Drought modelling

News story

We have supported a project to develop an approach to assess the welfare impacts of drought in Sub-Saharan Africa.

The Government Actuary's Department (GAD) has supported a project to develop a standardised approach to estimating the poverty and nutritional impacts of droughts in Sub-Saharan Africa.

The Centre for Disaster Protection is collaborating with the World Bank on this project. They are looking at various drought indicators and welfare measures to find a link between droughts and the impact on households, using historical weather event series as indicators of drought.

To support this work GAD developed a model that simulates soil moisture in Malawi based on historical data. This provided a methodology which can be used to develop models for simulating other drought measures in different countries.

GAD's involvement

The model we developed produces 10,000 simulations, over a 1-year time horizon, of soil moisture at 5-kilometer points throughout Malawi.

To create our model, we had to overcome the challenges posed by trying to accurately capture the following behaviours of the underlying drought indicators:

- temporal – how to capture the seasonal trends and varying levels of soil moisture during the rainy and dry seasons
- spatial – how to incorporate correlations between spatial points – this involved looking at the relationships between 32,000 data points
- scalability – how to make the model flexible and scalable so it can be applied to other countries and drought indicators

It is hoped that our model could be used to improve how we plan for and take

action to avoid or mitigate the impact of droughts in Sub-Saharan Africa.

New approaches through data science

As we are not climatologists, we approached this task using actuarial techniques. We carried out a detailed exploration of historical data to ensure we understood the features and dynamics we needed to capture in our modelling.

We used data science techniques to:

- build a model to reduce the dimensionality of the data
- fit an appropriate time-series model
- create simulated future projections of soil moisture for each of the data points

GAD actuary and project lead Georgina Bedenham said: “The work we have undertaken shows that actuarial work is not just restricted to traditional areas such as insurance and pensions.

“We really enjoyed this project as we were able to use new techniques. We brought together experts across GAD and built on our data science and coding skills. It meant we contributed towards a project that we hope will go on to improve the lives of the most vulnerable people.”

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