Remote sensing measurements at the Barbados Cloud Observatory

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Abstract

The Barbados Cloud Observatory (BCO) is located on the east coast of the island of Barbados (13°09’ N, 59°25’ W), where it is exposed to the relatively undisturbed easterly trade winds. The position of the BCO is well suited for studies of shallow cumulus clouds, which have a significant impact on Earth’s radiation budget and on the energy and water cycles. In this talk, measurements from a K-band cloud radar, with an exceptional sensitivity, and a ceilometer are used to analyze the lower environment of shallow cumulus clouds. Below their nominal base, which is well defined by the determination of the lifting condensation level and the ceilometer measurements, the cloud radar detects a weak reflectivity signal. It will be shown that this signal is observable down to 250 m below cloud base and represents hygroscopically grown sea salt particles, which mainly occur in the updraft region of shallow cumulus clouds. Furthermore, a new method is proposed to measure the shallow convective mass flux from almost ground to the top of shallow cumulus clouds by combining the data from a Doppler radar and a Doppler lidar. The shallow convective mass flux is a key parameter to represent atmospheric convection in model simulations, and the remote sensing measurements at the BCO show for the first time its interplay between the sub-cloud and cloud layer.