

# JAMES WEBER

University of Sheffield, Sheffield, S10 2TN  
j.weber@sheffield.ac.uk  $\diamond$  jm-weber.github.io

## ACADEMIC POSITIONS

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### Postdoctoral Research Associate

*November 2021 - Present*

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

## EDUCATION

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### PhD in Atmospheric Chemistry

*October 2018 - October 2021*

Pembroke College, University of Cambridge  
Vice-Chancellor's Award, Cambridge Trust  
Centre for Atmospheric Science, Department of Chemistry

### Natural Sciences (Chemistry) MA, MSci

*September 2012 - June 2016*

Pembroke College, University of Cambridge

First Class

## RESEARCH - Influence of biogenic volatile organic compound emissions on climate

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The chemical composition of our atmosphere is changing and this will affect climate. My current research focuses on the non-CO<sub>2</sub> climate impacts of wide scale tree planting as climate change mitigation strategy through changes to the emissions of biogenic volatile organic compounds (BVOCs) and surface reflectivity. 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](http://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 data from 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 Intergovernmental Panel on Climate Change (IPCC) and have published a study looking at how emission changes due to the COVID19 lockdown affected climate, also cited by the IPCC.

## ACADEMIC ACHIEVEMENTS & AWARDS

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

## TEACHING AND SUPERVISING

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- **UKCA Training Courses 2021, 2022** - I have demonstrated at three UKCA chemistry-climate model training courses run by Luke Abraham for NCAS. This involved explaining parts of the model and helping students work through the exercises.

- **1<sup>st</sup> year undergraduate Chemistry** - Molecular Structure, Kinetics, Thermodynamics, Organic & Inorganic Chemistry. Small group tutorial-style teaching 2018/19, 2019/20 academic years, 8 students in total.
- **3<sup>rd</sup> Atmospheric Chemistry** - Introduction to Stratospheric & Tropospheric Chemistry. Small group tutorial-style teaching 2018/19 academic year, 5 student.
- **4<sup>th</sup> year Atmospheric Science and Global Change** - Introduction to Stratospheric & Troposphere Chemistry and impacts of climate change. Small group tutorial-style teaching 2019/20 academic year, 6 students.
- **MSci Project Supervisor** - I have supervised three masters students (2 Cambridge, 1 Sheffield).
- **Thesis Mentor** - Mentored final year PhD student at Sheffield as they wrote their thesis.
- **1<sup>st</sup> year undergraduate Chemistry Laboratory Demonstrator** - I demonstrated for the 1<sup>st</sup> year undergraduate chemistry practical course at Cambridge.
- **University Bridging Courses** - I have written several courses on topics in Chemistry and Maths for incoming Pembroke Natural Sciences undergraduates designed to bridge the gap between sixth form and university-level study.
- **General Coding** - I taught basic coding in Python to students and staff at the University of Sheffield.

## EMPLOYMENT & EXPERIENCE

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**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. I learned how patents were structured via a series of claims and how the level of inventiveness could be challenged. Towards the end of my probation period I decided to pursue a PhD in climate science rather than continue my training.

## PUBIC ENGAGEMENT

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**Tapton School Sixth Form Seminars, Sheffield**

Chemistry and Climate Change: How atmospheric chemistry is critical to understanding climate change and climate change solutions. (Introducing 17 and 18 year old students to atmospheric chemistry.)

**Invited Speaker: Sheffield World Health Organisation Simulation**

Linking Climate Change and Air Pollution

**Cambridge Zero Research Symposium: Carbon Drawdown & Climate Repair**

I presented my research group's work on the effect of the COVID19 pandemic on climate to a general audience. March 2021

**Cambridge Zero Climate Change Festival**

I presented my research group's work on the effect of the COVID19 pandemic on climate to a general audience. Nov 2020

**Cambridge University Science and Policy Exchange report for Cambridgeshire County Council**  
How can Cambridgeshire can reach net-zero carbon emissions by 2050?

Along with other PhD researchers, I wrote a report which summarised Cambridgeshire carbon emissions and recommended ways to reach net-zero. I focused on waste management and the potential for afforestation. Apr-Oct 2019

**Rising Stars Programme**

I participated in a 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

### **PUBLICATIONS AND ARTICLES IN REVIEW**

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**Weber, J., King, J. A., Sindelarova, K., & Val Martin, M.** (2022): Updated Isoprene and Terpene Emission Factors for the Interactive BVOC Emission Scheme (iBVOC) in the United Kingdom Earth System Model (UKESM). *Geoscientific Model Development*, 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*

**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>, accepted.

**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): Improvements to the representation of BVOC chemistry–climate interactions in UKCA (v11.5) with the CRI-Strat 2 mechanism: incorporation and evaluation. *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**

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**Atmospheric Chemical Mechanisms - December 2022** Chemistry-driven changes strongly influence climate forcing from vegetation emissions.

**International Global Atmospheric Chemistry [Poster] - September 2022** Future atmospheric composition in a widescale but plausible tree planting scenario and implications for climate.

**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 2<sup>nd</sup> 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-CO<sub>2</sub> 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.