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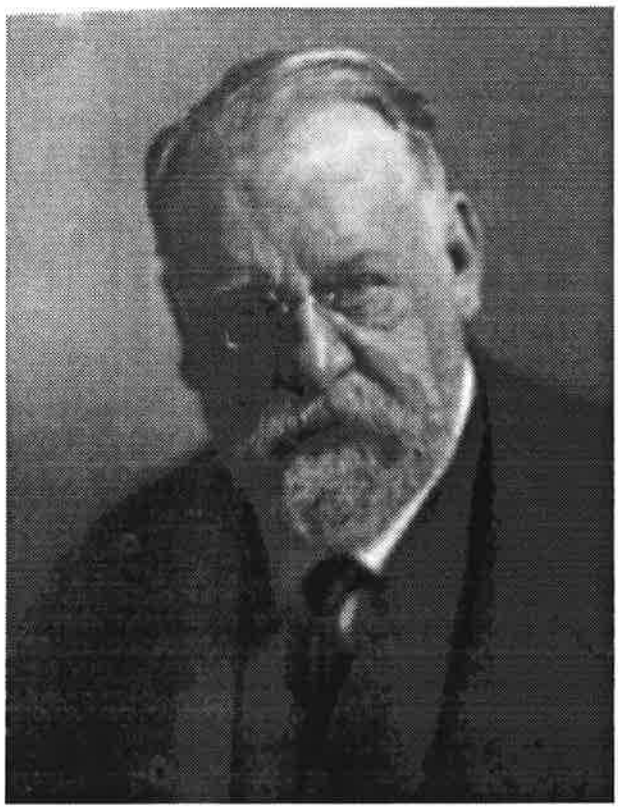

EDUARD BRÜCKNER
1862 - 1927

THE 19TH CENTURY DISCUSSION OF CLIMATE VARIABILITY AND CLIMATE CHANGE: ANALOGIES FOR PRESENT DEBATE ?

by

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THE 19TH CENTURY DISCUSSION OF CLIMATE VARIABILITY AND CLIMATE CHANGE: ANALOGIES FOR THE PRESENT DEBATE ? [1]

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ABSTRACT

Toward the end of the nineteenth and at the beginning of twentieth century significant discussions occurred among geographers, meteorologists and "climatologists" concerned with the notion of climate variability (Klimaschwankungen) and anthropogenic climate change (Klimawandel/Klimaänderungen), for instance, due to deforestation and reforestation. We identify two protagonists of this debate, Eduard Brückner and Julius Hann, who both accept the notion of climate variability on the decadal scale, but respond in very different ways to the discovery of climate change. Brückner assessed the impact of climate variability on society (e.g., on health, the balance of trade, emigration to the USA), and tried to bring these to the attention of the public, whereas Hann limited himself to the immediate natural scientific problem of monitoring and documenting climate variability.

We suggest that these discussions and the formation of national governmental and parliamentary committees almost 100 hundred years ago, are not merely of historical interest. In view of presents discussion of climate variability and anthropogenic climate change, and the need for of adequate socio-economic response strategies, past and now neglected arguments may prove important for methodological and theoretical as well as for practical reasons. The past discussions represent a significant social and intellectual analogy for the present situation.

INTRODUCTION:
THE CONCEPT OF CLIMATE VARIABILITY AND CLIMATE CHANGE

> Zahllos sind die Hypothesen und Theorien, die über Änderungen des Klimas in der Vergangenheit aufgestellt wurden und naturgemäß mehr oder minder lebhaft das Interesse weiterer Kreise in Anspruch nahmen, lässt doch der strenge Nachweis einer in vergangenen Zeiten vor sich gegangenen Änderung des Klimas sofort den Gedanken an die Möglichkeit einer zukünftigen Änderung auftauchen; eine solche aber könnte sich nicht ohne einschneidende Wirkung auf das wirthschaftliche Leben der Völker vollziehen.
>
> Brückner (1890:2)

The concepts of "climate variability", "climate change" and "climate impact" attract an enormous interest not only in the climatological, meteorological and oceanographic community (von Storch and Hasselmann, 1995) but also in sciences concerned with climate-sensitive systems, such as biometeorology, ecology or the social sciences.

Discussion of "the climate problem" [2] is by no means limited to the scientific community. It has drawn a great deal of interest from a general public (Lacey and Longman, 1993) perhaps haunted by anticipations of catastrophic developments as a consequence of future anthropogenic climate change (cf. Stehr and von Storch, 1995). Evidence of a public and scientific preoccupation with of "the climate problem" are such institutions as the "Intergovernmental Panel on Climate Change" (IPCC) and International Conferences aimed at the establishment of International Climate Conventions.

Most of the scientific and general public interprets the climate problem as a <u>new</u> challenge. Yet, although for much of past two centuries "climatologists" and meteorologists have been convinced, and have considered it to be almost an axiom, that global climate is a constant, [3] some 19th century climatologists, geographers and meteorologists recognized that

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2 We place the expression "climate problem" in quotations marks since it is not well defined. Natural scientists associate with this expression the understanding, prediction and, possibly, controll of climate variability. Social scientists, on the other hand, consider the perception of climate, and the social and political implications of this perception, as the "climate problem".

3 Brückner (1889:2) notes that during the 19th century a distinct disciplinary division with respect to the issue of climate change could be observed: Geographers and geologists were more inclined to consider a persistent climate change to be a reality while

climate is not a steady phenomenon (e.g., Brückner, 1890; Hann, [1883] 1893:362), recognizing that climate varies not only on geological time scales (1000s of years and longer) but also on decadal and century time scales due to natural and anthropogenic processes.

The dynamic processes which were discussed at the turn of the last century as the source of climate variability and change were different. The "natural variability", unrelated to man's activities, was in a speculative manner attributed to astronomical factors, such as the solar activity, and to processes in the interior of the earth. In addition, the idea of deterministic periodic processes attracted much attention among climatologists. Anthropogenic "climate change" was thought to be the result of such activities as de- and reforestation or new cultivation of land in North America, for instance. The possibility that anthropogenic emissions of carbon dioxide might alter the global climate was first suggested by the physicist Svante Arrhenius (1896; 1903), but the concept was not taken seriously, or simply not well understood, by the climatologists of the day who for the most part were geographers interested in descriptive approaches. [4]

The intensive debate among climatologists at the turn of the century quickly receded into the background when a new disciplinary consensus emerged that remained predominant until recently that the global climate system contained overriding equilibrating processes providing resilience against secular climate fluctuations; fluctuations that did occur were seen as distributed around a fairly stable mean climatic condition. Thus, the discussion in question and its findings are now virtually forgotten. [5] Stehr (1995) relates the disappearance of the climate variability discussion to the emerging prominence of racial theories in the first part of the 20th century, at least in Germany. Some of these anthropological theories, as put forward, for example, by Sombart ([1911] 1951:324; 1938), Ploetz (1911) or Hellpach (1938), require explicitly constant climatic conditions. Another reason why the perception of climate variations on historical time scales became unpopular may be the rejection of "catastrophism"

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meteorologists defended the thesis that climate is a constant. Brückner (1890:2) offers an explanation why most professional meteorologists and many geographers at the time were rather silent on the issue of climate change; as a matter of fact, he observes that they were embarrassed to engage in research and discussion about climate change. The reason for the reluctance is the wealth of competing hypotheses about climate change formulated earlier in the century. But previous efforts only resulted in many contradictory voices about the nature of climate change, so that climatologists became than reluctant to add to the cacophony of mere opinions.

4 It should also be noted that Arrhenius (for example, 1903:479) was not all that seriously alarmed about the changes in the global climate induced by growing CO_2 emissions. He anticipated that natural equilibrating processes would produce the necessary adjustments and that any noticeable changes in the composition of the atmosphere may be more than 1000 years away.

5 Among recent accounts of climate change the work discussed here is not incorporated (e.g. Flohn 1985).

and the acceptance of "`uniformitarism" in geology. This conept was proposed by Lyell, one of the founding fathers of modern geology, in 1830 - and led finally to the denial of the existence of the Little Ice Age by Lyell himself (after van Andel [1994: 397]).

In this essay, we therefore attempt to recover for methodological, theoretical and practical reasons a significant cluster of the spirited discussions among geographers, meteorologists and climatologists that occurred toward the end of the past and at the beginning of this century. We propose to analyze the dynamics of the discussion, and the degree to which it was introduced to the general public, with the explicit intention of comparing the situation at the time with the present discussions of climate variability and change and of climate policies designed to avoid or mitigate the risk of climate change or to allow for a smooth adaptation.

We concentrate on two of the main contributors to this early discussion of climate variability and change on time scales of decades, namely Eduard Brückner and Julius Hann, both professors in Vienna for a significant part of their lives. First, we introduce brief curricula vitae of these two prominent scientists and summarize their main climatological achievements. Second, we discuss their different social roles, their attitudes towards the role of the public, and their understanding of their own work as part of multiple contexts in which they attempted to play different functions. We show that the two protagonists Brückner and Hann, represent roles and self-conceptions that strikingly resemble present-day roles of climatologists in discussions within and outside the scientific community about the scientific significance and the social impact of climate variability and change. However, the similarities do not end here. Scientists also tried to extend their influence to the formation of national and regional governmental bodies dealing with the threats of anthropogenic climate change, and there are parallels in the conceptions and in the nature of discussions that ensued. We suggest that the contemporary "climate problem", as perceived by scientists and the public at the turn of the century, constitutes a valuable historical analogy for present debates on the "climate problem".

EDUARD BRÜCKNER

One of the central protagonists in the debate at the turn of the century about global climate variability and its significance for society was the geographer Eduard Brückner. Born July 27, 1863 in Jena, Germany, and died at the age of 65 in 1927 in Vienna, Austria. Brückner studied at the universities of Dorpat (now: Partu, Estonia), Dresden, and Munich and completed his doctorate with a dissertation on the ice fields in the Salzach region in Austria under Albrecht Penck in Munich. On the strength of his dissertation, be was appointed professor of geography at the university of Bern. He left Switzerland in 1904 for

two years at the university of Halle in Germany and finally moved as the successor of his former teacher Penck to the University of Vienna (cf. Oberhummer, 1927).

Brückner in 1890 published the first extensive book-length discussion of recent climate fluctuations, that is of climatic fluctuations in "historical times". [6] Brückner (1984:1) credits the head of the Bavarian meteorological services, C. Lang, with the discovery of decadal scale climate variability in a study of the climate of the Alps (Lang, 1885). After 1890, Brückner published only a few smaller articles on the observational evidence of climate variability (Brückner, 1895, 1902). [7] What is in the present context of particular importance, though, are his articles on the social consequences arising from the climate fluctuations, such as emigration, immigration and migration patterns (Brückner, 1912; [1912] 1915) or on harvests, the balance of trade of countries and shifts in the political predominance of nations (Brückner, 1894, 1895, 1909).

Brückner's methods are mainly limited to the exploratory statistical analysis of time series since confirmatory tools such as confidence intervals or hypothesis testing were not developed in combination with what might be called common sense. He is unfamiliar with dynamical arguments (for instance, concerning the geostrophic wind, which was well known among meteorologists of these days) and he was unaware of theories concerning the general circulation of the atmosphere (he failed to acknowledge the different dynamic character of the tropics as opposed to the extratropical westerly regime).

Brückner's work on climate change is none the less, quite distinctive. Although he was mainly concerned with establishing the fact of climatic fluctuations and their probable periodicity, he also reflected on the likely reasons for the observed climate fluctuations and he employed his observations as a tool for predicting impending climate changes. [8] In addition, Brückner also speculated about the geographical and socio-economic impact of climate

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6 We note in passing the curiosity that Brückner claimed in 1890 to have available about 100 year's of reliable data - that is about the same amount of reliable data contemporary climatologists believe to have at hand.

7 Brückner explains the small number of articles on the observational evidence as the result of a lack of new and appropriate meteorological data on the issue.

8 An example of such a prediction is the 1915 statement that by 1920 "we may expect a maximum of humidity" in the United States (Brückner, 1915: 132). This prediction exploits two pieces of information: First, the presence of Brückner's 35-year oscillation and secondly the observation that precipitation was at its minimum around 1900. (Whether these data are correct remains to be seen.) Brückner did not spell out another prediction based on the same reasoning, namely that in the middle of the 1930's the United States would again suffer from dry conditions. On the continental scale, his forecast was incorrect (Bradley, 1987: Fig. 6), but in a regional sense his forecasts were consistent with actual developments: The Great Salt Lake exhibited maximum lake levels from 1910 to 1930, and a sharp drop in the early 1930's. Also the "Dust Bowl" dry episode that lead to persistent disastrous harvest failures in Central North America took place in the mid 1930's.

change. He was convinced that the issue is both of considerable scientific merit and that future climate changes are of great importance to well-being of society as the well as for the strategic and economic balance of political and economic powers.

He therefore presented his conclusions about serious repercussions associated with climate change anticipated for the end of the past century in the form of oral publications addressing the general public and especially affected segments of the public, for example, farmers. As a result, in 1889, Brückner presented his initial findings on climate change not only to a congress of professional geographers in Berlin, but a year earlier also in a public lecture entitled "Is our climate changing ?" at the University of Dorpat (today: Partu, Estonia) that was duly noted in the local press (Brückner, 1888). Later Brückner (1894, 1909) published newspaper articles about the general issue of climate change as well as about its specific economic and social consequences. His work on climate variability was discussed at length in the contemporary press (e.g. Neue Freie Presse, Vienna, February 11, 1891). As a result of these activities and the response they generated, Brückner's work on climate variability found a considerable echo among the scientific community of climate researchers, geographers (e.g. Huntington, [1915] 1924:25), and physicists (e.g. Arrhenius, 1903: 570-571) , but to some extent also among the public at large.

EDUARD BRÜCKNER'S ANALYSIS OF CLIMATE VARIABILITY

In the following section we summarize Brückner's attempt to synthesize the observational evidence for global-scale simultaneous climate variability from his limited data and limited computing power.

Brückner (1889:2) indicates that he was first alerted to the possibility of climate change, aside from information about shrinking glaciers in the Alps, as the result of observations about changing water levels in the Baltic, the Caspian and the Black Sea. The changes in the water levels appeared to follow a specific pattern. The rhythm of the changes resembled changes in the glaciers of the Alps.

Core dimensions of the analysis of climate change in the late nineteenth century are temperature and precipitation. All other meteorological elements play a subsidiary role. Thus, Brückner focuses first and foremost on changes in the volume of rain and he links the water levels to the amount of rainfall in a region.

In his detailed discussion of "recent" climate fluctuations Brückner (1890) justifies his approach by referring to the studies of Richter (1883), Lang (1885) and Swarowsky (1886). Richter concluded that the cause for the secular variations of one certain glacier (Obersulzbachgletscher in Austria) are wet and dry periods lasting for several years in that particular region. Lang proved this result to be valid for the entire region of the Alps. Swarowsky stated a striking correlation between the variation of water level of the Neusiedler

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Figure 1: Rainfall variations (in percentage departures from a normal) in Europe and the United States and emigation to the United States. All data are five yearly means. After Brückner (1915)

Figure 2: Number of typhoid related deaths per 10,000 in Basel (Switzerland); the data have been smoothed with a five-year running mean filter. The light line represents the raw data. The heavy line represents the data after subtraction of the linear trend and of the mean value. Prepared with data offered by Brückner (1890: 280).

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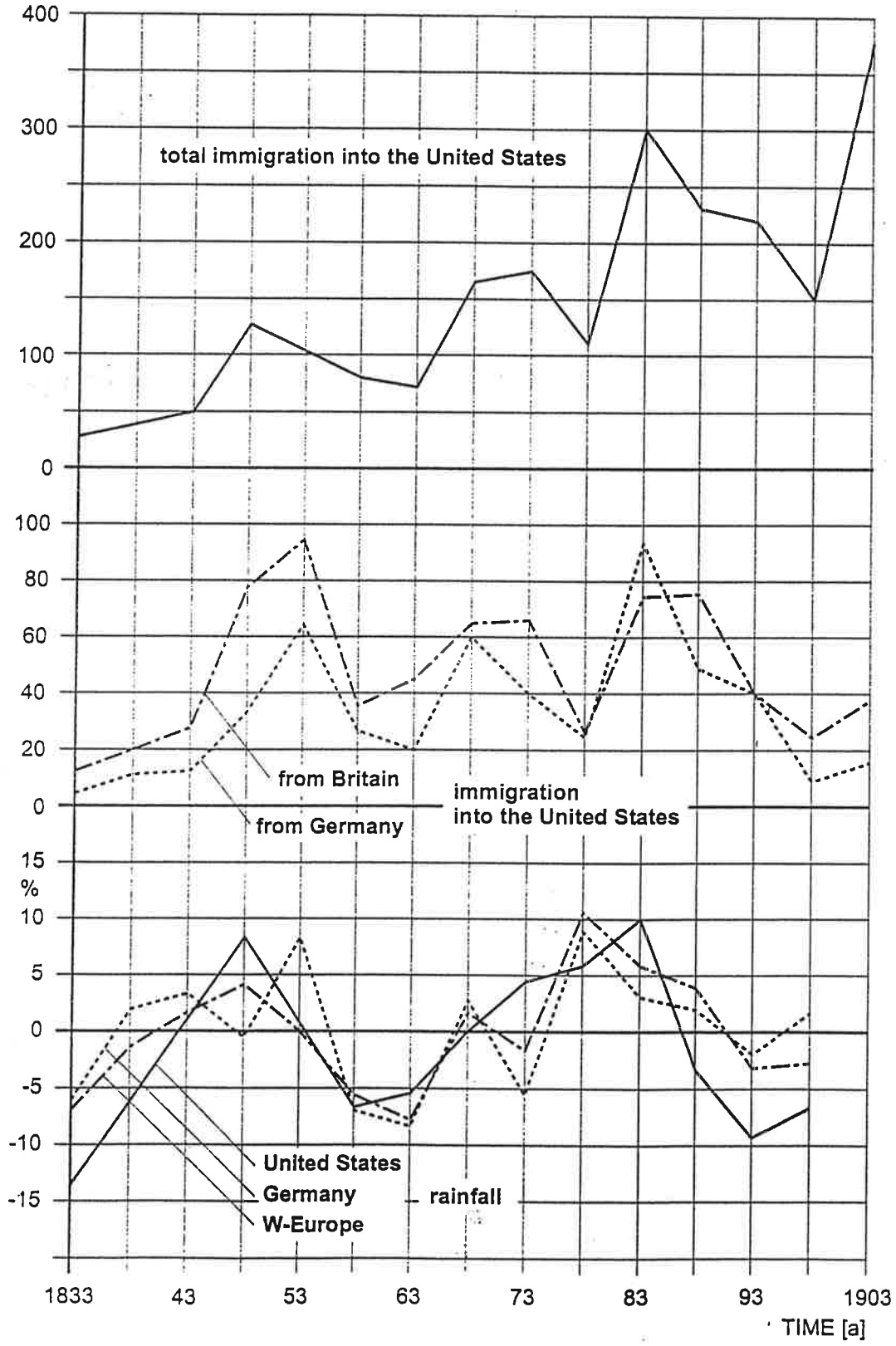

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