EGU21-8377
https://doi.org/10.5194/egusphere-egu21-8377
EGU General Assembly 2021


# On the size dependence of cumulus cloud spacing

**Thirza van Laar**[1] and Roel Neggers[2]
[1]Helmholt-Zentrum Geesthacht, Institute of Coastal Research, Geesthacht, Germany (thirza.laar@hzg.de)
[2]University of Cologne, Institute Geophysics and Meteorology, Cologne, Germany (neggers@meteo.uni-koeln.de)

The spatial variability of Trade wind cumulus cloud fields has been found to be of great importance for understanding their role in Earth's climate system. In this study the focus is on the spacing between individual cumulus clouds. The main objective is to establish how inter-cloud spacing depends on cloud size, information that is crucial for understanding cloud-radiation interaction and spatial organization, and for informing grey zone parametrizations. To this end, a large-domain high resolution ICON LES simulation of marine shallow cumulus cloud fields is used. The domain is located at the subtropical Atlantic and the simulations are performed for the time of the recent NARVAL South campaign (December 2013). The simulations are compared with MODIS satellite imagery and research flight measurements, showing a good agreement between observations and the simulation, on both cloud size statistics and the vertical structure of the boundary layer.

To determine the size and locations of the clouds, a cluster analysis was applied to the data. The inter-cloud, or nearest neighbor spacing (NNS), is addressed using four different expressions, classic definitions but also novel ones. For all definitions the spacing increases with cloud size, but the dependence is strongly influenced by the used definition. The classic definition, the spacing between clouds of any size, shows a well-defined logarithmic dependence on cloud size. The logarithmic relation can be explained by the abundance of closely-spaced small clouds. The small distances between these clouds form an upper bound for the NNS for the larger cloud sizes. In contrast, the spacing between clouds of a similar size increases exponentially with size. We argue that the exponential size-dependence reflects the mesoscale dynamics that drive the horizontal size of large convective cells, of which the cumulus clouds are the visible parts.