We designed an algorithm that concisely describes how hypsometry varies with the scale of analysis. Development of this algorithm was motivated by the observation that the hypsometric maximum of large regions can shift by several kilometers depending on the boundaries of analysis. The algorithm, which we term “progressive hypsometry,” (PH) involves the measurement of hypsometric maxima in nested catchments whose outlets span from the lowest to the highest elevations in a mountain range. Progressive hypsometry consists of three major components: (i) segmentation of the landscape into large catchments, (ii) calculation of hypsometry along flow paths, (iii) segmentation into nested subcatchments characterized by a shared modal elevation. We first segment the targeted mountain range into large (1000 km2) catchments, hereafter referred to as “supercatchments”, delineated on the condition that they link the main divide to a low reference elevation. This method typically segments each mountain range into 30-60 supercatchments. We then do the following*:*

1. Map channel network:
   1. define a channel network in each supercatchment using an arbitrary flow accumulation area threshold *A\_c—*this thins the set of all possible flow paths
   2. traverse downstream from each channel head *i=1…N* to the catchment exit to define a set of *N* along-channel pixel chains
   3. extend each chain *i* upstream from its channel head to the drainage divide by following path of greatest flow accumulation area, ensuring that each pixel chain spans the full range of elevation from ridge to exit
2. Map PH along network (Fig. 4):
   1. traverse each chain *i* upstream from the exit (shared by all chains)
   2. map along each chain a nested series of subcatchments, one at every channel pixel *j(i)*
   3. for each nested subcatchment, estimate its elevation pdf, its modal elevation *h\_mode\_j* (where the pdf peaks) and its outlet elevation *h\_out\_j* (Fig. 3)
   4. record as a set of *i=1…N* sequences of *[h\_out\_j(i),h\_mode\_j(i)]* pairs
3. Identify all PH “benches”, characteristic nested-catchment modal elevations (Fig. 5)
   1. perform change-point detection along each chain *i=1…N* to locate and define large jumps in *h\_mode* at each *h\_out*
   2. define the outlet elevation *h\_out* at each jump as *h\_change*
   3. designate the groups of between-jump modal elevations *{h\_mode}* as “benches”
   4. define each bench modal elevation *h\_bench = min{h\_mode}*
   5. record as a set of *i=1…N* sequences (one per chain) of *[h\_change\_k(i),h\_bench\_k(i)]* pairs, each of length *k(i)=1..n(i)*
   6. concatenate all *N* sequences of *[h\_change\_k(i),h\_bench\_k(i)]*

We performed progressive hypsometry on the ten selected mountain belts, using a low-elevation reference level of 150-250 m in each mountain range. This reference elevation focuses the analysis just above large depositional plains, which improves the efficiency of the algorithm. The Rwenzori are an exception, since they are more than 1000 km from the nearest coast and rise sharply above lowlands with several large lakes at 1200 m. We used a low-elevation reference level of 1200 m for the Rwenzori.