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CO2 suppression, land use change, and anthropogenic forcing - impacts on isoprene and the chemical composition of the troposphere

R. Pike (1), J. Lathière (2), P. Young (1,4), O. Wild (1,3), D. Beerling (2), N. Hewitt (3), and J. Pyle (1)

(1) Centre for Atmospheric Science, Chemistry, Cambridge, United Kingdom (rachel.pike@atm.ch.cam.ac.uk), (2) Department of Animal and Plant Sciences, University of Sheffield, Alfred Denny Building, Western Bank, Sheffield, S10 2TN, UK, (3) Department of Environmental Science, Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, UK, (4) NOAA/ESRL, 325 Broadway R/CSD8, Boulder,CO , 80305, USA

As the main source of volatile organic compounds (VOCs), the terrestrial biosphere plays a key role in tropospheric chemistry processes. Isoprene emissions, which contribute to more than half of biogenic VOC emissions, are controlled by climate conditions (temperature, radiation), vegetation characteristics (plant type, leaf area, soil moisture), as well as by the chemical composition of the atmosphere (impact of CO2 variation on plant emission capacity, for example). In the future, changes in climate, land-use, vegetation distribution and atmospheric CO2 concentrations are likely to affect significantly the isoprene emission level and, consequently, could have strong impact on the chemical composition of the atmosphere.

In this study, a biogenic emission scheme based on recent knowledge is used to provide estimates of isoprene emissions for the present-day and the future (2100) using climate forcing from the Unified Model and vegetation characteristics calculated by the Sheffield Dynamic Global Vegetation Model. The impact of changes in isoprene emission on the chemical composition of the troposphere is then investigated using the UK Chemistry and Aerosol community model, with special attention paid to ozone production and loss. A suite of integrations evaluate relative contributions of land use change, CO2 suppression of isoprene emissions, and anthropogenic emissions scenarios to future changes in the oxidising capacity of the atmosphere.