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Investigating simulated clouds at varying resolution with remote sensing measurements during the EUREC^{4}A field study

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Abstract Text:

Shallow convective clouds remain at the heart of climate sensitivity uncertainty. While recent studies have shown that simulations on hectometer resolution lead to improved cloud representation, open questions remain in the representation of small-scale variability and especially microphysical processes. Therefore, we investigate modeled cloud and water vapor conditions in the ICOsahedral Nonhydrostatic Large-Eddy Model (ICON-LEM) at varying horizontal resolution. We compare the model on a statistical basis to ground-based remote sensing observations obtained during the EUREC^{4}A field study at Barbados Cloud Observatory (BCO). More specifically, we evaluate cloudiness, liquid water and water vapor distribution at horizontal resolution ranging between 75m and 1.25km. Radiosonde profiles and retrieved microwave radiometer Integrated Water Vapor and Liquid Water Path are compared to the modeled conditions. By applying the instrument simulator PAMTRA to the model output, we analyze cloud properties in more depth based on simulated and observed cloud radar reflectivities.

Plain-Language Summary:
Shallow clouds pose a challenge to current climate modeling. While a higher horizontal model resolution improves the modeled cloud representation, small-scale variability and in-cloud processes still remain unclear. Therefore, we run simulations at different horizontal resolutions and compare the outcome to measurements made during the EUREC4A field study at Barbados Cloud Observatory. We evaluate modeled water vapor conditions and cloud properties by comparing them to remote sensing observations and radiosonde profiles. To analyze the modeled clouds in more depth, we simulate what a radar would see based on the model output, and compare these simulated measurements to the actual observations.

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