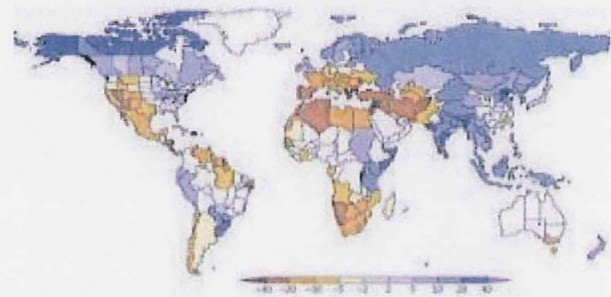


## Floods And Droughts: Water Planners Call For Fundamental Shift To Deal With Changing Climate



*Model-projected percentage change (2041-2060 vs. 1900-1970) in mean annual runoff volume for ice-free land, under the Intergovernmental Panel on Climate Change "SRES A1B" scenario. Blue areas are projected to gain water, while red areas will become significantly drier. (Credit: Science)*

ScienceDaily (Feb. 5, 2008) — The past is no longer a reliable base on which to plan the future of water management. So says a new perspectives piece written by a prominent group of hydrologists and climatologists, in the journal *Science*, that calls for fundamental changes to the science behind water planning and policy.

"With the climate changing, past years aren't necessarily representative of the future anymore," said co-author Dennis Lettenmaier, a professor of civil engineering at the University of Washington. "This paper says that the way business has been done in the past will no longer work in a changing climate."

Global spending on water infrastructure is currently more than \$500 billion per year. Until now, managers at municipal water boards, the Army Corps of Engineers, the U.S. Bureau of Reclamation and other federal, state and local agencies have operated on the premise that historical patterns could be counted on to continue. The assumption was that variability from year to year occurred within stationary, unchanging patterns.

But human-induced changes to Earth's climate have begun to shift the averages and the extremes for rainfall, snowfall, evaporation and stream flows, the authors write. These are crucial factors when planning for floods or droughts, choosing the size of water reservoirs or deciding how much water to allocate for residential, industrial and agricultural uses.



"Historically, looking back at past observations has been a good way to estimate future conditions," said lead author Christopher Milly, a research hydrologist with the U.S. Geological Survey. "But climate change magnifies the possibility that the future will bring droughts or floods you never saw in your old measurements."

The old way of doing business is dead, the authors write. And it cannot be revived. Even with an aggressive reduction in greenhouse gas emissions, warming will persist and global water patterns will continue to show never-before-seen behavior.

The authors thus propose a planning framework like the Harvard Water Program, a project from the late 1950s to the early 1960s in which scientists and engineers hammered out the basis for the current water-management policies. The authors call for a renewed effort in the spirit of the earlier program that would incorporate shifting averages and variability.

Not all regions will experience the same changes in flows. Global warming augments atmospheric humidity and water transport. This increases precipitation, and possibly flood risk, where prevailing atmospheric water-vapor fluxes converge. Glacial meltwater temporarily enhances water availability, but glacier and snow-pack losses diminish natural storage of freshwater. In coastal regions the supplies are endangered by rising sea levels. The risk of contamination with seawater is heightened, the authors state.

From projections of future water availability a broad picture emerges of regional gainers and losers. "Our best current estimates are that water availability will increase substantially in northern Eurasia, Alaska, Canada and some tropical regions, and decrease substantially in southern Europe, the Middle East, southern Africa and southwestern North America," Milly said. Drying regions will likely also experience more frequent droughts, he said.

In the Western US, changes in precipitation and the timing of snowmelt now seem likely to affect seasonal flow patterns that are critical to salmon runs, water supply and other water uses, Lettenmaier said.

"For agencies like the Army Corps of Engineers and the Bureau of Reclamation, this would mean fundamental changes in the way they do business," he said. "If you look at plans by those agencies for management of the Columbia River, essentially they've ignored climate change. For instance, until quite recently, the National Marine Fisheries Service didn't even mention what climate change might mean for rehabilitation of fish runs."

Asked whether the new paper would prompt changes in management practices, Lettenmaier said: "I think so. I think it will become increasingly hard to ignore climate change in water management."

Journal article: Milly, P. C. D., Betancourt, J., Falkenmark, M., Hirsch, R. M., Kundzewicz, Z. W., Lettenmaier, D. P., Stouffer, R. J. (2008). Stationarity is Dead: Whither Water Management? Science 319, 573-574 (January 31, 2008)

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