrological and Meteorological Institute (SMHI) and the KTH Royal Institute of Technology. This strategic collaboration across institutions further strengthened the research environment for advancement in climate modelling.

From its beginning, a key principle of the Bolin Centre was to strengthen its host organisations. A sizeable portion of the funds from FORMAS were therefore used to employ new researchers/lecturers at the host departments. This made it possible for new recruitments within the Bolin Centre to be seen as long term investments made in partnership with the host departments. In practice, 10-year agreements were made with the respective Heads of Department and promises were made to ensure continued funding after the first ten years. In this manner, the Bolin Centre sought to strengthen its host departments – creating an umbrella-style organization – rather than being a drain of its host departments by taking their best researchers from them. This strategy has proven itself a key to the Bolin Centre’s long-term success. Another key principle of the Bolin Centre was that a certain amount of funds should be available for the steering group to invest freely in collaborative initiatives. This was put into practices with open calls for cross-disciplinary research assistant positions and small grants.

An International Scientific Advisory Committee was established during the autumn of 2006. This group consists of leading international climate researchers representing the Bolin Centre’s multiple focus areas. Constructive feedback from this group has been of great value for the organisation.

## 4. A BIOGRAPHY OF BERT BOLIN, A WORLD LEADER IN CLIMATE SCIENCE

*This text is adapted from a text originally written by Henning Rodhe and published in the Bolin Centre webpage here: <https://bolin.su.se/about-us/bert-bolin>*

Bert Bolin was born in Nyköping, a town south of Stockholm, Sweden. He became interested in meteorology at an early age inspired by his parents, who were both school teachers. In his research career, Bert made fundamental contributions to both numerical weather forecasting and to the science of biogeochemical cycles. Bert began working on numerical weather prediction in 1950, when he spent a year at the Institute for

Advanced Study in Princeton, New Jersey working with Jule Charney, John von Neumann and other leading scientists on the first computerized weather forecast using ENIAC, the first electronic computer. Shortly after finishing his PhD in 1956, on the advice of his supervisor Carl-Gustaf Rossby, Bert began working on atmospheric chemistry and the cycling of pollutants in the atmosphere. Bert's work in this area led to fundamental advances in our understanding of the carbon cycle – not only in the atmosphere, but also in the oceans and terrestrial biosphere. Bert was a key person in establishing the science of biogeochemistry.

In addition to his considerable scientific contributions, Bert also played a leading role in establishing and running many of the international research organizations we now take for granted. As early as 1963, Bert became involved in organizing an international effort to use the new satellite tools that were becoming available to study the general circulation of the atmosphere and develop new methods for weather forecasting. This effort led to the formation of the ICSU Committee on Atmospheric Sciences (CAS) in 1964, and Bert became its first Chairman.

This led to the development of a number of international environmental research organizations in which Bert played a leading role. The CAS initiated the Global Atmospheric Research Programme (GARP) in 1967, again with Bert as the first Chairman. This effort brought together scientists from all over the world, a major feat in the days of the cold war. It also produced an early example of what could be done to combine large coordinated international field experiments with model testing and development. The success of this effort led to the transition of GARP into the World Climate Research Programme (WCRP) in 1980.

During the 1980s, the need for better collaboration between geoscientists and biologists became evident. Stimulated by Mustafa Tolba (then the Executive Director of UNEP), Bert in 1983 began a UNEP-supported project to look into the links between physical climate and global ecosystems. In 1985–86 Bert chaired an ICSU working group that produced background material used by ICSU in its decision in 1986 to launch the International Geosphere-Biosphere Programme (IGBP).

Bert played a central role in the formation and management of the Intergovernmental Panel on Climate Change (IPCC). After the UN Commission on Environment and Development's report *Our Common Future* (the *Brundtland report*) was published in 1987, the need was recognized for an intergovernmental assessment panel on the issue of climate change. The WMO and UNEP governing bodies agreed to work together to form this panel, and in November 1988 the IPCC took form. Yet again, Bert Bolin was selected to be the first Chairman of an important new international organization. Bert chaired the IPCC from 1988 to 1997, through its first two assessment reports. He was instrumental in establishing IPCC as a model for how international global environmental assessments should be done.

During much of this time (from 1961 to his retirement in 1990) Bert Bolin was professor of meteorology at Stockholm University. Bert was an esteemed colleague to many leading scientists, and mentor and guiding light for many young minds who have since become leading scientists. While it is easy to document Bert's many scientific and organizational achievements, perhaps his most important contribution has been building the human capital we now enjoy within the science of the Earth System. Bert Bolin has left a great legacy not only of world-class science, but also of how international, interdisciplinary science can be organized and carried out.