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Airborne measurements of trace gas emissions from African biomass burning during the MOYA Campaign

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Biomass burning (BB) is known to contribute significantly to the global budgets of atmospheric trace gases and aerosols. Approximately 1.6–4.1 Pg of CO_2, 11–53 Tg CH_4 and 0.1–0.3 Tg of N_2O is emitted to the atmosphere per year as a result of biomass burning on a global scale (Crutzen and Andreae, 2016). The contribution of BB to global GHG budgets is likely to increase over time due to climate feedback of warming and more widespread drought conditions increasing the likelihood and spread of wildfire events (Liu et al., 2014).

It is estimated that Africa accounts for approximately 52% of all BB carbon emissions, with the Northern Sub-Saharan African region alone accounting for 20-25% of global BB carbon emissions (van der Werf et al. 2010; Ichoku et al. 2016). Many of these fires are anthropogenic in origin, and occur for reasons such as clearing land for agricultural use, management of natural savannah vegetation, or as pest control (Andreae, 1991). Despite the African contribution to global BB emissions, there are limited in situ studies of African wildfire emissions.

In situ measurements of CH_4, CO_2 and N_2O and CO in biomass burning plumes were carried out in Senegal in February 2017 and in Uganda in January 2019 during the Methane Observations and Yearly Assessments (MOYA) project. These observations were carried out using the Facility for Airborne Atmospheric Measurements BAe-146 Atmospheric Research Aircraft (ARA), which is fitted with a range of specialist instrumentation for in situ trace gas sampling. Emission factors for these species were calculated for both near-field and far-field biomass burning plumes. A notable difference in the linear trend between methane emission factors and completeness-of-combustion was identified between Senegalese and Ugandan fires.