Winds of change bring winter rain to eastern Arabia

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Findings from a recent study on the relationship between rainfall across the Arabian Peninsula and the El Niño weather phenomenon could help improve long-term rainfall predictions over the region. Credit: KAUST; Veronica Moraru

Warmer waters in the central tropical Pacific in recent decades have led to shifts in atmospheric wind jets, bringing more winter rainfall to the eastern Arabian Peninsula and less to the south.

The Arabian Peninsula is one of the most arid regions in the world, making it important to understand how climate change could affect local

rainfall patterns. Now, data comparisons have shown that changing winter rainfall over the peninsula since the 1980s can be linked to an ocean-atmospheric phenomenon affecting sea surface temperatures in the central Pacific and westerly jet streams coming from North Africa. The findings could help improve long-term rainfall predictions for the region.

"About 75 percent of the peninsula's rainfall occurs during winter with marked spatial variation, and the total rainfall is relatively very little," says KAUST research scientist Hari Dasari. "This meager rainfall is critically important for local agriculture, drinking water and ecosystems. We wanted to investigate the long-term changes in winter rainfall patterns across the peninsula and understand how they might be associated with climate phenomena."

Earth modeling expert Ibrahim Hoteit led a team of KAUST scientists to quantify winter rainfall changes over the Arabian Peninsula in recent decades. They accessed rainfall data for the region from the University of East Anglia's Climate Research Unit in addition to rainfall measurements gathered by 39 stations across the peninsula spanning the period from 1951 to 2010.

They found a 25 to 30 percent increase in winter rainfall over the eastern Arabian Peninsula since 1981, with a concurrent decrease of about 10 to 20 percent in the south and northeast.

The team then looked at global climate patterns and found these winter rainfall changes were associated with a shifting El Niño pattern in the tropical Pacific Ocean since the mid-1970s.

Specifically, sea surface temperatures became warmer in the central tropical Pacific, with cooler waters on either side. In comparison, sea surface temperatures before this period were warmer in the eastern

Pacific and cooler in the western Pacific. The change caused a southward shift in the westerly winds, 8–10km above Earth, that guide low-pressure systems known to influence rainfall in the region.

"El Niños are the best predicted climate drivers on the interannual scale, often with lead times of 12 months or more," says Hoteit. "If climate models can capture the observed changes in the links between Indo-Pacific sea surface temperatures and Arabian Peninsula winter rainfall, they could help us predict variations in regional rainfall, with significant implications for sectors like agriculture and tourism."

The team will continue to further enhance understanding of ocean-atmospheric drivers of extreme rainfall and heat events, with the aim of exploring their consequences on future livability conditions.

More information: Hari Prasad Dasari et al, Long-term changes in the Arabian Peninsula rainfall and their relationship with the ENSO signals in the tropical Indo-Pacific, *Climate Dynamics* (2021). DOI: 10.1007/s00382-021-06062-7

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