

JAMES WEBER

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ACADEMIC POSITIONS

Postdoctoral Research Associate

November 2021 - Present

Leverhulme Centre for Climate Change Mitigation, Department of Biosciences, University of Sheffield

EDUCATION

Pembroke College, University of Cambridge

October 2018 - October 2021

Vice-Chancellor's Award, Cambridge Trust

PhD in Climate-Chemistry Interactions

Centre for Atmospheric Science, Department of Chemistry

Pembroke College, University of Cambridge

September 2012 - June 2016

Natural Sciences (Chemistry) MA, MSci.

First Class

RESEARCH - Influence of biogenic volatile organic compound emissions on climate

As an atmospheric chemist and climate scientist I am interested in how the chemical composition of our atmosphere is changing and how this will affect climate. My current research focuses on the non-CO₂ climate impacts of wide scale tree planting as climate change mitigation strategy through changes to the emissions of biogenic volatile organic compounds (BVOCs). I use the state-of-the-art chemistry-climate model UKESM (United Kingdom Earth System Model) to explore how changes to tree cover could affect atmospheric composition and climate. More information is available at jm-weber.github.io.

I have developed and published a new chemical mechanism, suitable for UKESM, describing how certain BVOCs can produce aerosol. I have also incorporated a state-of-the-art chemical mechanism into the Met Office model and shown how the updated chemistry improves the model's ability to reproduce performance against observation for several key gases. The final section of my PhD examined how different chemical mechanisms affect the feedback of BVOC emissions on climate with a focus on gas and aerosol-phase processes.

I am also a co-author on a study from the international climate model inter-comparison project (CMIP6) which serves as an evidence base for the IPCC and have published a study looking at how emissions change due to the COVID19 lockdown affected climate.

ACADEMIC ACHIEVEMENTS & AWARDS

- 2021 1st Prize Final Year PhD Physical Chemistry Showcase Talk, Department of Chemistry
- Vice-Chancellor's Award, Cambridge Trust
- 2016 Undergraduate Chemistry Symposium, University of Cambridge - 1st Prize
- 2016 Unilever Prize for best Physical Chemistry MSci research project, Department of Chemistry
- 2016 Norrish Prize for distinction in Physical Chemistry in 4th Year, Department of Chemistry
- Foundress and College Scholarships, Pembroke College (2014, 2015, 2016)
- 1st Class Exam Results in 2nd-4th Year of undergraduate degree, placed 4th overall in 4th Year

PUBLICATIONS AND ARTICLES IN REVIEW

Weber, J., Archer-Nicholls, S., Abraham, N. L., Shin, Y. M., Griffiths, P., Grosvenor, D.P., Scott, C.E., & Archibald, A.T. (2022): Chemistry-driven changes strongly influence climate forcing from vegetation emissions. *Nature Communications*, in review.

Russo, M. R., Kerridge, B. J., Abraham, N. L., Keeble, J., Latter, B. G., Siddans, R., Weber, J., Griffiths, P. T., Pyle, J. A., and Archibald, A. T. (2022): Seasonal, interannual and decadal variability of Tropospheric Ozone in the North Atlantic: Comparison of UM-UKCA and remote sensing observations for 2005–2018, *Atmos. Chem. Phys. Discuss.* [preprint], <https://doi.org/10.5194/acp-2022-99>, in review.

Abraham, N.L., et al (2021) Unified Model Documentation Paper 084: United Kingdom Chemistry and Aerosol (UKCA) Technical Description

Weber, J., Archer-Nicholls, S., Abraham, N. L., Shin, Y. M., Bannan, T.J., Percival, C.J., Bacak, A., Artaxo, P., Jenkin, M., Khan, M.A.H., Shallcross, D.E., Schwantes, R.H., Williams, J., & Archibald, A.T. (2021): Incorporation and evaluation of the CRI v2.2 chemical mechanism in UKESM1: An alternative mechanism with updated isoprene chemistry improves modelled surface isoprene and monoterpene concentrations. *Geoscientific Model Development*.

Archer-Nicholls, S. & Weber, J. The Conversation: Why lockdown had little to no effect on global temperatures. Oct 2020, 35K views. The article is available at this [link](#).

Archer-Nicholls, S., Abraham, N. L., Shin, Y. M., Weber, J., Russo, M.R., Lowe, D., Utembe, S., O'Connor, F.M., Kerridge, B., Latter, B., Siddans, R., Jenkin, M., Wild, O., & Archibald, A.T. (2020): The Common Representative Intermediates Mechanism version 2 in the United Kingdom Chemistry and Aerosols Model, *Journal of Advances in Modeling Earth Systems*.

Staunton-Sykes, J., Aubry, T. J., Shin, Y. M., Weber, J., Marshall, L. R., Abraham, N. L., Schmidt, A., and Archibald, A (2020): Co-emission of volcanic sulfur and halogens amplifies volcanic effective radiative forcing, *Atmospheric Chemistry & Physics*.

Weber, J, Archer-Nicholls, S, Griffiths, P, Berndt, T, Jenkin, M, Gordon, H, Knote, C & Archibald, A, T. (2020) CRI-HOM: A novel chemical mechanism for simulating Highly Oxygenated Organic Molecules (HOMs) in global chemistry-aerosol- climate models. *Atmospheric Chemistry & Physics*

Weber, J, Shin Y. M, Stauton-Sykes, J, Archer-Nicholls, S, Abraham, N & Archibald, A, T. (2020) Minimal climate impacts from short-lived climate forcers following emission reductions related to the COVID-19 pandemic. *Geophysical Research Letters*

Weber, J (2020) Afforestation's potential to help Cambridgeshire reach net-zero carbon emissions by 2050: a quantitative study. *Cambridge Journal of Science and Policy*.

Thornhill, G., Collins, W., Olivié, D., Archibald, A., Bauer, S., Checa-Garcia, R., Fiedler, S., Folberth, G., Gjermundsen, A., Horowitz, L., Lamarque, J.-F., Michou, M., Mulcahy, J., Nabat, P., Naik, V., O'Connor, F. M., Paulot, F., Schulz, M., Scott, C. E., Seferian, R., Smith, C., Takemura, T., Tilmes, S., & Weber, J. (2020): Climate-driven chemistry and aerosol feedbacks in CMIP6 Earth system models. *Atmospheric Chemistry & Physics*.

CONFERENCES & PRESENTATIONS

European Geophysical Union - May 2022 Climate feedback from vegetation emissions strongly dependent on modelling of atmospheric chemistry.

Invited Speaker: Centre for Atmospheric Science, University of Cambridge - May 2022 The role of chemistry and oxidants on the forcing from vegetation emissions and the next steps for understanding the atmospheric composition changes and forcing from widespread tree planting.

Invited Speaker: Princeton University Climate Seminar - February 2022 Chemistry-driven oxidant changes strongly influence climate feedback from vegetation emissions.

Plants, Photosynthesis & Soil Research Cluster, University of Sheffield - December 2021 Linking the biosphere and atmosphere: The influence of plant emissions on the atmosphere's chemical composition and climate.

TriMIPathlon (AerChemMIP, PDRMIP & RFMIP) - December 2021 Climate feedback from vegetation emissions is strongly dependent on simulated chemistry.

NCAS ECR Research Forum - November 2021 Climate feedback from vegetation emissions is strongly dependent on simulated chemistry.

Co-chair & Presenter 2nd Virtual UKCA Science Meeting - July 2021 Incorporation and evaluation of the CRI v2.2 chemical mechanism in UKESM1: An alternative mechanism with updated isoprene chemistry for investigating the influence of BVOCs on atmospheric composition and climate.

Royal Meteorological Society Atmospheric Science Conference - June 2021 Incorporation and evaluation of the CRI v2.2 chemical mechanism in UKESM1: An alternative mechanism with updated isoprene chemistry for investigating the influence of BVOCs on atmospheric composition and climate.

European Geophysical Union - April 2021 Incorporation and evaluation of the CRI v2.2 chemical mechanism in UKESM1: An alternative mechanism with updated isoprene chemistry for investigating the influence of BVOCs on atmospheric composition and climate.

Faraday Joint Interest Group Conference - March 2021 CRI-HOM: A novel chemical mechanism for simulating Highly Oxygenated Organic Molecules (HOMs) in global chemistry-aerosol- climate models.

Met Office, AerChemMIP Work Group - February 2021 Incorporation and evaluation of the CRI v2.2 chemical mechanism in UKESM1: An alternative mechanism with updated isoprene chemistry for investigating the influence of BVOCs on atmospheric composition and climate.

American Geophysical Union - December 2020 Minimal climate impacts from short-lived climate forcers following emission reductions related to the COVID-19 pandemic

American Geophysical Union - December 2020 CRI-HOM: A novel chemical mechanism for simulating Highly Oxygenated Organic Molecules (HOMs) in global chemistry-aerosol- climate models

Atmospheric Chemical Mechanisms - Principal Presentation November 2020 Minimal climate impacts from short-lived climate forcers following emission reductions related to the COVID-19 pandemic

Atmospheric Chemical Mechanisms - Principal Presentation November 2020 CRI-HOM: A novel chemical mechanism for simulating Highly Oxygenated Organic Molecules (HOMs) in global chemistry-aerosol- climate models

Met Office, AerChemMIP Work Group - November 2020 Minimal climate impacts from short-lived climate forcers following emission reductions related to the COVID-19 pandemic

Aerosol, Clouds, Precipitation and Climate - April 2020 The Effect on Climate and Atmospheric Composition from non-CO₂ Anthropogenic Emission Reductions associated with the COVID-19 Pandemic.

Royal Society of Chemistry Environmental Chemistry Conference - Oct 2019 CRI-HOM: A novel chemical mechanism for simulating Highly Oxygenated Organic Molecules (HOMs) in global chemistry-aerosol- climate models.

TEACHING AND SUPERVISING

- **1st year Chemistry** - Molecular Structure, Kinetics, Thermodynamics, Organic & Inorganic Chemistry
- **3rd and 4th year Atmospheric Science** - Introduction to Stratospheric & Tropospheric Chemistry
- **MSci Project Supervisor** - Supervised 4th year undergraduate projects on:
 - Using observational data from aircraft to evaluate chemical mechanisms and machine learning approaches
 - Comparing modelled O₃ changes from the COVID19 pandemic to observations.
- **1st year Chemistry Laboratory Demonstrator** - Demonstrating for the Part IA practical course
- **UKCA Training Courses 2021, 2022** - Demonstrating the UKCA climate model and troubleshooting
- **University Bridging Courses** - Wrote several bridging courses in Chemistry and Maths for incoming Pembroke Natural Sciences undergraduates.

- **General Coding** - Taught coding in Python to students and staff at the University of Sheffield.

EMPLOYMENT & EXPERIENCE

Co-founder, Sequester Sequester collates data from tree carbon sequestration and allows users to calculate the CO₂ sequestration from a project, with the aim of increasing interest in this form of climate repair.

Co-founder, Oxbridge Science Academy OSA provides bridging courses for students progressing from high school to a Physical Sciences degree. Bridging courses were made available to incoming Natural Sciences students at Pembroke College in September 2019 in a pilot scheme.

Trainee Patent Attorney, Carpmals & Ransford LLP (2016 - 2017)

I was involved in patent prosecution and opposition on cases involving polymers and pharmaceuticals. Towards the end of my probation period I decided to pursue a PhD in climate science rather than continue my training.

EXTRA CURRICULAR AND PUBIC ENGAGEMENT

Cambridge Zero Research Symposium: Carbon Drawdown & Climate Repair

Investigating the effect of the COVID19 pandemic on climate. March 2021

Cambridge Zero Climate Change Festival

Investigating the effect of the COVID19 pandemic on climate. Nov 2020

Cambridge University Science and Policy Exchange report for Cambridgeshire County Council

How can Cambridgeshire can reach net-zero carbon emissions by 2050?

Report and recommendations were presented to councillors and adopted as as part of the evidence base for the Council's Climate Change Mitigation Strategy. Oct 2019

Rising Stars Programme

Public engagement programme covering presentation of scientific topics to non-specialist audiences. Culminated in running a stand at the Cambridge Science Festival encouraging children to think about climate change. March 2019

BlueSci Magazine

Atmospheric feedbacks and their influence on future climate. Jan 2019