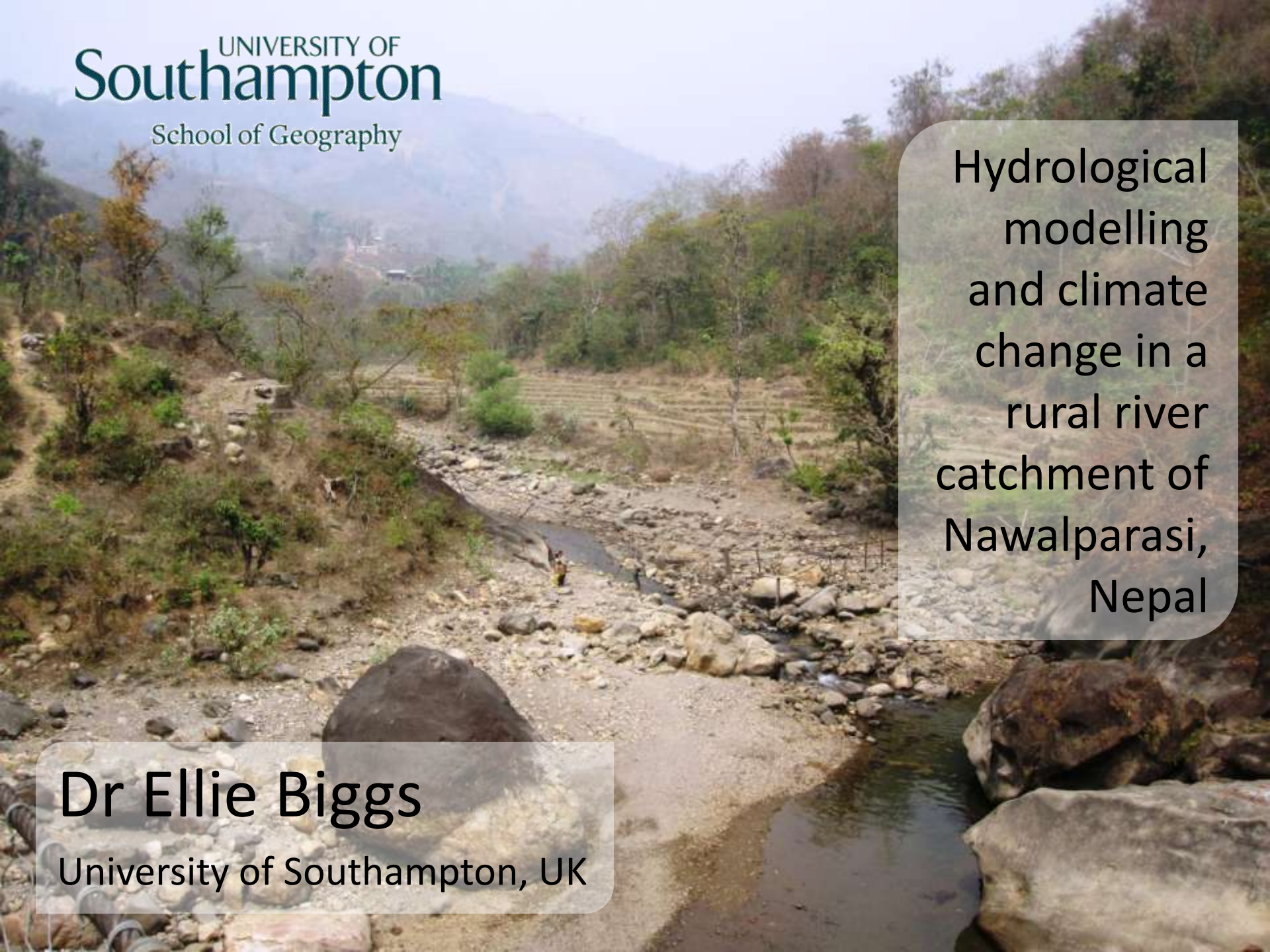

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Hydrological modelling and climate change in a rural river catchment of Nawalparasi, Nepal

Dr Ellie Biggs
University of Southampton, UK

The Glacier Trust

www.theglaciertrust.org

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Outline

- The Girubari catchment
  - Location
  - Climate change
- Hydrological modelling
  - SHETRAN
  - Data
  - Future river flows
- Climate change implications
- Data: access and availability
- Summary

Girubari catchment

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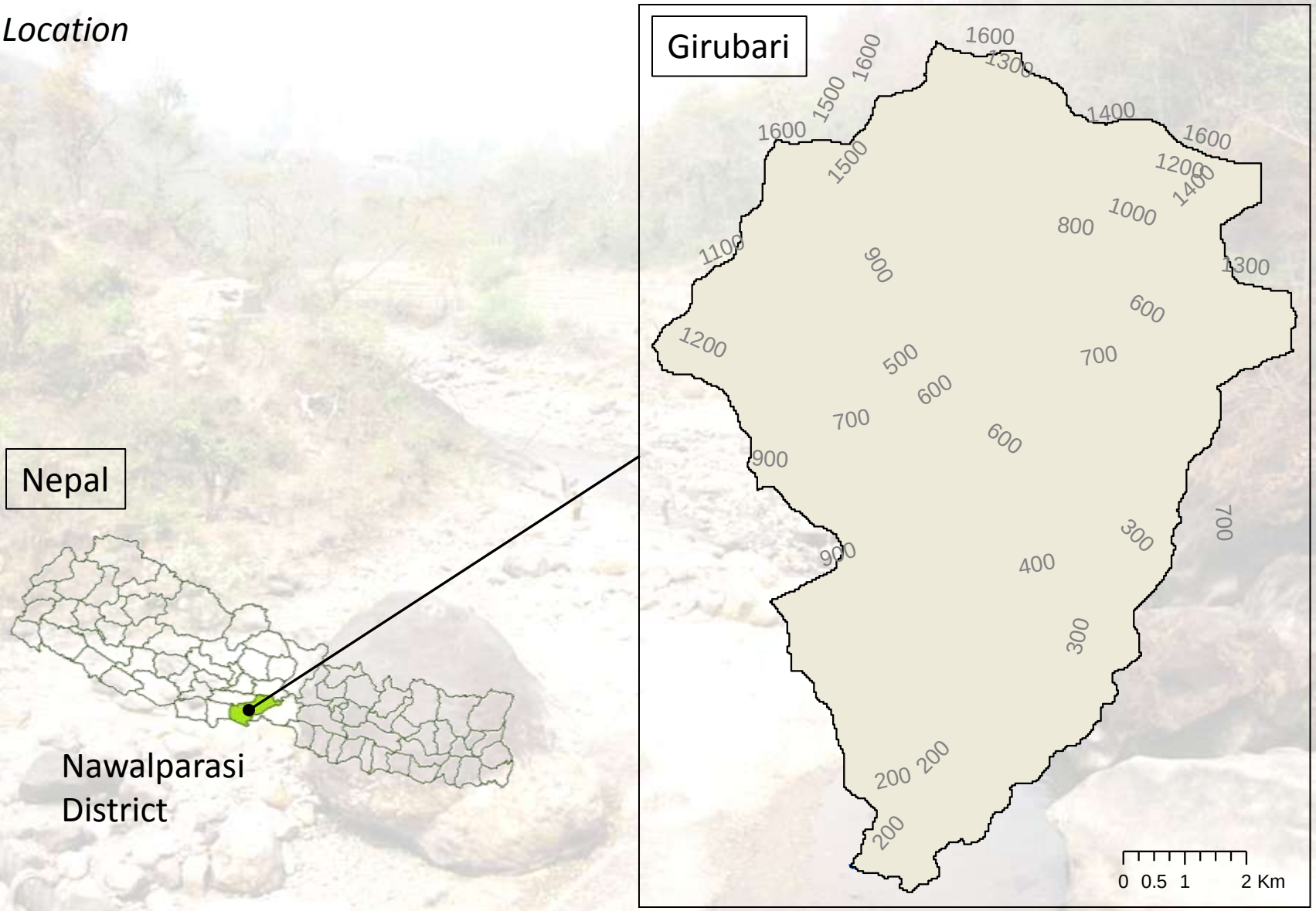
Location



Girubari catchment

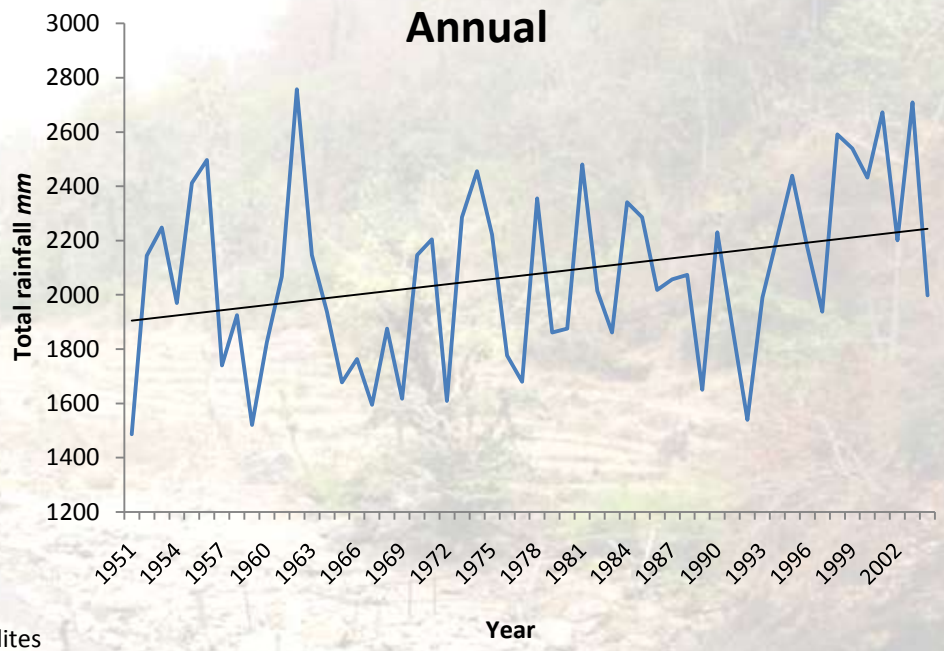
Climate change

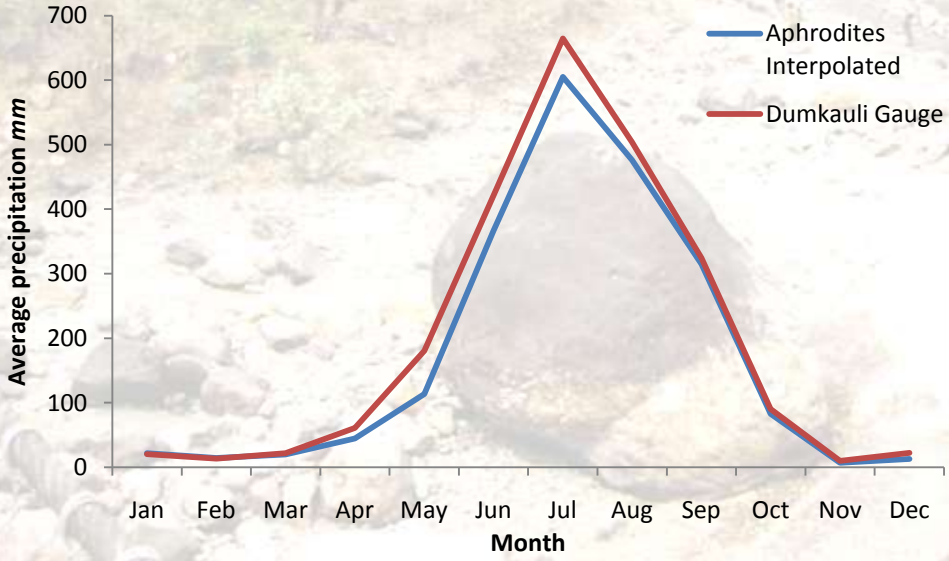
APHRODITEs

Gauge-interpolated gridded precipitation data for Monsoon Asia

Resolution: 0.25° x 0.25°

Data extracted for Girubari lat/long

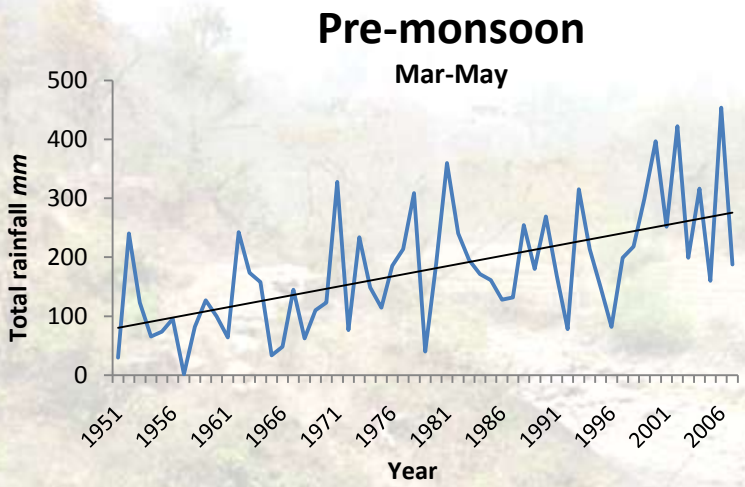


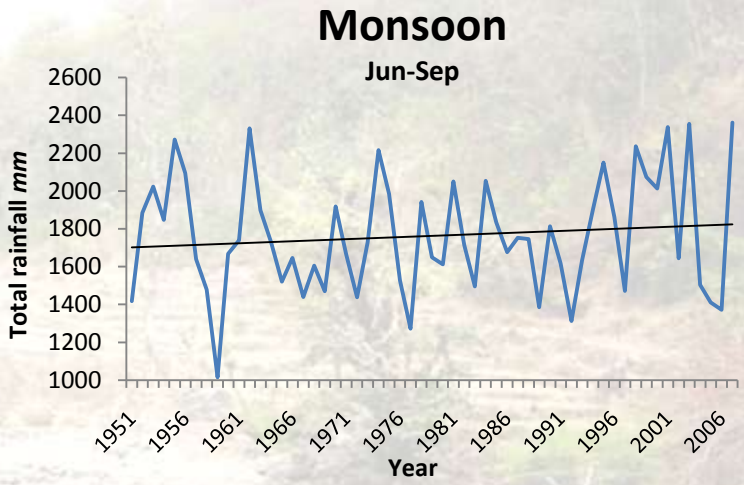


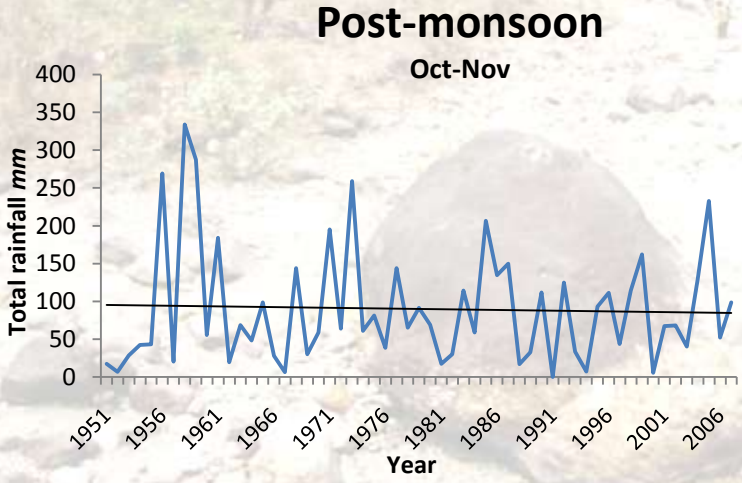
Average monthly precipitation data compared with nearest ground precipitation gauge at Dumkauli for validation

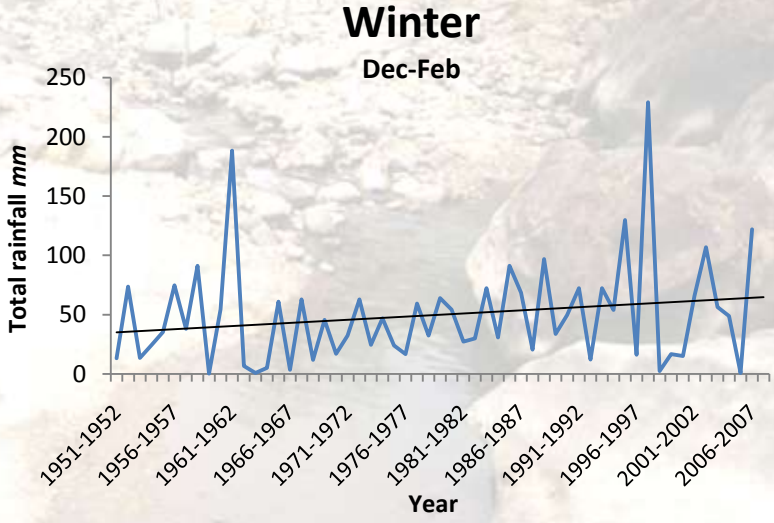
Girubari catchment

Climate change









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Hydrological modelling

SHETRAN

- A simple hydrological model
- Distributed modelling
- Given the lack of ground data this model was ideal
- GUI version

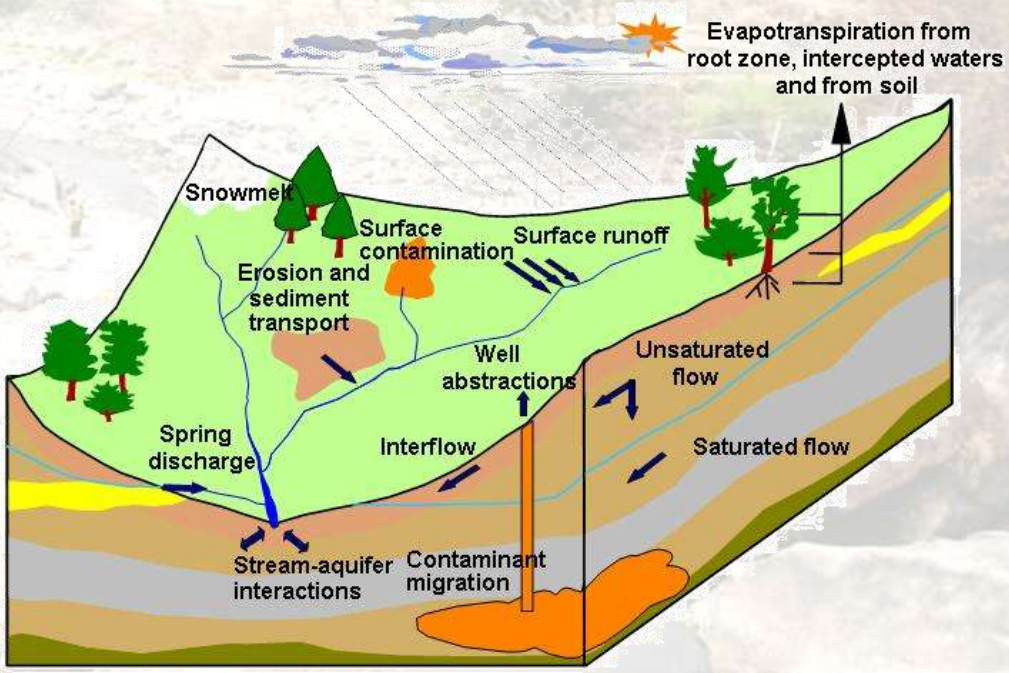


Image source: **www.ceg.ncl.ac.uk/shetran**

Hydrological modelling

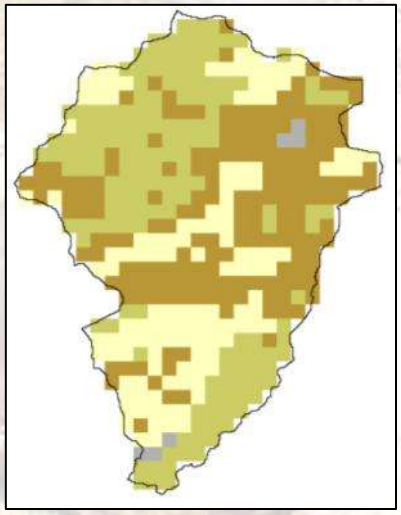
Data

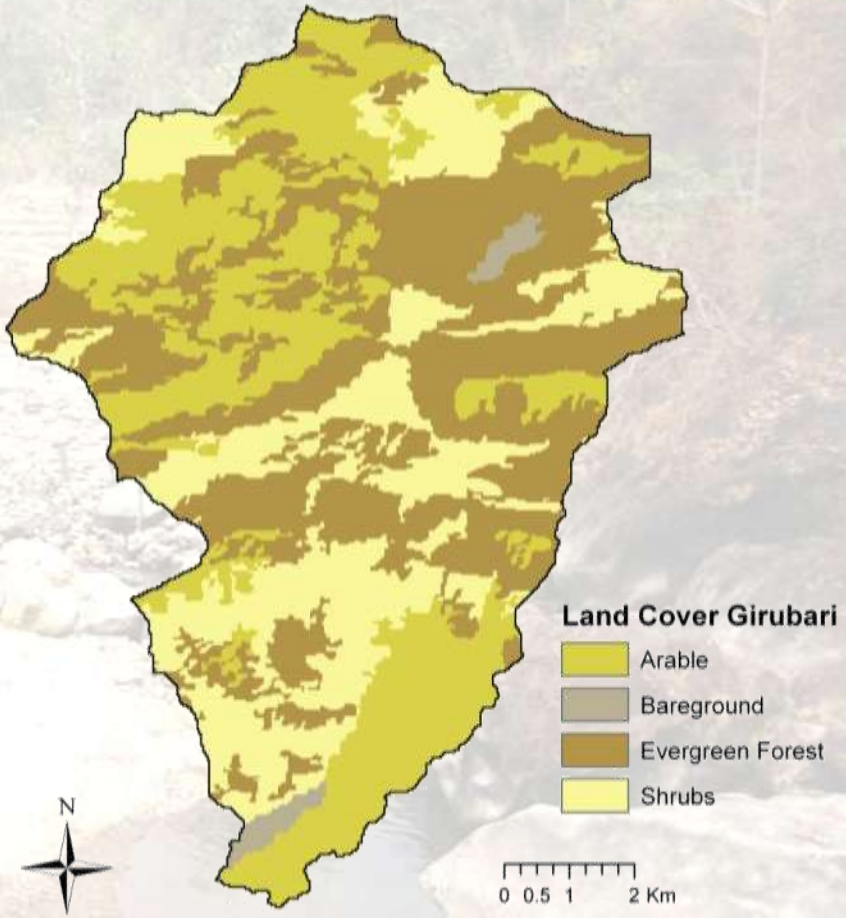
Aggregated to model resolution of 360m²

Land cover

Source: FAO

Developed from: Landsat





Hydrological modelling

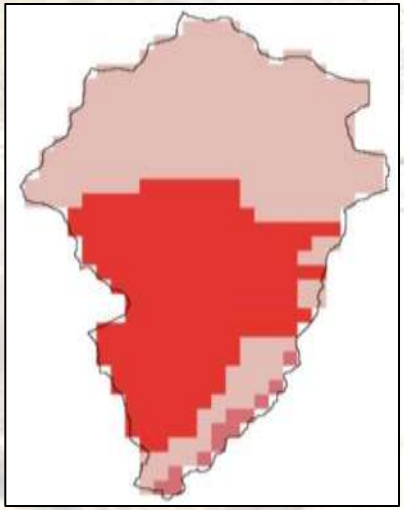
Data

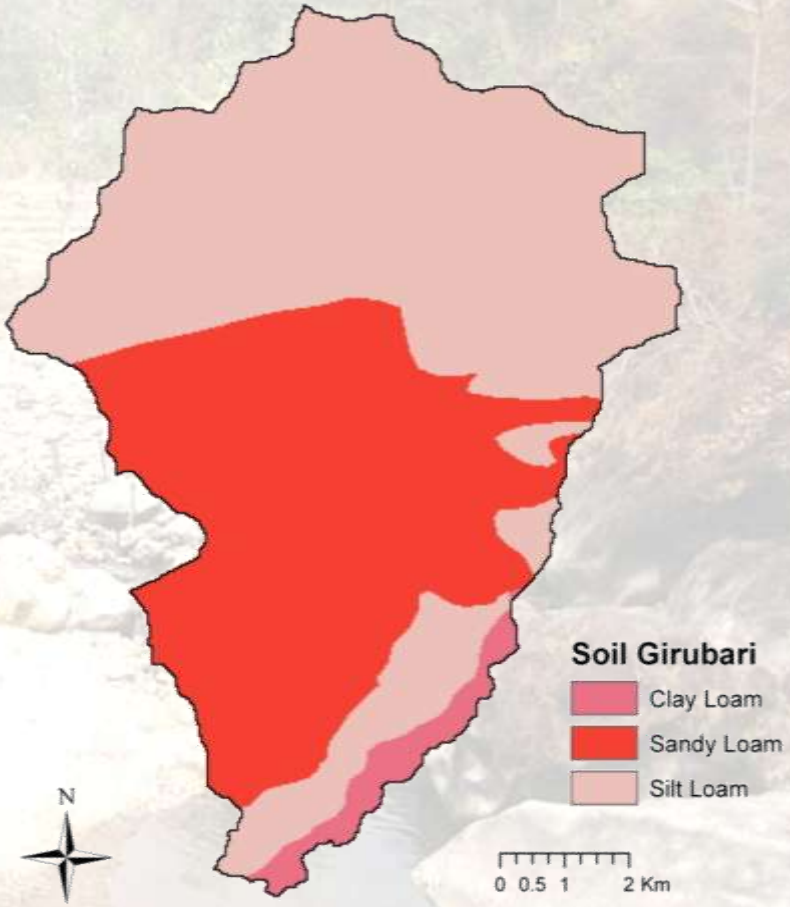
Aggregated to model resolution of 360m²

Soil

Source: SOTER

Developed from: Satellite images and land surveys





Hydrological modelling

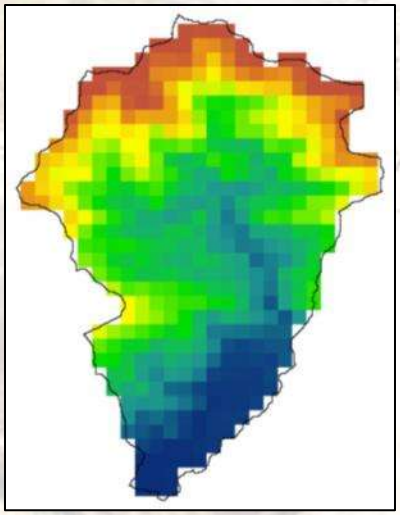
Data

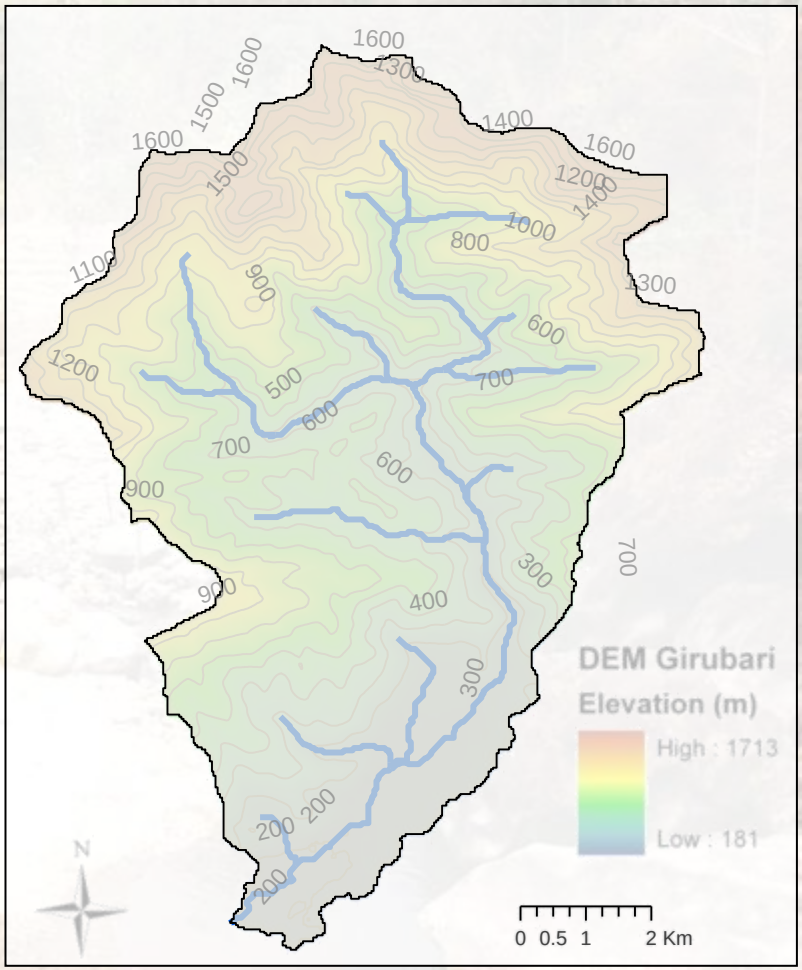
Aggregated to model resolution of 360m²

DEM

Source: USGS

Developed from: ASTER satellite imagery





Hydrological modelling

Data

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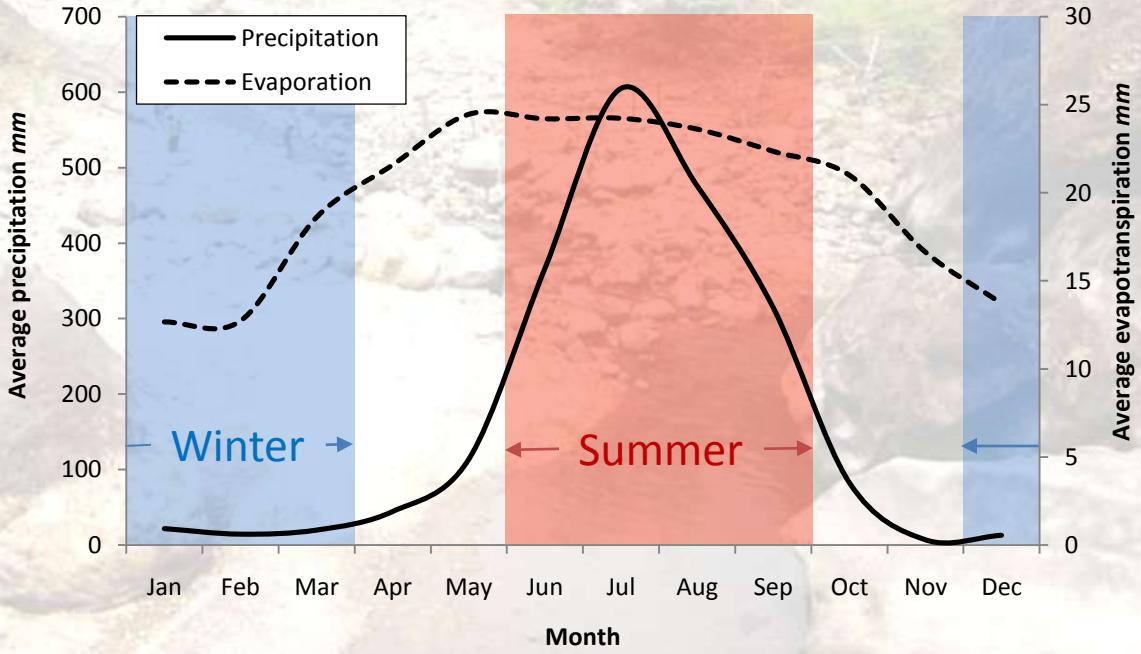
Precipitation and evaporation

Source: APHRODITEs and World Bank

Developed from: Interpolated gauge data



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Hydrological modelling

Future flows

A2 climate change scenario for Nepal (GCISC)

Time	Season	Temperature (°C)	Precipitation (%)
2020s	Summer	1.05 ± 0.20	-1.76 ± 4.07
	Winter	1.49 ± 0.11	-11.74 ± 2.69
2050s	Summer	2.09 ± 0.18	5.88 ± 6.67
	Winter	2.89 ± 0.14	-10.93 ± 3.63
2080s	Summer	3.67 ± 0.24	14.98 ± 9.74
	Winter	4.96 ± 0.19	-17.58 ± 2.53

Time	Season	Precipitation (mm)	Flow (m^3s^{-1})
2020s	Summer	-31.0 ± 71.2	-5.0 ± 4.4
	Winter	-8.1 ± 1.9	-65.3 ± 1.6
2050s	Summer	103.6 ± 117.5	3.3 ± 7.2
	Winter	-7.54 ± 2.5	-64.6 ± 2.2
2080s	Summer	264.0 ± 171.6	13.2 ± 10.5
	Winter	-12.1 ± 1.7	-67.6 ± 1.3

Climate change implications

- Increased risk from flash floods – landslides and sediment loads
- Heightened risk of rapid overland flow due to increased soil desiccation and erosion, especially given deforested nature of landscape
- Impact of water resource quantity, quality and access for drinking, hygiene and irrigation
- Hinder development opportunities
- Food security threats

Urgent requirement to implement sustainable mitigation and adaptation measures to reduce the impact of environmental risks being exacerbated by climate change

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Data: access and availability

Advantages

- Earth observation data can enable physical processes to be modelled using remotely collated data
- Useful for assessing environmental hazard and risk
- Scope for using EO to map aspects of environmental risk across Nepal

Limitations

- No local ground data for model creation or validation
- What little ground data exists is not readily accessible, especially to researchers external to Nepal
- Resolution of Earth observation (and climate change) data is limited (spatial and temporal)

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Summary

Water resources in Girubari

- Increasing trends observed in pre-monsoon, monsoon, winter and annual precipitation
- Decreasing trend observed in post-monsoon precipitation
- Generally, increases in summer flow are predicted for the 21st century
- Generally, decreases in winter flow are predicted for the 21st century
- Summer flows are more sensitive to changes in rainfall
- Winter flows are more sensitive to changes in temperature

EO can be used effectively for hydrological modelling but all data needs validation and results need to always be interpreted with caution

Acknowledgements

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