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Evaluation of ground-based retrieved droplet concentration for stratocumulus clouds, using cloud optical properties

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The droplet concentration of water clouds may increase as a result of an increase of anthropogenic aerosol production. The modified cloud properties influence the cloud-radiation feedback. The presented work focused on an accurate retrieval of cloud droplet concentration in low-level water clouds and to analyze the influence on the radiation budget. The droplet concentration retrieval technique combines ground-based remote sensing measurements (radar, lidar and microwave radiometer) with microphysical and thermodynamic model. The theoretical model is based on the inherent relation between cloud optical and microphysical properties as a function of height, whereas the vertical variability of concentration is predefined by two different mixing processes (homogenous versus inhomogeneous). Within these two extremes the vertical cloud inhomogeneity at small scales is not considered. Furthermore, the assumption of the cloud non-adiabaticity requires the accurate amount of liquid water content as a function of height, which can be derived from a ground-based radar-lidar retrieval technique. These uncertainties will be improved by using a combination of radiative transfer model calculations and shortwave irradiances measurements from ground in order to validate and optimize the retrieval technique. The retrieved microphysical properties will be used as input for the Doubling-Adding KNMI (DAK) model to simulate broadband and narrowband fluxes at the ground and to compare with radiation measurements made within the framework of BSRN Cabauw, Netherlands. Agreement or disagreement between the modeled and measured irradiances at the ground is expected to give the knowledge about the quality of the retrievals.