

ELOISE A. MARAIS

Department of Geography
North West Wing
University College London
London, UK

Tel: +44 2031082481
Email: e.marais@ucl.ac.uk
Profile page: tinyurl.com/33ezt2yn
Lab website: maraisresearchgroup.co.uk

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	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 , University College London, London, UK	2024-present
Associate Professor , University College London, 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 total £2.5 million.

2024	Enhancing utility of Earth Observations for monitoring air quality using research-enabled gridding techniques, UCL Knowledge Exchange Fund, (£20,000), PI
2023	Dynamics of ozone pollution and air pollution layer height in Central London, UCL Research Capital Equipment Fund, (£83,000), PI
2023	Engaging policymakers and industry to enhance the utility of a state-of-science air quality model, UCL Innovation Fund Award, (£13,600), PI
2022	First long-term MAX-DOAS instrument in London, UCL Research Capital Equipment Fund, (£48,000), PI
2021-2024	Dry deposition processes of oxygenated volatile organic compounds (VOCDep), NERC (£160,000), co-I
2021-2023	Health impacts and inequities of fossil fuel extraction in the US, SEI (£79,000), PI
2020-2022	Transboundary PM _{2.5} sources in Leicester and Leicestershire, DEFRA (£124,000), PI
2019-2025	UpTrop: Fundamental understanding of reactive nitrogen in the upper troposphere, ERC Starting Grant (£1.4 million), PI
2019-2020	Applying Earth observations to reduce uncertainties in emission inventories, DEFRA (£75,000), co-I
2019-2020	Future EO passive optical missions for small satellites, ESA (£40,000), co-I
2019-2022	Copernicus Master's Accelerator Programme (£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: 4920, h-index: 33 (Google Scholar). ORCID: 0000-0001-5477-8051

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

2024

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, in review, *Atmos. Chem. Phys.*

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, in review, *Environ. Sci. Technol.*

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, in review, *J. Geophys. Res.*

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. Balhatchet**, 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>

2024

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.

Commented [ME1]: ISSI in May
Royal Society UK-China bilateral something or other

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

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- Karn Vohra (**postdoc**) *Health impacts and inequities of fossil fuel extraction*, funded by the Stockholm Environment Institute (SEI).
- 2021- Rebekah Horner (**PhD**) *Reactive nitrogen in the global upper troposphere*, funded by the ERC.
- 2019- 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.

Past Supervision

- 2022-2024 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 Balhatchet (**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

- 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

- 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 TEEPSEA'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

- 2024 Session convener, AGU General Meeting, Washington, DC
 2024 Session co-chair, 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, 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, 9th International GEOS-Chem User's Meeting, 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:

- 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/m001l2fl>
- 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-rsquo-t-fear-china-rsquo-s-falling-rocket-mdash-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://eiconews.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://scienmag.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