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The European budget of isoprene and monoterpene emissions and its change since the Last Glacial Maximum

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Volatile organic compounds emitted from the terrestrial biosphere (BVOC) play an important role in atmospheric processes. BVOC species are oxidized in the atmosphere and influence levels of ozone. BVOCs that are less volatile, as well as their oxidation products, can be important for the formation of biogenic aerosol. Both effects influence the earth's radiation balance and thus climate, but in polluted atmospheres they can affect human health as well.

In this study we present a novel simulation of the changes in BVOC emissions (isoprene, monoterpenes) from the Last Glacial Maximum (LGM) to the present as derived from the dynamic changes in species distribution of the main European tree species. These simulations were performed with a dynamic vegetation model, driven with climate anomalies from model simulations and reconstructed CO_2 concentrations.

We can quantify three main driving factors for the changes in emissions of isoprene and monoterpenes since the LGM: (1) The changes in climate, with temperature changes as most important factor affecting plant physiology and terpenoid production, (2) a change in species distribution related to the changes in climate, causing local shifts in emission characteristics of the vegetation, and (3) a change in CO_2 concentration, causing opposing effects on the availability of different substrates for terpenoid production. Particularly the effect of atmospheric CO_2 concentration is uncertain, and sensitivity simulations showed a strong dependence of the emissions on the application of a CO_2 inhibition.