NASA data shows fierce surface temperatures during Phoenix heat wave

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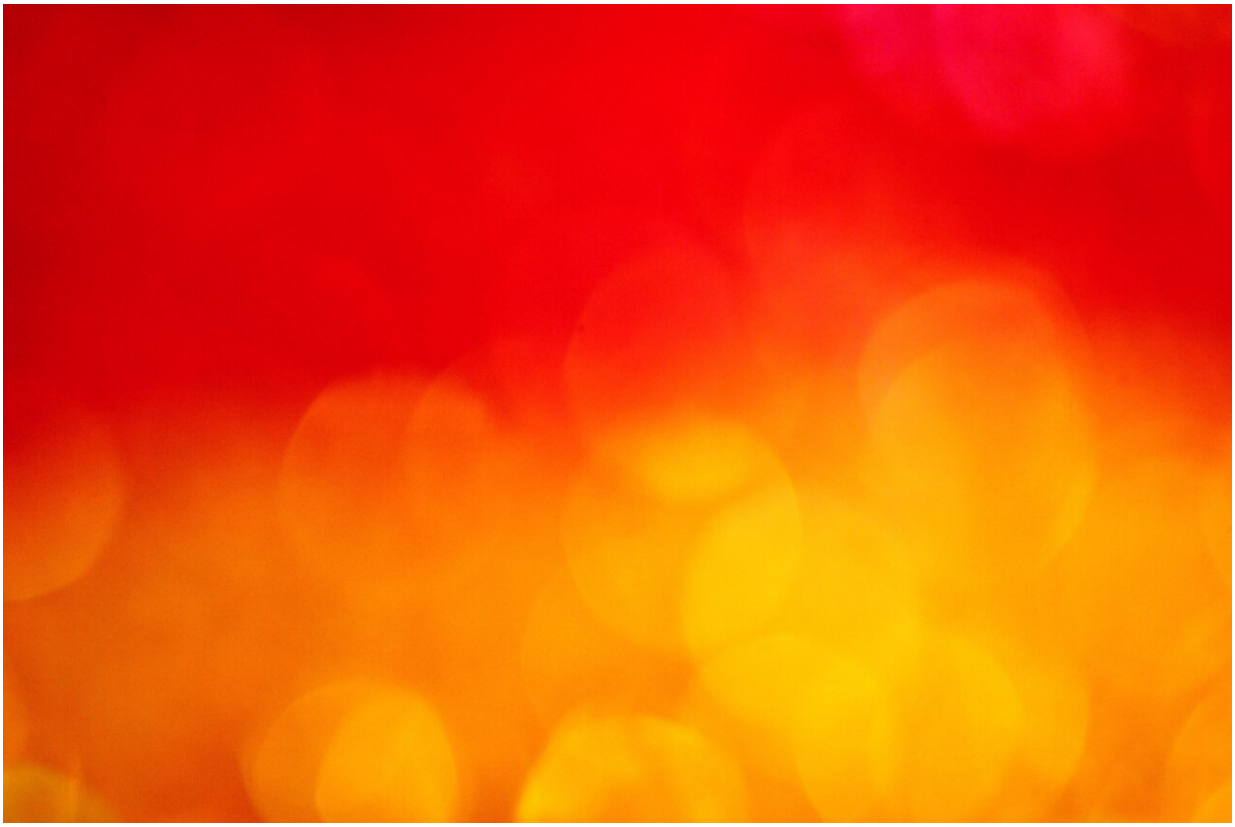

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Streets and other built surfaces in the region absorbed and retained heat long after sunset and grew hotter over many days of persistent high temperatures.

Researchers at NASA's Jet Propulsion Laboratory have created a series of maps showing land-surface temperatures in the Phoenix area in July 2023, when the city experienced a record-breaking run of hot weather. The images reveal the cumulative effect—overnight and across the month—of relentless daytime heating.

The data was captured during overnight hours (around 2 a.m.) on several days in July by an instrument called the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the NOAA-NASA Suomi National Polar-orbiting Partnership (Suomi NPP) satellite managed by the National Oceanic and Atmospheric Administration and NASA. The images show how built surfaces—roads, buildings, airport runways, and the like—retain heat, sometimes hovering around 100 degrees Fahrenheit (38 degrees Celsius) for hours after sunset.

From July 1 to July 19, the built surfaces in the maps grew progressively hotter, likely the combined effect of the heat wave intensifying and the cumulative heating of those human-made structures. Due to their high heat capacity, these surfaces didn't fully cool overnight before the onset of the next day's heat, said Glynn Hulley, the JPL climate scientist who produced the series.

At the center of the images is Phoenix's Sky Harbor International Airport, where VIIRS measured the hottest land-surface temperature within the city. The airport is also where Phoenix takes its official air temperature. By those measurements, the city experienced the hottest month on record in July, including a record 31 consecutive days in which the temperature exceeded 110 degrees Fahrenheit (43.3 degrees Celsius). The previous record was 18 days.

Land-surface temperatures in cities are usually warmer than in rural and undeveloped areas because of human activities and the materials used for building. Streets—seen in these maps as a grid pattern—are often the

hottest part of the built environment due to dark asphalt paving that absorbs more sunlight than lighter-colored surfaces; asphalt absorbs up to 95% of solar radiation. In the images, the mountains near Phoenix are also notably hot due to their angle to the sun and greater soil exposure from lack of vegetation.

"Dark asphalt and concrete have a high heat capacity, so most of the heat they absorb during the day goes into storage below the ground," Hulley said. "That heat gets released slowly at night, making air temperatures much warmer during the nighttime in dense urban areas, creating the classic urban heat island effect."

The hot surfaces in and around the city stand in contrast to nearby irrigated surfaces such as agricultural fields, golf courses, and parks, which fell as low as 68 degrees Fahrenheit (20 degrees Celsius) during the night. The Verde River and other nearby waterways also were significantly cooler.

VIIRS is one of five instruments aboard the NOAA-NASA Suomi NPP satellite. Short for Suomi National Polar-orbiting Partnership, the spacecraft is one of several in the Joint Polar Satellite System. The images were produced from the VNP21IMG Land Surface Temperature product, which is available at NASA's Land, Atmosphere Near-real-time Capability for EOS (LANCE).

Provided by NASA

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