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Evidence for a stronger global impact of fire on atmospheric composition

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Toward the development of the 5th generation of the Global Fire Emission Database (GFED5), we provide evidence for a significantly higher level of contemporary global fire emissions than what has been reported in previous inventories, as a result of advances in our understanding of burned area, fuel consumption, and emission factors. Increases in the availability of high-resolution burned area datasets from Sentinel and Landsat now allow for more effective estimation of fire scars associated with small and discontinuous fires in many biomes. By combining these regional-scale datasets with burned area and active fire observations from MODIS, we estimate that global burned area exceeded 700 Mha per year during 2001-2020. This estimate is more than 40% higher than previous estimates from GFED4 with small fires (GFED4s), mostly as a consequence of increases in savanna and grassland burning across Africa, South America, and Southeast Asia. At the same time, more extensive field observations in boreal forest ecosystems provide evidence for higher levels of fuel consumption than has been integrated into previous regional and global inventories. New emission factor observations from tropical peatlands and boreal forests provide evidence for a stronger smoldering phase of emissions, elevating emissions of carbon monoxide and organic carbon aerosol. Together, these advances suggest the impact of contemporary wildfires may have been underestimated in past work; we conclude by exploring the compatibility of this inventory with atmospheric aerosol and trace gas observations using a global atmospheric chemistry model.