OISÍN HAMILTON

oisin.hamilton@meteo.be | oisinhamilton.com
ORCID | in/oisin-hamilton

EDUCATION

PhD Climate Modelling With a Focus on Climate Tipping Points **2021 - 2025**
Université Catholique de Louvain & Royal Meteorological Institute of Belgium

MSc Mathematical Modelling **2018 - 2020**
University College London Distinction

BA Mathematics (Major) and Philosophy (Minor) **2013 - 2017**
Trinity College Dublin 1st Class Hon.

PUBLICATIONS

Hamilton, O., Demaeyer, J., Crucifix, M. and Vannitsem, S. (2025) Using Unstable Periodic Orbits to Understand Blocking Behaviour in a Low Order Land-Atmosphere Model *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 35 (8): 083126. https://doi.org/10.1063/5.0268852

Xavier, A. K., **Hamilton, O.**, Feranda, D. & Vannitsem, S. (2025) Predictability of North Pacific Blocking Events: Analogue Based Analysis of Historical MIROC6 Simulations [under review]. *Submitted to QJRMS* 10.48550/arXiv.2504.17691

Jonathan Demaeyer & **Oisín Hamilton** (2025) auto-AUTO: A Python Layer for Automatically Running the AUTO-07p Continuation Software [under review]. *Submitted to JOSS*. 10.5281/zenodo.14901321

Hamilton, O., Demaeyer, J., Crucifix, M. and Vannitsem, S. (2023) Multistability in a Coupled Ocean Atmosphere Reduced-order Model: Nonlinear Temperature Equations. *Quarterly Journal of the Royal Meteorological Society*, 1–17. 10.1002/qj.4564

RESEARCH WORK

Climate Change Impact on Atmospheric Blocking
PhD Project - Marie-Curie (MSCA) Doctoral Fellowship

- Prediction of atmospheric blocking and low frequency variability in the midlatitude atmosphere was studied using unstable periodic theory in simplified climate models.
- Analysis of jet stream behaviour in climate change scenarios was studied to understand the impact on North Atlantic storm tracks.
- Multi-stability in a reduced order coupled ocean-atmosphere model and its impact on low frequency variability was investigated.
- Project is part of the CriticalEarth EU Horizon 2020 project researching climate tipping points.

Quasi-Geostrophic Spectral (qgs) Model Development
PhD sub-project

- Lead developer of a modification to the temperature equations in the qgs model, we incorporated the non-linearised Stefan-Boltzmann radiation equation which resulted in multiple climate states.
- Lead developer of a symbolic Python version of the model, enabling continuation analysis and multi-language equation output.

- Lead developer introducing a meridional gradient in key parameters to allow simulation of climate change forcings.

Training Secondments
PhD sub-project

I spent three months at Utrecht University under the supervision of Henk Dijkstra focusing on geostrophic turbulence. I developed a novel shell model for atmospheric turbulence energy transfers.

I spent an additional three months in the University of Exeter under the supervision of Mark Holland learning about Extreme Value Theory. While here I investigated the behaviour of one dimensional maps that present switching behaviour between two persistent regions.

Forest Fire Modelling
MSc Dissertation

- Forest fire behaviour was modelled by deriving a reaction diffusion partial differential equation to simulate fire spread incorporating wind, topography, and fuel type.
- Multiple geospatial data sources were incorporated (wind, historical fire data, topography, soil moisture).
- The equation was simulated using a variety of finite difference methods, which I programmed.
- This equation was used to implement a cellular automata model, which incorporated discrete spreading elements such as firebreaks and floating embers.
- The model produced realistic spreading behaviour that was verified with fire spread observations.

Automated Mapping of Transport Networks
BA Dissertation

- Bus network maps were automatically created given the location of bus stops and the ordering of the stops for each bus route.
- From a specified stop, the program identified key routes and output a well designed transit map. The project produced an accurate bus and rail map for the Dublin network.
- This project involved graph theory, graph embeddings, linear programming, and data analysis of similarity between bus lines.

EMPLOYMENT

Climate Researcher, Royal Meteorological Institute, Brussels **Oct 2021 - Oct 2024**
Researcher of climate dynamics as part of my PhD studies.
My main tasks include analysing climate models, modifying climate models in python, and implementing new diagnostic tools to analyse results.

Transport Planner and Economist, WSP, London **Oct 2017 - Apr 2021**
Analyst and model builder for forecasting and analysing a wide range of public transport systems.
Responsibilities involve model design and coding, data analysis, geospatial analysis, auditing, and project management.

Key Projects:
UK Electric Car Uptake (2020): Using census data, UK vehicle fleet statistics, and fine grained population statistics I developed a model that forecast the uptake of electric cars. This analysis was used to help local authorities plan for electric grid improvements and vehicle charging locations.

Train Loadings During COVID-19 (2020): Using ticket gate-data I developed a process to provide daily reports to Chiltern Railways on the number of people on each train. This process helped ensure social distancing could be maintained and to aid in passenger demand forecasting.

Overground Service Reporting (2020): I created a process for Arriva Rail London (ARL) which incorporated different datasets on timetable, performance, and planned engineering work to output a forecast for capacity for the London Overground. I also managed this project and was responsible for liaising with stakeholders within ARL and TfL.

Journeys per Ticket (2019): Research project for the Department of Transport, calculating the number of journeys taken on season tickets. I created a program to search over 200 million ticket entries to identify trip rates. I also created a process to find and edit missing entries in the ticket data. Results from this project are included in the government transport guidance.

Carbon Emission Modelling (2018): I built a model to forecast the emissions of rail services as part of the West Coast franchise. This involved incorporating timetable information, rolling stock types, and researching the forecast carbon emissions of the UK power grid.

CONFERENCES

EGU General Assembly - Vienna, Austria - 2024
I presented the findings of a bifurcation analysis on the qgs model that used continuation methods to explain persistent blocking behaviour found in previous studies. This study allowed me to showcase the use of the symbolic python version of the model that I have developed and present a new code pipeline from the qgs model to the continuation software.

Extreme Events: Identification, Analysis and Prediction - Bad Honnef, Germany - 2024
Invited attendee of the Wilhelm and Else Heraeus-Foundation conference on extreme events. I presented work on persistent atmospheric blocks found in an idealised climate model.

TiPES General Assembly - Benasque, Spain - 2023
I presented my work on creating a symbolic python pipeline for the qgs model. I showed how this allows for time dependant forcing to be introduced, as well as continuation methods to be applied.

IUGG General Assembly - Berlin, Germany - 2023
I presented the findings in Hamilton et al. 2023, as well as introduced a symbolic python representation of the qgs model, which allows for continuation methods to be used on the model equations.

EGU General Assembly - Vienna, Austria - 2023
I presented the findings in Hamilton et al. 2023, in the tipping point seminar.

Tipping Points in the Earth System (TiPES) - Devon, UK - 2022
TiPES workshop and general assembly. As part of this workshop I also attended the first day of the *Tipping Points: From Climate Crisis to Positive Transformation* conference, which was held in the University of Exeter.

9th International Symposium on Bifurcations and Instabilities in Fluid Dynamics (BIFD) - Groningen, Netherlands - 2022
I gave a presentation of my work on nonlinear heat radiation terms in an ocean-atmosphere coupled model.

Modern Mathematics for Complex Systems - London, UK - 2022
I presented a poster on my initial results of including nonlinear heat radiation terms in a coupled ocean-atmosphere model.

TRAINING COURSES

CriticalEarth Training Event - Tromso, Norway - 2024
Climate sensitivity, grant and proposal writing.

CriticalEarth Training Event - Munich, Germany - 2024
Linear response theory, climate services workshop, climate model intercomparison project overview.

CriticalEarth Training Event - Exeter, UK - 2023
Atmospheric turbulence with the use of simple models to capture key energy transfers.

Science Communications - Exeter, UK - 2023
Science communications workshop and training event, conducted by David Trads. The topic covered blog post and article writing, aiming scientific literature for a more general audience, and how to interact with journalists and interview techniques.

MOOC Machine Learning in Weather & Climate - ECMWF - 2023
I completed the three tiers of the course, which introduced machine learning topics in the context of numerical weather prediction, and provided experiences in applying practical Machine Learning in weather and climate forecasting.

TUM Dynamical Systems Winter School - Munich, Germany - 2023
Fast-slow dynamical systems, machine learning, stochastic systems. I gave a presentation on finding multistability in an ocean-atmosphere coupled model.

CriticalEarth Training Event - Nijmegen, Netherlands - 2022
Event for the CriticalEarth PhD students where we had workshops on using machine learning in climate science, and using rare event algorithms.

Time Series Analysis - Germany - 2022
I attended a course on time series analysis conducted by Manfred Mudelsee, which covered topics such as: bootstrapping, regression methods, and correlation of bivariate time series.

CriticalEarth Training Event - Hornbæk, Denmark, 2021
Introduction to dynamical systems and bifurcation analysis.

TEACHING

Teaching Assistant, Nonlinear Dynamics - UC Louvain - 2024
I ran tutorials for the masters course in nonlinear dynamics. I developed visualisation tools in jupyter notebooks to aid with theoretical understanding. I also gave guest lectures to masters students in atmospheric dynamics.

SKILLS

Programming	Python (Expert), Julia (Intermediate), VBA (Intermediate), Fortran (Basic)
Software	LaTeX, AUTO continuation software, Excel, QGIS, Linux.
Languages	English (Fluent), French (A2)

SELF-EMPLOYED WORK

Senior Sailing Instructor, Howth Yacht Club **May 2015 - Apr 2017**
HYC Instructor of the year 2015
I was the team leader of up to eleven instructors during summer sailing courses. I was responsible for on the water safety and maintaining the high teaching standards expected at one of Ireland's most successful sailing clubs. I also had final say on the suitability of weather conditions and forecasts for teaching. I was in charge of handling customer feedback and administration for the courses and over three summers the club enrolled 500 students.

As well as leading sailing instructors I taught sailing for five years, during which time I taught all age groups and sailing abilities.

Boat Maintenance, Irish Sailing **May 2014 - Aug 2016**
I acted as bosun of Irish Sailing Association's eight J80s, where I was responsible for maintaining and refitting the boats for two years. I was responsible maintaining the yachts at racing standard, including for the 2015 European match racing finals.

INTERESTS AND ACHIEVEMENTS

Sailing: From the age of ten I lived on a yacht with my family. During this time I kept day and night watch, did route planning based on weather forecasts, and navigation. Together, we covered a total distance of over 40,000 km and visited 15 countries. My travels have allowed me to experience working with people from many different cultures.

I have competitively raced J80, J24, SB20 keelboats, as well as 420 dinghies.

Cycling: I have planned and completed three different cycling trips across Europe, together lasting a total of nine weeks. As part of the trips I have travelled through 13 countries and covered a total distance of over 7,000km.

In 2016 I completed a charity cycle for Amnesty Int. of over 300km in less than 24 hours, for which I raised over €500.