

Date of Hearing: July 1, 2025

ASSEMBLY COMMITTEE ON WATER, PARKS, AND WILDLIFE

Diane Papan, Chair

SB 599 (Caballero) – As Amended April 24, 2025

**SENATE VOTE:** 38-0

**SUBJECT:** Atmospheric rivers: research: forecasting methods: experimental tools

**SUMMARY:** Requires the Department of Water Resources (DWR) to research, develop, and implement experimental tools that produce seasonal and subseasonal atmospheric river (AR) forecasts under the Atmospheric Rivers Research and Forecast Improvement Program (Atmospheric Rivers Program). Specifically, **this bill:**

- 1) Requires DWR to research, develop, and implement experimental tools that produce seasonal and subseasonal AR forecasts under the Atmospheric Rivers Program.
- 2) Defines “seasonal forecast” as a forecast that covers approximately one to six months into the future for the purposes of this bill.
- 3) Defines “subseasonal forecast” as a forecast that covers approximately two to six weeks into the future for purposes of this bill.
- 4) Makes legislative findings and declarations regarding the positive and negative impacts of ARs and the need for this bill.

**EXISTING LAW:** Establishes the Atmospheric Rivers Program within DWR and requires DWR, upon appropriation of special funds, to research climate forecasting and the impacts climate change has on ARs. Further, requires DWR to take all actions within its authority to re-operate reservoirs to capture water generated by ARs (Water Code § 347).

**FISCAL EFFECT:** Unknown. This bill is keyed fiscal.

**COMMENTS:**

- 1) **Purpose of this bill.** According to the author, ARs “are a recently recognized phenomenon that bring narrow bands of water vapor that can transport large quantities of water from tropical regions to California where it falls as rainfall. These ARs have grown in intensity and frequency where they create the potential for flooding, coastal damage and intense winds. [This bill] builds upon [DWR’s] current research operations to advance extended range AR forecasts, to provide emergency operations ample lead-time for effective decision-making. With more accurate data and longer-range certainty, we can better prepare and protect our communities from catastrophic flood and other severe weather events, improve our water management and storage capabilities, and reduce financial devastation caused by flooding.”
- 2) **Background.** ARs are long narrow bands of atmospheric water vapor pushed along by strong winds. They transport large amounts of water vapor from the tropics to higher latitudes and strike coastlines globally from California to Europe to Antarctica. They can transport moisture equivalent to more than 25 times the amount of liquid water flowing

through the mouth of the Mississippi River.

ARs and their intense precipitation can be both beneficial and hazardous, presenting a special challenge to California's water managers and flood control planners. According to the Scripps Institution of Oceanography (Scripps) at the University of California, San Diego and the National Oceanic and Atmospheric Administration (NOAA), a small number of ARs supply on average between 40% to 50% of California's precipitation and snowpack annually. A single AR event can provide up to 30% of annual precipitation in Southern California. Problems occur when AR events last for more than a day or when several occur back-to-back such as occurred in January 2023; several ARs in sequence can cause hazards like flooding, mudslides, or ash flows in areas of recent wildfires. NOAA and Scripps research has shown ARs are implicated in most of the extreme precipitation and flooding events in California. Nearly 80% of levee breaches in the Central Valley have been associated with AR events.

A recent study by researchers at the Center for Western Weather and Water Extremes (CW3E) housed at Scripps examined the February 2017 AR event that contributed to the Oroville crisis and found that "California's reliance on precipitation from (ARs) is expected to increase as our climate warms." Similarly, research published in August 2022 ("ARkFuture") shows how climate change is leading to more extreme AR events. ARkFuture models a 30-day "megastorm" event in which "ARs are the primary storm mode" causing extremely high precipitation and associated runoff that is two to four times higher than historical averages.<sup>1</sup> Such an event would result in a "megaflood." Better modeling and forecasting could help to mitigate the risks associated with such an event.

*Forecast-Informed Reservoir Operations (FIRO).* FIRO is a reservoir operations strategy that, in effect, allows reservoirs to be managed in "real-time" so that operators can keep water in the reservoir if the weather forecast shows no imminent precipitation in a reservoir's watershed or, alternatively, release water from the reservoir to free up space for additional flow (thereby maintaining flood protection) when the forecast indicates an AR is headed towards a reservoir's watershed. Enhanced forecasting capability is essential to implementing FIRO. Sonoma Water Agency has piloted and implemented FIRO at Lake Mendocino since 2019 and has been able to increase water stored in that reservoir by nearly 20% while maintaining flood protection. This additional water was immensely helpful in 2021 when the Russian River basin experienced extreme drought conditions.

*DWR Atmospheric Rivers Program funding.* The Legislature has made previous appropriations to support this research, including \$3 million in the 2016-17 Budget, \$9.25 million in the 2019-20 Budget, \$10 million in the 2021-22 Budget, and \$16.75 million in the 2022-23 Budget. The 2024-25 Budget reduced funding by \$6.8 million. Previously appropriated funding has allowed DWR to leverage resources and participation from federal and local agencies to deepen the understanding of ARs and implement FIRO at Lake Mendocino. DWR and water agencies are also seeking to implement FIRO in the Feather-Yuba River basin and the Santa Ana River basin.

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<sup>1</sup> Xingying Huang and Daniel Swain, "Climate change is increasing the risk of a California megaflood," *Science Advances*, 8 (2022): eabq0995, <https://www.science.org/doi/10.1126/sciadv.abq0995>.

- 3) **Arguments in support.** The Association of California Water Agencies (ACWA) supports this bill and asserts that it will improve weather forecasting to inform decision-making about flood prevention and water management. Further, ACWA maintains that this bill will “increase DWR’s AR forecast capacity which would provide emergency operations with ample lead-time for effective decision-making and allow DWR and water managers across the state to better understand atmospheric rivers and their impacts, more effectively manage water resources, and prepare for natural disasters. These investments will save significant funding over time as the state is better able to manage this limited resource and plan for and avert potential disasters.”
- 4) **Related legislation.** AB 30 (Ward), Chapter 134, Statutes of 2023, reconfigures the existing Atmospheric Rivers Program at DWR.

**REGISTERED SUPPORT / OPPOSITION:****Support**

Association of California Water Agencies  
California Groundwater Coalition  
County of Fresno  
County of Monterey  
East Bay Municipal Utility District  
Valley Ag Water Coalition

**Opposition**

None on file

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