Fine-scale rainfall measurement and prediction to enhance urban pluvial flood control

Investing in Opportunities

This project has received European Regional Development Funding through INTERREG IV B.

INTERREG IVB

Pilot location: Torquay Town Centre, South Devon Borough of Torbay (UK)

Monitoring

Rainfall

Rain gauges:

- 4 tipping bucket rain gauges with 0.2 mm resolution, operated by Torbay Council and the Environment Agency.

Radars:

- The area is within the coverage of the Cobbacombe C-band radar operated by the UK Met Office:

Specifications	Cobbacombe Radar
Radar type	C-band
Polarisation	Single-polarisation*
Doppler (yes/no)	No*
Antenna	Parabolic 3.6 m diameter, 43 dB gain
Beamwidth	1°
Frequency range	5.4 – 5.8 GHz
Range resolution	1 km up to 50 km range / 2 km up to 75 km range
Temporal resolution	5 min scan repeat cycle**
Elevations (°)	0.0, 0.5, 1.0, 2.0, 4.0

*Currently being upgraded to dual-polarisation and Doppler
**Within the RainGain project the potential benefits of reducing the repetition cycle to 2-3 min will be tested

Water depth and flow sensors

- 3 water depth sensors located in 3 attenuation tanks
- 1 new pressure sensor for water depth measurement in sewers will be installed in 2013
- 1 new Doppler sensor for measurement of flow (depth + velocity) in sewers will be installed in 2013.

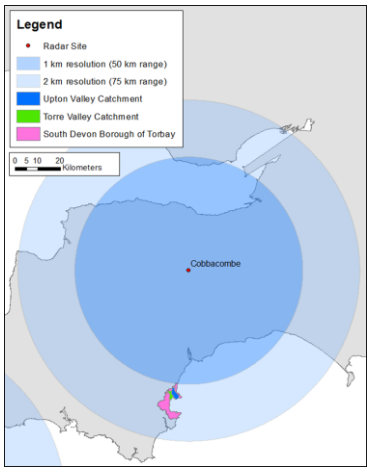

Figure 5: C-band radar coverage

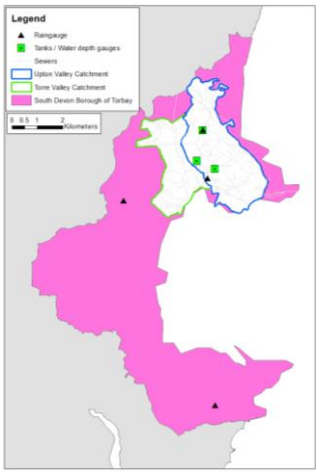

Figure 6: Sensor location

Spatial datasets

- **Digital Terrain Model (DTM):** 1 m horizontal resolution LiDAR-generated DTM with stated vertical accuracy of ±0.15 m and horizontal accuracy smaller than the pixel size (see *Figure 7*).
- **Location of buildings and critical infrastructure:** Bing maps were used as background to identify the location of buildings, roads, schools, hospitals, amongst other critical infrastructures (see *Figure 2*).
- **Topology of sewer system:** information of the sewer system was provided by Torbay Council. It comprises a total of 1288 nodes and 1235 pipes covering a total length of 93 km (see *Figure 7*)

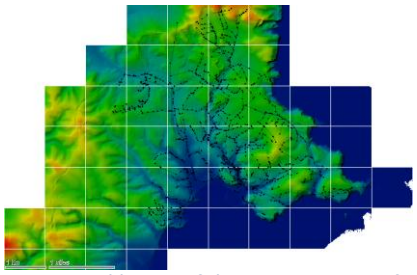

Figure 7: DTM and layout of the sewer system of Torquay

Urban pluvial flood models

An **InfoWorks CS model** of the study area was provided by Torbay Council. This model comprises a **1D model of the sewer system**, covering the entire study area, **coupled with a 2D model of the surface** which covers only the most critical area (i.e. along Union and Fleet Streets). The model also includes the ancillary structures present in the sewer system, such as 3 attenuation tanks and a number of pumping stations.

In this model **rainfall is applied through subcatchments** (i.e. semi-distributed model) and therefore flood water only reaches the surface once the sewer system surcharges. Each subcatchment is split into different surface types and **runoff is estimated using the Wallingford model**. The flow in the sewers and on the surface is simulated based on the full shallow-water equations (i.e. it is a **fully hydrodynamic model**). The interactions between the sewer system and the surface takes place at manholes and gullies.

This model was initially calibrated in 1994 and was further verified in 2008. During the **RainGain project the model will be updated and improved**, based on new monitoring data and on improved modelling and calibration techniques. Moreover, we will explore the possibility of **optimising the operation of the sewer system through real time control strategies supported by improved urban pluvial flood forecasting**.

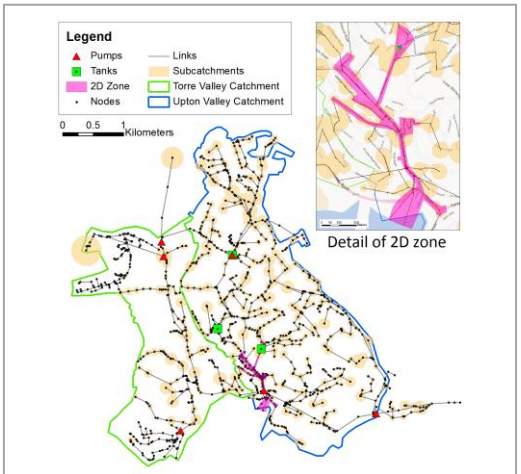

Figure 8: Urban pluvial flood model of Torquay

Project website: http://www.raingain.eu/en/raingain