

Proposed session groupings

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CLIMATE CHANGE AND SOCIETY: Lucy Veale, Sarah Davies, Jim Fleming, Rodolfo Acuña- Soto, Georgina Chair: Nash

'HOT AND COLD' CLIMATE HISTORIES: Nash/ Grab, Herrera, Burnette, Mikami and Zaiki Chair: Grossman

CLIMATE HISTORIES FROM RIVERS, LAKES AND OCEANS: Nicholson, Chenoweth, Wheeler, MacDonald, Prieto Chair: Endfield

EXTREME EVENTS: Palecki, Dodds, Kelso, Mock, Chair: Wheeler

DROUGHT HISTORIES: Jose et al., Isabel, Therrell, Stahle et al
Chair: Mock. Discussants: Endfield and Mock

Author	Abstract
David W. Stahle, Edward R. Cook & Jose Villanueva Diaz	The ongoing drought over western North America has been concentrated in Mexico and appears to be unprecedented in the instrumental climate record for Mexico. Drought Area Indices (DAI) computed on gridded reconstructions of the summer Palmer drought severity index (PDSI) for Mexico indicates that the area of Mexico afflicted by drought during the current event exceeds all previous Mexican droughts since AD 1500, including the 16th century "megadrought" which interacted with conquest, famine, and epidemic disease to result in the greatest demographic catastrophe in New World history. The dramatic warming of surface air temperature over Mexico may be an important component of the recent aridity trend. The intense warming is dominated by a rise in maximum daily temperature, which may be a partial consequence of land cover change in Mexico. The extensive land conversion for human use and settlement is believed to have reduced evaporative cooling and sharply increased the sensible to latent heat flux, favoring higher daily temperature maxima and overwhelming the potential cooling effect of increased surface albedo.
DROUGHT HISTORIES	The higher temperatures and deficit rainfall during winter, spring, and early summer have translated into a summer PDSI drought over Mexico unmatched for centuries.
Isabel Fernandez Tejedo	The impact of climate change in livestock management in 18th colonial Chihuahua, Mexico. The aim of this presentation is to assess the vulnerability of livestock to climate variations and particularly drought in Chihuahua, Mexico during the 18th Century. Attention focuses on an exploration of Mexico's national and regional colonial archives. The proxy of municipal slaughter houses and some related documents housed in Chihuahua, highlight the relevance of meat, particularly sheep and goats, for the general livelihoods in this mining settlement, where the semi-arid climatic conditions placed restrictions on the development of crop raising. Some landed estates near Chihuahua, particularly in the Conchos basin, did raise crops and grazed cattle, but their production was not sufficient enough to feed a growing population. Less vulnerable to drought, livestock raising in effect provided a more hardy natural resource. The impact of recurrent and damaging droughts had dramatic implications for livestock breeding and herding with evidence of epizootics and periods of animal mortality. The consequences for the population at large included famine, crop loss, epidemics, and the intensification of indigenous unrest.
DROUGHT HISTORIES	

Stefan W. Grab & David J.
Nash

HOT AND COLD CLIMATE HISTORIES

In this paper, documents including unpublished missionary correspondence, synod minutes, diaries, newspapers and colonial reports are used to assess relative thermal changes during the 19th century in Lesotho and surrounding regions. Materials covered the period from 1833, when the first mission stations were established in Lesotho, to 1900, and were sourced from archives in southern Africa and the UK. All references to cold, snow, ice and frost within the documents were recorded verbatim, with French and Sesotho-language quotations translated into English subsequently. Observations were then sorted chronologically. Winters were categorized as severe, average or mild, on the basis of written descriptions of conditions and the timing, frequency and severity of snow and frost events. As there are no quantitative 19th century temperature records against which to compare our results, 20th century temperature data and detailed snow records from 1960-1979 were used as a climate benchmark.

Our findings suggest: (a) a shortening of the cold season over time, with the onset of frosts becoming delayed towards the latter half of the 19th century; (b) a decrease in the occurrence of snowfalls during the course of the 19th century and an apparent shift of autumn snow from April (1800s) to May (1900s); and (c) that severe winters commonly occur after dry summers, although there are no strong trends between summer rainfall and winter conditions. We also highlight the methodological challenges of investigating historical cold climate phenomena, including the complexities of dealing with observations from environments with a diverse topographic and altitudinal range.

Rodolfo Acuña-Soto

CLIMATE CHANGE AND SOCIETY

Local and global epidemiological changes result from four main driving forces. The transport of pathogens allows the mobilization of pathogens from a natural habitat or reservoir to a new place or population (plague, yellow fever, cholera, etc.). The emergence of genetic changes in existing pathogens results in the generation of new variants (influenza, drug resistance). Human variables such as population density, age structure, nutrition, mobility, water supply and specific habits are also important. Climate has multiple and important effects on human disease. Mosquito borne diseases such as malaria and dengue, are related to rainfall and temperature. Drought can induce enormous damage to the human population by the induction of famine and epidemics. This report analyzes the epidemics and famines associated to drought in central Mexico in the last 1000 years. Epidemic disease associated to drought has been a recurrent problem in Mexico's history. The historical record of the last 1000 years identifies a total of 116 large epidemics and 22 famines. Drought was the primary cause of 18 famines (81.81%) and was directly associated in 42 of 116 epidemics (36.20%). The impact of drought in central Mexico has been enormous, epidemics and famines associated to drought killed more people than any other disease and all wars together.

Dennis Wheeler

CLIMATE HISTORIES FROM RIVERS, LAKES AND OCEANS

Land-based climatic records of a non-instrumental character exist from as early as Medieval times in Europe, for the past two millennia in parts of the Far East. Instrumental data begin in the seventeenth century, mostly in Europe. The oceans however, and for obvious reasons, do not enjoy such a prolonged wealth of climatic evidence. Instrumental data have become increasingly abundant following the Brussels Maritime Conference in 1853, and some scattered instrumental observation exist for earlier years. It might be concluded therefore that observations or evidence from earlier times would be absent for oceanic regions. This is not the case, and recent studies of the huge accumulations of ships' logbooks, mostly from the UK, and some from as early as the late seventeenth century, have revealed a remarkably rich source of valuable climatological information.

This presentation includes a review of logbook contents, their manner of preparation, the nature of the climatological information that they contain and geographic and temporal ranges that they collectively embrace. Further attention will be given to the way in which logbook data, most of which are non-instrumental for the pre-1850 period, can be treated and used in scientific analysis. The work of the EC-funded CLIWOC programme and related projects will be reviewed and examples given of the manner in which this source can provide a new and unique insight into the oceanic climates of past centuries.

Neil MacDonald

CLIMATE HISTORIES FROM
RIVERS, LAKES AND
OCEANS

Historical flood chronologies: a valuable resource in re-evaluating flood risk and determining periods of hydroclimatic variability

The average length of gauged river flow records in the UK is ~25 years, which presents a problem in determining flood risk for high-magnitude flood events. Severe floods have been recorded in many UK catchments during the past 10 years, increasing the uncertainty in conventional flood risk estimates based on river flow records. Current uncertainty in flood risk has implications for society (insurance costs), individuals (personal vulnerability) and water resource managers (flood/drought risk). An alternative approach is required which can improve current understanding of the flood frequency/magnitude relationship.

Historical documentary accounts are now recognised as a valuable resource when considering the flood frequency/magnitude relationship, but little consideration has been given to the temporal and spatial distribution of these records. Building on previous research based on the rivers (urban centre): Ouse (York), Trent (Nottingham), Tay (Perth), Severn (Shrewsbury), Dee (Chester), Great Ouse (Cambridge), Sussex Ouse (Lewes), Thames (Oxford), Tweed (Kelso) and Tyne (Hexham), this work considers the spatial and temporal distribution of historical flooding. The selected sites provide a network covering many of the largest river catchments in the UK, based on urban centres with long detailed documentary flood histories. The chronologies offer an opportunity to assess long-term patterns of flooding, indirectly determining periods of climatic variability and potentially increased geomorphic activity.

This research represents the first coherent large scale analysis undertaken of historical multi-catchment flood chronologies, providing an unparalleled network of sites, permitting analysis of the spatial and temporal distribution of historical flood patterns on a national scale.

Michael Chenoweth

CLIMATE HISTORIES FROM
RIVERS, LAKES AND
OCEANS

Tropical cyclones are responsible for some of the worst natural disasters in the Caribbean region from Mexico eastward to the Lesser Antilles. A new comprehensive data set of tropical cyclone data for the Lesser Antilles has been compiled for the years 1690 to present using daily to sub-daily resolution weather records from ships' logbooks along with newspaper accounts and other primary sources. Most of these sources have never been used in previous tropical cyclone compilations. Statistical analysis indicates that the number of tropical cyclones passing through the Lesser Antilles is unchanged during the time of European colonization to the present day. The El Niño-Southern Oscillation (ENSO) is indicated to be a consistent feature affecting the frequency and intensity of tropical cyclones. ENSO relationships with present-day climate are likely to have been similar since the Lesser Antilles were first settled in the 1620s and 1630s. The historical record reveals clusters of years with relatively high or low frequency of hurricane activity that are probably reflective of large-scale climate anomalies that dominate the weather in Central America and the Caribbean region. Social and economic impacts of hurricanes are likely to be contingent upon the areas affected by the hurricane (sometimes far from the storm's center), their local frequency of occurrence, which can be the inverse of regional rates of storm occurrence, and the particular cultural and political circumstances which generate particular economic and agricultural practices.

Georgina Hope Endfield

CLIMATE CHANGE AND SOCIETY

Representatives of British missionary societies were at the vanguard of imperial expansion in continental Africa and may have been at once explorers as well as evangelists. For this reason, missionaries might have played a critical role in the application of contemporary ideas about the so called Dark Continent but also in the collection of topographic, climatic and pathogenic information relating to the distinctive fields in which they worked. In this paper, the letters, personal documents, notes and journals written by various representatives of the Church Missionary Society posted to East Africa, and specifically Uganda, together with surveys and reports compiled by the commissioners of the British Imperial East Africa Company and early colonial administrators, are used to explore changing configurations of climate and health in this region in the late nineteenth and early twentieth centuries. Attention focuses on the way in which climate reports of the second half of the nineteenth century contributed to an approximate 'medical topography' of the region. This assumed a critical importance during the 1890s when the representation of Uganda as a potentially healthy place for European settlement became fundamental to early British colonial investment. Set against a backdrop of war, social unrest and political upheaval, however, the correspondence reveals that an alarming sequence of climate and epidemic disease events were to affect the region between 1890 and 1910. The repercussions of these events led to significant social, economic and environmental changes across the East African region and served to recast Uganda an exceptionally unhealthy place.

Cary J. Mock

EXTREME EVENTS

Plentiful documentary and early instrumental records were kept across North America since the early nineteenth century, yet much of these data have not been systematically analyzed because of the time required for historical data extraction, and techniques to integrate these data with the modern climate record. This presentation describes the application of historical climate reconstruction techniques to a vast newly compiled historical dataset for 1849, the first year with data available at the continental scale and much of it being sub-daily in temporal resolution. The dataset comprises of over 250 instrumental weather stations, about 200 diaries from emigrants traveling across and residing in the western United States, over 80 ship logbooks from the Pacific Ocean, and information from over 60 different newspapers. Results describe a most remarkable cold/warm anomaly contrasts for the winter of 1848-49 at the continental scale, short periods of high spring rainfall in the Plains, extreme severe drought in New England and eastern Canada, an extreme false spring event over the Southeast during April 1849, a dry summer over the Far West which contrasts with an extreme wet summer along the Gulf Coast, and a relatively quiet Atlantic hurricane season. The reconstructed weather was also applied to assess societal impacts, which 1849 ranks as one of the most significant years in American history concerning emigrant travel and exploration in the West, the perception of a Great American Desert, a major nationwide cholera epidemic, and the sudden growth of the whaling industry in the North Pacific Ocean.

Rosario Prieto

CLIMATE HISTORIES FROM RIVERS, LAKES AND OCEANS

In many areas of the Americas, mountain regions provide water that sustains adjacent arid lowland communities. Fresh water will be a scarce resource in the warmer world resulting from ongoing Global Changes. Future changes will be critical determinants of human activities in these areas. The IAI –CRN II-047 Project intends to respond to these problems. Comparative studies are being performed in selected drainage basins in four critical areas, namely: the southern Andes, the Bolivian Altiplano, Mexico and the Western Cordillera of North America. One of its principal objectives is to assess the variation of precipitation and streamflow over the last ca 300 years by mean of high-resolution paleoenvironmental records.

The purpose of this paper is contributing from the Climatic History to reach the objectives of that project, reconstructing by mean archive documents the hydroclimatic variability occurring in the high and middle basin of the Bermejo River in Subtropical Andes (22°00' 14"S,64°57' 38"W) during the 18th and 19th centuries.

Administrative documents from the colonial and republican periods have provided information to reconstruct climate and hydrology of the region. Documents from historical archives (from Spain; Bolivia and Argentina) have been used to obtain a series of precipitation in the high basin of the Rio Bermejo and verify its effects in the middle basin..

The documents show hydrological changes as response to the climatic fluctuations in its headwater basin. Periods of dryness followed by periods of abundant precipitation have been verified. Floods extension as well as the river course changes have been determined and mapped.

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We recovered instrumental temperature and pressure data for locations in western Japan from the 19th century, a period for which no instrumental records were believed to exist. The recovered data were collected by Dutch scientists living in Japan and by Japanese astronomers trained by the Dutch and extend the beginning of the instrumental record back from 1872 to 1819.

The temperature and pressure readings in the recovered data were converted to modern units and digitized into computer readable form. The pressure data were corrected for temperature, height, and gravity where needed. The temperature data were homogenized to compensate for changes in recording location. Then, both data sets were homogenized to account for varying observation schedules.

The corrected and homogenized data were shown to be reasonable after further testing for homogeneity and comparison with modern data. The temperatures for July and January also showed good agreement with reconstructed temperatures from old diaries from western Japan. The recovered data were used for a preliminary calculation of a West Japan Temperature series, a representative temperature series for the area. The results support evidence for the existence of a warm epoch in the 1850s in west Japan followed by a downward temperature trend that lasted until the early 20th century as previously inferred from documentary data.

HOT AND COLD CLIMATE HISTORIES

Stephanie Dodds

EXTREME EVENTS

A unique 19th Century duststorm record, extending over 30 years, exists for Yuma, AZ, which lies near the edge of the Sonoran desert region of North America. Increased duststorms can be a result of decreased precipitation if other conditions, such as ample wind speeds, sediment availability, and lack of vegetation, are conducive. Each duststorm account (usually denoted "sandstorm") is documented with available meteorological data to determine an estimated wind speed, direction, and cause of disturbance in addition to precipitation data. Monthly and seasonal differences in events vary due to the variability of precipitation, which occurs during late fall to early winter or late summer to early fall. Of interest, two persistent drought periods exist for the mid-19th Century that impacted the North American desert region, 1856-1865 and 1870-1877. Precipitation frequency for these years was consistently below the average, and duststorm events reflect this pattern. These prolonged drought events can be compared with the recent persistent drought record of 1998-2005 to

compare modern duststorm occurrence with the historical record. Surrounding precipitation data are also used to reconstruct dominant seasonal surface conditions within the drought periods.

Dorian Burnette

HOT AND COLD CLIMATE HISTORIES

A 180-year record of daily mean temperature in eastern Kansas, extending from 1 July 1828 to 31 August 2007, has been developed with historical and modern instrumental data from the U.S. Army Surgeon General, the Smithsonian Institution, the U.S. Signal Service, and the National Weather Service. These data were rigorously screened and corrected for errors and other non-climatic biases in a series of seven sequential operations, including screening for legibility, anomalous interhourly temperature range, corrections for time of observation bias and to ensure compatibility with daily means computed from modern minimum and maximum temperature measurements, inter-station screening to identify outlying observations, and screening during the calibration and verification of the regression-based reconstruction. These analyses allowed for the derivation of high-quality regression models to transfer daily mean temperature data from several short intermittent temperature records located primarily in eastern Kansas to the Manhattan station, thus developing the long 180-year long record. The resulting daily mean temperature data exhibit positive and significant trends in all seasons, extremes, and derived quantities such as cooling degree days and the frequency of winter warm spells. The winter warming trend in Kansas has nearly doubled the rate of summer warming. The Dust Bowl summer mean and extreme temperatures still dominate Kansas temperature history, but the warming of winter mean temperatures is now approaching the magnitude of the Dust Bowl anomalies. These new daily mean temperature data for Kansas provide the longest, daily-corrected record of instrumental temperature in the Americas to date.

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The growing of agricultural crops for exportation is a dominant activity in northwest Mexico, but is highly dependant on the water yielded in watersheds of the Sierra Madre Occidental draining toward the Pacific Coastal Region. Paleoclimate studies to determine historical hydroclimate variability are rare on this region. Three earlywood chronologies of *Pseudotsuga menziesii* were developed for mixed-conifer stands in the Sierra Madre Occidental. One of them is 531 years length (1472 - 2002) and is located in "Tutuaca", Chihuahua; the second one located in "El Cocono", Durango is 554 years length (1449 – 2002), and the third one located in Cerro Mohinora, Chihuahua is 349 years length (1657 – 2005). The earlywood chronologies are significantly related to the seasonal winter-spring precipitation and detect drought periods of greater intensity to those witnessed along the 20th century. The most intensive and prolonged drought episodes were reconstructed for the 1560s, 1700s, 1770s, and 1990s. Historical archives indicate that some of these droughts were related to grain scarcity and famine, dead of livestock, and epidemic diseases. The warm phase of ENSO has a strong signal on this region and produces above normal precipitation whereas the cold phase is related to drought. New tree-ring chronologies for this region are in process of development and will help to improve our knowledge of the warm season precipitation variability which is of greater economical importance for north-central Mexico.

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DROUGHT HISTORIES

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HOT AND COLD CLIMATE HISTORIES

Jim Fleming

CLIMATE CHANGE AND SOCIETY

Clare Kelso

EXTREME EVENTS

An attempt was made to reconstruct winter climate conditions in Japan for the period 1810/11-1858/59 based on daily weather records documented in old diaries. Daily weather maps for each winter were drawn using 19th century weather records collected by our research group. Maps were divided into five types by classifying daily snowfall and rainfall distributions and the occurrence frequencies of each weather pattern for the period 1810/11-1858/59 were analyzed. It was found that the occurrence frequencies of winter monsoon weather patterns were high from the late 1820s to the early 1840s. This period almost coincided with a summer cold period in the 19th century. The result implies that strengthening of a cold air mass around Japan occurred in the late 1820s, not only in summer but also in winter. The frequencies of the typical winter monsoon patterns correspond with freezing dates of Lake Suwa, which have been used as an indicator of winter coldness in previous studies. Based on the frequencies of the winter monsoon weather patterns, mean January temperatures for western Japan were estimated. In the time series of estimated temperatures, a cooling period from the late 1820s to the early 1830s was revealed.

Digitizing data, solving sets of dynamic equations, and parameterizing other processes to create numerical weather prediction (NWP) and general circulation models (GCMs) are scientific challenges of the first order that inform much of the scientific history of modern meteorology and computing from V. Bjerknes (1904) to the latest IPCC reports. Yet extra-scientific social contexts in the realm of public policy and public pressures have undoubtedly shaped the practice, products, and ultimately interpretation and use of the modeler's craft. Separating "purely" scientific from societal aspects is not a trivial task. Perhaps it is not even possible, or, as I will argue here, desirable. Instead, this presentation places climate modelers and their models in their larger historical and social context, capturing the motivations of GCM scientists, the cases they made for their research, and their evolving institutional support structures. This will be contrasted with broader social expectations and demands, both past and present, deriving from federal and international initiatives placing weather and climate modeling at the center of public policy concerns.

Identifying climate change is hampered by a lack of long term historical data sets, particularly in southern Africa. Various methods can be used for extending climate data into the past. In this paper the climate of Namaqualand area in the Northern Cape, South Africa, has been reconstructed for the period spanning 1800-1900. This reconstruction was achieved using published and unpublished historical documentary sources to compile a proxy-precipitation data set for the area. This data set was tested for accuracy against existing rainfall data available from 1878-1900. In addition the drought periods were compared to those identified in similar studies for the surrounding areas in order to identify widespread droughts. Droughts which coincided with the ENSO low phase events were also identified. In addition the study traces the livelihood activities of the Namaqua Khoikhoi group who inhabited the area during the 19th century and examines the adaptations and changes which they made during the period identifying those which made them better able to cope with fluctuating climate and those that decreased their resilience and increased their vulnerability to climatic extremes.

Sarah Davies

CLIMATE CHANGE AND SOCIETY

Documentary evidence of climate variability in Wales – unlocking the potential of an untapped resource

The use of documentary sources to investigate past climate variability has been widely applied in a variety of contexts. With regard to the historical climate record of the British Isles, the potential of a variety of documentary sources in Wales has remained largely undiscovered. Agriculture has traditionally played a vital role in the economy of Wales, as it continues to do so today. As a consequence, rural communities, particularly those in upland areas, feel most keenly the impacts of changing climatic conditions. This is exemplified by the extremely severe winter of 1947, during which a huge proportion of stock on hill sheep farms was lost, the economic and social effects leading to irreversible changes in some communities. Numerous farmers have kept weather diaries, a valuable resource, but often difficult to obtain. These highly personal accounts, however, can illustrate the emotional, social and practical responses to weather extremes. Such sources have potential to provide a greater depth and individual narrative to the evidence gleaned from more official sources, such as estate records and Board of Agriculture archives. Further potential lies in other less obvious documentary sources, such as poems and stories. *Carolau Haf* (summer carols), for example are types of poem, particularly popular in the 17th and 18th centuries, which describe the current summer in relation to the preceding winter. In a country famous for its tradition of poetry and song, these sources provide some fascinating insights into the relationship between the people of Wales and its weather.

Ricardo Garcia-Herrera

HOT AND COLD CLIMATE HISTORIES

In this paper we show the results obtained after using reports from daily newspapers to reconstruct a series of the annual number of snow days in the Mendoza area of Argentina (central Andes) for the period 1885-1996. Due to the scarcity of instrumental data, the quality of the series is evaluated by studying the atmospheric patterns related to anomalies in the reconstructed series. The origin of precipitation anomalies in this part of the world is relatively well known and is has been related to the El Niño / Southern Oscillation cycle through the Pacific South American pattern, which implies changes in the subtropical jet across the Pacific, the blocking activity in the Southeastern Pacific and the ice formation around the Antarctic Peninsula. We found that the reconstructed series of snow frequency reproduces every expected anomaly pattern related to precipitation in the central Andes during the period 1958-1996. The methodology developed can help to validate reconstructed series in absence of instrumental data to perform a direct calibration. In addition, it provides a physical link between the variability of a climate proxy and the underlying atmospheric dynamics.

Analysis of the series using Singular Spectrum Analysis (SSA) and the Maximum Entropy Method (MEM) showed that the number of snow days exhibits interdecadal and interannual oscillations with periods of about 28 and five years. Furthermore a positive trend was detected. This temporal pattern is consistent with studies of the variability of global surface temperature reflecting the strong relationship between temperature and snow occurrence.

Sharon E. Nicholson

CLIMATE HISTORIES FROM RIVERS, LAKES AND OCEANS

This talk describes a recently developed semi-quantitative rainfall data set that extends the climate record for Africa back to the beginning of the 19th century. It divides the continent into 90 rainfall regions, with annual rainfall being expressed on a scale of -3 (extremely dry) to +3 (extremely wet). This data set was created by merging documentary evidence from the historical record with the sporadic instrumental records. The latter became increasingly important towards the end of the 19th century. Because of the semi-quantitative nature of the data set, it can be analyzed with the same statistical tools used to examine the modern record. As new historical records become available, they can readily be incorporated into this data base. The data set also includes detailed records of lake level fluctuations based on documentary evidence. We have developed a methodology, based on water balance, to convert the lake records to actual, quantitative rainfall amounts. The interpretation of the lake records has produced some surprising results concerning rainfall variability in East Africa during the 19th century.

Matt Therrell
DROUGHT HISTORIES

1890s drought in Mexico

Lucy Veale

CLIMATE CHANGE AND
SOCIETY

This paper explores how, for much of the nineteenth century, British people living and working in "tropical" India constituted a "vulnerable" and frightened population. Medical theories of the time formed an association between tropical climates, disease, backwardness and accelerated death rates. The perceived "pathological potency" (Livingstone, 1999:106) of these regions, accompanied by very real high rates of death and disease, rendered them particularly dangerous for Europeans, relative to the temperate zone. In an attempt to preserve their mental and physical wellbeing, the British in India formulated a number of "acclimatization" strategies. Here focus will be placed on the formation and activities of the hill station Ootacamund in southern India. The "magic mountains" (Kennedy, 1996) were deemed salubrious escapes from the heat and diseases of the plains. With a climate marketed as distinctly "English" in character, residents set about introducing and acclimatizing familiar English vegetation (and to lesser extent animals) to the hills, in turn making themselves feel both safe, and at home. The British population of Ootacamund thrived and the region soon became, "a useful, perhaps essential, social node for the British in India that provided... for reinforcement of social standards, raising of morale, relaxation from the travails of loneliness, alienation, discomfort and disease" (Mandelbaum, 1989:15-16). The research uses a wide variety of archival sources (including published texts, newspapers, diaries, letters and government documents) to investigate the climate history of the region and theories and conceptions of it, alongside the identification of acclimatization strategies which helped to address the tropical "problem".

Michael A. Palecki
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EXTREME EVENTS

19th Century U.S. Daily Climate Observations and Extreme Events in Space and Time

Many issues related to natural climate variability and detecting anthropogenic climate change are directly impacted by the length and quality of existing records of climate observations. The growing availability of daily 19th Century digital climate data produced by the NOAA Climate Database Modernization Program (CDMP) is beginning to provide the information necessary for answering fundamental detection questions regarding short term climate extremes that cannot be resolved by monthly or annual data. The utilization of these data does require some care, including extensive quality control efforts. Additionally, adjustments must be made to temperature measurements taken at specific hours so as to relate these to true daily maximum and minimum temperatures.

Previous work has looked at national and regional time series of counts of extreme temperature and precipitation events at stations, and these results will be updated here. The analysis is now being expanded to characterize the spatial as well as temporal breadth of climate extreme events, eventually resulting in a Web catalog of 19th Century extreme climate events. The nature of the onset and ending of the growing season and longer term climate anomalies like droughts and pluvials can also be uniquely addressed by using daily data. Several case studies demonstrating the utility of these data for examining noteworthy historical events will be presented.

HOT AND COLD CLIMATE HISTORIES: Nash/ Grab, Herrera, Burnette, Mikami and Zaiki 5

CLIMATE HISTORIES: RIVERS, LAKES AND OCEANS: Nicholson, Chenoweth, Wheeler, MacDonald, Prieto 5

EXTREME EVENTS: Palecki, Dodds, Kelso, Mock, 4: + discussant

DROUGHT HISTORIES: Jose et al., Isabel, Therrell, Stahle et al 4 + discussant

CLIMATE CHANGE AND SOCIETY: Lucy Veale, Sarah Davies, Jim Fleming, Rodolfo Acuna- Soto, Georgina 5