Global warming -- a rise in river flows raises alarm

Margot Roosevelt, Los Angeles Times, 10-6-10

The volume of fresh water pouring from the world's rivers has risen rapidly since 1994, in what researchers say is further evidence of global warming. The study, led by a team at UC Irvine, is the first to estimate global fresh-water flow into the world's oceans using observations from new satellite technology rather than through computer or hydrological models.

Published this week in the Proceedings of the National Academy of Sciences, the study found that annual fresh-water flow increased 18% from 1994 to 2006, suggesting an acceleration in the global water cycle of evaporation and rainfall, which influences the intensity of storms, floods and droughts.

UC Irvine Earth System Science professor Jay Famiglietti, the principal investigator, said that the data have major implications for California, where warmer temperatures are already triggering earlier snow melt. Rising sea levels are expected to significantly alter the state's long coastline.

"Until now, we have had no continuous record of global-scale river discharge," said Famiglietti. He noted that the time period of the study was short, but added, "If these trends persist, they will be a smoking gun that the water cycle intensification, predicted by climate scientists, is already upon us."

Globally, river flows are often a politically-fraught subject. Countries measure the quantity of water locally, and inconsistently, with mechanical or electronic guages, but they often refuse to share the data, according to hydrologist Peter Gleick, editor of the biannual "World's Water" survey and director of the Oakland-based Pacific Institute think tank. Pakistan and India are in conflict over flows from the Indus. Israelis, Palestinians and Lebanese all depend on the Jordan River. Ten countries are sharing water along the Nile. [Corrected at 9:31 p.m.: An earlier version of this post implied Palestine is a country. It is not.]

The UC Irvine study "is additional clear evidence that the hydrological cycle is accelerating," Gleick said. "This is exactly what climate modelers have said would happen from climate change, and now we see it happening. How much more evidence do we need before we take action against climate change?"

In the hydrological cycle, as grade-schoolers learn, fresh water evaporates from the oceans, rains onto the land and flows into rivers which then empty into the oceans. The increase in fresh-water flow, documented in the paper, was the missing element that complemented existing evaporation, rainfall and sea level rise data, proving that the cycle is speeding up, Famiglietti said.

"If the water cycle intensifies, then we will see more frequent, more intense floods, and more persistent drought," he said. He noted that because of atmospheric circulation patterns, the impact will be uneven, with stronger rainfall and more severe storms in the tropics and the Arctic, and more drought in temperate regions such as California.

UC Irvine last year opened the UC Center for Hydrologic Modeling, directed by Famiglietti, which will do more specific climate-related studies on California, such as the implications of groundwater depletion in the Central Valley.

The study found that the 13-year increase in fresh-water discharge of 540 cubic kilometers was mostly due to rapid evaporation from the oceans, which led to more rainfall on land. Only 10% of the increase in discharge could be attributed to melting ice sheets in Greenland and the Antarctic, although those sources are expected to be a growing proportion as earth's temperatures rise, Famiglietti said.

Other causes for the rise in river flows include melting glaciers and permafrost on land, and practices such as groundwater pumping for irrigation.

"Given the importance of water and the impact of climate change, we need a comprehensive global monitoring network that can measure water stocks and fluxes," Famiglietti said. "We need ground-based measurements of snow, ice, permafrost, lake levels, river flows, soil moisture and groundwater levels. We need dedicated satellite missions. The technology is all there. We just need to make the investment in the ground, and in remote observations, and in the predictive models to synthesize them."

The lead author on the paper, which was funded by NASA, is Tajdarul Syed of the Indian School of Mines, who did most of the research as a graduate student and postdoctoral associate under Famiglietti. Other authors are Don Chambers of the University of South Florida, Joshua Willis of the Jet Propulsion Laboratory in Pasadena, and Kyle Hilburn of Remote Sensing Systems in Santa Rosa, CA.