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Supplement of

Modelling sediment clasts transport during landscape evolution

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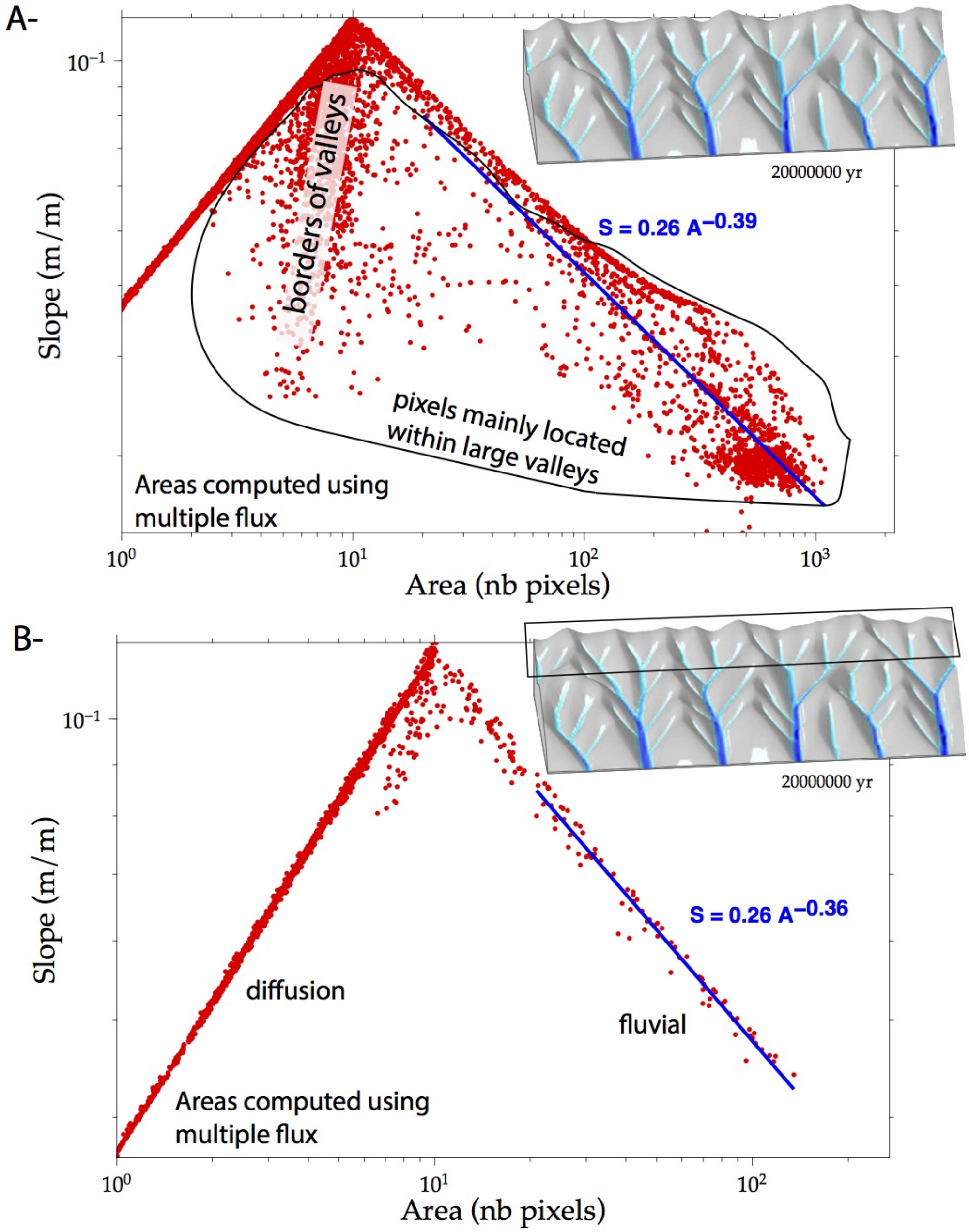

Figure S 1. Slope-Area (S-A) plots corresponding to the uplifting block in Figure 6 after 20 Myrs of evolution until a steady-state has been reached. A- The scatter corresponds to pixels belonging to a large valley floor (dark blue in the inset topography). B- When considering only the upper catchment area shown in the inset topography, the logA-logS plot shows an increasing linear relationship for the pixels dominated by diffusion, while pixels above a drainage area of 10 show a decreasing relationship consistent with the dominance of fluvial processes. The area exponent (-0.36) is different from the predicted -0.5 value for larger areas because diffusion influences the scaling near the catchment head. Lateral erosion may also influence the S-A scaling but this needs to be analysed in future works (see Figure **??**). $K_{sediment}$ =0.6 10^{-3} m/yr, $K_{bedrock}$ =0.3 10^{-3} m/yr, $m =$ 0.5, $n = 1$, $\xi = 0.1$ yr/m, $\alpha_{sediment} = 0.01$, $\kappa_{sediment} = \kappa_{bedrock}$ =10^{-4} m/yr, $Sc_{sediment} = Sc_{bedrock} =$ 0.8, $dx = 500$ m, $dt = 100$ yr.

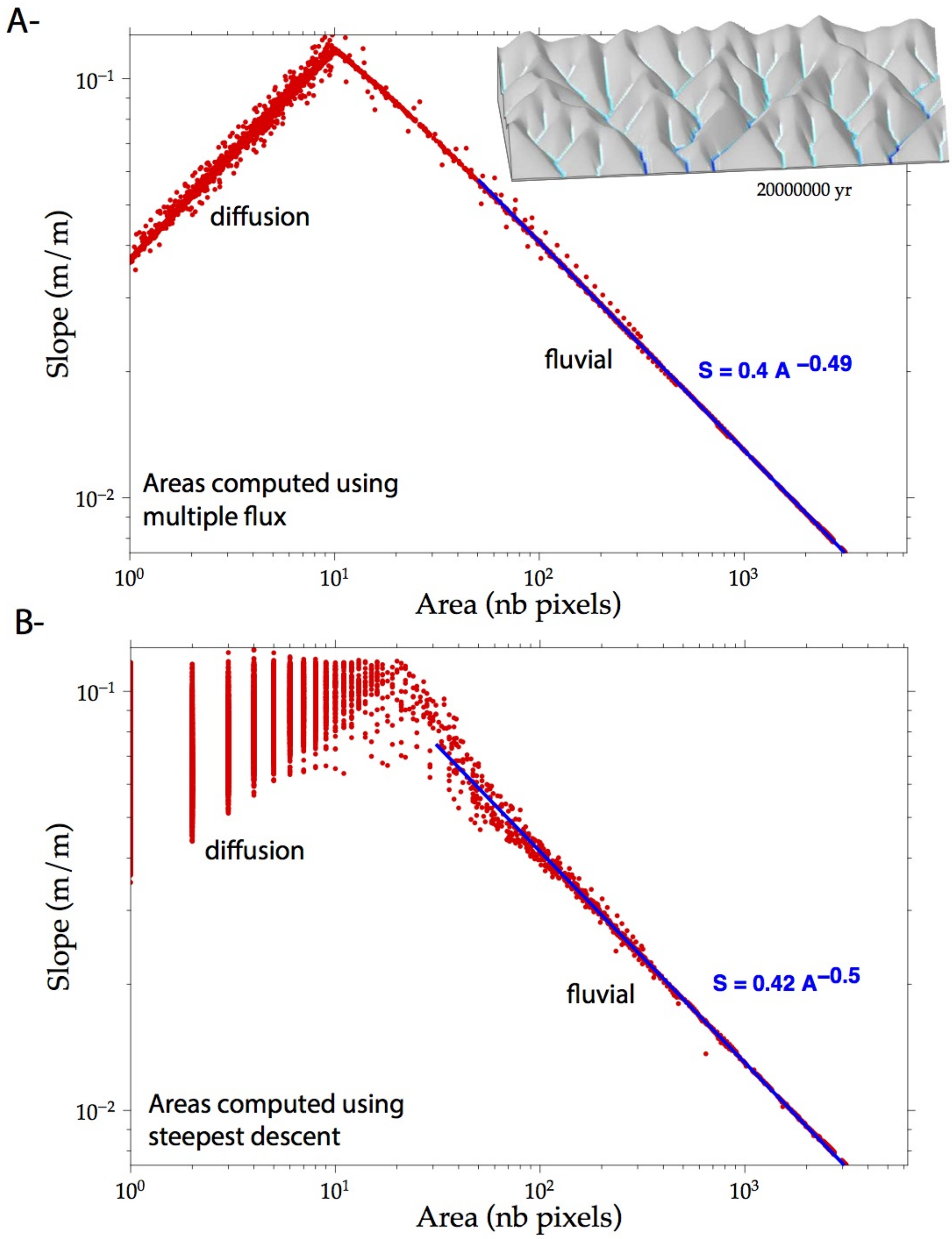

Figure S 2. Slope area plot corresponding to the uplifting block in Figure 6, except that the lateral erosion is turned off (compare with Figure **??**) and the bedrock and sediment have the same erodability. In this case, it is possible to derive a predicted Slope-Area relationship at steady-state. Steady-state corresponds to $U = E - D$, which leads, after development, to $S = \frac{U}{K}\frac{1}{dx^{0.5}}\left(1+\frac{1}{\xi}\right)N^{-0.5}$ (Davy and Lague, 2009) for fluvial-dominated pixels, where N is the drainage area in terms of the number of pixels, as displayed in the two graphs provided in this Figure. Using the parameters of this experiment, we obtain the predicted relationship at steady-state $S = 0.416N^{-0.5}$. This relationship is compared to the scaling obtained for large areas by applying a simple fit to the raw data. Cidre's result is consistent with this prediction, regardless of the drainage area calculated using the multiple flow algorithm (A-) or the steepest descent algorithm (B-). Note that the S-A relationship is much more scattered in B-. $K_{sediment} = K_{bedrock}$ =0.6 10^{-3} m/yr, $m = 0.5$, $n = 1$, $\xi = 0.1$ yr/m, $\alpha_{sediment} = 0$, $\kappa_{sediment} = \kappa_{bedrock}$ =10^{-4} m/yr, $Sc_{sediment} = Sc_{bedrock} = 0.8$, $dx = 500$ m, $dt = 100$ yr.

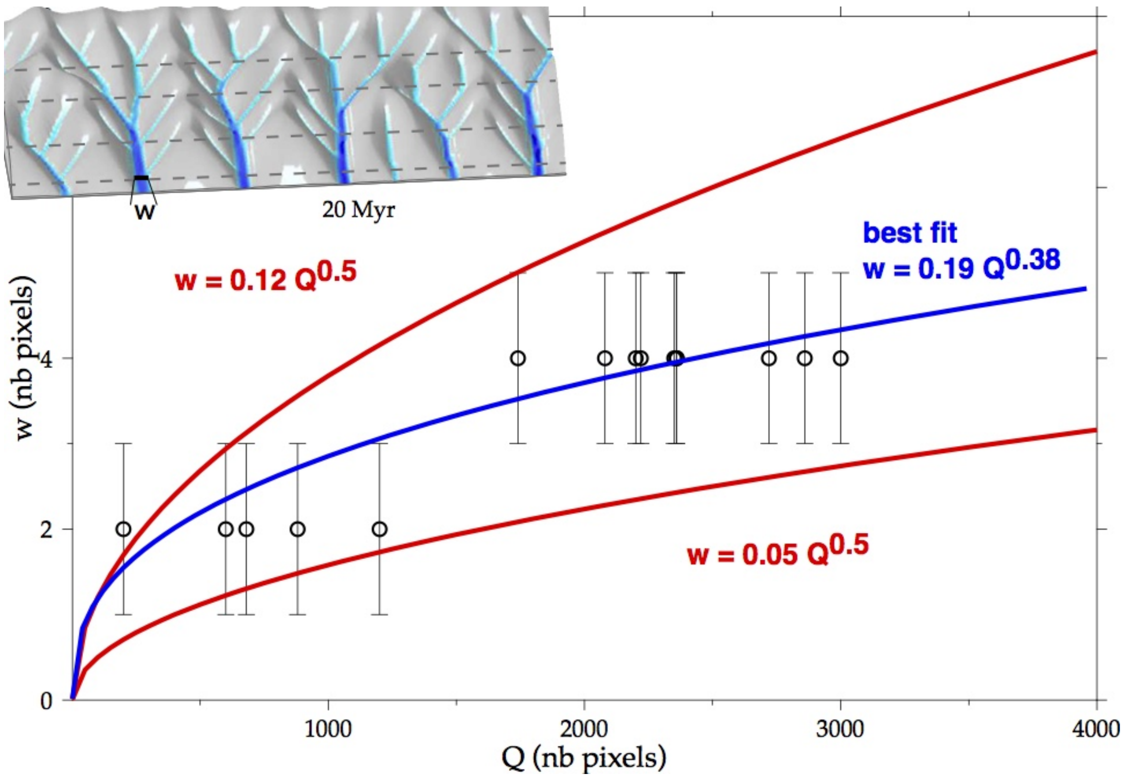

Figure S 3. Scaling between valley width and total discharge in the mountain block shown in Figure 6 during steady-state. For several transverse profiles indicated in the inset topography, the width of several valleys crossed by the profile line and their total discharge were determined. The model is too coarse to obtain good statistics with a large range of width values. Many of the total discharges correspond to the same valley width because the width tends to increase by synchronous steps for both sides of the valley. This justifies the $\pm$ 1 pixel vertical error bars. Nevertheless, even this coarse model may be consistent with hydraulic geometries observed worldwide showing that $w \propto Q^{0.3-0.5}$ (Brocard and Van der Beek, 2006). These results are preliminary and we leave this for future works on the influence of the chosen lateral erosion law on the predicted topography. $K_{sediment}$ =0.6 10^{-3} m/yr, $K_{bedrock}$ =0.3 10^{-3} m/yr, $m = 0.5$, $n = 1$, $\xi = 0.1$ yr/m, $\alpha_{sediment} = 0.01$, $\kappa_{sediment} = \kappa_{bedrock}$ =10^{-4} m/yr, $Sc_{sediment} = Sc_{bedrock} = 0.8$, $dx = 500$ m, $dt = 100$ yr.

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