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SHORT ABSTRACT

Abstract title: The effect of aerosol from biomass burning on meteorology and air quality over the UK

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Abstract text *(maximum 350 words.)*

Wildfires in the United Kingdom are not on the scale of other countries, but awareness is increasing because high impact wildfires do occur, especially in drought years. Most fires affect small areas, particularly on heathlands and peatlands, but they can still have a high impact if they occur at the rural-urban interface. Climate projections show that probabilities to have a wildfire will increase globally.

It is well known that air quality is worsen during wildfires due to emission of particulate matter (PM) and other gaseous pollutants.

Atmospheric aerosol can absorb or scatter the incoming solar radiation and this effect is known as aerosol direct effect. Here we further investigated the impact of the direct effect on surface PM concentrations, via changes to the radiation, boundary layer height, temperature etc. Previous studies have already investigated this topic, but a study like this has never been done for the United Kingdom, where we have different meteorology and smaller wildfires.

To better understand these processes, we used the Met Office on-line air quality model, which is currently operated with a 12-km horizontal resolution grid. We investigated the importance of the aerosol direct effect during UK wildfire events using simple prescribed or satellite-based wildfire emissions inventories. We focused on the Saddleworth Moor wildfires (June 2018) that had a large impact since the smoke was transported towards the highly populated area of Greater Manchester. We found very small effects, which we attributed to the coarse resolution of the model. The experiments were repeated using with a higher 2 km resolution model, where we found a more significant effect. This set-up simulates the new generation Met Office air quality model, which is likely to use a grid resolution of 1-2km. We found a difference in surface biomass burning aerosol concentration ranging from -5 to +5 μgm^{-3} and a decrease in surface short wave incoming radiation up to 100 Wm^{-2}.

The outcome of this project will help to outline the future model development priorities: in particular, whether it is required to include these fire-generated feedback mechanisms in an operational model.