Modelling water pathways and isotopes in the trade-wind boundary layer (MoWITrade)

Principal Investigator: Univ.-Prof.Dr. Stephan Pfahl (stephan.pfahl@met.fu-berlin.de)

Project Administrator: Dr. Ingo Kirchner (ingo.kirchner@met.fu-berlin.de)

The atmospheric water cycle and the formation of low-level clouds in the marine trade-wind boundary layer are very important for the earth's radiation budget and climate sensitivity. However, the representation of these processes in climate models is associated with large uncertainties. The goal of this project is to reduce these uncertainties and improve our understanding of water transport processes in the trade-wind region. To this end, we will apply sophisticated moisture transport diagnostics in climate model simulations over a wide range of resolutions (grid spacing from below 1 km to 100 km). The contribution of various source regions and transport pathways to the marine boundary layer moisture budget will be quantified with the help of numerical moisture tracers. Such passive tracers will be combined with prognostic water isotope simulations to determine specific isotopic fingerprints of the diagnosed moisture pathways. Finally, the simulated isotopic composition will be compared to measurements from the EUREC^{4}A field campaign in the tropical North Atlantic. In this way, we will investigate if and how water isotope observations can be used to constrain the modeled transport processes. This seamless modeling approach, together with unprecedented observational data from the EUREC^{4}A campaign, will provide exiting novel opportunities to evaluate and ultimately improve the representation of the tropical water cycle in climate models.

The work is supported under the DFG grant 668001 and will start in 2021 for three years. The project will use the ICON-modelframework with extension. In the first year a lot of develoment work is planned and validation experiments with different model resolution will be performed. In the second year the experiments will be continued with a high resolution reference experiment. In the last project year a series of low resolution runs are on the schedule.