Assessing Erosion Patterns of Hurricane Maria on the Caribbean Island of Dominica

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Introduction

- Landscape evolution occurs as the environment responds to weathering and erosive forces.
- Like other Caribbean islands, Dominica is well-vegetated, fairly steep, and experience tropical storms frequently (Rad et al., 2013; Engel et al., 2016; NHC, 2017)
- Tropical storms and hurricanes induce mass-wasting events (Bucknam et al., 2001).
- This study assesses erosion effects of Hurricane Maria on the Caribbean Island of Dominica by providing insight into the spatial and temporal variation occurring across Dominica's watersheds.

Methods

- River sediment (<63 and 250-850 µm) collected in July 2017 and Jan. 2018
- Analysis of cosmogenic nuclides (meteoric $^{10}Be_m$ and in situ $^{10}Be_i$)
- Estimated erosion rates (CRONUS-Earth online calculator; Balco, 2008)
- Measurements of landscape variables for each watershed via remote sensing

Results

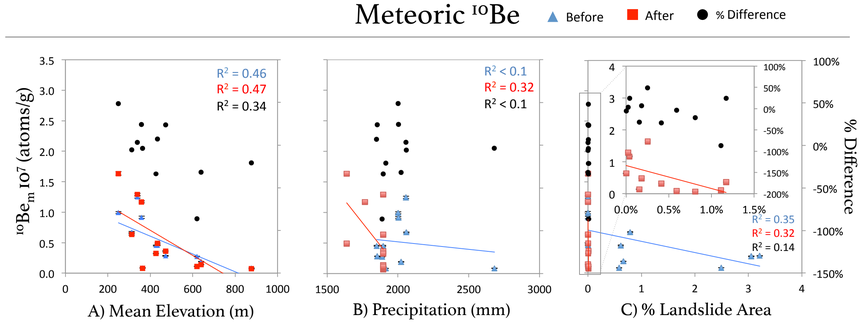

Figure 1: Relationships are shown between coarse-grain $^{10}Be_m$ and mean elevation (A), precipitation (B; mean annual & hurricane total), & percent landslide area (C)

>> $^{10}Be_m$ concentration decreases as mean elevation, precipitation, and percent landslide area increase.

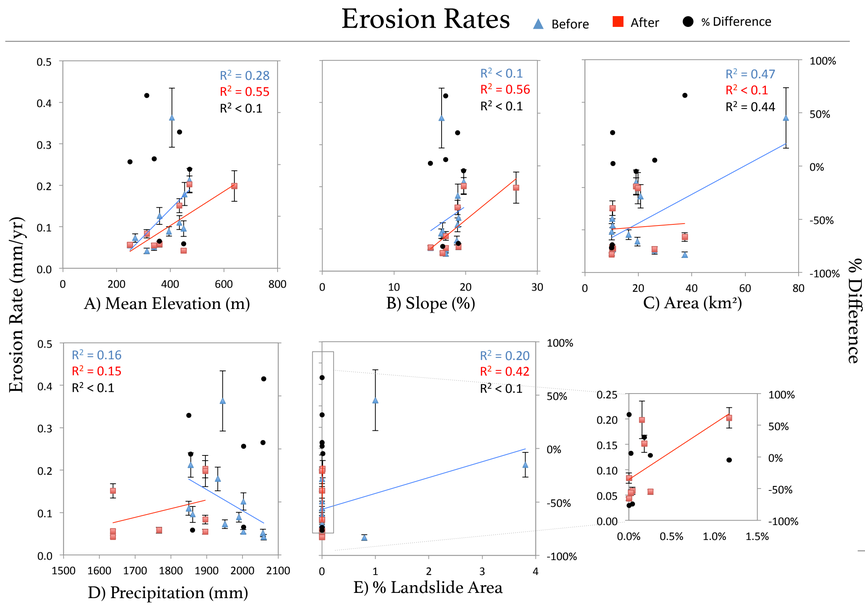

Figure 2: Relationships are shown between erosion rates and mean elevation (A), slope (B), area (C), precipitation (D; mean annual & hurricane total), & percent landslide area (E)

>> Erosion rates increase as watershed variables increase, except for samples before the hurricane in relation to precipitation.

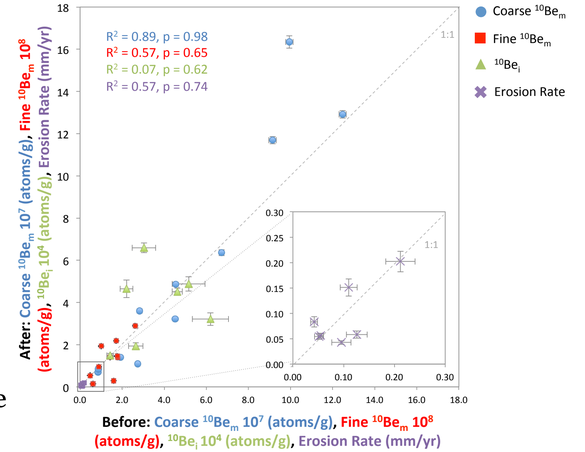

Figure 3: Before and after hurricane samples plotted for $^{10}Be_m$, $^{10}Be_i$, and erosion rates to examine temporal replicability of sample sites.

>> All sample data sets lie close to the 1:1 ratio line

Conclusions

- A decrease in ^{10}Be relative to landscape variables suggests there was a lot of deeply sourced sediment mixed with surface sediment caused by precipitation and landslides.
- Mann-Whitney U-Test produced p-values that show no population variation between data sets before and after the hurricane (Figure 3). This is also supported by similar before and after hurricane median values for data sets of $^{10}Be_m$, $^{10}Be_i$, and erosion rates.
- Majority of individual sample measurements do change after the hurricane.
- We may expect increases in anthropologic activity, which deforests the island, would lead to greater susceptibility to mass-wasting events in the future.

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