Impact of BBA on the radiative budget, cloud properties and climate over the Tropical Africa.

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The central Africa represents ~50 % of emitted Biomass-Burning Aerosols (BBA) worldwide mostly produced during the long dry season between June to September. A unique feature of these BBA layers is their ability to strongly absorb solar radiation, thereby affecting the radiative balance, cloudiness and precipitation in different complex ways when compared to nonabsorbing particles. By overlying the quasi-permanent stratocumulus clouds over the South-East Atlantic (SEA), these absorbing smoke aerosols transported over the ocean may produce an intense (warming) positive direct effect, of opposite sign to the classical cooling effect of anthropogenic particles. In addition, such absorbing BBA could have important impacts on low-cloud stratocumulus properties over the SEA related to the impact of induced solar radiative heating on the relative humidity and temperature profiles via the semi-direct effect (SDE). In addition to these effects on radiation and clouds, BBA can also affect atmospheric stability, circulation, and precipitation and have the potential to inhibit convection with implications on the hydrological cycle. In recent studies, we have analyzed these different effects by first investigating the ability of CMIP6 climate models to represent the direct radiative forcing of smoke over this region. The SDE of BBA and possible feedback's on circulation and precipitation have been then explored using the ARPEGE global climate model. Finally, the role and sensitivity of the sea surface temperature (SST) response has also been studied using ARPEGE coupled Ocean-Atmosphere simulations. Examples of results from these different works will be presented.

Keywords: biomass-burning aerosols, direct radiative forcing, low-level clouds, global climate model