NERC-funded Research Experience Placement (REPs) Summer 2025

Project title
Variability of North Atlantic storms

Lead supervisor
Sebastian Schemm

Project description
This project investigates the dynamics of the North Atlantic storms on daily to weekly time scales. Internal variability of the storm tracks is the main driver of daily to weekly weather variability over the UK, which is at the end of the North Atlantic storm track. The basic mechanism of midlatitude cyclone growth and decay has recently been described by a non-linear oscillator or predator-prey model. In this model, a period of baroclinic growth is followed by a period during which baroclinicity is rebuilt by surface heat flux. The model captures the basic variability found in the observations but lacks the crucial influence of moisture.

The aim of this project is to (a) explore the properties of the nonlinear oscillator model analytically and in simple Python code (e.g. Poincaré maps), (b) extend the model to account for the role of latent heat release, (c) compare the revised model with observations from the European Centre for Medium Range Weather Forecast (ECMWF).

The project is suitable for a student who is confident in mathematics -- e.g. who has taken mathematics up to second-year level as part of a degree course in (applied) mathematics, physics, engineering or atmospheric science plus some basic experience in reading, writing and modifying existing Python code (or an interest in learning). Students will work with observational data to verify the analytical model.

The student will be involved in the activities of the Atmosphere-Ocean Dynamics group, will have access to teaching materials, and will have the opportunity to discuss the broader context of their project with others.

Reading material:
Ambaum, M.H.P. and Novak, L. (2014), A nonlinear oscillator describing storm track variability. Q.J.R. Meteorol. Soc., 140: 2680-2684. https://doi.org/10.1002/qj.2352

Project restrictions
None noted.

Working arrangements
There is a preference for students working in DAMTP so that they profit from informal contact with the wider atmosphere-ocean dynamics groups. If remote working is essential some arrangements could be made.