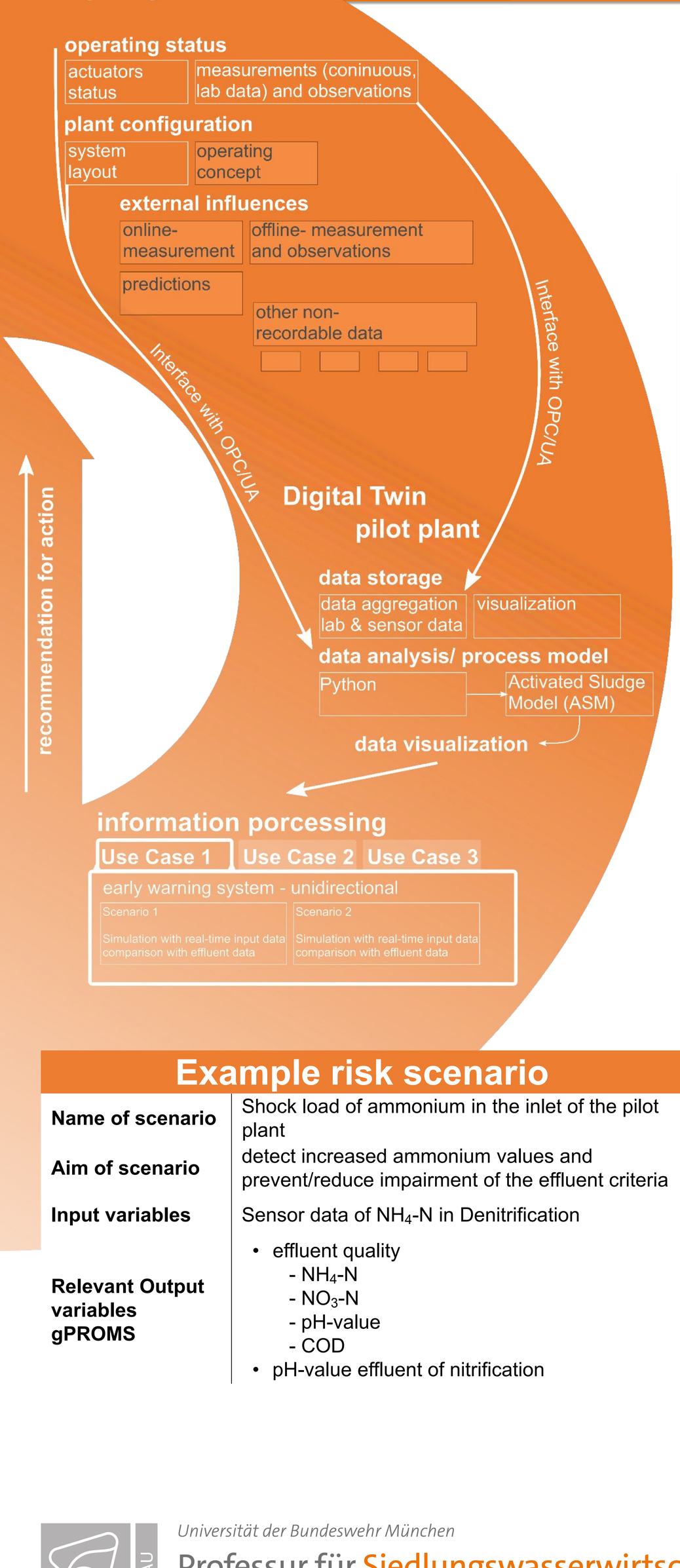
A Digital Twin for process resilience of WWTP

Nora Pankow, Steffen Krause, Christian Schaum
Professorship of sanitary enigneering and waste management

RISK.twin
Digitale Zwillinge zum Schutz kritischer Infrastruktur

Pilot plant



Aim for the setup of the Digital Twin

Being able to act and recover from stress situation is a key aspect for resilience of critical infrastructure. To enhance the resilience of wastewater treatment plants (WWTP) modelling can provide a strong support. A powerful tool for improved response during stress situations is the connection of real-time data with models in form of a Digital Twin DT). This research shows a possible setup for such a DT from the built up of the physical twin up to the model. The main steps for the setup of the DT were:

Establishment of a Pilot Plant to collect data and test different stress scenarios

- The pilot plant is designed for COD and nitrogen removal for a population equivalent of 2 (300 L/d).
- The static dimensioning of the pilot plant was calculated with the guideline DWA-A 131. With state-of the art measuring and control technology the plant produces over 40,000 data values per day.

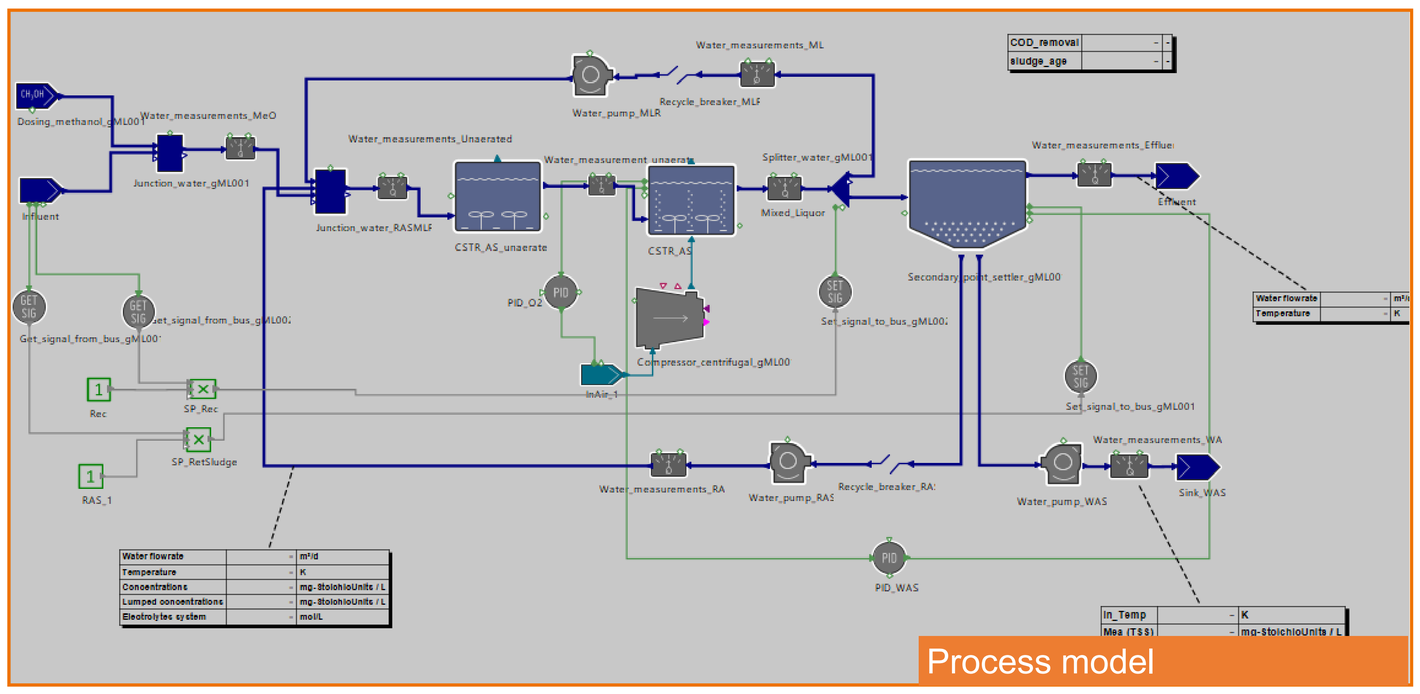
System for data storage and visualization

- setup system collects process and labrotory data as well.

Modelling of biological treatment porcess

- The proces is modelled with the activated sludge model (ASM) a mechanistic model that simpliefies the biologal processes in the WWTP

Data storage and visualization



Process model

Example risk scenario

Name of scenario	Shock load of ammonium in the inlet of the pilot plant
Aim of scenario	detect increased ammonium values and prevent/reduce impairment of the effluent criteria
Input variables	Sensor data of NH_4-N in Denitrification
Relevant Output variables gPROMS	• effluent quality - NH_4-N - NO_3-N - pH-value - COD • pH-value effluent of nitrification

WHAT 'S NEXT

After the successful establishment of the individual systems the systems have to be connected and tested:

Next steps for interface between Physical and Digital Twin

- Connecting the process variables in the pilot plant with the variables in the model and vice versa

Next step for data analysis and process modelling

- Develop adequate data validation for the automates transfer of process variables to the model
- The model needs to be validated with process data of the pilot plant

Next steps for data collection

- The pilot plant needs to be tested with different stress scenarios

Universität der Bundeswehr München
Professur für Siedlungswasserwirtschaft und Abfalltechnik

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