WEEG NEWSLETTER Aug-Sept 2022

The newsletter is published by the University of Southampton's Water and Environmental Engineering Group WEEG, and reports things of interest in this field worldwide, as well as ongoing undergraduate student and research work in WEEG itself.

We believe that water and energy are the most important topics worldwide for the next decades. Our work covers river and coastal engineering, water and wastewater and energy related to water.

Editorial: Deserts are by definition very dry or arid areas where it rains only rarely. This is however not the complete picture: as Albert Hammond once put it, "it never rains in California.., it pours.."; and these sudden downpours can cause ***flash floods***, so read on.

Hydraulic Engineering International: *Desert flash floods*

Common knowledge says there is no water in a desert, but the reality is somewhat different. In many cases when we look at images of deserts, we can identify dry stream beds: see Fig. 1. These are not just the remainders of a previous period, when the land was covered with plants and had regular rainfall (…more on this in a later Newsletter); they are caused by episodic events known as 'flash floods'.

Fig. 1: Dry river valley or 'Wadi' (Negev Desert)

Flash floods are sudden large-volume flows of water that can be caused by a number of events. In some cases they are initiated by sudden failures or collapses in the mountains, displacing or releasing water from natural or engineered dams. In desert areas as elsewhere, violent thunderstorms can occur, depositing tens of millimetres of rain in a short period.

Fig. 2: Death Valley National Park, California

In August 2022, heavy rainfall caused a flash flood in Death Valley California, one of the driest places in the world, Fig. 2. Rainfall of 38 mm occurred within a few hours. This was taken as a 1-in-10-year event, Fig. 3.

Fig. 3: Death Valley, flash flood 22.08.2022

Since the soil cannot absorb this large volume of water, the flow rushes into the valleys - in the Arabian Desert they are termed wadis, in Spain arroyos, in the US canyons. In these valleys the water creates sudden floods which start very rapidly, minutes to hours after the causative event – a rainstorm for example - and can last from several hours to days. Flood wave heights can reach 9 m or more, and velocities up to 2.7 m/s have been recorded.

For people hiking in the desert flash floods can be very dangerous, because they occur so suddenly in a seemingly totally dry environment, and because the flow velocities can be very high: easily enough to carry away people and vehicles. In the US, flash floods cause more fatalities every year than tornadoes, lightning strikes or hurricanes.

Flash floods can carry large volumes of debris (Fig. 4) and even rocks. This clip of a debris flow in 2018 shows the power of such events: https://www.youtube.com/watch?v=ORJtxkuD62E. They may cause severe erosion, taking sediment and plants with them and re-shaping the valleys; and can also damage roads, bridges and other infrastructure.

Fig. 4: Arriving flash flood with wood debris, Utah

Flash floods can occur at any time and with variable intensity: even very arid areas may experience flash flooding around once a year. Most of the literature deals with the statistics and prediction of such events, and with routing of flows through settlements to protect lives and prevent damage. Fig. 5 shows the stormwater canals in Los Angeles: they are big enough to hold car races within them, and of course have featured in films like 'Terminator'.

Fig. 5: Car race in LA stormwater drainage canal

This of course leads to a the big question. In arid areas, water is scarce. Then periodically a huge volume of water arrives, eroding the land and destroying things: and the only thing we do is to make it easier for the water to flow into drainage channels and out to sea. Would it not be wise to capture and store the water?

More on that topic in the next Newsletter…

New hydraulic engineering facility: *multi-role flume*

Our Group has been working on the design of a new multi-role flume facility to replace our existing 1.4 m wide and 25 m long tilting flume at Chilworth.

In the new flume, we want to model flows and sediment transport in river and tidal environments (i.e. with positive and negative bed slopes); hydraulic structures and in particular renewable energy systems; the interaction of aquatic animals and plants with an engineered environment which require a controlled water quality and temperature; and wave – current interaction problems.

For the latter we developed a revolutionary wave generation and absorption system with minimal interference with the current. This will allow us to generate and absorb waves within a current to create a realistic interaction of both.

The new facility has a length of 28 m, a width of 1.8 m, a depth of 0.6 m and a maximum flow volume of 2 m^3/s.

WEEG has just received news that EPSRC will provide £3.3M to fund this facility, so our design will now become reality. For more information contact Dr Gustavo DeAlmeida, g.dealmeida@soton.ac.uk

PhD research: *Wastewater systems*

A newly-submitted thesis by Thitirat Ditkaew looks at optimising microbial electrochemical systems for CO_2 conversion to alternative energy, e.g. storable biomethane. The work focuses on the cathode design, and also evaluates the long-term stability of organic contaminant removal from a synthetic swine wastewater, using abiotic and biotic anodes.

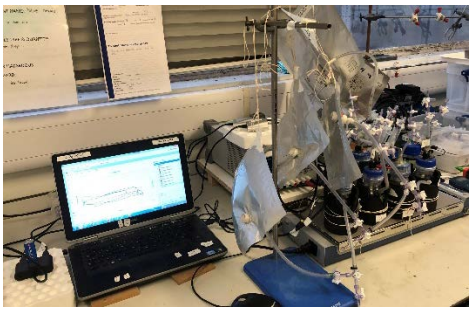

Fig. 6: Small-scale MES for process evaluation

Meanwhile 3 researchers attended the very successful EBNet ECR event. Jack Morton and Tararag Pincam gave platform presentations on 'Quantifying interactions between pH, VFA rejection and initial feed concentrations for resource recovery from wastewater' and on 'Simultaneous phosphorus release and VFA production from sewage sludge'. Matt Irwin's poster was on 'Targeted biocontrol of glycogen-accumulating organisms in enhanced biological phosphorus removal systems'.

Jobs in water engineering:

This section gives you ideas of the type of work you can do when working in industry.

Advert: Tying in with our editorial, many posts are currently available in flood management:

Engineer - Flood risk management

www.icerecruit.com/jobs/environmental-engineering-jobs

Water and Environmental Engineering at Southampton University:

WEEG: our modules offer the chance to deepen your knowledge in water-related areas, and give better preparation for environmental engineering projects.

Contact: Dr Sonia Heaven, s.heaven@soton.ac.uk, Bldg. 178, Room 5021

Further information:

We have two Facebook pages, which provide a logbook of our laboratory activities:

www.facebook.com/Hydraulicslaboratory/

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