Explicit tropical convection revealed by the ICON model hierarchy

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Emerging fine-scale structure

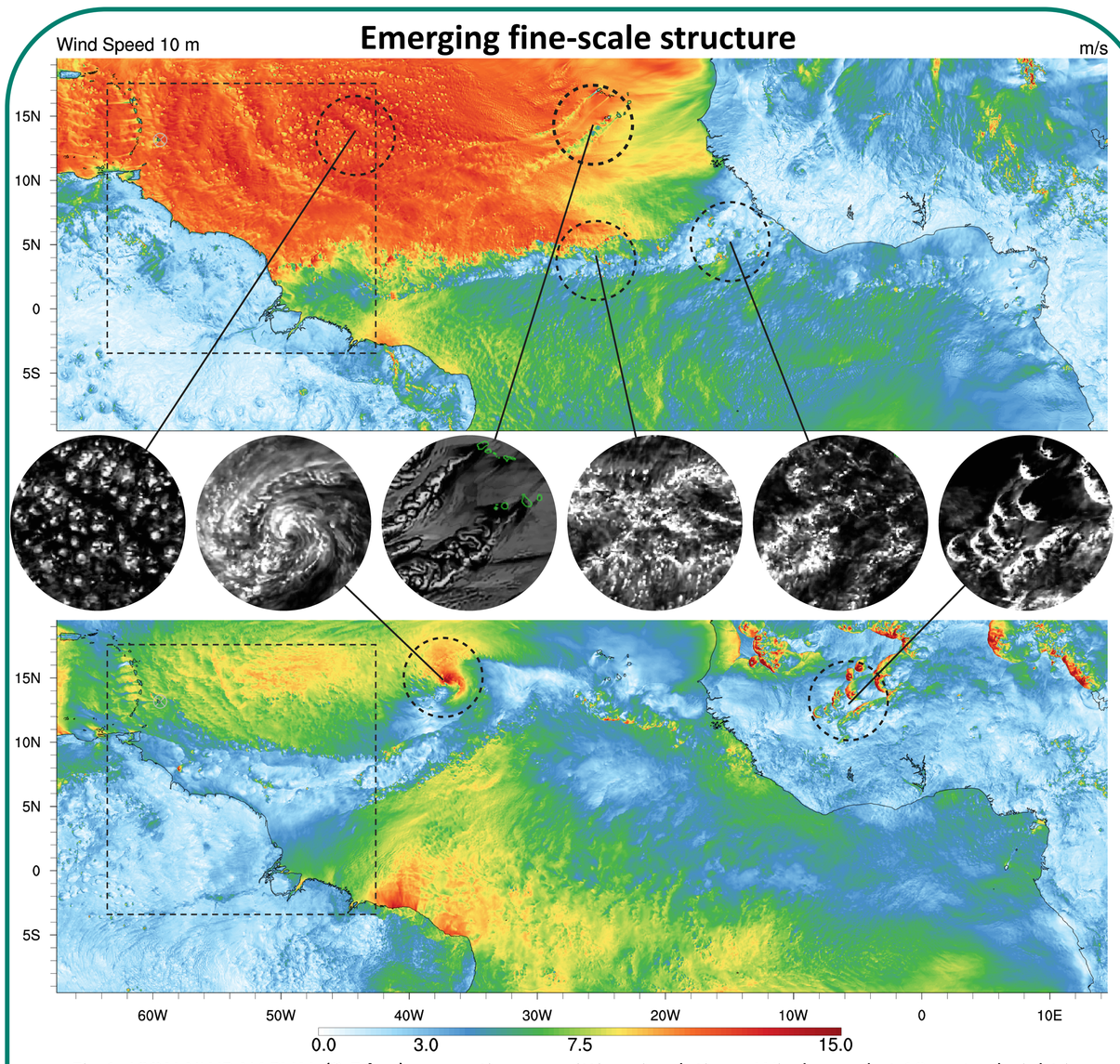

Fig.1: ICON NWP NARVAL (**2.5 km**) convection permitting simulations. Wind speed at 10 meter height is shown the for an exemplary Dec (a) and Aug (b) day. The bubble insets show liquid water path.

Abstract

Convection resolving (2 km to 100 m grid) simulations for the tropical Atlantic region (9000x3300 km) are performed using the icosahedral non-hydrostatic (ICON) model for two seasons.

Deactivating the convection parameterization facilitates the explicit evolution of convection across horizontal scales, enabling rich interactions with their environment and neighboring convective cells.

Towards cloud resolving scales

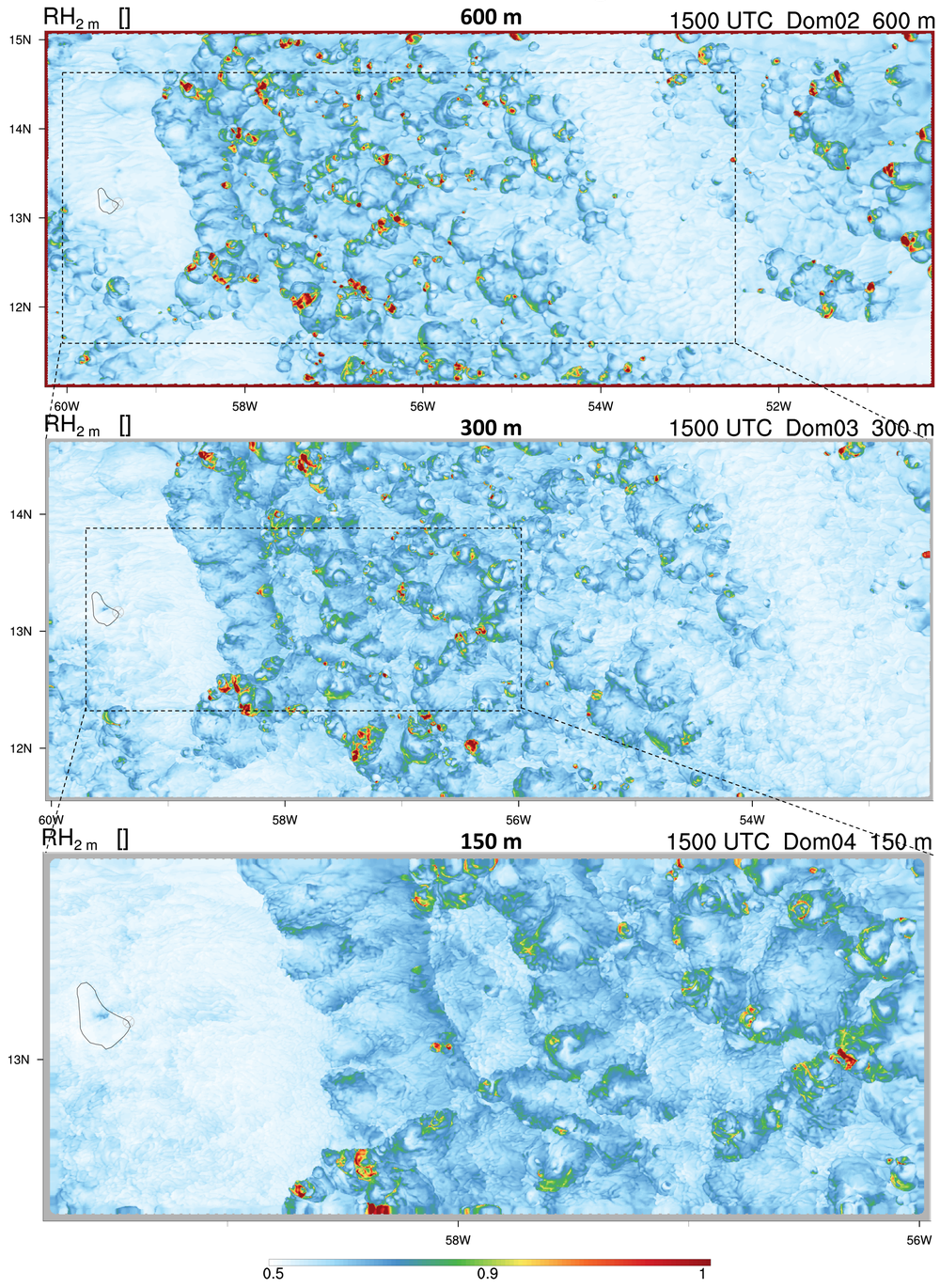

Fig. 2: The ICON LEM HD(CP)^2-TA using large-eddy physics (3D Smagorinsky). Driven by ICON NWP NARVAL. Accompanying the NARVAL HALO flights

Interaction of convection and surface convergence

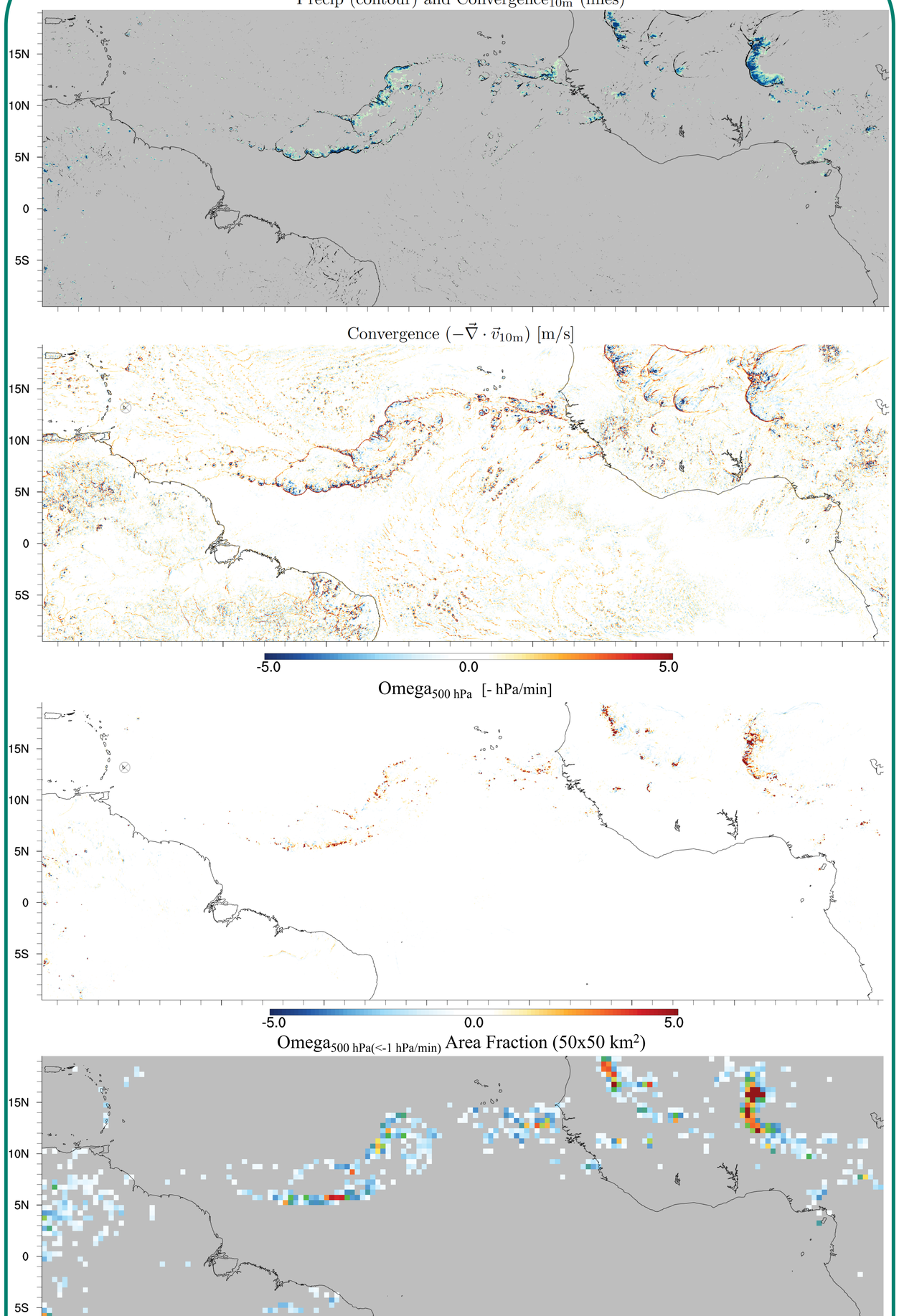

Fig. 3: Small-scale surface convergence is important for triggering new convection at the leading fronts of larger mesoscale convective clusters. This dynamical component of convection challenges the traditional thermodynamic design of conv. parameterizations in which atmospheric instability is balanced locally.

Added value relative to GCM

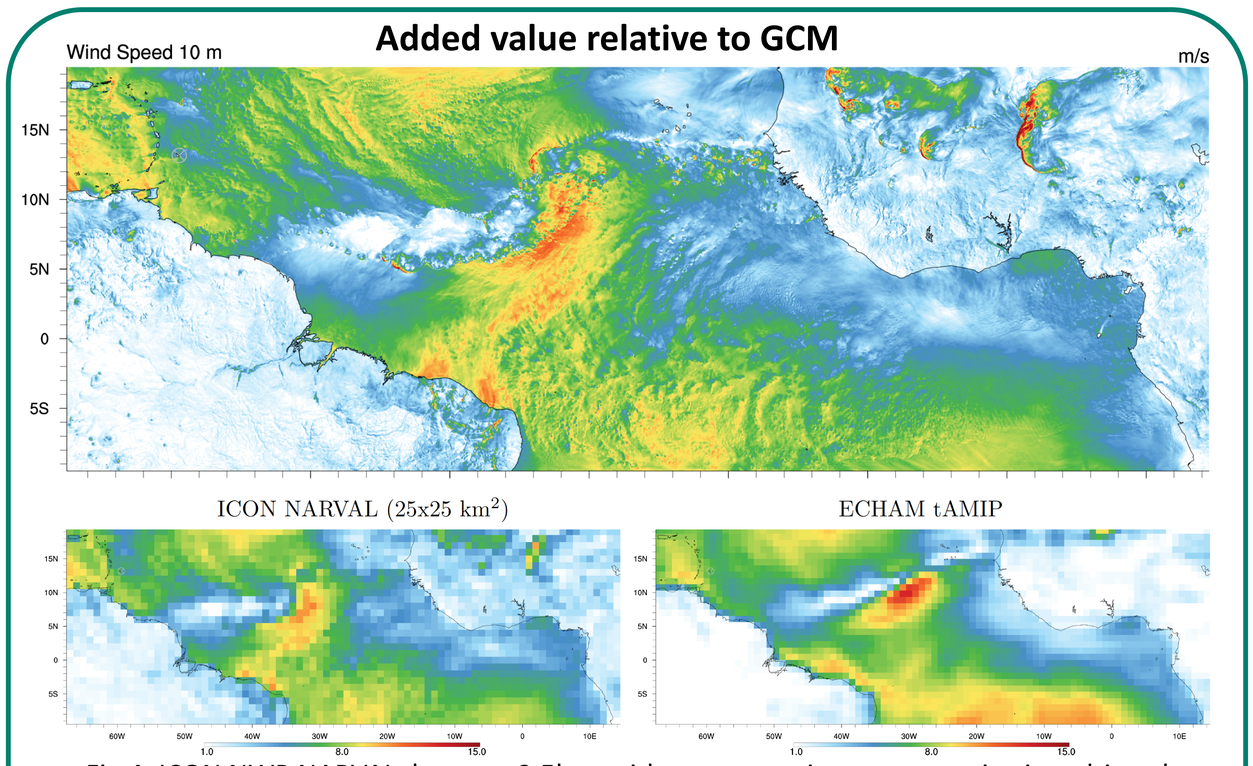

Fig.4: ICON NWP NARVAL: hor. res. 2.5km, without convection parameterization, driven by IFS, 60+ forecast simulations (36 h).ECHAM transpose AMIP: res. T127L95 (~100km), with convection parameterization, driven by IFS 60+ forecast simulations (132 h).

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HD(CP)^2 High definition clouds and precipitation for advancing climate prediction

Deutscher Wetterdienst Wetter und Klima aus einer Hand

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