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Uncertainties in biomass burning emission estimates and their impact on air pollution model predictions over Africa

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Africa is the biggest continental source of biomass burning (BB) emissions. The large fluxes of chemical pollutants and aerosol emitted during intense BB events can strongly alter tropospheric chemistry and cloud dynamics and can result in widespread air pollution. Available BB emission inventories differ in terms of satellite sensor data and assumptions and methodologies used to estimate emission fluxes, and show substantial differences in emission totals and spatial and temporal patterns. The omission of small fires (<100 ha) by most satellite products is one key factor on the accuracy of the emission inventories.

The ESA Fire_CCI project has released the first burned area product for Africa from 20 m Sentinel satellite information (FireCCISFD11). Here we present new BB emission estimates for Africa based on FireCCISFD11. By resolving small fires, this inventory (Fire_CCI) yields 60 to 110% higher burning rates in 2016 than the MODIS-based products such as GFED4s, GFED4, MCD64A1 Collection 6, FireCCI51 and FINN. We perform WRF-Chem model simulation with three BB emission inventories (FINN, GFED4s and Fire_CCI) for summer 2016 corresponding with the DACCIWA aircraft campaign, which took place in June-July 2016 over Africa. We investigate the impact of uncertainties in BB emission estimates on air pollution model predictions using measurements of chemical species and aerosols from DACCIWA, NO2 and CO data from OMI and MOPITT satellites, respectively, and ground-based AOD observations from the Aeronet network. We furthermore assess the ability of the model in terms of the representation of transport of BB air masses and of the representation of chemical composition in such plumes.