Flux of particles able to initiate first ice in clouds

Summary of the research plan

Figure 1: Spinx Observation

Clouds play a major role in regulating Earth's radiation budget. Their radiative properties and lifetime are modulated by ice nucleating particles (INPs). Despite being very rare, INPs active at or above -10 °C (INP_{-10}) can have significant effects on cloud development when initial ice formation is followed by ice multiplication, such as rime splintering. An enhanced number concentration of INP_{-10} sometimes coincides with rainfall, albeit other aerosol particles of similar size decrease during rain. This contrast poses a limit on parametrising INP_{-10} as a function of the more easily measurable aerosol number concentration. It also calls for investigating more closely the feedback between rainfall and INP_{-10}. To advance in this field of research, it is necessary to quantify the flux of INP_{-10} from land surfaces under dry and rainy conditions. Relevant here is the flux from lowlands to near an altitude where first ice may form in clouds. In this project we will determine this flux by measuring INP_{-10} with high precision and an hourly time resolution at the High Altitude Research Station Jungfraujoch on days when conditions change from free tropospheric conditions to a substantial planetary boundary layer influence.

Figure 2: Aerosol sampler modified for operating at high altitude

Radon measurements ongoing in the context of another project will, together with Lagrangian particle dispersion modelling, allow to quantify by radon mass balance approach the INP_{-10} flux from dry and rainfall-affected source regions. Our main objective is to quantitatively understand the effect of rainfall on INP_{-10} flux to an extent at which it can be meaningfully coupled to simulations of aerosolcloud interactions.