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Fog droplet distributions and liquid water fluxes in the hyperarid Namib

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The quasi-permanent stratocumulus deck over the South Atlantic is regularly advected into the hyper-arid Namib, where it appears as fog upon interception with the gradually ascending terrain and provides a water input for plants and animals besides scarce rain. The governing processes and dynamics are not properly studied and recent literature proposes radiation fog rather than an advection as partial origin process. fog precipitation, measured by various fog collectors is not necessarily the final water input received by the system and tells us little about the dynamics within the fog. Within the scope of the Namib Fog Life Cycle Analysis (NaFoLiCA) project, a cloud droplet probe sampled the fog droplet distribution at a higher rate than the fog collectors could. Liquid water content and flux were then derived by the eddy covariance method using an adjacent IRGASON. After a few months, the setup was moved to another location to investigate spatial variability in droplet distributions.
Before fog events, the background concentration consisted primarily of droplets smaller than 10 μm. The size of droplets during fog events was mainly between 10 and 40 μm with few droplets larger than this. The increase in droplet numbers, and thus liquid water content, occurs simultaneously with a decrease in visibility and a sudden change in longwave downward radiation. The first measurements of fog precipitation lagged by roughly 30 minutes compared to detection by the cloud droplet probe. Short decreases in droplet numbers were found to reduce the intensity of fog precipitation. Liquid water content was up to three orders higher during fog events compared to days without fog. Cumulative liquid water flux during one event was around 60 mg (0.06 ml) not including gravitational settlement of droplets. The analysis of droplet distribution and fluxes allowed detailed analysis of fog events, more so than by fog collectors alone. Selected fog events, their stages and links to the droplet distributions help to better understand the role of fog in the hyperarid Namib.