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# Can we use the infinite slope model within catchment scale landslide models given its landslide length assumption?

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The infinite slope model is widely used as the geotechnical component of geomorphic and landscape evolution models. Its assumption that landslides are infinitely long is usually considered valid for natural landslides on the basis that they are generally long relative to their depth. However, it is rarely justified since we lack a clear definition of the critical length / depth ratio below which edge effects become important and length dependence appears. Herein, we build on recent work to benchmark infinite slope predictions against those from a two-dimensional finite element stability model. We perform a set of benchmark tests across the range of possible slope properties found on natural slopes to establish the critical length at which infinite slope stability predictions fall within 5 and 10% of those estimated by the finite element model. We find that infinite slope stability predictions always converge to within 5% of the finite element benchmarks by a critical length / depth ratio of 17. However, they can converge at much lower ratios depending on slope properties, particularly the proportions of cohesive versus frictional soil strength, with convergence at low ratios for low cohesion soils. As a result the infinite length assumption within the infinite slope model is valid for: (1) coarse resolution models; but also (2) models with a much finer grid resolution since spatial organisation in the predicted pore water pressure field mitigates against short landslides and minimises the risk that predicted landslides will have length / depth ratio's less than 17.