EGU22-12045
https://doi.org/10.5194/egusphere-egu22-12045
EGU General Assembly 2022

Visualising and quantifying momentum transport in cloudy boundary layers using collocated lidar and cloud radars

José Dias Neto[1], Louise Nuijens[1], Christine Unal[1], and Steven Knoop[2]
[1]Delft University of Technology, Netherlands (j.diasneto@tudelft.nl)
[2]Royal Netherlands Meteorological Institute

Convective clouds may be associated with substantial transport of momentum. The process of convective momentum transport is typically investigated using simulations due to a lack of observations. This study exploits the currently available remote sensing techniques to visualize wind structures within clouds and their surroundings and quantify the vertical transport of momentum.

The Tracing Convective Momentum Transport in Complex Cloudy Atmospheres experiment (CMTRACE) took place in the experimental site in Cabauw (The Netherlands) between September 13th and October 3rd 2021, as part of the RUISDAEL project. The goal of CMTRACE was to provide continuous profiles of horizontal and vertical wind components with a temporal resolution of ~1 minute and vertical resolution of ~50 m within the cloud and sub-cloud layers to improve our understanding of the role of momentum transport on different scales. One scanning wind lidar provided the observations in the sub-cloud layer, while in the cloud layer, the observations were obtained by one scanning and one vertically pointing cloud radar. The high-resolution data produced by those instruments across the boundary layer can also benefit data assimilation and model evaluation.

During CMTRACE, we sampled various cloud regimes such as non-precipitating shallow cumulus, deep convective clouds and stratiform clouds. Due to the presence of insects, the radar provided almost identical wind profiles to the lidar up to cloud base, giving us confidence in the quality of the observations. The dataset was also validated against the data from radiosondes and the Cabauw mast tower.

In this presentation, we outline the CMTRACE observational dataset and present statistical analyses and classification of the data into different cloud regimes. The profiles of wind fluctuations and momentum fluxes are used to exemplify correlations between vertical and horizontal wind on both cloud- and mesoscale scales.