

“Bomb cyclone” and “atmospheric river” extreme weather event pummels West Coast with record rainfall and landslides

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Two extreme weather events, a “bomb cyclone” and an “atmospheric river,” combined on Saturday night to drench California with heavy storms and record amounts of rain in parts of the state. Heavy snows also blanketed the Sierra Nevada and severe storms caused by the weather system reached as far north as Oregon, Washington and British Columbia.

The gigantic storm swept into the Bay Area on Sunday, causing the collapse of utility lines and flattening trees in the urban area. Roadways were flooded and approximately 148,000 households and businesses lost power.

Debris flows were already occurring and causing road closures in California on Sunday morning, according to the National Weather Service (NWS), as heavy rains moved into the area near sites of recent wildfires. The NWS advised that it may be too late to evacuate, and no one should attempt to cross a debris flow. Instead, they advised residents to take shelter in the highest floor of one’s home.

Daniel Swain, climate scientist at the National Center for Atmospheric Research (NCAR), called the bomb cyclone “an incredible specimen of a textbook mid-latitude cyclone...affecting nearly the entire West Coast Sunday afternoon.” Bomb cyclones are caused by a massive drop in barometric pressure and can produce winds of up to 95 miles per hour.

Swain also noted in a tweet on Sunday evening that “It is worth noting that this exact situation—an extremely strong atmospheric river bringing brief period of record rainfall in midst of severe and temperature-amplified drought—is what we expect to see in California with #ClimateChange.”

Swain added: “Mean precipitation in California is not

expected to change much in a warming climate, but the extremes (both wet and dry) are expected to intensify. So, spatiotemporally, there will be more intense but likely fewer storms, spread out over a shorter but sharper rainy season.”

The storm is the strongest to hit the Bay Area in two years. Atmospheric moisture was vacuumed up from the tropics, creating the atmospheric river, which was all dumped across the whole state. The convergence of both weather systems hit the region with the force of a major hurricane according to meteorologists with the NWS. “It’s almost like a plow, and it’s pushing up all this warm and moist air,” said Brayden Murdock, an NWS meteorologist.

Multiple rainfall records were broken as of Monday morning. St. Helena in the Napa Valley wine region received 10.92 inches in 48 hours, and San Francisco International Airport recorded 4.62 inches of rainfall in two days. The *Mercury-News* reports that San Jose recorded about 2.5 inches of rain as of 5:00 a.m. Monday, and Oakland was saturated with 6.65 inches.

Evacuations were ordered in several areas across the coastal zones in San Mateo and Santa Cruz counties ahead of expected mudslides, debris flows and the next wave of heavier rains to come. Evacuation centers have been set up at Half Moon Bay High School in San Mateo County and San Lorenzo Valley Junior and High Schools in Santa Cruz County, which will reportedly follow COVID-19 protocols.

This storm arrives on the heels of the most active wildfire season in California history, which has exacerbated the floods and landslides. While wildfire activity has been dampened as a result of the current weather conditions, the lack of vegetation has made the

ground more unstable and susceptible to shifting debris.

Marc Chenard of the Weather Prediction Center and the NWS told Reuters that “Burn scars, that’s the area where the water tends to run off quicker, so that’s where the biggest flash flood risks are.”

Reports have been coming in of mudslides occurring in the 570,000 acres charred by the Dixie Fire northeast of San Francisco, the second largest wildfire recorded in state history, Chenard stated.

Yosemite Valley remained closed by the National Park Service on Saturday because of the flooding and threat of mudslides. The main roads through the valley have been inundated with water, as has the Housekeeping Camp on the south bank of the Merced River, said meteorologist Kris Mattarochia with the NWS.

In Seattle and King and Pierce Counties in Washington state, at least 100,000 residences lost power yesterday afternoon, and in most areas was not restored for ten hours, well into the early hours this morning. More power outages are still possible through Monday, said Samantha Borth, a meteorologist with the National Weather Service in Seattle. Strong winds and thunderstorms were expected along the coast through Monday, she told the *Seattle Times*.

“Overall, we got a number of systems still incoming,” Borth said. “This system is pretty strong for today and tomorrow. Tuesday and throughout the next week looks wet. In general, we have rain in the forecast for a little while.”

The storm has brought hurricane-force winds to the northeast Pacific Ocean and waves approaching 30 feet tall, and it is the strongest storm in the northeast Pacific since April 2012, according to meteorologists.

Joe Boomgard-Zagrodnik, an agricultural meteorologist for Washington State University, predicted that the storm would “explode out of nowhere.”

“What is remarkable is how big it is in scale, how deep the center is and the speed with which it goes from an open wave to a super-intense low-pressure system,” Boomgard-Zagrodnik said, according to the *Seattle Times*.

Wind gusts Sunday hit 50 mph on the coast at Quillayute airport, and winds gusted to 74 mph at Cape Disappointment according to Washington Weather Chasers on Twitter, a film crew documenting the large

swells crashing into the cliffs, as well as the massive surf battering the jetty at Fort Stevens State Park.

Climate specialists have predicted this weather behavior. In a paper published in 2019 in the journal *Nature Climate Change*, Daniel Swain analyzed how global warming made these dramatic shifts possible.

“Mediterranean climate regimes are particularly susceptible to rapid shifts between drought and flood—of which, California’s rapid transition from record multi-year dryness between 2012 and 2016 to extreme wetness during the 2016–2017 winter provides a dramatic example,” the summary of the paper states.



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