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 the hydrological cycle and the formation of low-level clouds in the marine trade wind boundary layer. This work is supported by the DFG grant 441025101 “Modelling water pathways and isotopes in the trade-wind boundary layer (MoWITrade)” (to Prof. S. Pfahl, funded from 2021 to 2024). We use an isotope-enabled global circulation model ICON-ART-Iso climate model (Eckstein et al., 2018) with a wide range of resolutions. In addition, we use the COSMOiso climate model (Pfahl et al., 2012). COSMOiso has a feature called “water tagging,“ also known as "moisture tagging,” which can be used to track water from specific, predefined sources during a model simulation. We conduct high-resolution regional experiments for the tropical Atlantic region for the EUREC4A field study period.

Performed experiments

In this project year, we have performed global ICON-ART-Iso experiments to both test and validate the integration of isotope tracking into the pre-release version of ICON and to test its ability to simulate isotope distribution in the boundary layer. We are also using the COSMOiso model to perform high-resolution regional simulations with water tagging capabilities. First, we have performed > 20 short (5 days) model simulations to test the representation of water isotopes in the newer version of ICON and the ability of the model to reproduce the modern isotope distribution globally. We found that additional model development is needed due to numerical problems in isotope simulation associated with sedimentation and evaporation schemes. Second, because ICON-iso is currently under development, we are conducting experiments with the COSMOiso model with horizontal grid spacing of 5 km. We use a regional setup with lateral boundary conditions (including isotopic conditions) from ECHAM6-wiso and previous COSMOiso simulations (Villiger et al., 2022). In this study, COSMOiso simulations were performed with horizontal grid spacing of 5 km over the tropical Atlantic Ocean for the period of the EUREC4A field experiment (February 2020). To keep the conditions in the domain as close as possible to real meteorology, we performed spectral nudging of the horizontal winds toward reanalysis data. Water vapor originating from the evaporative region must equilibrate in the atmosphere > 1 month. For the last month of 2023 we plan to performed experiment of a two months long (January and February 2020).