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Detecting cold pools from soundings during EUREC^{4}A

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We develop a novel method to detect cold pools from atmospheric soundings over tropical oceans and apply it to sounding data from EUREC^{4}A. The proposed method exploits the fact that the air in a cold pool is denser than the air above it. It leads us to define cold pool soundings as those for which the mixed-layer height is smaller than 400 m. We first test this criterion by verifying its consistency with surface temperature and precipitation in a realistic high-resolution simulation over the western tropical Atlantic. Applying to EUREC^{4}A data, we then identify 7 % of EUREC^{4}A dropsondes and radiosondes as cold pool soundings. In two selected case studies, we find that cold pool soundings coincide with mesoscale cloud arcs and temperature drops in the surface time series. Statistics for the entire campaign further characterize the signature of cold pools in temperature, humidity and wind profiles. In the presence of wind shear, we show in particular that the spreading of cold pools is favored downshear, suggesting downward momentum transport by unsaturated downdrafts. These results support the robustness of our simple method in different environmental conditions and illustrate the new insights it offers for the characterization of cold pools and their environment.