Moist processes and their interaction with storm tracks

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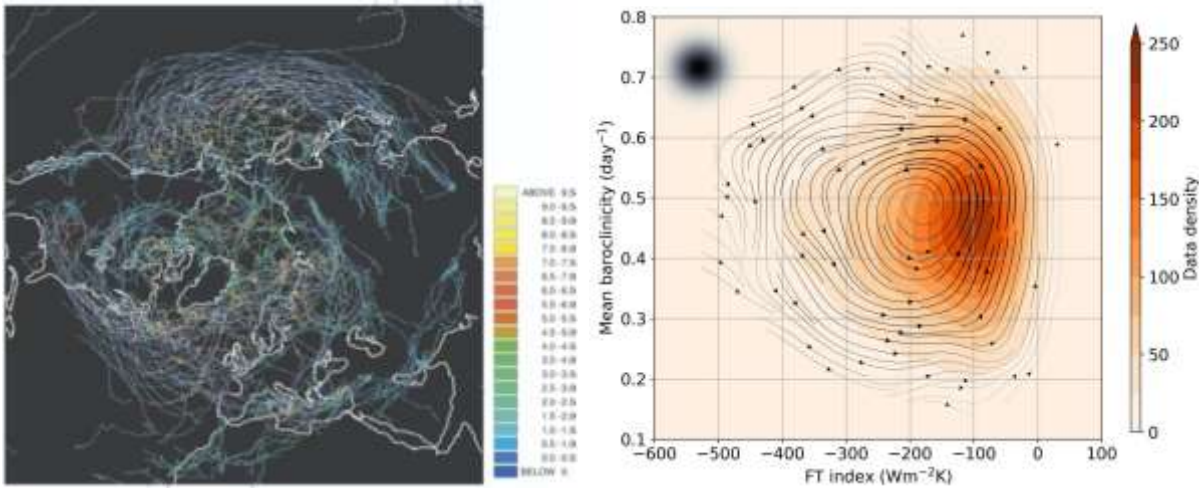
Atmospheric storm tracks are the regions on earth where midlatitude weather systems predominantly grow, evolve and decay. They are strongly associated with the well-known midlatitude jet streams and are responsible for the majority of extreme weather events away from the tropics. Their longer-term prediction and their behaviour in a future climate is one of the great challenges of atmospheric science. A key uncertainty is the role of *latent heating* (condensation and evaporation of water) in the setting of the intensity of the storm track, its geographical structure, and its evolution.

The dynamics of the storm track involves a complex, non-linear interplay between the jet stream, individual storms, different air masses, cloud fields, and the ocean surface. In this project we will work on capturing and understanding those interplays in terms of a *dynamical system*, a low-order, non-linear description of the most important physical interactions. As an example, earlier work on this topic has demonstrated that the interplay between the jet stream and storm intensity can be described as a non-linear oscillator, similar to a predator -- prey system known from mathematical biology!



Left: Storm tracks in the northern hemisphere, here seen as geographical tracks of individual storms. Right: Dynamical systems picture of the same storm tracks highlighting the physical relationshop between effective jet strength (*y*-axis) and effective storm activity (*x*-axis).

In this project we will particularly focus on how latent heating in the storm track can be incorporated in such a dynamical systems approach to the storm track. The project involves novel data analysis tools, applied mathematics, and computer simulations of the storm track, and provides a broad avenue of possible research foci and developments.

The aim is to improve our understanding of the dynamics of the storm track and be able to make more confident predictions of their future behaviour.

Training opportunities:

The student will spend time working in the research group of Prof. Spengler at the University of Bergen in Norway, interacting with different scientists working on related topics, and develop further transferable skills.

Student profile:

This project is most suitable for a student with a numerate background, either with a physics or mathematics degree, or a related numerate science. The student must be interested to work with and to develop appropriate software for analysis and computation. Aptitude and interest in more theoretical problems is desirable. Programming skills would be desirable but can be further developed in the course of the studentship.

Funding particulars:
The project provides a placement at the Geophysical Institute at the University of Bergen.

https://research.reading.ac.uk/scenario/