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Survey of microphysical properties of marine boundary-layer clouds in the Western North Atlantic

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Oceanic low level clouds strongly affect the atmospheric radiation budget. Uncertainties in their microphysical properties and cover currently limit the accuracy of climate predictions. Further, studies quantifying the relative importance of aerosol and dynamics on cloud properties in specific meteorological regimes are poorly constrained by observations in the Western North Atlantic boundary layer.

Low level clouds were measured during the Aerosol Cloud meTereology Interactions oVer the western ATlantic Experiment (ACTIVATE) campaign in winter and summer 2020. The two NASA LaRC research aircraft HU-25 Falcon and UC-12 B-200 King Air conducted 35 simultaneous flights to investigate aerosol-cloud interactions of maritime clouds and their impact on radiation. Number concentration, liquid water content, ice water content, and particle size distribution in the size range of 3 µm to 1460 µm in diameter were measured with the fast forward scattering cloud probe (FCDP) and 2-dimensional optical array imaging probe (2D-S) onboard the Falcon. Here, we present an overview of late winter (February-March) and late summer (August-September) oceanic cloud properties in the region 65°W to 80°W and 30°N to 40°N. We compare cloud properties in these two seasons and investigate their dependence on meteorological parameters and aerosol abundance. In a case study, we present cloud observations in a cold air outbreak event on 1 March 2020 with a specific focus on mixed-phase clouds.