Newsweek

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# The Lake Effect

**What new research about how dams affect rainfall says about man-made climate change.**

By **Sharon Begley** | Newsweek Web Exclusive
Dec 29, 2009

It's impossible to write about how human activities are altering the climate without bringing protests that such a thing is impossible, that puny humanity cannot possibly alter such a gargantuan system through (for instance) loading the atmosphere with an additional .000115 percentage points of carbon dioxide. (At this point, someone often sneers that believers in anthropogenic climate change think they've overturned the old chestnut about everyone talking about the weather but no one doing anything about it.) Borrowing from Richard Dawkins on those who deny evolution, we can call this the "argument from personal incredulity", as in, "I don't know physics, but I can't understand how raising atmospheric levels of carbon dioxide from 270 parts per million to the current 385 ppm could possibly alter climate."

Unfortunately for the denialists, examples of how human activities can alter climate keep accumulating. The latest has nothing to do with the greenhouse effect but underlines the fact that ordinary activities can have unexpected meteorological consequences. To wit: large dams seem to be altering rainfall patterns.



Geophysicists have suspected as much for years, notes a team of scientists in a paper in the Dec. 1 issue of *Eos*, a publication of the American Geophysical Union. But it is becoming clearer that in addition to providing lots of water to evaporate and then return to the ground as rainfall, as scientists at MIT described in a 1996 study, dams also make local meteorological conditions more conducive to precipitation.

In particular, explain Faisal Hossain and Indumathi Jeyachandran of Tennessee Technological University and Roger Pielke Sr. of the University of Colorado, Boulder, dams increase atmospheric instabilities in the vertical profile of temperature and humidity. Those instabilities arise because the presence of a dam—specifically, the reservoir it creates—increases evaporation and therefore atmospheric moisture. That enhances the amount of convective energy in the air above the reservoir. The end result: more precipitation.

Weather records support this theoretical reasoning. For one thing, there are more thunderstorms in the vicinity of a large dam compared with before the dam was built. For another, large dams are contributing to the "when it rains, it pours" phenomenon: longer periods without precipitation punctuated by drenching, flood-inducing downpours. Extreme precipitation events (rainfall that's greater than 99 percent of historic rainfalls) around large dams have increased significantly, as Hossain describes in an upcoming paper: 99th-

percentile downpours in the region of a large dam have increased 4 percent per year after a large dam was built, especially in southern Africa, India, the western United States, and Central Asia. Other studies have shown how changes in land cover as seemingly innocuous as irrigating fields and draining swamps can alter local precipitation patterns, as this paper as well as this one have described.

The significance of dams altering local weather is not merely another example of the power of human activities to change the climate. There is also a more practical issue. When dams are constructed, engineers make assumptions about how frequently large floods will occur, and they build the dam to withstand them. But if the proverbial 100-year flood occurs more frequently because of the very presence of a dam, that calculation is wrong, and the dam may be subjected to more frequent and more extreme flood-inducing downpours. A "flood-safe" dam may not be.

As the *Eos* authors warn, "it is therefore possible that a large dam may be found years later to actually have been designed for a flood with a much lower recurrence interval (or higher frequency) than originally expected because the frequency of extreme precipitation events has increased due to the reservoir's presence. Such a possibility raises concerns about dam safety...[That risk is] compounded by the fact that conventional dam and reservoir design over the past century has been 'one- way,' with no acknowledgment of the possible feedback mechanisms" between the presence of a dam and rainfall. "Indeed, dam design protocol in civil engineering continues to assume unchanging [patterns of] extreme precipitation events." The risk is also compounded by the age of dams: some 85 percent of large dams in the United States will be more than 50 years old by 2020.

If only the idea that "no one does anything about the weather" were true.

*Sharon Begley is NEWSWEEK's science editor and author of* The Plastic Mind: New Science Reveals Our Extraordinary Potential to Transform Ourselves *and*Train Your Mind, Change Your Brain: How a New Science Reveals Our Extraordinary Potential to Transform Ourselves.

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