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INFERNO, a simple approach for interactive fires and their emissions within the Met Office Unified Model

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Forest fires remain a crucial element of the Earth system, affecting and affected by the biosphere and the atmosphere. In particular emissions of trace gases (CO_2, CO, NO_x...) from forest fires can affect radiative forcing as well as atmospheric composition, similarly aerosols such as Black Carbon (also a strong sunlight absorber) and Organic Carbon emitted by fires can participate in cloud droplet nucleation, contributing to the aerosol indirect effect. Global estimates of fire emissions have greatly improved over the last decade, mainly through the developments in satellite observations. However, such estimates remain constrained to the recent satellite observational period; to study fires under past and future climates one has to resort to models. We will present the INteractive Fire and Emission algoRithm for Natural envirOnments (INFERNO) scheme for the Met Office's Unified Model, which builds on previous work for the GISS climate model. We start from simulated fire counts using proxies for flammability (meteorology and vegetation), ignitions and fire suppression. We then extend this parameterisation to predict burnt area, burnt biomass and subsequent emissions. This climate-sensitive parameterisation utilises temperature, relative humidity, precipitation and vegetation modelling (biomass and leaf area index) to model flammability. Ignitions depend on population density and lightning strikes. Of all these variables, only population density needs to be prescribed, hence INFERNO can be run interactively within a coupled earth system model. Our approach is also distinct owing to its simplicity and is computationally inexpensive, a necessary characteristic as it is aimed to run interactively over climatological timescales. The performance of this scheme is assessed against the Global Fire Emissions Database (GFED); early analysis shows this new approach effectively captures the spatial and interannual variability of burnt area and fire emissions of CO_2 and CO over the 2003-2011 present-day period. We will also provide early estimates of the sensitivity of fires in our model to meteorology.