SAMUEL J. CLIFF

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EDUCATION

University of York York, UK
PhD in Atmospheric Chemistry *Oct. 2020 - Nov. 2023*

- **Thesis Title**: Emissions measurement applications for understanding the evolution of urban air pollution sources.
- Funded through the NERC Panorama Doctoral Training Programme (∼£85,000 award) with an additional Collaborative Award in Science and Engineering (CASE) for industry collaboration (£8000).
- Performed six weeks of SIFT-MS operation in a mobile measurement platform to quantify VOC emissions from road transport.
- Measured the first long-term fluxes of NO_x in a megacity (London, UK) using traditional and wavelet-based eddy covariance.
- Developed novel methodology to source apportion changes in emissions brought on by COVID-19 lockdowns and air quality policy.
- Investigated future emissions scenarios resulting from the transition away from natural gas combustion to H_2 combustion and heat pump technologies for UK net zero pledges.
- Started discussions with UK Government departments on how findings can be used in the development of future air quality policy.

Key Skills: Operation of advanced mass spectrometry instrumentation including in complex field environments. Development and application of novel analysis techniques. Eddy covariance data processing via cluster computing. Short and long-term measurement campaign planning and execution.

University of York York, UK
Master of Chemistry (MChem) - 1st Class Hons. with Distinction (1)* *Oct. 2016 - July 2020*

- **Thesis Title**: Characterisation of VUV fluorescence and mid IR OA-ICOS for their suitability for airborne atmospheric measurement of carbon monoxide.
- Sole awardee of the 1* degree classification in chemistry (awarded for a mean mark > 80% with no more than 5% of credits below first-class level).

RESEARCH EXPERIENCE

University of York York, UK
Net Zero Data Analyst *Sept. 2021 - Present*

- Responsible for calculating the University of York Chemistry Department's carbon footprint via utility and purchasing data.
- Led the data analysis and supervised a summer placement and an MSci student through their net zero projects.
- Gave feedback of methodology to the University as a whole and other departments to improve their calculations.

Key Skills: Collating and handling large volumes of data. Communication of science to a range of audiences. Supervision of undergraduate and graduate student projects.

Facility for Airborne Atmospheric Measurements (FAAM) Cranfield, UK
MChem Placement Student *July 2019 - Aug. 2020*

- Responsible for the operation and maintenance of FAAM's core chemistry payload (measurements of CO_2, CH_4, CO, O_3, SO_2) on > 40 science flights.
- Conducted a research project characterising different spectroscopic methods for their suitability for airborne measurement of carbon monoxide.
- Performed data and error analysis for flight and laboratory characterisation data in IgorPro.
- Made measurements for the Methane Observations and Yearly Assessments (MOYA) project including the quantification of CH_4 emissions from Scandanavian wetlands and GHG emissions from oil and gas rigs.

Key Skills: Planning and execution of gas phase atmospheric experiments in the laboratory. Instrument operation onboard an aircraft. Processing of flight data and production of standardised data products.

Wolfson Atmospheric Chemistry Laboratories York, UK
Summer Placement Student *July 2018 - Sept. 2018*

- Research project using vehicle emission remote sensing techniques to measure the effectiveness of bus emission reduction schemes.
- Handled large remote sensing data sets in R.
- Helped discover that the retrofitting of bus emissions control technologies was ineffective at controlling NO_x emissions under certain driving conditions.

AWARDS AND PRIZES

Kathleen Mary Stott Prize (2023) - Awarded to final year PhD students for outstanding research performance.

IGAC Poster Prize (2022) - Awarded for the best early career researcher poster at the International Global Atmospheric Chemistry Conference.

Whinfield Medal (2020) - Awarded for graduating top of the class in chemistry at the University of York.

LIST OF PUBLICATIONS (ORCID: 0000-0002-1078-3972)

9. Evolving NO_x sources in a megacity with future implications from net zero pledges. **Cliff, S. J.**, Lewis, A. C., Drysdale. W. S., Lee, J. D., Helfter, C., Moller, S. J., Nemitz, E., Metzger, S. Smith, E., Barlow, J., *in preparation.*

8. Unreported VOC emissions from road transport including electric vehicles. **Cliff, S. J.**, Lewis, A. C., Shaw, M. D., Lee, J. D., Flynn, M., Andrews, S. J., Hopkins, J. R., Purvis, R. M., Yeoman, A. M., *Environ. Sci. Technol.*, 2023, **57**, 8026-8034.

7. Pandemic restrictions in 2020 highlight the significance of non-road NO_x sources in central London. **Cliff, S. J.**, Drysdale, W. S., Lee, J. D., Heltfer, C., Nemitz, E., Metzger, S., Barlow, J., *Atmos. Chem. Phys.*, 2023, **23**, 2315-2330.

6. Flaring efficiencies and NO_x emission ratios measured for offshore oil and gas facilities in the North Sea. Shaw, J. T., Foulds, A., Wilde, S. E., Barker, P., Squires, S., Lee, J., Purvis, R. M., Burton, R., Colfescu, I., Mobbs, S., **Cliff, S. J.**, Bauguitte, S. J. B., Young, S., Schwietzke, S., Allen, G., *Atmos. Chem. Phys.*, 2023, **23**, 1491-1509.

5. Eddy covariance measurements highlight sources of nitrogen oxide emissions missing from inventories for central London. Drysdale, W. S., Vaughan, A. R., Squires, F. A., **Cliff, S. J.**, Metzger, S., Durden, D., Pingintha-Durden, N., Helfter, C., Nemitz, E., Grimmond, C. S. B., Barlow, J., Beevers, S., Stewart, G., Dajnak, D., Purvis, R. M., Lee, J. D., *Atmos. Chem. Phys.*, 2022, **22**, 9413-9433.

4. Airborne quantification of net methane and carbon dioxide fluxes from European Arctic wetlands in Summer 2019. Barker, P., Allen, G., Pitt, J. R., Bauguitte, S. J. B., Pasternak, D., **Cliff, S. J.**, France, J. L., Fisher, R. E., Lee, J. D., Bower, K. N., Nisbet, E. G., *Philos. Trans. Royal Soc. A*, 2022, **380**, 2215.

3. Ozone production and precursor emission from wildfires in Africa. Lee, J. D., Squires, F., Sherwen, T., Wilde, S. E., **Cliff, S. J.**, Bauguitte, S. J. B., Reed, C., Barker, P., Bannan, T. J., Matthews, E., Mehra, A., Percival, C., Heard, D., Whalley, L. K., Ronnie, G. V., Seldon, S., Ingham, T., Keller, C. A., Knowland, E., *Environ. Sci.: Atmos.*, 2021, **1**, 524-542.

2. Airborne measurements of fire emission factors for African biomass burning sampled during the MOYA campaign. Barker, P. A., Allen, G., Bannan, T. J., Nisbet, E. G., Pitt, J. R., Bauguitte, S. J. B., Pasternak, D., **Cliff, S. J.**, Schimpf, M., Mehra, A., *Atmos. Chem. Phys.*, 2020, **20**, 15443-15459.

1. Characterizing the particle composition and cloud condensation nuclei from shipping emission in Western Europe. Yu, C., Pasternak, D., Lee, J., Yang, M., Bell, T. G., Bower, K. N., Wu, H., Liu, D., Reed, C., Bauguitte, S. J. B., **Cliff, S. J.**, Trembath, J., Coe, H., Allan, J. D., *Environ. Sci. & Technol.*, 2020, **54**, 15604-15612.

CONFERENCE PARTICIPATION

6. "Unreported VOC emissions from road transport including from electric vehicles." **Cliff, S. J.**, Lewis, A. C., Shaw, M. D., Lee, J. D., Flynn, M., Andrews, S. J., Hopkins, J. R., Purvis, R. M., Yeoman, A. M., Oral presentation at European Geosciences Union (EGU), 2023.

5. "Eddy covariance measurements of black carbon emissions in central London." Cheng, Z., Allan, J., Hu, D., Nemitz, E., Langford, B., Helfter, C., Drysdale, W., Lee, J., Cash, J., **Cliff, S.**, Liu, D., Rutambhara, J., Poster presentation at European Geosciences Union (EGU), 2023.

4. "Speciated VOC emissions from road transport". **Cliff, S.J.**, Lewis, A. C., Shaw, M. D., Lee, J. D., Flynn, M., Andrews, S. J., Hopkins, J. R., Poster presentation at International Global Atmospheric Chemistry (IGAC), 2022.

3. "Using eddy covariance flux measurements made at the BT Tower to understand policy and pandemic reductions in central London NO_x emissions." **Cliff, S.J.**, Drysdale, W., Lee, J., Helfter, C., Metzger, S., Oral presentation at American Geosciences Union (AGU), 2021.

2. "Net methane and carbon dioxide exchange from European Arctic wetlands in Summer 2019: Airborne quantification and bottom-up intercomparison." Barker, P., Allen, G., Pitt, J. R., Bauguitte, S. J. B., Pasternak, D., **Cliff, S. J.**, France, J. L., Fisher, R. E., Lee, J. D., Bower, K. N., Nisbet, E. G., Oral presentation at American Geosciences Union (AGU), 2021.

1. "Airborne measurements of trace gas emissions from African biomass burning and from Arctic wetlands as part of the MOYA project." Barker, P. A., Allen, G., Pitt, J. R., Bauguitte, S., Lee, J. D., Pasternak, D., **Cliff, S. J.**, Nisbet, E. G., Fisher, R., Coe, H., Bannan, T., Mehra, A., Bower, K., Gallagher, M. W., Poster presentation at American Geosciences Union (AGU), 2020.

INVITED PRESENTATIONS AND SEMINARS

4. "Unreported VOC emissions from road transport including from electric vehicles." International Global Atmospheric Chemistry (IGAC) ECR Conference Highlight Talk, 2023.

3. "Evolving NO_x sources in a megacity with future implications from net zero pledges." Department for Environment, Food and Rural Affairs (DEFRA, UK Government) Air Quality Evidence Team meeting, 2023.

2. "Evolving NO_x sources in a megacity." National Centre for Atmospheric Science Seminar Series, 2023.

1. "Characterisation of atmospheric trace gases on and beside the road." 3rd European SIFT-MS User Group Meeting, 2021.

SELECTED MEDIA COVERAGE

- "Hidden in plain sight: Windshield washer fluid is an unexpected emission source." 30th May 2023, *Science Daily*.
- "London observatory reveals traffic reduction success but points to future pollution challenge." 3rd Mar 2023, *National Centre for Atmospheric Science*.
- "Pollutionwatch: London Ulez cuts traffic fumes but heating is concern." 24th Feb 2023, *The Guardian*.

TEACHING AND SUPERVISION

Teaching: $>$ 250 hours of demonstrating in the University of York Undergraduate Chemistry Laboratory.

Student Supervision: Megan Goss (summer placement), Jordan Goodnough (MSci).

ADDITIONAL SKILLS AND INTERESTS

Interests: Interested in the use of emissions data sets for decision-making in the transition to net zero GHG emissions and safe levels of air quality.

Computer Languages/Software: R (5+ years, highly proficient), LaTeX (4+ years, highly proficient), IgorPro (1 year of data processing experience), Python (some experience from running HYSPLIT and data logging). Additional experience in Git, Docker, Linux and SLURM (both personal and as part of the eddy4R professional development environment).

Languages: English (Native), Chinese (LFA Level 1 & 2 passes with Distinction, limited working proficiency).