# David S Lee (BSc, PhD)

**Professor of Atmospheric Science**
**Director, Centre for Aviation, Transport and the Environment**
**Department of Natural Sciences**
**Faculty of Science and Engineering**
**Manchester Metropolitan University**

## Career Profile

Professor of Atmospheric Science and Director of the Centre for Aviation, Transport, and the Environment (CATE), a premium research group within Manchester Metropolitan University. My background is in atmospheric science, and I have specialized in climate science for the last 23 years, particularly the impacts of aviation. I have considerable scientific project and personnel management experience and have led large international multi-institutional projects. I have particular skills in developing links between science and policy, and work at an international level, e.g., the European Commission, ICAO, UNEP, IMO, WMO, IPCC[1]. I have long experience in international scientific assessments at e.g., IPCC, UNEP, ICAO, IMO, peer-reviewed publications

## Outputs – research

A balance of internationally authored high-profile, high citation papers on aviation impacts and emissions (Scopus citations in brackets);

- 2005 (**339**), 2009 (**793**), 2010 (**543**), 2010 (**329**), 2010 (**1,631**) 2021 (**448**);
- A recent November 2021 paper has had 35,911 downloads since publication in November 2021 with an Altimetric score of 729, putting it in the top 5% of research.

with group/project-focussed papers, e.g.:

*Science of the Total Environment* (2023, 2024), *Wiley Interdisciplinary Reviews: Climate Change* (2023), *Aerospace* (2022); *Nature Communications* (2021); *Journal of Geophysical Research* (2018); *Environmental Science and Technology* (2018, 2017); *Atmospheric Environment* (2015); *Atmosphere* (2015); *Environmental Science and Policy* (2015)

## Outputs – Lead Author in international assessments

A long history of contributing to international assessments of:

- The International Governmental Panel on Climate Change (IPCC) in 1999, 2006, 2007, 2013, 2021;
- The United Nations Environment Programme (UNEP) Emissions Gap Reports of 2011, 2017, 2020;
- The International Maritime Organization (IMO) Greenhouse Gas Studies 2009, 2014, 2020.

## Outputs – UK academic partners, examples

Scientists of international standing, with whom I have recently published:

[1] International Civil Aviation Organization, United Nations Environment Program, International Maritime Organization, World Meteorological Organization (all these are United Nations Agencies), Intergovernmental Panel on Climate Change.

Prof. Myles Allen, CBE – University of Oxford |Prof. Nick Cumpsty, Imperial College | Prof. Piers Forster, Director of the Priestley Centre for Climate Change, University of Leeds | Prof. Keith Shine, FRS – University of Reading |

## Outputs – International academic partners, examples

Scientists of international standing, with whom I have recently published:

Prof. Susanne Becken – Griffith Univ., Australia |Dr Qi Chen – Peking Univ., China | Dr Dave Fahey – NOAA, US | Dr Jan Fuglestvedt – CICERO, Norway | Prof. Didier Hauglustaine – IPSL, France | Prof. Paulina Jaramillo – Carnegie Mellon Univ., US |Prof. Peter Newman, Curtin Univ., Australia | Prof. Joyce Penner, Univ. of Michigan, US | Prof. Michael Prather – Univ. California, Irvine | Prof. Suzana Khan Ribeiro – Fed. Univ. Rio, Brazil | Prof. Don Wuebbles – Univ. Illinois, US |

## Outputs – knowledge exchange, public visibility

### KE - international policy and emissions regulation

My team have been supporting the UK Department for Transport since my arrival from a prior position within MoD in 2003 where I previously supported DFT, with historical income in excess of £10 million to the university. My group currently supports the DFT under a £1.8M award. This work has been consistently won by open competitive tender at FEC. The area of support relates to DfT's work primarily within the International Civil Aviation Organization's Committee on Aviation Environmental Protection (ICAO-CAEP). ICAO is the UN agency that sets international aviation emissions regulations and standards. There are 6 permanent groups under CAEP, of which Manchester Met co-chairs 2, and we lead a sub group of the Modelling and Database Group (Ling Lim). The groups are generally of the order 30-100+ in size from industry and regulators around the world. We chair the emissions regulatory group (Bethan Owen) and the Impacts and Science Group (David Lee). CAEP has set recent international emissions standards for $CO_2$ and particulates, and developed an international market-based measure. We have been directly involved in the technical supporting work for all these impactful measures.

In addition, my inputs have been pivotal in European policy and legislation, designing the framework for the European Aviation Emissions Trading Scheme, and advising the Commission on whether and how to incorporate non-$CO_2$ impacts of aviation, for which Bethan Owen led the technology team, and David Lee the climate science team.

### KE - invitations and nominations to participate in:

- UK Government to participate in the Sixth Assessment Report of the IPCC WGIII
- Direct invitation by UNEP to contribute to Emissions Gap Reports of 2011, 2017, 2020 for COP events
- The *Royal Society* to participate in their Net Zero Aviation Working Group (reporting, July 2022)
- Member of Jet Zero Council

### Public visibility - many press interviews for radio, television, mainstream press including:

- The Daily Telegraph (January 2022)
- Panorama (November 2019, see interview at 9:31)
- New Scientist (March 2021)

### Sample Publications

I have 99 peer-reviewed publications and many reports/book chapters.

### Recent IPCC and other assessment-based chapters (selective)

1. Naik, V., S. Szopa, B. Adhikary, P. Artaxo, T. Berntsen, W. D. Collins, S. Fuzzi, L. Gallardo, A. Kiendler Scharr, Z. Klimont, H. Liao, N. Unger, P. Zanis, (& D. S. Lee [contributing Author]) (2021), Short-Lived Climate Forcers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds)]. Cambridge University Press.
2. Arrowsmith S., D. S. Lee, B. Owen, J. Faber, L. van Wijngaarden, O. Boucher, A. Celikel, R. Deransy, J. Fuglestvedt, J. Laukia, M. T. Lund, R. Sausen, M. Schaefer, A. Skowron, S. Stromatas and A. Watt, Updated analysis of the non-$CO_2$ climate impacts of aviation and potential policy measures pursuant to the EU Emissions Trading System Directive Article 30(4). European Union Aviation Safety (EASA), MOVE/E1/SER/2019-475/SI2.81706, Köln, (2020).
3. Faber J. & Lee D. S. (2020) Bridging the gap – the role of international shipping and aviation. Chapter 5 in: Emissions Gap Report 2020, United Nations Environment Programme, Nairobi.
4. Faber J., Hanayama S., Zhang S., Pereda P., Comer B., Hauerhof E., Schim van der Loeff W., Smith T., Zhang Y., Kosaka H., Adachi M., Bonello J-M., Galbraith C., Gong Z., Hirata K., Hummels D., Kleijn A., Lee D. S., Liu Y., Lucchesi A., Mao X., Muraoka E., Osipova L., H. Qian, Rutherford D., Suárez de la Fuente S., Yuan H., Velandia Perico C., Wu L., Sun D., Yoo D.-H. and Xing H. (2020) Fourth IMO GHG Study. CE-Delft, Delft, The Netherlands.
5. Lee D. S. (**2018**) International aviation and the Paris Agreement temperature goals. Report for the UK Department for Transport.
6. Lee D. S. (**2018**) The current state of scientific understanding of the non-CO2 effects of aviation on climate. Report for the UK Department for Transport.

**Recent relevant recent aviation & climate related papers (selective)**

1. Becken S., Miller G., Lee D. S. and Mackey B. (**2024**) The scientific basis of 'net zero emissions' and its diverging sociopolitical representation. *Science of the Total Environment* 918, 170725 https://doi.org/10.1016/j.scitotenv.2024.170725.
2. Lee D. S., Allen M., Cumpsty N., Owen B., Shine K. P. and Skowron A. (**2023**) An assessment of the uncertainties involved in mitigating the non-$CO_2$ effects of aviation using liquid kerosene fuels. *Environmental Science: Atmospheres* 3, 1693–1740 https://doi.org/10.1039/D3EA00091E
3. de Leon R. R. and Lee D. S. (**2023**) Contrail radiative dependence on ice particle number concentration. *Environmental Research Climate* 2, 035012 https://doi.org/10.1088/2752-5295/ace6c6.
4. Fuglestvedt J., Lund M.T., Kallbekken S., Samset B. H. and Lee D. S. (**2023**) A 'greenhouse balance' for aviation in line with the Paris Agreement. *WIREs Climate Change* https://doi.org/10.1002/wcc.839.
5. Becken S., Mackey B. and Lee D. S. (**2023**) Implications of preferential access to land and clean energy for Sustainable Aviation Fuels. *Science of the Total Environment* 866, 163883 https://doi.org/10.1016/j.scitotenv.2023.163883.
6. Matthes S., Lee D. S., de Leon R. R., Lim L., Owen B., Skowron A., Thor R. N. and Terrenoire E. (**2021**) The effects of supersonic aviation on ozone and climate. *Aerospace* 9(1), 41 https://doi.org/10.3390/aerospace9010041
7. Klöwer M., Allen M. R., Lee D. S., Proud S. R., Gallagher L. and Skowron A. (**2021**) Quantifying aviation's contribution to global warming. *Environmental Research Letters* 16, 104027 https://doi.org/10.1088/1748-9326/ac286e
8. Skowron A., Lee D. S., De León R. R., Lim L. L & Owen B. (**2021**) Should we reduce aircraft $NO_x$ emissions for the sake of climate? *Nature Communications* 12, 564 https://doi.org/10.1038/s41467-020-20771-3
9. Lee D. S., Fahey D. W., Skowron A., Allen M. R., Burkhardt U., Chen Q., Doherty S. J., Freeman S., Forster P. M., Fuglestvedt J., Gettelman A., De León R. R., Lim L. L., Lund M T., Millar R. J., Owen B., Penner J. E., Pitari G., Prather M. J., Sausen R. & Wilcox L. J. (**2020**) The contribution of global aviation

to anthropogenic climate forcing for 2000 to 2018. *Atmospheric Environment* https://doi.org/10.1016/j.atmosenv.2020.117834

10. De León R. R., Lim L. L., Lee D. S., Bennet M., Krämer M. (**2018**) Simple versus complex physical representation of the radiative forcing from linear contrails, an uncertainty analysis. *Journal of Geophysical Research (Atmospheres)*, 123, 2831–2840. DOI: 10.1002/2017JD027861
11. Freeman S., Lee D. S., Lim L. L., Skowron A. and De León R. R. (**2018**) Trading off aircraft fuel burn and $NO_x$ emissions for optimal climate policy. *Environmental Science and Technology*. 52, 2498–2505. **DOI:** 10.1021/acs.est.7b05719
12. Christie S., Lobo P., Lee D. S., Raper D. W. (**2017**) Gas turbine engine nonvolatile particulate matter mass emissions: correlation with smoke number for conventional and alternative fuel blends. *Environmental Science and Technology 51, 988 – 996*.