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Assessing the impact of open biomass burning on UK air quality

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Abstract: Wildfires are a fundamental part of the Earth's ecosystem. However, climate change and other factors such as population and land-use changes are affecting propensities for fire around the globe, posing an increasing risk to humans and the environment.

Some regions may become less vulnerable to wildfires, while others are likely to see an increase in wildfire frequency, magnitude and intensity. The latter includes many European regions, where changes have become apparent over the last decades. The UK, categorised as increasingly vulnerable to wildfire, is also likely to see increases in fire danger and duration (Arnell et al. 2021, Perry et al. 2022). A better understanding of the impact of wildfires, and more generally open biomass burning[1], is therefore crucial to pre-empting and mitigating the impact of wildfires in different environments.

The aim here is to gain an overview of the contribution of open biomass burning to UK air quality. While its absolute contribution is small compared to current conventional anthropogenic emissions, its relative contribution will become more important if increasingly stringent air quality targets are to be met in the future. Fine particulate matter ($PM_{2.5}$) is the pollutant considered here, due to its impact on human health and the ambitious new Air Quality Guideline values recently published by the WHO (2021), which include an annual $PM_{2.5}$ guideline level of 5 $\mu g\ m^{-3}$.

The EMEP4UK chemistry transport model (Vieno et al. 2016) is used, over a European domain and a nested UK domain with 3 km x 3 km horizontal resolution. Emissions from open biomass burning are included using the Fire INventory from National Center for Atmospheric Research (FINN) v1.5.

We quantify the magnitude of modelled surface concentrations and identify sources contributing to this, distinguishing between contributions from burning within and outwith the UK, and between primary and secondary $PM_{2.5}$. We also aim to distinguish between contributions from wildfires and prescribed burning. UK-wide averages and individual episodic events are considered, with comparison to other emission sources and future air quality targets. Comparison of modelled vs observed concentrations of $PM_{2.5}$, including detailed speciated particulate matter data, will be undertaken with data from UK air quality supersites.

References

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[1] 'Open biomass burning' is defined here as wildfires, prescribed burning and agricultural burning.

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