Modelling the impacts of climate and land-use change on the sediment transport of the River Thames (UK).

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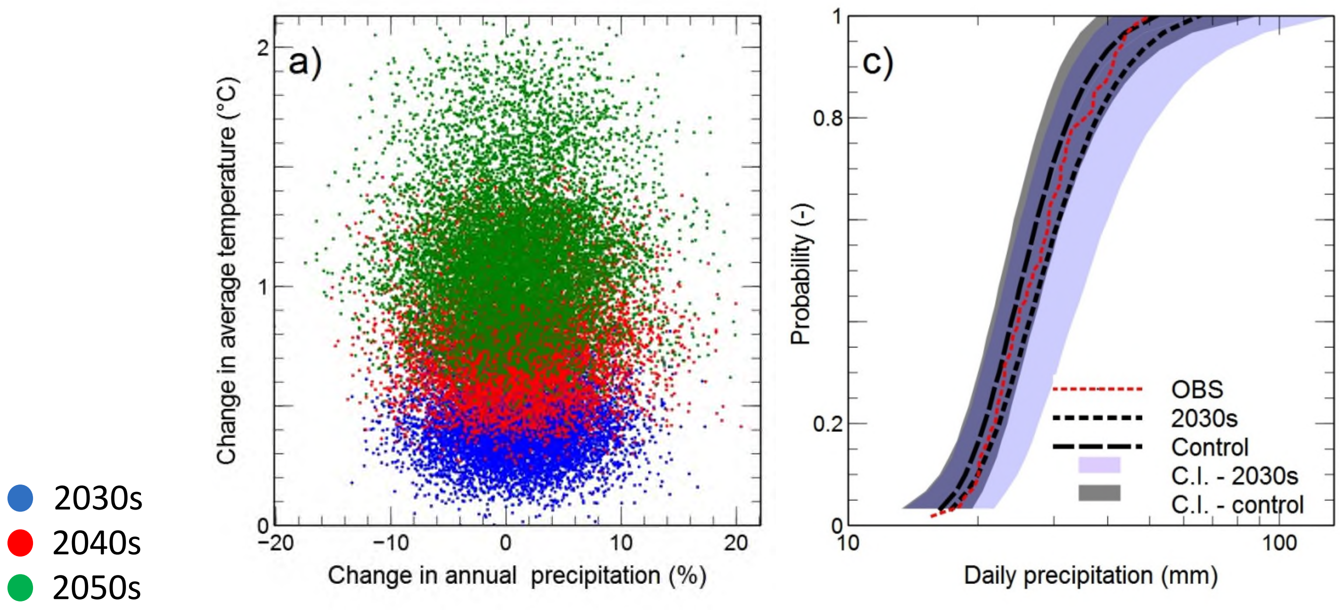
Introduction

- Sediment transport in a changing environment
  - Climate change



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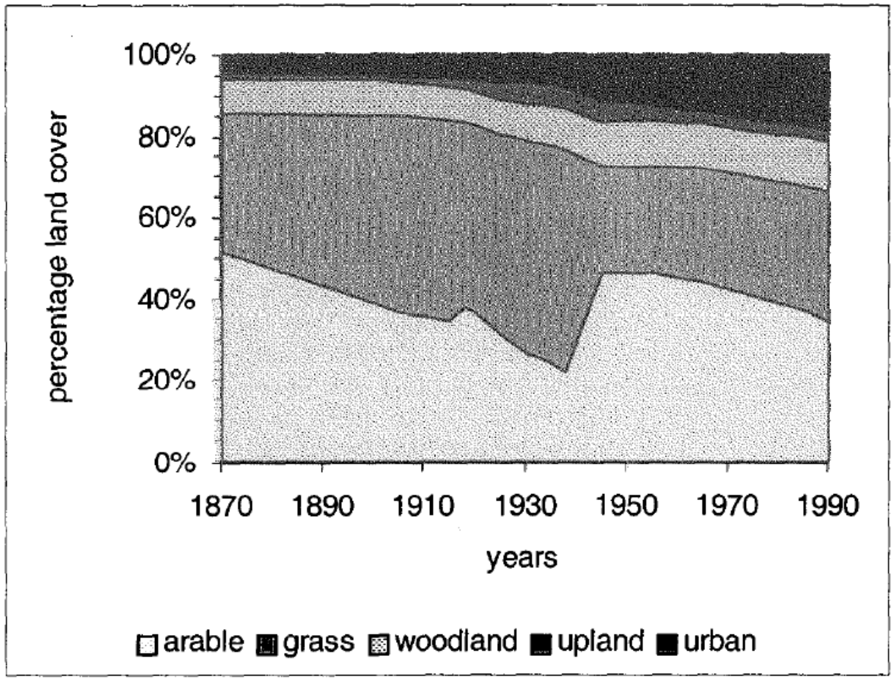
Introduction

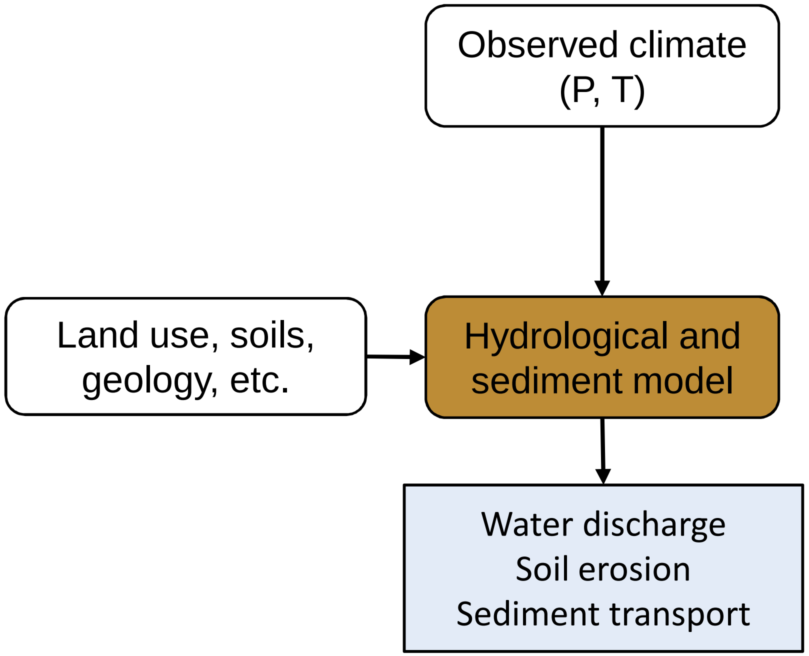
- Sediment transport in a changing environment
  - Land-use change



Source: Crooks and Davies (2001). Assessment of land use change in the Thames Catchment and its effects on the flood regime of the river.

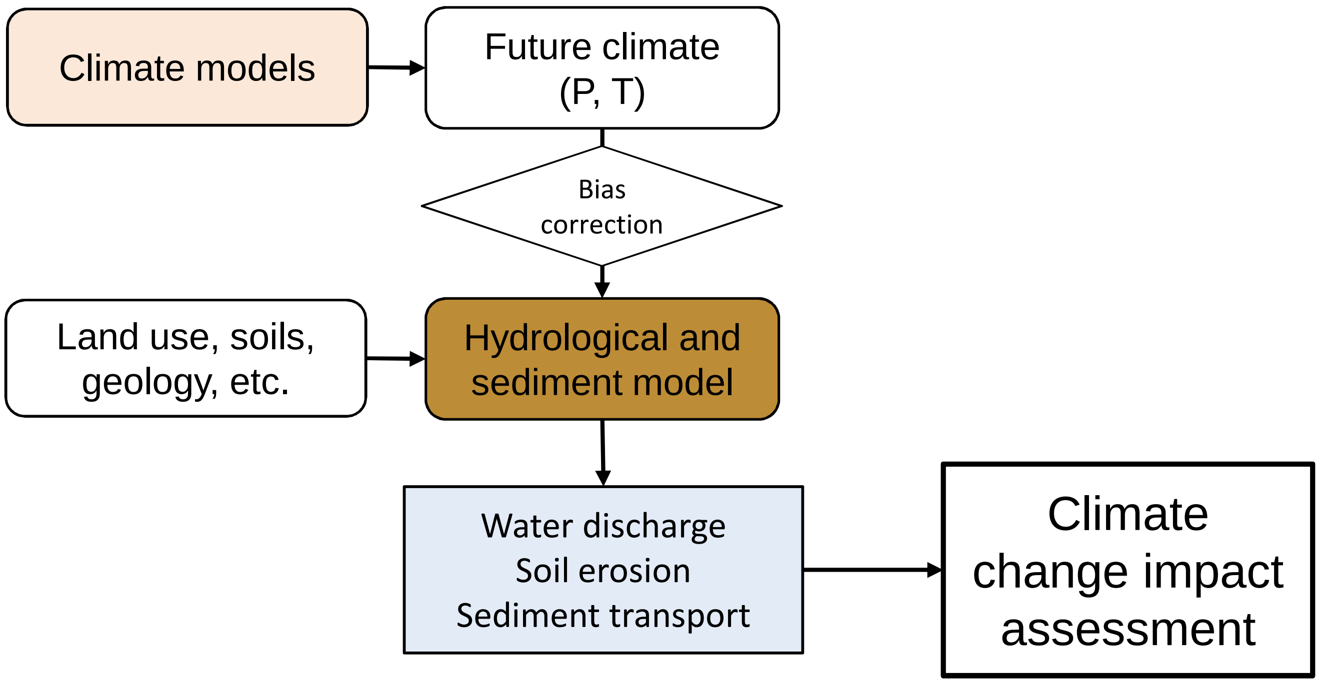
Introduction

- Sediment transport modelling



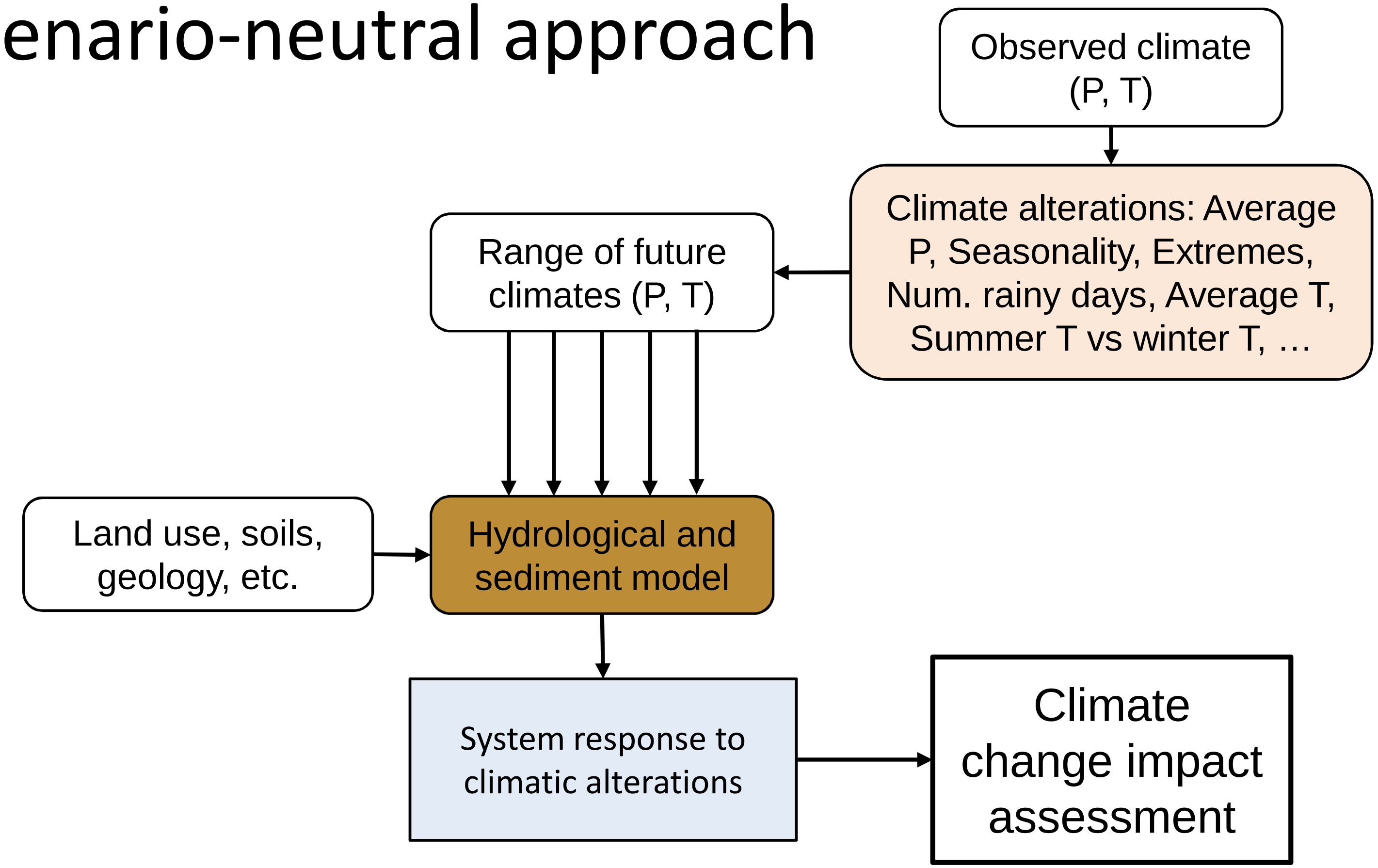
Introduction

- Sediment transport modelling under climate change



Methods

- Scenario-neutral approach



Methods

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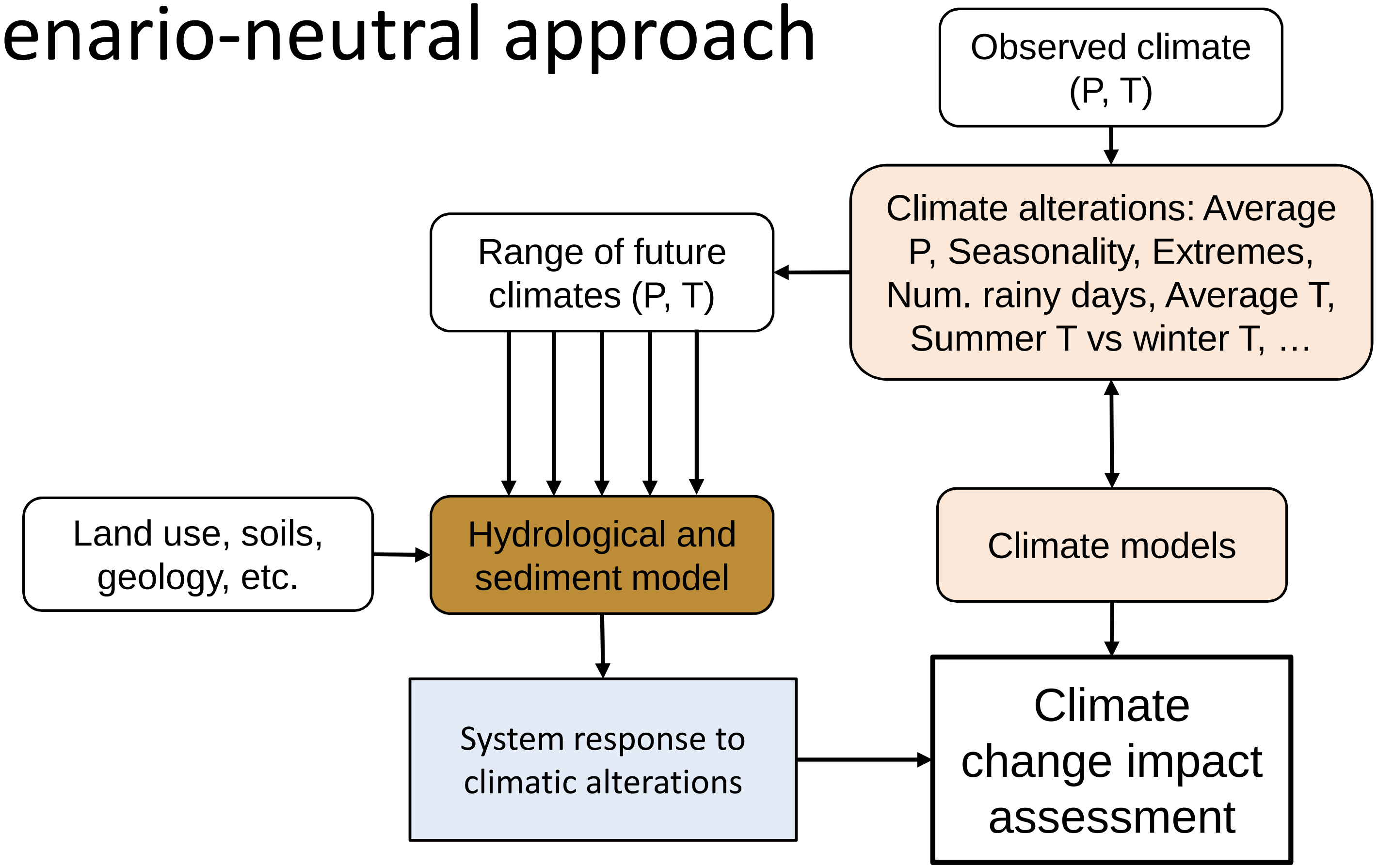

Methods

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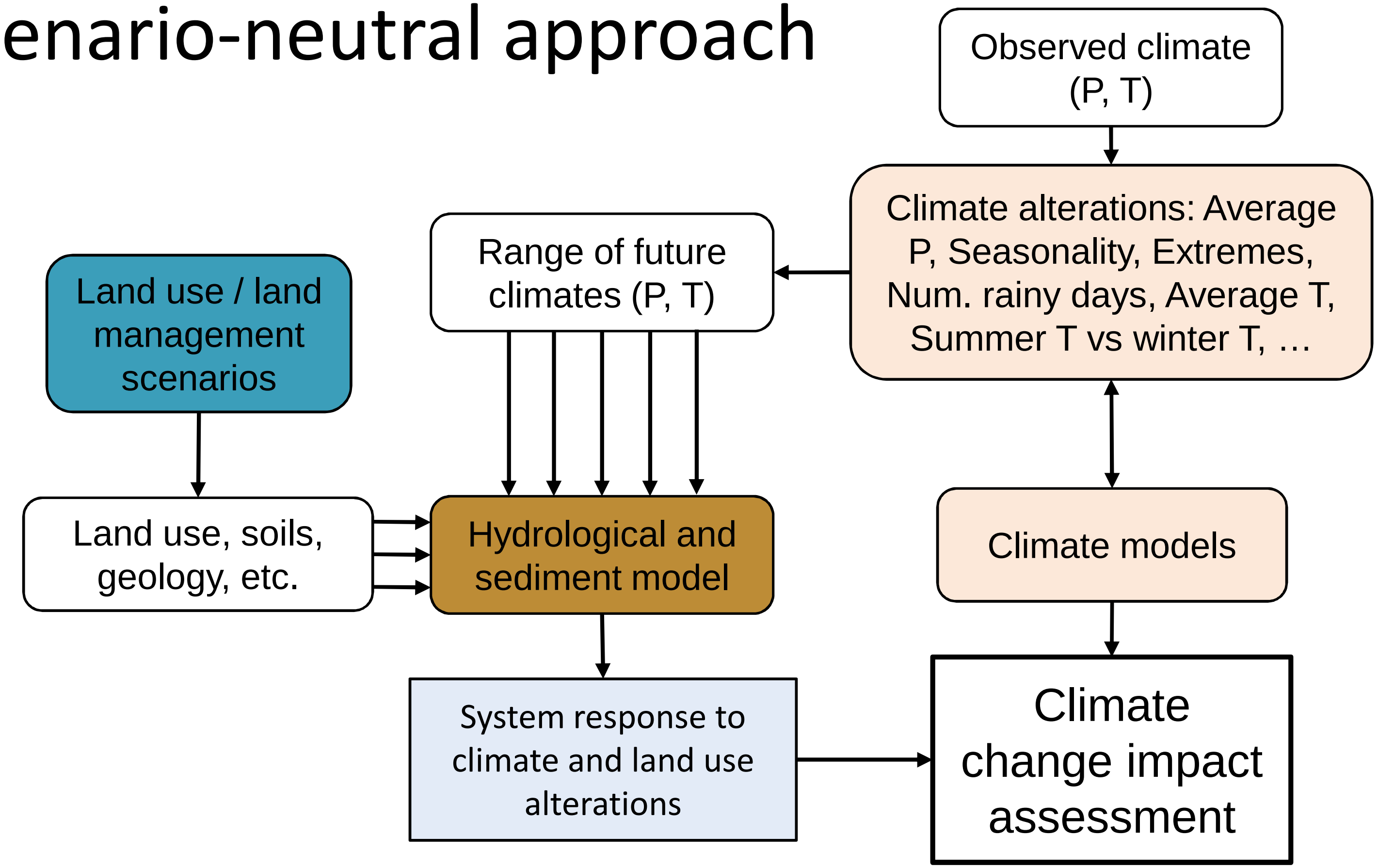
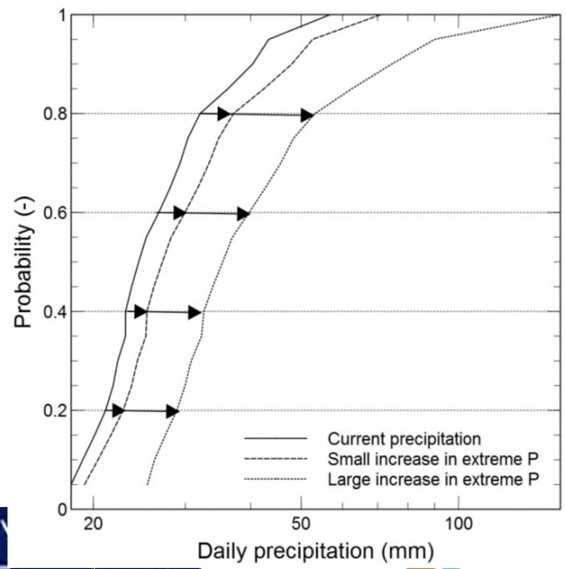


Methods

- Climatic alterations
  - Average precipitation (-30% to +40%)
  - Average temperature (-1°C to +6°C)
  - Extreme precipitation

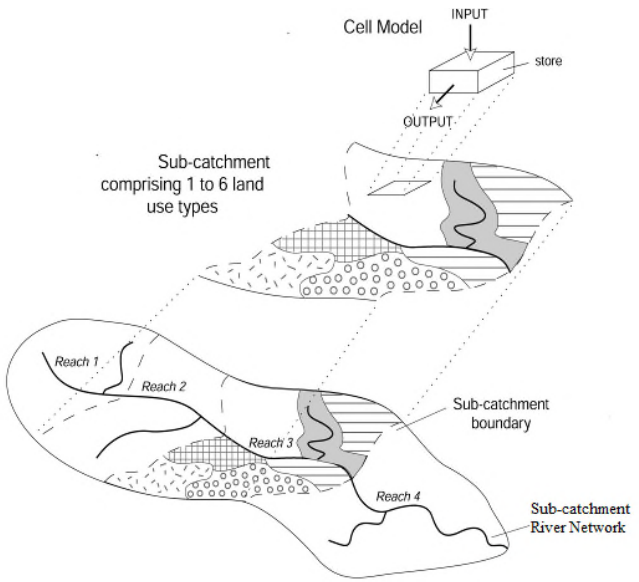


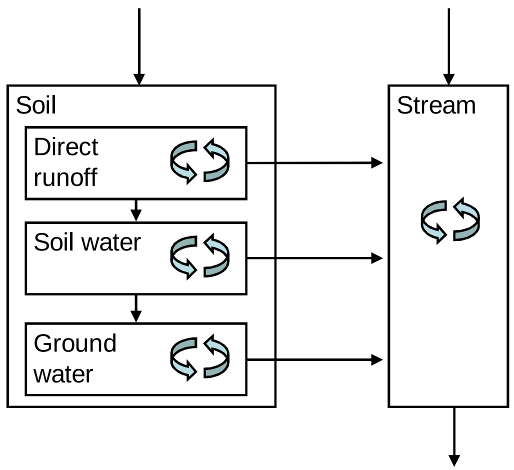
Methods

- Land use scenarios
  - Current land use
  - Increase in agriculture (but no change in erosion mitigation policy)
  - Increase in agriculture and optimal soil erosion mitigation measures (better agricultural practices, buffer strips, etc.)

The INCA model

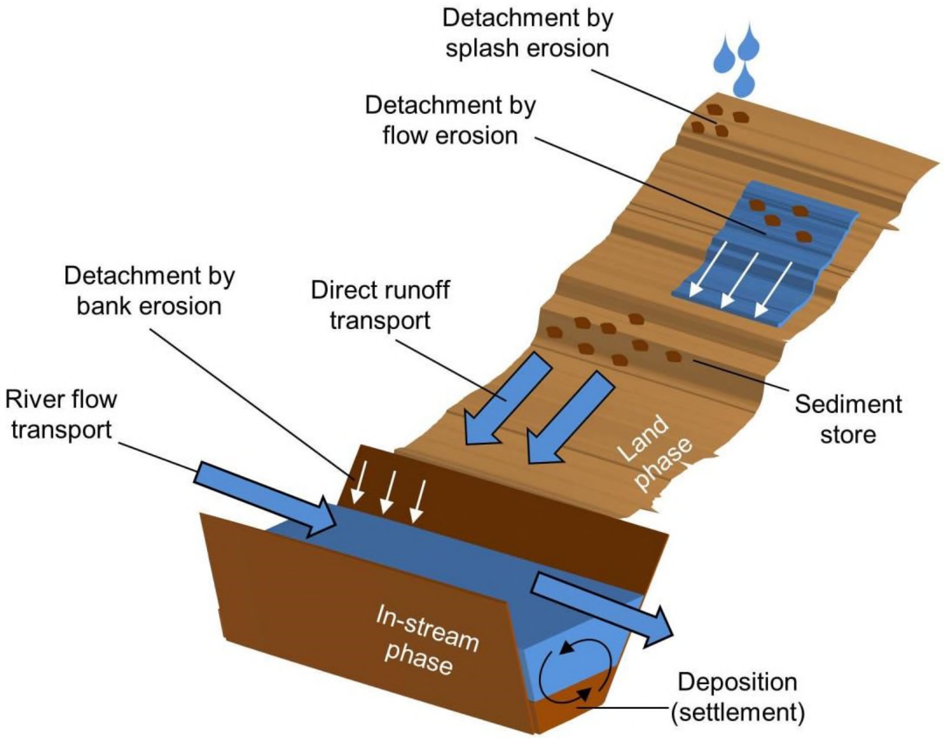
– Originally developed by P. Whitehead in the 90s for hydrology, N and P
  - Semi-distributed
  - Considers different land uses
  - Hillslope and channel processes





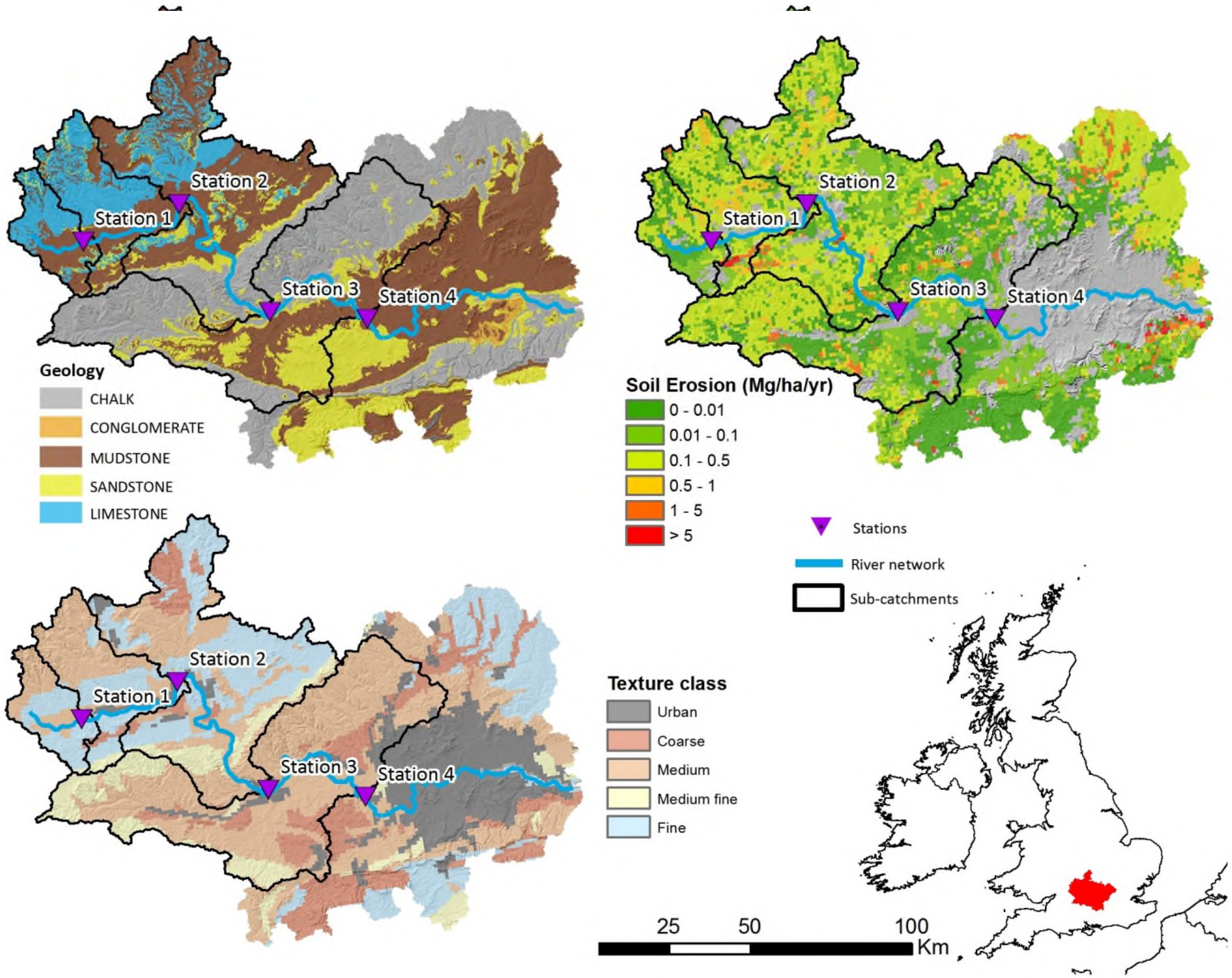
The INCA model

– Sediment sub-model developed by Lázár et al (2010) – STotEn 408, 2555–2566



European Geosciences Union

The River Thames



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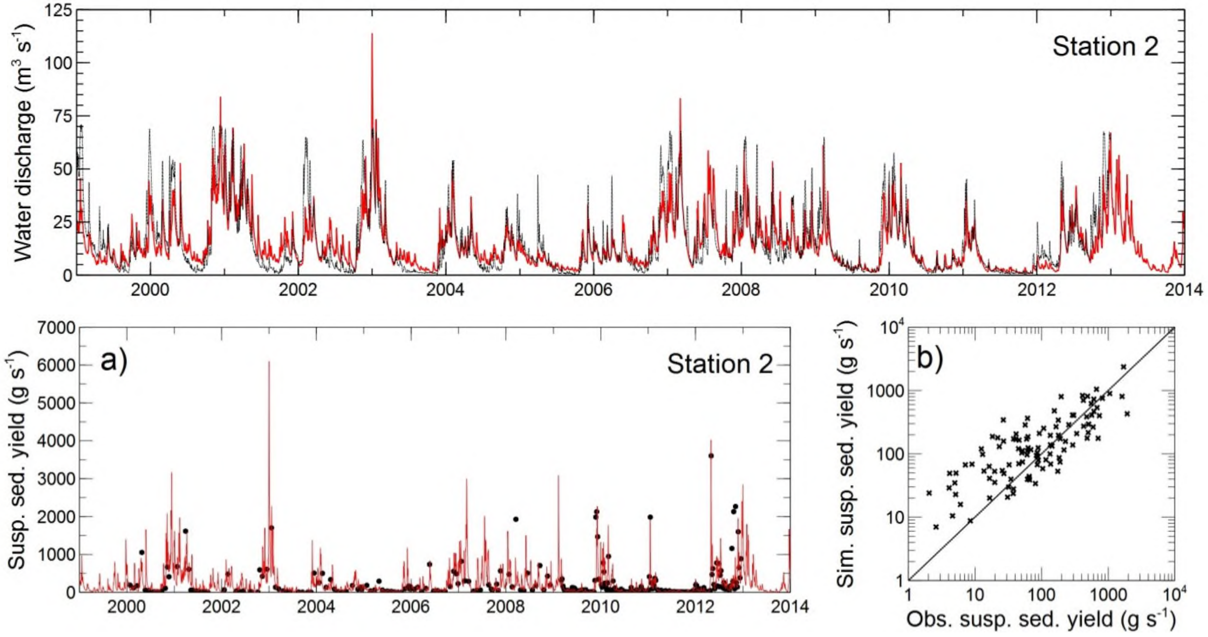
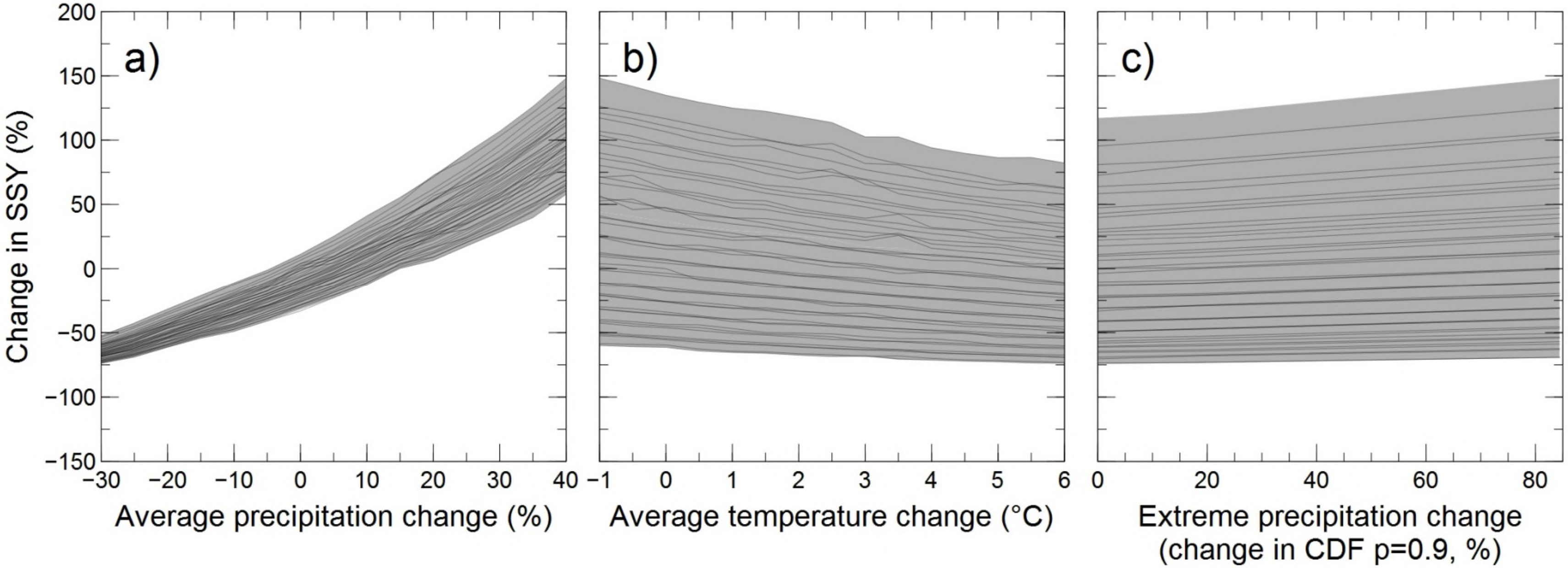
Results

– Model implementation
  - Calibration/validation: 1999-2013



Results

– Impact of the **climatic alterations** (under current land use)



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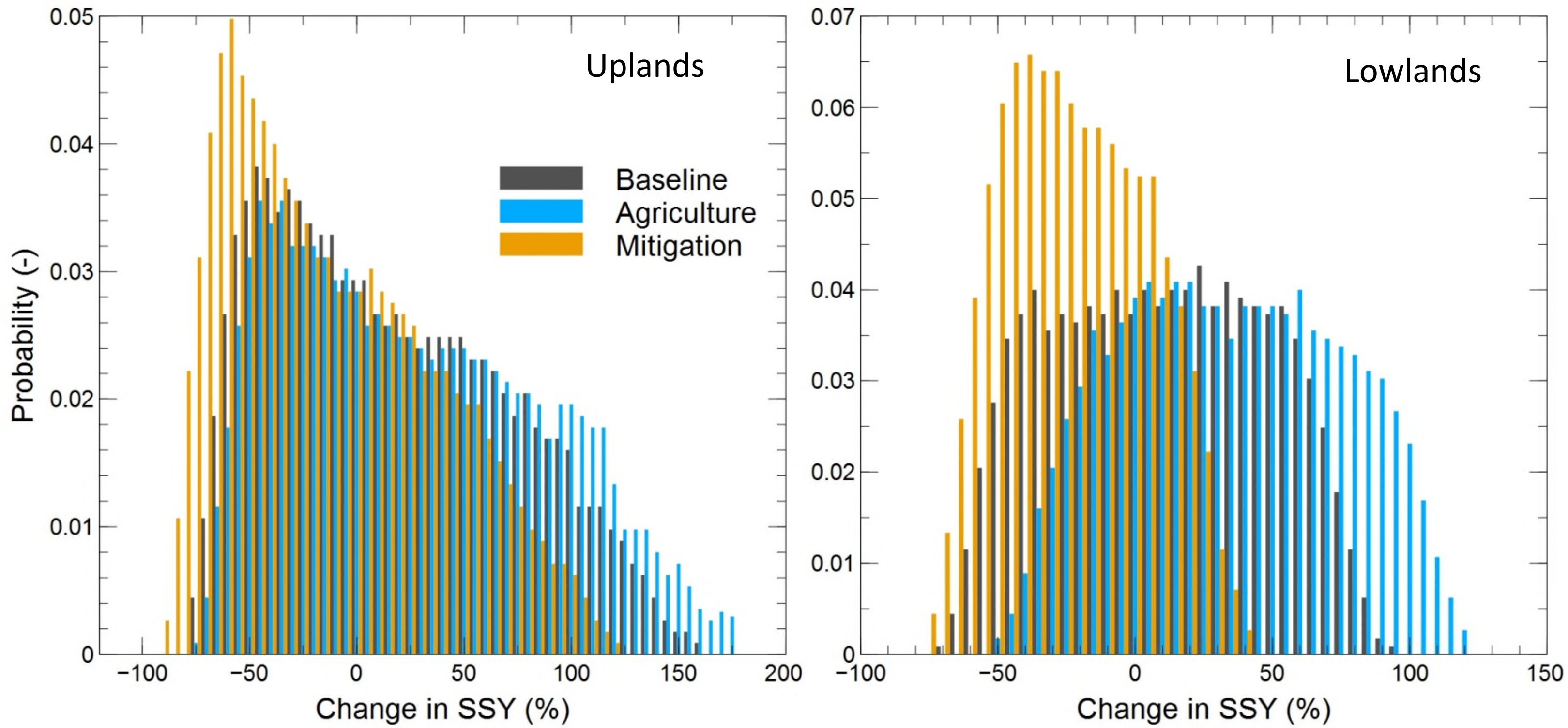
Results

– **Climate** and **land-use** change impact



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Results

– **Climate** and **land-use** change impact

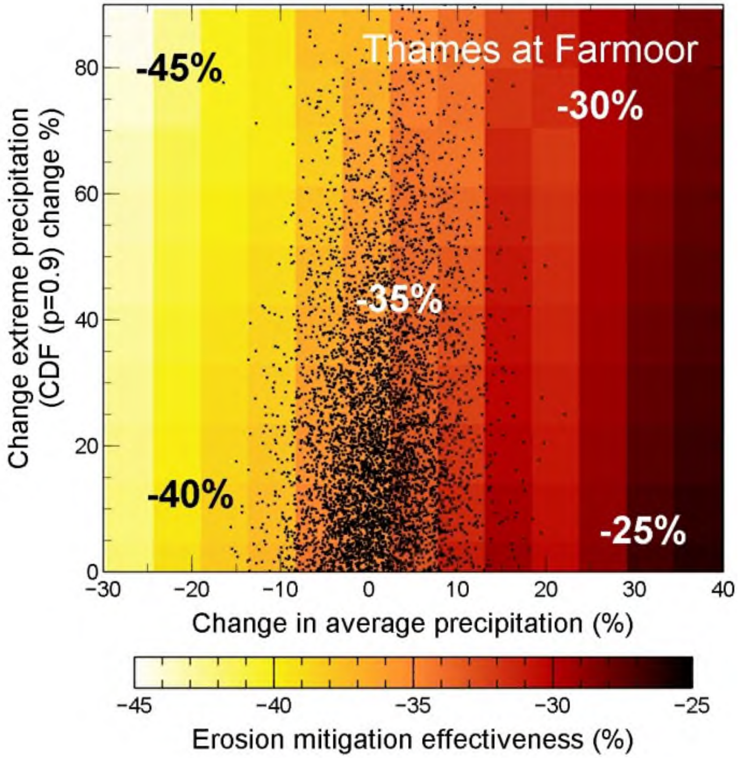
- Effect of **increase in agriculture**:
  – Uplands: **+10%**(+4%;+15%), lowlands: **+17%**(+11%;+20%)

- Effect of soil **erosion mitigation**:
  – Uplands: **-25%**(-11%;-38%), lowlands: **-19%**(-5%;-32%)

Results

– Soil erosion mitigation **effectiveness**

- Difference between sediment transport under increase of agriculture scenario and under erosion mitigation scenario



Conclusions

- Mean annual **precipitation** exerts the most relevant **control** on sediment transport
- Joint control of CC and LUC: ΔP, ΔX and ΔT have **different** effects **depending on the LU**
- Soil erosion mitigation is a **robust** climate change adaptation measure
- The effectiveness of the mitigation strategy may **vary** depending on the **future climate**

Thank you for your attention!

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