

Ben-Asher, M., Haviv, I., Crouvi, O., Roering, J.J., and Matmon, A., 2020, The convexity of carbonate hilltops:  $^{36}\text{Cl}$  constraints on denudation and chemical weathering rates and implications for hillslope curvature: GSA Bulletin, <https://doi.org/10.1130/B35658.1>.

## Supplemental Material

**Figure S1.**  $^{36}\text{Cl}$  denudation rates vs. mean annual rainfall of carbonate samples categorized by (A) hillslope position: hilltop (gray circles) and maximum gradient (red circles), (B) sample type: rock clasts (orange rectangle) and exposed bedrock (blue diamonds), and (C) soil covered (gray triangles) and exposed bedrock (blue rectangles).

**Figure S2.** (A) Bulk soil chemical depletion factor ( $CDF$ ) vs. mean annual rainfall. (B) Bulk soil dust fraction ( $f_d$ ) vs. mean annual rainfall. Based on Ben-Asher et al. (2019) and derived from the ratio of two immobile elements (Ti-Y and Ce-La) (Eq. 4 and 5) measured in rock, soil and dust. Soft chalk is marked by blue circles and hard dolo-limestone by orange circles.

**Figure S3.** Analysis of potential spatial patterns in hilltop curvature in each site. Left: Stacked histograms of hilltop clusters. Each color represents a different cluster (see Fig. 5 for more details). Right: Boxplot diagrams of hilltop clusters in each site. (A) BGV, (B) GOR, (C) RAM, (D) BRG, (E) MER, (F) GLB, (G) ZET. Black horizontal lines show range of  $\pm$ standard deviation around the mean of all 12 mean values. On each box, the central mark indicates the median, and the bottom and top edges of the box indicate the 25th and 75th percentiles, respectively. The whiskers extend to the most extreme data points not considered outliers.

**Figure S4.** Left: sample of less-resistant chalk rock (GOR site). Right: sample of hard dolomite rock (MER site).

**Figure S5.** Mean hillslopes slope (m/m) vs. mean gradient. Error bars represent standard deviation. Note that the landscape in our study sites is of relatively low relief and slope. Analysis was made on a compilation of 1D swath profiles of flow routes from all the mapped hilltops pixels ( $n = 10^3 \sim 10^4$ ) at each site. Swath profiles were calculated using a MATLAB code based on the methods described by Hurst et al. (2012) and documented in <https://lsdtopotools.github.io/>.

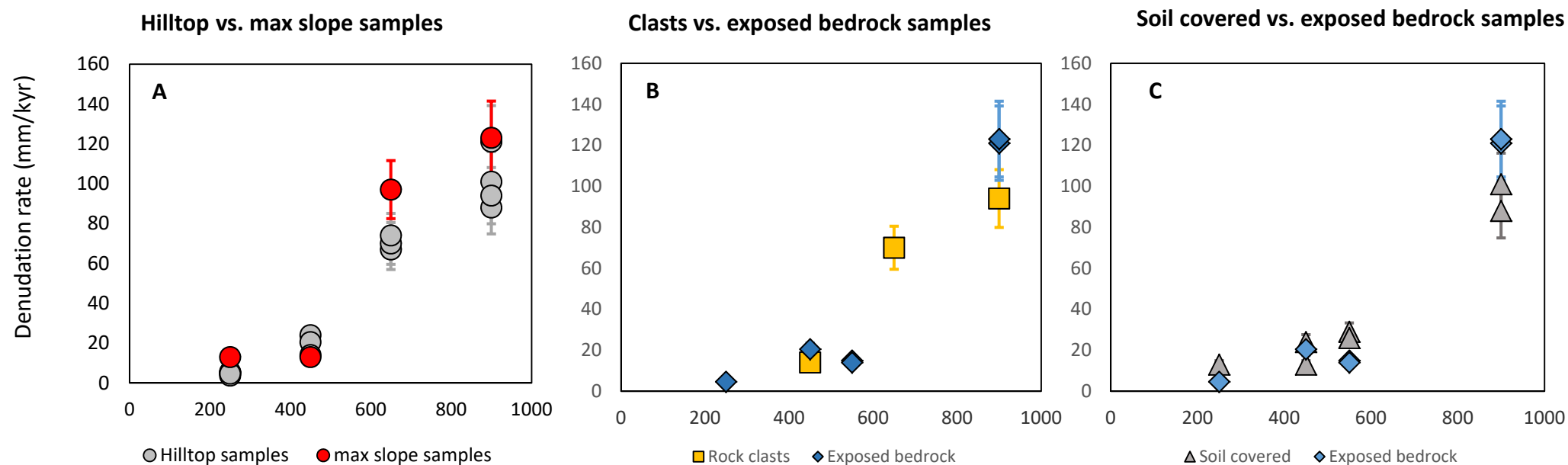


Figure S1:  $^{36}\text{Cl}$  denudation rates vs. mean annual rainfall of carbonate samples categorized by A) hillslope position: hilltop (gray circles) and maximum gradient (red circles), B) sample type: rock clasts (orange rectangle) and exposed bedrock (blue diamonds), and C) soil covered (gray triangles) and exposed bedrock (blue rectangles).

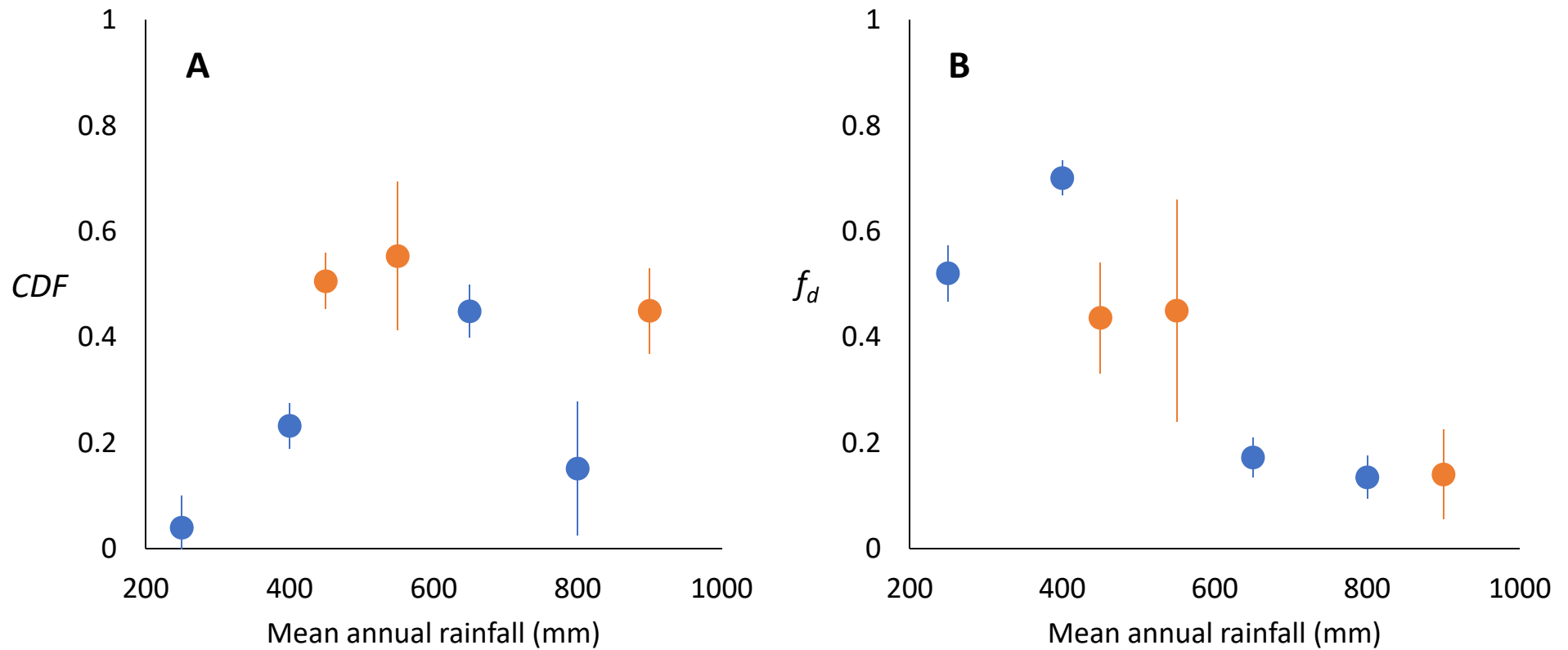


Figure S2: A) Bulk soil chemical depletion factor ( $CDF$ ) vs. mean annual rainfall. B) Bulk soil dust fraction ( $f_d$ ) vs. mean annual rainfall. Based on Ben-Asher et al. (2019) and derived from the ratio of two immobile elements (Eq. 6 and 7) measured in rock, soil and dust. Soft chalk is marked by blue circles and hard dolo-limestone by orange circles.

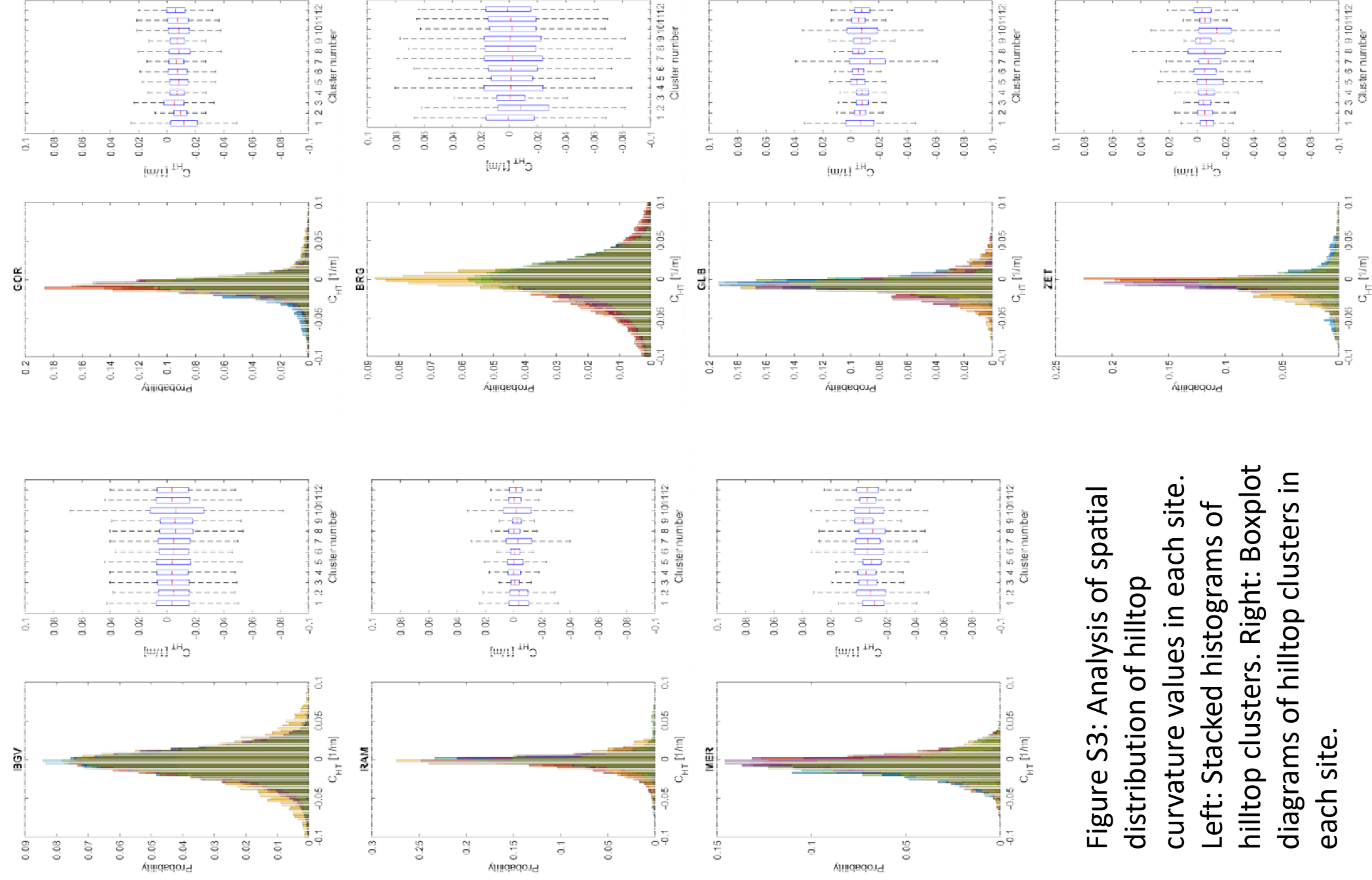


Figure S3: Analysis of spatial distribution of hilltop curvature values in each site. Left: Stacked histograms of hilltop clusters. Right: Boxplot diagrams of hilltop clusters in each site.





Chalk rock  
Avdat group (mid Eocene)  
Density:  $1.4-2 \text{ g/cm}^3$   
compressive strength of 8-13 MPa



Dolo-limestone rock  
Mt. Judea group (Turonian)  
Density:  $2.7 \text{ g/cm}^3$   
compressive strength of 70-170 MPa





### Mean slope vs. mean relief

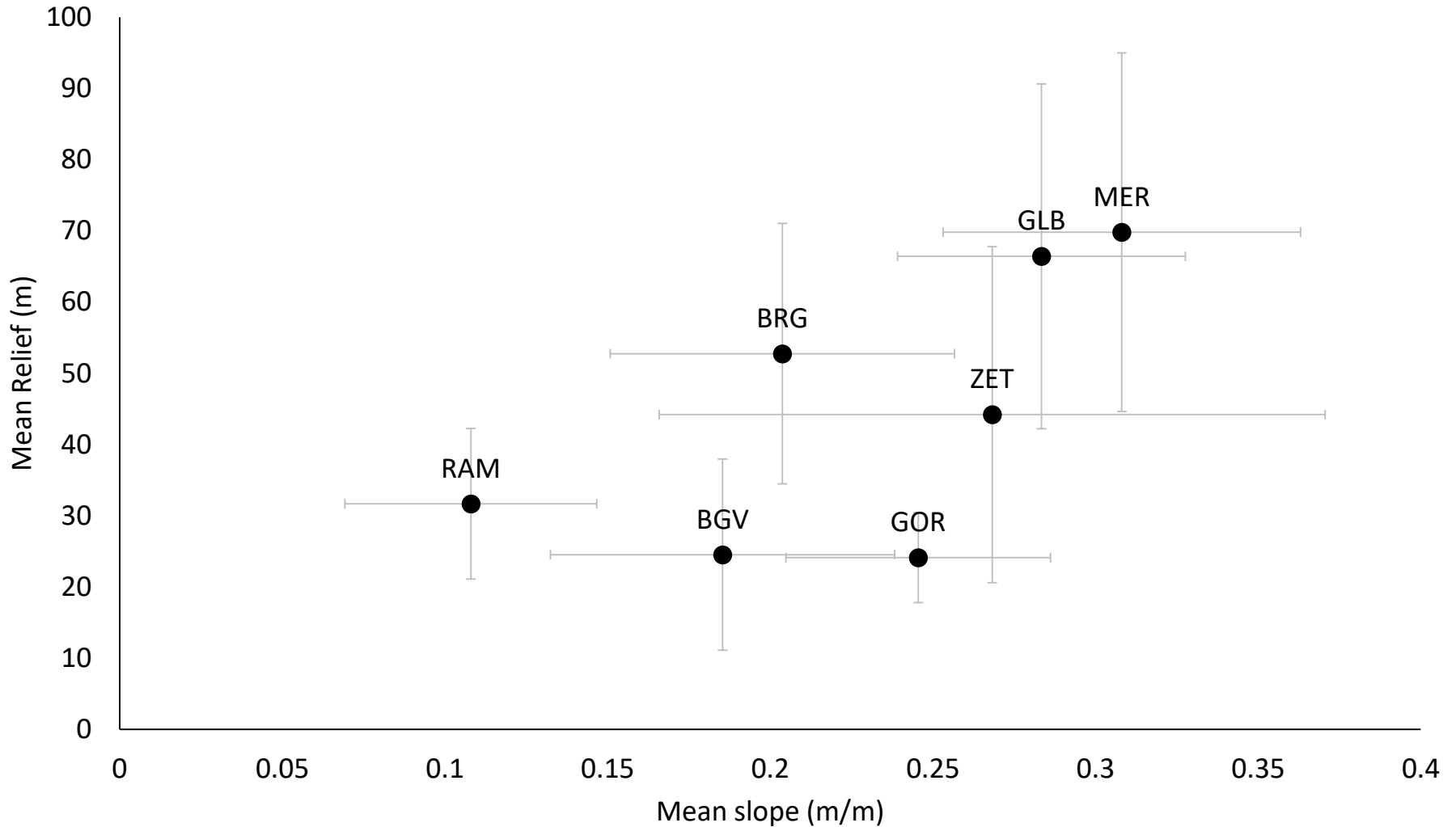


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