PROJECT TITLE: Predicting stratospheric drivers of extreme winter weather

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Project description

The stratospheric polar vortex is a region of intense winds at above 10 km in altitude (just above the level that jet airplanes fly), encircling the winter pole. About one in every three winters, this vortex can temporarily break down in a dramatic event known as a sudden stratospheric warming (SSW; see Fig 1), with impacts propagating downwards to the Earth’s surface (see this explainer video: https://youtu.be/VnlFFaF_17I). SSWs have preceded many of the most extreme winter weather events in Northern Europe and North America, including, for instance, the ‘Beast from the East’ in 2018. However, SSWs and their impacts remain extremely challenging to predict beyond a week before they occur.

This project will build on recent work in our group to investigate the predictability of SSWs and their impacts on surface weather. The student will make use of an idealised climate model, developed by our group (https://execlim.github.io/IscaWebsite/index.html), to investigate how small perturbations impact SSW predictions, as well as how the nature of SSWs impact surface weather. To do so, the student will run a series of idealised ‘weather forecasts’ of a modelled SSW. This work is complementary to an ongoing project in collaboration with the Met Office. The project would suit students with an interest (though not necessarily experience) in fluid dynamics, climate, and computational modelling. Previous experience with computer programming would be advantageous for this project.

![Figure 1. Breakdown of the stratospheric polar vortex during the January 2021 SSW (adapted from Wright et al. 2021).](image-url)
Candidate requirements

The project would suit students with an interest (though not necessarily experience) in fluid dynamics, climate, and computational modelling. Previous experience with computer programming would be advantageous for this project.

Background reading and references