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The ubiquity of mesoscale shallow circulation in the trades

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From EUREC^{4}A observations, we find evidence for shallow circulations at meso-scales in the trades. Shallow circulations have been shown as one of the main drivers behind genesis and maintenance of convective aggregation. They have been studied in models, as well as been identified in moisture space. We identify similar signals for the first time in physical space. Over time-means of 3-6 hours, the mean divergence anomaly in the sub-cloud layer correlates negatively with that in the cloud layer. Here, *anomaly* means the deviation from the month-long campaign mean. Divergence fields from ERA5 reanalysis confirm these observed findings and show that these circulations exhibit a ubiquity in space and time. Moreover, the sub-cloud divergence anomaly has a strong anticorrelation with the humidity anomaly in the cloud as well as sub-cloud layers. We show that these shallow circulations create and maintain moist and dry sub-cloud layers due to the influence of vertical velocity on the cloud-layer moisture, and a subsequent change in entrainment drying efficiency. These circulations leave an imprint on mesoscale humidity and their persistence potentially impacts cloudiness. Thus, investigating these circulations can help better understand the patterns of meso-scale cloud organization within the trades.

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