UC SANTA BARBARA

THE Current

September 10, 2020
Harrison Tasoff

Future Flooding

California is on track to get drier over the coming decades. But that doesn’t mean the golden state’s water woes come only from too little rain. In a new study, researchers at UC Santa Barbara and UCLA warn that flooding potential associated with extreme precipitation events is set to sharply increase.

These storms are anticipated to become more intense overall, but a smaller fraction of their precipitation will fall as snow. This means a smaller snowpack in the Sierra Nevada, a critical part of the state’s water storage. The twofold impact of increased precipitation and reduced snowfall, the researchers said, could lead to unprecedented flooding that could overwhelm the current capacity of many California reservoirs. The study was recently published in Geophysical Research Letters.

“Climate warming is contributing to the acceleration of the global hydrologic cycle with increasing emissions of heat-trapping gases,” said lead author Xingying Huang, a postdoctoral climate researcher at UC Santa Barbara’s Bren School of Environmental Science & Management and Earth Research Institute. “Evidence and projection show precipitation extremes will be more extreme.”

This is due to the strengthening of a phenomenon Californians know all too well: Atmospheric river storms. Aptly named, atmospheric rivers are corridors of water vapor in the sky. They stretch hundreds of miles wide and can carry volumes of water comparable to the flow at the mouth of the Mississippi River.

Atmospheric rivers can pour heavy rain over short periods of time, on the order of a few hours to a couple days. These rivers in the sky are essential to California’s water supply, contributing up to half of the state’s water. Extreme activity is heavily associated with flooding.

The new study predicts that precipitation during heavy atmospheric river storms will become more extreme. Runoff from the storms could increase by an average of 50% by the 2070s, as projected in a high-emission scenario, and could double or more in elevations above 5,000 feet, where decreases in snowfall will be the greatest.

Huang — along with UCSB professor Samantha Stevenson and Alex Hall, the director of the Center for Climate Science at UCLA — leveraged data from previous studies and historical rain and snowpack data to simulate atmospheric river events under future climate warming scenarios.

“Extreme atmospheric rivers like the ones we analyzed have the potential to cause a lot of flooding as the precipitation pours quickly,” Huang said. While more rain for California may sound good, the infrastructure that manages water resources and flood control may not be prepared for the magnitude of runoff the scientists project.

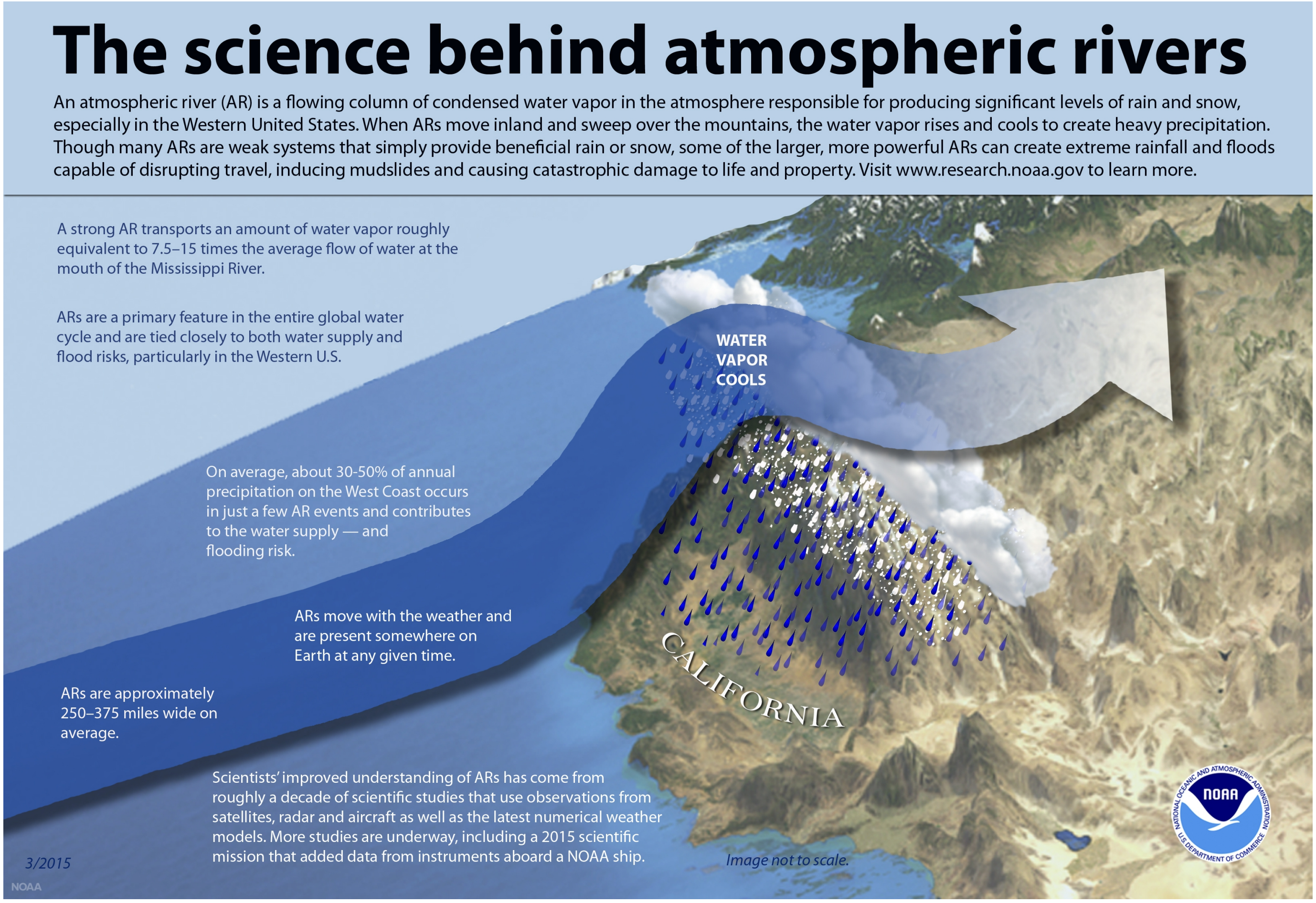

Photo Credit: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

The extra water provided by these events could be a boon — especially for the much drier eastern Sierra Nevada slopes — if it can be captured and stored. However, that is not a simple task. The extra water supplied during more intense atmospheric rivers could also lead to more flash floods, debris flows and landslides.

Nearly all rivers draining from the Sierra Nevada mountain watersheds are impounded by reservoirs, which serve to store water for the drier months of the year. "The capacity of those reservoirs could be exceeded by river water volumes in a way that is unprecedented," Huang said. The study suggests that preparing infrastructure for storing water from heavy precipitation will become extremely important for later use during drought periods.

According to the California Department of Water Resources, the state has experienced more than 30 major flood events in the past 60 years, resulting in hundreds of lives lost and billions of dollars in disaster claims. Damage from more extreme storms has the potential to be worse than that of hurricanes typically seen on the East Coast.

Reduced snowfall in the Sierra Nevadas is the other half of the “double whammy” effect the study predicts. Less snow means less streamflow supply during dry periods. “It matters whether precipitation falls as snow — which stays stored away in the mountains until it melts in the spring — or as rain, which flows into our reservoirs and flood control channels right away,” Huang says.

Snowpack acts as a natural reservoir, which melts slowly and releases water little by little. Snow both stores water late into the year and prevents runoff from overwhelming natural waterways and human infrastructure. Heavy snow loss in the future could further jeopardize the future of California’s water supply.

The researchers plan to build on the results of this study, further investigating potential flood control and water resource management strategies. “I am also interested in researching the potential ecologic and economic impacts, and adaptation strategies,” Huang said. She and Stevenson hope their research will inform risk assessments of future climate extremes, which can help California communities, industries and public agencies prepare for extreme weather.
