

Swmm-Heat Simulation of the Rümlang Single Stretch Section

Description:

The following document details the parameters used for the simulation of the Rümlang single stretch section. It consists on a 1.8Km sewer section that lays between Rümlang and Oberglatt. For more information see [1,2,3].

Parameters of the simulation:

Tabelle 2.1: Kennwerte des Kanalabschnitts zwischen Rümlang und Oberglatt

Parameter	Symbol	Wert	Einheit
Länge	L	1845	m
Innendurchmesser	D	0.9	m
Wanddicke	s	0.1	m
Neigung	S_0	0.00091	-
Stricklerbeiwert	k_{st}	70	$m^{1/3}/s$

Tabelle 2.3: Standardwerte für die einzugebenden Parameter

Parameter	Symbol	Wert	Einheit
wirksame Bodentiefe	δ_S	0.1	m
Bewuchsfaktor	f	200	$W/m^2 \cdot K$
Luftaustauschkoeffizient	b	0.1	-
Wärmeleitfähigkeit Rohr (armierter Beton)	λ_p	2.3	$W/m \cdot K$
Wärmeleitfähigkeit Boden (sandiger Lehm)	λ_s	$0.5 \cdot 10^{-6}$	m^2/s
Wärmeübergangskoeffizient Rohr (armierter Beton)	α_p	0.7	$W/m \cdot K$
Wärmeübergangskoeffizient Boden (sandiger Lehm)	α_s	$0.6 \cdot 10^{-6}$	m^2/s

Tabelle 2.4: Meteorologische Daten zu der für die Kalibration bzw. zu den beiden für die Validierung verwendeten Messperioden

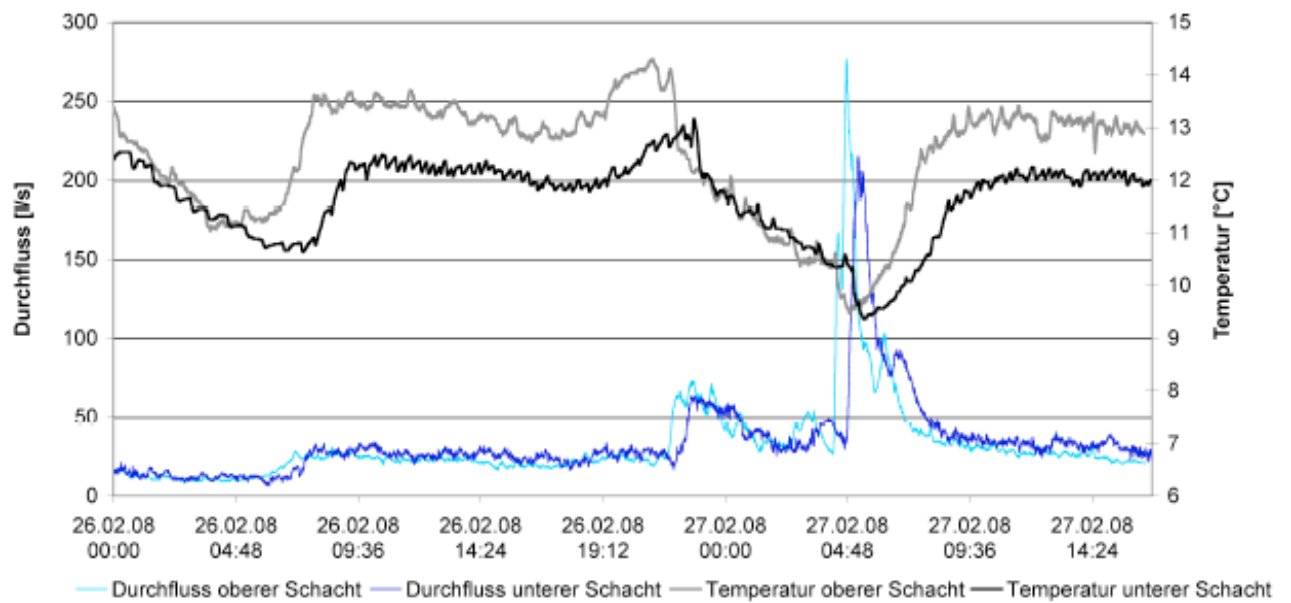
	26.02 - 27.02.08	08.03 - 09.03.08	11.03 - 12.03.08	
Bodentemperatur	5.02	6.36	6.29	$^{\circ}C$
Lufttemperatur	8.33	1.20	7.24	$^{\circ}C$
Luftfeuchtigkeit	75.12	72.00	72.35	%
Luftdruck	966.24	961.58	948.16	hPa
Niederschlag	7.70	0.00	4.60	mm

Inflows and Temperature:

Scenario 1: February

Input data:

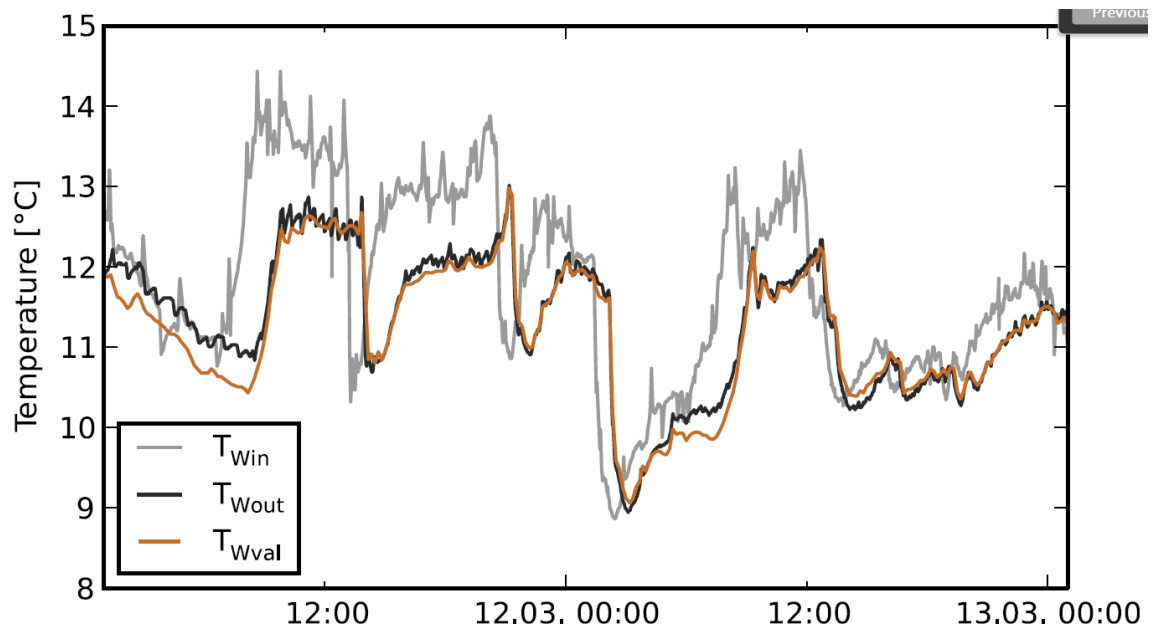
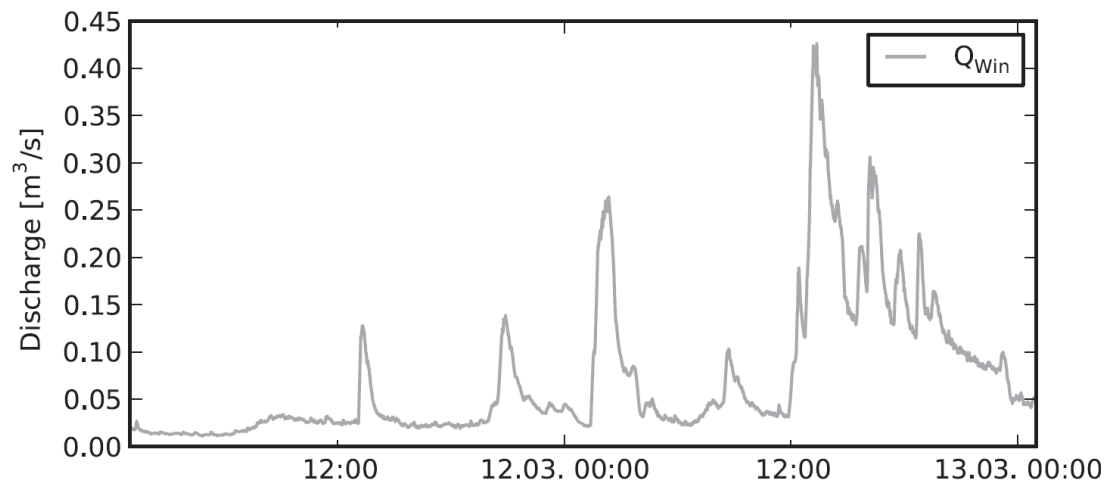
- Input Flow: " flow_edit.txt "
- Input Temperature: " temp_edit.txt "
- Output Observed Flow: "flow_out.txt "
- Output Observed Temperature: " temp_out.txt "



Scenario 2: March

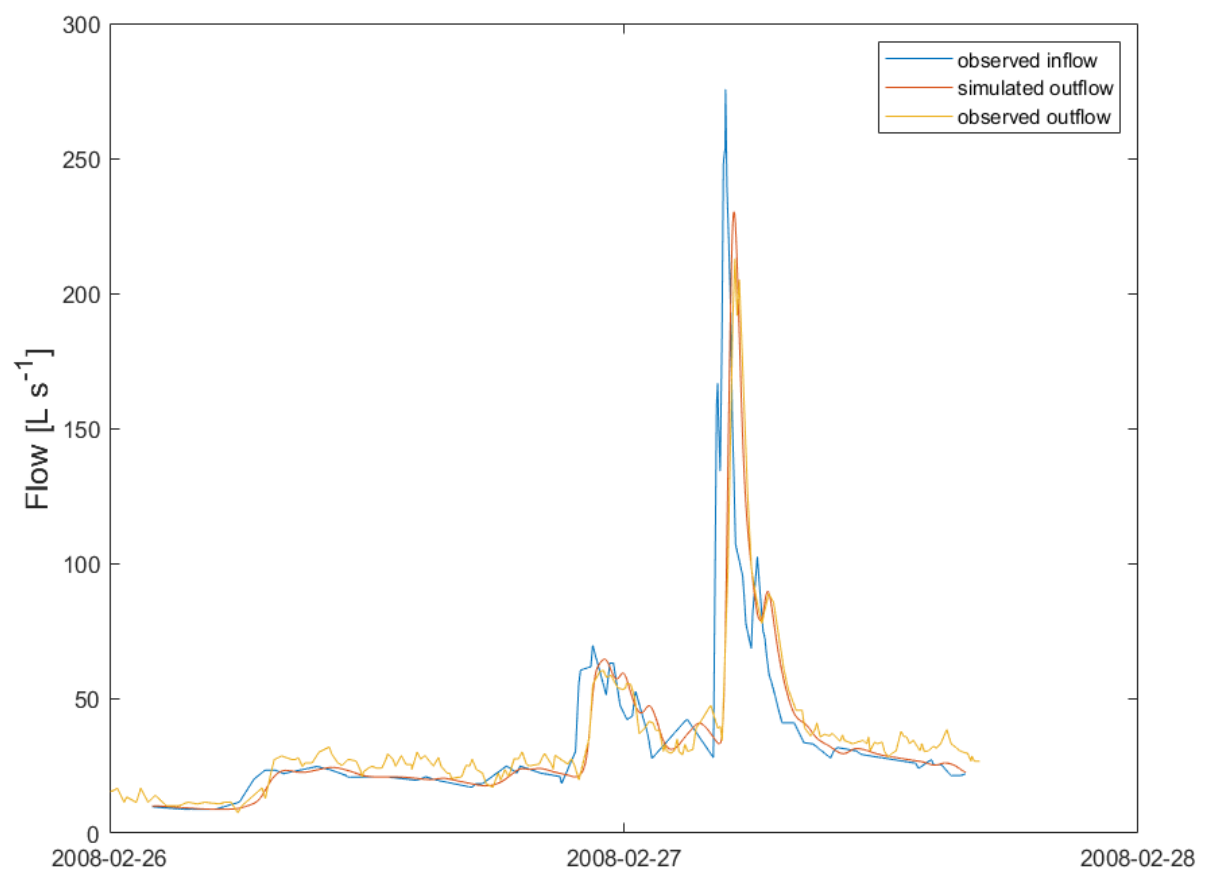
Input data:

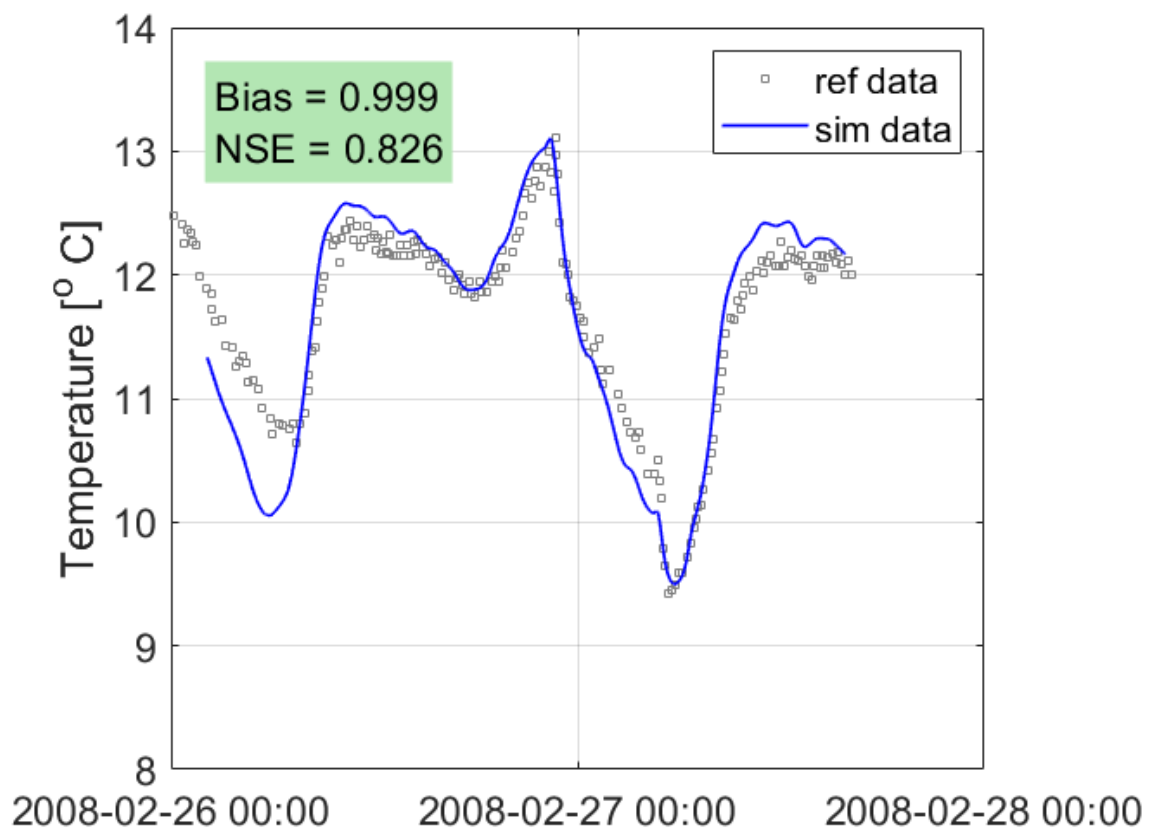
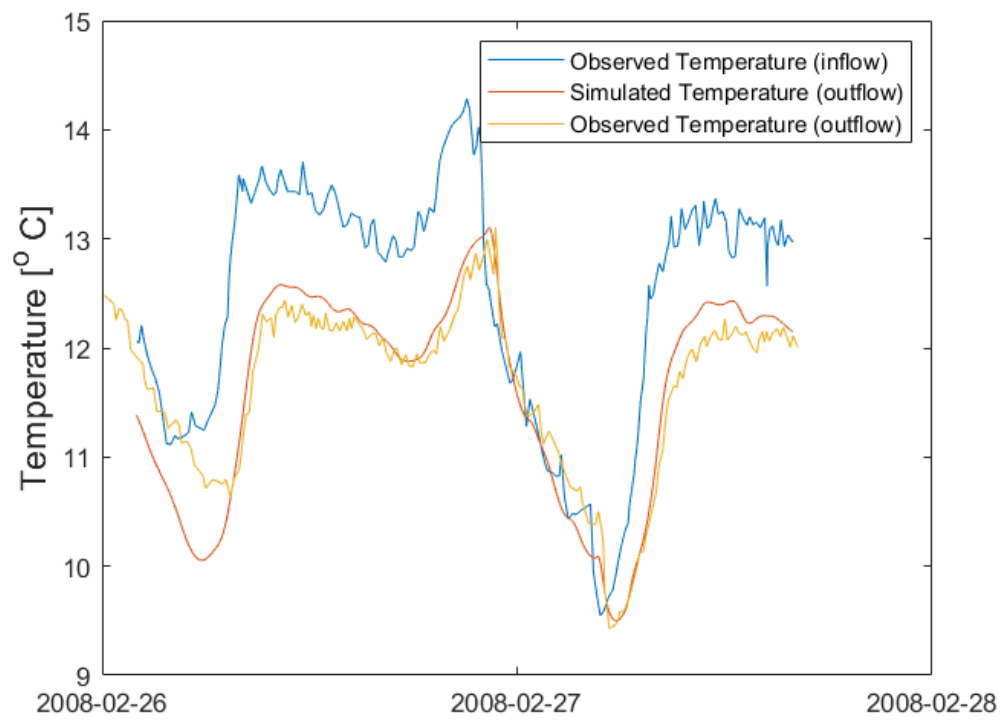
- Input Flow: " Flow_march_default.txt"
- Input Temperature: " temp_march_default.txt"
- Output Observed Temperature: " temp_march_out"



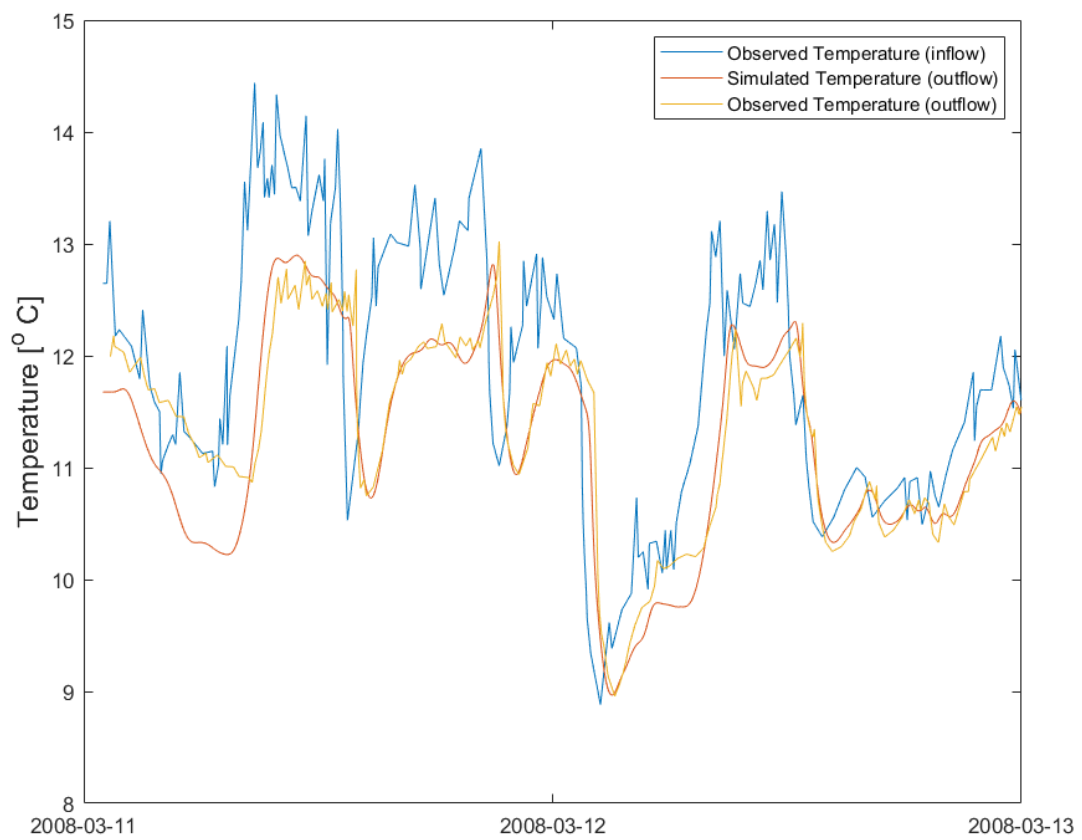
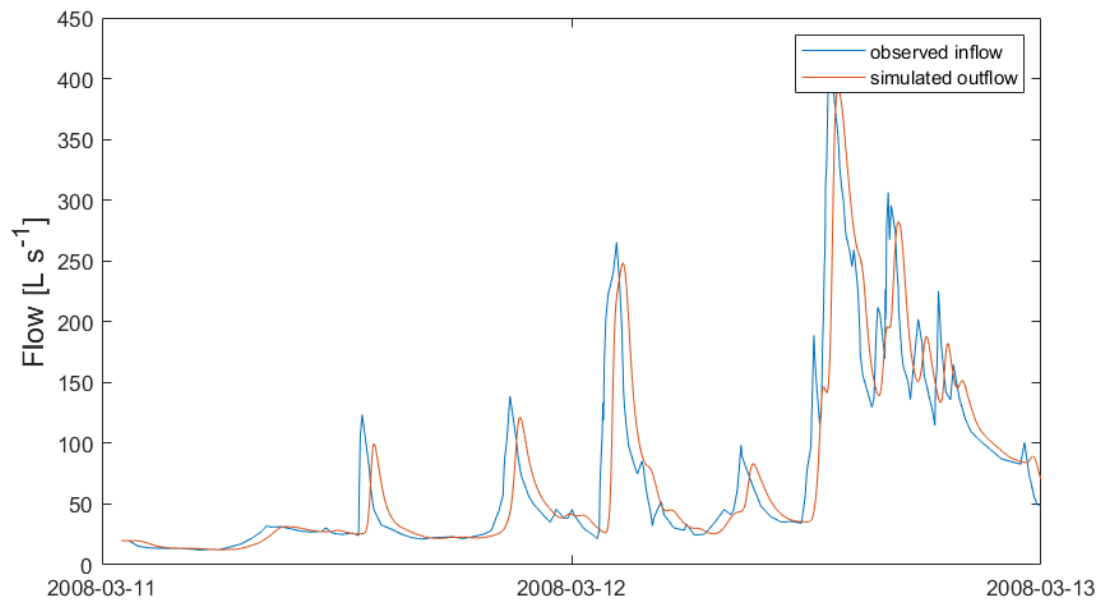
Results:

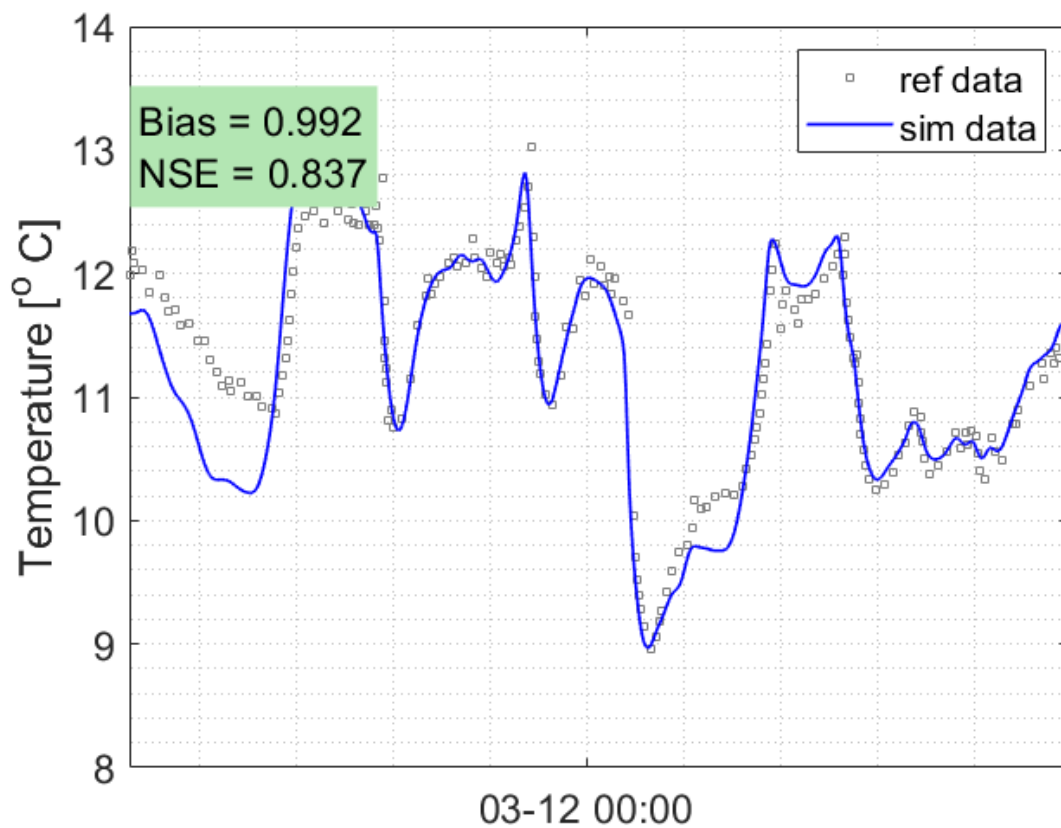
Scenario 1:





Scenario 2:





Results from Durrenmatt & Wanner Publication

Scenario 1:

Before Calibration:

Root mean squared root: 0.35 °C,

Nash Sutcliffe coefficient: 0.79.

After Calibration:

Root mean squared root: 0.14 °C,

Nash Sutcliffe coefficient: 0.97.

Scenario 2:

Root mean squared root: 0.20 °C,

Nash Sutcliffe coefficient: 0.94.

References:

- [1] André Daniel Müller. "Wärmerückgewinnung Aus Abwasser". Bachelor Thesis (2008)
- [2] Dürrenmatt, David J., and Oskar Wanner. "A mathematical model to predict the effect of heat recovery on the wastewater temperature in sewers." Water research 48 (2014): 548-558.

- [3] Dürrenmatt, David J., and Oskar Wanner. "Simulation of the wastewater temperature in sewers with TEMPEST." Water Science and Technology 57.11 (2008): 1809-1815.

Complementary Information:

