Modeling leads to a better understanding of the role El Niño plays in increasing rainfall along the Red Sea coast

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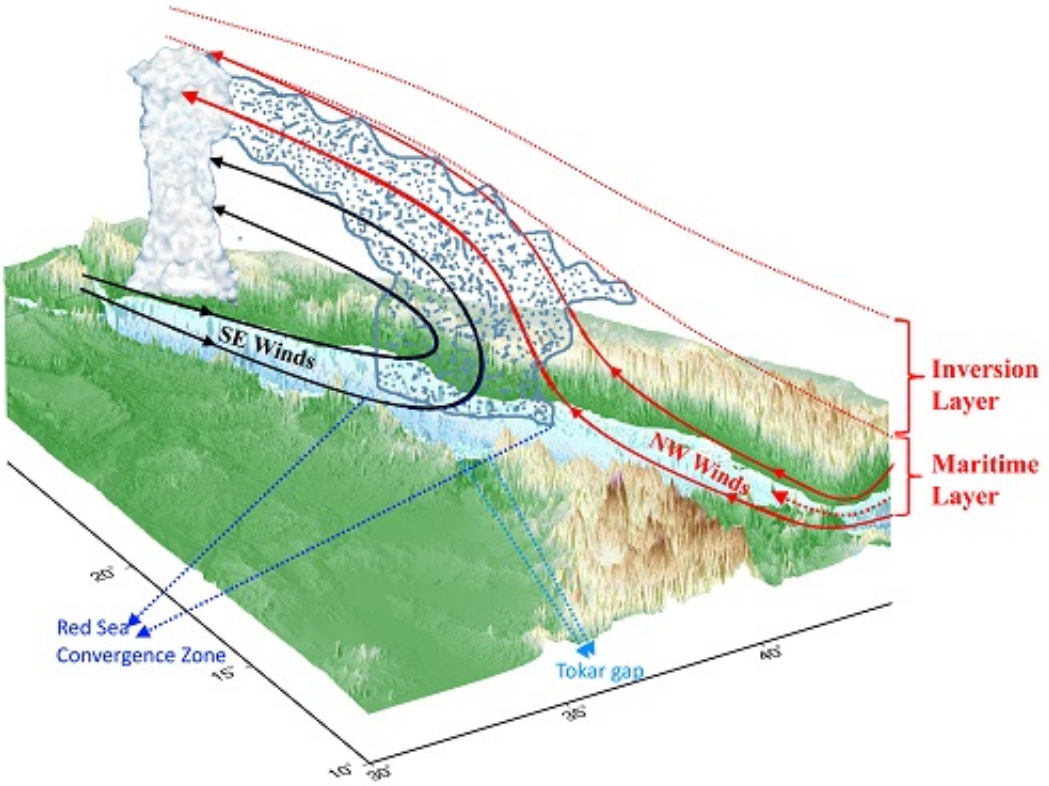

Vertical structure of the winter wind circulation over the Red Sea depicts the Red Sea Convergence Zone and the transport of moisture to the northern regions. Credit: KAUST

The El Niño Southern Oscillation (ENSO) has been shown, for the first

time, to play a role in increased rainfall and storms along the Red Sea and surrounding regions.

During the winter months, from October to March, the northern Red Sea experiences northwesterly winds from the Mediterranean and southeasterly winds from the Gulf of Aden. These winds form the Red Sea Convergence Zone (RSCZ), an area characterized by cloudy skies and drizzle that contrasts with the typically clear weather of the region.

Associate Professor of Earth Science and Engineering Ibrahim Hoteit and colleagues at KAUST have explored how the intensity and position of the RSCZ affects rainfall during the winter months and how it is influenced by ENSO.

"The Red Sea is a narrow basin, and so requires high spatially resolved data to accurately describe variations in the RSCZ," explained Hoteit. "This means we require extensive and accurate datasets to assess the influence of ENSO variability on the region's rainfall."

The team modeled rainfall patterns for the period 1979-2016. This involved combining data from a number of datasets from NASA's ERA-Interim global atmospheric reanalysis and the Advanced Very High Resolution Radiometer for sea surface temperatures with satellite data from the Tropical Rainfall Measuring Mission and the Asia focused APHRODITE, a dataset containing gridded daily precipitation.

Using data on wind speeds and patterns, the researchers first identified the position and intensity of the RSCZ and the locations of the associated high- and low-pressure systems. Then, to explore the mechanisms responsible for rainfall, they analyzed variables, such as convective available potential energy, total column perceptible water vapor and evaporation.

"Because rainfall intensity is associated with the meeting of different water-vapor fluxes, we used a moisture budget analysis to identify the sources of moisture and to estimate the amount of rainfall in the region," said Dr. Hari Dasari, the first author of the study.

They found that the RSCZ shifts northward during the warming El Niño phase of the ENSO, transporting more moisture from the Arabian Sea and increasing the number of rainy days and the intensity of rain events. This results in cooler than normal air from the North combining with warm air from the South over the RSCZ.

"We are working on building advanced models for short- and long-term predictions as well as investigating how changes in the global circulation patterns during ENSO years are connected with the Red Sea weather and climate, and vice-versa," explained Hoteit.

More information: Hari Prasad Dasari et al. ENSO influence on the interannual variability of the Red Sea convergence zone and associated rainfall, *International Journal of Climatology* (2017). DOI: 10.1002/joc.5208

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