Remote-controlled ocean drones observe atmospheric cold pools

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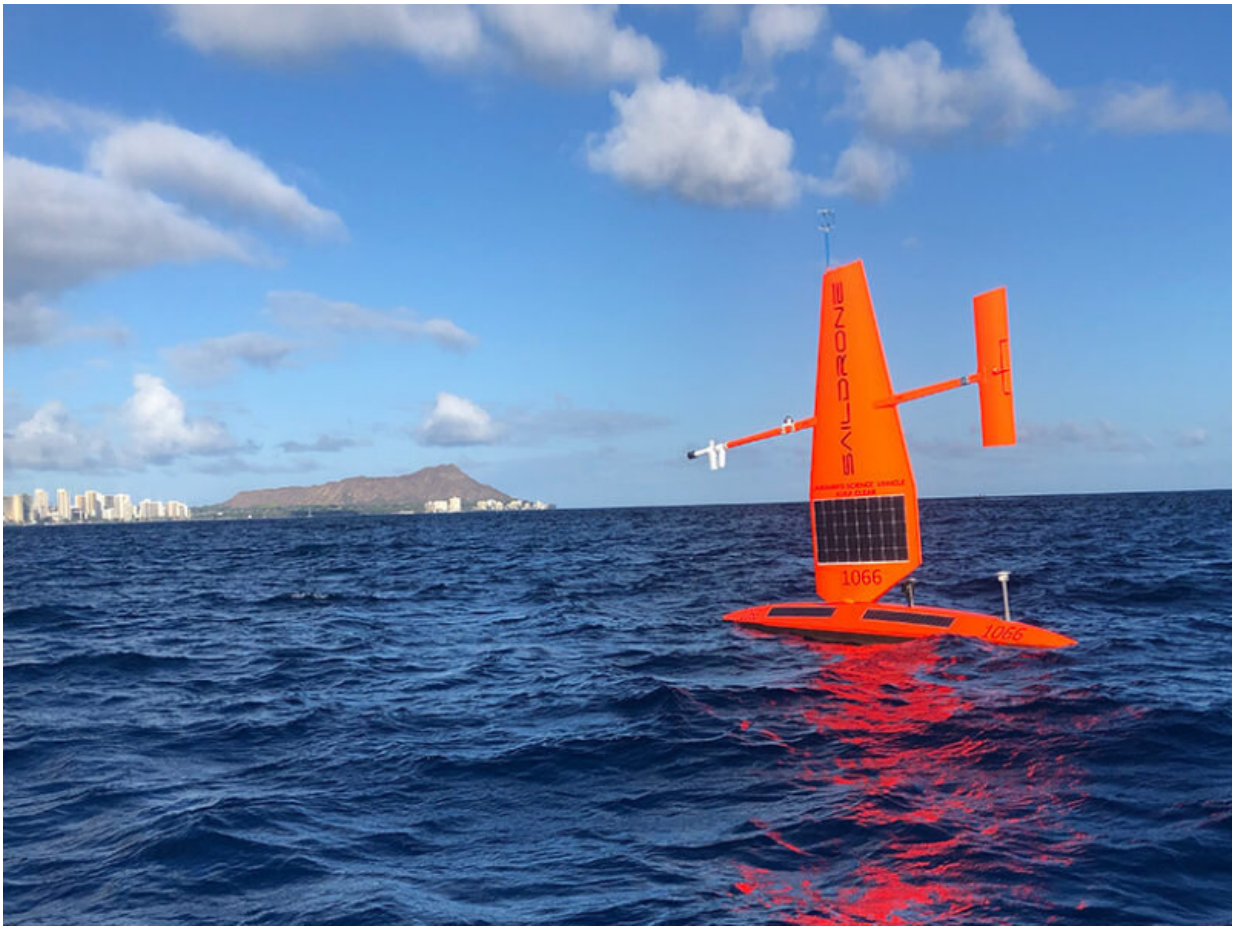

Saildrone uncrewed sailing vehicles (USVs), like the one pictured here, made measurements of atmospheric cold pools in remote regions of the tropical Pacific Ocean. Credit: Saildrone Inc.

Atmospheric cold pools are pockets of air cooler than their surrounding environment that form when rain evaporates underneath thunderstorms. These relatively dense air masses, ranging between 10 and 200 kilometers in diameter, lead to downdrafts that upon hitting the ocean surface, produce temperature fronts and strong winds that affect the surrounding environment. Cold pools over the tropical oceans produce large changes in air temperature and wind speed in the planetary boundary layer. But how they affect the larger atmospheric circulation is not clear. To understand the role of cold pools in tropical convection, scientists need detailed measurements of these events; however, observations in hard-to-reach ocean locations have been lacking.

Uncrewed sailing vehicles, or USVs, could be a solution. In a new study, Wills et al. describe the use of Saildrone USVs, wind-propelled sailing drones with a tall, hard wing and solar-powered scientific instruments. Over three 6-month missions, 10 USVs covered a distance of over 137,000 kilometers within regions of the central and eastern tropical Pacific Ocean and made measurements of over 300 cold pool events, defined as temperature drops of at least 1.5°C in 10 minutes. In one case, four USVs separated by several kilometers captured the minute-by-minute evolution of an event and revealed how the cold pool propagated across the region.

The Saildrone USVs measured variations in air temperature, wind speed, humidity, pressure, and sea surface temperature and salinity. Analysis of these variables revealed key features of cold pool events, including how much and how quickly air temperatures dropped, how long it took for wind speeds to reach their peaks, and the dynamics of sea surface temperature changes. The results could be used to evaluate mathematical models of tropical convection and explore more questions, such as how wind gusts at cold pool fronts affect air–sea heat fluxes.

More information: Samantha M. Wills et al, Cold Pools Observed by

Uncrewed Surface Vehicles in the Central and Eastern Tropical Pacific, *Geophysical Research Letters* (2021). DOI: 10.1029/2021GL093373