5.005 Wildfires in a warmer climate: Emission fluxes, emission heights and black carbon concentrations in 2090-2099.

Early Career Scientist

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Abstract:

While there is consensus about a future decrease in carbonaceous aerosol emissions from anthropogenic sources, the future trend in aerosol emissions from wildfires is much more uncertain. Previous studies indicated that global warming could significantly increase wildfire activity in the 21st century, but the complex links between future changes in emission fluxes, emission heights and aerosol long-range transport remain to be quantified.
In this study, we use the process-based fire model SPITFIRE within the global vegetation model JSBACH to simulate wildfire activity for present day climate conditions and different future Representative Concentration Pathways (RCPs). Simulated fire emissions serve as input for the aerosol-climate model ECHAM6-HAM2, which has been extended by a semi-empirical plume height parametrization.
In our presentation, we will show that, compared to present day climate conditions, the modelled changes in emission fluxes for the period 2090-2099 are most pronounced for the strongest warming scenario RCP8.5 (-37% in the tropics, +49% in the extra-tropics). Tropospheric Black Carbon (BC) concentrations are similarly affected by changes in emission fluxes and changes in climate conditions with regional relative variations of -50% to +100%. In the vicinity of the major extra-tropical biomass burning regions the enhanced wildfire emission fluxes in turn introduce a distinct increase in Aerosol Optical Thickness (AOT). Due to the compensating effects of fire intensification and more stable atmospheric conditions, simulated future changes in mean emission heights do not exceed 0.3km.
Overall, we conclude that the radiative impact of the expected future increase in wildfire activity is of a similar magnitude like the opposed radiative impact introduced by a decrease in anthropogenic BC emissions. Changes in emission heights, however, are of minor importance.