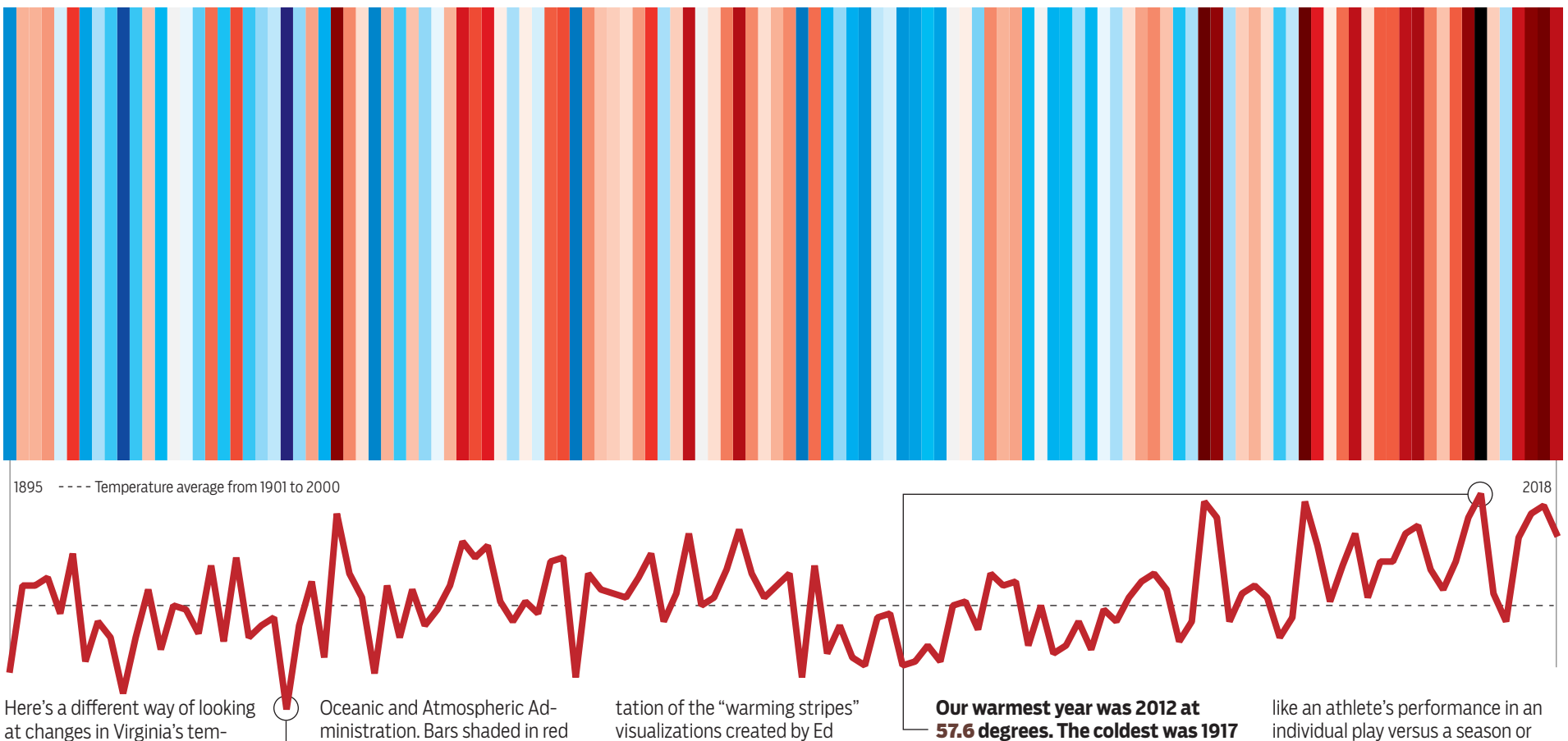


Here's a different way of looking at changes in Virginia's temperature. The bars at the top of the page, read from left to right, use color to show the statewide average temperature in each year from 1895 to 2018. That data comes from the National Oceanic and Atmospheric Administration. Bars shaded in red represent years that were warmer than the 20th-century average in Virginia, with darker red showing a greater departure. Likewise, cooler years are shaded in darker blue.

The design is our localized adaptation of the "warming stripes" visualizations created by Ed Hawkins, a climate scientist from the United Kingdom.

In 2018, Virginia's mean temperature was 56.6 degrees Fahrenheit, which is 1.8 above our 20th-century average of 54.8 degrees.

Our warmest year was 2012 at 57.6 degrees. The coldest was 1917 at 52.2.

Most people wouldn't think of 57 degrees as a hot day, but these annual temperatures blend all of the daily highs and lows into one statistic. You can think of weather versus climate like an athlete's performance in an individual play versus a season or their entire career. When it comes to temperature, we're on a hot streak that, unfortunately, isn't slowing down.

Notably: Eight of our 10 warmest years were since 1990. In the past decade, only one year, 2014, was cooler than the 20th-century average.

You can read more about the open source climate project and see examples for other regions at www.climate-lab-book.ac.uk

STATE OF OUR CLIMATE

BY JOHN BOYER • Richmond TImes-Dispatch

The world is warming up, and so is Virginia.

What we've experienced in recent years is consistent with the larger trends driven by climate change.

This page features state and local weather statistics from 2018, using data from the National Oceanic and Atmospheric Administration.

Taking into account all of the highs and lows, 2018 was tied for Virginia's 11th-warmest year since 1895.

It wasn't our warmest year outright, but when averaged together, the low temperatures during 2018 were higher than we've ever seen.

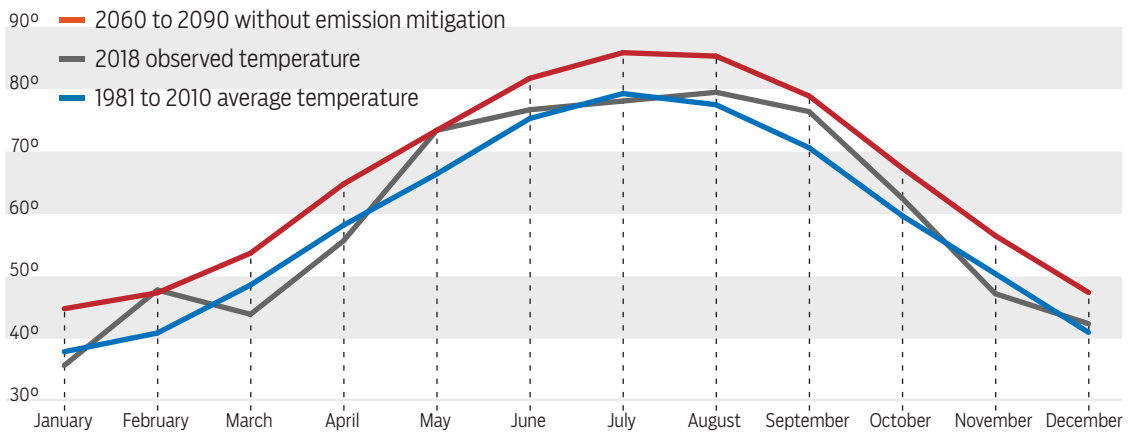
Extra-warm ocean temperatures and a persistently humid weather pattern likely contributed to our warmer nights and wetter days.

Climate change doesn't hit all areas equally, or all at once. That's why temperature rankings can differ for a given year. Worldwide, it was the fourth-warmest year of the industrial era. The United States ranked 14th.

Natural cycles of warm and cool weather still take place on weekly or yearly scales. But that variability rests on a long-term upward trend.

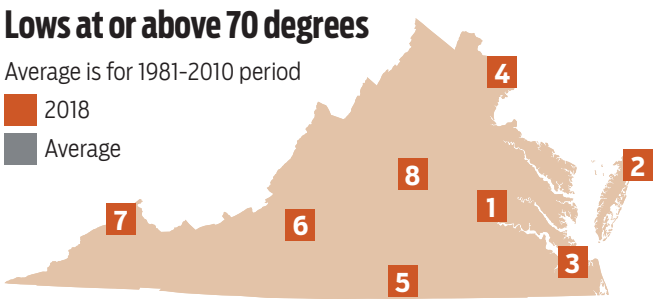
The consequences of climate change extend far beyond what we can measure with thermometers and the rain gauges: from worsening sea level rise and ecological disruption, to agricultural losses and spreading range of diseases.

Richmond's monthly mean temperature



2018 featured three months with unusual and persistent warmth in Virginia. Statewide, it was the second-warmest February, warmest May and second-warmest September of the past 123 years. This graph shows Richmond's monthly mean temperatures in 2018, which is an average of each month's highs and lows. It's compared with the recent climatological norms (in blue) and a future scenario (in red). You could think of last year as a preview of what February, May and September will routinely be like later this century, if heat-trapping industrial emissions continue in unmitigated fashion. That scenario is called RCP 8.5 by climate modelers. A several-degree increase may not sound like much, but it's like expanding summer by a month on either side. We'll still see natural fluctuations, like the kind that gave us that chilly March, but warmth is dominating. Since 2012, Virginia has set records for warmest February, March, April, May, July and December. The last time the state experienced an all-time cool month was October 1988.

Lows at or above 70 degrees



1. Richmond record set
73
39

2. Wallops Island record set
94
41

3. Norfolk record set
118
67

4. Arlington record set
91
54

5. South Boston record set
52
11

6. Roanoke
35
18

7. Grundy
1
3

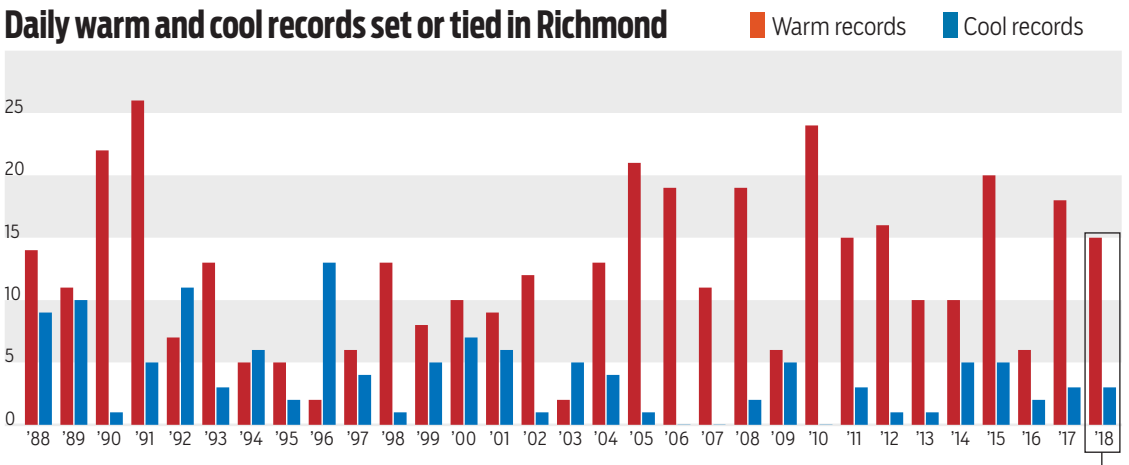
8. Charlottesville
33
17

Warmer nights are one of the clearest signs of climate change in Virginia. Last year, Richmond, Norfolk and Northern Virginia experienced more days with a low temperature in the 70s than ever before.

We're also getting more of those warm nights in spring and autumn, which makes summer feel longer and changes the timing of things like pollen season and fall colors.

The urban heat island effect makes summer nights extra sultry in large cities, but small towns and rural areas are trending warmer, too. Cities are just leading the way, and that's not a good thing. People living in areas surrounded by asphalt and concrete feel more heat and face more health risks.

Daily warm and cool records set or tied in Richmond

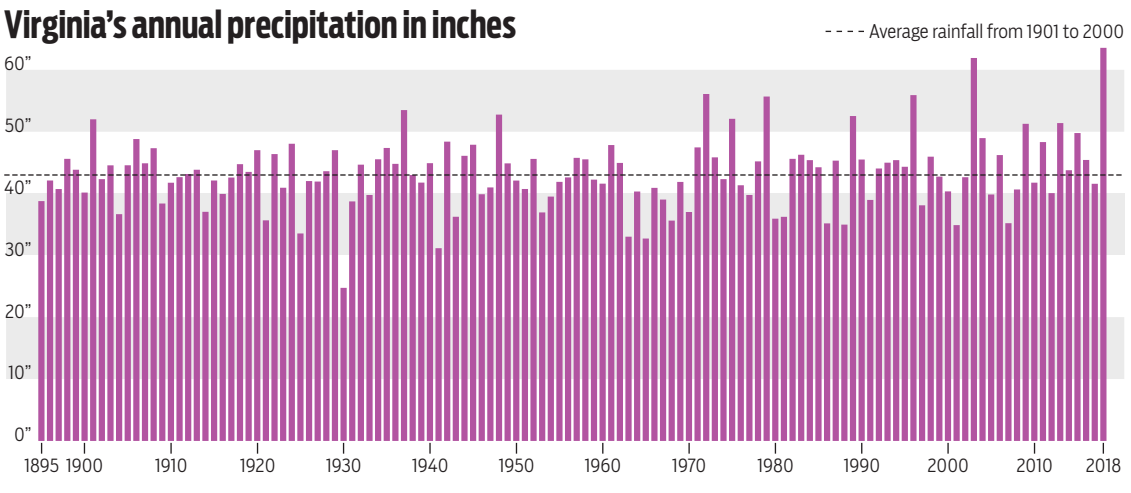


One hot day in a single city doesn't tell us much about the big picture of climate change. Neither does a cold snap. After all, weather is different than climate. We can still experience episodes of brutal cold and snow while scorching heat hits other continents. But we're setting fewer cold records than we used to in the 20th century, and they're far outpaced by the number of records for warmth. 2018 was no exception to that trend. These numbers are for Richmond in particular, but observations from all around the country show that warm records are now more common. Some daily records charted above have also been superseded once or even twice over the years.

Of the 18 daily temperature records broken or tied in Richmond in 2018:

- 12 were for warm lows
- three were for warm highs
- two were for cold lows
- one was for a cold high

Virginia's annual precipitation in inches



Heavy, frequent rain was our defining weather extreme of 2018, but the connection between climate change and precipitation is nuanced. In 2018, the statewide precipitation was 63.55 inches, according to NOAA. That beat 2003 to become Virginia's wettest year in records dating to 1895. The graph shows great year-to-year variation in amounts, and not much of a trend over the past century. Climate models suggest that our average annual precipitation could increase slightly by the end of the century — perhaps by 2 or 3 inches — but the results are unlikely to be even from place to place and season to season. On a smaller scale, heavy downpours are happening more often because warmer air contains more water vapor. Hurricanes and tropical storms, which bring a significant fraction of our moisture, will also be affected by changes in the oceans and atmosphere. Studies suggest they could dump even heavier rain, but there's still uncertainty about how frequently they'll strike, and where.

JUSTIN MORRISON/TIMES-DISPATCH