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WAVE OVERTOPPING ON STEEP LOW-CRESTED STRUCTURES: ANOTHER CLIMATE CHANGE CHALLENGE

We need a good understanding of wave overtopping to protect the Belgian coastline.

Climate change is responsible for sea level rise and increase in the storminess (i.e. more frequent and more severe storms), posing risks to coastal communities.
In this climate change scenario, the existing coastal structures protecting the Belgian coastline against wave attack should remain at least equally effective against future storms.

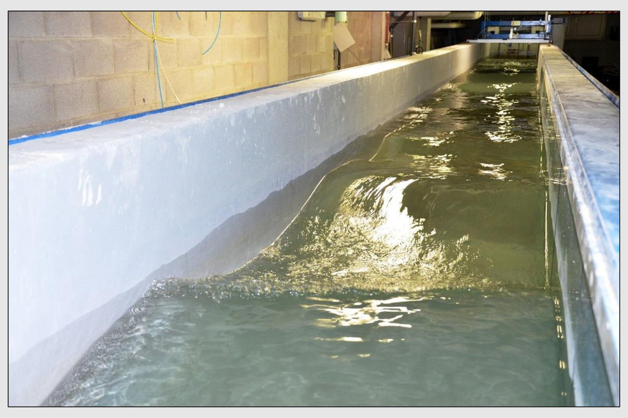
Wave overtopping is the coastal process occurring when a volume of water passes over a sea defence structure when waves attack the structure. It is a key design parameter as its tolerable value determines the necessary crest level of this type of structures (e.g. breakwaters). As sea levels rise, the crest freeboard of sea defence structures will decrease leading to more wave overtopping. A good knowledge of the physics behind wave overtopping is then necessary to improve the safety of this type of structures.

Wave overtopping damaging the railway infrastructure in Dawlish (UK).

To improve the knowledge of wave overtopping , we performed physical model tests in a wave flume.

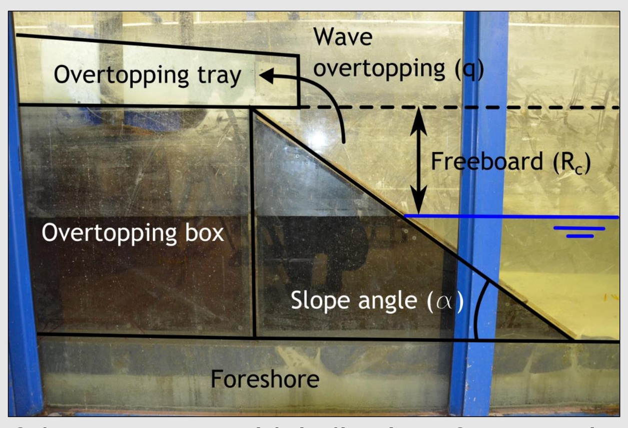
Although wave overtopping has been widely investigated in literature, there is still a knowledge gap on overtopping for very steep slopes and vertical walls with very small and zero freeboards (steep low-crested structures).

To cover this knowledge gap, we performed wave overtopping tests in the wave flume of Ghent University on smooth and impermeable steep low-crested structures, obtaining two new datasets called UG13 (overtopping in deep water conditions) and UG14 (overtopping in shallow water conditions).



Wave flume at Ghent University.

Wave overtopping during a test.

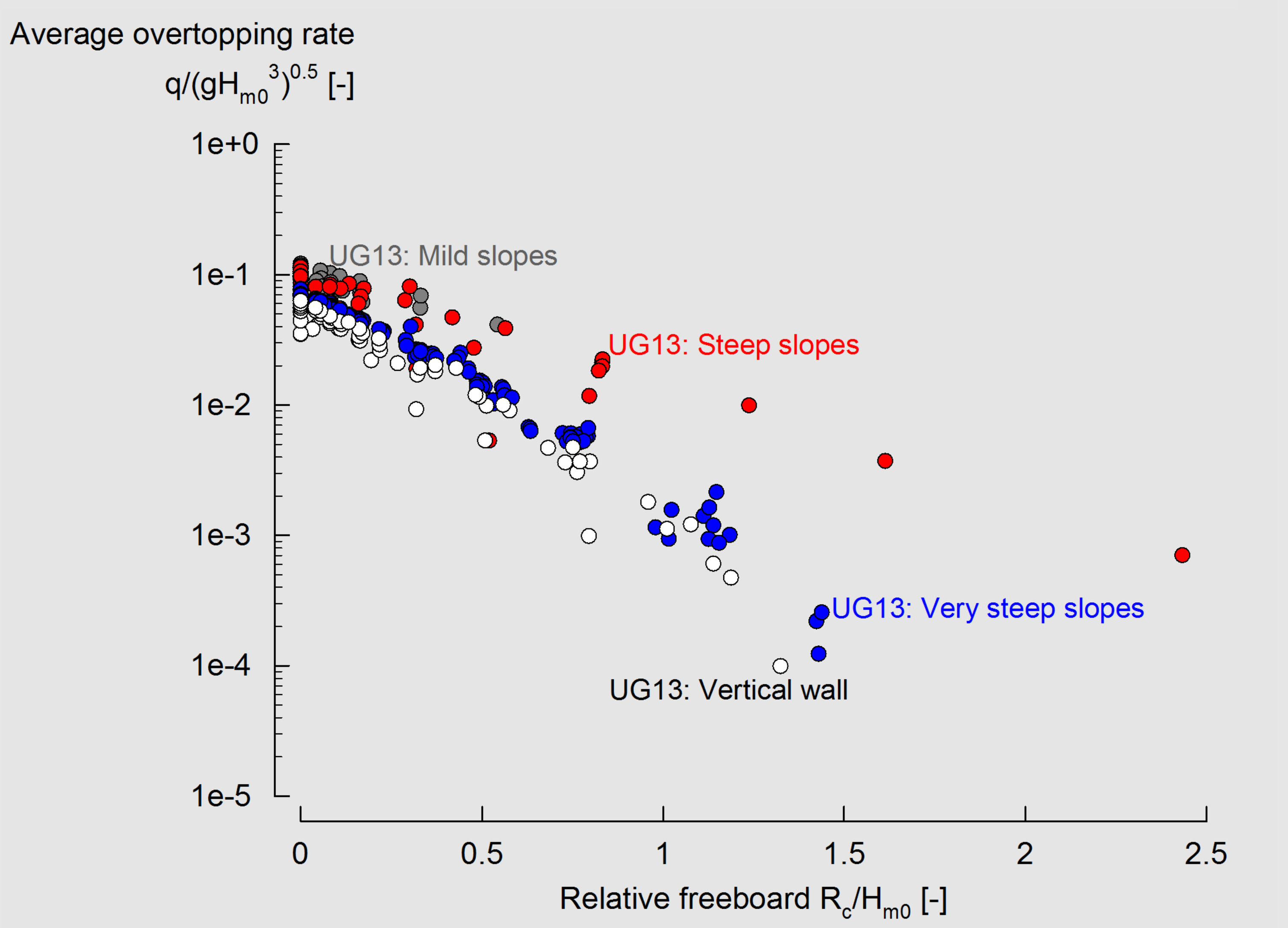


Cross section of the test set-up with indication of overtopping parameters.

The average overtopping rate depends on the relative freeboard and the slope angle.

Dataset UG13 is formed by overtopping data for very steep slopes and vertical walls, with very small and zero freeboard, in deep water conditions.

The overtopping rate decreases for increasing values of relative freeboard, while it increases for milder slopes.

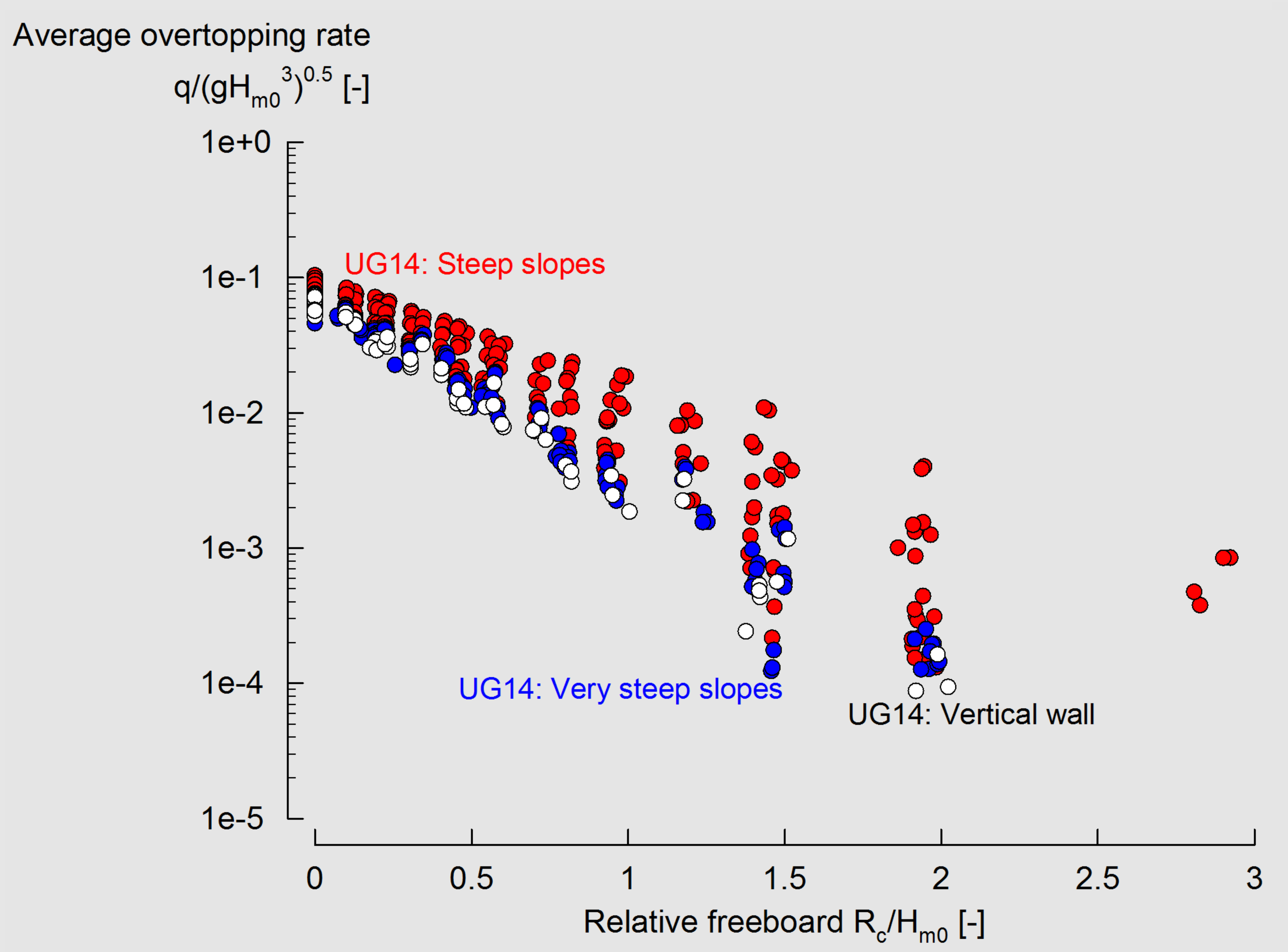


Average wave overtopping rate as a function of the relative freeboard for dataset UG13
Troch et al. (2015). Experimental study of overtopping performance for the cases of very steep slopes and vertical walls with very small freeboards. Proceedings of the 34th International Conference on Coastal Engineering

The data for shallow water conditions show an increase of overtopping for larger relative freeboards.

Dataset UG14 is an extension of dataset UG13 with overtopping data for steep low-crested structures in shallow water conditions.

The overtopping behaviour in shallow water is similar as in deep water, however the overtopping rate increases for larger relative freeboards.



Average wave overtopping rate as a function of the relative freeboard for dataset UG14
Gallach-Sánchez et al. (2014). Experimental study of overtopping performance of steep smooth slopes for shallow water wave conditions. Proceedings of Coastlab14

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