Quantifying Arctic storm risk in a changing climate

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A dramatic reduction in Arctic sea ice has opened up opportunities for business in diverse sectors such as fossil fuel & mineral extraction, shipping and tourism. Industrial activities in the Arctic are expected to be subject to high levels of investment over the coming decades. As a result, there has been an increase in the exposure of humans and infrastructure to extreme Arctic weather. This is particularly true in summer, when large swathes of ice-free water have opened up. Unlike the mid-latitude storm track, which is most active in winter, cyclones within the Arctic Ocean are more common in summer, during months of low sea ice cover.

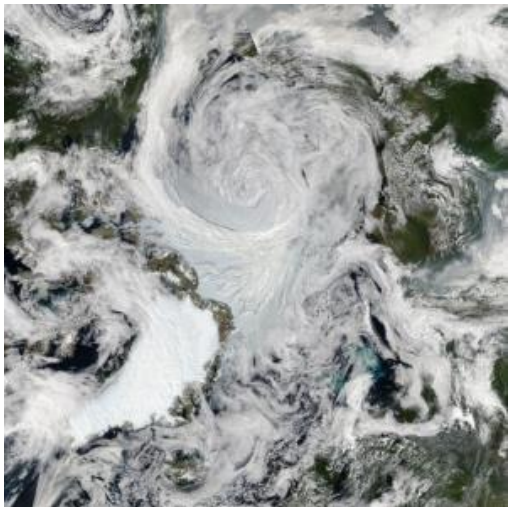

Figure 1 The "Great Arctic Cyclone of August 2012

This project will seek to quantify the risk posed by Arctic summer cyclones to offshore infrastructure, such as oil platforms, and shipping. It will examine the strength of surface winds and waves associated with such storms and how often extreme conditions, which pose a risk to infrastructure, occur. It will also investigate the mechanisms for the development of these cyclones and whether recent changes in Arctic sea ice cover are playing a role. The project will be in two parts:

1. *Assessing risk from Arctic cyclones in Reanalysis products, and understanding their shortcomings for long term analysis and trends:* Uncertainty in frequency, strength and intensity of Arctic cyclones will be assessed across different reanalysis products in order to quantify the risk from Arctic storm events. This inter-comparison of storm statistics in reanalysis products will be conducted using the Hodges objective feature tracking algorithm.

The same algorithm will be applied and a cyclone compositing approach will be used to investigate the spatio-temporal structure of these Arctic cyclones and the processes responsible for their development, for the first time. A key question will be whether, the conceptual models of cyclone development, such as the Norwegian cyclone model can be applied to Arctic cyclones.

2. *Understanding interanual-to-decadal variability in storm frequency and its drivers using reanlaysis and model experiments:* Presently, little is known about how the frequency of Arctic weather extremes changes on interannual-to-decadal timescales. In the second half of the project, the student will combine observational analysis with the use of state-of-the-art climate model experiments to investigate the links between decadal shifts in key variables, such as sea ice cover, and Arctic storminess.

Training opportunities :
The successful student will spend a 3 month placement within XL Catlin's risk management team, in London, to develop skills in risk analysis within a business setting. They will also have the opportunity to attend science meetings of the €8M EU funded APPLICATE project, involving supervisors Shaffrey and Day.

Student profile :
This project would be suitable for students with a degree in meteorology, physics, mathematics or a closely related environmental or physical science.

Funding particulars :
CASE sponsorship from XL Catlin has been confirmed.

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