1. ABOUT THE DATASET

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Title: Use of Spatially Distributed TOPMODEL to Assess Effectiveness of Diverse Natural Flood Management Techniques for a UK Catchment - dataset

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Description: Modelling data from SD-TOPMODEL for land cover types and NFM interventions in Upper Aire Catchment, Yorkshire, UK. The dataset includes selected model parameter values, Nash-Sutcliffe Efficiency (NSE) coefficients, peak discharge, and peak timing of the corresponding modelled results. Additionally, comparisons of results across various NFM scenarios are provided. All data collection and simulations were conducted during 2023–2024.

Cite as: Qiuyu Zhu, Megan Klaar, Thomas Willis, and Joseph Holden (2024). Use of Spatially Distributed TOPMODEL to Assess Effectiveness of Diverse Natural Flood Management Techniques for a UK Catchment - dataset. University of Leeds. [Dataset]. https://doi.org/10.5518/1628.

Related publication: Zhu, Q., Klaar, M., Willis, T., and Holden, J. Use of Spatially Distributed TOPMODEL to Assess Effectiveness of Diverse Natural Flood Management Techniques for a UK Catchment. Hydrological Processes. (Submitted)

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2. TERMS OF USE

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3. PROJECT AND FUNDING INFORMATION

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This dataset was not created in the course of a funded project.

4. CONTENTS

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File listing:

SD-TOPMODEL parameters sensitivity test [Sensitivity\_test\_results.xlsx]

Summary of SD-TOPMODEL NFM scenario results [Summary\_NFMscenario\_results.xlsx]

5. METHODS

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This dataset is organized around the structure of the associated research paper and includes model parameters and hydrological modelling outputs. The files are grouped into folders according to the type of data or analysis, and each folder is named to match key sections of the paper for ease of reference. Refer to the associated paper if more detail is required on the methods.

1. **SD-TOPMODEL parameters sensitivity test:**

Sensitivity tests of SD-TOPMODEL: using fixed intervals where parameters (overland flow velocity *Kv*, soil hydraulic conductivity *Ks*, and soil active water storage depth *m*) were selected and paired within the multiplier test range for five sets of tests. Nash-Sutcliffe Efficiency (NSE) coefficients, peak discharge, and peak timing of the corresponding modelled results were revealed and compared with Model 0 results, followed by Pearson correlation analysis among parameter values and modelling outputs.

**Explanation of terms in the table:**

‘m\_00’: Parameter soil active water storage depth *m* value is 1.5 for testing.

‘m\_01’: Parameter soil active water storage depth *m* value is 2 for testing.

‘m\_02’: Parameter soil active water storage depth *m* value is 1 for testing.

‘m\_03’: Parameter soil active water storage depth *m* value is 1.25 for testing.

‘ks\_00’: Parameter soil hydraulic conductivity *Ks* value is 2 for testing.

‘ks\_01’: Parameter soil hydraulic conductivity *Ks* value is 4 for testing.

‘ks\_02’: Parameter soil hydraulic conductivity *Ks* value is 6 for testing.

‘ks\_03’: Parameter soil hydraulic conductivity *Ks* value is 8 for testing.

‘ks\_04’: Parameter soil hydraulic conductivity *Ks* value is 10 for testing.

‘ks\_05’: Parameter soil hydraulic conductivity *Ks* value is 1.5 for testing.

‘ks\_06’: Parameter soil hydraulic conductivity *Ks* value is 3 for testing.

‘ks\_07’: Parameter soil hydraulic conductivity *Ks* value is 5 for testing.

‘ks\_08’: Parameter soil hydraulic conductivity *Ks* value is 2.5 for testing.

‘ks\_09’: Parameter soil hydraulic conductivity *Ks* value is 1 for testing.

‘kv\_00’: Parameter overland flow velocity *Kv* value is 0.4 for testing.

‘kv\_01’: Parameter overland flow velocity *Kv* value is 0.5 for testing.

‘kv\_02’: Parameter overland flow velocity *Kv* value is 0.6 for testing.

‘kv\_03’: Parameter overland flow velocity *Kv* value is 0.75 for testing.

‘kv\_04’: Parameter overland flow velocity *Kv* value is 0.7 for testing.

‘kv\_05’: Parameter overland flow velocity *Kv* value is 0.8 for testing.

All sensitivity tests were conducted by pairing the parameter terms above:

Test ‘a-1~20’: Tests for woodland land cover type (broadleaf woodland and coniferous woodland) when *m* was 1.5 and paired different *Ks* and *Kv* values.

Test ‘b-1~20’: Tests for woodland land cover type (broadleaf woodland and coniferous woodland) when *m* was 2 and paired different *Ks* and *Kv* values.

Test ‘c-1~16’: Tests for grassland land cover type (calcareous grassland and acid grassland) by pairing different *Ks* and *Kv* values.

Test ‘d-1~15’: Tests for NFM intervention soil aeration by pairing different *Ks* and *m* values.

Test ‘e-1~5’: Tests for NFM intervention hedgerow planting by pairing different *Ks* values to the certain *Kv* value of 0.5.

Test ‘d-1~15’: Tests for NFM intervention woodland planting by pairing different *Ks* and *Kv* values.

1. **Summary of SD-TOPMODEL NFM scenario results:**

SD-TOPMODEL modelling results: peak discharge reduction and peak time delay. Seven NFM scenarios were compared against a land cover model with no NFM interventions applied, evaluating their effectiveness across seven storm events.