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Fire pollution for preindustrial, present day and future conditions in an interactive Earth System Model

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A climate model with prognostic biomass burning allows us to study the drivers, feedbacks, and interactions of fire in time periods outside of the satellite era. As recent works have shown (e.g. Westerling et al., 2006; Veira et al., 2016) a region's fire activity is sensitive to changing temperatures and the arrival of spring, i.e. a changing climate. Other than regulating the atmospheric carbon monoxide budget, fires release to the atmosphere a suite of reactive gases and aerosol particles that affect air quality. We set out to study fire pollution of different regions in the world under different climate conditions by further developing the GISS fire model (Pechony and Shindell, 2009, 2010). We correlated the modeled flammability with MODIS fire counts, in a vegetation specific parameterization, which allowed us for the first time to interactively simulate climate and fire activity with GISS-ModelE2.1. Biomass burning occurrence was driven by environmental factors such as vapor pressure deficit and precipitation, as well as natural and anthropogenic ignition. With this new method we were able to attribute the source of the fire to either natural or anthropogenic origin. Present day results were evaluated against GFED4 data. Our results indicate that fire pollution is high in all time periods, but expected to play a bigger role in the future. We also show that humans play an important role in the spatial distribution of fire activity, and in curbing fire pollution.