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Geometric relationships between orogenic indenters and drainage divides: The India - Asia collision zone

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We present results from a study in which we investigate the plan-view spatial relationships between orogenic indenters and topographic divides with a two dimensional mechanical finite element model coupled with a landscape evolution model to describe erosion. In particular, we apply the model to the India - Asia collision zone. It is shown that the distance between the zone of highest topography (and greatest crustal thickness) and the indenter front is about 10% - 20% of the indenter width and is quite robust towards erosion rate. Our results are compared with first order geomorphic features of the Himalayan region, where the principal topographic divide is not located near the Indian indenter, but north of the Indus-Tsangpo suture zone in southern Tibet at a distance predicted by the model. It is shown that the geometry of most of the major drainages around the India-Asia collision zone is also consistent with the model. We therefore suggest that the geometry of major drainages and ultimately the erosion history of this orogen is independent of high precipitation contrasts, strike slip displacements and even the timing of uplift of the Tibetan plateau.