**Research Experience Placement (REP) Scheme 2024**

**Supervisor Project Proforma**

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| **Project title:** | Long-term trends of air pollution in the UK |
| **Host Institution:** | UKCEH Edinburgh |
| **Project supervisor (name, department):** | Yuanlin Wang  |
| **Project enquiries (supervisor email):** | yuawan@ceh.ac.uk  |
| **Co-Supervisor, if any (name, department):** | James Cash (jamcas@ceh.ac.uk ) |
| **Proposed start date:** | 01/07/2024 |
| **Project description** (max 700 words, 1-2 figures may be included):Outdoor air pollution has become a severe environmental and social issue, high concentrations of air pollution not only affect the environment and climate, but also negatively impact human health. In the first half of the 20th century, many industrialized countries experienced significant increases in air pollution levels due to increased combustion of fossil fuel. Since the first Clean Air Act was enacted in 1956, the UK has implemented a series of legislations aimed at reducing ambient air pollutants, including sulphur dioxide (SO2), nitrogen dioxide (NO2), particulate matter with an aerodynamic diameter of less than 2.5 µm (PM2.5) and ozone (O3). In this project, we will assess the efficacy of these policies to improve air quality and, help to inform future mitigation strategies in reducing adverse health effects on the UK population. This will be achieved using high-resolution data from an atmospheric chemistry transport model (EMEP) with updated emissions to analyse the long-term spatial-temporal variations of major air pollutants in the UK from 1960 to 2020. This analysis will help to better understand the hotpots and main sources of air pollution. Additionally, this project will offer students the opportunity to do fieldwork at our Auchencorth Moss site, where they will learn how to maintain and collect measurements. Auchencorth Moss is a background monitoring site that has been in operation for ~25 years and is part of multiple atmospheric measurement networks including the Global Atmospheric Watch (GAW), the Integrated Carbon Observation System (ICOS), the network of EMEP supersites, and is a future site for the Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) network. This project requires the student to join our fieldwork team to maintain and collect data from our array of analysers measuring species such as CO2, CH4, SO2, NOx, particulate matter and O3. The work will involve the observation of instrument parameters and the detailed reporting of instrument faults. This will help to inform the ongoing development of our automated data flagging systems. There is also the opportunity for the student to analyse the measurements collected at Auchencorth Moss and untangle the trends and patterns of atmospheric species at a UK background site, leading to potential new scientific understanding.The main aims of the project:* To understand the efficacy of UK air quality policy between 1960 to 2020 and build skills in model and data analysis using tools such as Python/R
* To help maintain instruments and collect valuable data at a background monitoring site, and gain experience in fieldwork and analytical instruments
* To build a broad understanding of UK atmospheric science, ranging from field site observations to chemical transport models
* To help explore for new scientific understandings of the UK atmosphere

All data used in this project is under the UK Status, Change and Projection of the Environment (UK-SCAPE) programme (<https://uk-scape.ceh.ac.uk/> ). The vision of UK-SCAPE is the development of a whole system approach to addressing environmental challenges in the UK. |
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| **Project timeline:** |
| * Week 1: we will introduce the project, objectives, and team, give training on data handling and relevant software, and encourage initial review of literature.
* Weeks 2-3: students will learn data analysis during these two weeks. Specifically, obtain and preprocess data and be conducted to analyze the data trends. Then they will do a detailed spatial-temporal analysis of air pollutant concentrations, identify air pollution hotspots and potential sources.
* Week 4: fieldwork will be organized this week. Students will prepare for fieldwork to obtain practical application.
* Week 5: integrate field data with earlier model analysis and evaluate findings based on advanced statistical analysis.
* Week 6: prepare and give a presentation summarizing the project findings.
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| **Candidate requirements:** |
| * Current enrollment in Environment Science, Atmospheric, Geography, Chemistry, or a related field
* Familiarity with data analysis, and experience with statistical software (e.g. Excel, Python, R) will be highly valued
* Have experience or enjoy working in the outdoors
* Knowledge of and/or experience with analytical instruments
* Experience in good laboratory practice
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| **Background reading and references:** |
| * Vieno, M., Heal, M.R., Williams, M.L., Carnell, E.J., Nemitz, E., Stedman, J.R. and Reis, S., 2016. The sensitivities of emissions reductions for the mitigation of UK PM 2.5. Atmospheric Chemistry and Physics, 16(1), pp.265-276.
* Carnell, E., Vieno, M., Vardoulakis, S., Beck, R., Heaviside, C., Tomlinson, S., Dragosits, U., Heal, M.R. and Reis, S., 2019. Modelling public health improvements as a result of air pollution control policies in the UK over four decades—1970 to 2010. Environmental Research Letters, 14(7), p.074001.
* Cape, J.N., Coyle, M. and Dumitrean, P., 2012. The atmospheric lifetime of black carbon. Atmospheric Environment, 59, pp.256-263.
* Coyle, M., Cape, J.N., Flechard, C., Fowler, D., Helfter, C., Jones, M., Kentisbeer, J., Leeson, S.R., Leith, I.D., Mullinger, N. and Nemitz, E., 2019. Meteorological measurements at Auchencorth Moss from 1995 to 2016. Geoscience Data Journal, 6(1), pp.16-29.
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**To be completed by institutional CENTA PoC**

I confirm that:

* The host institution takes responsibility for selecting a suitable undergraduate student and ensuring eligibility (see NERC REP student eligibility requirements above) and confirming their eligibility using the UKRI criteria listed under the NERC REP student eligibility criteria
* This REP project falls within the NERC remit and is of suitable quality
* Appropriate supervisory arrangements are in place
* The student recruited to undertake this placement will have a PhD student mentor from the DTP/CDT
* The application processes used will be inclusive and accessible
* Reasonable adjustments will be made for students that need them whilst undertaking placements
* The placement will be carried out in accordance with all applicable ethical, legal and regulatory requirements including but not limited to relevant provisions of the General Data Protection Regulation, the Data Protection Act 2018, the Bribery Act 2010, the Fraud Act 2006, the Equality Act 2010 and the Modern Slavery Act 2015
* The host organisation takes responsibility for identification, protection and exploitation of any intellectual property rights arising from the work
* All facilities, agreements about access and collaborations necessary for the work will be obtained before the work commences and can be ensured through the period of the work
* All costs awarded by NERC for the REPs will be used and accounted for appropriately
* A report of the project by the student will be submitted no later than one week after the end date of the placement or Friday 27th September 2024, whichever falls first.

Signed:

Date:

Position: