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# Estimation of boreal fire emissions under future climate scenarios and their impacts on Arctic atmospheric composition

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As climate in the boreal regions warms, wildfire frequency and intensity in these areas are believed to increase. This leads to increased summer-time emissions of short-lived pollutants (SLP) that can reach the Arctic. These emissions can affect Arctic climate, e.g. by altering the concentrations of aerosol and tropospheric ozone and its precursors, leading to changes in local radiation fluxes and heat transport, causing further warming of the boreal regions. These processes may constitute an important Earth system feedback element in the global climate.

Here, we investigate potential feedbacks between climate, boreal fires and short-lived pollutants over the Arctic region using output from CMIP5 climate simulations, a 3D global chemistry transport model (CTM) and a statistical model. The CMIP5 simulations constitute a coherent set of climate experiments using an ensemble of several world-leading coupled ocean-atmosphere general circulation models, driven using the same scenarios for emissions and greenhouse gas forcings. These allow us to apply estimates of near-future (2035) and end of century (2100) climate from several models to estimate future boreal fire activity.

To evaluate how future climate conditions will affect the frequency and intensity of boreal fires we use a statistical model based on that used by Crevoisier et al. (2007). Within this model, climatological variables (precipitation, humidity, soil moisture and snow cover) and anthropogenic variables (road density) are used to predict area burned in boreal wildfires, tuned to present day using observations. Output from the CMIP5 climate models corresponding to future scenarios is used to predict future boreal wildfire and subsequent emissions from the statistical model. The contribution of these emissions to future Arctic pollution is then estimated by including them in the 3D CTM TOMCAT. The off-line CTM simulations are driven by the meteorology from the same CMIP5 climate simulations used to obtain our fire emissions. By employing a full-chemistry CTM we can also evaluate how the future boreal fire emissions will affect chemistry of climatically-relevant trace gases such ozone and methane, which play fundamental roles within the Earth System.