Exploring controls on coastal overwash morphology in natural and built environments

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Introduction

• Low-lying barrier islands provide protection from storms to coastlines around the world.

• Overwash is a key mechanism controlling the flux of sediment from the front of a barrier island to the top and back of an island during storm events.

• Overwash is an essential process for barrier environments to maintain their height and width relative to sea level.

• Overwash flow, and therefore sediment deposition, is influenced by the spatial characteristics of the floodplain, or the floodplain “fabric”.

Aim

• To quantitatively compare barrier floodplain controls across a range of spatial "fabrics".
Methodology

Empirical
• Post-storm satellite imagery
• Historic overwash deposits identified using Google Earth

Physical
• Analogue Model
  • Small experimental basin (1.5mx1m)
  • Vegetation and Buildings represented with Lego

Numerical
• Simple cellular numerical model
• Erodible barrier
• Driven by water height variation on seaward side
• Varying topography as representative of nature
Methodology

- Individual deposits identified via all three methods.
- Area and perimeter of deposit measured.
- Distortion index calculated to allow comparison between different overwash deposit geometries.
- Ideal perimeter calculated based on measured area, assuming perfect semi-circular deposit.

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\text{Distortion Index} = \frac{\text{Measured Perimeter}}{\text{Ideal Perimeter}}
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Results

• Similarity in overwash morphology across methods (empirical, physical experiment, numerical model)

• Greater distortion evident in built environments.
Results

- Urban distortion > natural distortion (for a given area)
Conclusions

- The findings illustrate a continuum in overwash pattern formation between endogenous self-organisation and exogenous forcing templates (such as topography, vegetation, infrastructure and buildings).

- This sets up further inquiry into the dynamics of flood deposition in both natural and built environments.