DROUGHTS IN AFRICA

What does real-world climatic *history* have to say about the subject?

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One of the many dangers of global warming, according to the world's climate alarmists, is the predicted propensity for rising temperatures to produce more frequent, more severe, and longer-lasting droughts almost everywhere on Earth. But just how realistic are the climate models upon which these claims are based? And what does real-world climatic *history* have to say about the subject? In this brief summary, we discuss the findings of several scientific papers that broach these questions as they pertain to Africa.

We begin with the work of Lau *et al.*, (2006)[1], who conducted a multi-model study of Sahel drought from the 1970s to the 1990s using nineteen CGCMs that were "driven by combinations of realistic prescribed external forcing, including anthropogenic increases in greenhouse gases and sulfate aerosols, long-term variation in solar radiation, and volcanic eruptions." Their work revealed that "only eight models produce a reasonable Sahel drought signal, seven models produce excessive rainfall over [the] Sahel during the observed drought period, and four models show no significant deviation from normal." In addition, they report that "even the model with the highest skill for the Sahel drought could only simulate the increasing trend of severe drought events but not the magnitude, nor the beginning time and duration of the events." Consequently, since *all nineteen* of the CGCMs that were used in preparing the IPCC's Fourth Assessment Report were unable to adequately simulate the basic characteristics of what Lau *et al*. call one of the past century's "most pronounced signals of climate change," this *failure* of what they call an "ideal test" for evaluating the models' abilities to accurately simulate "long-term drought" and "coupled atmosphere-ocean-land processes and their interactions" would almost *mandate* that it would be unwise to rely on any of the models' outputs as guides to the future, especially in light of the fact that even though the models were "driven by combinations of realistic prescribed external forcing," they *still* could not properly simulate even the *recent* past.

Since all nineteen of the CGCMs that were used in preparing the IPCC's Fourth Assessment Report were unable to adequately simulate the basic characteristics of what Lau et al. call one of the past century's "most pronounced signals of climate change," this failure would almost mandate that it would be unwise to rely on any of the models' outputs as guides to the future.

[1] http://www.co2science.org/articles/V9/N35/C3.php.

Leaving climate models behind, then, we turn our attention to instrumental and proxy drought records to see what they reveal about the propensity for rising temperatures to alter drought characteristics in different parts of Africa.

In a review of information pertaining to the past two centuries, Nicholson (2001)[2] reports there has been "a long-term reduction in rainfall in the semi-arid regions of West Africa" that has been "on the order of 20 to 40% in parts of the Sahel." Describing the phenomenon as "three decades of protracted aridity," she reports that "nearly all of Africa has been affected ... particularly since the 1980s." Nevertheless, Nicholson says that "rainfall conditions over Africa during the last 2 to 3 decades are *not unprecedented* [italics added]," and that "a similar dry episode prevailed during most of the first half of the 19th century," when much of the planet was still experiencing Little Ice Age conditions.

Five years later, Therrell *et al*. (2006)[3] developed what they describe as "the first tree-ring reconstruction of rainfall in tropical Africa using a 200-year regional chronology based on samples of *Pterocarpus angolensis* [a deciduous tropical hardwood known locally as Mukwa] from Zimbabwe." This project revealed that "a decadal-scale drought reconstructed from 1882 to 1896 matches the most severe sustained drought during the instrumental period (1989-1995)," and that "an even more severe drought is indicated from 1859 to 1868 in both the tree-ring and documentary data." They report, for example, that the year 1860 (which was the most droughty year of the entire period), was described in a contemporary account from Botswana (where part of their tree-ring chronology originated) as "a season of 'severe and universal drought' with 'food of every description' being 'exceedingly scarce' and the losses of cattle being 'very severe' (Nash and Endfield, 2002)." At the other end of the moisture spectrum, Therrel *et al*. report that "a 6-year wet period at the turn of the nineteenth century (1897-1902) exceeds any wet episode during the instrumental era." Consequently, for a large part of central southern Africa, it is clear that the supposedly unprecedented global warming of the 20th century did *not* result in an intensification of either extreme dry or wet periods. If anything, just the *opposite* appears to have occurred.

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Looking further back in time, Verschuren *et al*. (2000)[4] developed a decadal-scale history of rainfall and drought in equatorial east Africa for the past *thousand* years, based on level and salinity fluctuations of a small crater-lake in Kenya that were derived from diatom and midge assemblages retrieved from the lake's sediments. Once again, they found that the Little Ice Age

[2] http://www.co2science.org/articles/V5/N3/C2.php.
[3] http://www.co2science.org/articles/V9/N38/C1.php.
[4] http://www.co2science.org/articles/V3/N4/C1.php.

was generally wetter than the Modern Warm Period; but they identified three intervals of prolonged dryness within the Little Ice Age (1390-1420, 1560-1625, and 1760-1840), and of these "episodes of persistent aridity," as they refer to them, *all* were determined to have been "more severe than any recorded drought of the twentieth century."

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Introducing their study of the subject, Esper *et al.* (2007)[5] write that "analysis of the PDSI [Palmer Drought Severity Index], a standardized measure of surface moisture conditions, revealed distinct 20th century aridity changes in vulnerable NW Africa, including a sharp downward trend towards drier conditions in the 1980s (Luterbacher *et al*., 2006)," but they say that "a high-resolution long-term reconstruction that could place current conditions in the context of the past millennium is missing for N Africa." And that is the problem they set out to correct. More specifically, Esper *et al*. "re-use *Cedrus atlantica* tree-ring data generated in the 1980s (Glueck and Stockton, 2001) and combine these measurements with a major update collected in 2002," which "allows analysis of tree growth and instrumental data during the current drought episode in comparison to PDSI estimates back to AD 1049." So what did they find?

The six scientists report that "PDSI values were above average for most of the 1450-1980 period, which let recent drought appear exceptional." However, they say that the long-term results they obtained indicate that the "pluvial episode of the past millennium was preceded by generally drier conditions back to 1049," leading them to state that the late 20th-century drought "appears more typical when associated with conditions before 1400." In addition, they conclude their paper by stating that the "ultimate drivers" for the medieval hydroclimate pattern that led to the earlier drought conditions in Morocco "seemed to be high solar irradiance and low volcanic forcings (Emile-Geay *et al*., 2007)." Such work demonstrates, once again, the importance of acquiring long-term (millennial-scale) records of various climatic and meteorological phenomena in order to determine how exceptional 20th-century changes in their characteristics might be, which can help to determine whether there is compelling reason to attribute these changes to historical increases in the atmospheric concentrations of various greenhouse gases.

Probing some 1500 years into the past was the study of Holmes *et al.* (1997)[6], who wrote that since the late 1960s, the African Sahel had experienced "one of the most persistent droughts recorded by the entire global meteorological record." However, in a high-resolution study of a sediment sequence extracted from an oasis in the Manga Grasslands of northeast Nigeria, they

[5] http://www.co2science.org/articles/V11/N1/C2.php.
[6] http://www.co2science.org/articles/V3/N22/C2.php.

too determined that "the present drought is not unique and that drought has recurred on a centennial to interdecadal timescale during the last 1500 years."

Looking still further back in time, Russell *et al*. (2007)[7] conducted lithostratigraphic analyses of sediment cores obtained from two crater lake basins in Western Uganda, Africa - Lake Kitagata (0°03'S, 29°58'E) and Lake Kibengo (0°04.9'S, 30°10.7'E) - spanning the past two millennia. Among other things, the trio of authors report that "variations in sedimentation and salt mineralogy of hypersaline Lake Kitagata, and a succession of fine-grained lake sediments and peat in the freshwater Lake Kibengo, suggest century-scale droughts centered on AD ~0 [and] ~1100."

In discussing what they call the "broader climatic implications" of their findings, the three researchers write that "based on comparison of proxy water-balance records from Lakes Edward (Russell *et al*., 2003; Russell and Johnson, 2005), Naivasha (Verschuren *et al*., 2000), Turkana (Halfman *et al*., 1994), and Tanganyika (Alin and Cohen, 2003), Russell *et al*. (2003) argued that drought around 2000 years ago (AD ~0) affected 'much, if not all, of equatorial Africa'." Similarly, they say "Verschuren (2004) argued that drought centered on AD 1150 affected much of the region, a hypothesis supported by Russell and Johnson (2005)." Consequently, and in light of the three scientists' similar newer results, they conclude that "droughts at AD ~0 and ~1150" - which roughly mark the midpoints of the Roman and Medieval Warm Periods, respectively - "do appear to have affected much of equatorial Africa."

Going back in time almost 5500 years, from the start of the record until about 1800 years ago, [there] were major droughts of "at least century-scale duration," centered at approximately 850, 1500, 2000 and 4100 years ago.

Consequently, it would not be unnatural for another such drought to grip the region in the not-too-distant future; and if such were to happen, the world's climate alarmists would be quick to claim that the ongoing rise in the air's CO_2 content was responsible for it.

Nevertheless, there would be no compelling reason to believe they were correct, for if such droughts have occurred before – with much less CO_2 in the air than there is currently – they can easily occur again, independent of whatever the air's CO_2 concentration might be doing.

[7] http://www.co2science.org/articles/V10/N35/C2.php.

Last of all, and going back in time almost 5500 years, Russell and Johnson (2005)[8] analyzed sediment cores that had been retrieved from Lake Edward - the smallest of the great rift lakes of East Africa, located on the border that separates Uganda and the Democratic Republic of the Congo - to derive a detailed precipitation history for that region. In doing so, they discovered that from the start of the record until about 1800 years ago, there was a long-term trend toward progressively more arid conditions, after which there followed what they term a "slight trend" toward wetter conditions that has persisted to the present. In addition, superimposed on these long-term trends were major droughts of "at least century-scale duration," centered at approximately 850, 1500, 2000 and 4100 years ago. Consequently, it would not be unnatural for another such drought to grip the region in the not-too-distant future; and if such were to happen, the world's climate alarmists would be quick to claim that the ongoing rise in the air's CO_2 content was responsible for it. Nevertheless, there would be no compelling reason to believe they were correct, for if such droughts have occurred before - with much *less* CO_2 in the air than there is currently - they can easily occur again, independent of whatever the air's CO_2 concentration might be doing.

In summation, real-world evidence from Africa suggests that the global warming of the past century or so has *not* led to either a greater frequency or severity of drought in that part of the world. In fact, even the continent's worst drought in recorded meteorological history does not seem to have been any worse (it was actually much milder) than droughts that occurred periodically during much colder times. Thus, there is no reason to put any credence in the climate-alarmist claim that global warming leads to more frequent or severe droughts in Africa. *It doesn't!*

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[8] http://www.co2science.org/articles/V8/N45/C1.php.

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