



Melbourne, Australia, is a hotbed for thunderstorm asthma: with seven outbreaks since 1984.

METEOROLOGY

Australian state forecasts deadly thunderstorm asthma

Scientists probe ways that storms weaponize pollen

By Katherine Kornei

On 21 November 2016, an evening thunderstorm rumbled across Victoria state in Australia—a normal springtime event with abnormal consequences. “We’ve seen a rise in breathing probs tonight following the weather,” Ambulance Victoria tweeted at 8:40 p.m. That would turn out to be an understatement: Thousands of people experiencing respiratory distress were rushed to hospitals, and at least nine died. Thunderstorm asthma had struck again.

First identified in the 1980s, thunderstorm asthma is a phenomenon that meteorologists are just beginning to understand. It is known to require high airborne pollen counts, along with thunderstorm winds to sweep up pollen grains and send them pouring down onto a vulnerable populace, says Andrew Grundstein, a climate scientist at the University of Georgia in Athens. He is now sharpening that picture. Earlier this month, at a meeting of the American Meteorological Society in Austin, he presented a study of seven thunderstorm asthma events in Melbourne, the capital of Victoria and the epicenter of this odd confluence of meteorology and medicine. He found a common pattern: All seven featured high pollen levels, multiple storm cells, and strong but not damaging winds.

Late last year, Victoria unveiled a forecasting system that gives residents 3 days’ warning of a likely thunderstorm asthma event. The forecast is based on pollen levels and

the likely strength of wind gusts in storms, says Jeremy Silver, an atmospheric scientist at the University of Melbourne working with Grundstein. But it’s not a perfect system. “This is a bit rudimentary,” Silver says. “There are going to be false positives.” By determining the types of thunderstorms that have been dangerous in the past, Grundstein and Silver hope to improve predictions. “The work we’re doing can help to refine that warning system,” Grundstein says.

Thunderstorm asthma events have been reported across North America, Europe, and the Middle East. But Grundstein says the ingredients for severe incidents come together in Melbourne: nearby fields of pollen-producing rye grass, regular thunderstorms, and a large population. The rising convective updrafts that power thunderstorms sweep up pollen grains and send them kilometers into the sky, where they encounter high humidity levels. Scientists believe that when a grain absorbs moisture, it can swell and rupture into hundreds of smaller pieces. This pollen shrapnel is much more dangerous to the lungs than whole pollen grains, says Guy Marks, a respiratory physician at The University of New South Wales in Sydney, Australia, who studies thunderstorm asthma. “They’re small enough to enter the lower respiratory tract and cause an inflammatory response.” And in the right kind of thunderstorm, these fragments ride cooler downdrafts that crash into Earth’s surface and create lateral gusts, which scatter the pollen for tens of kilometers.

Grundstein and his collaborators mined meteorological records to look for commonalities among the seven Melbourne thunderstorm asthma events since 1984. All took place in November, when pollen levels were already high—sometimes more than 100 grains per cubic meter of air. Multiple storm cells were typically involved. “More thunderstorms spread more pollen around,” Grundstein says. And the gusty lateral winds needed to be strong, but not necessarily extreme. “Damaging winds aren’t necessary,” Grundstein says. “Pollen is light.”

Last year, Victoria’s government put \$15.6 million toward developing its warning system, which went live on 1 October 2017, just in time for the start of the grass pollen season. It combines thunderstorm forecasts provided by Australia’s Bureau of Meteorology with pollen counts coordinated by Ed Newbigin, a botanist at the University of Melbourne. The pollen monitoring system is based on eight counting stations across the state, powered by antique air pumps—“1950s British technology,” he says—that direct air over adhesive-coated glass slides. “We’re literally counting pollen grains,” Newbigin says. Forecasters combine these meticulous observations with temperature, humidity, wind, and satellite-derived grass coverage data to predict future pollen levels.

The system’s advance warning will help people prepare for events by giving them time to collect asthma medications and make plans to stay indoors. But refining Victoria’s forecasts requires a better understanding of the 3D structure of these storms, says Silver, a challenge because thunderstorm asthma events occur just a few times per decade. Grundstein isn’t deterred, however: He’s planning a multi-year study of thunderstorm asthma in the United States. ■

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