How does our current climate compare to the natural climate of the Dark Ages Cold Period?
A key aspect of the debate over potential CO$_2$-induced global warming centers on how much of the modern rise in temperature is the product of the contemporaneous anthropogenic-induced rise in atmospheric CO$_2$ concentration and how much is due to natural forcings. The world’s climate alarmists contend that most of the warming is due to CO$_2$, while climate skeptics claim that natural factors dominate. In promoting their opposing positions, climate alarmists frequently turn to climate models for support. Climate skeptics, on the other hand, look to real-world data, arguing that there have been multiple periods in Earth’s recent history when temperatures rose to levels that were just as high as, or even higher than, they are presently, when the air’s CO$_2$ content was much lower than it is today. And since atmospheric CO$_2$ was obviously not responsible for the higher temperatures of those prior periods of warmth, logic suggests it may well have had nothing to do with the current rise in temperature either. Thus, discovering the cause or causes of past climatic oscillations has become an important goal of paleoclimate research.

One climatic cycle that has been found to occur throughout the globe during both glacial and interglacial periods alike is a millennial-scale oscillation that regularly alternates between warmer and colder intervals, the past two cycles of which have brought us the relative warmth of the Roman Warm Period\(^1\), the relative coolness of the Dark Ages Cold Period\(^2\), the heat of the Medieval Warm Period\(^3\), the global chill of the Little Ice Age\(^4\), plus the welcome warmth of the Current Warm Period. And considering the need to evaluate the climate of the modern era within the historical context of natural climate change, we here examine what researchers have learned about the Dark Ages Cold Period, specifically focusing on North America.

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\(^1\) http://www.co2science.org/subject/r/subject_r.php.  
\(^2\) http://www.co2science.org/subject/d/subject_d.php.  
\(^3\) http://www.co2science.org/subject/m/subject_m.php.  
\(^4\) http://www.co2science.org/subject/l/subject_l.php.
Starting in the Pacific northwest portion of the continent, **Reyes et al. (2006)**\(^5\) compiled and analyzed both new and previously published geological data obtained from 17 glacier fields in coastal and near-coastal British Columbia (Canada) and Alaska (USA). Their results indicate there was a widespread glacier advance during the first millennium AD along an ~2000-km transect of the Pacific North American cordillera that was centered on AD 400-700. And “the synchroneity of this glacier advance and inferred cooling over a large area,” in the words of the eleven researchers, “suggest a regional climate forcing” that “together with other proxy evidence for ... regional climate amelioration ca. AD 850-1200 (Hu et al., 2001) during the Medieval Warm Period (Cook et al., 2004; Moberg et al., 2005), and subsequent Little Ice Age glacier expansion (Larocque and Smith, 2003; Wiles et al., 2004), are consistent with a millennial-scale climate cycle in the North Pacific region.”

Nearby, but working five years earlier, **Hu et al. (2001)**\(^6\) conducted multiproxy geochemical analyses of a sediment core obtained from Farewell Lake in the northwestern foothills of the Alaska Range, obtaining what they describe as “the first high-resolution quantitative record of Alaskan climate variations that spans the last two millennia,” while stating as the reason for their study that “knowledge of natural climatic variability is essential for evaluating possible human impacts on recent and future climate changes.”

What they found, in the words of the five scientists, “suggest that at Farewell Lake SWT [surface water temperature] was as warm as the present at AD 0-300 [during the Roman Warm Period], after which it decreased steadily by ~3.5°C to reach a minimum at AD 600 [during the depths of the Dark Ages Cold Period].” And from that point in time, they say “SWT increased by ~3.0°C during the period AD 600-850 and then [during the Medieval Warm Period] exhibited fluctuations of 0.5-1.0°C until AD 1200.” Completing their narrative, they say that “between AD 1200-1700, SWT decreased gradually by 1.25°C [as the world descended into the depths of the Little Ice Age], and from AD 1700 to the present, SWT increased by 1.75°C,” the latter portion of which warming initiated the Modern Warm Period.

Also in Alaska, **Wiles et al. (2008)**\(^7\) used “comparisons of temperature sensitive climate proxy records with tree-ring, lichen and radiocarbon dated histories from land-terminating, non-

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\(^6\) http://www.co2science.org/articles/V7/N49/EDIT.php.  
surging glaciers for the last two millennia” to “identify summer temperature as a primary driver of glacial expansions,” based on “field and laboratory work over the past decade” that yielded “five new or updated glacier histories,” one each for Bear Glacier (Kenai Mountains), Marathon Mountain Cirque (Kenai Mountains), Amherst Glacier (Chugach Mountains), Crescent Glacier (Chugach Mountains) and Yakutat Glacier (St. Elias Mountains), all located just above the Gulf of Alaska (about 60°N) between approximately 140 to 150°W. And according to the four researchers, they detected “general glacier expansions during the First Millennium AD” that experienced their “strongest advance” at AD 600, which latter cold interval -- with ice extent “as extensive as [the] subsequent Little Ice Age” -- occurred during the Dark Ages Cold Period. In addition, their record revealed an alternating warm-cold-warm-cold-warm sequence during the past 2000 years, which they say “is consistent with millennial-scale records of ice-rafted debris flux in the North Atlantic and Northern Hemisphere temperature reconstructions.” And noting that “variable Holocene solar irradiance has been proposed as a potential forcing mechanism for millennial-scale climate change,” they conclude that “this is supported by the Southern Alaskan glacial record,” which conclusion implies that the past century’s lead-in to the Current Warm Period may well have been similarly orchestrated and have had essentially nothing to do with the concomitant increase in the air’s CO$_2$ content.

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In one final study from Alaska, Clegg et al. (2010)\(^8\) conducted a high-resolution analysis of midge assemblages found in the sediments of Moose Lake (61°22.45′N, 143°35.93′W) in the Wrangell-St. Elias National Park and Preserve of south-central Alaska (USA), based on data obtained from cores removed from the lake bottom in the summer of AD 2000 and a midge-to-temperature transfer function that yielded mean July temperatures (T$_{July}$) for the past six thousand years.

The results of this study are portrayed in the figure below, where it can be seen, in the words of Clegg et al., that “a piecewise linear regression analysis identifies a significant change point at ca 4000 years before present (cal BP),” with “a decreasing trend after this point.” And from 2500 cal BP to the present, there is a clear multi-centennial oscillation about the declining trend line, with its peaks and valleys defining the temporal locations of the Roman Warm Period (RWP), the Dark Ages Cold Period (DACP), the Medieval Warm Period (MWP), the Little Ice Age (LIA) -- during which the coldest temperatures of the entire interglacial or Holocene were reached -- and, finally, the start of the Current Warm Period (CWP), which is still not expressed to any significant degree compared to the Medieval and Roman Warm Periods.

\(^8\) http://www.co2science.org/articles/V14/N4/C2.php.
In discussing their results, the seven scientists write that “comparisons of the T\textsubscript{July} record from Moose Lake with other Alaskan temperature records suggest that the regional coherency observed in instrumental temperature records (e.g., Wiles \textit{et al}., 1998; Gedalof and Smith, 2001; Wilson \textit{et al}., 2007) extends broadly to at least 2000 cal BP,” while noting that (1) climatic events such as the LIA and the MWP occurred “largely synchronously” between their T\textsubscript{July} record from Moose Lake and a δ\textsubscript{18}O-based temperature record from Farewell Lake on the northwestern foothills of the Alaska Range, and that (2) “local temperature minima likely associated with First Millennium AD Cooling (centered at 1400 cal BP; Wiles \textit{et al}., 2008) are evident at both Farewell and Hallet lakes (McKay \textit{et al}., 2008).”

Dropping down to the central part of the conterminous United States, Follett \textit{et al}. (2004)\textsuperscript{9} “used $^{13}$C:$^{12}$C ratio (δ$^{13}$C) and $^{14}$C dating to evaluate relationships and changes in warm (C\textsubscript{4}) versus cool season (C\textsubscript{3}) plant signatures with age of soil organic carbon” across “three soil temperature regimes and three soil moisture regimes within the historic grasslands [of the] US Great Plains and Western Corn Belt” for the entire period of the current interglacial or Holocene. They report that their data “indicate a

\footnote{9 \url{http://www.co2science.org/articles/V8/N11/C2.php}.}
change from C₄ plants to increasing C₃ plant dominance (as a surrogate of cooler temperature) at ~1,500 yr BP.” More specifically, they say that “the yr BP when δ¹³C was least negative was 1560,” and that “δ¹³C was more negative before or after that time,” which places this significantly colder interval of time well within the Dark Ages Cold Period.

Moving to the east coast of the United States, Willard et al. (2003)¹⁰ examined “the late Holocene (2300 yr BP to present) record of Chesapeake Bay and the adjacent terrestrial ecosystem in its watershed through the study of fossil dinoflagellate cysts and pollen from sediment cores.” They report that “several dry periods ranging from decades to centuries in duration are evident in Chesapeake Bay records.” The first of these periods of lower-than-average precipitation, which spanned the period 200 BC-AD 300, occurred during the Roman Warm Period. The next such period (~AD 800-1200) “corresponds to the ‘Medieval Warm Period’, which has been documented as drier than average by tree-ring (Stahle and Cleaveland, 1994) and pollen (Willard et al., 2001) records from the southeastern USA.” In addition, they note that “mid-Atlantic dry periods generally correspond to central and southwestern USA ‘megadroughts’, described by Woodhouse and Overpeck (1998).” Hence, it would appear that the intervening Dark Ages Cold Period was a time of relatively greater wetness throughout much of the United States.

A similar pattern of alternating multi-century wet and dry regimes was found by Campbell (2002)¹¹, who analyzed the grain sizes of sediment cores obtained from Pine Lake, Alberta, Canada to provide a high-resolution record of climate variability for this part of North America over the past 4000 years. Periods of both increasing and decreasing grain size (moisture availability) were noted throughout the 4000-year record at decadal, centennial and millennial time scales. The most prominent of the major dry periods once again occurred during the Roman Warm Period (about 900-100 BC) and Medieval Warm Period (about AD 700 to 1300), while the major wet periods occurred during the Dark Ages Cold Period (about 100 BC to AD 700) and Little Ice Age (about AD 1500 to 1900).

In considering the above studies, it appears that the Dark Ages Cold Period in North America was a time of both relative coolness and wetness, much like the Little Ice Age was in this part of the world. It is also instructive to note, in this regard, that the climatic transition from the Little Ice Age to the Current Warm Period was of the same type and magnitude as the climatic transition from the Dark Ages Cold Period to the Medieval Warm Period. And because the earlier of these two warming eras occurred at a time when the air’s CO₂ content was stable and much lower than it is today, there is no compelling reason to believe that 20th-century

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warming was in any way related to the concurrent increase in the atmosphere’s CO₂ concentration. Quite to the contrary, it was most likely the result of whatever drives the natural millennial-scale cycling of Earth’s climate that has operated for eons throughout glacial and interglacial periods alike (Oppo et al., 1998; McManus et al., 1999).

REFERENCES


Cover photo of the highest waterfall in North America, Yosemite Falls, in California, USA, as uploaded by MikeSFArea to wunderground.com.