

Dr. Matt Amos

Email: matt.r.amos@outlook.com

github.com/mattramos

mattramos.github.io

An experienced data scientist passionate about solving important environmental challenges.
Quick learner with a strong background in machine learning, climate science and physics.
Motivated by tricky problems and working with others.

Employment

2021–Present

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

Leading independent and collaborative research to build statistical models for climate change and the environment. Producing innovative advances that couple expert knowledge, climate models and multiple streams of data within state-of-the-art machine learning models.

Current projects:

- Probabilistic climate forecasting using Gaussian processes and optimal transport
- Developing sparse methods for hierarchical Gaussian processes
- High resolution air quality predictions using neural processes and Bayesian neural networks
- Graph Gaussian processes for modelling street level air quality

Education

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:

- Developed heteroscedastic Bayesian neural networks to assimilate stratospheric ozone data
- Built and tested custom machine learning models
- Advanced climate model ensemble assimilation techniques by creating innovative statistical methods
- Produced robust up-to-date estimates of Antarctic ozone hole recovery using a model weighting framework

MPhys Physics Hons with Study Abroad Year - Lancaster University (First)

2013-2017

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

Experience

Computing & Programming

Skilful and experienced with a typical python and ML development tech stack. Please see links provided for examples.

- **Code:** UNIX systems, conda, git, VSCode, pytest
- **ML:** [tensorflow](#), [JAX](#), [GPflow](#), sklearn
- **Big data:** [xarray](#), dask, pandas/polars
- **Cloud:** Google Cloud Platform
- **Distributed computing:** SLURM, LSF on large compute clusters
- **Visualisation:** [plotly](#), [matplotlib](#), dash, seaborn, blender, Adobe Illustrator
- **Publishing:** GitHub, \LaTeX , [binder](#)

Statistics & Machine learning

- Bayesian neural networks
- Gaussian processes (including hierarchical and sparse methods)
- Spatio-temporal modelling
- Time series analysis (e.g. dynamic time warping, wavelet transforms)
- GANs and CNNs

Responsibilities & Teaching

- Co-organiser of a departmental coding support group
- Manager of a group workstation on a petascale computing platform
- Conference organising committee for the 2021 International Global Atmospheric Chemistry conference (IGAC)
- Peer reviewer for Nature Communications, Geoscientific Model Development, Journal of Geophysical Research, Atmospheric Chemistry and Physics
- Designing and risk assessing data collection campaigns
- Member of the statistics working group for the tropospheric ozone assessment report
- Lectured at an environmental science summer school about stratospheric ozone
- Assisted in teaching data analysis methods, maths, machine learning and atmospheric science
- Led and instructed hundreds of young adults in high risk outdoors activities

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 2nd year excellence (2015)

Publications (* denotes equal authorship)

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

U. Sengupta*, M. Amos*, et al. **Ensembling geophysical models with Bayesian neural networks.** *Advances in Neural Information Processing Systems 33*, (2020). [Link](#). [Code](#)

M. Amos et al. **Projecting ozone hole recovery using an ensemble of chemistry-climate models weighted by model performance and independence.** *Atmospheric Chemistry and Physics*, (2020). [Link](#). [Code](#)

T. Mondain-Monval, M. Amos et al. **Flyway-scale analysis reveals that the timing of migration in wading birds is becoming later.** *Ecology and Evolution*, (2021). [Link](#)

Submitted/in prep work

M. Amos, T. Pinder **Sparse hierarchical Gaussian processes** *In prep.* [Code](#)

M. Amos*, T. Pinder*. **Probabilistic climate model projections, using Gaussian Processes and Optimal Transport** *In prep.* [Code](#)

M. Amos, et al. **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](#). [Code](#)

M. Amos*, et al. **LancasterAQ: A city-wide street-level air quality dataset of ultrafine particulate matter** *In prep.*

T. Pinder, D. Booker, M. Amos et al. **Street level air quality modelling using graph Gaussian processes: A demonstration for Lancaster, UK.** *In prep.*

P.J. Young et. al. **Update on Global Ozone: Past, present and future, Chapter 3 in Scientific Assessment of Ozone Depletion: 2022**, World Meteorological Organization, 2022. (In review).