HYDROLOGICAL MODELLING WORKSHOP

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Workshop Overview

The **Hydrological Modelling** workshop (20-21 January 2020) took place in the Herschel Learning Lab at Newcastle University, UK. This two-day interactive workshop focused on physically-based hydrological modelling using the SHETRAN tool.[1] This workshop was attended by participants from globally reputed institutions including Newcastle University, UK; Universiti Teknologi Malaysia (UTM), Malaysia; Indian Institute of Technology (IIT) Delhi, India; University of Leeds, UK; Makerere University, Uganda; Addis Ababa University, Ethiopia; and the Water and Land Resource Centre (WLRC), Ethiopia.

Under the aegis of the Water Security and Sustainable Development Hub, this workshop offered an invaluable learning opportunity to Early Career Researchers (ECRs) and the chance to strengthen the global network of young researchers who will support the delivery of the Hub's research program over the next five years.[2] The learning outcomes were (i) to gain knowledge of the overall concepts and theory of physical-based hydrological modelling, and (ii) to understand the assumptions and limitations of models in practical applications and decision-making.

Workshop participants and facilitators

[1] SHETRAN is a physically-based spatially-distributed hydrological model developed by Newcastle University. See more: https://research.ncl.ac.uk/shetran/

[2] The Water Security and Sustainable Development Hub is funded by the United Kingdom Research and Innovation's (UKRI) Global Challenges Research Fund (GCRF) [grant number: ES/S008179/1].

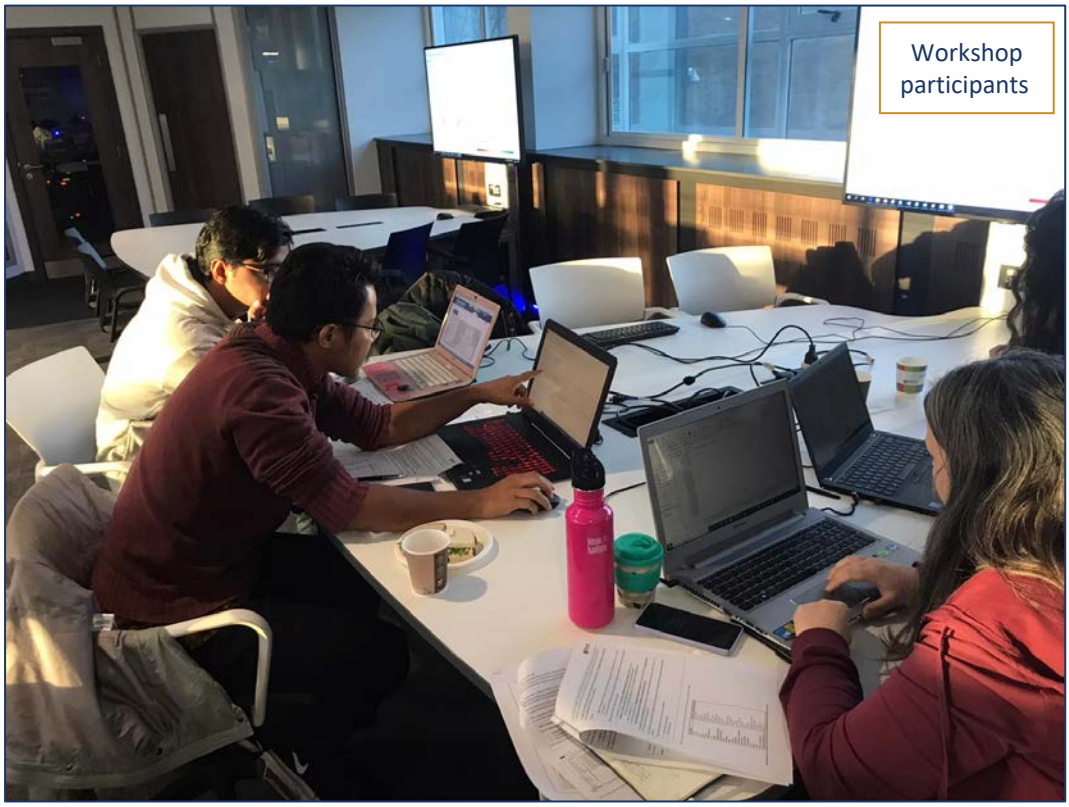
Workshop Content

On the first day, participants were introduced to **physically-based modelling**, followed by **modelling and impact assessment** on day two. The following course content was covered in the workshop:

- Explore data requirements and data sources;
- Set-up a basic model of a catchment;
- Run the model to conduct a range of impact assessments, e.g., climate change, land-use variation;
- Consider methods for model validation, testing and uncertainty analysis;
- Analyse and present results using appropriate methods and visualisation tools.

On day one, the workshop began with a lecture on the introduction to **Hydrological Modelling** and an **Overview of SHETRAN**. This was followed by the first practical session on **SHETRAN Installation and First Run**. This practical session aimed to demonstrate how to install SHETRAN, perform a simulation, and view the results. For this session, we used data from the Wansbeck catchment (287 km^2), which is located north of Newcastle.

In the afternoon, the workshop continued with a lecture on the **Sources of Uncertainty and Model Calibration and Evaluation**. These modules were reinforced by the second practical, **Model Calibration and Evaluation**. This practical session aimed to explain how to modify SHETRAN data files and calibrate the model based on hydrological reasoning. Day one ended with a lecture and practical example on **Water Supply Systems and Decision Making**.



On day two, the workshop started with three successive lectures on **Input and Data Processing**; **Contaminant and Sediment Transport**; and **Land Use Change Impact Assessment**. These lectures focused on the geospatial data for 3D surface modelling, rainfall and river flows as well as sediment, contaminant transport, and water flow. The workshop continued with a third practical sessions, **Land Use Change**, using a baseline simulation of the Wansbeck to perform SHETRAN simulations for three different land-use scenarios and analyse the results. Two extreme land-use scenarios were considered *viz.* (i) converting the catchment to 100% urban and, (ii) specifying 100% forest.

In the afternoon, a lecture was delivered on the **Principles of Climate Models and Downscaling for Impact Assessments**. This was followed by the fourth and final practical session, **Climate Change**, on downscaling climate model data using the delta change method to calculate and apply simple change factors. This practical exercise aimed to demonstrate the concept of downscaling and put it in to practice using a simple methodology. Using observations and the latest climate model output for the Wansbeck, the participants gained experience in understanding the need, and applying, downscaling methods using a simple delta change approach and interpreting uncertainty in the output through the use of model ensembles.

Overall, the participants improved their knowledge of hydrological modelling tools, and can apply these skills in their ongoing/future research.

References

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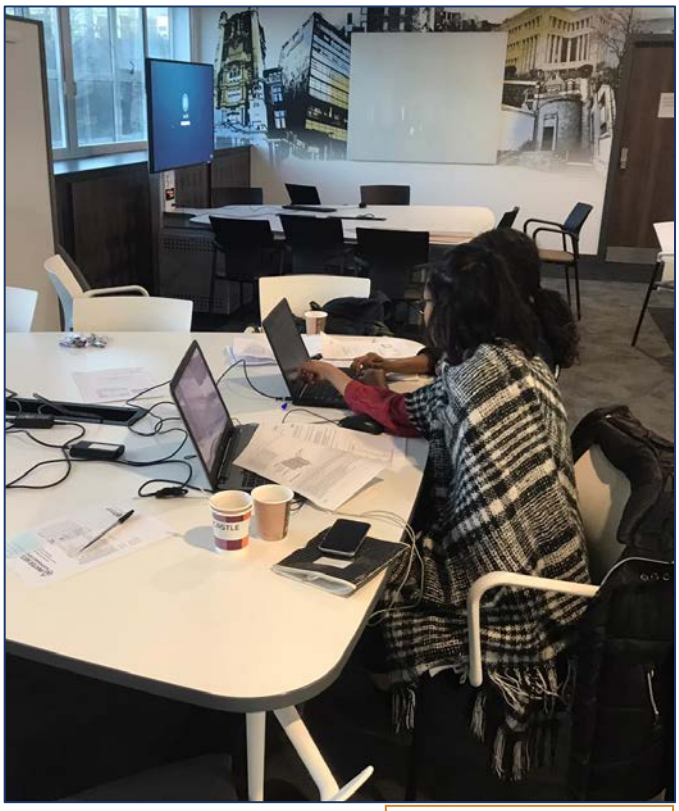

Workshop participants