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Emission characteristics of atmospheric pollutants from field-scale crop residue burning in Northeast China

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Crop residue burning in china increased significantly in the last decade, especially it took up a majority in Northeast China, which plays an important role of severe haze pollution. Hence, two main types of crop residues (corn and rice straw) were chosen to characterize the particle number concentration, chemical components of fine particulate matter and optical properties of carbonaceous aerosols by a suite of fast-response online portable instruments, together with offline sampling and analysis, during the field-based combustion experiments in Northeast China. For the range of 0.25 and 2.5 μm, more particles were emitted from rice straw burning than those from corn straw burning, and the time-averaged number concentration of particles during the flaming process was approximately 2 times higher than that during the smoldering process for these two straws. Organic carbon (OC), elemental carbon (EC) and water-soluble ions were the most abundant components and accounted for 42.5±7.5%, 7.7±1.7% and 18.0±3.4% of the $PM_{2.5}$, respectively. Furthermore, rice straw burning emitted higher OC and lower Cl^- and K^+ than those from corn straw burning. The average absorption Ångstro□m exponent (AAE) of carbonaceous aerosols was 2.1±0.3, while the AAE of brown carbon (BrC) was 4.7±0.4 during the whole burning process. On average, BrC contributed to 63% and 20% of the total light absorption at 375 nm and 625 nm, respectively. Parameterization of BrC absorption revealed that the fraction of absorption from BrC has a reasonably good correlation with EC/OC (-0.84) and AAE (0.94) at 375 nm. Generally, combustion conditions can affect the optical properties of carbonaceous aerosols, and a negative correlation (-0.77) was observed between the AAE and modified combustion efficiency; in addition, the percentage of absorption due to BrC were lower at the flaming phase. To explorer the spatial and temporal variability of open agricultural burning in Northeast China from 2014 to 2019, the emission inventory of key gaseous and particle pollutants was established, which derived from a combination of geostationary (Himawari) and polar (VIIRS) orbiter fire radiative power products.