COUPLING REAL-TIME URBAN FLOOD FORECASTING WITH POLLUTION ASSESSMENT

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Content

- Objectives of the new system
- Methodology and model description
- Results of the analysis
- Online real-time monitoring and forecasting system
Objectives of the new system

- **Morges - Switzerland**: fast growing urban and peri-urban region into a high quality environment (35’000 EH)
- **Main objective**: adapt the existing wastewater and stormwater drainage system

- Increasing the **knowledge** and understanding of the existing sewer system
- Identify **local hotspots**
- Estimate the capacity **reserve** of the system
- Define a maintenance and **adaptation strategy**
Methodology
Methodology

**MODELLING**

- System diagnosis
- Definition of adaptation strategy
- Limited uncertainties

**FIELD OBSERVATIONS**

- Validation of the adaptation strategy
- Optimization of the measures
- Keep knowledge growing

Update of the model into

**REAL-TIME MONITORING AND FORECASTING**
**MODELLING CONCEPT**

**Data**
- Weather gauging stations
  - Precipitation
  - Temperature

**STORMWATER**
- Rainfall-runoff model
  - Snow-melt model
  - Impervious coefficient

**Concept**
- Permeable area
  - Infiltration model (GR3)
  - Runoff from permeable areas
  - Runoff model (SWMM)

**Impervious area**
- Runoff model (SWMM)
- Runoff from impervious areas

**Parameters**
- Rate of system separation (EC)
- Rate of groundwater infiltration water (ECP)

**Natural drainage system**

**WASTEWATER**
- Waste water generation (EU)
  - EU/hab/day

**Runoff-runoff model**

**Inhabitants equivalent (EH)**
- Generation of unit discharge per EH
- Application of hourly and daily cycles

**EU**
- Treatment plant
MODELLING TOOL - RS2012 City

Natural drainage system

Urban region

Stormwater flowing into stormwater and natural drainage system

Wastewater flowing into stormwater and natural drainage system

Application

Tools

Projects

Engine

New project

Natural Basin A

Urban Basin I

Urban Basin X (100% Combined)

Chamber EU

Chamber 2 EU

Chamber 3 EU

Pipe 1 EU

Pipe 2 EU

STORM OVERFLOW SO1

Chamber 4 EU

Chamber 5 EU

TREATMENT PLANT

Releases to the natural drainage network

NATURAL BASIN B

RIVER E-LA

NATURAL BASIN C

RIVER C-LAKE

RIVER B-C

LAKE
Methodology

**Modelling RS2012-City**

- **Continuous simulation**
- **Field observations**

**Input data**
- P, T, EU*

**Parameters**
- Basins + pipe network

**Model calibration**
- Continuous simulation
- Field observations

**Reference model**
- \( E_H \)
- \( E_U \)
- Separation ratio

**Current state of the system**
- Treatment plant
- Networks
- Pumping stations and stormwater spillways

**Scenarios of evolution**
- Increase population
- Refactoring / extension networks

**Control data**
- Q, pollution indices

**Analysis / diagnose**
- Capacity reserve of the pipe networks
- Capacity of treatment plants
- Environmental impact
- Local failures of the network
- Global hydraulic drainage efficiency
- Global environmental efficiency

**DATA**

**SIMULATION MODEL**

**SCENARIOS**

**INDICATORS**
Results
Global calibration – Local validation

Clarmont: 139 inhab.
Yens: 1'050 inhab.
Bussy: 314 inhab.
Vaux: 135 inhab.
Vufflens: 806 inhab.
Lonay: 2'469 inhab.
Tolochenaz: 1'720 inhab.
Morges: 4'778 inhab.
Bussy: 314 inhab.
Clarmont: 139 inhab.
Vaux: 135 inhab.
Vufflens: 806 inhab.
Lonay: 2'469 inhab.
Tolochenaz: 1'720 inhab.
Morges: 4'778 inhab.

Parc: 12'020
(36.3% de STEP)

# inhabitants

- STAR
- STAP 2008-2012
- Mesures 2006
Results

Global calibration – Treatment plant

Discharge in m$^3$/s

Local validation – field campaigns

Ecublens  Lonay  City
Groundwater infiltration

Average at treatment plant STEP : 30.4%
**Results**

Filling rate of pipe network (rainfall event)

Map showing filling rate during rainfall with various color codes for different rate ranges.
Spilled wastewater

31’000 m$^3$/y
1% of total inflow at treatment plant
Groundwater infiltration

Average at treatment plant STEP : 30.4%
Online platform
Example of situation

Yellow color indicates the spilling of waste water at the storm overflow.

Yellow color indicates that the flow will exceed the hydraulic capacity at the pipe chamber. Risk of inundation.

Red and large drop indicates that alert level 3 is reached at the treatment plant.
Example of situation

- Measurement
- Forecast (72 hours)
- Threshold value
Online platform

- Predict flood events in the **wastewater** as well as in the **stormwater** drainage systems
- Predict **inflows at the treatment plant**: optimization of energy consumption and maximization of treatment efficiency

✓ **Efficiency control** of the adaptation measures
✓ **Regular increase of the knowledge** of the system by a daily analysis of the model – reality of the basin
✓ **Planning of field campaigns and construction works** on the infrastructure
Thank you for your attention