

With several locations in the UK having broken the 40°C barrier for the first time in history in the hot, dry summer of 2022, it is clear that anthropogenic climate change is loading the dice towards more frequent and intense heatwaves. Light winds overnight, and cooling and contraction of the boundary layer under the anticyclones that tend to initiate these heatwaves, help to trap pollutants such as particulates worsening ground level air quality. Resulting from the increases in these summer anticyclonic conditions and the heatwaves they bring, there are likely to be a number of additional factors adversely affecting air quality, especially in urban areas.

Ozone pollution episodes are likely to become more frequent, for a number of reasons. Firstly, more frequent 'blocking high' anticyclones due to climate change induced slowing of the jet stream, as we have seen in recent years during the summer, are likely to lead to more frequent heatwaves during summer, which will potentially last for longer and become more intense at their peak. This will be especially true for urban areas where the heat island effect exacerbates the situation. The combination of heat and intense sunshine helps to generate ground-level ozone in the first instance. Secondly, as the vehicle fleet becomes ever cleaner with ongoing incremental reductions in tailpipe NO_x emissions and electrification, there could be less NO_x available in a NO_x-limited regime, leading to a build-up of ozone to the greater levels sometimes seen nearer the cleaner coastal areas. However, NO₂ concentrations are likely to continue their downward trend as a result of the reduction in tailpipe NO_x emissions and ongoing fleet electrification.

Drier, hotter summers in general and more frequent droughts will lead to drier ground and soil conditions, which could increase wind-blown airborne particulate matter – especially coarse mode – from urban parks and gardens, but is likely to also increase ambient PM_{2.5} concentrations. These weather and climatic conditions could make it harder for construction sites to manage dust and coarse PM emissions via dust suppression measures, especially those that require the use of water, which under drought conditions may also become more restricted.

The risk from grassland, moorland and forest fires in the UK continues to amplify under climate change in the UK, as increasing temperatures and longer stretches of dry weather, particularly in spring and summer, dry out vegetation and allow accidental and naturally occurring fires to ignite more easily, and spread more quickly. These will help generate pockets of locally poor air quality from particulate matter and black carbon, and if they spread further and burn for longer, they could affect larger areas.

Unfortunately, the same weather patterns delivering more prolonged sunshine and heat to the UK, as we have seen recently, are likely to lead to a greater incidence of forest and grass fires on the near continent, and the smoke plumes from these could drift towards the UK under the right wind patterns, worsening air quality across both rural and urban areas. Recent years have seen incidences of widespread poor air quality due to wildfire smoke in places such as California and the south-western United States in particular, which could become an increasing phenomenon across Europe.

However, as the continued roll-out of cleaner sources of energy, such as solar photovoltaic arrays, generate a greater proportion of Europe and the UK's energy needs in summer, there should be a corresponding decline in energy production from the dirtiest sources for air pollution, such as coal and biomass, and similarly, it is anticipated that industry and transport will follow a similar trajectory towards cleaner sources of fuel and electrification, which should prove beneficial on both a local and a regional scale.