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Modeling study of biomass burning effects on the climate over SWA during summer monsoon

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Biomass burning aerosol has attracted lot of attention as it has some detrimental effects on the climate through its radiative properties. Long-range transport of biomass burning aerosols from central Africa reaching South West Africa (SWA) coastal region has been well documented. It has been shown that the biomass burning aerosols influences the atmospheric composition over SWA mainly over the coastal cities. Therefore there is a need to investigate the impact of these biomass burning aerosols on the SWA climate. This is where our study sets in. We investigated the effects of biomass burning on surface temperature, radiation, precipitation and atmospheric circulation over SWA using COSMO-ART a regional climate model coupled with an aerosol module. We compare two set of simulations with and without biomass burning emissions for a three day case study (5-7 July 2016) during the summer monsoon covering SWA. The primary finding of this study is a reduction of surface shortwave radiation up to about 60 W m-2 south over the Gulf of Guinea and SWA cities where the maximum of biomass burning aerosol is located. This induces a slight decrease of surface temperature mainly south of 8° N. An increase of shortwave radiation as well as surface temperature over the northwest and north is simulated where less clouds are presents. Previous studies suggested that less clouds allow more shortwave radiation reaching the surface and the extinction due to biomass burning aerosol is lower over that area of the domain. Precipitation is slightly reduced due to cooling effect of biomass burning averaged over the domain. Analyzing a cross section of the wind averaged between 9W-4E we found a slight weakening of the wind speed over the Gulf of Guinea between 3-5° N and also aloft. At the same altitude the maximum biomass burning aerosol is found suggesting that biomass burning aerosols induce a reduction of the wind speed. In the PBL this might lead to a reduction of the amount of moisture over the region explaining the slight decrease in precipitation.