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International Perspectives on the History of Meteorology:

Science and Cultural Diversity

Papers from the Inaugural Symposium of the

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Introduction

The inaugural symposium of the International Commission on the History of Meteorology (ICHM), "International Perspectives on the History of Meteorology: Science and Cultural Diversity," was held in Mexico City in July 2001 during the XXIst International Congress of History of Science. The twelve presenters addressed scientific, technological, environmental, social, political, and cultural dimensions of the history of meteorology. How did meteorology emerge as an international science? What tensions have existed between national weather services, national research styles, and international or global agendas? What were the social and cultural implications of transnational research, education, service, and forecasting? Answers to these and other questions emerge in the papers that follow.

The first paper in the volume, *Benjamin Franklin and the First Lightning Conductors* by E. Philip Krider, examines Franklin's electrical hypotheses of the 1750s, namely, that tall insulated conductors might be useful in examining the electrification of thunderclouds and that grounded metal rods would protect buildings from lightning damage. Professor Krider examines the origin of these ideas and traces their reception and implementation in the American colonies and in Europe. He describes the design of the earliest protective rods and how they were gradually improved as experience was gained in practice between 1752 and 1762.

The paper by Lizardo Seiner Lizárraga, *Los Inicios de la meteorología en el Perú y la labor del Cosmografiato: 1753-1856,* traces the beginnings of meteorology in Peru to the Cosmografiato, an institution responsible for observing and recording celestial and climatic phenomena. Between 1753 and 1856 five principal directors of the Cosmografiato observed, measured, and, on occasion, provided qualitative descriptions of the climate of Lima. Their uninterrupted series of meteorological observations includes annual maximum and minimum air temperatures and atmospheric pressure. It represents the most complete record of any Peruvian city or institution until the 1890s.

The great German poet Goethe (1749-1832) turned his attention to meteorology in 1815, after completing a number of scientific studies in other fields. The paper by Karl-Heinz Bernhardt, *Johann Wolfgang von Goethes Beziehungen zu Luke Howard und sein Wirken auf dem Gebiet der Meteorologie*, examines Goethe's role in bringing Luke Howard's cloud classification scheme of 1803 to the attention of German readers and his use of the Howard's typology in an observation network in Sachsen-Weimar-Eisenach. Although Goethe extended and refined Howard's classification, pointing to dynamic factors controlling cloud formation, he is best known for his poems, including one on clouds written in honor of Howard.

Dmitrii Mendeleev (1834-1907), although primarily known for his work on the Periodic Law of the Elements, actively pursued a variety of meteorological investigations, including the study of gases at low pressures in order to understand the functioning of the upper atmosphere and the expansion and compressibility of gases in order to demonstrate the existence of the ether. In a time when most meteorologists in Russia focused on collecting data, Mendeleev called for active experimentation in order to provide explanations of the weather. He constructed precision apparatus to measure air pressure and other meteorological variables and advocated the use of this equipment in balloon flights to study the properties of the atmosphere at various altitudes. These

perspectives are presented by Nathan M. Brooks in his paper, *Dmitrii Mendeleev and Russian Meteorology During the Second Half of the Nineteenth Century.*

Meteorology in America in the late nineteenth century is the focus of Edmund P. Willis and William H. Hooke, who write on *Cleveland Abbe and the Birth of the National Weather Service, 1870-1891.* Cleveland Abbe (1838-1916) started the first private weather service in Cincinnati 1869 then joined the U. S. Signal Office weather service in 1871 as its chief scientist. Abbe established professional standards, selected equipment, built a library, trained soldiers as observers and forecasters, and initiated many basic research projects in meteorology. Beyond the immediate call of duty, Abbe translated and distributed foreign meteorological publications in America, promoted the adoption of standard time, established the *Monthly Weather Review,* and edited the *Bulletin of International Simultaneous Observations.* Using a biographical approach, the authors present Abbe as an exemplar of the nineteenth-century American scientist.

The paper by Cornelia Luedecke, *The First International Polar Year (1882-83): A big science experiment with small science equipment,* examines the meteorological experiments conducted during the first International Polar Year to monitor arctic weather with a dense network of basic instruments. It documents the problems of organization, the expeditions, and the results. The author concludes that measurements taken during the first big international meteorological experiment provided a valuable data set for half a century until the second International Polar Year took place in 1932-33.

Gregory T. Cushman's paper, *Enclave Vision: Foreign networks in Peru and the internationalization of El Niño research during the 1920s,* examines the research styles of U.S. and German scientists interested in the powerful El Niño event of 1925-1926. Although they interacted with locals, foreign scientists relied primarily on existing foreign enclaves to organize idiosyncratic observation networks in Peru to investigate this noteworthy climate anomaly. The paper focuses on the network organized by the U.S. ornithologist Robert Cushman Murphy (1887-1973), who happened to be in Peru studying marine birds when this event struck and who had ties to the Standard Oil Corporation, the U.S. Naval Mission to Peru, W.R. Grace & Co., the American Geographical Society, and the Scripps Institution of Oceanography. Through diplomatic intervention, Murphy was able to use data gathered by German "ships of opportunity" and the famed Puerto Chicama sea-surface thermometer installed by a German-Peruvian sugar magnate. Using the network established by Murphy, H. P. Berlage, a Dutch colonial scientist in Java, was able to posit a physical relationship between El Niño and the Southern Oscillation in the late 1920s. In documenting these ad hoc and idiosyncratic networks, Cushman clarifies the role of foreign enclaves in the production and international exchange of environmental knowledge. He also cautions that a purely Anglo-centric intellectual history of the science of El Niño would be oblivious to many key participants in these networks and their social function in the act of scientific discovery.

The beginning of the end of World War Two in Europe depended on what were arguably the three most critical forecasts in history -- two successful ones by the Allies and one failure by the Germans. On the Allied side, six meteorologists working in three different teams were responsible for the D-Day forecasts. The American team used an analogue method that compared the current weather with past conditions. Their forecast was overly optimistic and would have resulted in disaster on June 5, 1944. The British

Admiralty and the British Meteorological Office urged delay. They were aided by the brilliant Norwegian theoretician Sverre Petterssen (1898-1974), a giant in the field of weather analysis and forecasting and an international leader in meteorology during the mid-twentieth century. *Sverre Petterssen, the Bergen School, and the Forecasts for D-Day,* by James R. Fleming, focuses on Petterssen's early career and contributions to the war effort, highlighting his role as the only Norwegian-trained meteorologist involved in the contentious forecasts for D-Day.

The Scandinavian Tag-Team: Providers of atmospheric reality to numerical weather prediction efforts in the United States (1948-1955), by Kristine C. Harper, revisits the historiography of the Meteorology Project established by John von Neumann at the Institute for Advanced Study and assigns primary credit for the success of early numerical weather prediction (NWP) experiments to Carl-Gustav Rossby, Jule Charney, and a series of Scandinavian scientists who had theoretical training, practical experience, and sound meteorological intuition. They included Harald Sverdrup, Jacob Bjerknes, Arnt Eliassen, Ragnar Fjörtoft, Bert Bolin, Ernst Hovmöller, and Roy Berggren. Harper argues that members of the Scandinavian "tag-team," were better prepared to answer the question, "Is the computer generated representation of the atmosphere a valid one?"

Although most explanations of the rise of numerical modeling look to dramatic developments in computing technology, Vladimir Jankovic´ emphasizes local circumstances shaping Yugoslav NWP in his paper, *Choosing the Right Axis: An institutional history of the Belgrade Eta forecast model.* The Eta model, conceived in 1972 by Fedor Mesinger and Zavisa Janjic, and first used for short-term forecasts at the Yugoslav Federal Hydrometeorological Institute and the Institute of Meteorology of the University of Belgrade, provides a case study intended to alert us to the possibility that "non-Western" socio-political actors could exert enough power to shape and "customize" local scientific research. The paper presents the early (and somewhat controversial) history of the model and examines its growth from a local Yugoslavian innovation into a model now used for research purposes in more than twenty meteorological institutions throughout the world and for operational forecasting (since 1993) by the U.S. National Centers for Environmental Prediction.

Maureen Christie's paper, *Data Collection and the Ozone Hole: Too much of a good thing?* reminds us that in 1977 a new phenomenon in the atmosphere was recorded—a seasonal "hole" in the ozone layer over the Antarctic at altitudes between 16 and 25 kilometers. Although it shows up clearly in the archive of recorded measurements from 1977 onwards, there is no evidence that anyone noticed the phenomenon until 1981, and it was not until 1985 that it was first reported in the scientific research literature. Given the growing worldwide concern about possible ozone depletion as a result of human activity, it is very surprising in these circumstances that the Antarctic seasonal ozone depletion should have taken so long to be noticed and reported. Christie's paper presents reasons for the delay, including the sheer size of the available data-set and the consequent inaccessibility for casual and speculative examination.

Scholars wishing to examine meteorological records have been handicapped by the overwhelming number of collections and the dearth of guides and bibliographical tools to assist their efforts. In order to ameliorate this situation, Roy E. Goodman's paper, *Archives, Libraries and Bibliography in the History of Meteorology Prior to 1900,* provides an overview of pre-1900 resources for the history of meteorology. This

bibliography describes materials in printed, manuscript, cartographic and electronic formats, international in scope, culled from disciplines as diverse as medicine, geography, agriculture, economics, literature, art, and the popular press.

As a result of a proposal submitted to the Division of History of Science in 1999, the ICHM was founded at the 2001 International Congress of History of Science in Mexico City. Our bylaws include the following goals:

a) to promote the scholarly study of the history of meteorology, climatology, and related sciences including their social and cultural aspects;

b) to facilitate international cooperation, communication, and friendship among historians, philosophers, and scientists;

c) to organize symposia at the International Congresses of History of Science, to sponsor or co-sponsor other meetings of similar character, and to disseminate the proceedings of these meetings;

d) to promote identification, collection, preservation, and access to historical materials;

e) to encourage the compilation of international historical bibliography;

f) to support the broader goals of the DHS, IUHPS, and ICSU (International Council of Scientific Unions).

The web site of the ICHM, http://www.meteohistory.org, contains current announcements, a directory of members, the bylaws,, an on-line membership form, and a growing list of links. I invite you to visit the website and consider joining the ICHM.

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China, Maine
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Note

A version of these proceedings is forthcoming from the Division of History of Science of the International Union of History and Philosophy of Science.