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Cloud driven intermittent surface wind fluctuations revealed by ICON-LEM simulations

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Convection resolving simulations (2 km to 100 m grid) are performed for the tropical Atlantic region (9000x3300 km) using the icosahedral non-hydrostatic (ICON) model. Deactivating the convection parameterization facilitates the explicit evolution of moist convection across horizontal scales, enabling rich interactions with their environment and neighboring convective cells.

Short forecast simulations of 36 hours are performed for over 60 days accompanying the NARVAL observational campaign and the Barbados observatory measurements using a grid spacing of 2.5 km and a 1.2 km in a nested domain. This data further serves to drive a second set of simulations in context to the HD(CP)2 project using 600, 300 and 150 m grid spacing. The model setups are related to NWP setup of ICON, but the kilometer scale simulations explicitly treat convection and the sub-kilometer simulations further, using the 3D Smagorinsky turbulence parameterization (ICON-Large Eddy Model).

This ICON model hierarchy offers a powerful framework to analyze the emerging fine-scale interactions of convection and turbulence with the surface wind field. Fueled by evaporative cooling of precipitation, surface deflected downdrafts leave a strong dynamical signature which is especially prominent in the intermittent fluctuations of the surface wind. Along this scientific question more technical aspects like the resolution dependence of convection, turbulence and surface wind are studied.