

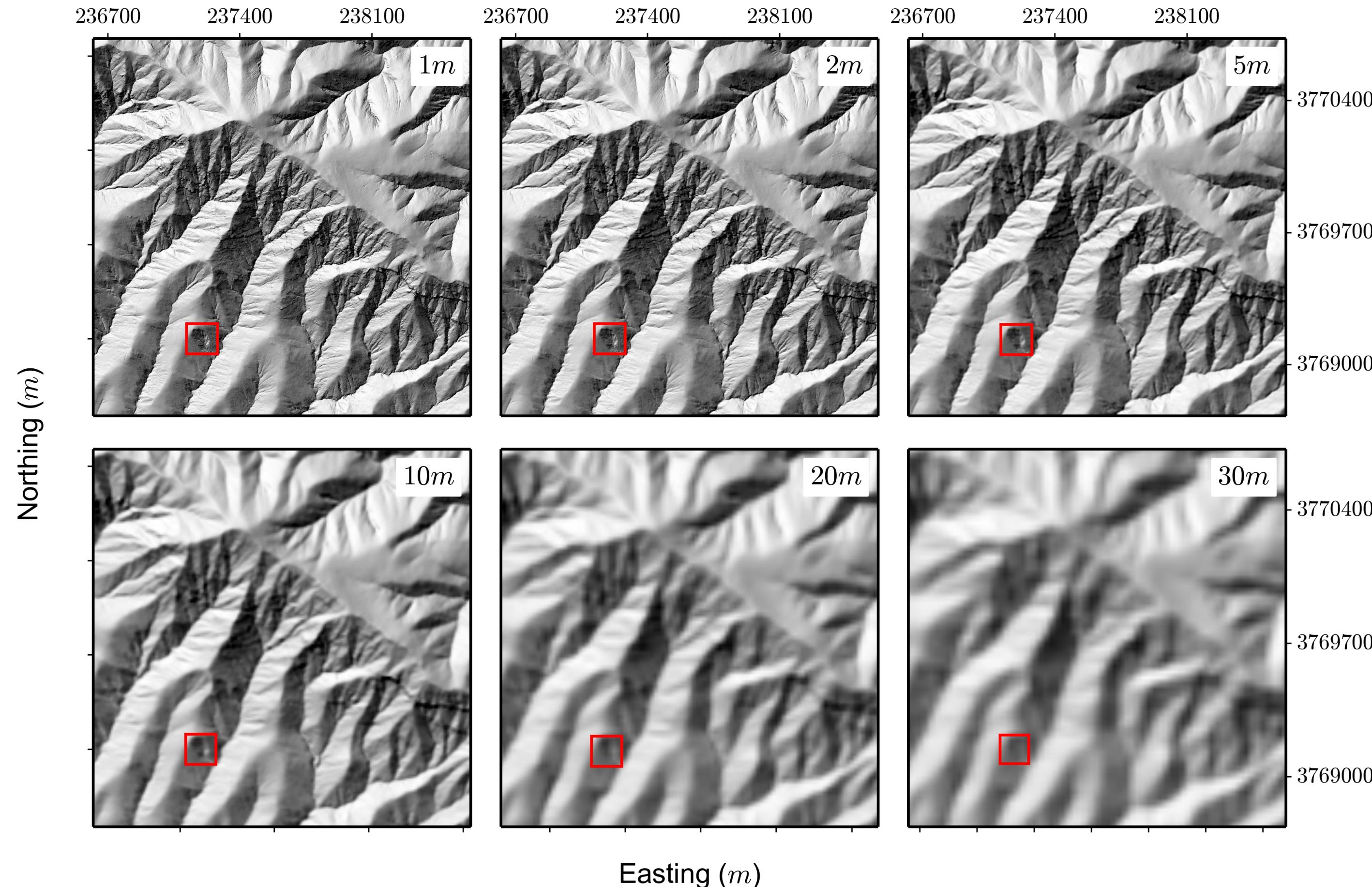
HOW DOES GRID-RESOLUTION MODULATE GEOMORPHIC PROCESSES?

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Motivation

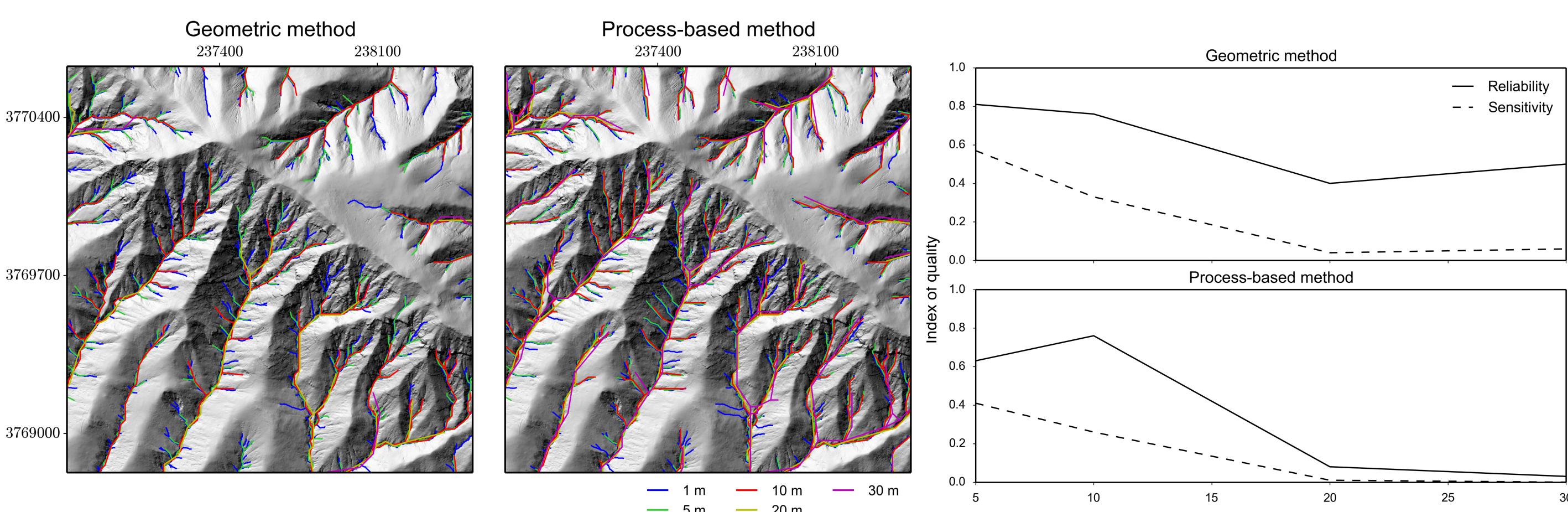
Digital elevation models (DEMs) are an integral part of modern geomorphic research yet in many locations high resolution data are not available.



Is it possible to perform geomorphic analysis on low resolution data?

Channel extraction

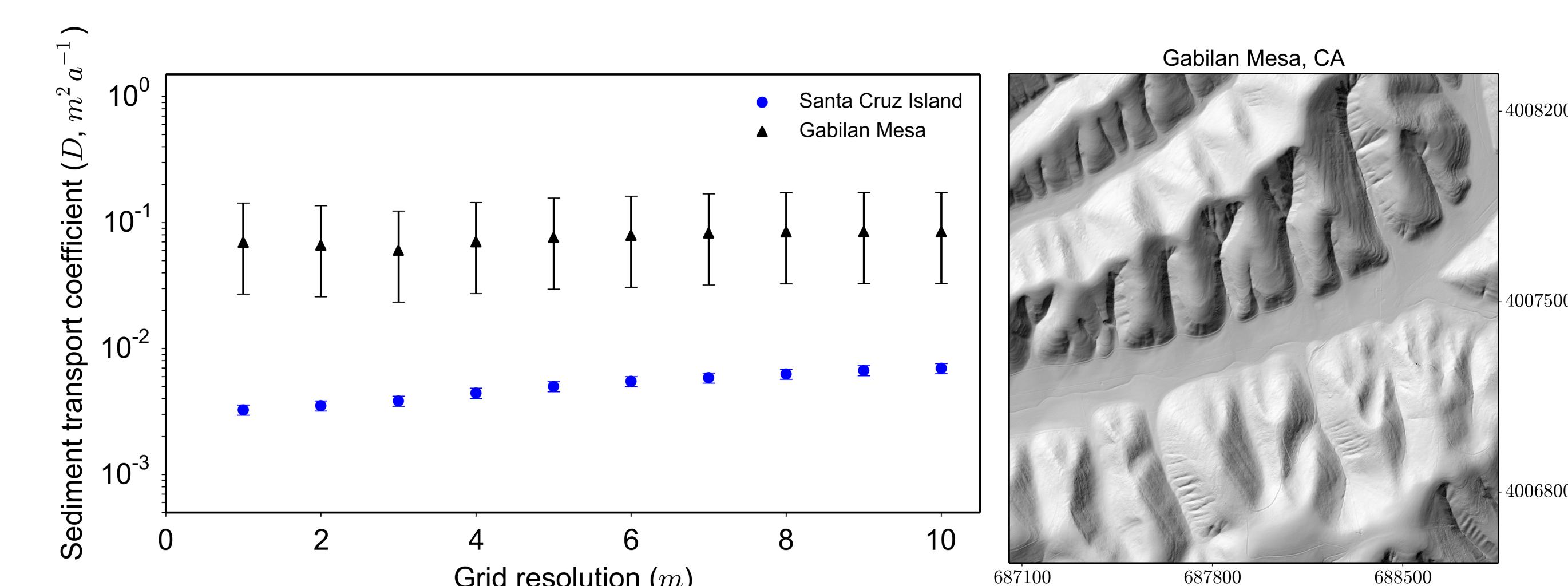
Channels can be extracted from high resolution DEMs using methods based on the **curvature of hillslopes** or the **topographic signature of fluvial processes**. Our ability to apply these methods to low resolution data can be quantified using indices of quality, which measure rates of over- and under-prediction of network extent.



Drainage density is reduced as resolution decreases, but the geometric method preserves more of the channel network.

Sediment transport coefficient

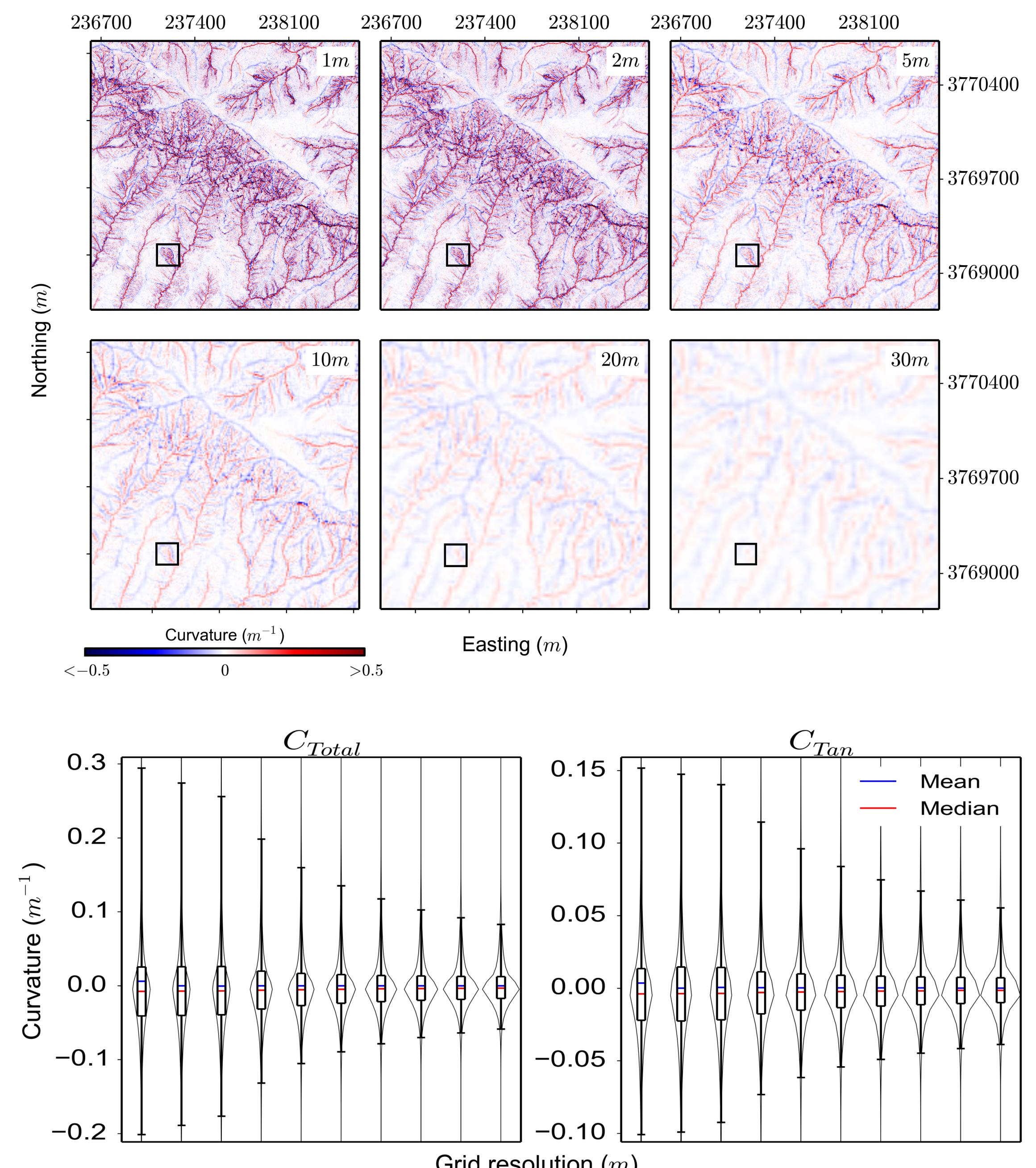
The sediment transport coefficient (D) can be calculated for a hillslope, given an independent constraint on the erosion rate, using measurements of **hilltop curvature**.



Measurements of D from topographic data depend on ridgeline width in addition to data resolution.

Curvature

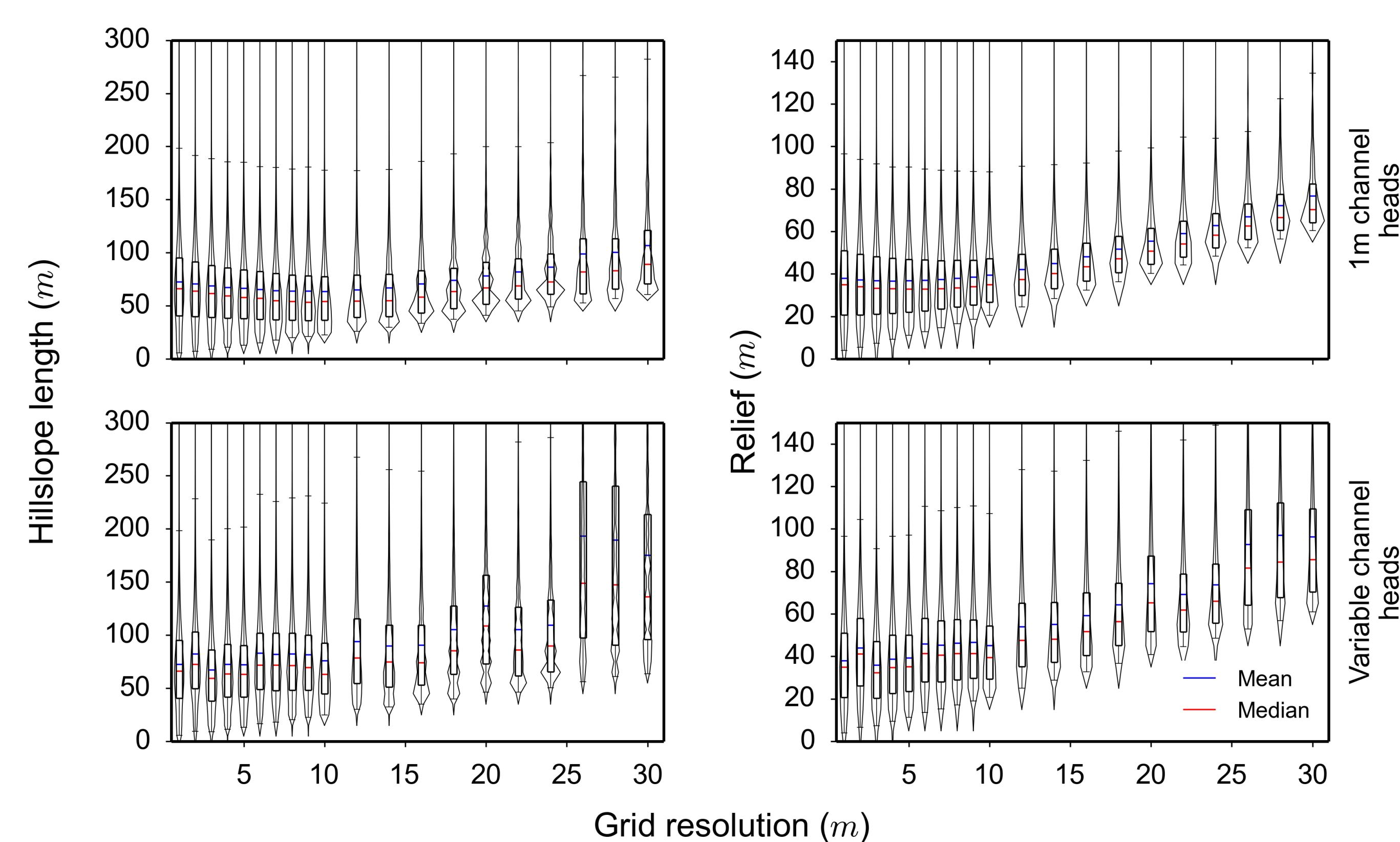
Landscape curvature is a common measurement performed on topographic data, used to identify **channel networks**, estimate **erosion rates** and **sediment transport coefficients**.



As grid-resolution is decreased, extreme curvatures are lost, yet the majority of the curvature distribution is unchanged.

Hillslope length and relief

Measuring hillslope length and relief yields important insights into **sediment transport**, **landscape evolution** and **landslide hazard**. These metrics are tested using channel networks extracted from 1 metre and reduced resolution topographic data.



The measurement of hillslope length and relief is stable up to resolutions in excess of 10 metres.

More information

Read the paper: How does grid-resolution modulate the topographic expression of geomorphic processes?, *Earth Surf. Dynam.*, 4, 627-653, 2016.

Get the software: LSDTopoTools.github.io