

# Dr. Matt Amos

Email: [m.amos1@lancaster.ac.uk](mailto:m.amos1@lancaster.ac.uk)

[github.com/mattramos](https://github.com/mattramos)

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Quick learner with a strong background in data-science, machine learning, climate science and physics. Motivated to address challenging problems with novel statistical models. Excited by working with and learning from others.

## Employment

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**2021 - present      Senior Research Associate - Mathematics and Statistics Dept.,  
Lancaster University**

My research focuses on developing environmental hybrid models that combine physical and statistical understanding to better answer questions about the environment and specifically climate change.

**Current projects:**

- Probabilistic climate model ensembling using Gaussian processes and Wasserstien Barycenters
- Developing sparse methods for hierarchical Gaussian processes
- Modelling street level air quality with graph Gaussian processes
- Air quality downscaling with neural processes

## Education

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**2017-2021      PhD Atmospheric Science - Lancaster University and the British  
Antarctic Survey**

**Title:** Data science techniques to improve the robustness, accuracy and utility of chemistry-climate model ensembles.

**Summary of thesis:**

- Produced a heteroscedastic Bayesian neural network to assimilate stratospheric ozone data
- Developed climate model ensemble assimilation techniques, particularly in relation to chemical composition, by creating novel statistical methods
- Created a robust model weighting framework to predict Antarctic ozone recovery based upon model performance and independence

**Research skills:**

- Conducting and publishing interdisciplinary research
- Accessing, understanding and processing climate model and Earth observation data
- Understanding important environmental science questions and developing suitable data science solutions

**2013-2017      MPhys Physics Hons with Study Abroad Year - Lancaster University  
Awarded First Class Honours**

**MPhys dissertation** - Nonlinear wave interactions and the physical origin of rogue waves in the ocean.

## Experience

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- Computer literacy

- Python
    - Plotting: plotly, matplotlib
    - Stats/ML: Tensorflow, sklearn, JAX, GPflow
    - Data: xarray, pandas/polars, dask
  - SQL
  - Computing: Google cloud compute, Git, batch computing, Linux
  - Design/visualisation: Dash, Adobe Illustrator, blender
  - L<sup>A</sup>T<sub>E</sub>X
- **Statistical skills**
- Bayesian neural networks
  - Gaussian processes (including hierarchical and sparse methods)
  - Spatio-temporal modelling
  - Time series analysis (e.g. dynamic time warping, wavelet transforms)
- **Positions of responsibility**
- Co-organiser of a departmental coding support group
  - Manager of a group workstation on the JASMIN petascale research computing platform
  - Conference organising committee for the 2021 International Global Atmospheric Chemistry conference (IGAC)
  - Peer reviewer for Nature Communications, Atmospheric Chemistry and Physics, Journal of Geophysical Research, Geo-scientific Model Development
  - Producing risk assessments for data collection campaigns
  - Member of the statistics working group for the tropospheric ozone assessment report
- **Funding/Awards**
- Google cloud credits \$5000 (2020) from a successful proposal to use deep generative models to create synthetic climate data
  - Google cloud credits \$5000 (2019) from a successful proposal to infill historic ozone records with Bayesian neural networks
  - Poster prize at the Lancaster Physics Conference (2017)
  - Lancaster University Physics Award for 2<sup>nd</sup> year excellence (2015)
- **Teaching responsibilities**
- Lectured at an environmental science summer school about stratospheric ozone
  - Assisted teaching UG and PG modules including atmospheric science, data analysis methods and maths
- **Academic memberships and affiliations**
- Centre of Excellence in Environmental Data Science ([www.ceeds.ac.uk](http://www.ceeds.ac.uk))
  - Data Science Institute ([www.lancaster.ac.uk/dsi](http://www.lancaster.ac.uk/dsi))
  - European Geophysical Union ([www.egu.eu](http://www.egu.eu))
  - Association of Polar Early Career Scientists ([www.apecs.is](http://www.apecs.is))

## Relevant conferences attended

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**Apr 2022** European Geophysical Union - short talk  
**Apr 2021** European Geophysical Union - short talk  
**Dec 2020** NeurIPS - poster  
**Jul 2019** Data science of the natural environment summer conference  
**Jun 2019** Machine learning for environmental sciences workshop - poster  
**Jun 2019** Data science institute: Big data in the geosciences - poster

## Invited presentations

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**Dec 2021** Science and Technology Facilities Council (virtual)  
**May 2021** Cambridge Environmental Data Science Group (virtual)

## Publication list (\* denotes equal authorship)

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M. Amos, P. J. Young, J. S. Hosking, J.-F. Lamarque, N. L. Abraham, H. Akiyoshi, A. T. Archibald, S. Bekki, M. Deushi, P. Jöckel, D. Kinnison, O. Kirner, M. Kunze, M. Marchand, D. A. Plummer, D. Saint-Martin, K. Sudo, S. Tilmes, and Y. Yamashita. **Projecting ozone hole recovery using an ensemble of chemistry-climate models weighted by model performance and independence.** *Atmospheric Chemistry and Physics*, (2020). [Link](#)

U. Sengupta\*, M. Amos\*, J. S. Hosking, C. E. Rasmussen, M. Juniper and P. J. Young. **Ensembling geophysical models with Bayesian neural networks.** *Advances in Neural Information Processing Systems 33*, (2020). [Link](#)

T. Mondain-Monval, M. Amos, J.-L. Chapman, A. MacColl and S. P. Sharp. **Flyway-scale analysis reveals that the timing of migration in wading birds is becoming later.** *Ecology and Evolution*, (2021). [Link](#)

M. Amos. **Data-science techniques for improving the robustness, accuracy, and utility of chemistry-climate model ensembles.** *Thesis*, (2021). [Link](#)

## Submitted/in prep work

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M. Amos, U. Sengupta, J. S. Hosking and P. J. Young. **A continuous vertically resolved ozone dataset from the fusion of chemistry climate models with observations using a Bayesian neural network.** *Environmental Data Science*, (In review). [Link](#)

P.J. Young et. al. **Update on Global Ozone: Past, present and future, Chapter 3 in Scientific Assessment of Ozone Depletion: 2022, Global Ozone Research and Monitoring Project - Report No. xx**, World Meteorological Organization, Geneva, Switzerland, 2022. *Under review*.

M. Amos\*, T. Pinder\*, , P. J. Young, D. Leslie. **Probabilistic ensembling of climate models** *In prep.*

M. Amos, J. S. Hosking, P. J. Young. **High resolution surface ozone hindcasting.** *In prep.*

T. Pinder, et al. **Street-scale modelling of air quality** *In prep.*

M. Amos, T. Pinder **Sparse herarchical Gaussian processes** *In prep.*