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UV depol lidar measurements of marine stratocumulus microphysical properties

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In the summer of 2016 and 2017, measurements were performed on Ascension Island, a remote island in the south-east Atlantic Ocean, using a polarization UV-lidar. Polarization lidars present a promising source of information for cloud-base microphysical properties. Polarization lidars measure not only the intensity of the backscattered signal but also the amount of depolarisation occurring in the returned signal. This depolarization signal in liquid clouds occurs due to multiple scattering and is influenced by lidar characteristics as well as cloud macro-physical and micro-physical cloud properties. The multiple scattering inside the cloud near the cloud-base can be simulated using a Monte Carlo model inside idealised semi-adiabatic liquid clouds. Using lookup tables generated by the MC model, cloud micro- physical properties such as cloud-droplet number density, effective radius and liquid water content lapse rate can be derived from the depolarization ratio observed by the polarization lidar.We present observations of microphyiscal properties from marine stratocumulus clouds present over Ascension Island in 2016 and 2017, derived from the UV depolarization lidar, compared to cloud microphysical properties derived from lidar and radar observations from the US ARM mobile facility that was present on Ascension from 2016-2017. Furthermore, in-situ measurements from aircraft were performed around the island in summer 2017, further characterising the cumulus cloud properties. The measurements show the evolution of the marine cumulus clouds near Ascension Island, a pristine oceanic region, that is episodically invaded by heavy smoke from African vegetation fires. During smoke incursion, the clouds show a change in microphysical properties, due to the increase in cloud condensation nuclii. The quantification of such aerosol-cloud interactions are necessary to improve climate models and assess the climate effect of aerosols on a regional and global scale.