Diversity in the Global Reconstruction and Representation of Weather and Climate: East, South, West, North

Papers from the 2005 Beijing International Congress of History of Science

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Symposium Editors' Introduction

In July 2005 the XXIInd International Congress of History of Science met in Beijing, China, under the auspices of the International Union of History and Philosophy of Science, Division of History of Science, with the general theme of "Globalization and Diversity: Diffusion of Science and Technology throughout History." As part of the Congress, the International Commission on History of Meteorology sponsored a symposium convened by James Fleming (USA), Rudolph Brádzil (Czech Republic), Cornelia Lüdecke (Germany), and Youngsin Chun (Republic of Korea) entitled "Diversity in the Global Reconstruction and Representation of Weather and Climate: East, South, West, North." Thirteen papers were presented, and eight are published here, representing authors from seven different nations.

The Commission hopes that symposia like these will develop into a primary source for dissemination of research results for climate scientists who use historical data as their source for study, and for historians who look to extract climatological information from as-yet unused sources. Whether the historical data used are logbooks from ships plying the English Channel, reports of missionaries in the high Arctic, records of bridge masters and tollhouse operators on the rivers of Europe, diarists in North America and the Low Countries, Byzantine Church records, or the length of ancient European leg bones, they represent a uniquely human record of the weather, unlike any other proxies used for climatic reconstruction today. Specific methodologies, from content analysis to cultural analysis, to forensic synoptic analysis are today converging to allow researchers of these historic data an opportunity to unlock the secrets of the weather of the past, as well as acquiring insight into the life experience of the observers, without cultural bias.

Combined with modern-day computer modeling, we are now approaching a better understanding of both changes in climate and their effects on the human condition. A firmer foundation for forecasting future effects is developing from the use of historical records. Without the interdisciplinary work done from this historical and very human point of view, the insights and results presented here would not be possible. Without history, and the attention paid to it by both cultural and climate researchers, the emerging science of paleotempestology would not exist. Without interdisciplinary work of the kind presented here, much insight and knowledge might remain within the purview of individual disciplines.

We encourage historians to realize the importance of any archive as a potential weather record, and suggest that they work together with climate researchers, using and refining the methodologies outlined herein, to bring this new interdisciplinary insight to the community at large. We hope also that work presented here will both generate interest among historians to develop further research, and encourage climate scientists to make use of the very valuable resource that historical records can now provide to them. Key questions about climate change remain. We hope that the additional input gleaned from history will help with the answers.

The papers are presented on the order of the centuries from which documentary evidence is garnered, beginning with Ioannis Telelis, whose data extend back to the 4th century C.E. Adriaan de Kraker uses data from the 14th and 15th centuries, Christian Rohr from the 15th and 16th centuries, Jian Liu, et al, from the 16th to the 19th centuries, Louis McNally from the late 18th century, Cornelia Leudeke from the 18th and 19th centuries, Dennis Wheeler from the 18th and 19th centuries, and Nikola Koepke and Joerg Baten examine the last two millennia.

Ioannis Telelis is a specialist on Byzantine sources related to climate and weather. Most of these sources are neglected in the well known "weather compilations" of Hennig (1904), Easton (1928) and Weikinn (1958). The author's two-volume collection from 2004 was able to fill this lacuna. Most of his sources are narrative ones determined by social and religious preconceptions. The author did not make any systematic attempt to explore the working of weather phenomena. The structure of the meteorological information is discontinuous and heterogeneous. Nevertheless, Telelis provides a typological and geographical distribution of documentary paleoclimatic information derived from Byzantine sources. He points to more work to be done, since detailed climatic fluctuations cannot be reconstructed on the basis of this type of meteorological data alone.

Adriaan de Kraker focuses on the reconstruction of storms in Belgium and in the Southwestern part of the Netherlands. His study is based on written archival sources from smaller towns situated near the North Sea shore. The town accounts are quite homogeneous for the period between 1400 and 1625 and are therefore excellent long-time proxy data. In this way, a period of significant increasing storminess during the second half of the 16th century can be identified. The connection between a drop in temperature during the same period is, however, only a weak one. On the other hand, he is able to draw connections between storminess and annual summer temperature especially for the 15th century: there are far more storms in warm summers than in cold ones.

Christian Rohr examines the reactions to floods of the people living close to the Danube River and its catch area in Austria between the 14th and 17th centuries. He uses a "mentality bound approach," which asks about the perception, interpretation, management and cultural responses to floods. He tries to contextualize non-instrumental records on floods, such as the "millennium flood" of 1501, by reconstructing the "normal" floods as well. The accounts of the bridge master of Wels provide detailed insights into the history of floods and their management during the 15th and 16th centuries. Through the expenses for the craftsmen many more floods can be reconstructed than through annalistic or normative sources.

The paper by Jian Liu, Hans von Storch, Eduardo Zorita, Xing Chen and Sumin Wang is somewhat experimental. They attempt to compare reconstructed decadal temperature series of eight regions in China to two multi-century computer simulations. The climate model for these simulations includes time variable volcanic aerosols, solar output and atmospheric greenhouse gas concentrations. The period from the Little Ice Age (1550-1850) to the end of the twentieth century always provides a "hockey-stick" pattern. From the beginning of the twentieth century

onwards, the increase of temperatures is significant. What may be more important is the use of computer modelling in an attempt to match reconstructed records, as opposed to forecasting the trends.

Louis McNally reconstructs the global weather of a single year by comparing proxy data from all over the world. He applies his "Forensic Synoptic Analysis" technique to reconstruct the upper-air circulation of the year 1785. He identifies the upper flow over northeastern North America, and then collects data for North America, Iceland and the Arctic region, the Atlantic Ocean and Europe, India, China, Japan and the Pacific Ocean, and for the Tropics and the Southern Hemisphere. The reconstruction is completed using these and other proxy studies and tracking the volcanic signal from contemporary eruptions. The results agree with a theory by Lamb (1977) for the general circulation of the atmosphere at the beginning of the last ice age. He presumes a relatively cold flow over central and eastern North America for most of the year 1785, and a "short-circuit cross-polar flow" which infers a preferential displacement of the polar cell to a position over the North Atlantic Ocean.

Cornelia Luedecke's article leads us into the arctic climate of Greenland. The Moravians, a pre-reformation Protestant group, later on called Herrnhuter Brüdergemeinde after a village in Saxonia, settled down in Greenland and Moravia during the 18th and 19th centuries. They did not only try to convert the indigenous Eskimo population, but also made very accurate observations of the weather. Their records played a major role within the global meteorological network of the Societas Meteorologica Palatina in Mannheim (Germany). At the end of the 1830's, Johann von Lamont, an astronomer from the observatory of Munich, received many of the Greenland and Labrador observational data. So, they survived in an institute of the Technical University of Munich at Weihenstephan and will be digitized soon.

Dennis Wheeler presents results from a recently completed CLIWOC (Climatological Database for the World's Oceans) project funded by the European Union. He uses logbooks for the reconstruction of daily oceanic weather. The earlier observations are non-instrumental and have to be translated into modern scales such as the Beaufort wind force scale. The use of these sources is still in its infancy, although they provide a unique insight into the climate of past centuries. About 120,000 logbooks from 1680 to 1850 can be found in British archives alone. The CLIWOC database extends this to a comparison of logbooks from different European countries.

Nikola Koepke and Joerg Baten examine climate and economic history from an unusual point of view. Koepke, originally trained as an archaeologist for Early Medieval burial places, argues that anthropometric indices are an important proxy variable, reflecting the climate and the quality and quantity of nutrition. The study uses recent estimates of human stature over the last two millennia in the west of central Europe, in the European Mediterranean and in North-East Europe. Through a comparison with estimates of temperature it becomes clear that the impact of temperature is economically, but not statistically significant. It is remarkable that after the High Middle Ages, when population density had increased to a previously unknown level, the European population became more vulnerable to climatic shocks. On the other hand, a lower population like during the Migration Period Pessimum, provided a better nutritional status and an increased average height.

The fact that documentary (and other) evidence is now being used in the reconstruction of weather, climate, and the human condition points the way to an exciting future for interdisciplinary and international collaboration and comparison. The ICHM intends to play an important role in facilitating and communicating such efforts.

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Authors and titles of other symposium papers presented in Beijing

Aryan F.V. van Engelen (The Netherlands), How weather and climate could be deduced from historical sources and how weather and climate could influence the course of history: A reconstruction for the Low Countries from AD 800 onwards.

Zhang De-er (China), Variation of Dry-Wet Climate and Severe Drought Events as Revealed in the Climate Records of China over the Past 1000 Years.

Youngsin Chun (Republic of Korea), Recovering the Historical Meaning of Asian Dust Events (in Korea).

Xing Chen (China), Hans von Storch (Germany), Jian Liu (China), Eduardo Zorita (Germany), Jingyun Zheng (China), Simulated and reconstructed temperature anomalies of eastern China for the last millennium.

Don Garden (Australia), Droughts and Flooding Rains: Understanding El Niño and La Niña in Australia.