

Using a ULA to test horizontal lidar measurements for characterizing shallow convective clouds

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The international campaign EUREC4A (Elucidating the role of clouds-circulation coupling in climate, www.eurec4a.eu) will take place in January-February 2020 over the tropical Atlantic East of Barbados. Its aim will be to test the mechanisms underlying one of the greatest uncertainties in climate sensitivity: the dependence of trade-winds shallow cumuli on the strength of convective mixing in the lower troposphere. This study requires to measure the area covered by shallow cumuli at their base, and its dependence on environmental conditions. For this purpose, the French research aircraft ATR42, managed by the SAFIRE unit (www.safire.fr), will be equipped with a backscatter lidar system using a 355 nm laser emission that will perform measurements along the horizontal just above cloud base. These measurements will characterize the cloud mask and the cloud size distribution, and thus will help constrain recent theories on the regulation of shallow cumulus clouds. Past experiments have shown the scientific potential of horizontal lidar measurements from an aircraft, even if seldom performed in the history of airborne campaigns due to their technical complexity. In early summer 2017, we tested this approach by performing horizontal measurements from an ultra-light aircraft to study a field of shallow cumuli over the Rhone valley in France. We will present the demonstration campaign and the relevance of the experimental approach. A theoretical extrapolation will then be proposed for horizontal lidar measurements from the ATR42 through a lateral window especially designed to meet the needs of EUREC4A.