

2.069 Including the biogeochemical impacts of deforestation increases projected warming of climate.

Early Career Scientist

Presenting Author:

Catherine Scott, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK, c.e.scott@leeds.ac.uk

Co-Authors:

Sarah Monks, Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado, USA. & Chemical Sciences Division, NOAA Earth System Research Laboratory, Boulder, Colorado, USA

Dominick Spracklen, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Stephen Arnold, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Piers Forster, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Alexandru Rap, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Ken Carslaw, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Martyn Chipperfield, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Carly Reddington, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Chris Wilson, Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK

Abstract:

Forests cover almost one third of the Earth's land area and their distribution is changing as a result of human activities. The presence, and removal, of forests affects the climate in many ways, with the net climate impact of deforestation dependent upon the relative strength of these effects (Betts, 2000; Bala *et al.*, 2007; Davin and de Noblet-Ducoudré, 2010).

In addition to affecting surface albedo and exchanging carbon dioxide (CO₂) and moisture with the atmosphere, vegetation emits biogenic volatile organic compounds (BVOCs), altering the formation of short lived climate forcers (SLCF) including aerosol, ozone and methane.

In this work, we combine a land-surface model with a chemical transport model, a global aerosol model, and a radiative transfer model to compare several radiative impacts of

idealised deforestation scenarios in the present day.

Here, we calculate that a scenario of complete global deforestation results in a radiative forcing (RF) of 1.37 W m^{-2} due to changes in well-mixed greenhouse gases, surface albedo, ozone and the direct and indirect effects of aerosol. We estimate that SLCFs contribute a RF of 0.11 W m^{-2} , 8% the net RF due to deforestation, with the positive aerosol direct (0.14 W m^{-2}) and indirect (0.19 W m^{-2}) effects partially offset by the negative RF from changes to ozone (-0.15 W m^{-2}) and methane (-0.08 W m^{-2}). We estimate that the positive RF from SLCFs increases the net warming impact from global deforestation by approximately 0.05 K, suggesting that deforestation has a stronger warming impact on climate than previously thought.

References:

Bala, G. *et al.*, 2007, PNAS, 104, 6550-6555.

Betts, R. A. 2000, Nature, 408, 187-190.

Davin, E. L. & De Noblet-Ducoudré, N. 2010, Journal of Climate, 23, 97-112.