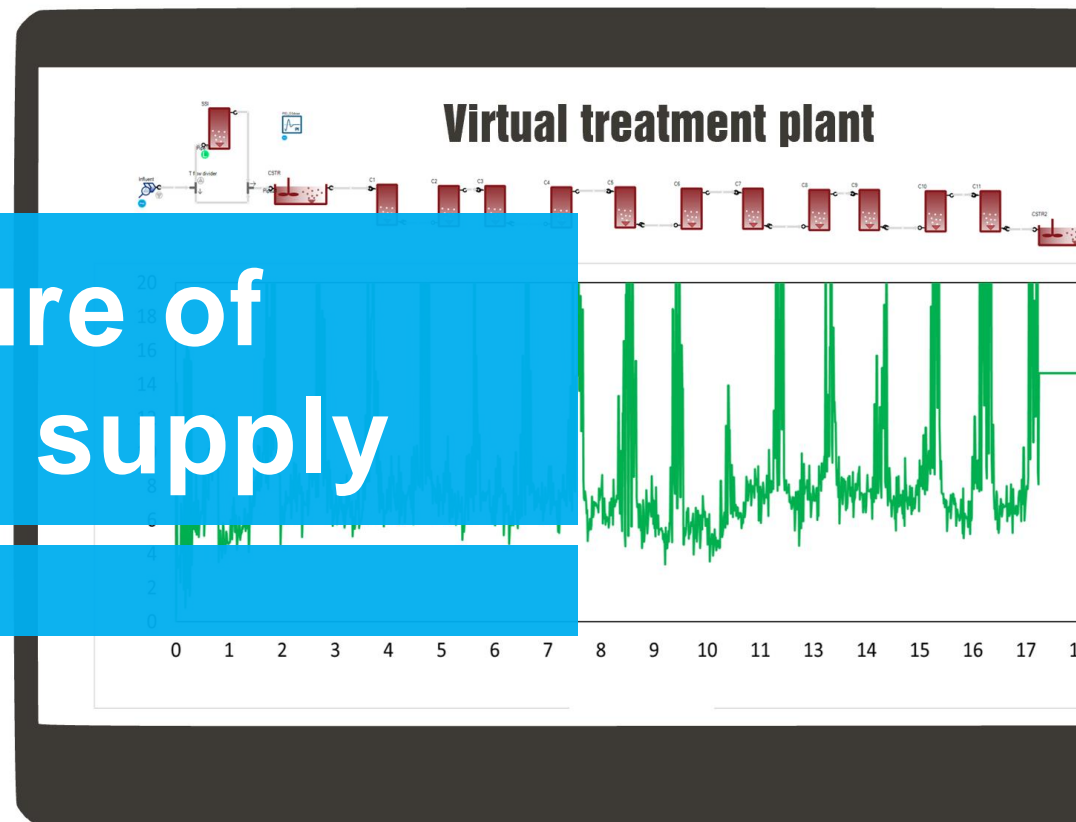




# Past, present and future of digital twins for water supply

13 FEBRUARY 2024



# AGENDA

- Introduction & Poll  
*Oliver Grievson, AtkinsRealis/Chair IWA DWP*
- Digital Twins for water distribution systems  
*Pilar Conejos, Idrica/ Member IWA DWP*
- Clean and wastewater moving into your 3E example  
*Wim Audenaert, AM-Team/ Member IWA DWP*
- AI optimised Digital Twins and their adoption and scaling/delivery  
*James Torres Ballard, Severn Trent Water*
- Q&A Panel Discussion  
*All speakers and moderator*
- Close  
*Oliver Grievson, AtkinsRealis/Chair IWA DWP*

## WEBINAR INFORMATION



- This webinar will be **recorded and made available “on-demand”** on the [IWA Connect Plus](#) platform and IWA Network website, with presentation slides, and other information.
- The **speakers** are responsible for **securing copyright permissions** for any work that they will present of which they are not the legal copyright holder.
- The opinions, hypothesis, conclusions or recommendations contained in the presentations and other materials are the **sole responsibility of the speaker(s)** and do not necessarily reflect IWA opinion.

## WEBINAR INFORMATION



- **'Chat' box:** please use this for general requests and for interactive activities.
- **'Q&A' box:** please use this to send questions to the panelists. (We will answer these during the discussions)

*Please Note: Attendees' microphones are muted. We cannot respond to 'Raise Hand'.*

# MODERATORS & SPEAKERS



**Oliver Grievson**

Associate Director,  
AtkinsRealis, UK



**Pilar Conejos**

Digital Twin Manager,  
Idrica, Spain



**Wim Audenaert**

Co-founder & CEO  
AM-Team, Belgium



**James Ballard**

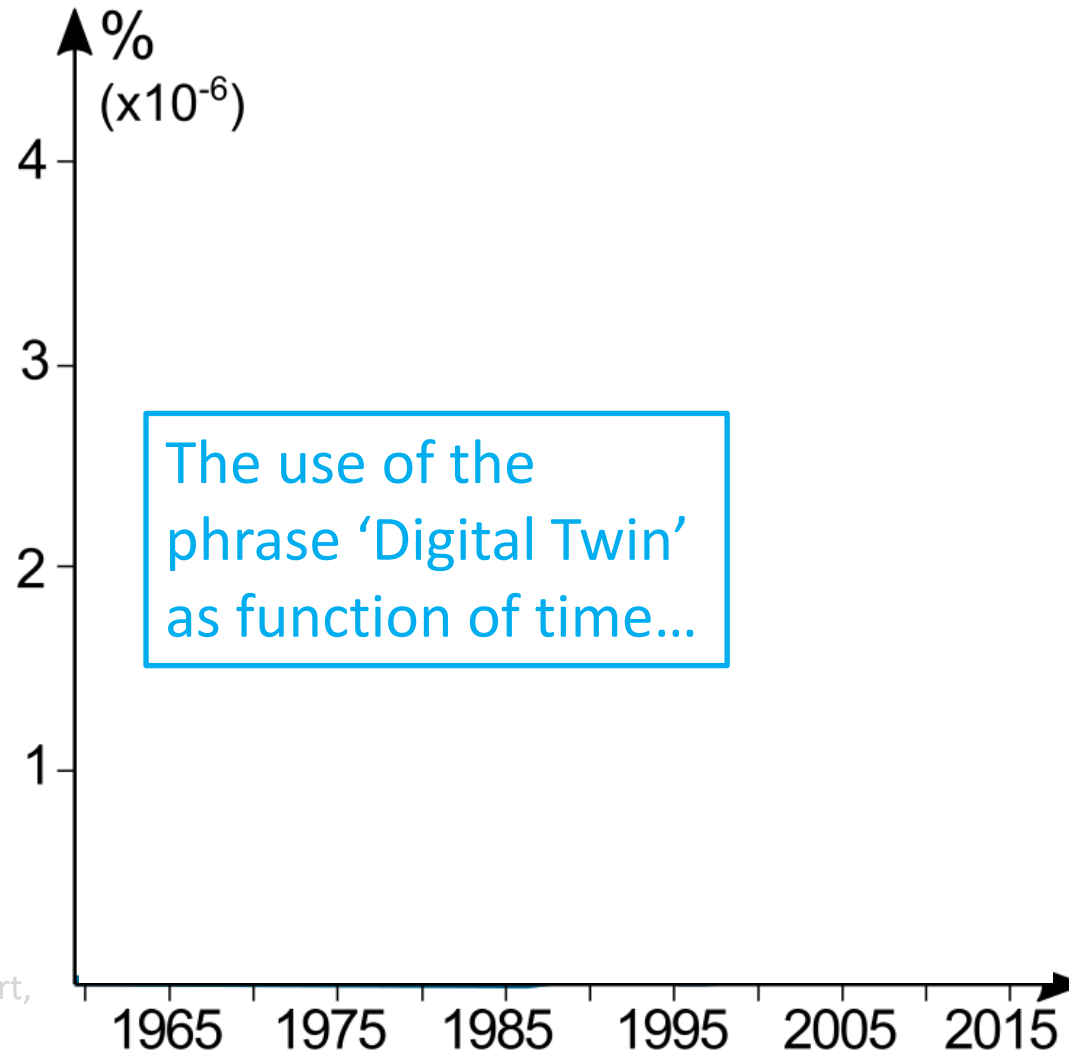
Control &  
Automation  
Architect, Severn  
Trent Water, UK

# Digital twin applications at the treatment side

WIM AUDENAERT, PHD, ENG

| CEO AND CO-FOUNDER AT AM-TEAM

# DIGITAL TWIN: HYPE OR REALITY?

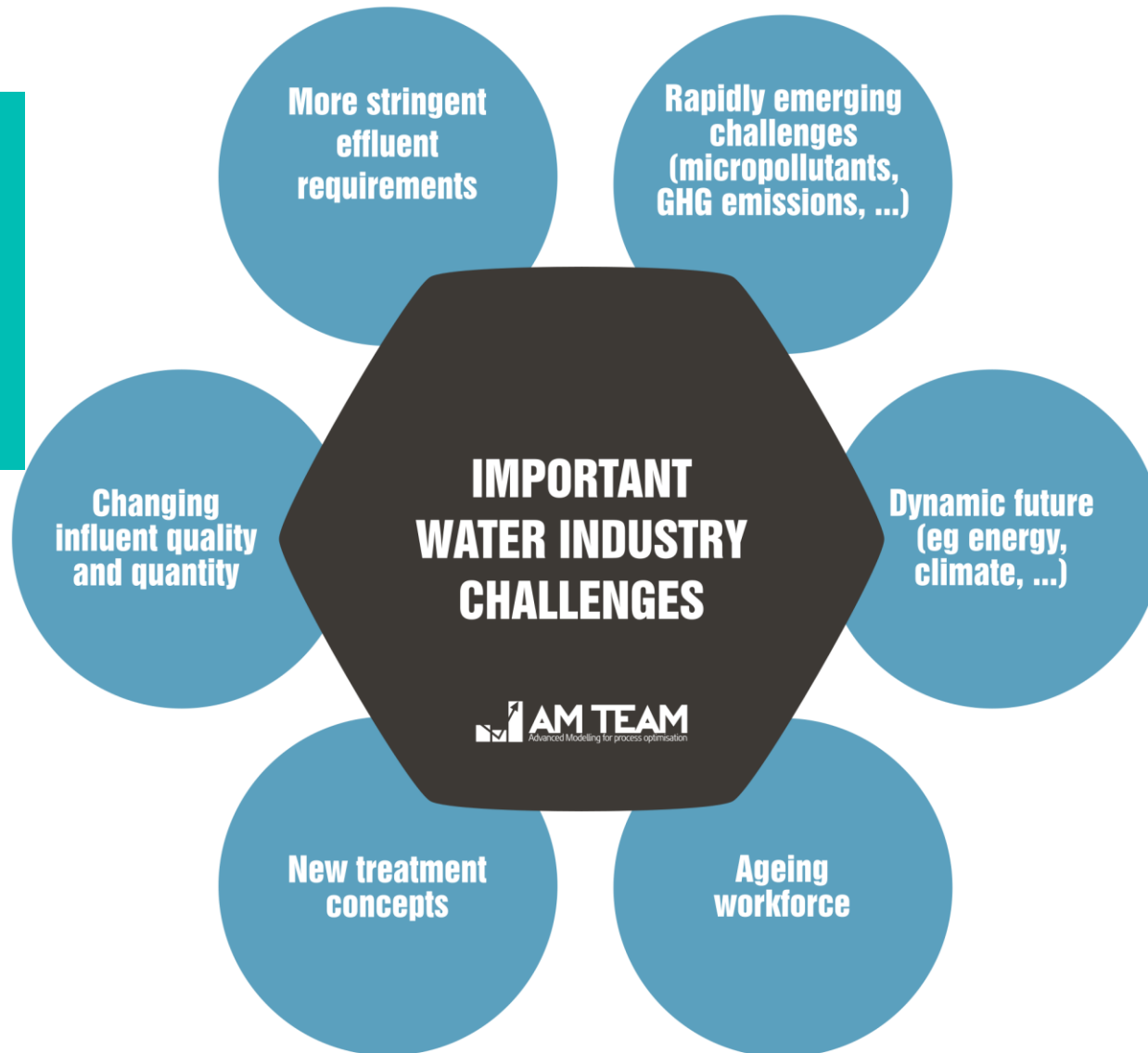


Generated by Wim Audenaert,  
using google Ngram

**Question:**  
How will this  
translate to  
adoption in the  
water industry?

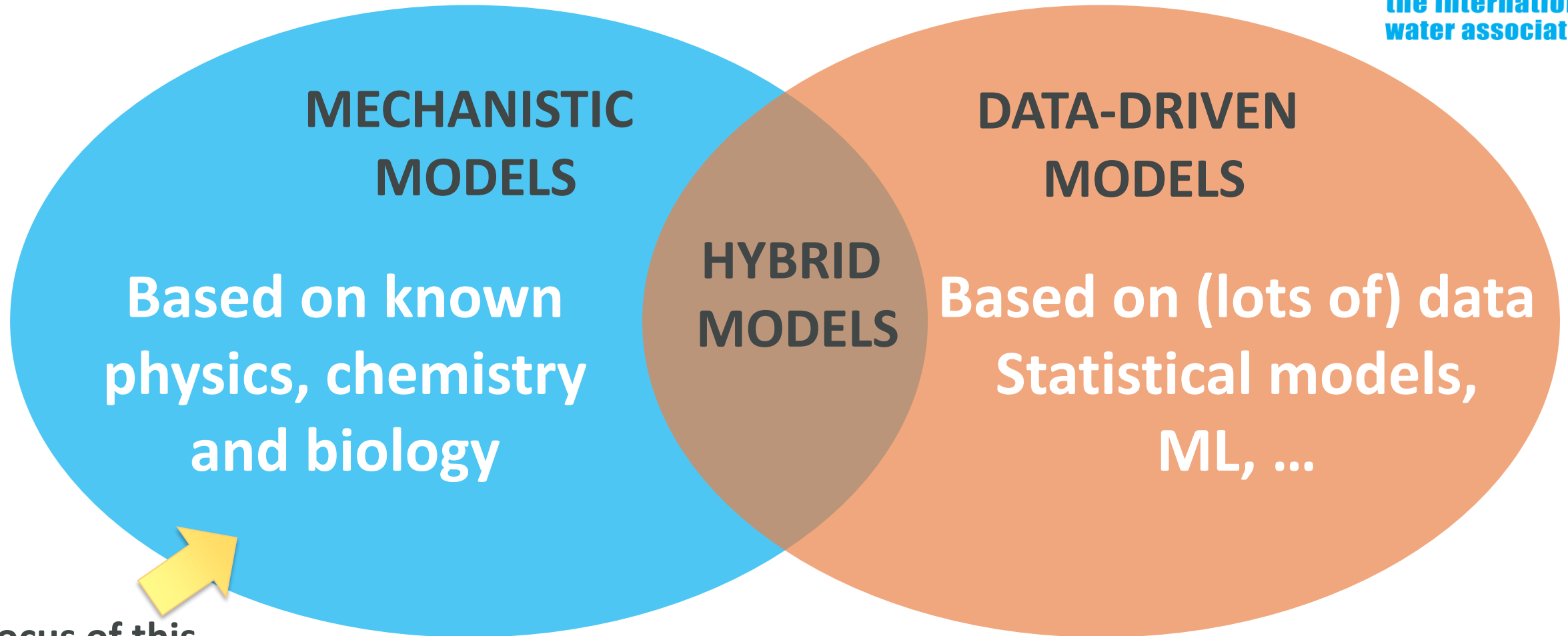
# THE 'WHY' OF DIGITAL TWINS

The value  
will drive the  
adoption!





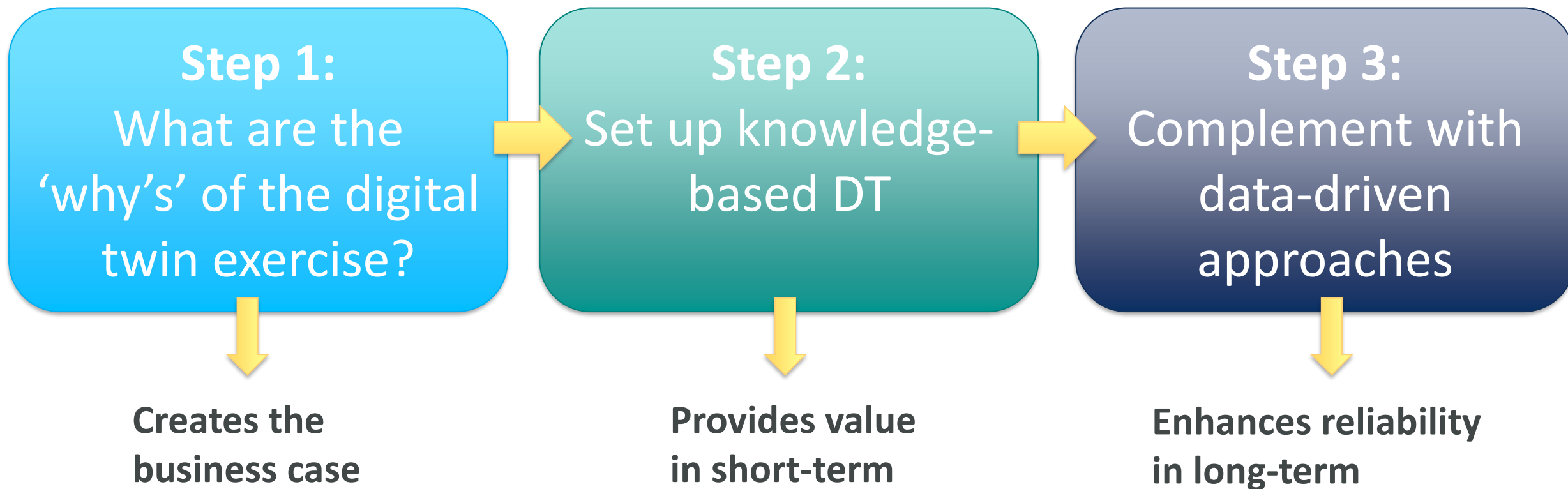
# THE 'HOW' OF DIGITAL TWINS



Focus of this presentation

## THE 'HOW' OF DIGITAL TWINS

### The knowledge-based approach



# **CASE EXAMPLE 1: DRINKING WATER**

## **A DIGITAL TWIN TO ASSESS CLIMATE CHANGE IMPACT AND DRIVE PLANNING DECISIONS**

Verenigd Koninkrijk Newcastle upon Tyne

DW Intake (PWN)



Amsterdam

Nederland

Duitsland

IJssel Lake

WPJ (5 mio m<sup>3</sup>)

PSA (3.8 mio m<sup>3</sup>)

Scope of digital twin: plant-wide

Coagulation  
Rapid SF

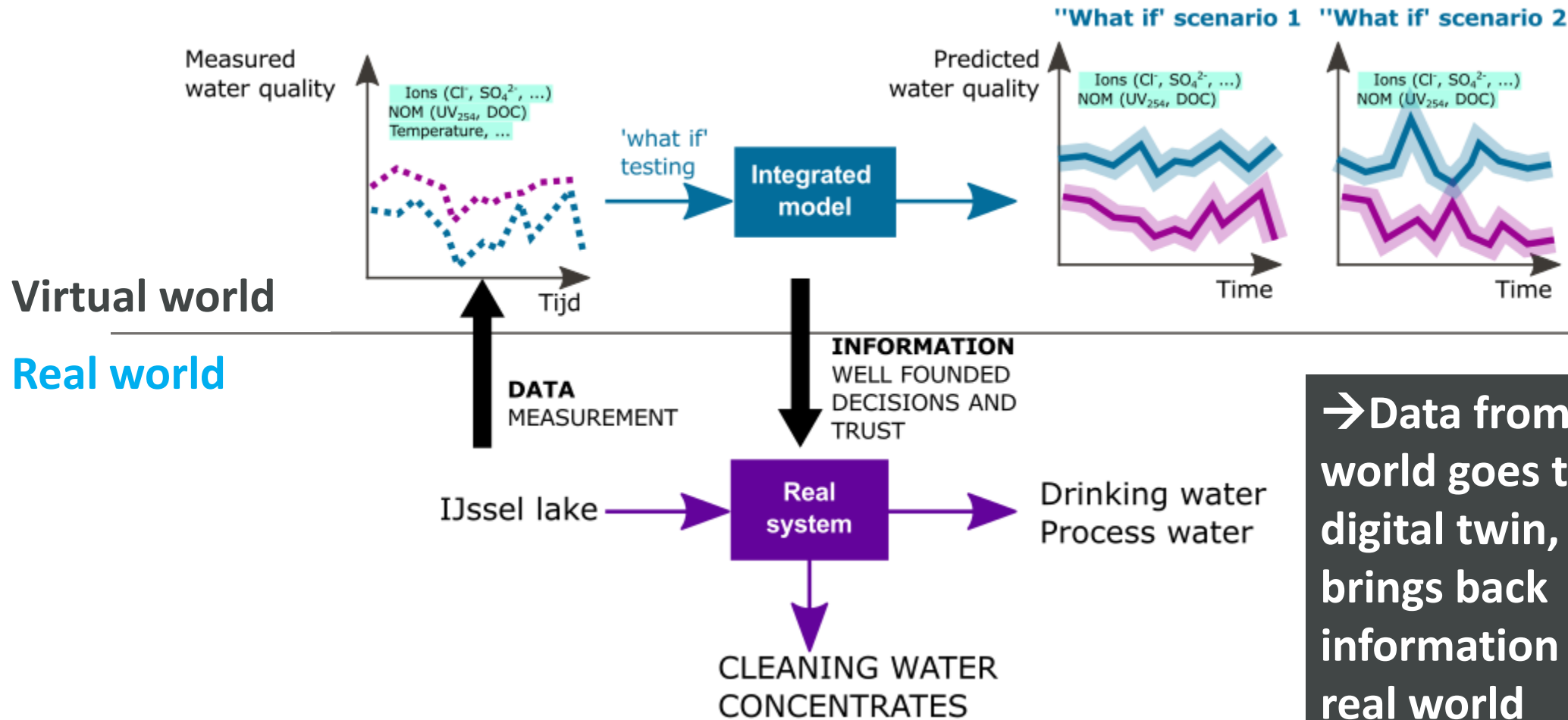
IEX  
Ceramic MF

Case presented at

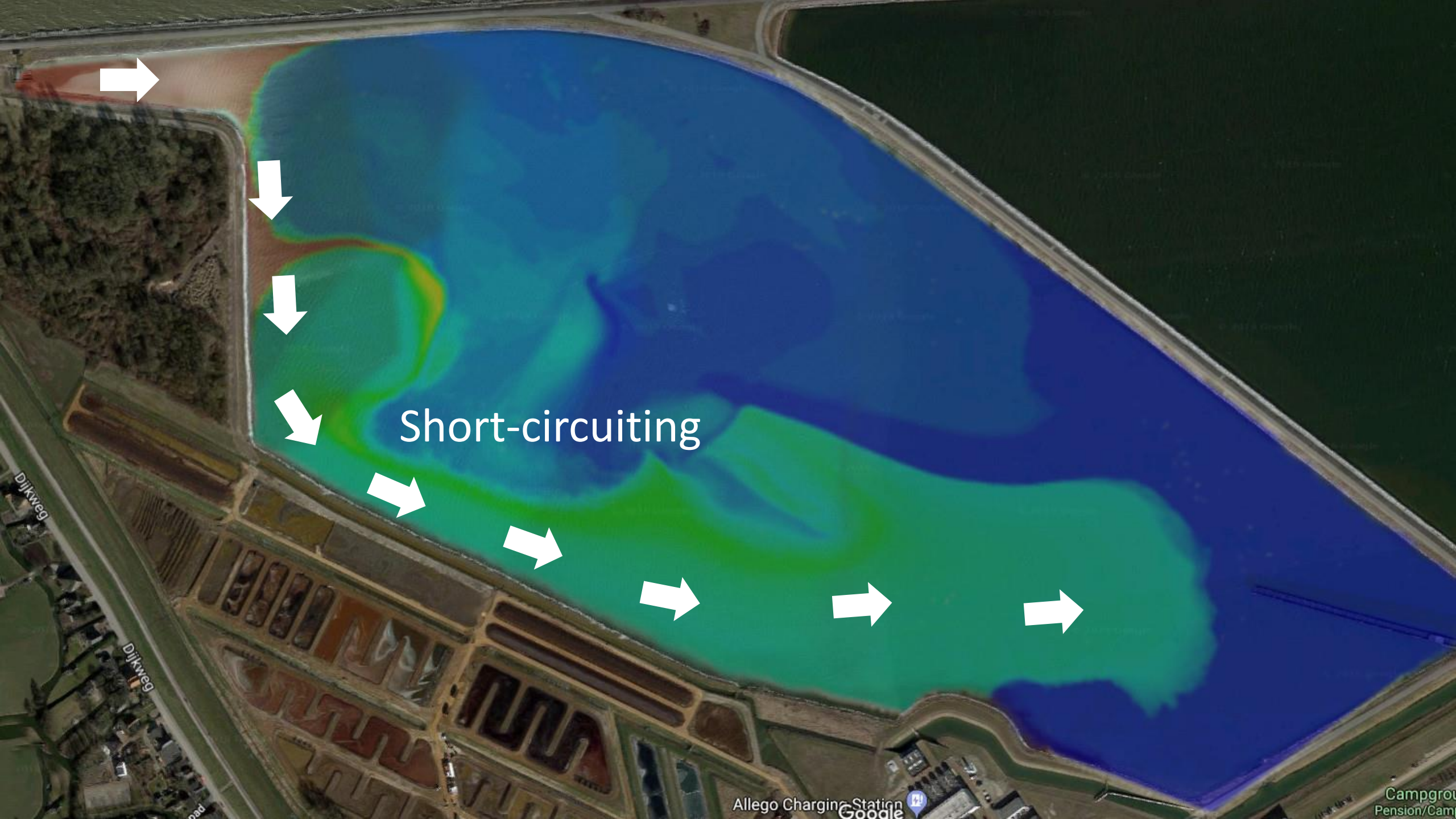




# FROM DATA TO INFORMATION WITH A DIGITAL TWIN



→ Data from the real world goes to the digital twin, which brings back information to the real world



Short-circuiting



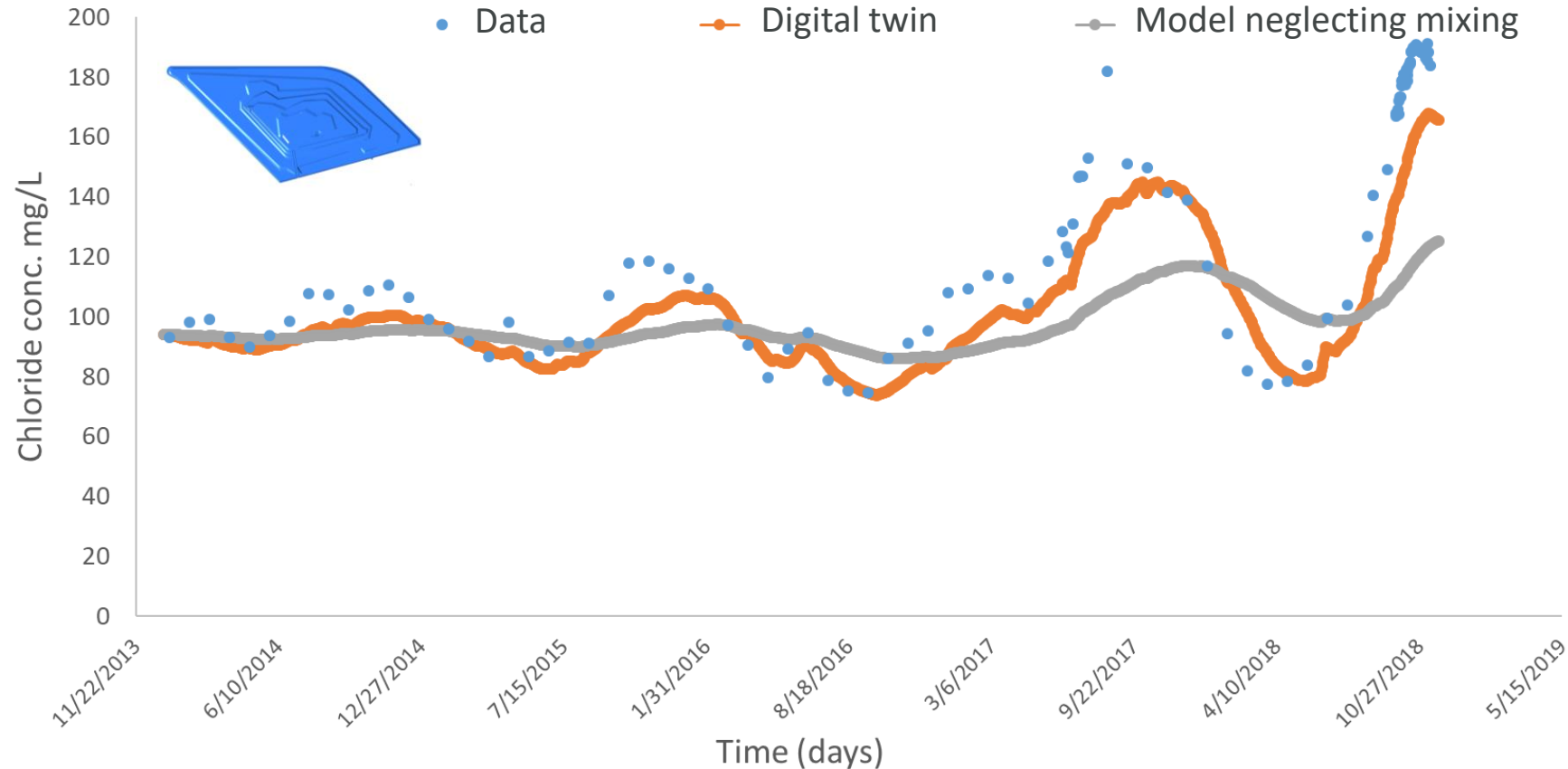
Dijkweg

Dijkweg

Allego Charging Station

Campgro...  
Pension/Cam...

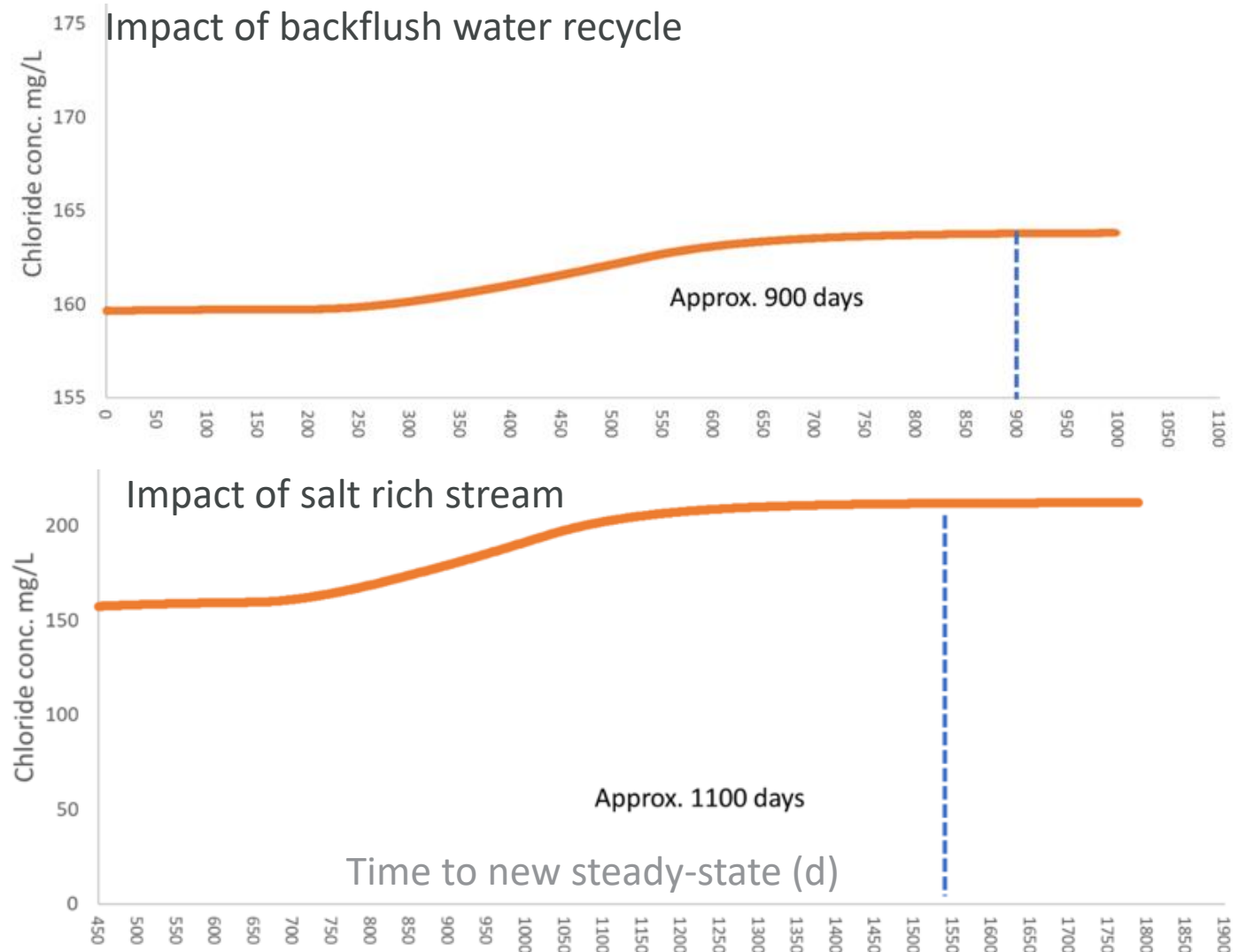
# DYNAMIC PREDICTION OF CHLORIDE CONCENTRATION



5 years of simulation

# SCENARIO ANALYSIS FOR DECISION SUPPORT

- > 20 scenarios tested!





# **CASE EXAMPLE 2: DRINKING WATER**

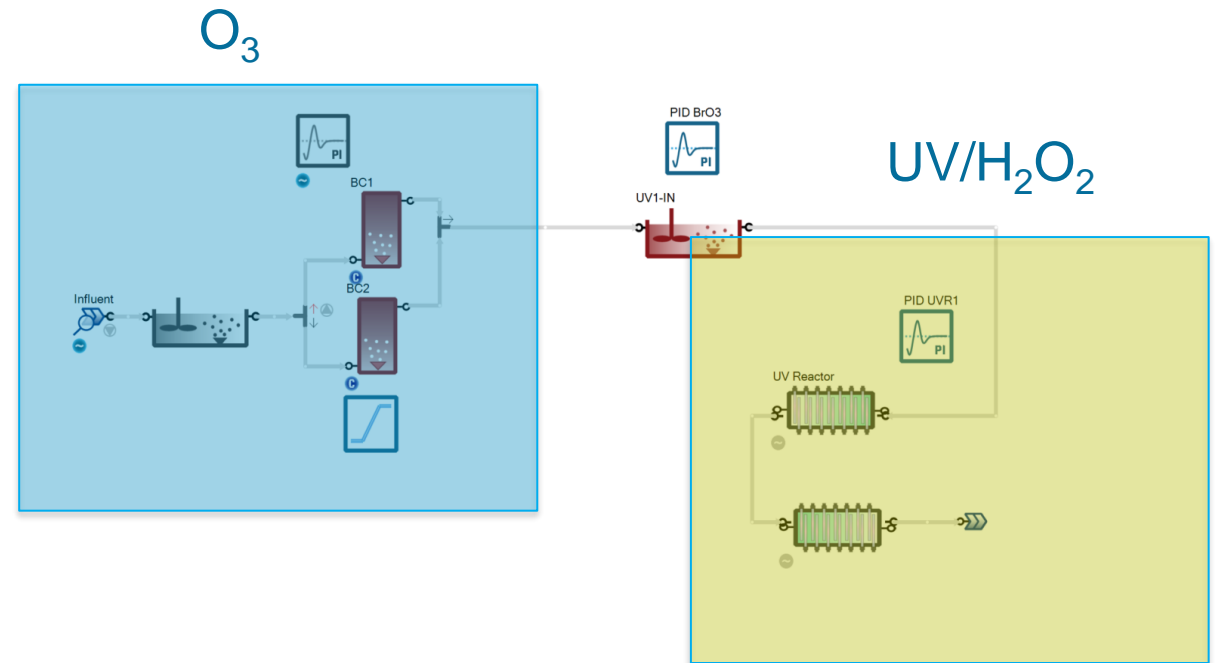
## **A DIGITAL TWIN TO MAXIMISE WATER QUALITY WHILE SAVING ENERGY AND CHEMICALS**

# CASE DESCRIPTION

REAL WORLD



VIRTUAL WORLD



Case story: Xylem Dunea - Full version

Case story

Dunea zuivert water op unieke wijze!

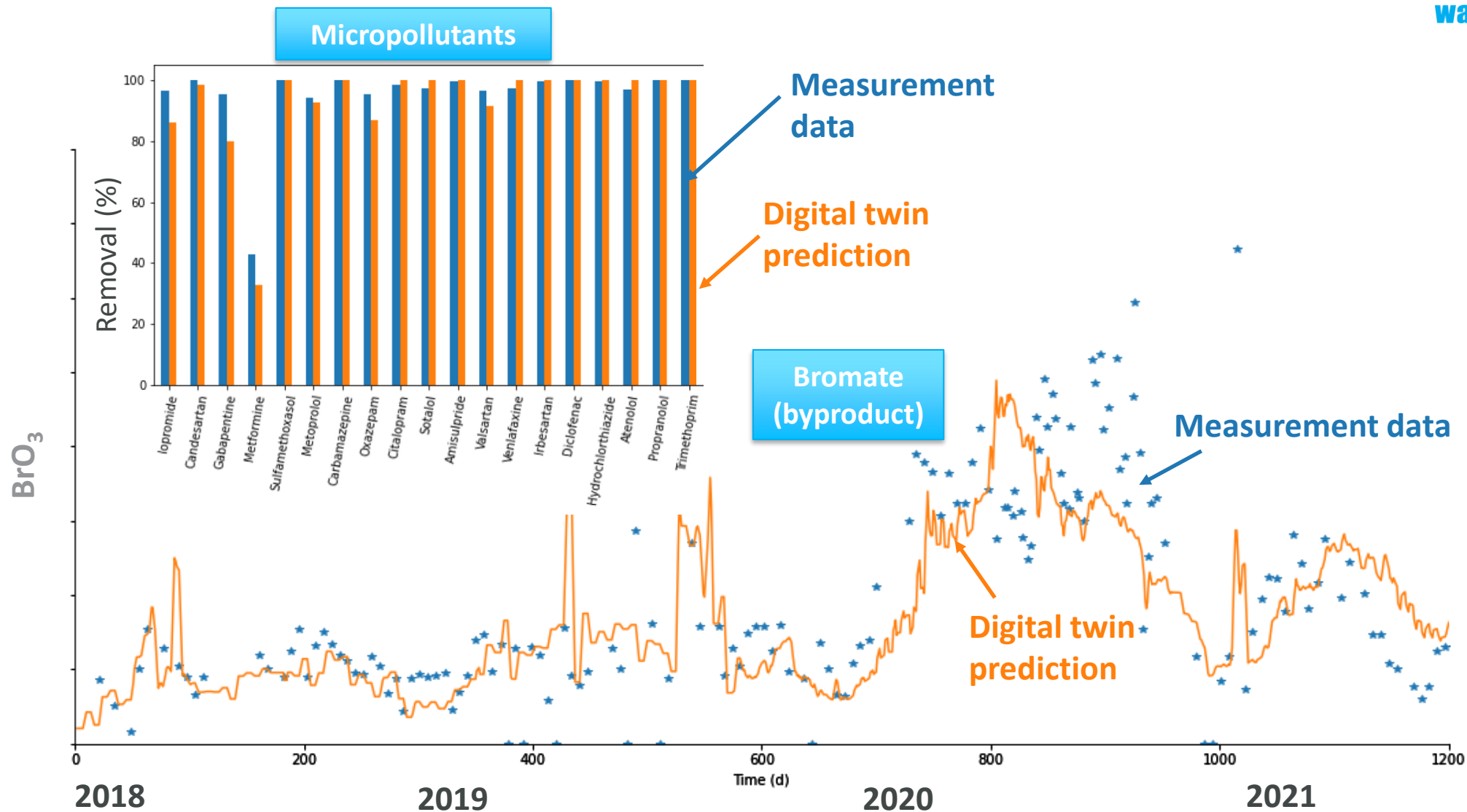
Watch later Share

Watch on YouTube

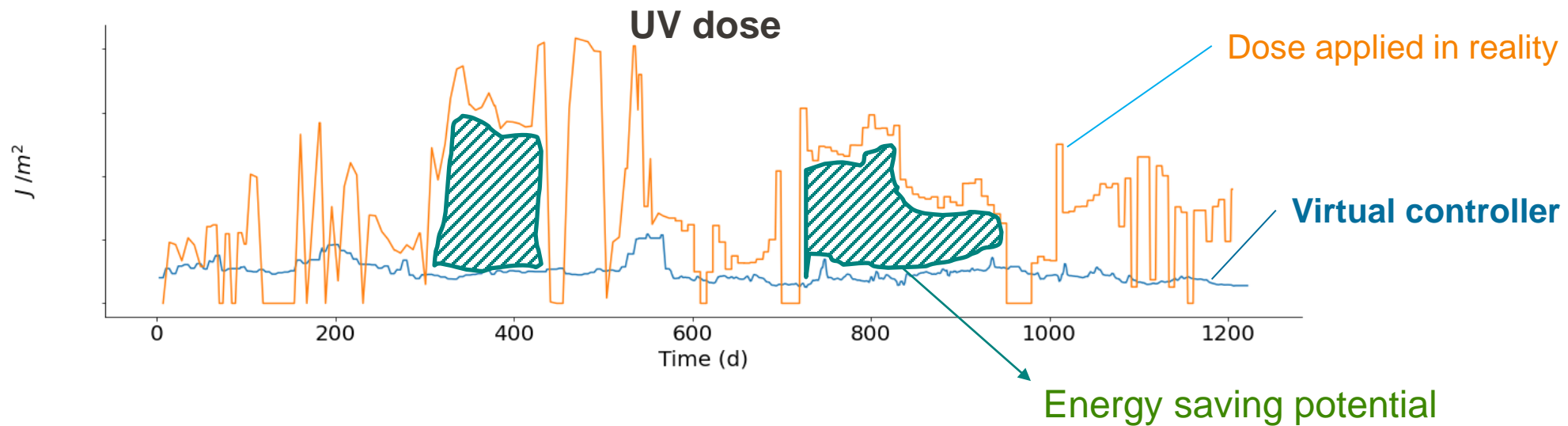
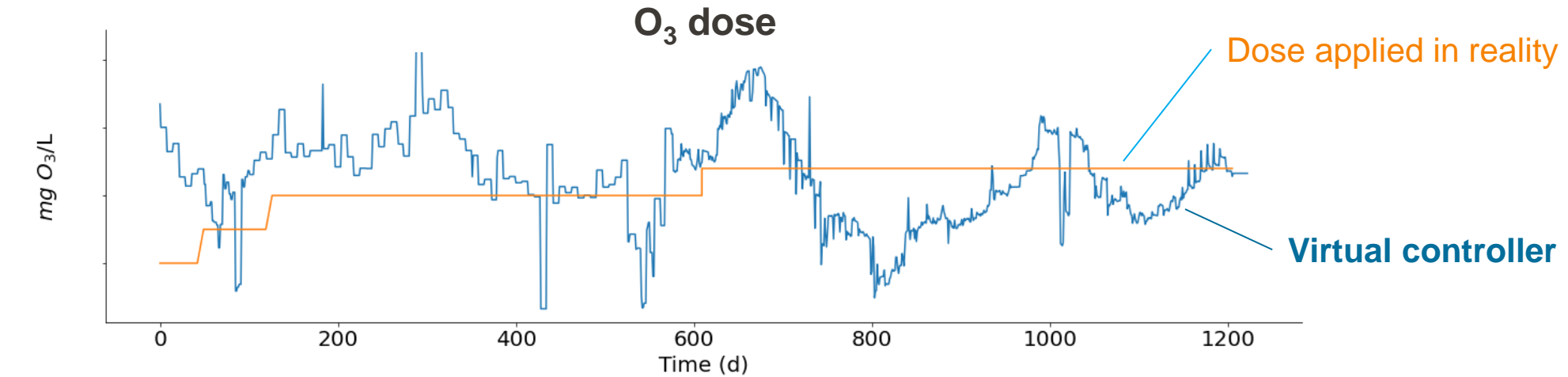


**AM OZONE**  
A product of AM TEAM

Powered by **SUMO**

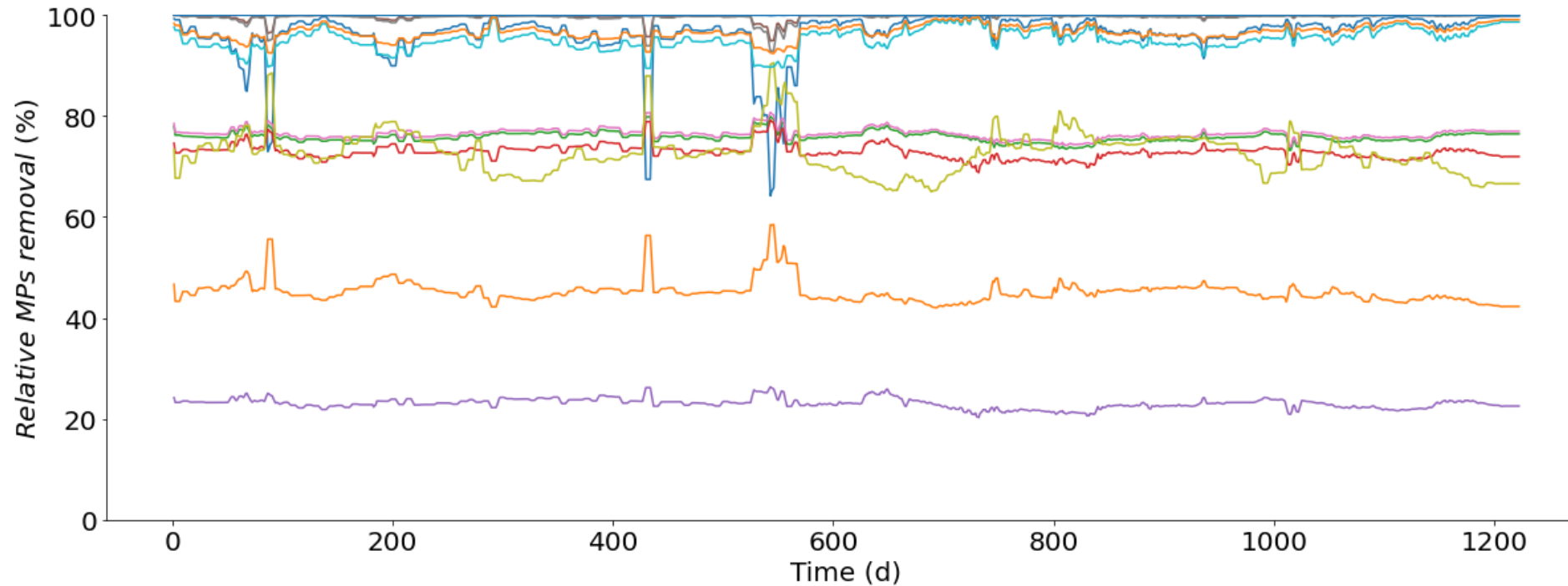


# DT FOR ENERGY AND CHEMICALS SAVING



# REAL-TIME PREDICTION OF TRACE ORGANICS

The DT as soft-sensor:  
 Predict what cannot be measured,  
 based on what can be measured



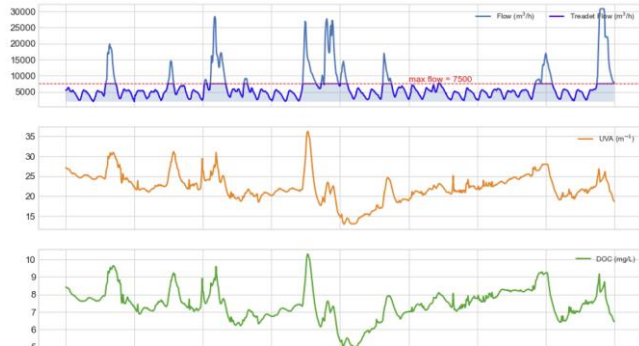
- Diclofenac
- Carbamazepine
- Trimethoprim
- Bentazone
- Furosemide
- Phenazone
- Metoprolol
- Isoproturon
- Ibuprofen
- Iopromide
  
- Atrazine
  
- Metformin

## **CASE EXAMPLE 3: WASTEWATER**

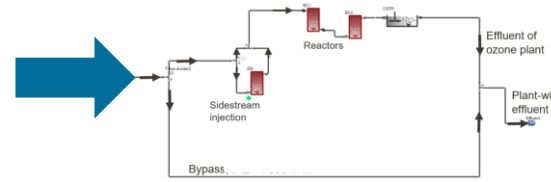
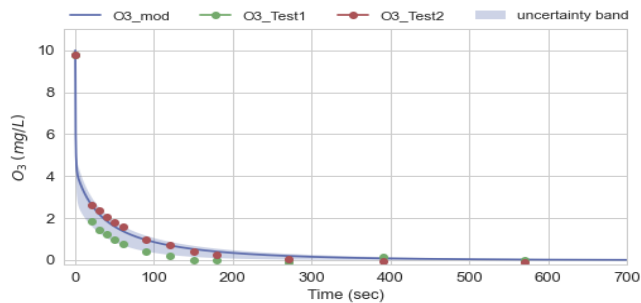
# **A DIGITAL TWIN TO FOR SMART MONITORING AND CONTROL OF ADVANCED TREATMENT**

# THE VIRTUAL TWIN BABY WAS BORN FIRST

### Secondary Effluent data



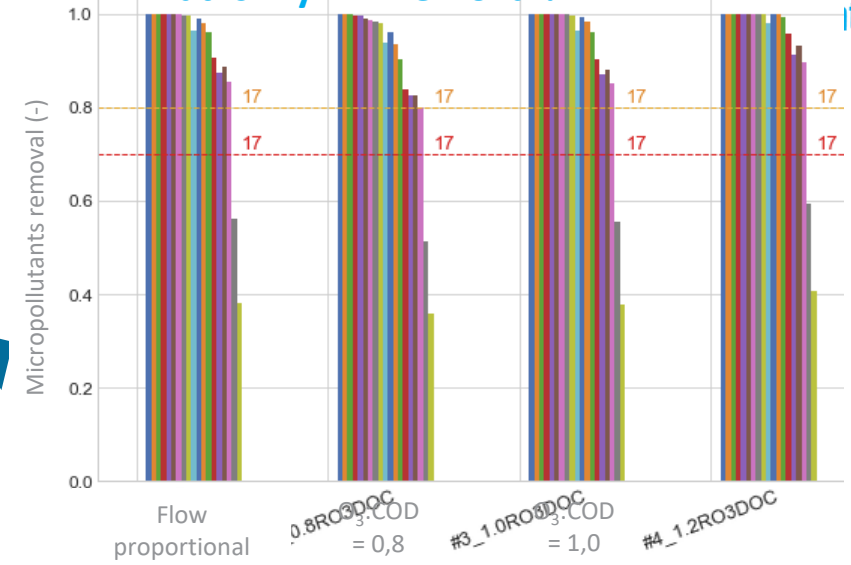
### Batch test data



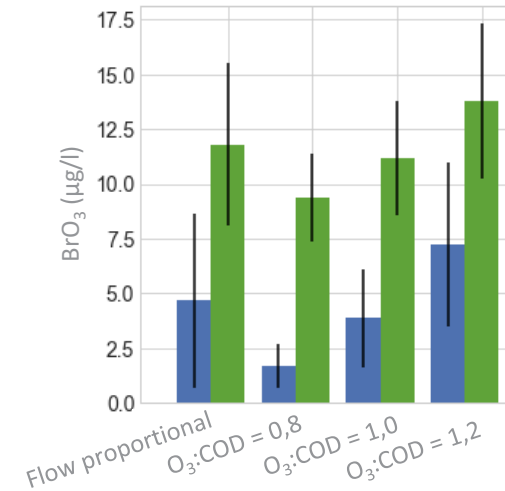
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### What is my MP-removal?

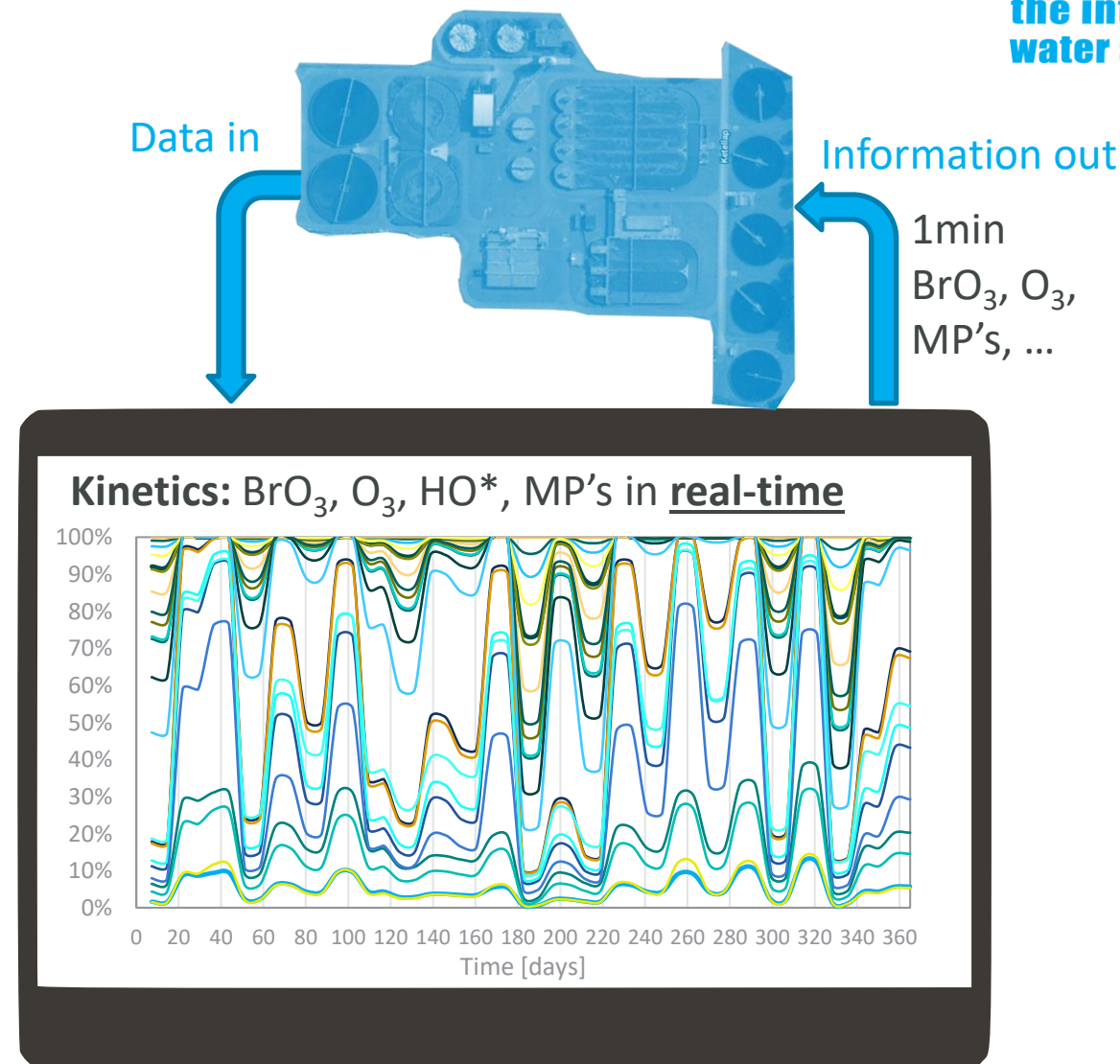


### Bromate risk



# THE BIRTH OF THE SECOND TWIN BABY

- Operator and technologist training (before plant is in operation)
- Phase 1: monitoring (2024)
- Phase 2: process control (2025)



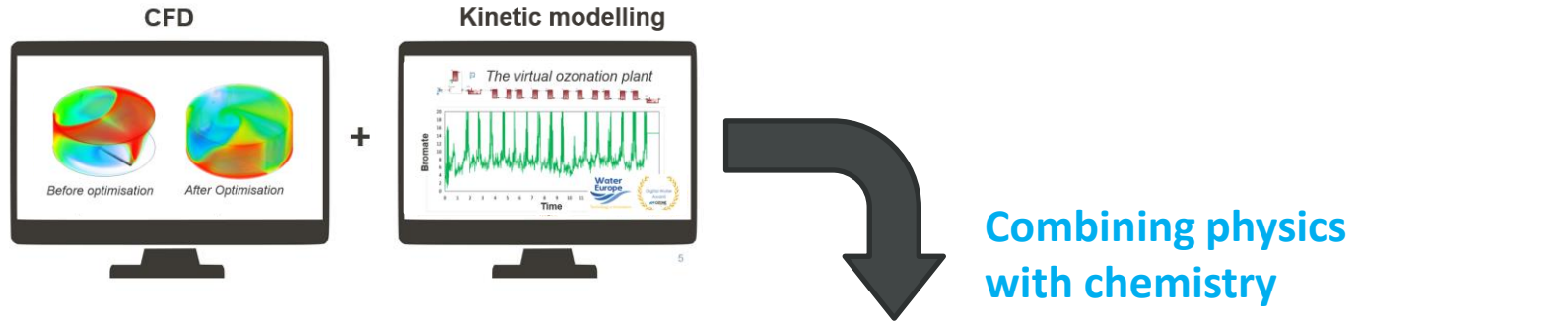


# **OUTLOOK**

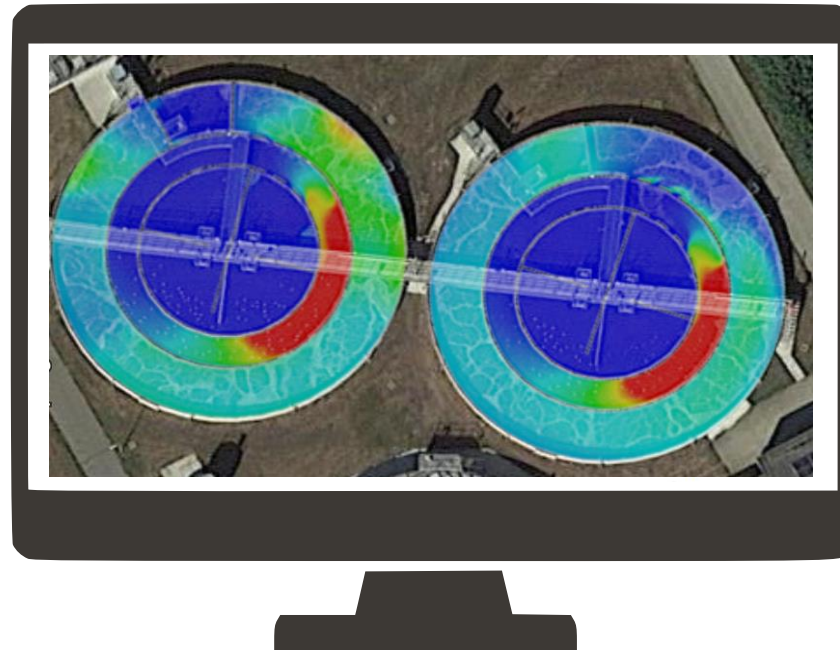
## **CASE EXAMPLE 4: WASTEWATER**

### **A DIGITAL TWIN TO MONITOR AND MITIGATE NITROUS OXIDE (N<sub>2</sub>O) EMISSIONS**

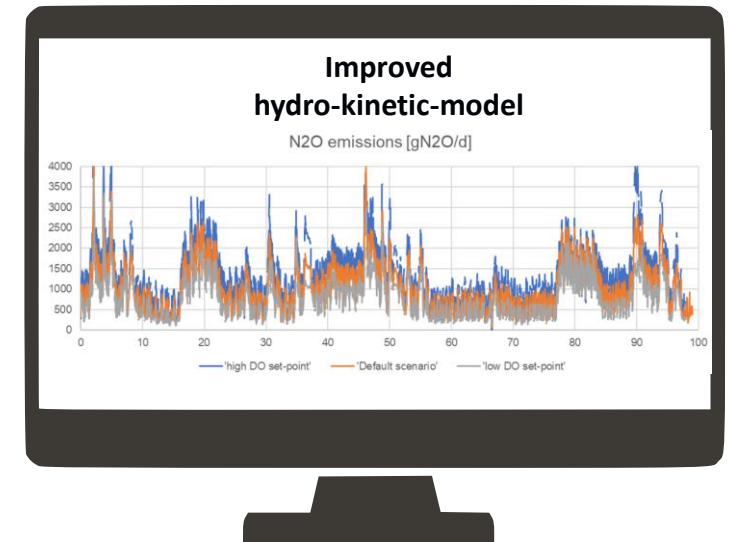
# GENERAL OUTLINE OF METHODOLOGY



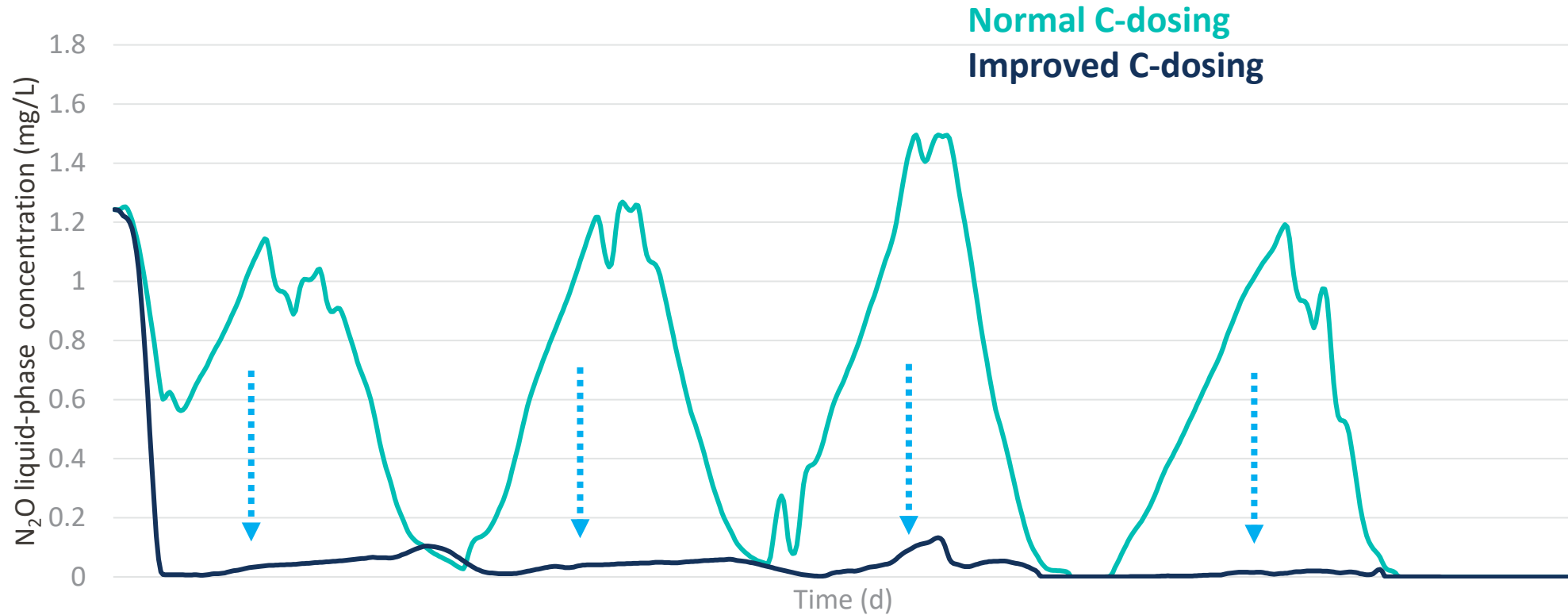
## 3D CFD-N<sub>2</sub>O model



## Digital twin model



# DIGITAL TWINS FOR N<sub>2</sub>O MITIGATION

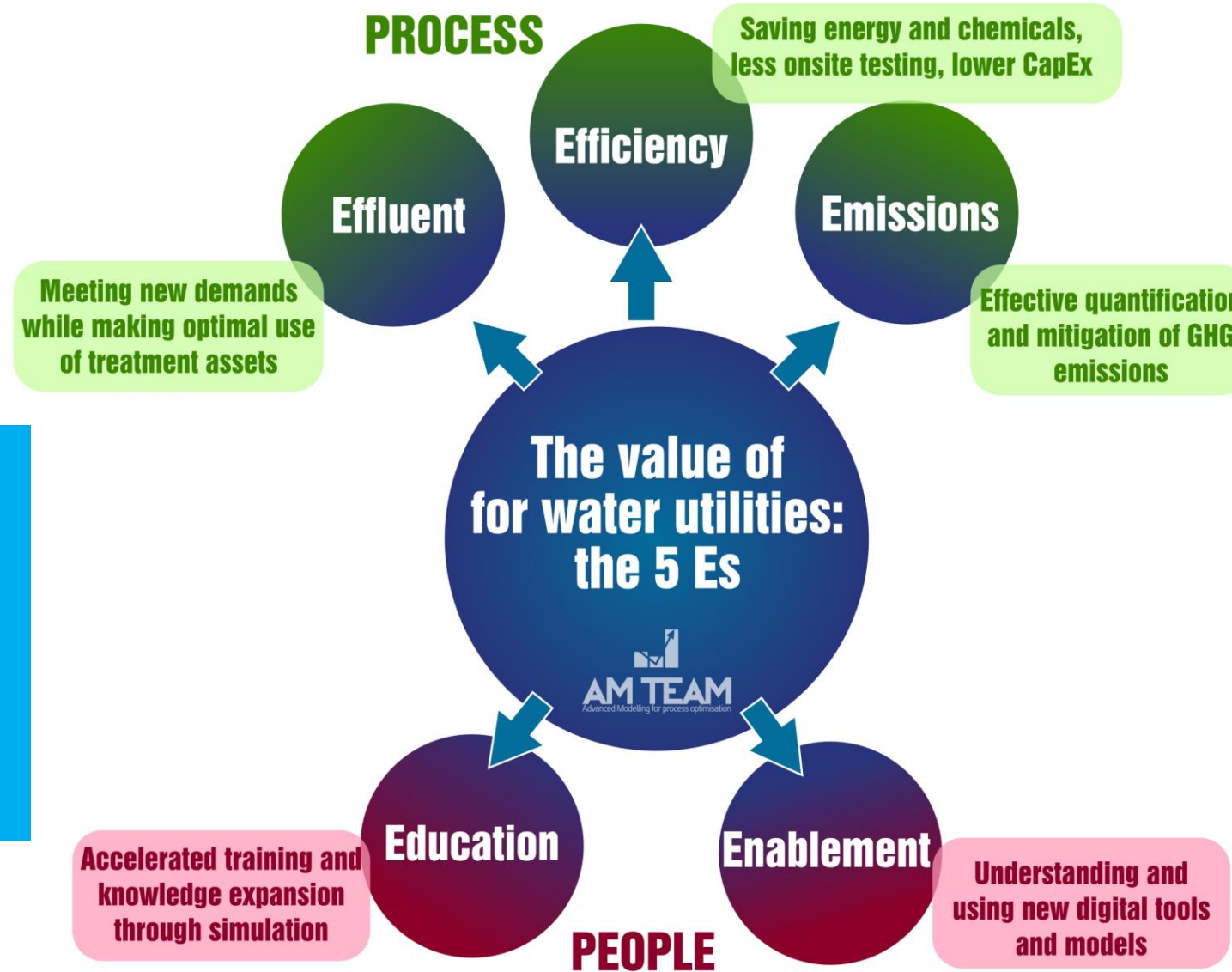


**Drastic reduction of  
N<sub>2</sub>O production**

# CONCLUSIONS

# CONCLUSION

**A DIGITAL  
TWIN SERVES  
MULTIPLE  
GOALS**



# THANK YOU !

Scan to  
connect



[Wim.Audenaert@AM-Team.com](mailto:Wim.Audenaert@AM-Team.com)

# REALISING DIGITAL TWINS

JAMES BALLARD, SEVERN TRENT



SEVERN  
TRENT

# AGENDA

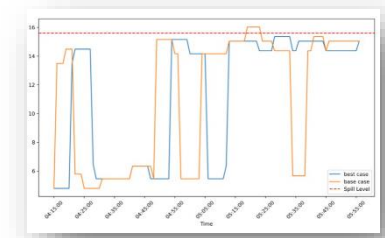
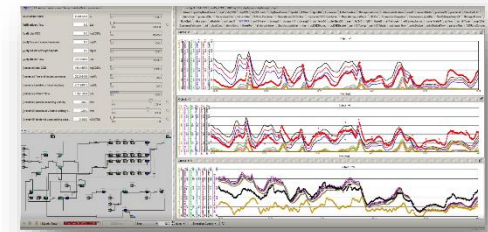
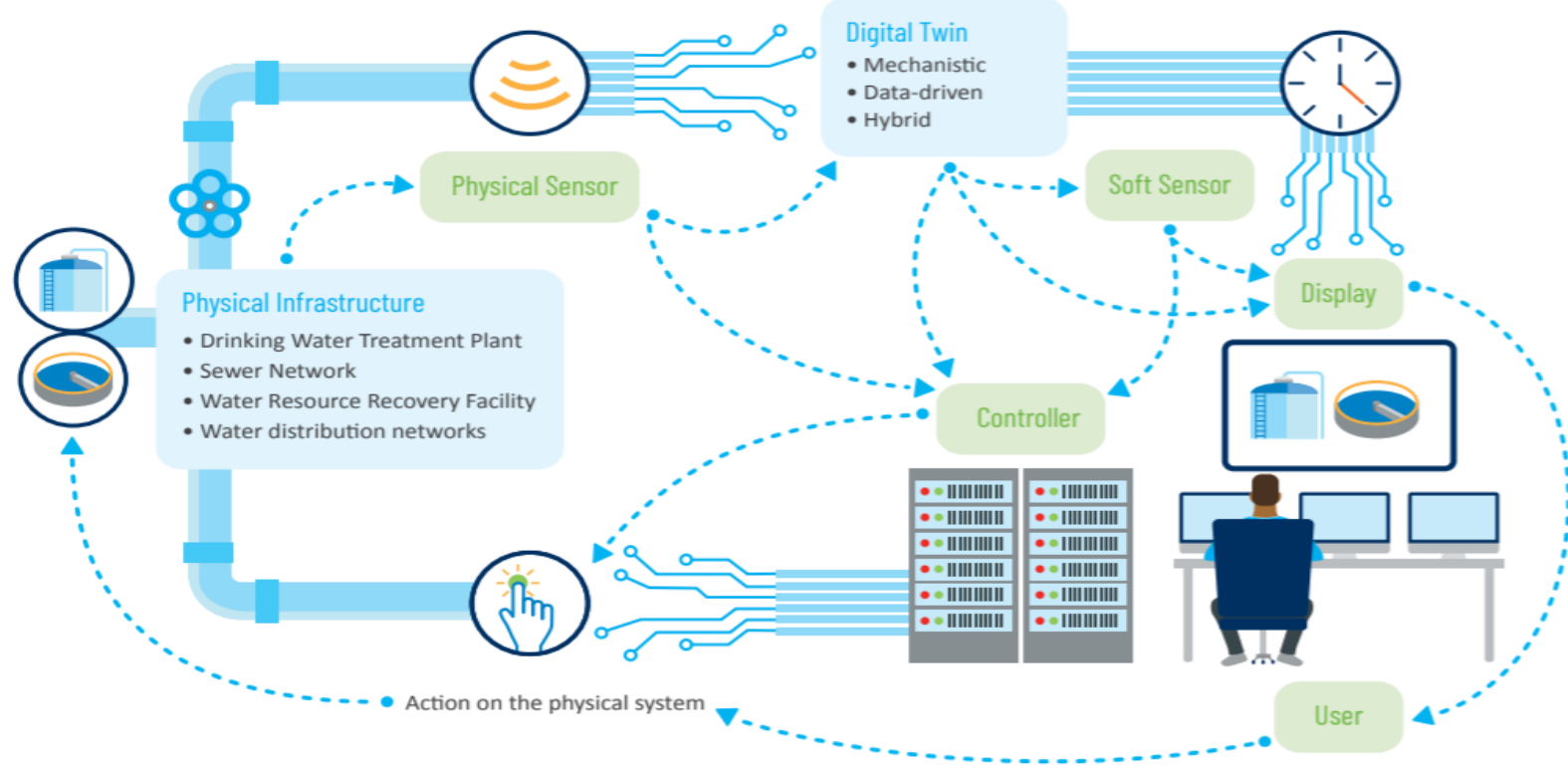
- Data Quality
- Mechanistic vs Data Driven
- Insights – how far can we go?
- Technology Stack





# WHERE DO DIGITAL TWINS FIT IN?

- 1. Data Catalogue:
- 2. Data Acquisition and Storage:
- 3. Analytics and Diagnostics:
- 4. Simulation and Optimisation:
- 5. Visualisation and Reporting (UI/UX):
- 6. Alerts and alarms:

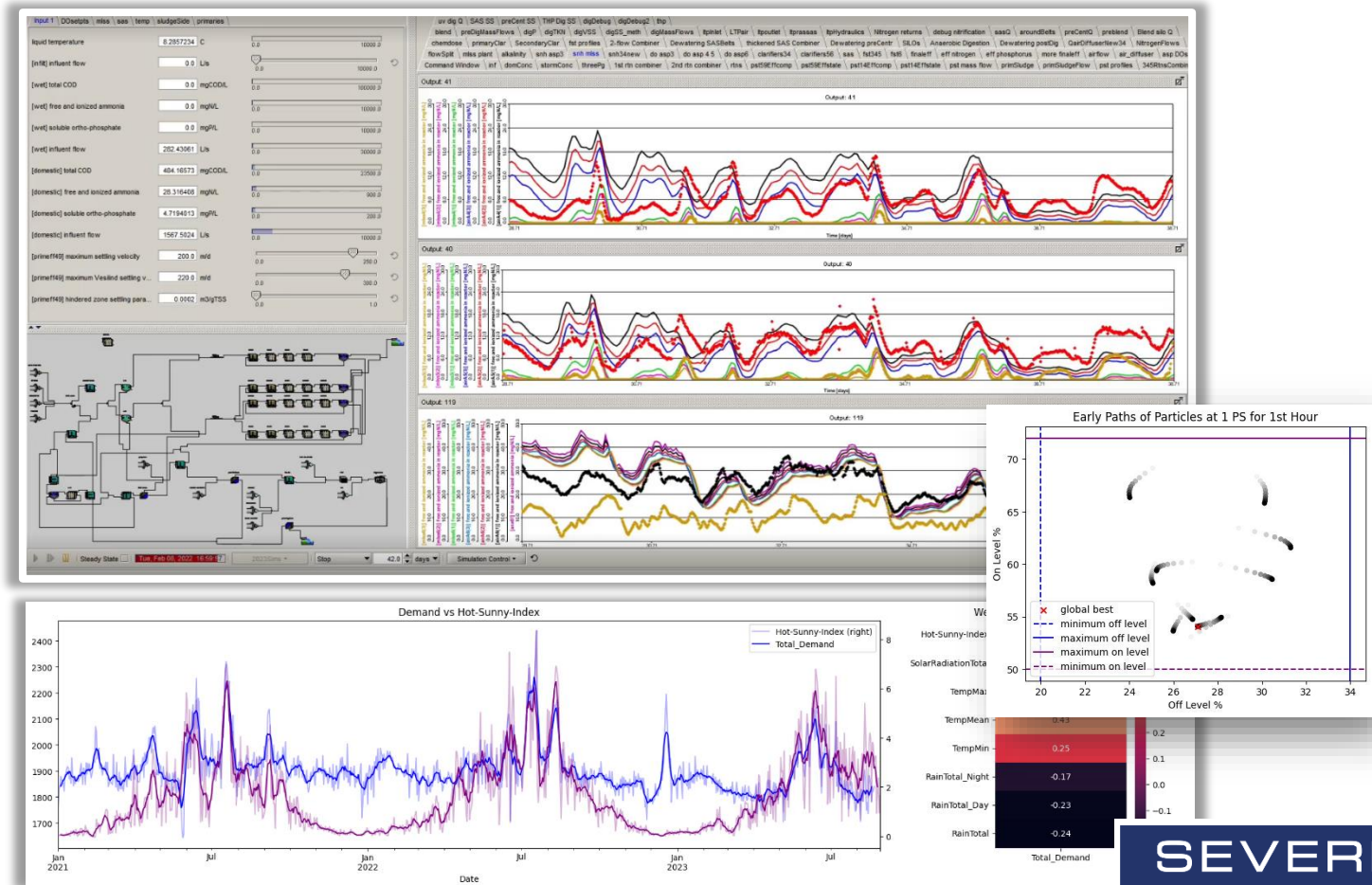


Ref: <https://iwa-network.org/>

# REQUIREMENTS OF A DIGITAL TWIN

How do we build digital twins, and how do we enhance them?

- Scalability
- Baseline performance
- Calibration and validation
- Drift from “normal”
- Soft sensing
- Alarms and alerts
- AI/ML



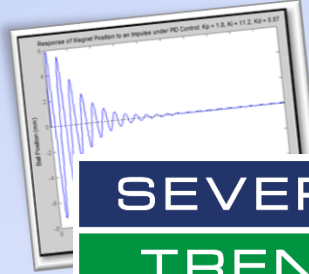
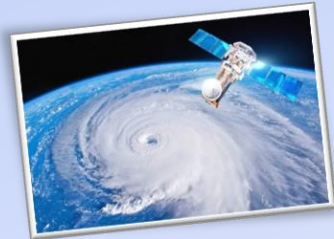
# EXAMPLE1: AIOT – WASTE NETWORK DIGITAL TWIN

Artificial Intelligence of Things - optimising the use of existing latent storage



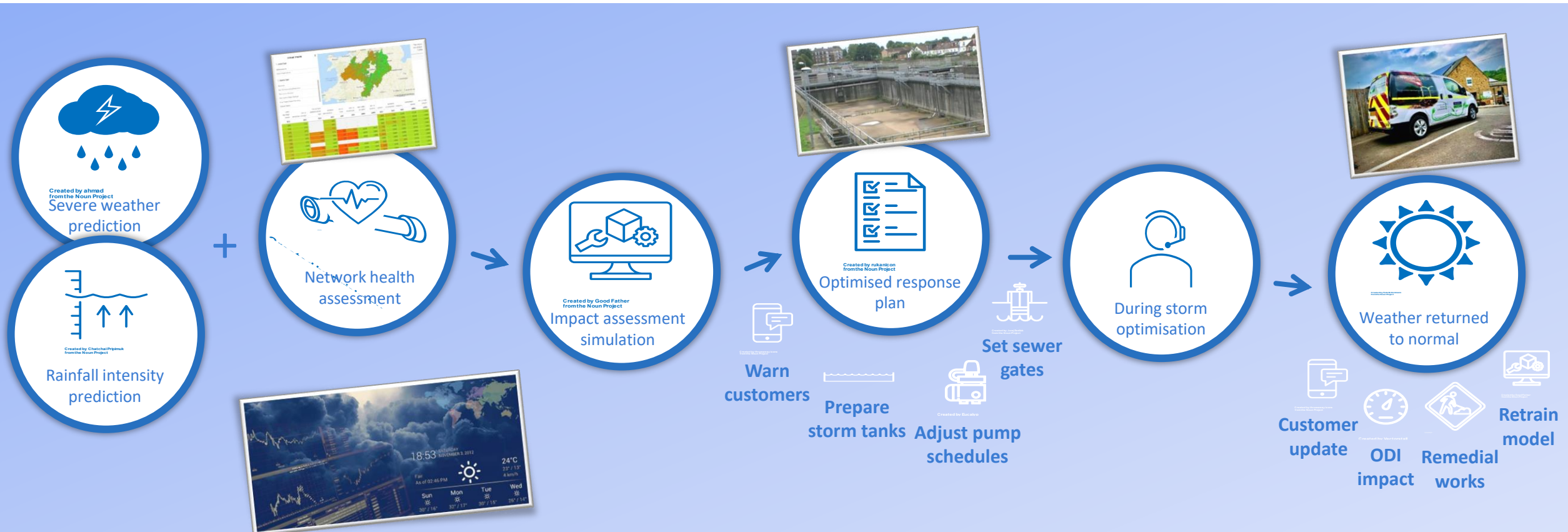
Flooding, Overflow Spills, Pollutions

Digital Twin – Minimise Additional Storage



SEVERN  
TRENT

# EXAMPLE1: AIOT – WASTE NETWORK DIGITAL TWIN



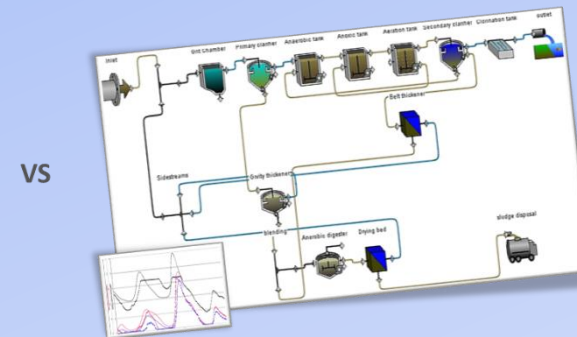


# EXAMPLE 2: WWTW – NET ZERO DIGITAL TWIN

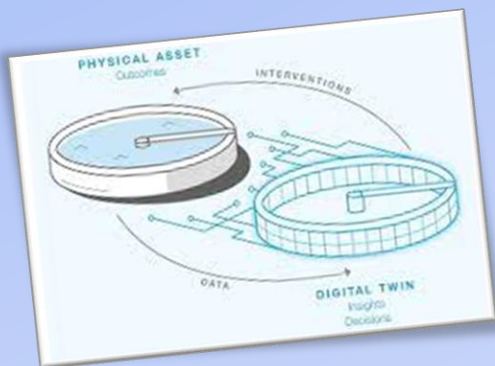
Ensuring waste is safely taken away



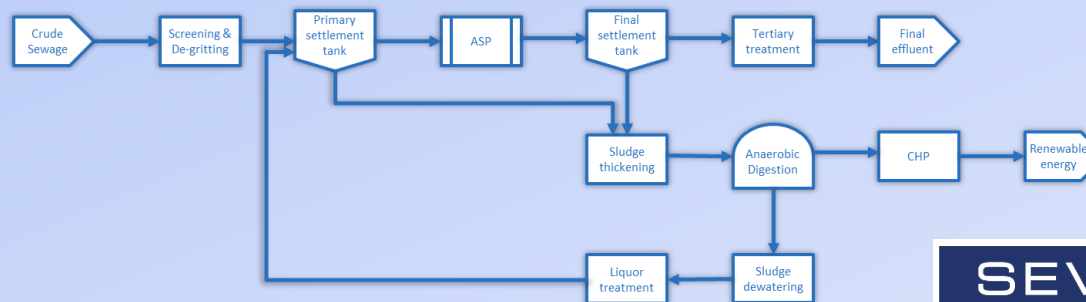
Moving from 3D models to Digital Twins



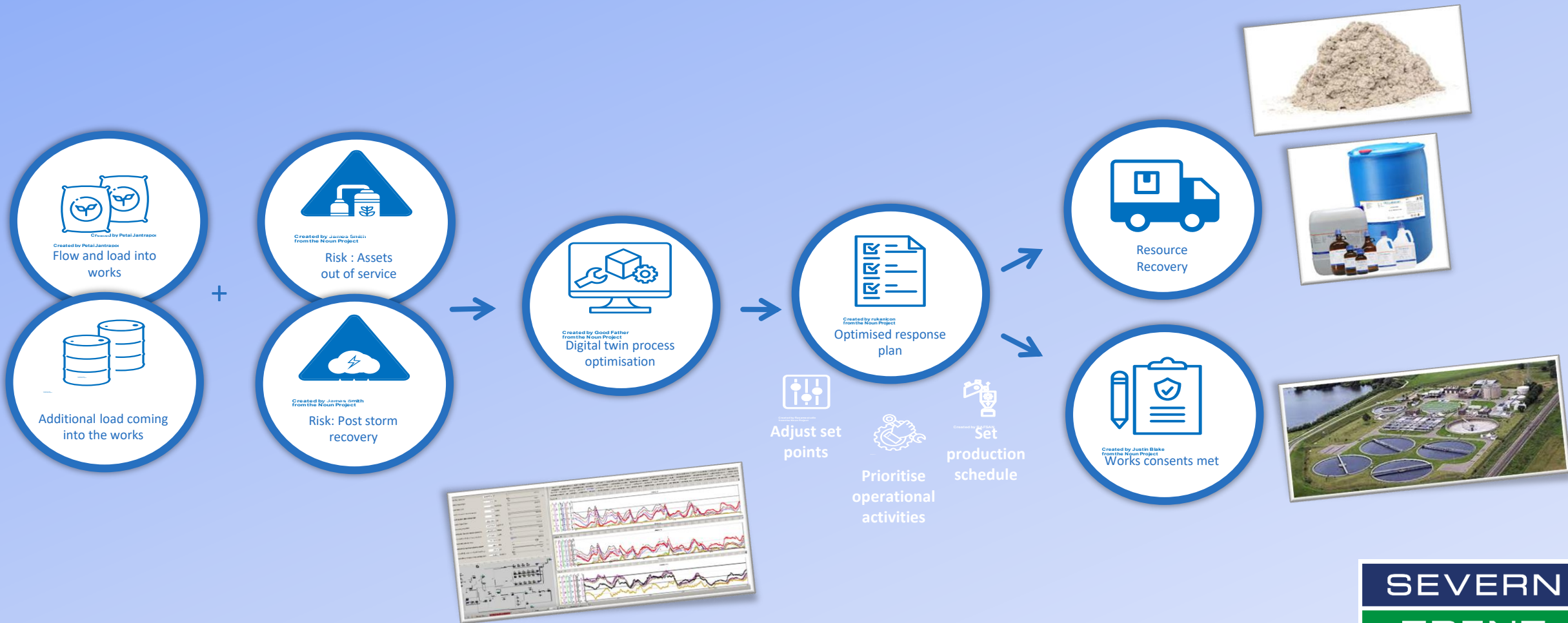
1000's simulations to optimise



Increasing complexity of WWTW



# EXAMPLE 2: WWTW – NET ZERO DIGITAL TWIN



## SUMMARY

- Data Quality
- Mechanistic vs Data Driven
- Insights – how far can we go?
- Technology Stack



# Q&A Discussion

MODERATOR: OLIVER GRIEVSON



# UPCOMING IWA WEBINARS & EVENTS



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Empowering Women in  
Water: Perspectives from  
the Asia-Pacific Region

8 MARCH 2024  
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# UPCOMING IWA WEBINARS & EVENTS

A promotional poster for the World Water Congress & Exhibition. The background is a high-angle photograph of the Toronto skyline, including the CN Tower, set against a blue sky with light clouds. The water of Lake Ontario is visible in the foreground. The text 'Shaping our water future' is at the top in a light blue font. The IWA logo is in the top right corner. The main title 'World Water Congress & Exhibition' is in large white font. At the bottom, it says 'TORONTO CANADA' and '11-15 AUGUST 2024'. Logos for CAWQ/ACQE, CWWA/ACEPU, and the City of Toronto are at the bottom left.

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