

# There's a change in rain around desert cities

July 26 2006

---



This image shows warm air rising from an urban area, and subsequent cloud formation. Cities tend to be one to 10 degrees Fahrenheit (.56 to 5.6 Celsius) warmer than surrounding suburbs and rural areas and the added heat can destabilize the atmosphere and change the way air circulates around cities. Added heat creates wind circulations and rising air that can produce or enhance existing clouds. Under the right conditions, these clouds can evolve into rain-producers or storms. It is suspected that converging air due to city surfaces of varying heights, like buildings, also promotes rising air needed to produce clouds and rainfall. Winds can carry these clouds to the east of the cities. Credit: Susan Gonnelli Byrne, NASA GSFC

Urban areas with high concentrations of buildings, roads and other artificial surface soak up heat, lead to warmer surrounding temperatures, and create "urban heat-islands." This increased heat may promote rising air and alter the weather around cities. Human activities such as land use, additional aerosols and irrigation in these arid urban environments also

affect the entire water cycle as well.

Although the urban heat-island effect has been known to affect large cities such as Atlanta and Houston, effects on arid cities such as Phoenix, Ariz. and Riyadh, Saudi Arabia were relatively unknown. These cities both experienced explosive population growth.

A study by J. Marshall Shepherd, a climatologist at the University of Georgia, Athens, used a unique 108-year-old data record and data from NASA's Tropical Rainfall Measuring Mission (TRMM) satellite, to examine arid cities' rainfall patterns.

Shepherd found a 12-14 percent increase in rainfall in the northeast suburbs of Phoenix from the pre-urban (1895-1949) to post-urban (1950-2003) periods. This increase in rainfall is likely related to changes in the city and the lands within the city, such as more roadways and buildings in place of open natural area. The increase may also be related to changes in irrigation. However, the role of irrigation in changing the weather of cities in arid areas requires more study, Shepherd said.

"We think that human activities, such as changing the landscape, can affect the flow of the winds associated with the U.S. southwest's monsoon and rising air and building storms on the east side of mountains," said Shepherd. The weather in Phoenix, in fact, is affected by both, and that can change where the rains fall.

The city of Riyadh has also grown quickly in the past few decades, and its weather has been affected by the urban heat-island effect, although the causes are less clear than they are in Phoenix. Weather stations on the ground have confirmed a recent significant increase in rainfall around the city Riyadh.

Shepherd used satellite images from the Landsat satellite and the

Advanced Spaceborne Thermal Emission and Reflection Radiometer instrument aboard NASA's Terra satellite to determine expansion characteristics. He used the TRMM satellite's rainfall data to pinpoint precipitation areas. This study shows the importance of satellite data in regions like the Middle East, where traditional measurements are sparse or inaccessible.

"Many of the fastest-growing urban areas are in arid regimes," said Marshall Shepherd, author of the report just published in the online edition of the Journal of Arid Environments. "Because their total rainfall is low, these areas have been largely ignored in studies on how human activities affect the water cycle. But these cities are particularly sensitive to such changes, since the water supply is so critical."

Cities in arid areas or desert cities have shown great growth only in the last 30-50 years because of new methods of irrigation and ways to obtain water for daily use. Shepherd had access to a unique 108-year-old data record for Phoenix, and for the first time confirmed a significant change in rainfall took place in certain areas of the city from the late 1890s to the present.

Understanding rainfall changes in arid cities is very important. One United Nations estimate projects that 60 to 70 percent of all people will live in cities by 2025, and many of the fastest-growing areas for city growth are in arid areas.

"The results showed us just how sensitive the water cycle can be to human-induced changes, even under arid or drought conditions," Shepherd said. These findings have real implications for water resource management, agricultural efficiency and urban planning.

Source: NASA/Goddard Space Flight Center

Citation: There's a change in rain around desert cities (2006, July 26) retrieved 20 April 2024 from <https://phys.org/news/2006-07-cities.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.