PROJECT TITLE: Future changes in convective storms across Africa in new km-scale climate scenarios

DTP Research Theme(s): Changing Planet

Lead Institution: University of Bristol

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Project keywords: climate change, severe storms, convective-scale climate models

Flooding in Sofala, Mozambique, following Cyclone Idai (Photo: Mozambique Institute of Disaster Management)

Hourly rainfall snapshot (4th August 2003) in convection-permitting model (CP4A) compared to traditional 25km climate model (R25)

Project Background

Africa is a uniquely vulnerable region. Both drought and flooding are expected to increase in future with climate change [1], which is a major threat to rainfed agriculture, drinking water supplies, ecosystems and a risk to human life. These extremes are a manifestation of changes in convectively driven precipitation, which dominates across Africa. However, despite their importance, our understanding of how the properties of convective storms will change in future is limited. This is in part due to the relatively coarse resolution of traditional climate models, which provide a simplified representation of convection. With increases in supercomputing power, we are now able to run very high resolution (km-scale) models that give a much better representation of convection and individual storms. The first so called ‘convection-permitting’ climate simulation for Africa (CP4A) was carried out as part of the IMPALA project [2] and provided new insights into future changes across Africa. For example, it showed enhanced increases in both wet and dry precipitation extremes [3], of key importance for impacts.

Project Aims and Methods

This project, in collaboration at the Met Office, will exploit the first ever ensemble of km-scale climate simulations spanning all of Africa to understand future changes in convective storms. This will provide new insights into future changes in flooding and drought, and the extent to which existing climate projections across Africa are reliable. The new ensemble simulations are currently underway and will consist of 6 different CP4A climate change simulations driven by different global climate models, allowing us for the first time to assess uncertainties in future changes at local and hourly scales.

The PhD project will explore how convective storm properties change and will include developing new metrics to explore changes in the spatial organisation of convection – a critical aspect of future changes that has received little study to date. There will be the ability to utilise a new convective cell tracking algorithm developed at the Met Office to identify and track convective storms. Research direction will be guided by the student and could evolve in many different directions depending on interest. For example, it could include examination of the triggering and development of convection, its degree of organisation, and to what extent these change in a future warmer climate.


[2] IMPALA project

**Candidate requirements**
This project would suit someone with a keen interest in hazards and climate change, and excellent quantitative analysis and communication skills. Some experience and enthusiasm for computer programming (e.g. Python, Matlab) is important. We welcome and encourage student applications from under-represented groups, and value a diverse research environment.

**Project partners**
This project is in partnership with the Met Office. The student will be co-supervised by Dr Will Keat, who has spent many years exploiting high-resolution models to study African climate [4]. He will provide guidance on the scientific direction and support to analyse the CP4A ensemble data. The student will be part of the Bristol-Met Office Academic Partnership and will be invited to undertake an extended research placement at the Met Office for 3-18 months. As such they will benefit from the wide expertise on high resolution climate modelling as well as established links to African partners at the Met Office. CASE funding will be applied for, and if successful the Met Office will cover the costs of this visit and provide a £1000 per year contribution to the Research & Training Support Grant.

**Training**
The student will receive world-leading training in analysis of weather and climate data, from supervisors at University of Bristol and the Met Office. They will have access to training in programming and data analysis from University of Bristol’s Advanced Computing Research Centre. The student will be supported to attend specialist short courses and to present their research at conferences. International collaboration will be encouraged, including with our partners in Africa, experts in the regional climate, and organisations working with policy-makers to inform adaptation (e.g. University of Cape Town, Kulima).

**Background reading and references**

**Useful links**
http://www.bristol.ac.uk/geography/courses/postgraduate/

Bristol NERC GW4+ DTP Prospectus:
http://www.bristol.ac.uk/study/postgraduate/2023/doctoral/phd-great-western-four-dtp/

How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

Please note: If you wish to apply for more than one project please contact the Bristol NERC GW4+ DTP Administrator to find out the process for doing this.

The application deadline is Monday 9 January 2023 at 2359 GMT. Interviews will take place during the period 22 February – 8 March 2023.

NERC GW4+ DTP Website:
For more information about the NERC GW4+ Doctoral Training Partnership please visit
https://www.nercgw4plus.ac.uk.

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