Ensuring beach stability through new sand boil research

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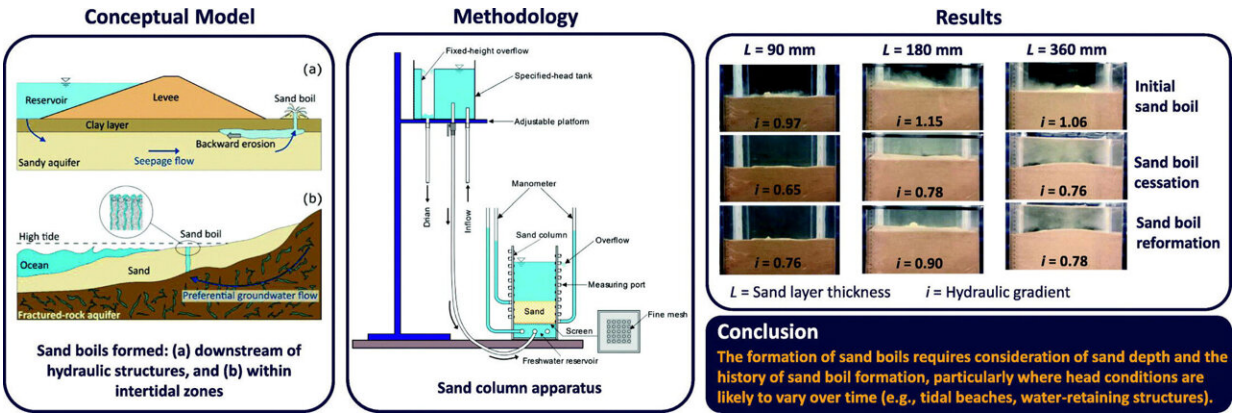

Credit: *Science of The Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.163235

Sand boils caused by groundwater discharges affect beach stability, yet knowledge of these damaging underground erosions is largely misunderstood, and therefore hard to curb.

Researchers at Flinders University's College of Science and Engineering have been conducting tests to provide a better understanding of sand boil formation mechanisms, with particular relevance to those found in intertidal zones—including at Sellicks Beach on South Australia's Fleurieu Peninsula.

Sand boils occur where groundwater discharges to the land surface under sufficient hydraulic gradient to cause internal erosion and the upward transport of particles—and new research from Dr. Amir Jazayeri (postdoctoral researcher) and Professor Adrian Werner at Flinders University's College of Science & Engineering and the National Center for Groundwater Research and Training has identified better ways to identify and measure them.

"The effect of sand layer thickness and the implications of driving head fluctuations on the formation and reformation of sand boils have not been explored previously—and we found significant differences to existing theories," says Dr. Jazayeri.

"A proper understanding of sand boil processes is essential in evaluating a wide range of geomechanical and sediment transport situations under which groundwater seepage occurs, such as the effects of groundwater discharge on beach stability."

To perform this research, laboratory experiments examined sand-depth and head-change effects on sand boil behavior in a sand column apparatus (0.28 m × 0.28 m × 0.60 m) designed and constructed at Flinders University's College of Science and Engineering workshop.

"Our research focused on two key knowledge gaps in the current understanding of sand boil formation, being the effect of sand layer thickness on sand boil formation and the reformation of sand boils under variable driving head conditions," says Professor Werner.

The researchers found that the critical hydraulic gradient is lower for sand boil re-emergence under fluctuating head conditions. Therefore, sand boils are more likely to reappear in the same location within the beach even though they tend to come and go under natural conditions.

The study, titled "Effects of porous media thickness and its hydraulic gradient history on the formation of sand boils: Experimental investigation," has been published in *Science of the Total Environment*.

"The contribution of sand boils to the erosion that occurs along Adelaide's beaches is likely hard to avoid—sand boils are probably here to stay."

"It's a strong start, but these results highlight the need for further investigation to improve the existing theory to account for these effects."

More information: Amir Jazayeri et al, Effects of porous media thickness and its hydraulic gradient history on the formation of sand boils: Experimental investigation, *Science of the Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.163235

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