California drought -- what's causing it?

Paul Rogers, Bay Area News Group, 1-14-14

As California struggles through a run of historically dry weather, most residents are looking at falling reservoir levels, dusty air and thirsty lawns.

But meteorologists have fixed their attention on the scientific phenomenon they say is to blame for the emerging drought: a vast zone of high pressure in the atmosphere off the West Coast, nearly four miles high and 2,000 miles long, so stubborn that one researcher has dubbed it the "Ridiculously Resilient Ridge."

Like a brick wall, the mass of high pressure air has been blocking Pacific winter storms from coming ashore in California, deflecting them up into Alaska and British Columbia, even delivering rain and cold weather to the East Coast. Similar high-pressure zones pop up all the time during most winters, but they usually break down, allowing rain to get through to California. This one, ominously, has anchored itself for 13 months, since December 2012, making it unprecedented in modern weather records and leaving researchers scratching their heads.

"It's like the Sierra -- a mountain range just sitting off the West Coast -- only bigger," said Bob Benjamin, a forecaster with the National Weather Service in Monterey. "This ridge is sort of a mountain in the atmosphere. In most years, it comes and goes. This year it came and didn't go."

The current high-pressure ridge is even stronger and more persistent than a similar ridge that parked over the Pacific Ocean during the 1976-77 drought, one of the driest in the 20th century.

Scientists know that changes in temperature cause high- and low-pressure zones around the world. In many ways, air works like water. The deeper you swim in the ocean, the stronger the water pressure, because the weight of the water above is pressing down on the water below. Air in the atmosphere also has weight, and as temperatures of the ocean and land fluctuate, the atmospheric pressure also changes, helping drive much of our weather.

What researchers don't know, however, is why the current high-pressure ridge is so persistent, or when it is going away, allowing California to enjoy some much-needed rain. A few scientists say that it may be related to climate change, but nobody knows for sure.

"I wish I had a really good answer for this," said Daniel Cayan, an oceanographer and atmospheric scientist with the Scripps Institution of Oceanography in La Jolla. "It's unusual for the pattern to have not broken down to allow some relatively active, vigorous winter storm systems to track across California."

With each passing week, California's lack of rainfall becomes more serious.

Last year was the driest calendar year in recorded history in California in most cities, with records going back 160 years. The first snowpack reading in the Sierra Nevada earlier this month found a snowpack of just 20 percent of normal.

Meanwhile, major reservoirs in Shasta and Oroville are each 36 percent full, about half of normal for this time of year. San Luis Reservoir near Los Banos is 30 percent full, 42 percent of normal. Major Bay Area water agencies haven't yet called for mandatory summer water restrictions but are expected to make the decision in the next month or two, depending largely on whether the high-pressure ridge breaks down and rain falls.

State Department of Water Resources Director Mark Cowin told members of the California State Board of Food and Agriculture in Sacramento a week ago that his agency is likely to recommend that Gov. Jerry Brown declare a drought by Feb. 1, which would make it easier for water transfers between agencies and for emergency loans and other assistance.

On Monday at a news conference in Fresno, Brown told reporters, "It's coming. Just be patient."

Still, he said last week: "Governors can't make it rain."

Since July 1, San Francisco has received 2.1 inches of rain -- just 20 percent of normal; San Jose has received 1.57 inches, or 26 percent of normal; and Oakland has received 2.08 inches, or 22 percent of normal.

All is not lost. Experts note that California still has another two or three months left in its winter season.

"In California, most of our water in the reservoirs comes from just a handful of big storms each winter," said Daniel Swain, a Ph.D. candidate at Stanford University in the Department of Environmental Earth System Science who coined the term "Ridiculously Resilient Ridge" on his blog, weatherwest.com.

"If we do manage to get a few decent storms, we could definitely get enough water to stave off the worst consequences of a really extreme water shortage," he said. "But if we don't, we've essentially lost the whole water year."

For anyone concocting plans to set up giant fans or other schemes to get rid of the Ridiculously Resistant Ridge, meteorologists say that's impossible. The energy in weather systems is greater than the energy in nuclear bombs, they remind us.

For at least the next week, the National Weather Service forecasts a few occasional sprinkles but no major storms and no breakdown in the ridge.

"We've had a few weather systems come through," said Leslie Wanek, a meteorologist in Salt Lake City at the regional headquarters of the National Weather Service. "But it just keeps rebuilding there. It's kind of a mystery about why. Why is the global atmospheric pattern stuck like this?"