EGU General Assembly 2021

EGU21-2219
https://doi.org/10.5194/egusphere-egu21-2219
EGU General Assembly 2021

The sensitivity of cloud radiative forcing with respect to the macrophysical properties and organization of the trade-wind cloud field during EUREC^{4}A

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The clouds in the Atlantic trade-wind region are known to have an important role in the global climate system, but the interactions between the microphysical, macrophysical and radiative properties of these clouds are complex. This work seeks to understand how the macrophysical properties and organization of the cloud field impact the large-scale cloud radiative forcing in order to provide the necessary information for the evaluation of the representation of these clouds in models. During the 2020 EUREC^{4}A campaign, the German HALO aircraft was equipped for the first time with two instruments - the BACARDI instrument, a broadband radiometer that encompasses a set of pyrgeometers and pyranometers to measure the upward and downward solar and terrestrial radiation at flight level, and the VELOX Thermal IR imager. Simultaneously, one-minute resolution observations of the flight domain were obtained by the GOES-E satellite, thus providing information about the properties of the clouds on a spatial scale compatible with the large footprint of the BACARDI instrument. Using the products of these three instruments, we observe how the changing cloud field (e.g. cloud fraction, mean liquid water path (LWP), cloud top height, degree of clustering) in the EUREC^{4}A domain impacts the radiation measured at flight level. We see that although cloud fraction plays a significant role as expected, it is not sufficient to parameterize the cloud radiative effects. Furthermore, the results indicate that the general organization of the cloud field as well as other properties describing the cloud population are necessary, but their relative importance varies between different cloud scenes.