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# Isoprene measurements in an oak-dominated forest during the 2018 heatwave in the UK

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Global change over the next decades, and in particular increasing temperatures, are expected to profoundly affect the emissions of isoprene, one of the largest biogenic emissions on the planet (estimated 300-700 TgC year$^{-1}$, *cf.* $\sim$500 TgC year$^{-1}$ from $CH_4$). A better understanding of how isoprene emissions will change in the near future is crucial for an accurate characterisation of the composition and oxidising capacity of the lower atmosphere, which ultimately affect air quality and climate. In particular, an improved description of the canopy-to-atmosphere exchange for isoprene is highly desirable, along with the characterisation of emission changes in response to extreme events such as droughts and heatwaves, both of which are predicted to become more frequent.

In this work we describe the deployment of the iDirac, an autonomous, custom-built portable gas chromatograph with photo-ionisation detection (GC-PID) to measure isoprene concentrations in Wytham Woods (UK) in summer 2018. Wytham Woods is Oxford University's research forest and is dominated by European oaks (*quercus robur*), one of the strongest isoprene emitters in mid-latitude/temperate regions. Taking advantage of the treetop walkway available onsite, isoprene abundances were measured continuously at four heights within, below and above the canopy during the whole 2018 growth season (May-Oct). Carbon dioxide concentrations, as well as a number of meteorological variables (temperature, relative humidity, photosynthetically active radiation (PAR) and wind) were also measured at various heights across the canopy. These continuous observations were complemented with occasional leaf gas exchange measurement and whole air samples, as well as with satellite retrievals of normalised difference vegetation index (NDVI) and photochemical reflectance index (PRI) for the area.

The measurement period overlapped with a long and uninterrupted heatwave in the UK (22/06/18-08/08/18), characterised by unusually high temperatures and virtually no rainfall. Our observations show a strong correlation of isoprene with temperature and PAR for most of the summer, with daily peak isoprene concentrations during the early heatwave higher than those before and after the heatwave by up to a factor of 5. The lack of precipitation during the heatwave allows an assessment of the effects of prolonged drought on isoprene emissions, using NDVI and PRI as an indicator of ecosystem health. We observe a large decrease in isoprene emissions during the August heatwave which was coincident with changes in NDVI and PRI. Further analysis of the data from this measurement campaign will be discussed, along with modelling approaches and the wider implications of future scenarios with more frequent heatwaves.