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Flux measurements on top of the research station Jungfraujoch in Switzerland

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The microphysics of orographic clouds has been measured over a 4-week period on top of the high-alpine research station Jungfraujoch in Switzerland (3580 m a.s.l.) during January and February 2017. These experiments aim to improve our current lack of understanding about the discrepancy between high ice number concentrations previously measured at this site (Lloyd et al. 2015) and those predicted by primary ice nucleation parameterizations. Farrington el al. (2016) shows with the use of the Weather Research and Forecasting model (WRF) that secondary ice processes as well as an increase in ice nucleating particles (INPs) cannot explain the observed concentrations. By implementing a surface flux parameterization into the WRF model, they found a possible solution for the quantity of observed concentrations.

As such a surface flux has been mentioned by other authors as well (i.e. Lloyd et al 2015), the goal of the experiments in 2017 is to measure the existence of these vertical fluxes from the surface and their contributions to the measured number concentration of ice particles. For this goal, the well-adapted system of a rotation wing that points the attached instruments into the mean wind field (Lloyd et al. 2015) was used. Those instruments are: a 3 View-Cloud Particle Imager (3V-CPI), a combined probe of a two-dimensional stereoscopic (2DS) shadow imaging probe and a cloud particle imager (CPI), a cloud droplet probe (CDP). These measure the size distribution of ice particles and number concentration of ice particles and water droplets in the range of 10-1250 μm and 3-50 μm, respectively.

Ice crystal fluxes were calculated by the use of the eddy covariance method that couples the deviation from the mean of the number concentration measurements of the 3V-CPI and the deviation from the mean of the vertical wind measured by a sonic anemometer that has been placed nearby the 3V-CPI. The results show the presence of periods with strong upward and downward fluxes. It also shows that the measurements have been too far away to distinguish the different kind of fluxes by the habit composition. However, the measured habits were consistent with particles that have grown through vapour diffusion on the surface.

References

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