Atlantic coastal boulder deposits: A mapping approach for wave energy analysis

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INTRODUCTION:

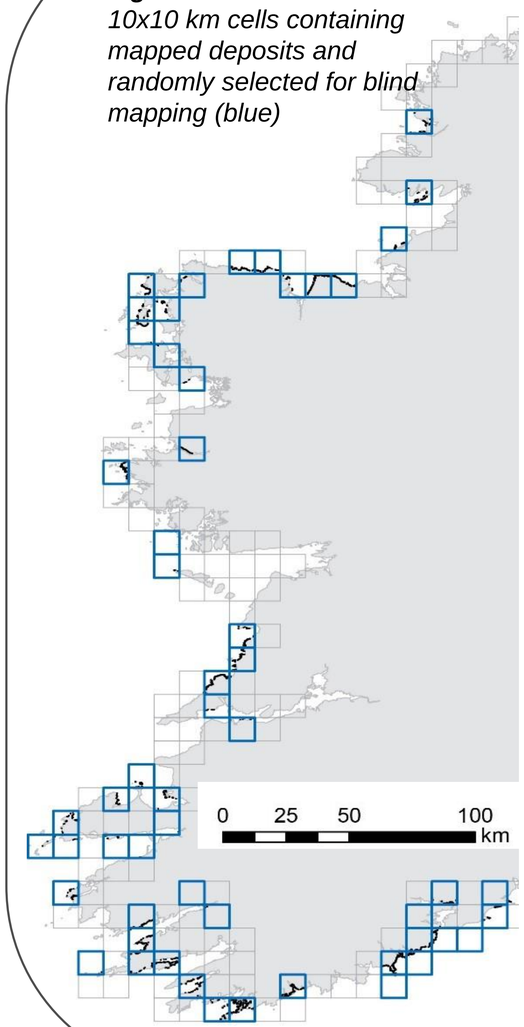
The erosion of Ireland's coastline due to storm wave climate and sea level rise is a pressing concern. Management is hampered by the absence of geomorphological maps of coastal type and composition at sufficient resolution. Coarse boulder deposits, especially those located at supra tidal elevations, are known to indicate past storm wave energies (Cox et al., 2019).

***Figure ?**: Field image of coarse boulder deposits.*

Climate models predict extreme wave height will increase and more severe storms will track across Ireland (Nolan and Flanagan, 2020). Here we present the preliminary results of an undergraduate mapping program undertaken at Trinity College, Dublin during summer 2023.

Three undergraduates [LC-S, AMcH and JR] mapped coastal boulders along the 6,000 km-long Irish Atlantic Coastline (see Figures 1 & 3).

***Figure 2**: Location of 10x10 km cells containing mapped deposits and randomly selected for blind mapping (blue)*



METHODS:

Mapping:

We use DigiGlobe World View satellite data (downgraded by national agency to 5m/px) and the ArcGIS platform to map. These data were cross-checked during mapping with Image data on Google Earth Pro. Confidence values were assigned to each deposit and ranged from 1 (high confidence) down to 3. Deposit extent was mapped by polygon.

Validation: Two methods were used.

1. *Blind-mapping*: A grid (10 x10 km) was overlain and cells that contained mapped deposits were selected. Then 30% of these cells were randomly selected and blind mapped (Figure 2).
2. *Published data:* We use location data of boulders taken from published papers (Sources are found in Bourke et al., 2023).

METHODS cont.

- We used the ISROC Broad classification of the deposit's (ISROC, 2023) to derive a baseline boulder classification for mapping. We mapped boulder clusters, fields and ridges/ramparts (Table 1 & Fig. 3)
- As high tide could not be readily identified, we mapped all visible boulders (including intertidal and supra-tidal. We did not map offshore boulders.

***Figure 3**: DigiGlobe image of boulder ridge, Achill Island*

Deposit Characteristic	Classification of deposit context	Used
Singular boulde	Singular boulder(s) up to 10.	NO (due to resolution limitations)
Boulder cluster	Small cluster of up to 10 individual boulders	YES
Boulder field	>10 singular boulders across a spatially well constrained area.	YES
Boulder ridge	Boulder accumulation building up an entire ridge or rampart	YES

RESULTS

We find that:

1. The distribution of deposits are spatially variable.

2. There are higher volumes of boulder deposits in the northwest coastline relative to the southwest.

3. This aligns with higher wave energy zones on the Atlantic-facing coastlines.

4. Rock joint and bedding spacing and coastline orientation) are important controls on the geographical distribution of deposits.

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