Project: **1247**

Project title: **Modelling water pathways and isotopes in the trade-wind boundary layer (MoWITrade)**

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Overview and model development

This project aims to investigate water cycle and the formation of low-level clouds in the marine trade-wind boundary layer. This work is supported by the DFG grant 441025101 (to S.Pfahl, funded from 2021 to 2024). We use an isotope-enabled global circulation model ICON-ART-Iso climate model with a wide range of resolutions. A first version ICON, which allows prognostic simulations of water isotopes, was published by Eckstein et al. (2018). During the first project phase in 2021-2022 this version has been integrated to pre-released version (2.5) of ICON and a new framework that allows tracing specific moisture sources ("water tagging") have been developed. We have developed specific tracers for moisture source region tracing, as well as the ability moisture prominence from 3D domains, such as the planetary boundary layer.

Experiments performed in 2021

In the first year of the project, we conducted global ICON-ART-Iso experiments at R2B4 resolution to test and validate both the integration of isotope tracing into the pre-release version of ICON and developed water tagging capabilities. First, we have performed 10 short (20 days) model simulations to test the representation of water isotopes in the newer version of ICON and to fix some bugs related to the implementation if isotopes into sedimentation and evaporation schemes. Since the model at the moment is initiated with climatological isotope values, the first ~15 model days are necessary to reach the equilibrium of the isotopes in the atmosphere. Thus, these simulation we run for ~20 days. Second, we tested the implementation of "water tagging" in the model. Vapor, traced from the evaporation region needs to be equilibrated in the atmosphere > 1 month, thus we performed experiment of a few month lengths. For the last month of 2022, we plan to perform additional tests of ICON with regional set-up with lateral boundary conditions (including isotopic conditions) from ECHAM6-wiso.