Marine Boundary-Layer Cloud Physics in ICON (MBL-ICON)“

In MBL-ICON I will explore the interactions between cloud physics, radiation and boundary layer mixing parametrisations in marine stratocumuli in the Southern Ocean (SO) and the subtropics. Both, pure liquid-phase and mixed-phase stratocumuli are governed by a sensitive interplay of cloud-generated mixing below a sharp moisture and temperature inversion and a sensitive balance between cloud formation and dissipation through evaporation and precipitation. In MBL-ICON, I propose to explore the impact of different boundary layer parametrisations on simulated cloud and boundary layer properties. In the SO we will mainly focus on the impact of a unified representation of marine boundary layer mixing on simulated cloud properties and the top-of-atmosphere energy balance. We will also assess the impact of ocean-atmosphere coupling on SO cloud-radiative biases and the typical time-scales over which climatological biases manifest. Finally, the impact of additional cloud physics on stratocumulus regime transitions in the subtropics will be investigated in nested cloud-resolving simulations along subtropical sea-surface temperature gradients.
Large radiative biases remain associated with MBL clouds in ICON. Fixing these biases is paramount for future climate projections with ICON and will also yield additional benefits in terms of model physics evaluation relevant for European weather forecast. In addition to the gained new scientific understanding, these studies will demonstrate the utility of ICON in future high-resolution climate simulations panned in ICON-Seamless in a region of strong cloud-ocean-radiation interactions. This research is funded by the German Weather Service (DWD).