Severe Drought Predicted to Grip the Globe By 2040

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BOULDER, Colorado, October 21, 2010 (ENS) - Global warming will bring on severe and prolonged drought across the United States and many other heavily populated countries within 30 years, finds a new study by the National Center for Atmospheric Research.

Atmospheric scientist Dr. Aiguo Dai, with NCAR's Climate and Global Dynamics Division in Boulder, concludes that warming temperatures associated with climate change will likely create increasingly dry conditions across much of the globe in the next 30 years, possibly reaching a scale in some regions by the end of the century that has rarely, if ever, been observed in modern times.

"We are facing the possibility of widespread drought in the coming decades, but this has yet to be fully recognized by both the public and the climate change research community," Dai said today. "If the projections in this study come even close to being realized, the consequences for society worldwide will be enormous."

Most of the western two-thirds of the United States will be significantly drier by the 2030s, Dai's study shows. Large parts of the nation may face an increasing risk of extreme drought during the century.

Using an ensemble of 22 computer climate models and a comprehensive index of drought conditions, as well as analyses of previously published studies, Dai found that most of the Western Hemisphere, along with large parts of Eurasia, Africa, and Australia, will be at risk of extreme drought this century.

By contrast, higher-latitude regions from Alaska to Scandinavia are likely to become more moist.

Dai cautioned that his findings are based on the best current projections of greenhouse gas emissions.

What actually happens in coming decades will depend on many factors, including actual future emissions of greenhouse gases as well as natural climate cycles such as El Niño.

Dr. Dai's findings appear this week as part of a longer review article in "Wiley Interdisciplinary Reviews: Climate Change." The study was supported by the National Science Foundation, NCAR's sponsor.

Richard Seager of Columbia University's Lamont Doherty Earth Observatory, a climate change expert not associated with the study, said, "As Dai emphasizes here, vast swaths of the subtropics and the midlatitude continents face a future with drier soils and less surface water as a result of reducing rainfall and increasing evaporation driven by a warming atmosphere."

"The term 'global warming' does not do justice to the climatic changes the world will experience in coming decades," warned Seager. "Some of the worst disruptions we face will involve water, not just temperature."

While regional climate projections are less certain than those for the globe as a whole, Dai's study indicates much of Latin America, including large sections of Mexico and Brazil will be affected.

Regions bordering the Mediterranean Sea could become especially dry.

Dai predicts drought across large parts of Southwest Asia and also across Southeast Asia, including parts of China and neighboring countries.

Finally, drought will affect most of Africa and Australia, with particularly dry conditions in some regions of Africa, Dai's analysis shows

While the planet's land areas should be drier overall, the study also finds that drought risk can be expected to decrease this century across much of Northern Europe, Russia, Canada, and Alaska, as well as some areas in the Southern Hemisphere.

"The increased wetness over the northern, sparsely populated high latitudes can't match the drying over the more densely populated temperate and tropical areas," says Dai.

Previous climate studies have indicated that global warming will probably alter precipitation patterns as the subtropics expand.

The 2007 assessment by the Intergovernmental Panel on Climate Change, IPCC, concluded that subtropical areas will likely have precipitation declines, with high-latitude areas getting more precipitation.

In a much-cited 2004 study, Dr. Dai and colleagues found that the percentage of Earth's land area stricken by serious drought more than doubled from the 1970s to the early 2000s.

Last year, he headed a research team that found that some of the world's major rivers are losing water.

Droughts are complex events that can be associated with reduced precipitation, dry soils that fail to sustain crops, and reduced levels in reservoirs and other bodies of water that can imperil drinking water supplies.

A common measure called the Palmer Drought Severity Index classifies the strength of a drought by tracking precipitation and evaporation over time and comparing them to the usual variability one would expect at a given location.

For this study, Dai utilized results from the 22 computer models used by the IPCC in its 2007 report to gather projections about temperature, precipitation, humidity, wind speed, and Earth's radiative balance, based on current projections of greenhouse gas emissions.

He fed the information into the Palmer model to calculate the drought severity index number. A reading of +0.5 to -0.5 on the index indicates normal conditions, while a reading at or below -4 indicates extreme drought.

By the 2030s, the results show that much of the central and western United States could experience particularly severe conditions, with average readings over the course of a decade potentially dropping to -4 to -6 on the PDSI scale.

Parts of the Mediterranean region hit -8 or lower on the PDSI scale.

By the end of the century, many populated areas, including parts of the United States, could face readings in the range of -8 to -10, and much of the Mediterranean could fall to -15 to -20. Such drought readings would be unprecedented.

Dai cautions that global climate models remain inconsistent in capturing precipitation changes and other atmospheric factors, especially at the regional scale. However, the 2007 IPCC models were in stronger agreement on high-altitude and low-latitude precipitation than those used in previous reports, he points out.

There are also uncertainties in how well the Palmer index captures the range of conditions that future climate may produce. The index could be overestimating drought intensity in the more extreme cases, says Dai.

On the other hand, he said, the index may be underestimating the loss of soil moisture should rain and snow fall in shorter, heavier bursts and run off more quickly. Dai says such precipitation trends have already been identified in the United States in recent years.

Dai says, "The fact that the current drought index may not work for the 21st century climate is itself a troubling sign."