Linz Pilot

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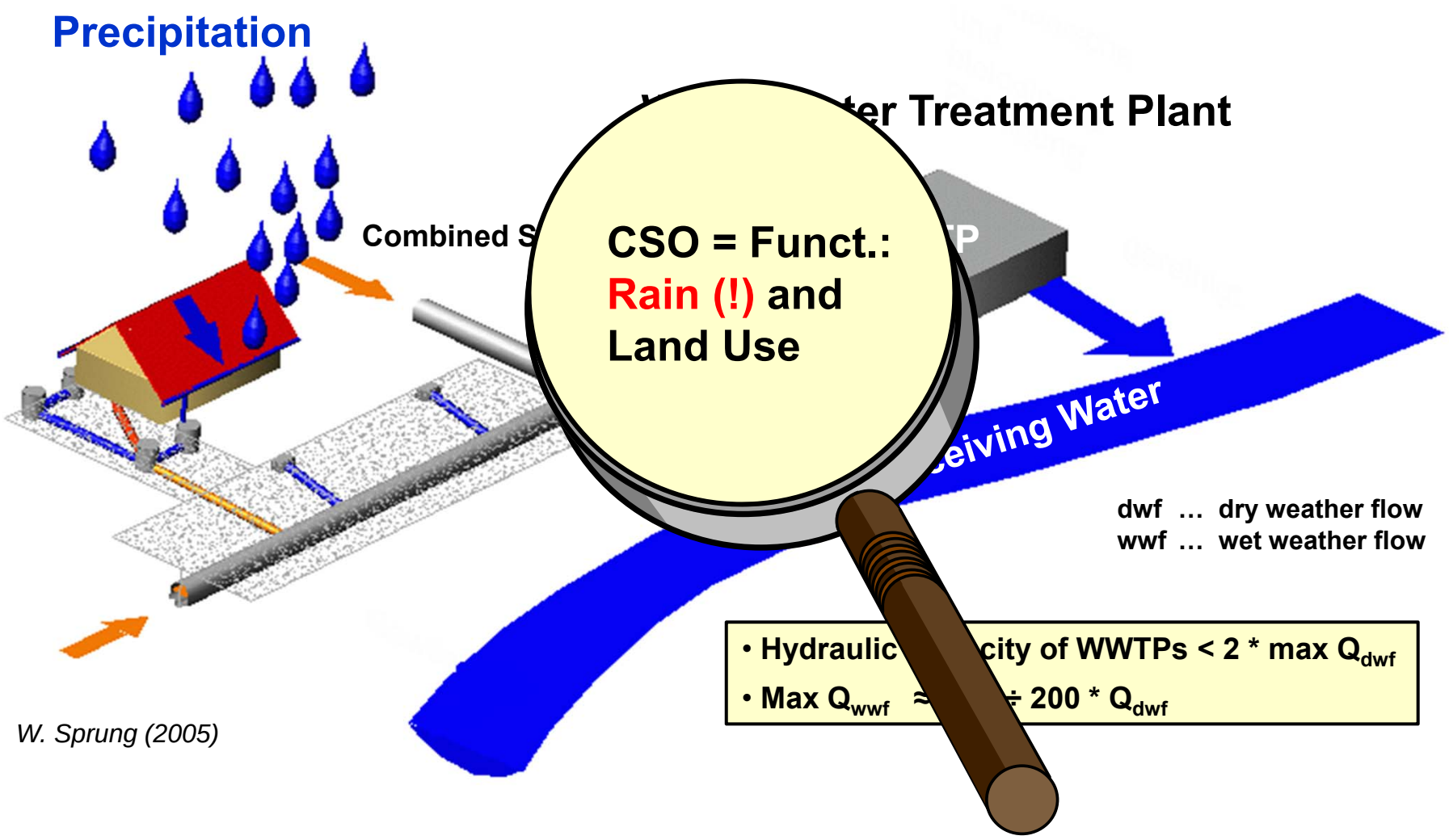
Linz AG: Martin Hochedlinger and Friedrich Hochegger

Introduction and Goals – Pilot Definition

- Effects of climate change scenarios on combined sewer overflows (CSO)
- Assessment according to an Austrian Guideline:
  Estimation of CSO efficiency rates for hydraulics and particulate pollutants

Problem Description: Combined Sewer System

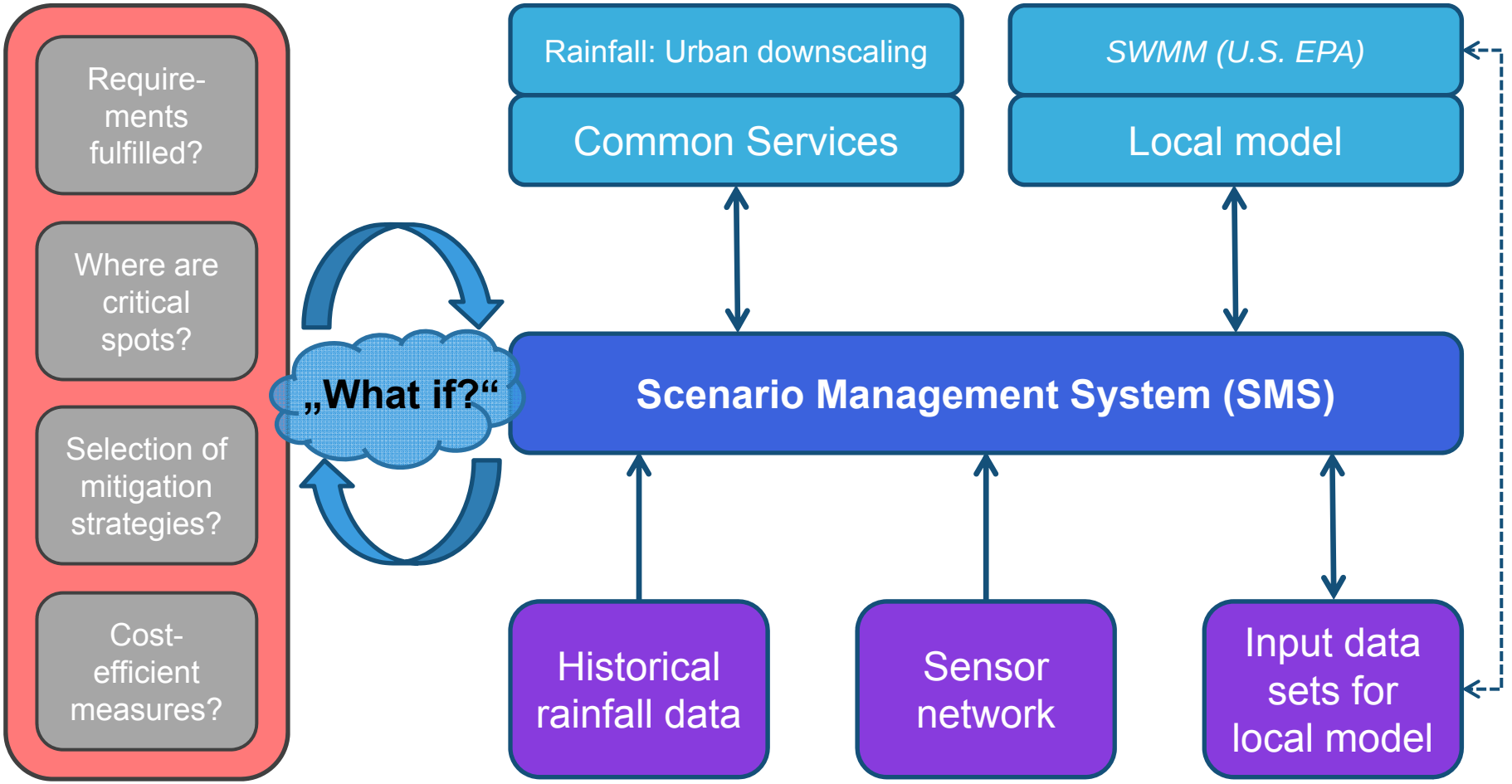


W. Sprung (2005)

Urban Wastewater Management – Prevention of water pollution

Issues ...

... and the tools to manage them.



Introduction – Linz Catchment

Linz AG

- Total area ~ 900 km²
- Wastewater treatment plant (WWTP): Downtown Linz and 39 neighbour communes
- 950 000 PE, high industrial contribution
- Receiving Waters: Danube, Traun, Enns

Introduction – Linz Catchment

- Combined & separate system
- Partly real time controlled (since 2005)
- Several CSO tanks
- Total estimated storage volume 115 000 m³
- Primary clarifiers on WWTP work as CSO tanks during combined sewer flow

Photos: Wendner

Method – Austrian Regelblatt 19 Guideline

- **CSO efficiency rate η:**
  - Percentage of stormwater runoff routed to WWTP on average
- **Required CSO efficiency rates η_{req} :**
  - For dissolved (η_d) and particulate pollutants (η_p)
  - Based on $r_{720,1}$, PE and ratio combined/separate system
- **Actual efficiency rate η_{act}:**
  - Calculated by simulation model (long term simulations)
  - Sedimentation efficiency η_{sed} for particulate pollutants

Method – Austrian Regelblatt 19 Guideline

Actual efficiency rate > Required efficiency rate

Efficiency ratio $\nu = \eta_{act} / \eta_{req}$

- η_{act} … Actual efficiency rate from simulation
- η_{req} … Required efficiency rate

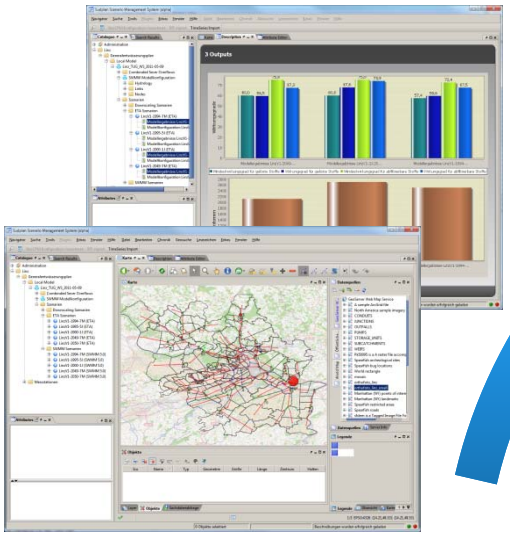
$\nu > 1{,}0$ ➔ Requirements met ✓

Method – Sewer System Model

- Aggregated model in SWMM5
- All relevant structures included
- 43 combined sewer overflows
- Estimated η_{sed} for tanks: 20%
- Global sensitivity analysis and automated model calibration

Gamerith et al. (2011)

Method – Scenario Management System (SMS)

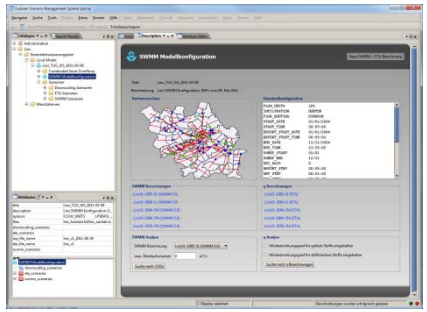


Result Visualization and Comparison

CS Rainfall Integration

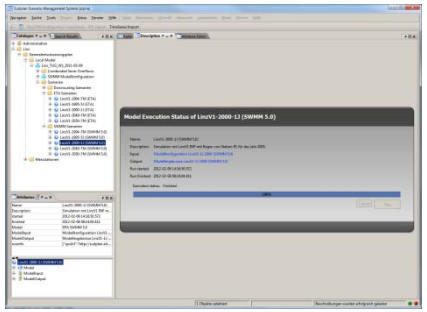
historic
CCSM3A1B
ECHAM5A1B3
ECHAM5A21
HADLEYA1B

Local Model Integration



Import Local Model Input Data Sets

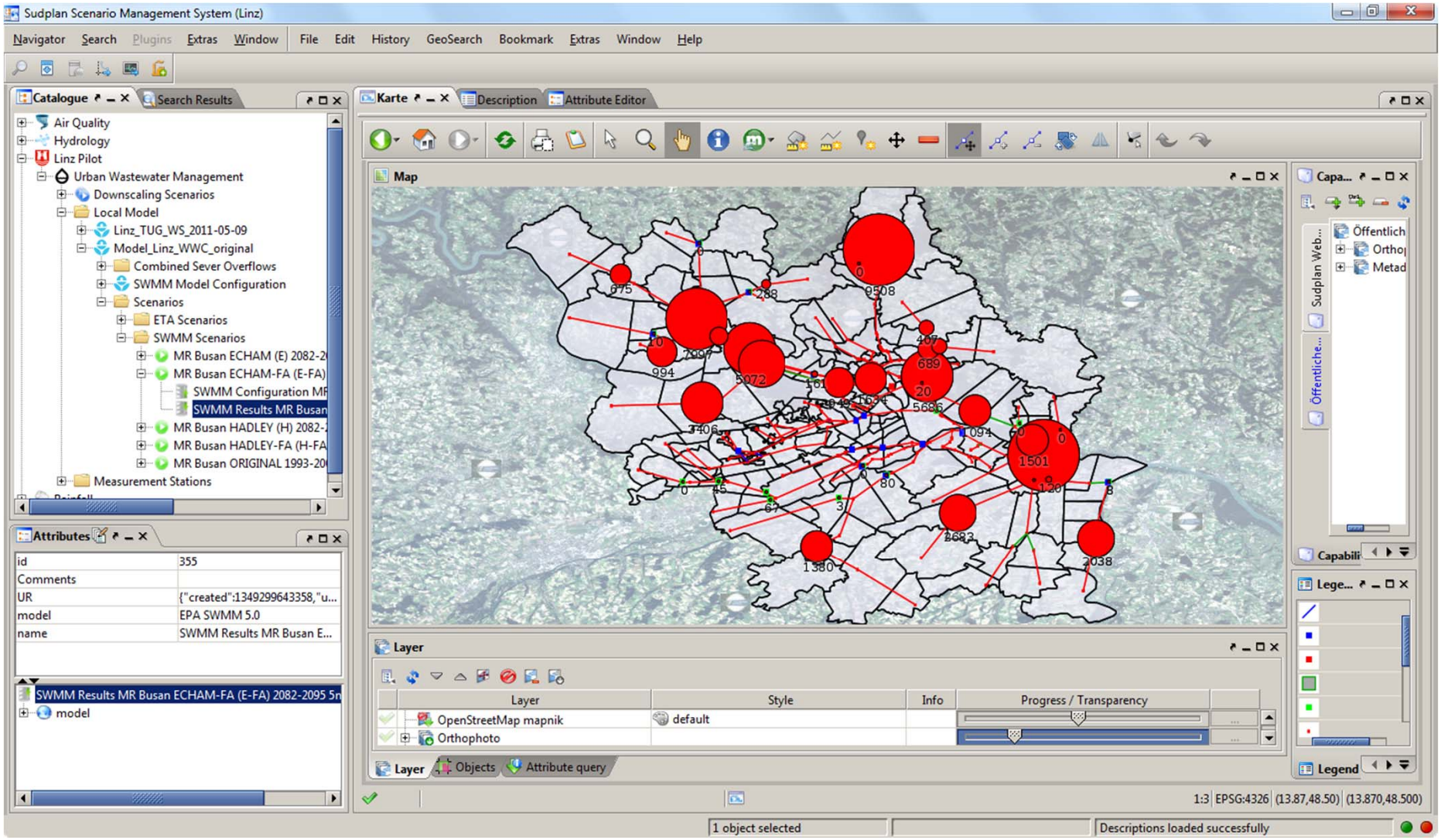
Local Model Execution



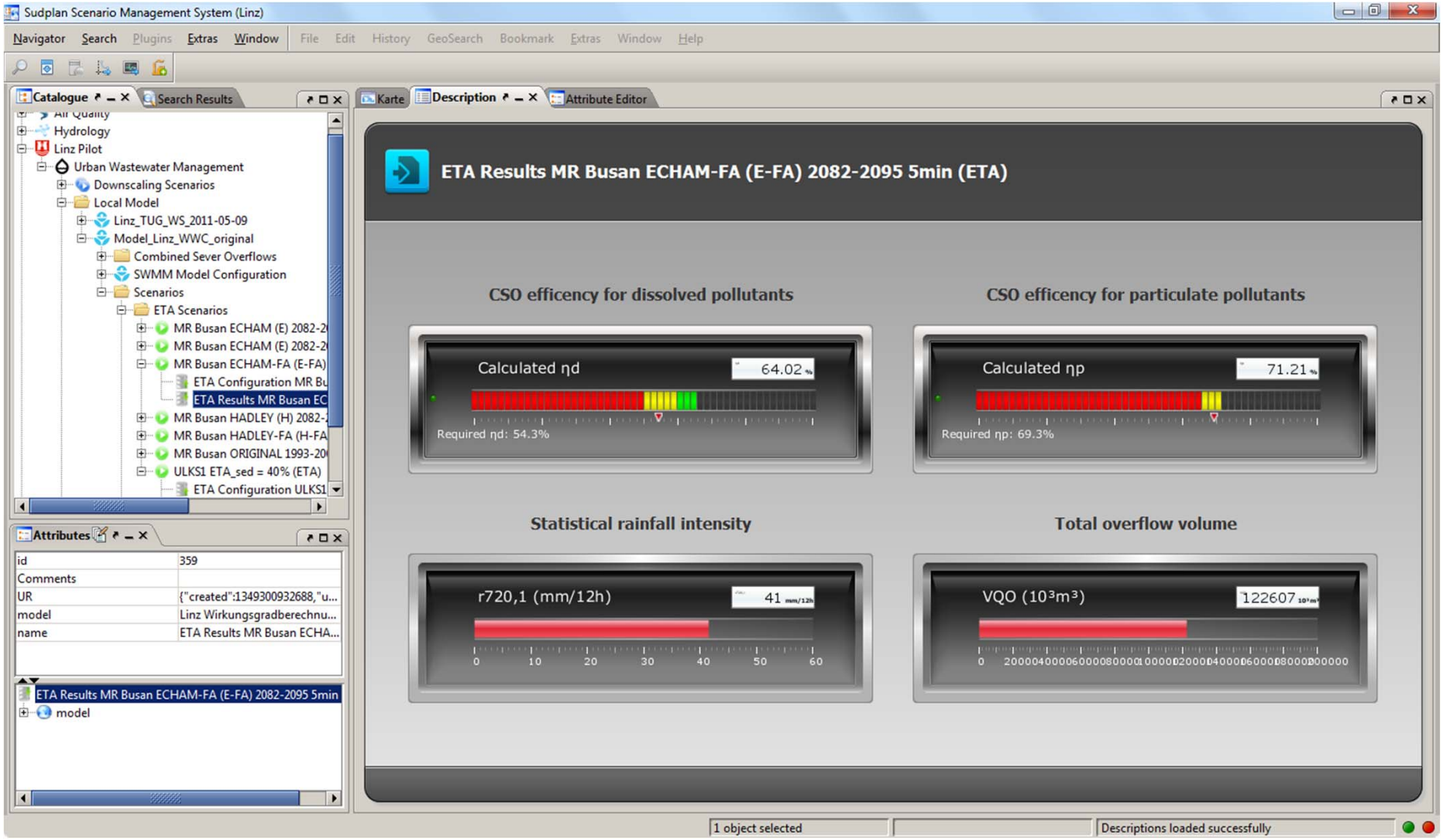
CSO Eta Calculation

SUDPLAN SMS LINZ PILOT

Results – Hotspot Detection of CSO Volumes



Results – Requirements fulfilled?

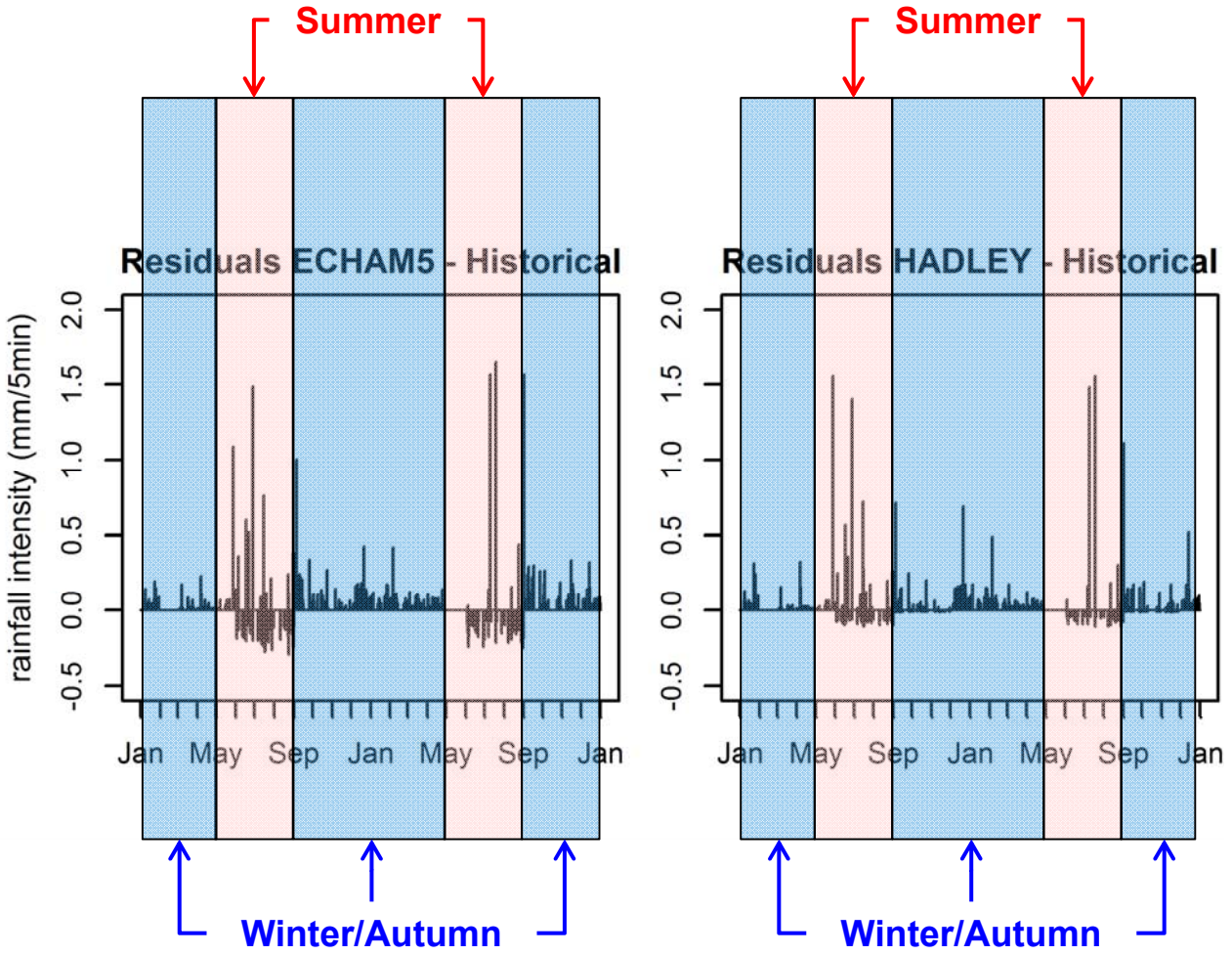


Results: Annual Means and CSO Efficiencies

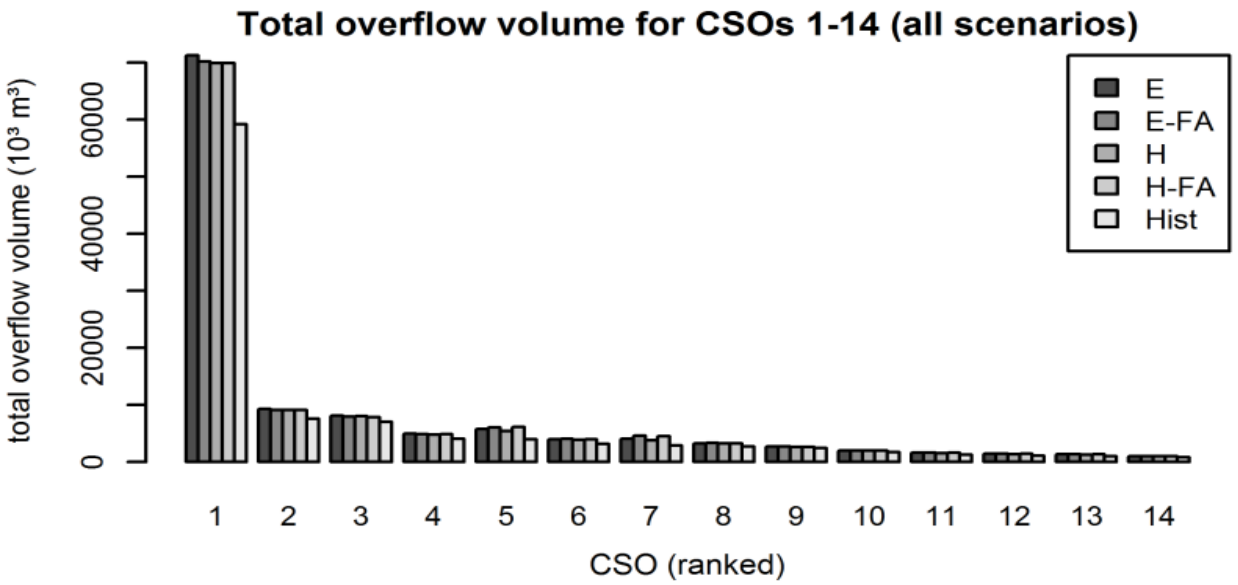
Time Series	Period	Annual Mean	$r_{720,1}$	CSO Efficiencies Rates and Ratios					
				$\eta_{d,req}$	$\eta_{d,act}$	v_d	$\eta_{p,req}$	$\eta_{p,act}$	v_p
		mm/a	mm	%	%	-	%	%	-
Historical	**1993 – 2006**	**849,7**	**35,1**	**57,4**	**67,3**	**1,17** ✓	**72,4**	**73,6**	**1,02** ✓
ECHAM5 (E)	2079 – 2092	941,2	39,2	55,4	63,9	**1,15** ✓	70,4	70,8	**1,01** ✓
ECHAM5-FA (E-FA)	2079 – 2092	941,6	40,8	54,6	64,2	**1.18** ✓	69,6	71,1	**1,02** ✓
HADLEY (H)	2079 – 2092	933,8	38,7	55,7	64,5	**1,16** ✓	70,7	71,3	**1,01** ✓
HADLEY-FA (H-FA)	2079 – 2092	932.8	40,9	54,6	64,1	**1,17** ✓	69,6	70,9	**1,02** ✓
Trend	2079 – 2092	↑	↑	↓	↓	→	↓	↓	→

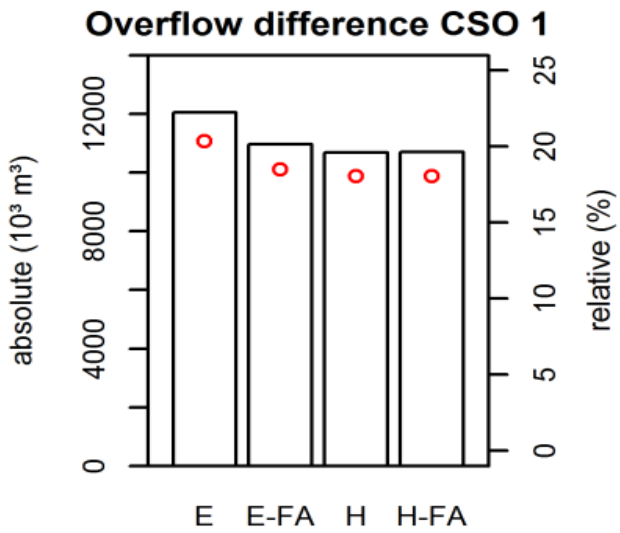
IWA WWC-2012 (Busan): Gruber et al. (2012)

Results: Comparison historical and predictive rain



Results: Total Overflow Volume for 14 CSO

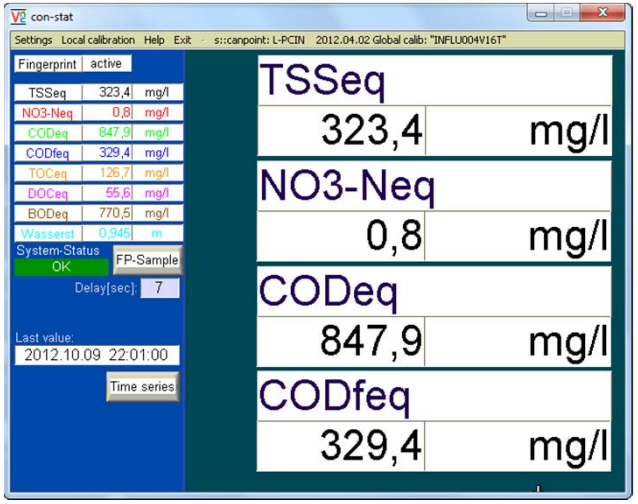




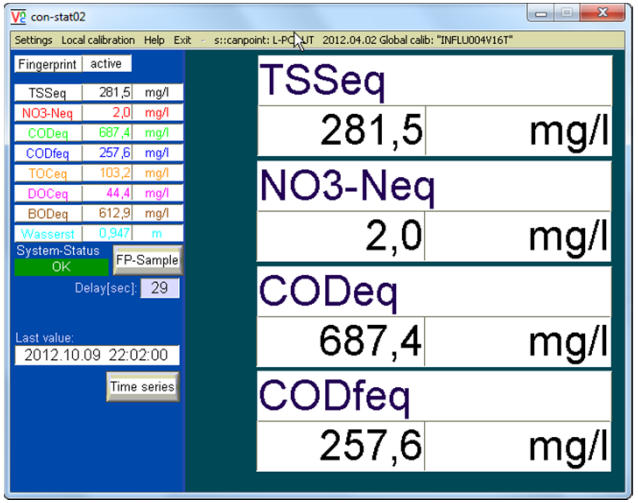
- 14 CSO from 43 => 95% of overflow volume
- At CSO 1 (Primary Clarifiers of WWTP) approx. 55% of the total overflow volume was spilled
- All 4 predicted scenarios lead to a total overflow volume increase of 21 – 23%

Sensor Network – Estimation of η_{sed} of WWTP`s PC

Primary Clarifiers Inflow



Outflow



Conclusions

- Linz Pilot estimates the impact of climate change scenarios on combined sewer overflows (CSOs)
- Comparison of different scenarios based on long term simulations using the Common Services for rainfall prediction
- For the future of Linz: Increase of rain intensities during winter/autumn period, decrease of rain intensities during summer period but general increase of peak intensities
- Increase in total overflow volume of approx. 20%
- Hotspot detection, comparison of proper mitigation strategies and portability is possible for each combined sewer system

Acknowledgements

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➔ www.sudplan.eu

LINZ AG ABWASSER

Sewer and WWTP operator of Linz

… and for your kind attention!

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