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Confronting and combining high-resolution simulations (ICON-LEM) with remote sensing observations

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The current generation of large-eddy models (e.g. the ICON-LEM) allows us to go beyond idealized simulations and to capture synoptic variability by including heterogeneous land surfaces as well as lateral boundary conditions. This would offer the possibility to compare simulations and observations of clouds on a detailed day-to-day basis. But while LEMs are able to reach resolutions that start to be comparable to state-of-the-art observations (e.g. Radar data), they are still facing the issue of different parameter spaces: either the model output has to be transferred to observable quantities, or the other way around. We will present examples from recent field campaigns (e.g. ACLOUD, EUREC4A), where we combined ICON-LEM simulations with remote sensing observations by applying the Passive and Active Microwave TRAnsfer simulator (PAMTRA). By the selection of examples, we will show the potential of this combination of high-resolution modeling, remote sensing observations and forward simulations at different places under different conditions (Arctic, European and Caribbean). While the general structure of clouds (e.g. timing, type, height) is often already captured quite well, the comparison to the remote sensing observations allows us to also get insights into the composition of clouds and to constrain microphysical parameterizations as well as the influence of the large-scale forcing on a more detailed level.