Self-organised dynamics of breaching in coastal barrier systems

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Summary

Breaching is a universal geomorphic phenomenon that occurs when a channelized or otherwise contained fluid flow overwhelms its confining boundary. Common fluvial examples of breach-related morphologies range from crevasse splays, where flow through a levee breach delivers sediment to the proximal floodplain, to flood-induced avulsions that create a new channel course. Breaching is also typical along sandy coastlines, where water elevated by storm surge and wave action can push through dune fronts and drive cross-shore overwash. Storm-driven overwash is a sediment-transport process fundamental to the evolution of low-lying coastal environments. In barrier island systems, overwash is an essential mechanism by which the islands maintain their height and width relative to sea level. A locally persistent or energetically focused coastal breach can cause a new inlet to open, which in turn affects habitats, nutrient pathways, and sediment transport in the back-barrier environment. Physical insight into overwash morphodynamics is crucial for improved risk assessment and hazard forecasting in vulnerable coastal zones. Spatially extended observations of washover deposits have shown that back-barrier shoreline planforms can be quasi-periodic. These rhythmic patterns have been attributed to the influence of a forcing template in bathymetry or topography, or inherent in the forcing itself. With an alternative to this prevailing explanation, we present results of a physical experiment in which quasi-periodic patterns in washover deposits are self-organized, arising from interactions between barrier topography, routing of overwash flow, and sediment flux (Lazarus & Armstrong 2015).

Related publications & presentations

- Lazarus ED, Armstrong S (2015) Self-organized pattern formation in coastal barrier washover deposits, *Geology* 43(4), 363–366.
- Virtual poster at the "Stormy Geomorphology" meeting (11 May 2015) sponsored by the Royal Geographical Society, BSG, and Wiley.

Other media

Blog posts and photos from experimental trials at the National Center for Earth-surface Dynamics, St Anthony Falls Laboratory (University of Minnesota, USA):
https://environmentaldynamics.wordpress.com/blog-posts/

Value

The results of this BGS Research Grant are propelling two additional papers currently in preparation and one new collaborative research proposal (also currently in preparation, intended for submission to EPSRC).

Figure 1 – A topographic laser scan captures mm-scale experimental washover topography during laboratory trials at the National Center for Earth-surface Dynamics, St Anthony Falls Laboratory (University of Minnesota, USA).