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## The ubiquity of shallow circulations in the trades

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We find an abundance of low-level, mesoscale circulations in the atmosphere below the trade-wind inversion layer based on observations of the mesoscale atmospheric circulation taken during the EUREC4A campaign. Over time-means of 3-6 hours, the mean sub-cloud divergence anomaly correlates negatively with the mean divergence anomaly in the cloud layer. Here, the term anomaly means the deviation from the EUREC4A-wide month-long mean of divergence at the corresponding altitude. Additionally, sub-cloud divergence anomaly correlates negatively with specific humidity anomaly in the sub-cloud and cloud layers, indicating moist, convergent regimes and dry, divergent regimes. We hypothesise that the presence of shallow circulations below the inversion layer explains these associations. Our proposed mechanism of shallow circulations is that regions of ascending air are balanced by neighbouring cells of subsidence, thus creating and maintaining moist and dry regions, which reinforce the shallow circulations. We use mixed-layer theory to estimate the time-scales at which the sub-cloud layer moisture would respond to such divergence patterns. The observed relationships are also evident in reanalysis data, which further reinforce that these are indeed mesoscale features and not large-scale signals captured by the observations.