

ELOISE A. MARAIS

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Major Research Area

I lead a research group that uses atmospheric chemistry transport models, measures city-scale air pollution, develops new datasets from satellite observations, and determines the impact of air pollutants on health, habitats and climate to inform environmental policies.

Education

Ph.D. , Earth and Planetary Sciences, Harvard University, Cambridge MA	2014
<i>Research Supervisor:</i> Professor Daniel J. Jacob	
M.Sc. , <i>distinction</i> , Chemistry, Rhodes University, South Africa (SA)	2008
B.Sc. Hons , <i>cum laude</i> , Chemistry, University of KwaZulu-Natal, South Africa	2004
B.Sc. , <i>summa cum laude</i> , Chemistry, University of Natal, South Africa	2003

Professional Experience

Professor of Atmospheric Chemistry and Air Quality , UCL, London, UK	2024-present
Extraordinary Professor , Department of Geography, U. Pretoria, SA	2025-present
Associate Professor , Department of Geography, UCL, London, UK	2020-2024
Associate Professor , University of Leicester, Leicester, UK	2018-2020
Research Fellow , University of Birmingham, Birmingham, UK	2016-2018
Postdoctoral Research Fellow , Harvard University, Cambridge MA	2014-2016

Research Support

Funds awarded totals £2.5 million.

2024	<i>Enhancing utility of Earth Observations for monitoring air quality using research-enabled gridding techniques</i> , UCL Knowledge Exchange Fund, (£20,000), PI
2023	<i>Dynamics of ozone pollution and air pollution layer height in Central London</i> , UCL Research Capital Equipment Fund, (£83,000), PI
2023	<i>Engaging policymakers and industry to enhance the utility of a state-of-science air quality model</i> , UCL Innovation Fund Award, (£13,600), PI
2022	<i>First long-term MAX-DOAS instrument in London</i> , UCL Research Capital Equipment Fund, (£48,000), PI
2021-2024	<i>Dry deposition processes of oxygenated volatile organic compounds (VOCDep)</i> , NERC (£160,000), co-I
2021-2023	<i>Health impacts and inequities of fossil fuel extraction in the US</i> , SEI (£79,000), PI
2020-2022	<i>Transboundary PM_{2.5} sources in Leicester and Leicestershire</i> , DEFRA (£124,000), PI
2019-2025	<i>UpTrop: Fundamental understanding of reactive nitrogen in the upper troposphere</i> , ERC Starting Grant (£1.4 million), PI
2019-2020	<i>Applying Earth observations to reduce uncertainties in emission inventories</i> , DEFRA (£75,000), co-I
2019-2020	<i>Future EO passive optical missions for small satellites</i> , ESA (£40,000), co-I
2019-2022	<i>Copernicus Master's Accelerator Programme</i> (£10,000), PI

- 2018-2023** *Launching urban air quality and green space monitoring into the 21st century*, NERC-funded EPSRC Researcher In Residence Award (£50,000), PI
- 2017-2019** *A systems approach to air pollution in East Africa*, UK Department for International Development (DFID) East Africa Research Fund (£20,000), co-I
- 2017-2018** NASA ATom Science Team Member Travel Award (£6,000)
- 2016-2018** Birmingham Independent Research Fellowship (£27,000), PI
- 2016** *Health effects of current and future fossil fuels*, Wallace Foundation (£8,000), co-I
- 2014-2015** *New regional inventory of diffuse and inefficient emissions for Africa*, Schlumberger Faculty for the Future Postdoctoral Grant (£59,000), PI
- 2014-2015** Postdoctoral fellowship for research abroad, South African National Research Foundation (NRF) (£29,000)
- 2011-2012** Harvard Center for the Environment Graduate Fellowship (£12,000)
- 2011-2013** Graduate scholarship for study abroad, South African NRF (£16,000)
- 2008-2011** International Fulbright Science and Technology Award (£134,000)
- 2004-2007** Numerous BSc Honours and Masters Fellowships, South Africa (£10,000)

Peer-Reviewed Publications

Total citations: 6050, h-index: 36 (Google Scholar). ORCID: 0000-0001-5477-8051

Students and postdocs I supervise identified as: ** UG/MSc, * PhD, § Postdoc

2025

N. Wei*, E. A. Marais, G. Lu§, R. G. Ryan§, B. Sauvage, Characterization of reactive nitrogen in the global upper troposphere using recent and historical commercial and research aircraft campaigns and GEOS-Chem, accepted, *Atmos. Chem. Phys.*

B. Opacka, T. Stavrou, J.-F. Müller, I. De Smedt, J. van Geffen, E. A. Marais, R. P. Horner*, D. B. Millet, K. C. Wells, A. B. Guenther, Natural emissions of VOC and NO_x over Africa constrained by TROPOMI HCHO and NO₂ data using the MAGRITTEv1.1 model, *Atmos. Chem. Phys.*, 25, 2863–2894, doi:10.5194/acp-25-2863-2025.

T.-L. He, G.-M. Oomen, and 28 authors including E. A. Marais, Challenges and opportunities offered by geostationary space observations for air quality research and emission monitoring, *BAMS*, doi:10.1175/BAMS-D-23-0145.1.

G. Lu§, E. A. Marais, K. Vohra§, R. P. Horner*, D. Zhang, R. V. Martin, S. Guttikunda, Near-automated estimate of city nitrogen oxides emissions applied to South and Southeast Asia, *J. Geophys. Res.*, 130, e2024JD041000, doi:10.1029/2024JD041000.

2024

C. R. Barker§, E. A. Marais, J. C. McDowell, Global 3D rocket launch and re-entry air pollutant and CO₂ emissions at the onset of the megaconstellation era, *Nature Scientific Data.*, 11, 1-15, doi:10.1038/s41597-024-03910-z.

R. P. Horner*, E. A. Marais, N. Wei*, R. G. Ryan§, V. Shah, Vertical profiles of global tropospheric nitrogen dioxide (NO₂) obtained by cloud-slicing TROPOMI, *Atmos. Chem. Phys.*, 24, 13047–13064, doi:10.5194/acp-24-13047-2024.

K. Vohra§, E. A. Marais, P. Achakulwisut, G. Lu§, J. M. Kelly§, C. Harkins, B. McDonald, Influence of oil and gas end-use on summertime particulate matter and ozone pollution in the eastern US, *Environ. Sci. Technol.*, 58, 19736–19747, doi:10.1021/acs.est.4c10032.

2023

Marais, E. A., J. M. Kelly§, K. Vohra§, Y. Li**, G. Lu§, N. Hina, E. C. Rowe, Impact of legislated and best available emission control measures on UK particulate matter pollution, premature

mortality, and nitrogen-sensitive habitats, *GeoHealth*, 7(10), e2023GH000910, doi:10.1029/2023GH000910.

Ryan, R. G.[§], **E. A. Marais**, E. Gershenson-Smith*, R. Ramsay, J.-P. Muller, J.-L. Tirpitz, U. Friess, Measurement Report: MAX-DOAS measurements characterise Central London ozone pollution episodes during 2022 heatwaves, *Atmos. Chem. Phys.*, 23, 7121–7139, doi:10.5194/acp-23-7121-2023.

Kelly, J. M.[§], **E. A. Marais**, G. Lu[§], J. Obszynska, M. Mace, J. White, R. J. Leigh, Diagnosing domestic and transboundary sources of fine particulate matter (PM_{2.5}) in UK cities using GEOS-Chem, *City & Environ. Interac.*, 18, doi:10.1016/j.cacint.2023.100100.

2022

Ryan, R. G.[§], **E. A. Marais**, C. J. Ballhatchet**, S. D. Eastham, Impact of rocket launch and space debris air pollutant emissions on stratospheric ozone and global climate, *Earth's Future*, 10, e2021EF002612, doi:10.1029/2021EF002612, **Wiley certificate for most downloaded article in 2022**.

Vohra, K.*[§], **E. A. Marais**, et al., 180,000 excess deaths in fast-growing tropical cities from 2005 to 2018 linked to rapid rise in anthropogenic air pollution, *Sci. Adv.*, 8, doi:10.1126/sciadv.abm4435.

Marais, E. A., O. Akker**, C. Wiedinmyer, Greenhouse gas and air pollutant emissions from power barges (powerships), *RSC Environ. Sci.: Adv.*, 1, 164–169, doi:10.1039/D1VA00049G.

R. Pope, R. Kelly, **E. A. Marais**, et al., Exploiting satellite measurements to reduce uncertainties in UK bottom-up NO_x emission estimates, *Atmos. Chem. Phys.*, 22, 4323–4338, doi:10.5194/acp-22-4323-2022.

A. Mazzeo et al., including **E. A. Marais**, Evaluation of WRF-CHIMERE coupled models for the simulation of PM_{2.5} in large East African urban conurbations, *Atmos. Chem. Phys.*, 22, 10677–10701, doi:10.5194/acp-22-10677-2022.

Langford, B. et al. including **E. A. Marais**, Seasonality of isoprene emissions and oxidation products above the remote Amazon, *Environ. Sci.: Atmos.*, doi:10.1039/D1EA00057H.

2021

Marais, E.A., A. Pandey[§], et al., UK ammonia emissions estimated with satellite observations and GEOS-Chem, *J. Geophys. Res.*, 126 (18), doi:10.1029/2021JD035237, **Wiley certificate for most downloaded article in 2021**.

Marais, E. A., J. F. Roberts[§], R. G. Ryan[§], et al., New observations of upper tropospheric NO₂ from TROPOMI, *Atmos. Meas. Tech.*, 14, 2389–2408, doi:10.5194/amt-14-2389-2021.

Vohra, K.*[§], **E. A. Marais**, S. Suckra** et al., Long-term trends in air quality in major cities in the UK and India: A view from space, *Atmos. Chem. Phys.*, 21, 6275–6296, doi:10.5194/acp-21-6275-2021, 2021.

Vohra, K.*[§], A. Vodonos, J. Schwartz, **E. A. Marais**, et al., Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem, *Environ. Res.*, 195, 110754 doi:10.1016/j.envres.2021.110754. **Extensive media coverage:** <https://www.altmetric.com/details/99822433>. Amongst *Environ. Res.*'s most downloaded articles: <https://www.journals.elsevier.com/environmental-research/most-downloaded-articles>, **ISI Web of Science Hot and Highly Cited Paper (573 citations)**

Potts, D. A., **E. A. Marais** et al., Diagnosing air quality changes in the UK during the COVID-19 lockdown using TROPOMI and GEOS-Chem, *Environ. Res. Lett.*, 16, 054031, doi:10.1088/1748-9326/abde5d.

Nault, B. et al. including **E. A. Marais**, Models underestimate the increase of acidity with remoteness biasing radiative impact calculations, *Nature Comm Earth & Environ.*, 2, doi:10.1038/s43247-021-00164-0.

2020

Bockarie, A.*, **E A. Marais**, A. R. MacKenzie, Air pollution and climate forcing of the charcoal industry in Africa, *Environ. Sci. & Technol.*, 54, 13429–13438, doi:10.1021/acs.est.0c03754.

de Souza, P. et al. including **E. A. Marais**, Combining low-cost, surface-based aerosol monitors with size-resolved satellite data for air quality applications, *Atmos. Meas. Techn.*, 13, 5319–5334, doi:10.5194/amt-13-5319-2020.

McDuffie, E. E. et al., including **E. A. Marais**, A global anthropogenic emission inventory of atmospheric pollutants from sector- and fuel-specific sources (1970-2017): An application of the Community Emissions Data System (CEDS), *Earth Sys. Sci. Data*, 12, 3413-3442, doi:10.5194/essd-12-3413-2020.

Zheng, Y. et al. including **E. A. Marais**, Long-term observational constraints of organic aerosol dependence on inorganic species in the southeast US, *Atmos. Chem. Phys.*, 20, 13091–13107, doi:10.5194/acp-20-13091-2020.

Pai, S. J. et al. including **E. A. Marais**, An evaluation of global organic aerosol schemes using airborne observations, *Atmos. Chem. Phys.*, doi: 10.5194/acp-20-2637-2020.

2019

Marais, E. A., R. F. Silvern, A. Vodonos, E. Dupin**, A. S. Bockarie* et al., Air quality and health impact of future fossil fuel use for electricity generation and transport in Africa, *Environ. Sci Technol.*, 53, 13524-13534, doi:10.1021/acs.est.9b04958.

Worden, H. M. et al. including **E. A. Marais**, New constraints on biogenic emissions using satellite-based estimates of carbon monoxide fluxes, *Atmos. Chem. Phys.*, 19, 13569-13579, doi:10.5194/acp-19-13569-2019.

Silvern, R. F. et al. including **E. A. Marais**, Using satellite observations of tropospheric NO₂ columns to infer long-term trends in US NO_x emissions: the importance of accounting for the free tropospheric NO₂ background, *Atmos. Chem. Phys.*, 19, 8863-8878, doi:10.5194/acp-19-8863-2019.

Jo, D. S. et al. including **E. A. Marais**, A simplified parameterization of isoprene-expoxydiol-derived secondary organic aerosol (IEPOX-SOA) for global chemistry and climate models, *Geosci. Model Dev.*, 12, 2983-3000, doi:10.5194/gmd-12-2983-2019.

Liao, J. et al. including **E. A. Marais**, Towards a satellite-in situ hybrid estimate for organic aerosol abundance, *Atmos. Chem. Phys.*, 19, 2765–2785, doi:10.5194/acp-19-2765-2019.

2018

Marais, E. A., D. J. Jacob et al., Nitrogen oxides in the global upper troposphere: interpreting cloud-sliced NO₂ observations from the OMI satellite instrument, *Atmos. Chem. Phys.*, 18, 17017-17027, doi:10.5194/acp-18-17017-2018.

Weagle, C. L. et al. including **E. A. Marais**, Chemical sources of fine particulate matter: interpretation of PM_{2.5} chemical composition observed by SPARTAN using a global chemical transport model, *Environ. Sci. Tech.*, 52, 11670-11681, doi:10.1021/acs.est.8b01658.

2017

Li, C. et al. including **E. A. Marais**, Trends in chemical composition of global and regional population-weighted fine particulate matter over the recent 25 years, *Environ. Sci. Tech.*, 51, 11185–11195, doi:10.1021/acs.est.7b02530.

Lacey, F. G., **E. A. Marais et al.**, Improving present day and future estimates of anthropogenic sectoral emissions and the resulting air quality impacts in Africa, *Faraday Discuss.*, 200, 397-412, doi:10.1039/C7FD00011A.

Zhu, L. *et al.* including **E. A. Marais**, Long-term (2005–2014) trends in formaldehyde (HCHO) columns across North America as seen by the OMI satellite instrument: Evidence of changing emissions of volatile organic compounds, *Geophys. Res. Lett.*, 44, 7079–7086, doi:10.1002/2017GL073859.

Cady-Pereira, K. E. *et al.* including **E. A. Marais**, Seasonal and spatial changes in trace gases over megacities from Aura TES observations: two case studies, *Atmos. Chem. Phys.*, 17, 9379–9398, doi:10.5194/acp-17-9379-2017.

Chan Miller, C., D. J. Jacob, **E. A. Marais et al.**, Glyoxal yield from isoprene oxidation and relation to formaldehyde: chemical mechanism, constraints from SENEX aircraft observations, and interpretation of OMI satellite data, *Atmos. Chem. Phys.*, 17, 8725–8738, doi:10.5194/acp-17-8725-2017.

Horowitz, H. M. *et al.* including **E. A. Marais**, A new mechanism for atmospheric mercury redox chemistry: implications for the global mercury budget, *Atmos. Chem. Phys.*, 17, 6353–6371, doi:10.5194/acp-17-6353-2017. **ISI Web of Science Hot Paper and Highly Cited Paper (146 citations)**

Marais, E. A., D. J. Jacob *et al.*, Evidence of 1991–2013 decrease of biogenic secondary organic aerosol in response to SO₂ emission controls, *Environ. Res. Lett.*, 12 054018, doi:10.1088/1748-9326/aa69c8.

Silvern, R. F. *et al.* including **E. A. Marais**, Inconsistency of ammonium-sulfate aerosol ratios with thermodynamic models in the eastern US: a possible role of organic aerosol, *Atmos. Chem. Phys.*, 17, 5107–5118, doi:10.5194/acp-17-5107-2017.

2016

Marais, E. A., D. J. Jacob *et al.*, Aqueous-phase mechanism for secondary organic aerosol formation from isoprene: application to the Southeast United States and co-benefit of SO₂ emission controls, *Atmos. Chem. Phys.*, 16, 1603–1618, doi:10.5194/acp-16-1603-2016. **ISI Web of Science Highly Cited Paper (153 citations)**

Marais E. A., C. Wiedinmyer, Air Quality Impact of Diffuse and Inefficient Combustion Emissions in Africa (DICE-Africa), *Environ. Sci. Tech.*, 50, 10739–10745, doi:10.1021/acs.est.6b02602.

Travis, K. R. *et al.* including **E. A. Marais**, Why do models overestimate surface ozone in the Southeast United States?, *Atmos. Chem. Phys.*, 16, 13561–13577, doi:10.5194/acp-16-13561-2016. **ISI Web of Science Hot Paper and Highly Cited Paper (207 citations)**

Fisher, J. A. *et al.* including **E. A. Marais**, Organic nitrate chemistry and its implications for nitrogen budgets in an isoprene- and monoterpene-rich atmosphere: constraints from aircraft (SEAC⁴RS) and ground-based (SOAS) observations in the Southeast US, *Atmos. Chem. Phys.*, 16, 5969–5991, doi:10.5194/acp-16-5969-2016.

Yu, K. *et al.* including **E. A. Marais**, Sensitivity to grid resolution in the ability of a chemical transport model to simulate observed oxidant chemistry under high-isoprene conditions, *Atmos. Chem. Phys.*, 16, 4369–4378, doi:10.5194/acp-16-4369-2016.

B. Franco, **E. A. Marais et al.**, Diurnal cycle and multi-decadal trend of formaldehyde in the remote atmosphere near 46°N, *Atmos. Chem. Phys.*, 16, 4171–4189, doi:10.5194/acp-16-4171-2016.

2015

Franco, B. *et al.* including **E. A. Marais**, Retrievals of formaldehyde from ground-based FTIR and MAX-DOAS observations at the Jungfraujoch station and comparisons with GEOS-Chem and IMAGES model simulations, *Atmos. Meas. Tech.*, 8, 1733-1756, doi:10.5194/amt-8-1733-2015.

Marais, E. A. and K. Chance, A geostationary air quality monitoring platform for Africa, *The Clean Air Journal*, 25, 40-45, doi:10.17159/2410-972X/2015/v25n1a3.

2014

Marais, E. A., D. J. Jacob *et al.*, Anthropogenic emissions in Nigeria and implications for ozone air quality: a view from space, *Atmos. Environ.*, 99, 32-40, doi:10.1016/j.atmosenv.2014.09.055.

Zhu, L., *et al.* including **E. A. Marais**, Anthropogenic emissions of highly reactive volatile organic compounds in eastern Texas from oversampling of satellite (OMI) measurements of HCHO columns, *Environ. Res. Lett.*, 9, 114004, doi:10.1088/1748-9326/9/11/114004.

Nowlan, C. R. *et al.* including **E. A. Marais**, Global dry deposition of nitrogen dioxide and sulfur dioxide inferred from space-based measurements, *Global Biogeochem. Cy.*, 28, 1025-1043, doi:10.1002/2014GB004805.

Marais, E. A., D. J. Jacob *et al.*, Improved model of isoprene emissions in Africa using OMI satellite observations of formaldehyde: implications for oxidants and particulate matter, *Atmos. Chem. Phys.*, 14, 7693-7703, doi:10.5194/acp-14-7693-2014.

Wang, Q. *et al.* including **E. A. Marais**, Global budget and radiative forcing of black carbon aerosol: constraints from pole-to-pole (HIPPO) observations across the Pacific, *J. Geophys. Res.*, 119, 195-206, doi:10.1002/2013JD020824. *ISI Web of Science Highly Cited Paper. (131 citations)*

2013

Barkley, M. P. *et al.* including **E. A. Marais**, Top-down isoprene emissions over tropical South America inferred from SCIAMACHY and OMI formaldehyde columns, *J. Geophys. Res.*, 118, 6849-6868, doi:10.1002/jgrd.50552.

2012

Marais, E. A., D. J. Jacob *et al.*, Isoprene emissions in Africa inferred from OMI observations of formaldehyde columns, *Atmos. Chem. Phys.*, 12, 6219-6235, doi:10.5194/acp-12-6219-2012.

Invited Talks

Archive of presentation slides: <http://maraisresearchgroup.co.uk/presentations.html>

2025

Use of column abundances of ammonia detected from space-based sensors to derive agricultural emissions, *virtual*, DEFRA Deep-Dive Series, Episode 6: Detection of Ammonia from Agriculture.

2024

Cloud-sliced TROPOMI retrieval of vertically-resolved tropospheric NO₂ and O₃, *virtual*, Atmospheric Environmental Remote Sensing Society meeting.

Current emissions estimate capabilities with EO, *virtual*, DEFRA Emissions Monitoring Deep Dive Symposium.

Are emission control policies and technologies sufficient to mitigate harm of poor air quality?, Royal Society UK-South Africa Bilateral Frontiers of Science meeting, South Africa.

Cloud-slicing to obtain vertical profiles of tropospheric NO₂ and ozone, *virtual*, ISSI Workshop on Geostationary Satellites.

Deriving new and exploiting existing remote sensing observations to better understand sources and abundances of natural and anthropogenic reactive nitrogen, Royal Society UK-China Bilateral Workshop in London.

Understanding the Atmospheric Effects of Spacecraft Re-entry, ESA workshop, ESTEC, Noordwijk, The Netherlands

2023

University of York Atmospheric Chemistry seminar series, York, UK.

International Space Science Institute Workshop on Geostationary Satellites, *virtual*, Bern, Switzerland.

Workshop on Air Quality in Africa, *virtual*, Kigali, Rwanda.

2022

University of Edinburgh Global Change Seminar Series, Edinburgh, UK

Harvard Climate Tea Talk Series, Harvard University, Cambridge, MA

UCL Lunch Hour Lecture Series, UCL, London, UK.

Global Air Quality Conversation, *virtual*, Peking University, China.

Institute of Environmental Sciences webinar, *virtual*, London, UK.

Royal Society of Chemistry Desktop Seminar, *virtual*, Royal Society, London, UK.

European Geophysical Union (EGU) Annual General Meeting, Vienna, Austria.

European Research Council HEAL Workshop, U. Mannheim, Mannheim, Germany.

2021

Investigation of Air Pollution Standing Conference (IAPSC), *virtual*, Birmingham, UK.

Harvard Atmospheric and Environmental Chemistry Seminar, *virtual*, Cambridge, MA.

DEFRA EO Centre of Excellence workshop, *virtual*, London, UK.

Great Ormond Street Hospital (GOSH) lunchtime seminar, *virtual*, London, UK.

Joint EIONET/TFEIP meeting, *virtual*, Slovakia.

University of Birmingham Air Pollution and Atmospheric Chemistry seminar series, *virtual*, Birmingham, UK.

MIT Program in Atmospheres, Oceans and Climate seminar series, *virtual*, MIT, Cambridge, MA.

Town hall meeting on African greenhouse gas emissions and air quality, *virtual*, Manchester Environmental Research Institute, UK.

NCAR workshop on Advancing Air Quality and Carbon Science in Africa, *virtual*, Boulder, CO.

University of Leeds Institute for Climate & Atmospheric Science, *virtual*, Leeds, UK.

2020

University of Cambridge Centre for Atmospheric Science, *virtual*, Cambridge, UK.

Oxford Air Quality Meeting, Keble College, Oxford, UK.

2019

Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands.

Connected Places Catapult, London, UK.

Webinar on Understanding the Sources of Outdoor Air Pollution in Sub-Saharan Africa, hosted by the Health Effects Institute (HEI).

Royal Meteorological Society National Meeting on Air Pollution in Megacities, University of Leeds, Leeds, UK.

Environment, Earth and Ecosystem Sciences Seminar Series, Open University, Milton Keynes, UK.

2018

Harvard University, Environmental Science and Engineering, Cambridge, MA.

Air Pollution Extremes Workshop, Columbia University, New York, NY.

Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa.

2017

University of Cambridge, Department of Chemistry, Cambridge, UK, 2017.

University of St Andrews, School of Earth and Environmental Sciences, St Andrews, UK.

Centre for Ecology & Hydrology, Edinburgh, UK.

University of Edinburgh, School of Geosciences, Edinburgh, UK.

2016

University of Birmingham, School of Geography, Earth, and Environmental Sciences, Birmingham, UK.

MIT, Department of Earth, Atmospheric, and Planetary Sciences, Cambridge, MA.

Texas A&M, Atmospheric Sciences, College Station, TX.

2015

Rhodes University, Department of Chemistry, Grahamstown, South Africa.

Georgia Institute of Technology, School of Civil and Environmental Engineering, Atlanta, GA.

University of East Anglia, School of Environmental Sciences, East Anglia, UK.

University of York, Department of Chemistry and National Centre for Atmospheric Science, York, UK.

University of Leeds, School of Chemistry, Leeds, UK.

University of Manchester, School of Earth, Atmospheric and Environmental Sciences, Manchester, UK.

Colorado University, Cooperative Institute for Research in the Environmental Sciences (CIRES), Boulder, CO.

National Center for Atmospheric Research, Atmospheric Chemistry Observations and Modeling, Boulder, CO.

2014

North-West University, Unit of Environmental Sciences and Management, Potchefstroom, South Africa.

West Africa Air Quality Workshop, Abuja, Nigeria.

Research Supervision

Professional Development

2022 *Advancing Principal Investigators*, research team leadership training, UCL, <https://www.ucl.ac.uk/human-resources/learning-development/learning-academy/researcher-development/advancing-principal-investigators>.

Current Supervision

2024- Huilin Zhan (**PhD**) *Biogenic small acids from multiphase processing of isoprene epoxydiols*.

2023- Connor Barker (**postdoc**) *Influence of megaconstellations on climate and air quality; dry deposition of oxygenated VOCs*, funded by the ERC and NERC.

2022- Eleanor Gershenson-Smith (**PhD**) *Near-term regional climate impact of tropospheric NO_x*, funded by the ERC.

2022- Terrence Sepuru (**PhD**), *Quantifying air pollutant emissions over the industrial highveld region in South Africa*, funded by the South African NRF.

2021- Rebekah Horner (**PhD**) *Reactive nitrogen in the global upper troposphere*, funded by the ERC.

Past Supervision

- 2019-2025** Nana Wei (**PhD**) *Improved understanding of reactive nitrogen in the global upper troposphere using NASA aircraft observations and the GEOS-Chem model*, funded by the ERC and a University of Leicester studentship.
- 2021-2024** Karn Vohra (**postdoc**) *Health impacts and inequities of fossil fuel extraction*, funded by the Stockholm Environment Institute (SEI) and the ERC.
- 2022-2023** Gongda Lu (**postdoc**) *Cloud-slicing software development and improved derivation of city NO_x emissions using satellite observations*, funded by the ERC.
- 2018-2022** Gongda Lu (**PhD**) *Interpreting changes in anthropogenic emissions underlying abrupt changes in observed air quality using surface and satellite observations and a chemical transport model*, funded by the Chinese Scholarship Council
- 2020-2022** Robert Ryan (**postdoc**) *Rockets and lightning influence on atmospheric composition*, ERC Research Fellow.
- 2021-2022** Jamie Kelly (**postdoc**) *Sources of PM_{2.5} pollution in UK cities determined with GEOS-Chem*, Defra Air Quality Grant.
- 2022** Marco Barnfield (**UG at U. Bristol**) NERC REP Programme, *Influence of returning space junk on the atmosphere*.
- 2021-2022** Kavitha Mottungan (**postdoc**) *Air pollutants and precursors over India: A Satellite and Modeling Perspective*, Royal Society Newton International Fellow.
- 2017-2021** Karn Vohra (**PhD**) *A new tool to monitor air pollution in rapidly urbanizing cities*, funded by the University of Birmingham Global Challenges Fund.
- 2021** Orianna Akker (**UG at U. Bath**) NERC REP Programme, *Greenhouse gas and air pollutant emissions from floating power plants*.
- 2020** Alok Pandey (**postdoc**) *Satellite-derived emissions of ammonia in the UK*.
- 2017-2021** Alfred Bockarie (**PhD**) *Air quality and climate impacts of charcoal production in Africa*, funded by the Islamic Development Bank.
- 2020** Chloe Ballhatch (**UG at U. Cambridge**) summer student, *Emission inventory of reactive gases and aerosols from rocket launches and space junk re-entry in 2019*, now a PhD student at University of Cambridge.
- 2019** Junju Ng (**MSc at UCL**) external supervisor, *Satellite sensing of NO₂ pollution in a large city: a case study using TROPOMI over London*, now Senior Executive at the Singapore National Environment Agency.
- 2018** Shannen Suckra (**MSc**) *Trends and variability in PM_{2.5} in Birmingham*, now at the National Environment and Planning Agency in Jamaica.
- 2018** Isobel Ward (**MSc**) *The influence of meteorological conditions on ground-level ozone in the UK*, now at AECOM.
- 2017** Gongda Lu (**MSc**) *Validation of satellite-derived PM_{2.5} in Chinese megacities*, now a PhD student in my group.

PhD Examiner

External

- 2025** B.A.H. Gutierrez, University of Toronto, Canada.
- 2023** L. Fakes, University of York, UK.
- 2023** R. Abeed, Laboratoire Atmosphères, Observations Spatiales (LATMOS), France.
- 2022** C. Mogno, University of Edinburgh, UK.
- 2022** I. Riádigos Sánchez, University of Santiago de Compostela, Spain.
- 2022** Y. Liu, University of Helsinki, Finland.
- 2022** C. K. Segakweng, North-West University, South Africa.

2020 A. de Lange, University of Pretoria, South Africa.

2019 L. Gonzalez Alonso, University of Sheffield, UK.

Internal

2021 Damian Oyarzun, Department of Geography, UCL.

Awards

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- 2024 Wiley's *Earth's Future* most downloaded paper in 2023
 - 2023 Wiley's *J. Geophys. Res: Atmospheres* most downloaded paper in 2022
 - 2018 ESA Copernicus Masters Competition Finalist, Leicester, UK
 - 2012 Commendable oral presentation, American Meteorological Society's 1st Conference on Atmospheric Biogeosciences, Boston, MA
 - 2012 Outstanding student poster award, Atmospheric Sciences Division of the European Geophysical Union, Vienna, Austria
 - 2005 South African Chemical Society Medal awarded to top BSc Chemistry Honours student, University of KwaZulu-Natal, South Africa
 - 2004 Merck, SASOL and Perkin-Elmer Medals awarded to top 3rd year Chemistry Undergraduate student, University of KwaZulu-Natal, South Africa
 - 2002-2004 Dean's commendations for outstanding achievement in Undergraduate and Postgraduate courses, University of Natal/KwaZulu-Natal, South Africa

Service and Leadership

UCL

2023-2024 Department of Geography Graduate Tutor

National and International

- 2025 Organizer, 3rd GEOS-Chem Europe User's Meeting, UCL, London
- 2024 GEOS-Chem International Model Co-lead
- 2024 Member, ESA led Atmospheric Impacts of Spacecraft Re-entry Working Group
- 2023 Organizer, 2nd GEOS-Chem Europe User's Meeting, UCL, London
- 2023 International Science Team for a Geostationary Mission over Africa
- 2023 Organizing committee, Health Effects Institute Workshop on Air Quality in East Africa
- 2022-2023 UK Air Quality Experts Group (AQEG) invited *ad-hoc* member
- 2021-2022 UK Research and Innovation Future Leader Fellowship Peer Review College
- 2020-2023 Health Effects Institute Global Health Oversight Committee
- 2017- International GEOS-Chem Model Steering Committee, Co-Chair of the Emissions and Deposition Working Group
- 2020 Co-organizer, 1st GEOS-Chem Europe User's Meeting, *online due to COVID-19*
- 2018 HEI Working Group, Contribution to report on Household Air Pollution to Ambient Air Pollution in Ghana

Environmental Consultancy:

- 2023 *Expert critique of Climate Change Impact Assessment for Tetra4 Cluster 2 Gas Production Project in South Africa*, prepared for Earthjustice and the Centre for Environmental Rights.
- 2023 *Expert critique of Climate Change Impact Assessment for TEEPSA's Offshore Production Right and Environmental Authorization Application for Block 11B/12B, Southern Cape Coast, South Africa*, prepared for Earthjustice and Natural Justice.

Chair of Conferences and Seminar Series

- 2025** Session convener, EGU General Assembly, Vienna, Austria
- 2024** Session co-chair, AGU General Meeting, Washington, DC
- 2024** Session co-convener, EGU Annual Assembly, Vienna, Austria
- 2023** Session convener, AGU General Meeting, San Francisco, CA
- 2023** Session co-chair, Health Effects Institute Workshop on Air Quality in East Africa
- 2022** Session co-chair, Health Effects Institute, Virtual Workshop on Health Applications for Satellite-Derived Air Quality
- 2022** Session chair, 10th International GEOS-Chem User's Meeting (IGC10), Washington University in St Louis, MO.
- 2021** Session co-chair, Health Effects Institute Annual Conference, *online due to COVID-19*
- 2020** Session co-chair, American Geophysical Union (AGU) Annual General Meeting, *online due to COVID-19*
- 2019** Session chair, IGC9, Harvard, Cambridge, MA
- 2018** Session co-chair, UK National Centre for Earth Observation Conference, Birmingham, UK
- 2018** Session co-chair, AGU Annual General Meeting, Washington, DC
- 2017** Chair, Air Pollution and Atmospheric Chemistry seminar series, University of Birmingham, Birmingham, UK
- 2017** Session co-chair, AGU Annual General Meeting, New Orleans, LA
- 2015** Chair, Atmospheric Chemistry seminar series, Harvard, Cambridge, MA

Author: International Reports

- 2019** Household Air Pollution Working Group, *Contribution of Household Air Pollution to Ambient Air Pollution in Ghana: Using Available Evidence to Prioritize Future Action*, HEI, Communication 19, <https://www.healtheffects.org/system/files/Comm19-HAP-Ghana.pdf>.
- 2016** Contributing Author, *Air Quality in Tropical and Subtropical Megacities*, Submitted to 2017-2027 USA National Research Council Decadal Survey for Earth Observations from Space Request for Information (RFI-2)

Peer Review

Grant Agencies

- 2024** UK National Environmental Research Council (NERC) Pushing the Frontiers review panel
- 2022** Belgian Science Policy Office (BELSPO) BRAIN-be 2.0 Research Programme review panel
- 2022** UK **Engineering** and Physical Sciences Research Council (EPSRC) review panel
- 2020** Canada Foundation for Innovation's (CFI) Innovation Fund review panel
- 2020** UK NERC review panel
- 2020** BELSPO BRAIN-be 2.0 Research Programme review panel
- 2019** US EPA STAR Grant reviewer and review panel
- 2019** Irish Research Council Government of Ireland Postdoctoral Fellowship Scheme reviewer
- 2017** UK NERC reviewer
- 2017** National Oceanic and Atmospheric Association (NOAA) Atmospheric Chemistry, Carbon Cycle and Climate (AC4) Program reviewer
- 2016** European Research Council (ERC) Advanced Grant reviewer
- 2015** NOAA AC4 Program reviewer
- 2015** BELSPO STEREO Research Programme reviewer

- 2013** NASA Research Opportunities in Earth and Space Science (ROSES) Carbon Cycle Science reviewer

Journals

Frequent reviewer for numerous prestigious scientific journals:

Proceedings of the National Academy of Sciences, Nature Communications, Scientific Reports, Environmental Science & Technology, Atmospheric Environment, Atmospheric Chemistry and Physics, Atmospheric Measurement Techniques, Journal of Air & Waste Management, Environmental Science & Technology Letters, Geoscientific Model Development, Journal of Geophysical Research, Aerosol & Air Quality Research, Environment International, Science of the Total Environment, GeoHealth, NPJ Climate & Atmos Sci., RSC's Environ. Sci: Atmos.

International Assessment Reports

- 2022** European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Atmospheric Composition Monitoring Satellite Application Facilities (AC SAF) IASI instrument data products
- 2018** International Global Atmospheric Chemistry (IGAC) project Tropospheric Ozone Assessment Report

Teaching

Training and Accreditation

- 2020** Fellow of the Higher Education Academy (FHEA)
- 2010** Harvard Bok Center Teacher Training, Harvard University, Cambridge, MA
- 2009** *Scientists Teaching Science*, graduate course on effective science teaching, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA

Experience

- 2022-2023** Convener, **GEOG0170: Environmental Consequences of Human Activity**, Physical Geography 3rd Year Module, UCL, London, UK
- 2022** Lecturer, **GEOG0151: Thinking Geographically I**, Physical Geography 1st Year Module, UCL, London, UK
- 2021-2022** Lecturer, **GEOG0012: Thinking Geographically II**, Physical Geography 1st Year Modules, UCL, London, UK
- 2021-2023** Supervisor, **GEOG0105: Master's Research Project and Dissertation**, Geography Master's Module, UCL, London, UK
- 2020-2023** Lecturer, **GEOG0005: Understanding Our Planet**, Physical Geography 1st Year Module, UCL, London, UK
- 2020-2021** Supervisor, **GEOG0042: Independent Study**, Geography 3rd Year Module, UCL, London, UK
- 2019-2020** Lecturer, *Waves and Quanta*, Physics 1st Year Module, University of Leicester, Leicester, UK
- 2019** Course Developer, *Masters in Satellite Data Science*, University of Leicester, Leicester, UK
- 2018-2019** Supervisor, Physics 3rd and 4th Year project students, University of Leicester, Leicester, UK
- 2017** Lecturer, *Environmental Protection*, Environmental Science 3rd Year Module, University of Birmingham, Birmingham, UK
- 2013** Teaching Assistant, *Energy Technology*, Harvard University, Cambridge, MA

- 2010 Teaching Assistant, *Introduction to Environmental Science*, Harvard University, Cambridge, MA
- 2009 Teaching Assistant, *Environmental Science and Technology*, Harvard University, Cambridge, MA
- 2009 Teaching Assistant, *Atmospheric Chemistry*, Harvard, Cambridge, MA
- 2006 Tutor and Laboratory Demonstrator, *Introductory Chemistry*, Rhodes University, South Africa
- 2005 Tutor, *Introduction to Chemistry*, University of KwaZulu-Natal, South Africa

Media Engagement

Expertise sought on air pollution and public health:

Evening Standard, <https://www.standard.co.uk/news/health/air-pollution-measures-reduce-thousands-deaths-uk-b1115838.html>

Meteored, <https://www.yourweather.co.uk/news/science/air-pollution-regulations-won-t-protect-sensitive-ecosystems-biodiversity-atmosphere.html>

New Scientist, <https://institutions.newscientist.com/article/2320777-pollution-killed-9-million-people-worldwide-in-2019-alone/>

Expertise sought on climate and ozone layer impact of the space industry:

BBC, <https://www.bbc.co.uk/news/articles/c8xe7exjy1go>

BBC Radio 4 Inside Science, <https://www.bbc.co.uk/programmes/m00112fl>

The Guardian,

<https://www.theguardian.com/environment/2024/nov/01/pollutionwatch-air-pollution-inventory-space-launches-reentries>

New York Times, <https://www.nytimes.com/2024/01/09/science/rocket-pollution-spacex-satellites.html>

CBC, <https://newsinteractives.cbc.ca/features/2023/rocket-pollution/>

Japan Times,

<https://www.japantimes.co.jp/environment/2023/12/17/sustainability/space-environmentally-sustainable-satellites/>

NPR Science Friday, <https://www.sciencefriday.com/segments/private-space-launches-pollution/>

BBC4 Inside Science Podcast, <https://www.bbc.co.uk/programmes/m00112fl>

Physics World, <https://physicsworld.com/a/uk-spaceports-the-good-the-bad-and-the-ugly/>

Al Jazeera, <https://www.aljazeera.com/features/2022/10/23/the-battle-over-space-emissions-in-cornwall>

France24, <https://www.france24.com/en/environment/20230207-rise-in-space-tourism-rocket-launches-poses-new-threat-to-ozone-layer-researchers-warn>

Wall Street Journal, <https://www.wsj.com/articles/rocket-launches-emissions-concerns-11675445394>

The Big Issue, <https://www.bigissue.com/news/environment/the-uk-launched-its-first-orbital-space-rocket-but-how-much-is-this-historic-moment-polluting-the-atmosphere/>

Media coverage of Kelly et al. (2023), doi:10.1016/j.cacint.2023.100100 on source contributors to PM_{2.5} in UK cities:

The Guardian, <https://www.theguardian.com/environment/2023/mar/24/uk-farming-causes-over-quarter-cities-particle-pollution-study>

BBC Radio's Farming Today, <https://www.bbc.co.uk/programmes/m001kgsb>

The Independent, <https://www.independent.co.uk/news/uk/home-news/farms-particles-pollution-ucl-environment-b2307616.html>

Media coverage of Vohra et al. (2022), doi:10.1126/sciadv.abm4435 on premature deaths from rapid rise in air pollution for fast-growing cities in the tropics:

The New York Times, <https://www.nytimes.com/2022/04/08/climate/air-pollution-cities-tropics.html>

World Economic Forum, <https://www.weforum.org/agenda/2022/04/air-pollution-cars-remote-sensing-air-quality-improvement/>

The Guardian, <https://www.theguardian.com/environment/2022/jun/03/satellite-imagery-air-pollution-rise-tropical-megacities>

Popular Science, <https://www.popsci.com/environment/tropic-megacities-air-pollution/>

New Scientist, <https://institutions.newscientist.com/article/2315496-tropical-city-air-pollution-led-to-470000-premature-deaths-in-2018/>

Air Quality News, <https://airqualitynews.com/2022/04/12/air-pollution-responsible-for-180000-excess-deaths-in-tropical-cities/>

South Africa Today, <https://southafricatoday.net/environment/air-pollution-is-fast-getting-worse-in-tropical-cities/>

Media coverage of the environmental impact of space tourism and space debris:

BBC, <https://www.bbc.com/future/article/20220713-how-to-make-rocket-launches-less-polluting?>

Time Magazine, <https://time.com/6191846/billionaire-space-race-climate/>

Forbes, <https://www.forbes.com/sites/davidrvetter/2022/07/05/bezos-vs-musk-which-billionaires-rockets-are-worse-for-the-climate/?sh=7fe5425b150c>

Sky News, <https://news.sky.com/story/space-tourism-from-companies-like-spacex-virgin-atlantic-and-blue-origin-could-undo-work-to-repair-ozone-layer-study-finds-12640296>

Scientific American, <https://www.scientificamerican.com/article/don-t-fear-china-s-falling-rocket-m-dash-fear-the-future-it-foretells/>

Evening Standard, <https://www.standard.co.uk/news/uk/space-tourism-ucl-massachusetts-institute-of-technology-university-of-cambridge-spacex-b1008378.html>

Australian Broadcasting Corporation's Future Tense, <https://www.abc.net.au/radionational/programs/futuretense/space-pollution-stunted-high-rise-and-the-joy-of-missing-out/13736086>

Yale Climate Connections, <https://yaleclimateconnections.org/2022/09/the-climate-cost-of-space-tourism/>

Space.com, <https://www.space.com/space-junk-threat-research-reduce-impact>

International Business Times, <https://www.ibtimes.com/space-debris-polluting-our-atmosphere-researchers-look-ways-reduce-impact-3610800>

abc News, <https://abcnews.go.com/Technology/experts-climate-impacts-question-mark-space-tourism-takes/story?id=81609878>

Sky News, https://www.youtube.com/watch?v=At7D7_LhsyA

Die Zeit, [The Dirty War to Mars](#) [German]

Channel 4 News, <https://www.channel4.com/news/spacex-launch-makes-history-as-four-amateur-astronauts-orbit-earth>

CNBC, <https://www.cnn.com/2021/08/27/how-blue-origin-spacex-virgin-galactic-space-race-could-impact-the-atmosphere.html>

Smart Prosperity Podcast, <https://institute.smartprosperity.ca/podcast21> [interview at 10 min 09 sec]

The Guardian, <https://www.theguardian.com/business/2021/jul/25/billionaire-space-cowboys-could-become-heroes-by-focusing-on-the-climate-crisis>

The Guardian, <https://www.theguardian.com/science/2021/jul/19/billionaires-space-tourism-environment-emissions>

CTV News, <https://www.ctvnews.ca/climate-and-environment/space-travel-is-open-for-business-but-what-about-the-environmental-impact-1.5506132>

BBC World Service, <https://www.bbc.com/afrique/monde-59556066> [French],

<https://www.bbc.com/zhongwen/trad/world-59551259> [Chinese]

ABC's The Signal Podcast, <https://www.abc.net.au/radio/programs/the-signal/billionaires-space-race/13597636> [interview at 18 min 22 sec]

NPR's 1A Podcast, <https://the1a.org/segments/bezos-branson-space-billionaires/> [interview at 36 min 40 sec]

Aerospace America, <https://aerospaceamerica.aiaa.org/features/space-transportations-pollution-conundrum/>

Mashable, <https://mashable.com/article/space-tourism-environmental-costs>

Media coverage of Vohra et al. (2021), doi:10.5194/acp-21-6275-2021 on air pollution trends in cities in the UK and India:

<https://phys.org/news/2021-04-hidden-air-pollutants-cities-india.html>

<https://economics.com.au/66423/hidden-air-pollutants-on-the-rise-in-cities-in-india-and-the-uk-study/>

<https://www.cnbctv18.com/india/levels-of-air-pollutants-on-rise-in-indian-cities-study-9104501.htm>

<https://economictimes.indiatimes.com/news/india/levels-of-air-pollutants-on-rise-in-indian-cities-study/articleshow/82304287.cms>

<https://sciencemag.com/hidden-air-pollutants-on-the-rise-in-cities-in-india-and-the-uk-study/>

<https://www.eurasiareview.com/29042021-hidden-air-pollutants-on-rise-in-cities-in-india-and-uk/>

Extensive media coverage of Vohra et al. (2021), doi:10.1016/j.envres.2021.110754 on global early deaths due to air pollution from fossil fuel combustion. Select coverage:

Tweet by environmental activist Greta Thunberg: [tinyurl.com/7liwiev](https://twitter.com/GretaThunberg/status/1359244585852092419)

Tweet by historian Naomi Oreskes:

<https://twitter.com/NaomiOreskes/status/1359244585852092419>

<https://www.theguardian.com/environment/2021/feb/09/fossil-fuels-pollution-deaths-research>

<https://www.independent.co.uk/news/uk/home-news/air-pollution-fossil-fuels-deaths-b1799380.html>

<https://www.reuters.com/article/us-health-pollution-fossil/fossil-fuel-pollution-causes-one-in-five-premature-deaths-globally-study-idUSKBN2A90UB>

<https://www.thetimes.co.uk/article/pollution-from-fossil-fuels-twice-as-deadly-as-thought-scientists-warn-lxbgtp6pc/>

<https://www.bloomberg.com/news/articles/2021-02-09/fossil-fuel-pollution-kills-millions-more-than-scientists-knew>

<https://www.newscientist.com/article/2267035-deaths-from-fossil-fuel-air-pollution-are-double-what-we-thought/>
<https://www.bostonglobe.com/2021/02/09/metro/burning-fossil-fuels-kills-an-estimated-350000-people-year-study-finds/>
<https://news.harvard.edu/gazette/story/2021/02/deaths-from-fossil-fuel-emissions-higher-than-thought/>
<https://www.forbes.com/sites/carlieporterfield/2021/02/09/fossil-fuel-pollution-caused-nearly-1-in-5-global-deaths-in-2018-groundbreaking-study-suggests/>
https://www.huffpost.com/entry/fossil-fuel-air-pollution_n_6022a51dc5b6c56a89a49185
<https://www.cbsnews.com/news/fossil-fuel-air-pollution-emissions-1-in-5-deaths-worldwide-each-year/>

Expertise sought on the climate impact of aircraft emissions:

BBC, <https://www.bbc.co.uk/news/science-environment-49349566>.

Public Engagement

- 2023** The Conversation, Cornwall space launch: Why the environmental cost of rocket launches is large even when they fail, <https://theconversation.com/cornwall-space-launch-why-the-environmental-cost-of-rocket-launches-is-large-even-when-they-fail-197567>, **3,520 reads, 18 Facebook shares, 5 comments**
- 2022** The Conversation, Air pollution in fast-growing African cities presents a risk of premature death, <https://theconversation.com/air-pollution-in-fast-growing-african-cities-presents-a-risk-of-premature-death-183944>, **4,912 reads, 70 Facebook shares**
- 2022** The Conversation, Axiom launch: why commercial space travel could be another giant leap for air pollution, <https://theconversation.com/axiom-launch-why-commercial-space-travel-could-be-another-giant-leap-for-air-pollution-180990>, **40,459 reads, 77 Facebook shares, 20 comments**
- 2021** The Conversation, Ditching fossil fuels will have immediate health benefits for millions – world leaders must seize the chance, <https://theconversation.com/ditching-fossil-fuels-has-immediate-health-benefits-for-millions-world-leaders-must-seize-the-chance-171015>, **8,710 reads, 277 Facebook shares, 2 comments**
- 2021** The Conversation, Space tourism: rockets emit 100 times more CO₂ per passenger than flights – imagine a whole industry, <https://theconversation.com/space-tourism-rockets-emit-100-times-more-co-per-passenger-than-flights-imagine-a-whole-industry-164601>, **114,186 reads, 4,292 Facebook shares, 53 comments**
- 2019** Co-ordinator, First Leicester chapter of the *International Pint of Science Festival*, Leicester, UK.
- 2019** Presenter, *International Pint of Science Festival*, Leicester, UK.
- 2019** Lecturer, *British Council Air Quality Capacity Building Workshop*, University of Nairobi, Nairobi, Kenya.
- 2018** Presenter, *International Pint of Science Festival*, Birmingham, UK.
- 2017** Lecturer, *NASA/COSPAR Capacity Building Workshop*, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Professional Membership

NASA ATom Science Team and Airborne Program
 European Geophysical Union
 American Geophysical Union
 Royal Society of Chemistry
 Earth Science Women's Network

Fulbright Alumni Association
Harvard Alumni Association