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: Morée Sausset Catchment, Paris area (France)

Monitoring

Rainfall

Rain gauges:

- 26 tipping bucket rain gauges with a 0.2 mm resolution operate in real time over the Seine-Saint-Denis County, 5 are located within the studied catchment (Fig. 7). Two rain gauges are collocated at each location to ensure a backup.

Radars:

- C-band radar: the operational C-band weather radar network of Météo-France covers the whole catchment. The closest radar which is dual pol. and Doppler, is located in Trappes at approximately 45 km South-West. The resolution is 1 km in space and 5 min in time.
- X-band radar: dual pol. and Doppler radar will be installed in front of Ecole des Ponts ParisTech, located at approximately 15 km South East from the catchment. The resolution will be of approximately 100 m in space and 2.5 min in time.

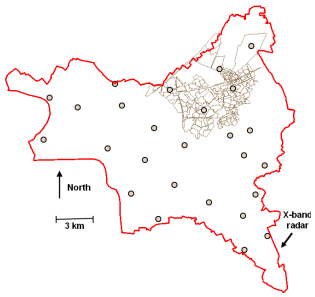

Figure 7: Position of the rain gauges and of the X-Band radar

Figure 8: Rain gauges located near the Gérad Philippe basin

Water depth sensors

Morée-Sausset catchment

At least one water level and velocity sensor is installed near each storage basin

Kodak catchment

Water level and velocity sensor at point 171 (see Fig. 2)

Figure 9: Sensor of the Kodak Catchment

Spatial datasets

The spatial data that is used for the Kodak catchment is provided by the French National Institute of Geography:
- Land use cover: the spatial resolution is of 50 cm x 50 cm
- Digital elevation model: the current spatial resolution is of 25 m x 25 m with a vertical precision of 1 m. An improved DEM with a spatial resolution of 1 m x 1 m with a vertical precision of 10 cm is currently being developed and will soon be available for this area.

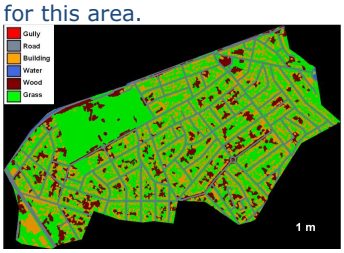

Figure 11: Illustration of the land use cover for the Kodak catchment with a spatial resolution of 1m

Drainage system

For the whole Morée-Sausset catchment, only the main sewer network (i.e. operated by the Seine-Saint-Denis County) is modelled. It consists of 69 km of pipes (see Fig. 1) with an average slope of 0.009 m/m.
For the Kodak catchment, the whole sewer network is considered, leading to 560 conduits (of total length 18.4 km) that are collecting water from 510 manholes.

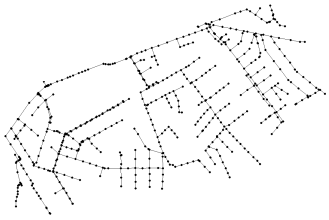

Figure 12: Modelled sewer network for the Kodak catchment

Urban pluvial flood models

Two types of urban hydrological/hydraulic models are used:

- Canoe, a semi-distributed 1D model. In Canoe the hydrologic response of each sub-catchment (see Fig. 1) is modelled with the help of a lumped model (a linear reservoir) and the flow in the pipes is modelled with the help of a numerical solution of Saint-Venant equations. The Direction Eau et Assainissement of Seine-Saint-Denis (the local authority in charge of urban drainage) calibrated the model on the Morée-Sausset catchment and runs it operationally.
- Multi-Hydro, a fully distributed physically based model (2D/1D). It consists of an interacting core between open source software packages, each of them representing a portion of the water cycle in urban environment. It is currently being developed at Ecole des Ponts ParisTech. The 2D surface flow module uses square pixels and relies on an approximation of the 2D Saint-Venant equations. The flow in pipes is modelled in a similar way as in Canoe. Multi-Hydro is implemented on the Kodak catchment.