The BARDEX experiment is funded through HYDRALAB-III (see http://hydralab.eu/) and will be undertaken in a large wave flume (see http://www.wldelft.nl/facil/delta/) in July/August 2008. Briefly the work involves placing a scale model of a gravel barrier beach to study its response to tides and storm waves.

The project is lead by the School of Geography at the University of Plymouth and includes partners from:
University of Birmingham - http://www.eng.bham.ac.uk/civil/
Queens University Belfast - http://www.qub.ac.uk/schools/gap/
University of Algarve - http://www.ualg.pt/ciacomar/
University of Southampton - http://www.soton.ac.uk/
Universität Hamburg-Harburg - http://www.tu-harburg.de/
University of New South Wales - http://www.civeng.unsw.edu.au/staff/ian_turner/
(see also http://www.civeng.unsw.edu.au/news/newsdetail/index.html?no_cache=1&tx_ttnews%5Btt_news%5D=211&tx_ttnews%5BbackPid%5D=264&cHash=7a23bec385)
Objectives

BARDEX will examine GB overtopping and over-washing on the proto-type scale and investigate the role of the back-barrier water table and associated groundwater fluxes on GB stability. The experiments will focus on measuring all relevant hydrodynamic and sediment processes from the lee side of the GB to the offshore closure depth in order to quantify:

(1) the GB response to combined wave action and tides;

(2) the GB response to storms and;

(3) post-storm GB recovery.

BARDEX will provide new data sets for testing, developing and validating numerical models of GB morphodynamics.

Details

Most previous large-scale and small-scale laboratory flume experiments have used a fixed mean water level to study the response of sandy beaches to waves. Although a few studies have attempted to examine the response of gravel beaches to waves and tides, the experiments are subject to scaling problems and the beaches used are usually emplaced on fixed impermeable ramps at the end of the test facilities and fail therefore to simulate important aspects of natural beach hydrology. Although these simplifications may be attractive from a practical standpoint, most of the world’s gravel beaches are found in meso- and macro-tidal settings, where tidal effects on beach morphodynamics cannot be ignored and where beach porosity can exert a significant influence on morphodynamic behavior.

Moreover, many gravel beaches are barrier beaches (hereafter simply called gravel barriers, GB), which front and protect low-lying areas (lagoons, estuaries and coastal plains) from coastal flooding, and are subjected to water-level changes on both their seaward and lee sides. In these cases, hydraulic gradients are an important element governing GB dynamics and may play an important role in their stability. The permeability (or hydraulic conductivity) of gravel greatly exceeds that of sand, making the former a much more suitable sediment type to experiment with. During extreme events, frequent over-washing can sometimes lead to breaching and contribute over time to large-scale roll-back. This essentially 2-D response differs significantly from sandy barrier where frequently weak coastal dune sections often provide foci of destructive wave action, making the overwash process highly three-dimensional and thus not amenable to study in a flume.

Although there have been a limited number of attempts to simulate storm conditions at prototype scales, the post-
storm recovery process acting to restore GBs has not been examined in the laboratory. It is known that over-washing plays an important role in the reestablishment of the pre-storm beach profile, but our understanding of the processes by which this are achieved remains incomplete. Therefore, in terms of process understanding, there is a great deal that can be learned from a series of controlled large-scale experiments where a GB is subjected to simulated tidal modulation and a range of wave conditions that include storms. The data sets generated by such experiments will also enable rigorous testing of existing morphodynamic models and assist the development of more advanced models that incorporate more physical processes.