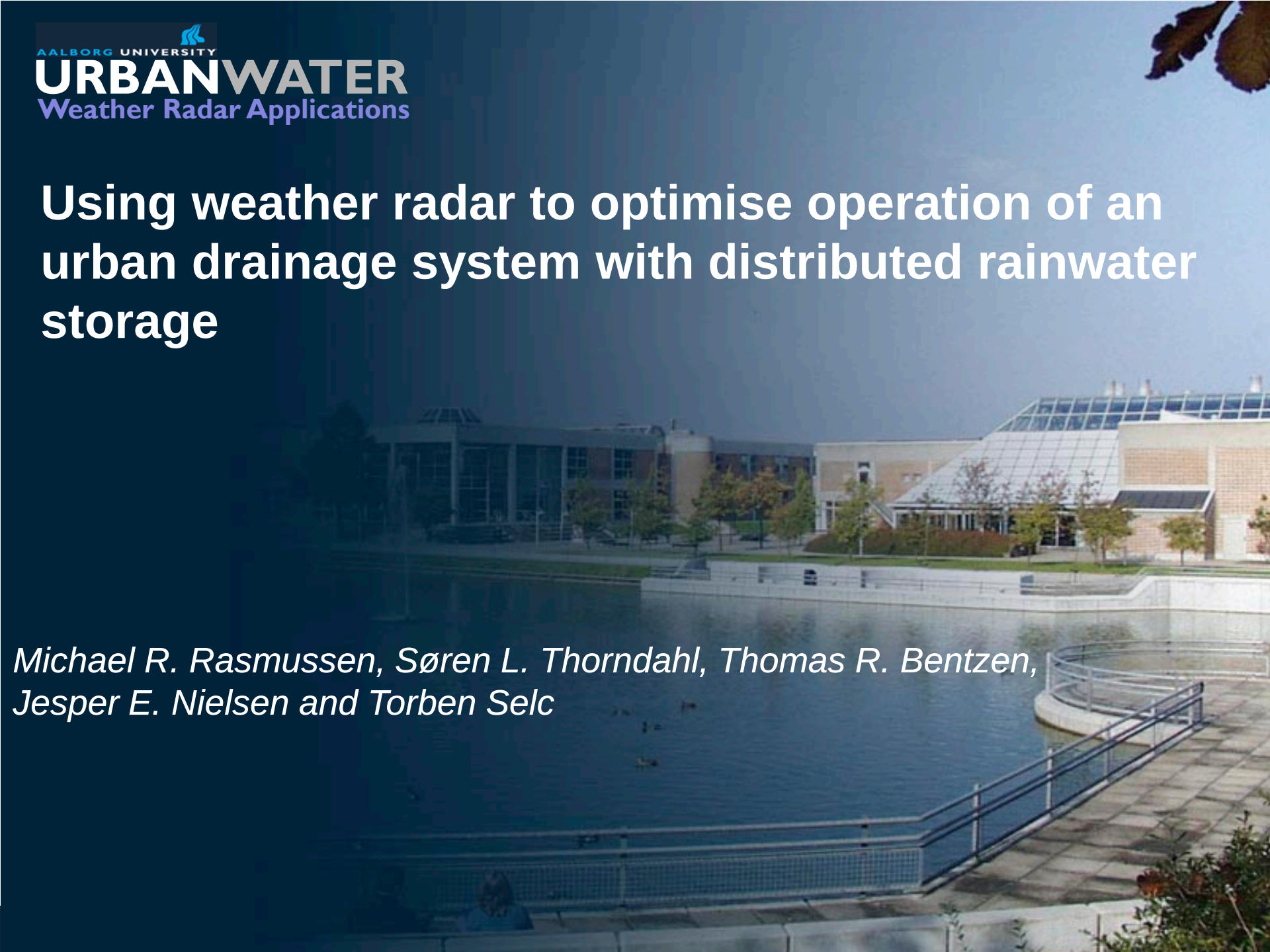
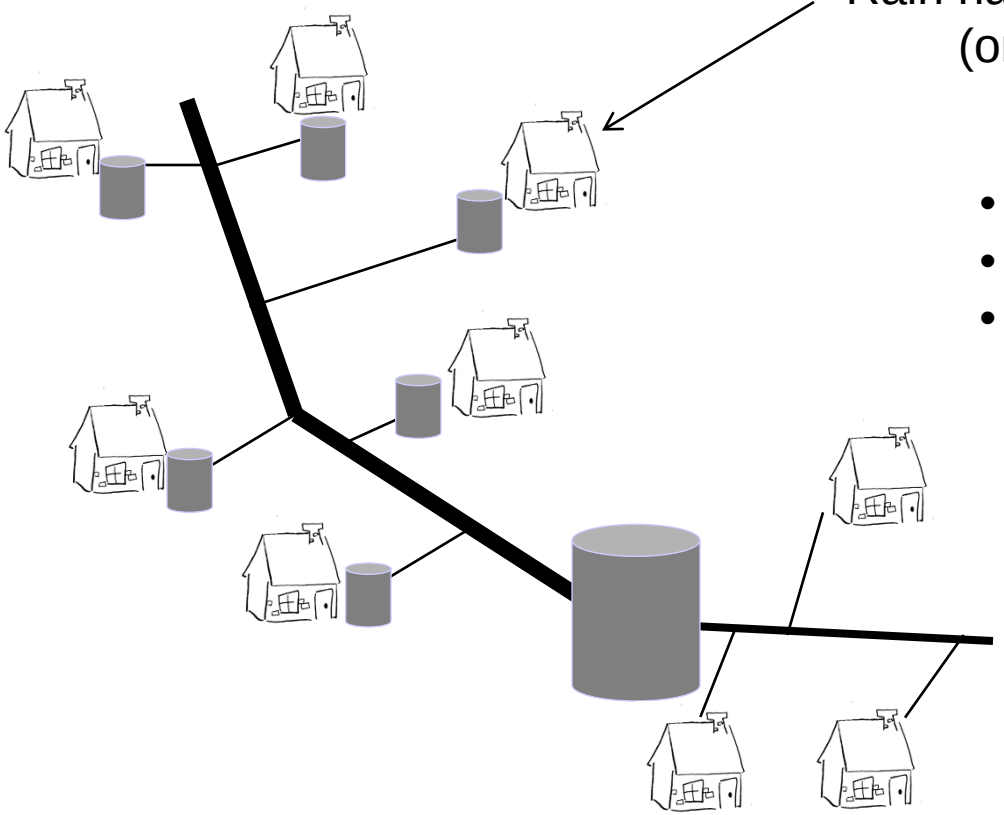
AALBORG UNIVERSITY
URBANWATER
Weather Radar Applications

Using weather radar to optimise operation of an urban drainage system with distributed rainwater storage



Michael R. Rasmussen, Søren L. Thorndahl, Thomas R. Bentzen, Jesper E. Nielsen and Torben Selc

Distributed storage vs centralised storage



Rain harvest/Distributed storage
(only runoff from roof)

- Water for household usage
- Potential for RTC
- Private commitment to sustainable water management

The idea

Passive system

Runoff from roof

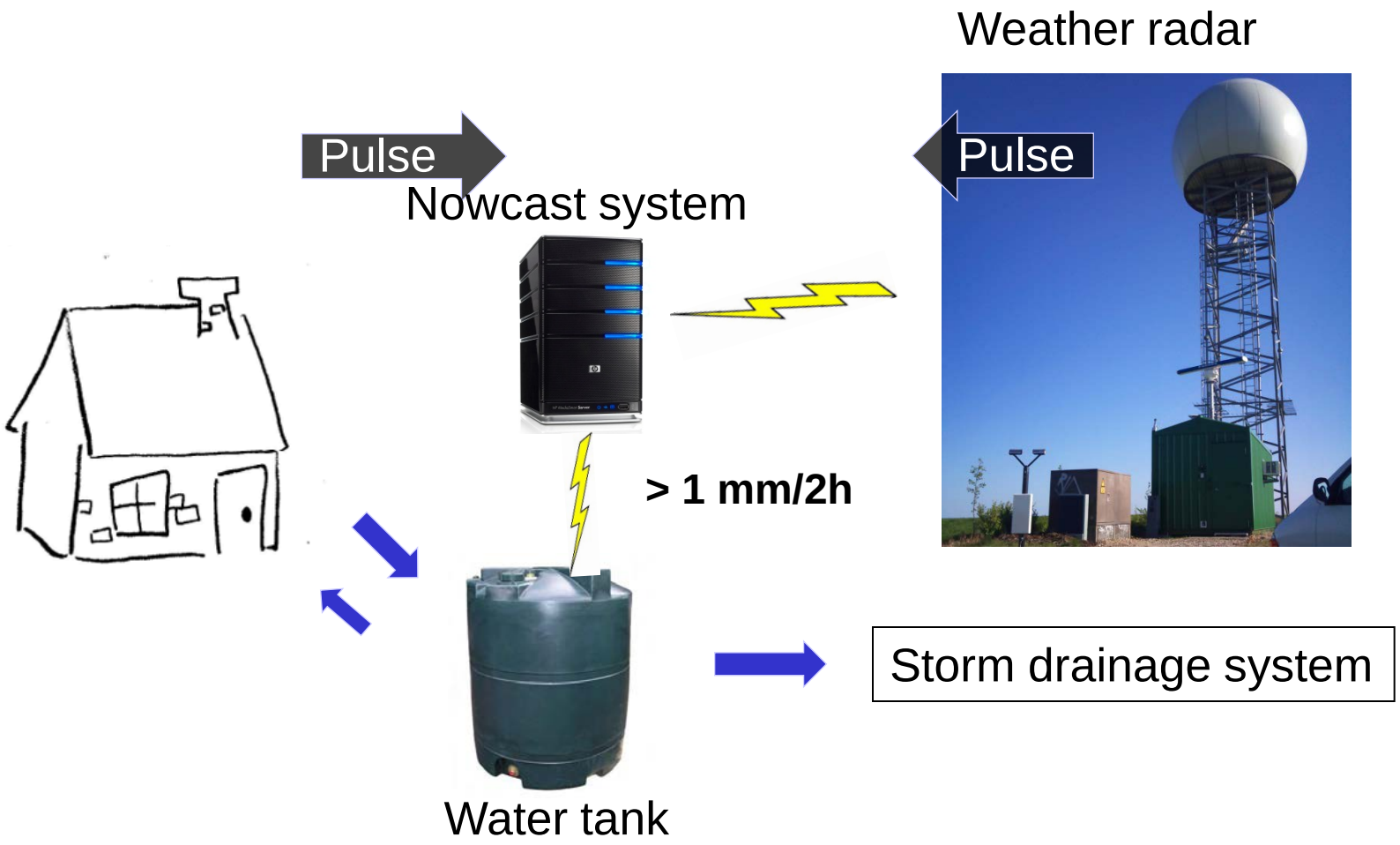
Household use (Washing)

Water tank

Storm drainage system

The idea

Active system

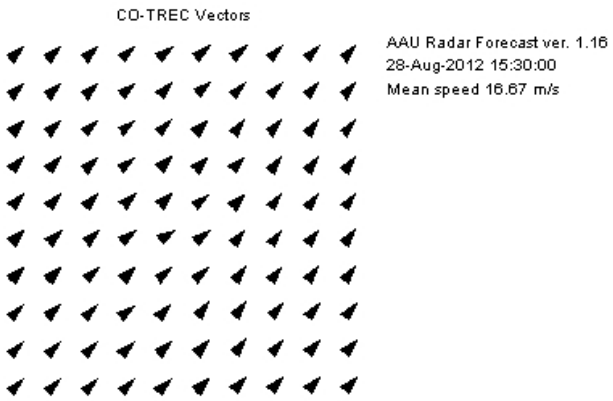


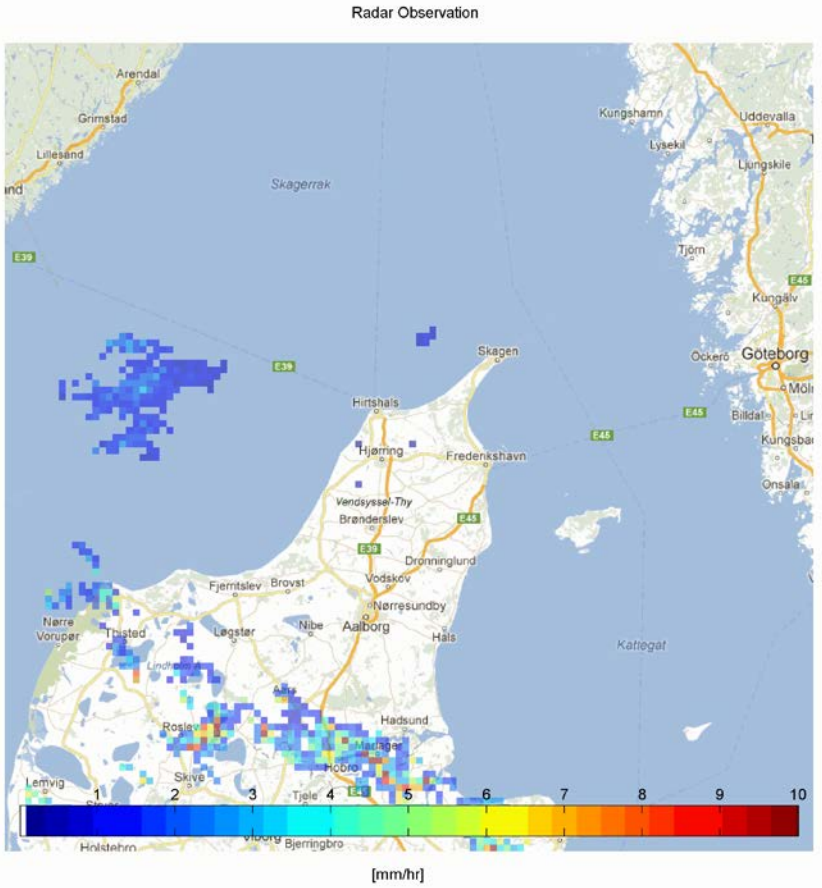
We are using ***simulations*** to test concept,

- but all needed technologies and infrastructures are developed and ready for real test

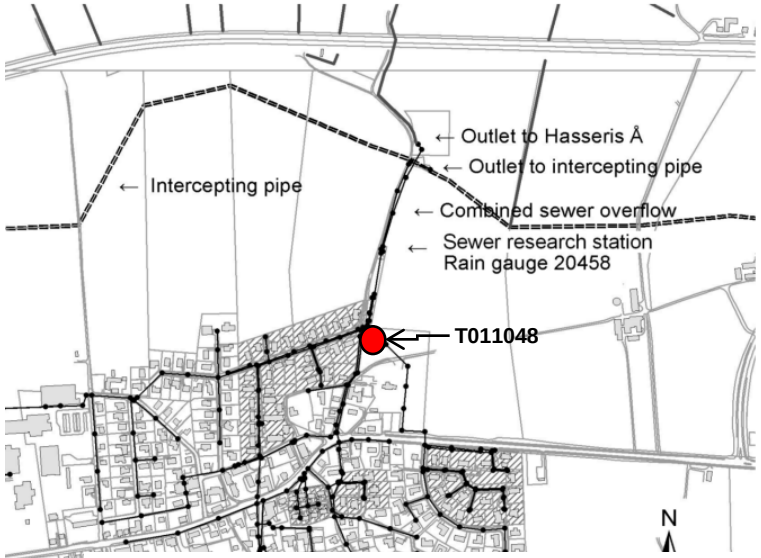
Nowcast model: AAU nowcast

- EEC/Ericson C-band Doppler radar (DMI)
- 2 x 2 km spatial resolution
- 10 minute temporal resolution
- CO-Trec derived extrapolation model
- Runs in real time (10 minute update)
- Continuous mean field bias corrected
- 2 hours nowcast lead time
- One year of data used (2011)

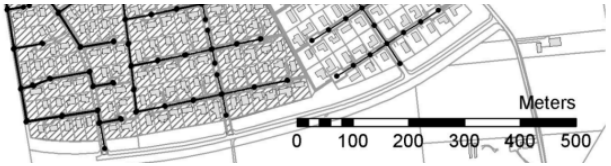




Case: Frejlev catchment, Denmark



Total area: 87 ha
Reduced area: 30 ha
Approx 500 individual houses
5 mm storage



Distributed rainwater storage tank

Mathematical implemention into MOUSE model

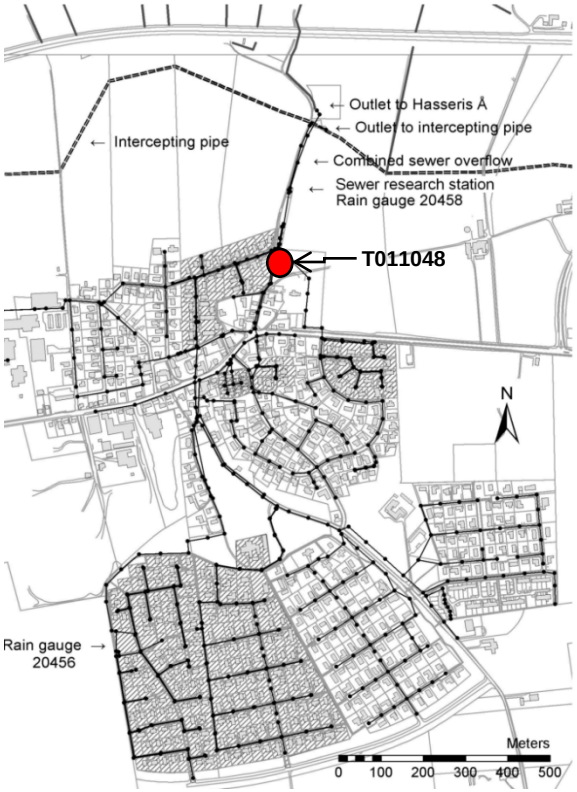
Local storage model

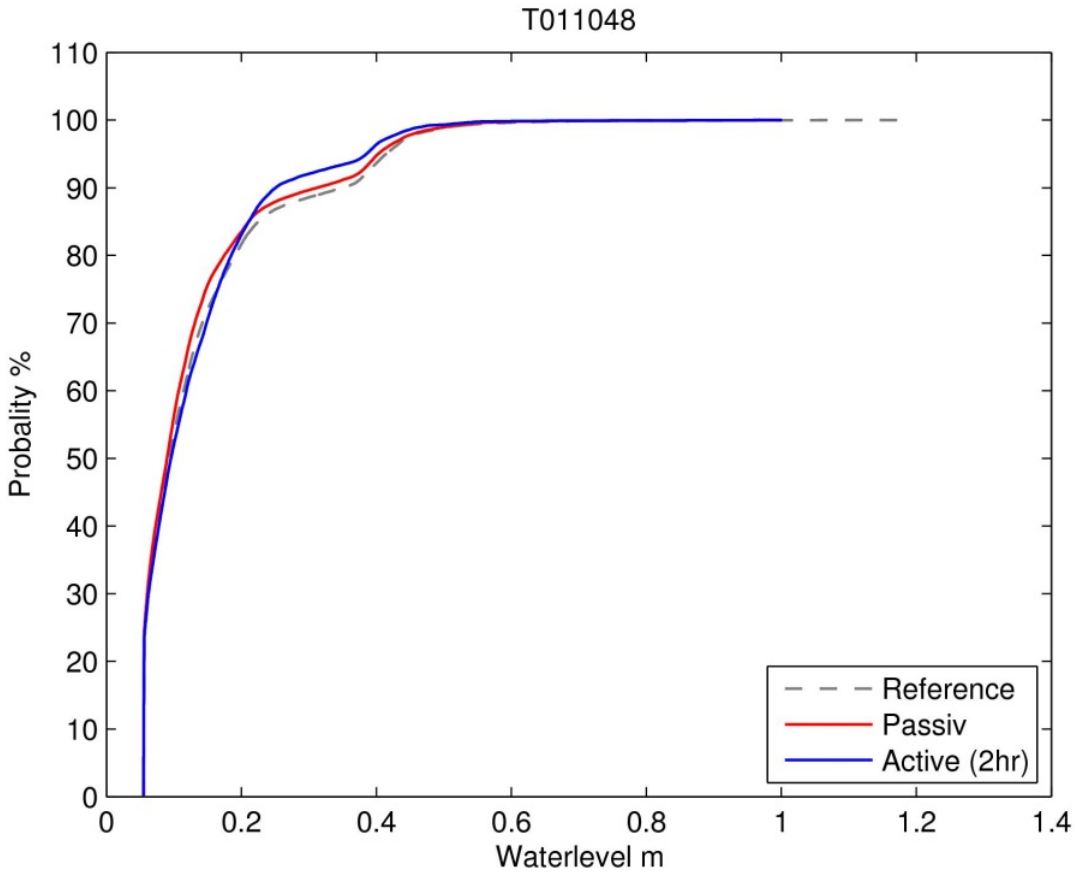
$$\frac{dS}{dt} = i_{effective} - \frac{Q_{consumption}}{F_{roof}}$$

Precipitation modification model

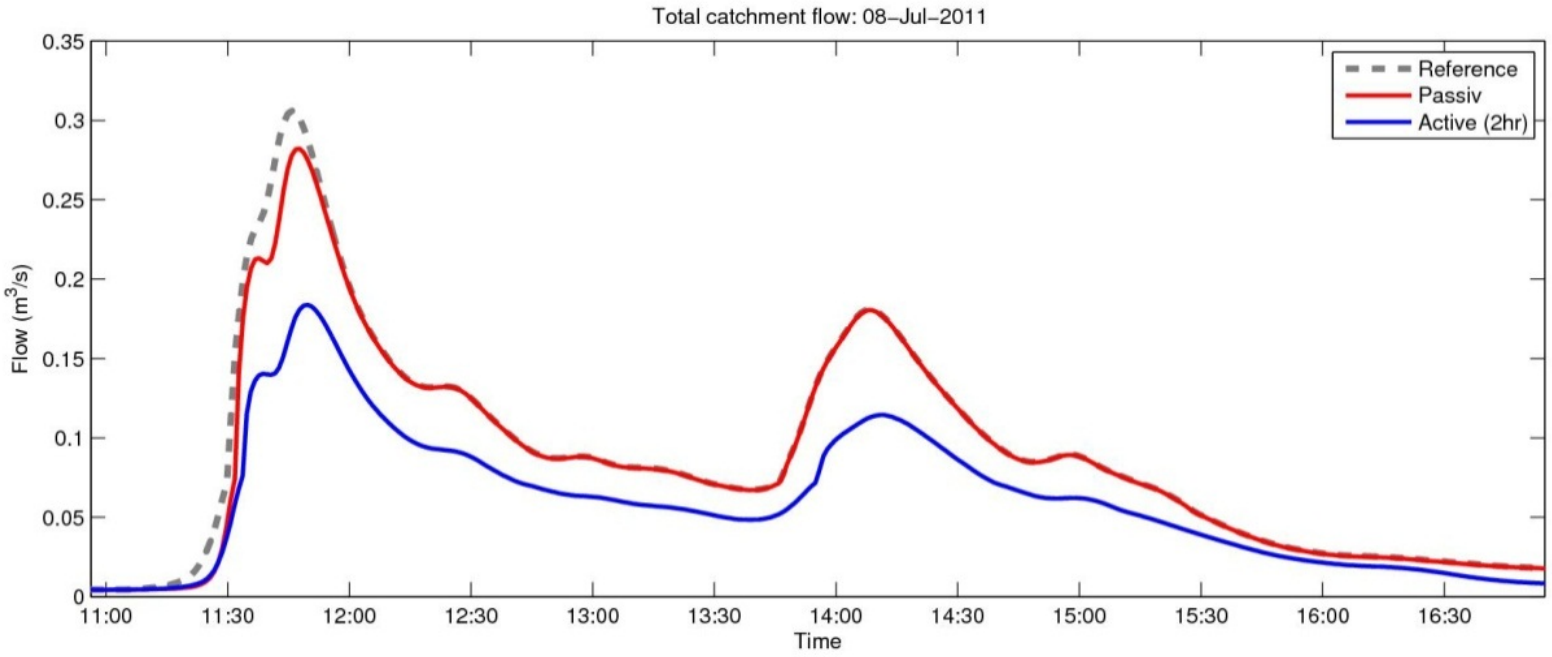
$$i_{effective} = \begin{cases} \frac{\left((F_{Total} \cdot \varphi) - F_{Roof}\right)}{F_{Total} \cdot \varphi} \cdot i_{measured} & for \quad \int_0^t i_{measured}\, dt < S_{\boldsymbol{max}\ retention\ tank} \\ i_{measured} & for \quad \int_0^t i_{measured}\, dt > S_{\boldsymbol{max}\ retention\ tank} \end{cases}$$

Results: Statistics for waterlevel i manhole T011048



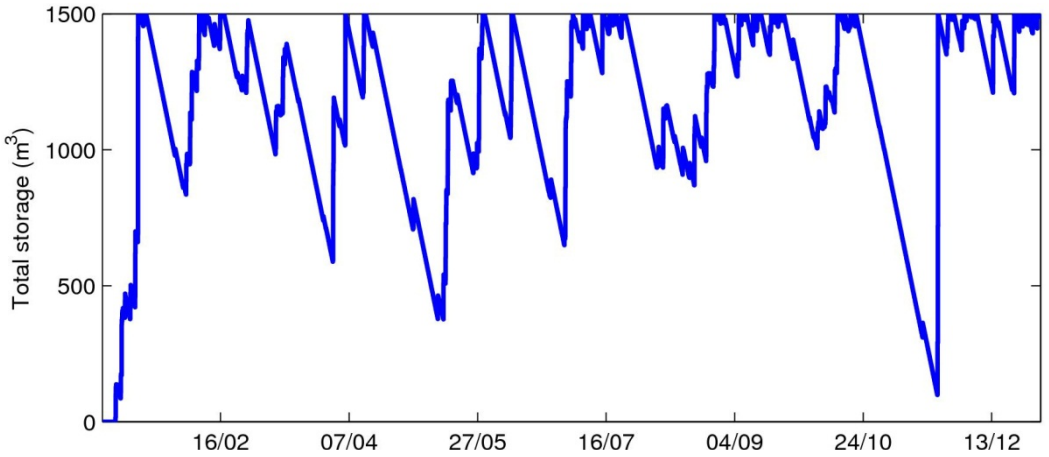


Results: Flow though research station

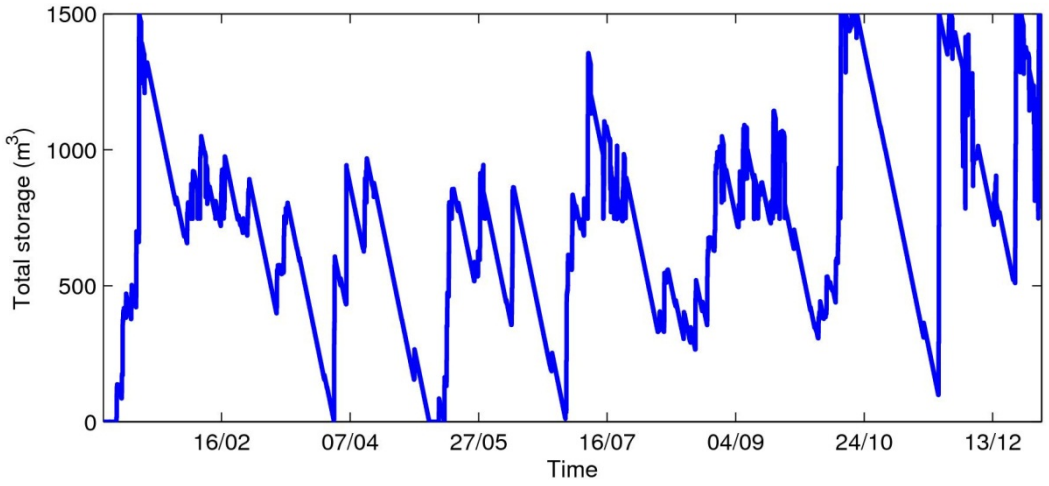


Results: Waterlevel in local storage tank (2011)

Passive:



Active:



	Reference	Passive control	Active control (2 hour)
Total storm runoff (m^3)	212.594	193.915	194.134
Total CSO (m^3)	9.377	6.920	4.885
Number of CSO	14	13	8
CSO duration (hour)	14.1	11.9	7.6

Perspectives

- Using more sophisticated control strategies could improve performance
- With NWP we could:
  - use more aggressive RTC strategy
  - increase available storage capacity
- Could be used as a sediment flushing system in dry weather situation (coordinated wave flushing)

Conclusion

- Even simple control strategies have a large impact
- Using weather radar based nowcast to control each local storage tank increases the effect of distributed storage from 25 % to 50 %
- ***Some*** of the expenses can be recouped in water savings and reduced building cost for increased flow and storage capacity

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