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The boundary layer of the remote southeast Atlantic is often smoky and other recent findings from the LASIC campaign

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From June 1, 2016 through October 31, 2017, the DOE ARM Mobile Facility 1 characterized the aerosol and cloud structure during two biomass-burning aerosol seasons to unprecedented detail over Ascension Island (14W, 8S). The island is subject to the outflow of biomass-burning aerosol from continental Africa, over 1500 km away, from approximately July to November and is located within warm ocean waters that encourage trade-wind cumulus within deep boundary layers. An early, unexpected finding is that smoke reaches the surface more often than not, at times reaching black carbon mass concentrations similar to those near fire sources on land. The synoptic variation is strong, with very clean surface conditions also occasionally present. The aerosol vertical distribution shifts, broadly, from one weighted towards the surface to more in the free-troposphere, from July to November. Free-tropospheric aerosol, when present, is typically in contact with the uppermost cloud layer. Filter-based estimates indicate more shortwave absorption and lower single-scattering albedos earlier in the boreal summer for the same black carbon mass, indicating changes in the composition of the accompanying (e.g., brown) carbon. The event with the highest aerosol loading is explained by a direct transport into the boundary layer of smoke from the continent, but this transport pathway is otherwise atypical. The boundary layer is deeper when smoke is present near the surface and more well-mixed, with a stronger diurnal cycle in the boundary layer potential temperature. The non-precipitating low cloud fraction decreases when smoke is present in the boundary layer (a cloud 'burn-off' response). In summary the new observations indicate an aerosol-cloud regime that is extensive and with the potential to demonstrate unanticipated aerosol-cloud interactions.