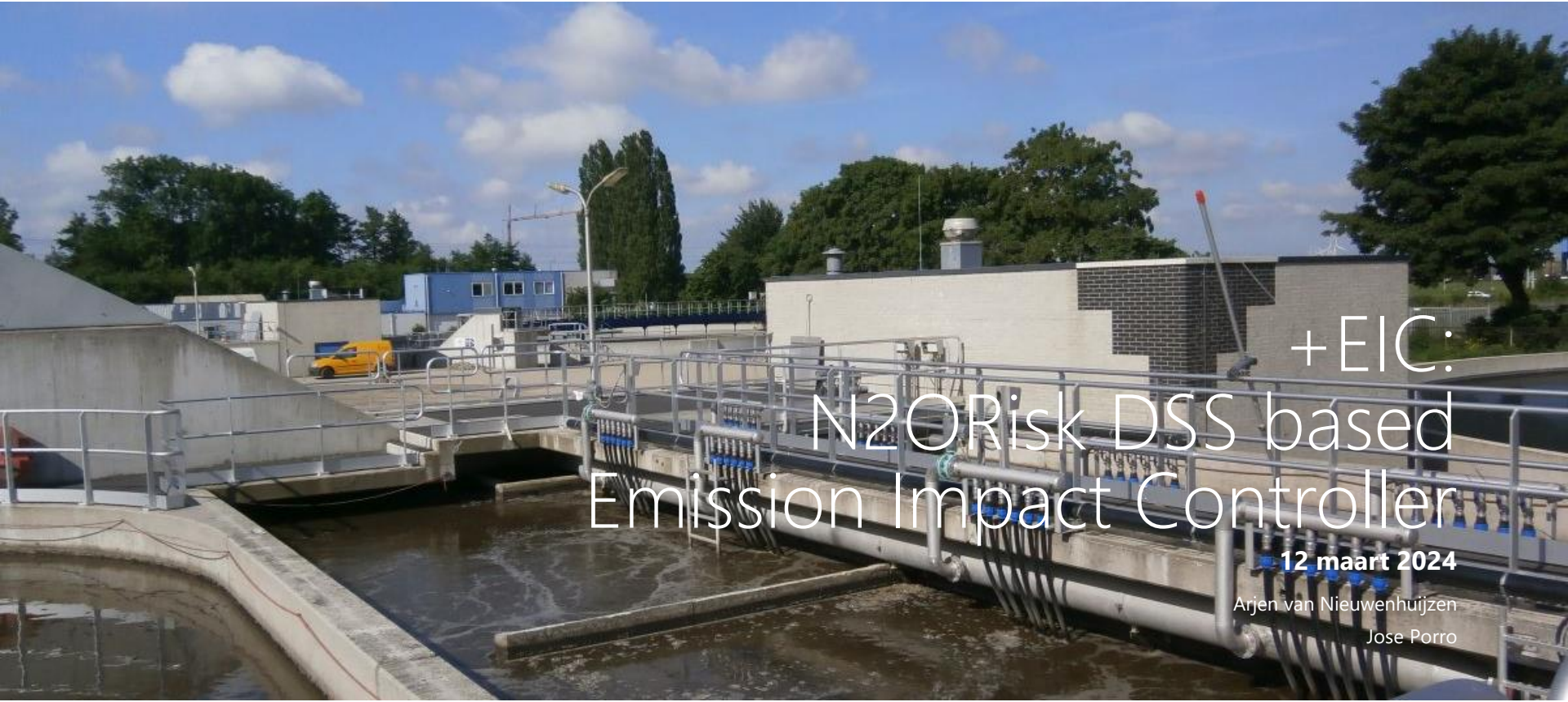


+EIC: N2ORisk DSS based Emission Impact Controller

12 maart 2024

Arjen van Nieuwenhuijzen
Jose Porro

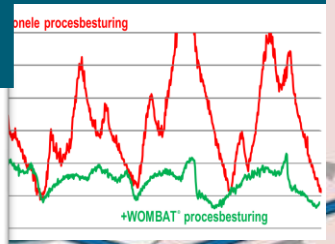
+Digital Water Solutions

https://digitalsolutions.witteveenbos.com

+Dataprofeet

+DigiProH$_2$O Sewage water

+WOMBAT: Model Based N/O$_2$Controler

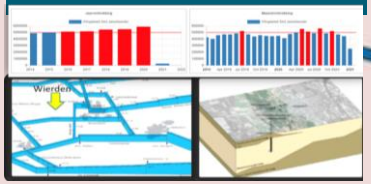


+OSCA Optimal Sewage water system Control AI

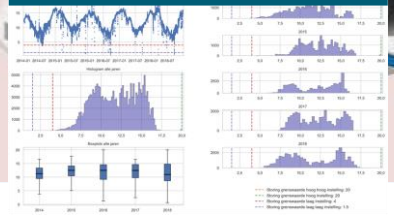
+EIC – Emission Impact Controller

+Circular Design Tool

+BrineScan

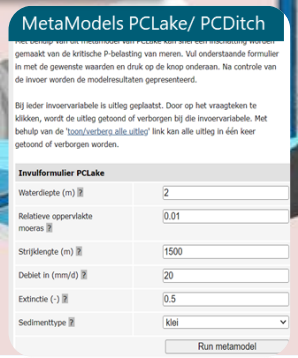


+DigiProH$_2$O Potable water

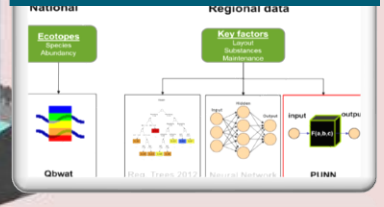


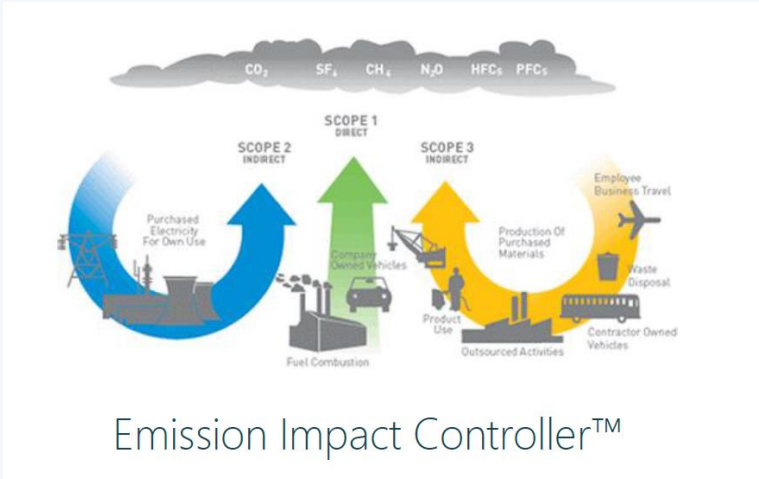
+ZoetWaterScan

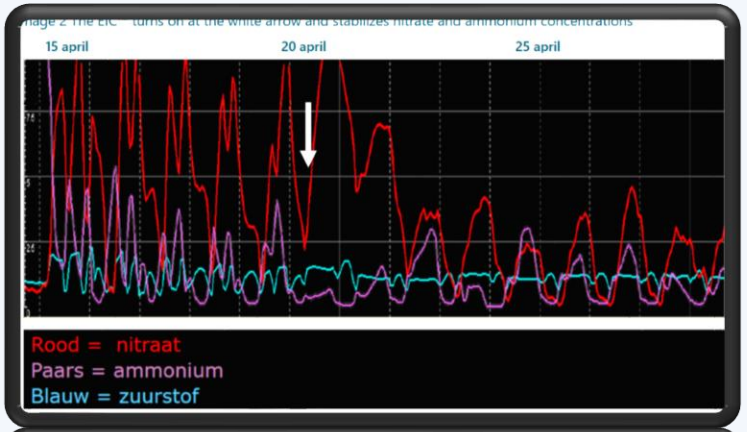
MetaModels PCLake/ PCDitch



+AI-model Ecologische Kwaliteitsratio





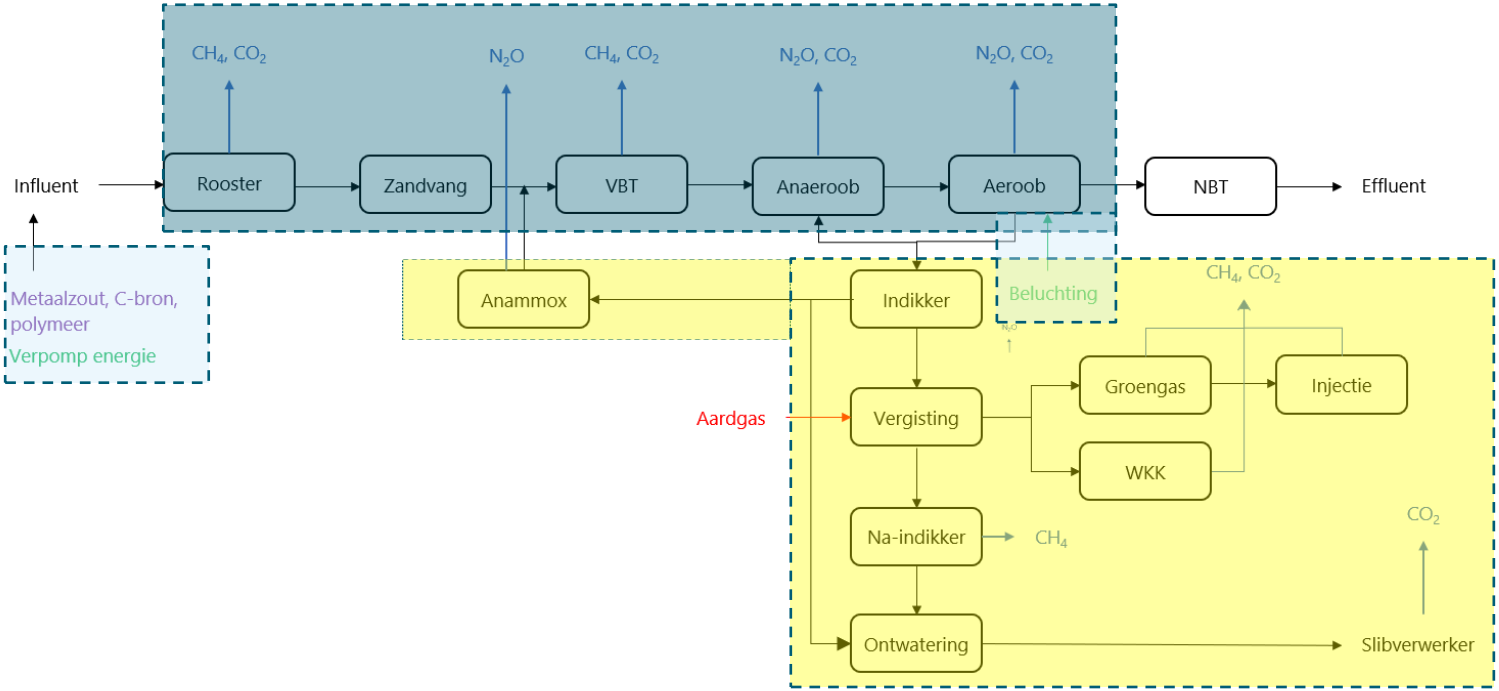


+EIC – Python based Emission Impact Controller

+Emission Impact Controller (+EIC)

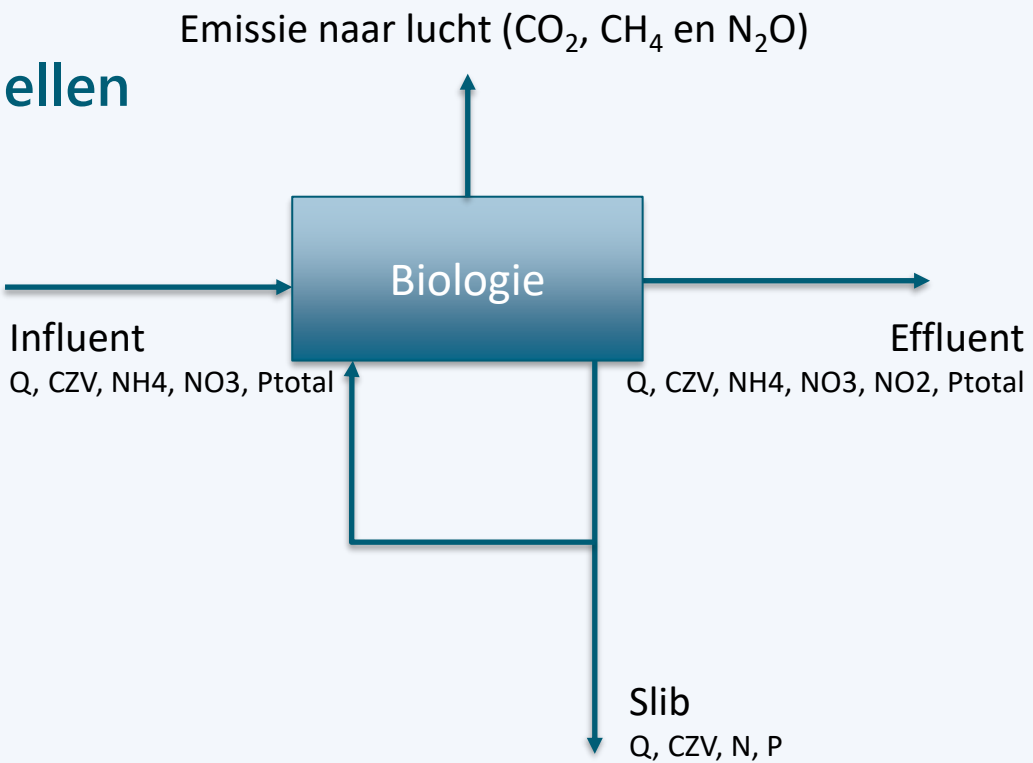
- Real time monitoring op **Overall $CO_{2\text{-equivalent}}$-emissie**
- Procesemissies: **Machine Learing + risico N2ORisk DSS-modellering** (Cobalt Water)
- Procesemissies: **IPCC berekening** op basis van massabalansen voor **CO_2 en CH_4**
- Indirecte $CO_{2\text{-equivalent}}$-emissies via **elektra beluchting + recirculatie en chemicaliëndosering**.
- Sturing op **effluentkwaliteit** met +WOMBAT
- Optioneel: Machine Learning integrale instelling voor beluchting en recirculatie met DigiProH_2O
- **Python based combinatie van totale $CO_{2\text{-equivalent}}$-emissie** van energieverbruik, chemicaliëndosering en procesemissies verlaagd worden én effluentkwaliteit behaald wordt.
- **Besluitvormende KPI's** $CO_{2\text{-equivalent}}$ in **+EIC Dashboard** voor integrale procesoptimalisatie
- Optioneel: **setpoints naar SCADA-controller**

+EIC ($CO_{2\text{-equivalent}}$) met focus op de waterlijn RWZI



Data validatie & RWZI modellen

- Validatie van processdata met de Dataprofeet® (noise removal, outliers)
- Massabalansen o.b.v. stromen van CZV, N en P

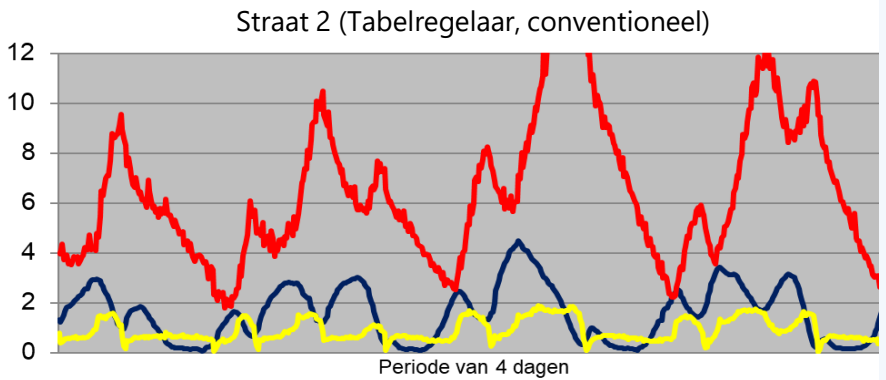


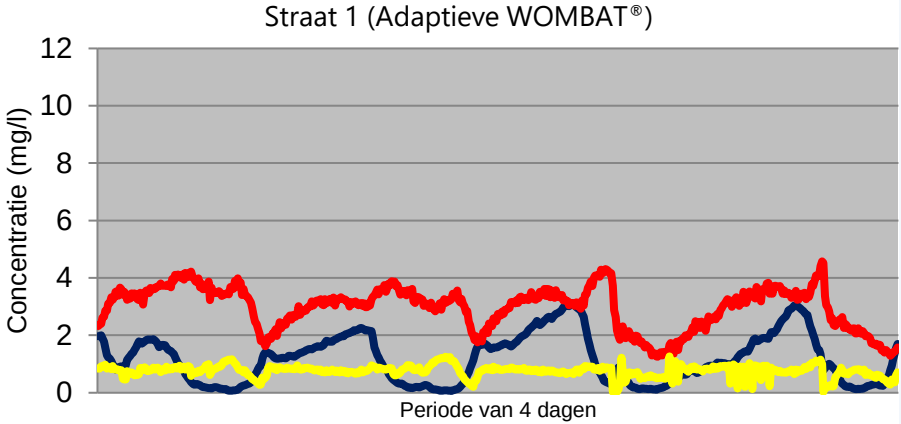
+EIC op basis van +WOMBAT

+WOMBAT-regelmodule in SCADA:

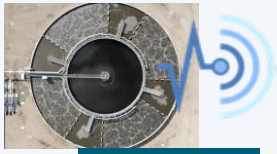
- Minder pieken
- Verlaging pieken DO, NH4, NO3
- Lager energieverbruik
- Lager Ntotaal
- Lager Ptotaal
- Lager metaalzoutverbruik

rood = nitraat
blauw = ammonium
geel = zuurstof

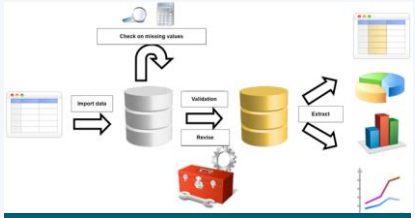




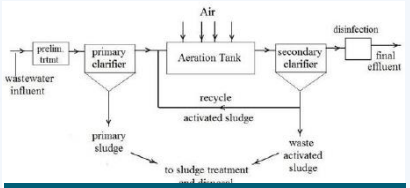
+EIC



MEETDATA



+DATAPROFEET



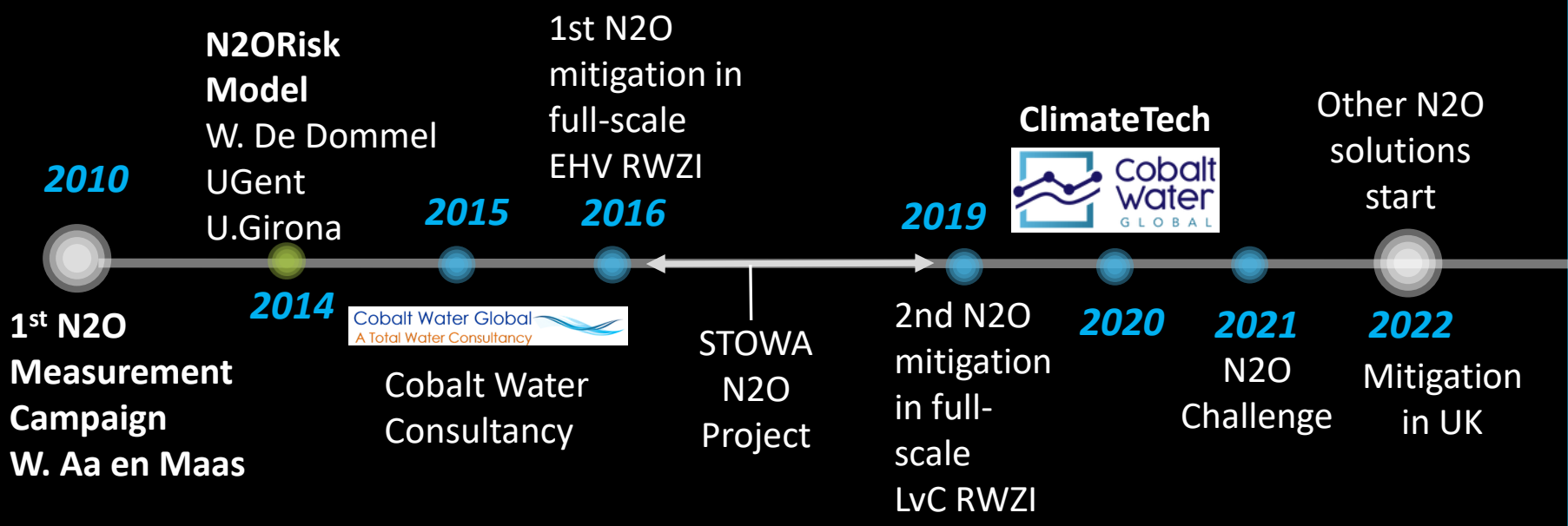
RWZI IPCC EMISSIE MODEL

BEREKENING ML + RISISCO
N2ORISKDSS

RWZI +WOMBAT MODEL

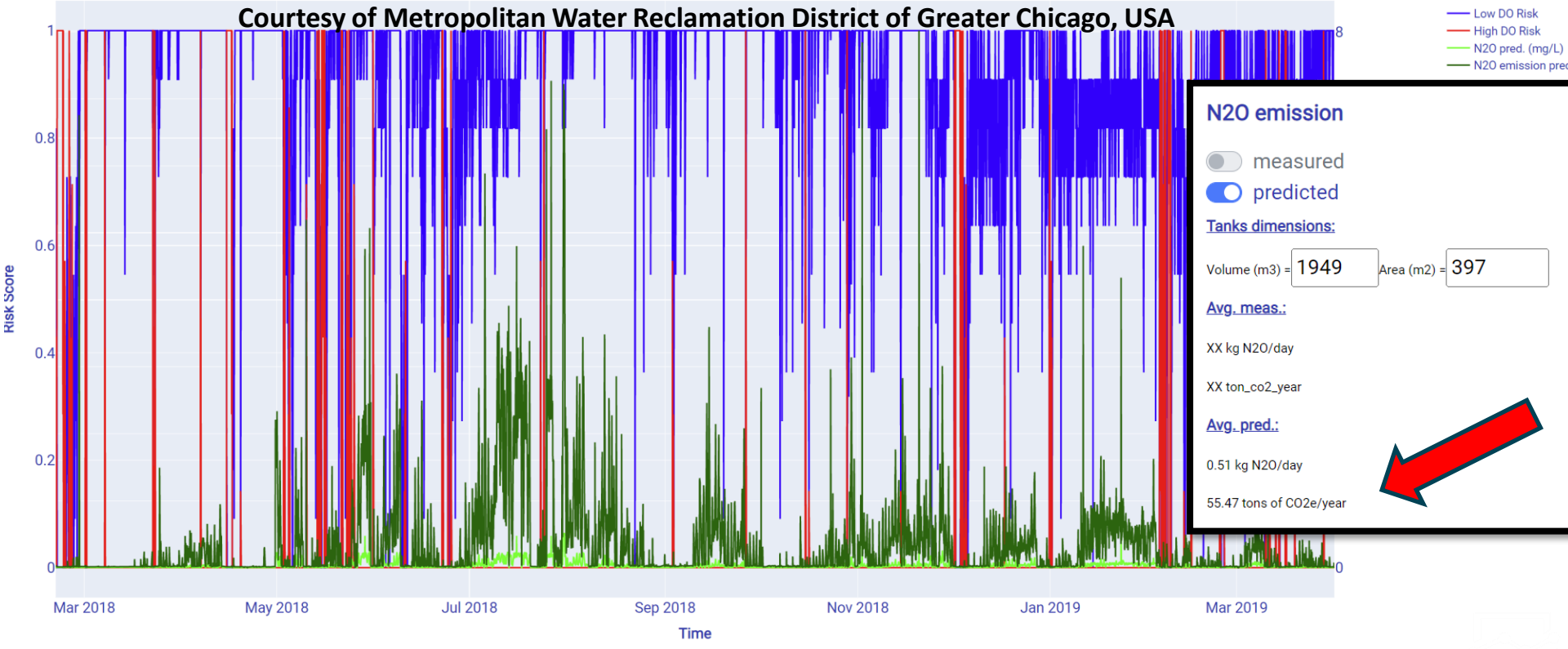
VISUALISATIE DASHBOARD

Cobalt Water Global N2O timeline in NL



The N2ORisk DSS has also assessed N2O for more than 10 million people in 10 countries

Assessing N_2O Risk (with AI) and Emissions (with ML)



Dynamic assessment because N2O is dynamic

Reducing N2O with Risk-based AI insights

N2ORisk DSS

Logout

Data to Visualize:

n2oriskdss_jporro...

n2oriskdss_jporro_LVC3.3

Upload .CSV File

Date Selection

Reset Date Range

02/16/2019 →

02/20/2019

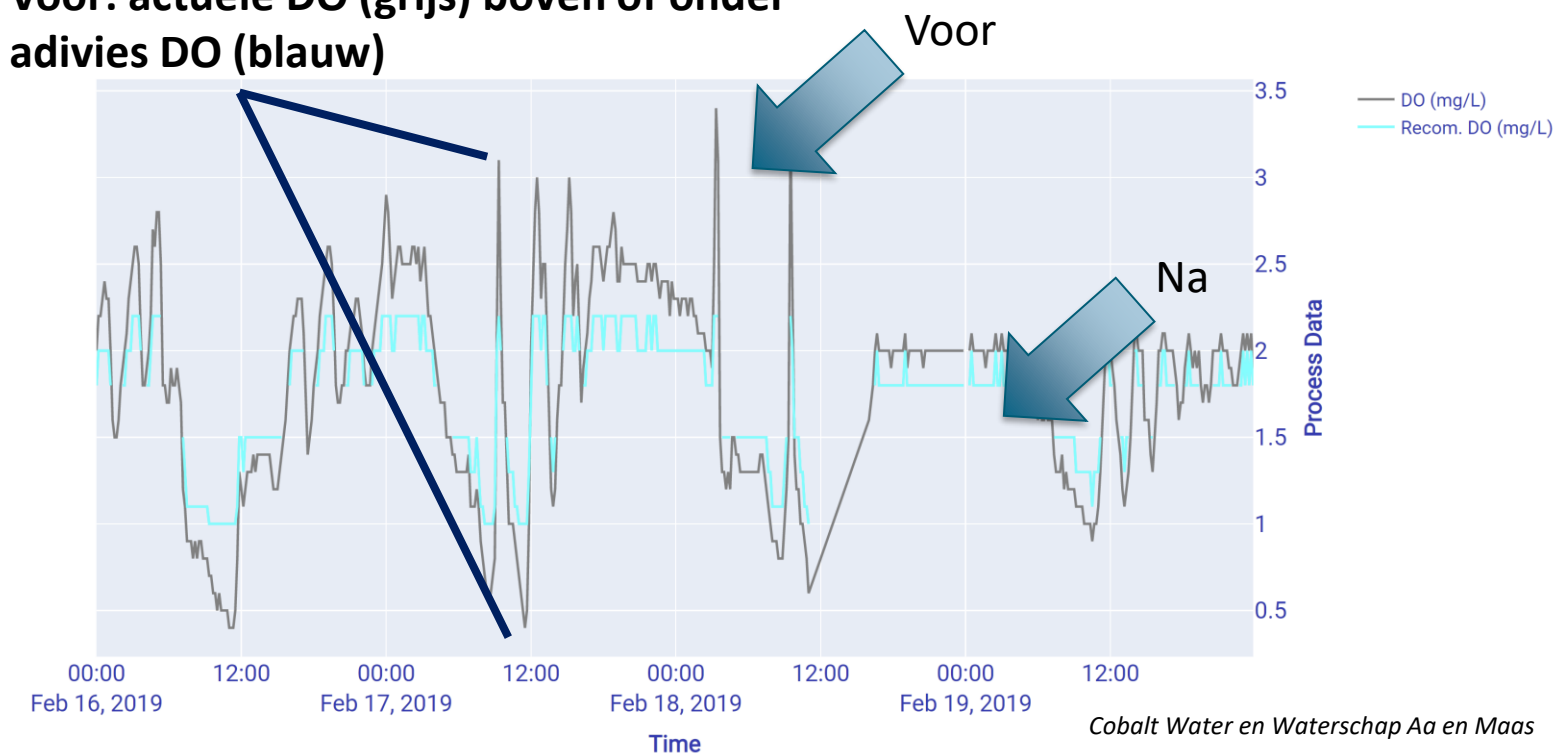
Risk to Display

- Low DO
- High DO
- Overall
- NO2 n/d
- pH
- High DO Denitrif.
- COD/N
- Overall Denitrif.

Nitrification Mode

Data to Display

Voor: actuele DO (grijs) boven of onder adivies DO (blauw)



Cobalt Water en Waterschap Aa en Maas

Witteveen + Bos

Cobalt water GLOBAL

Cobalt water GLOBAL

N2ORisk DSS

Logout

Data to Visualize:

n2oriskdss_jporro...

n2oriskdss_jporro_LVC3.3

Upload .CSV File

Date Selection

Reset Date Range

02/16/2019 →

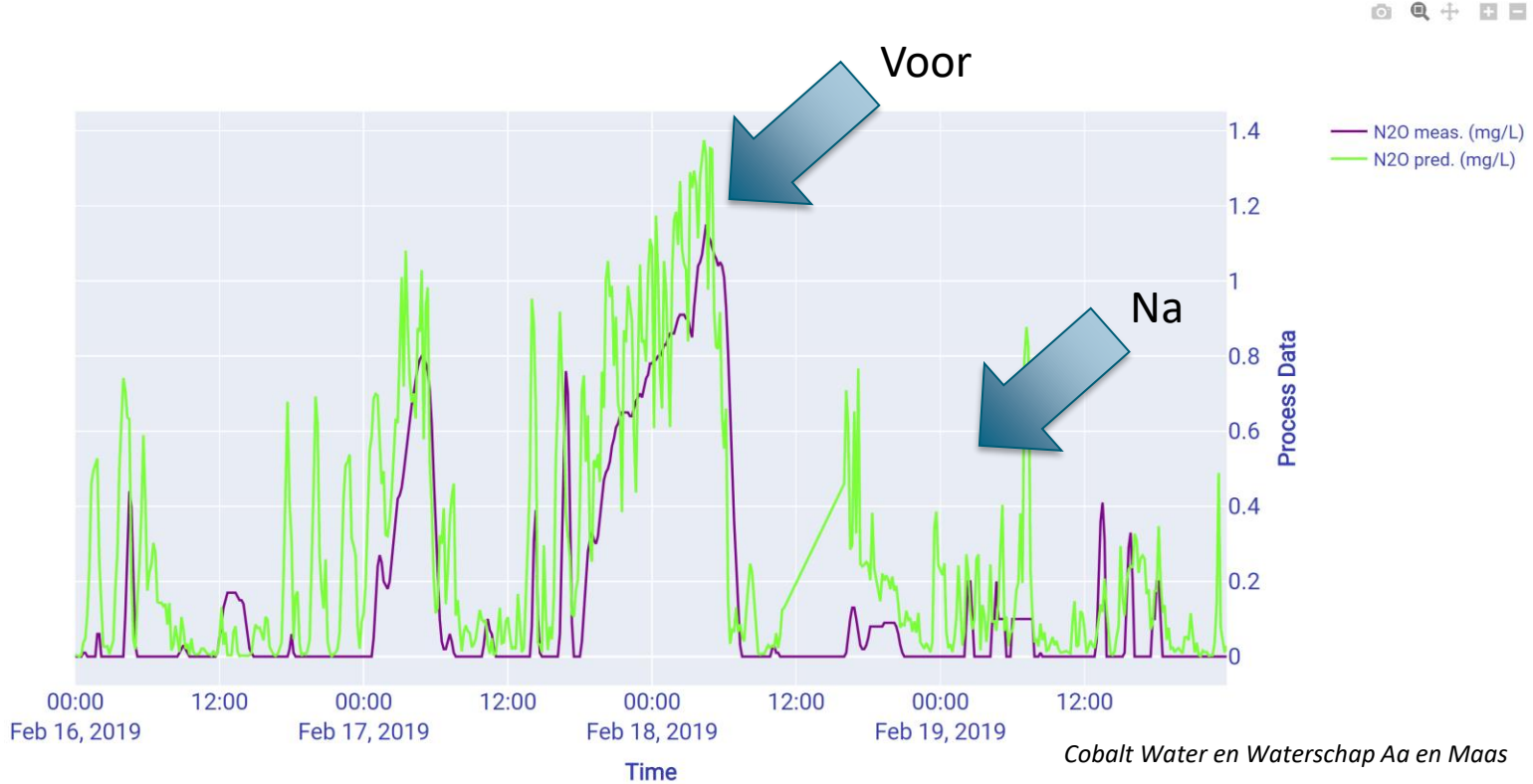
02/20/2019

Risk to Display

- Low DO
- High DO
- Overall
- NO2 n/d
- pH
- High DO Denitrif.
- COD/N
- Overall Denitrif.

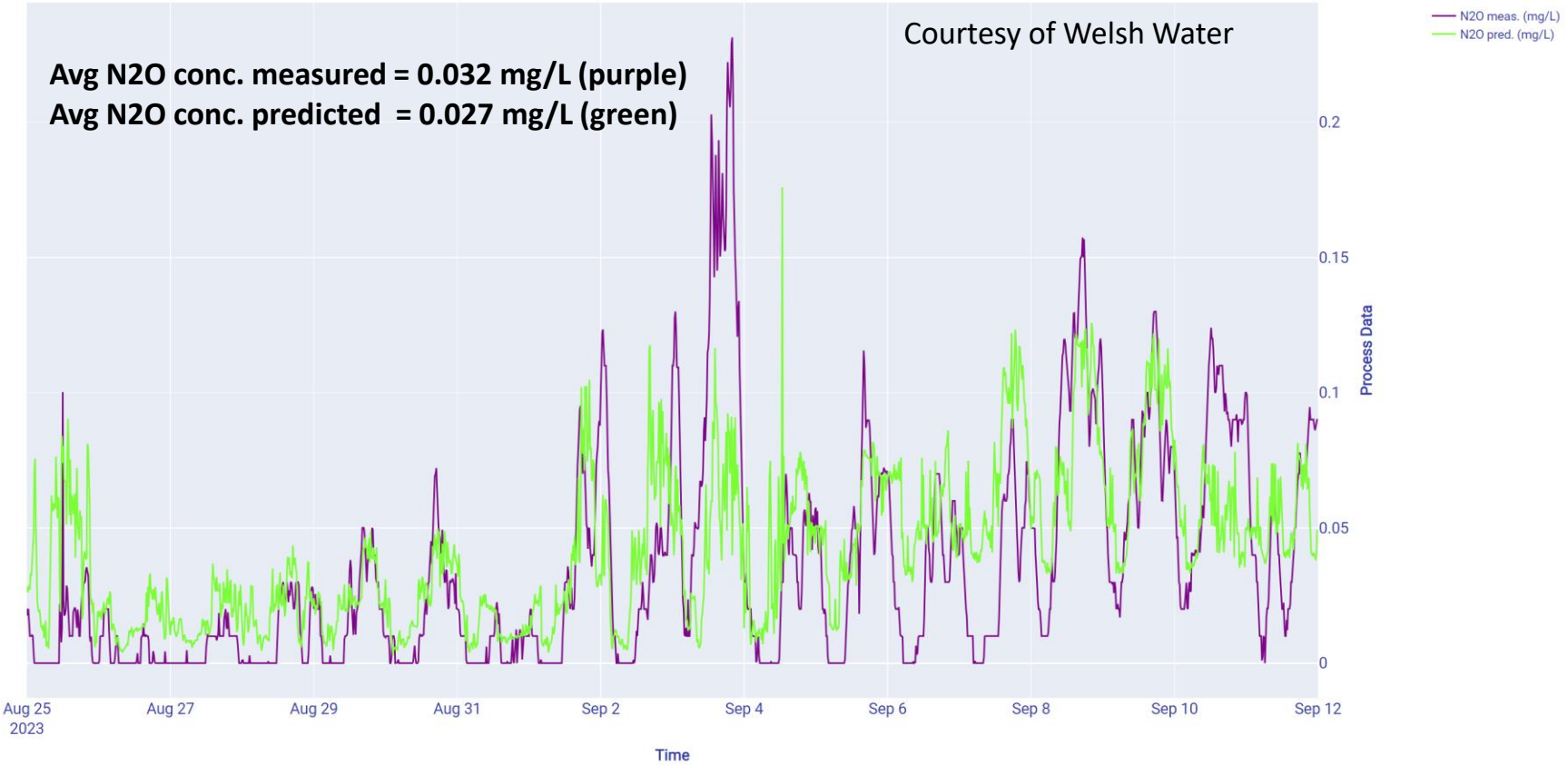
Nitrification Mode

Data to Display

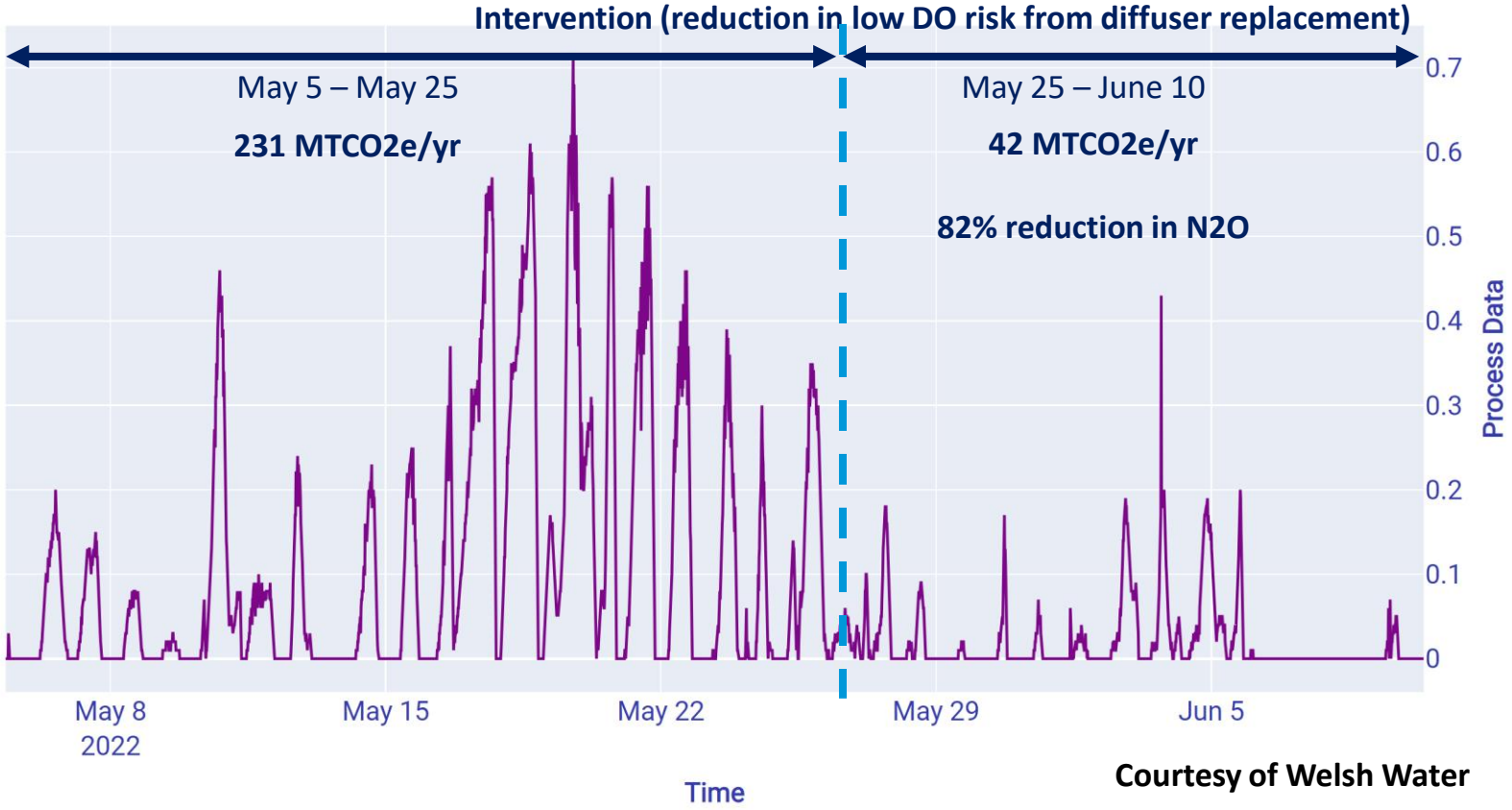


Cobalt Water en Waterschap Aa en Maas

Monitoring N2O in other lanes w/ ML
Lane 1 measured N2O versus Lane 2 model predictions
(Model trained on Lane 2 N2O measurements)



N2O Reduction – Cog Moors (Lane 3, Zone 2)



Courtesy of Welsh Water

$CO_{2\text{-equivalent}}$ modellering

- Berekening van CO_2 en CH_4-emissies conform IPCC2021,
- N_2ORisk DSS model van Cobalt Water (risico + N_2O emissies)
- Energieverbruik beluchting en recirculatie
- Chemicaliënverbruik (metaalzout)
- Monitoring effluentkwaliteit: NO_3, NO_2, NH_4

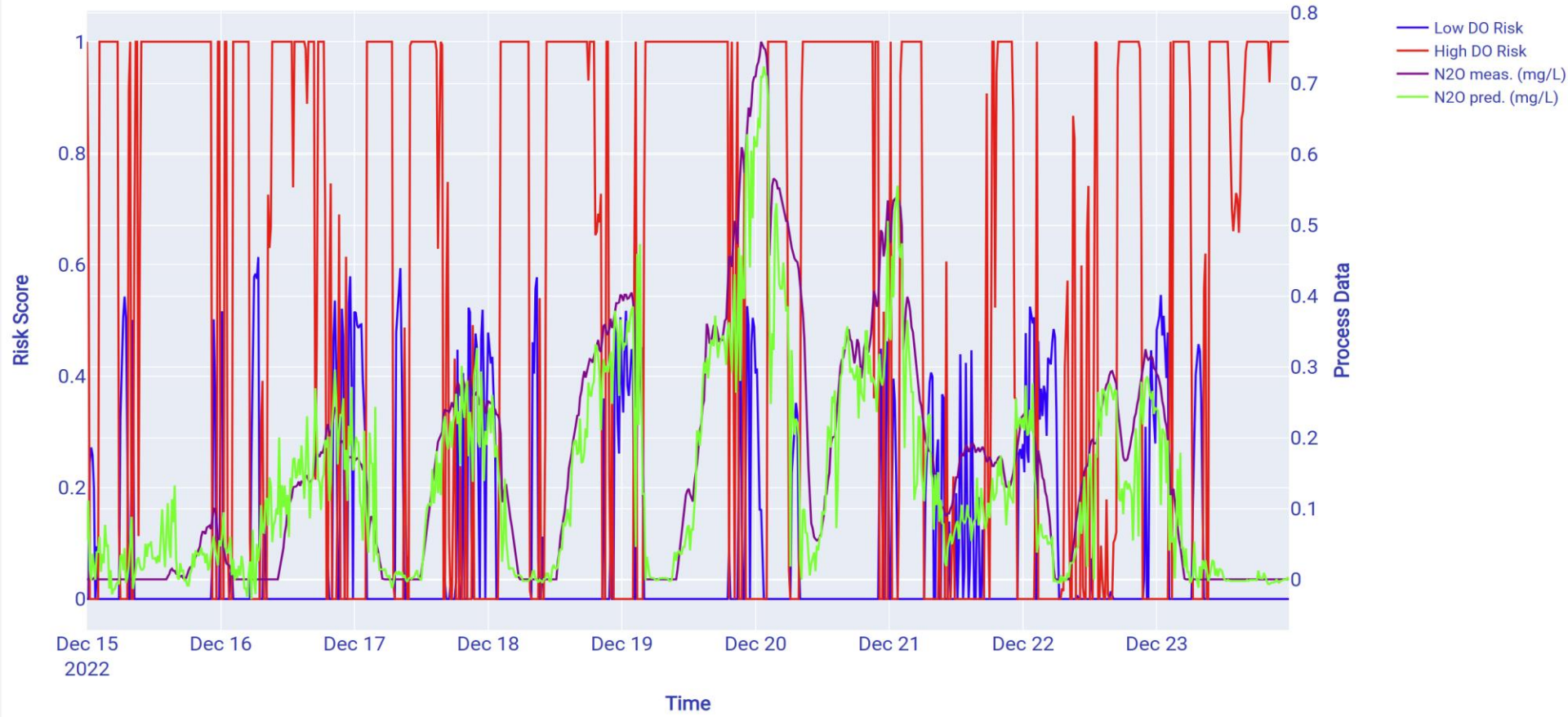
=> vertaling naar overall $CO_{2\text{-equivalenten}}$

=> Dashboard voor besluitvorming aanpassing procesinstellingen

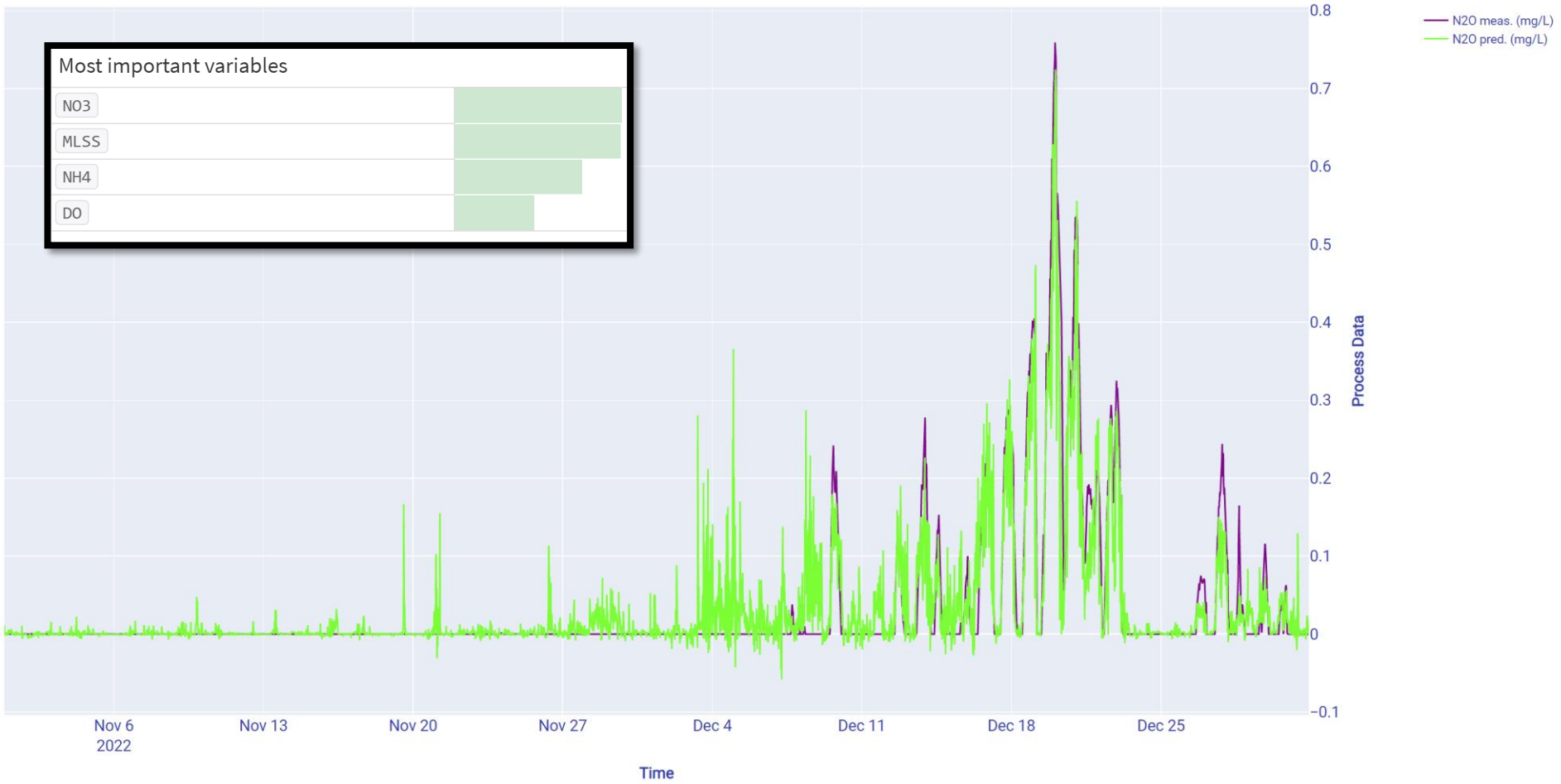
=> Optioneel setpoint voor procesregeling beluchting en recirculatie

2023/2024: demonstratieproject RWZI Dronten - Zuiderzeeland

Dronten Nitrificatie Tank
N2O mainly from risk due to high DO (red)



Dronten Nitrificatie Tank

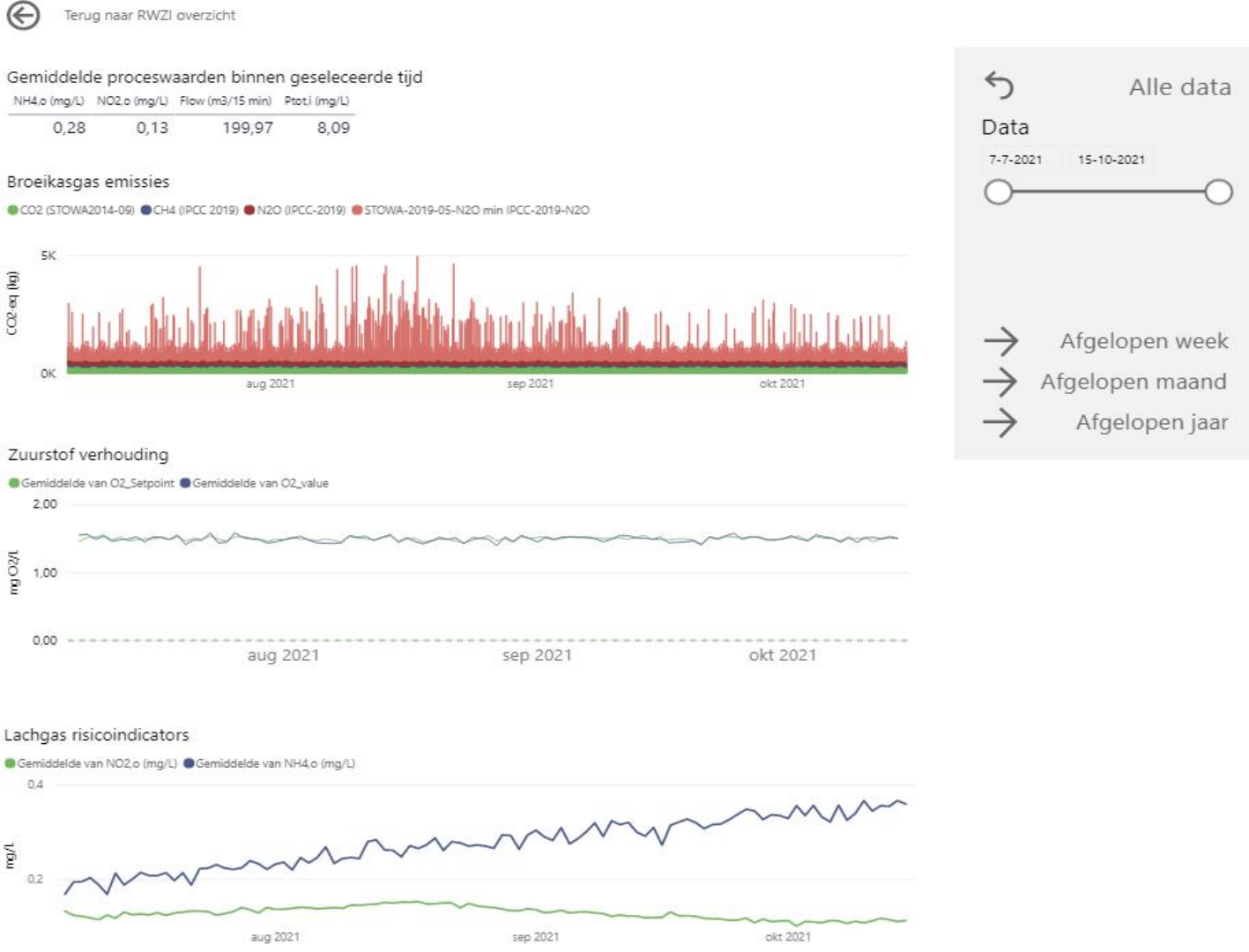


Witteveen + Bos

+EIC

Dashboard

op maand- of weekbasis

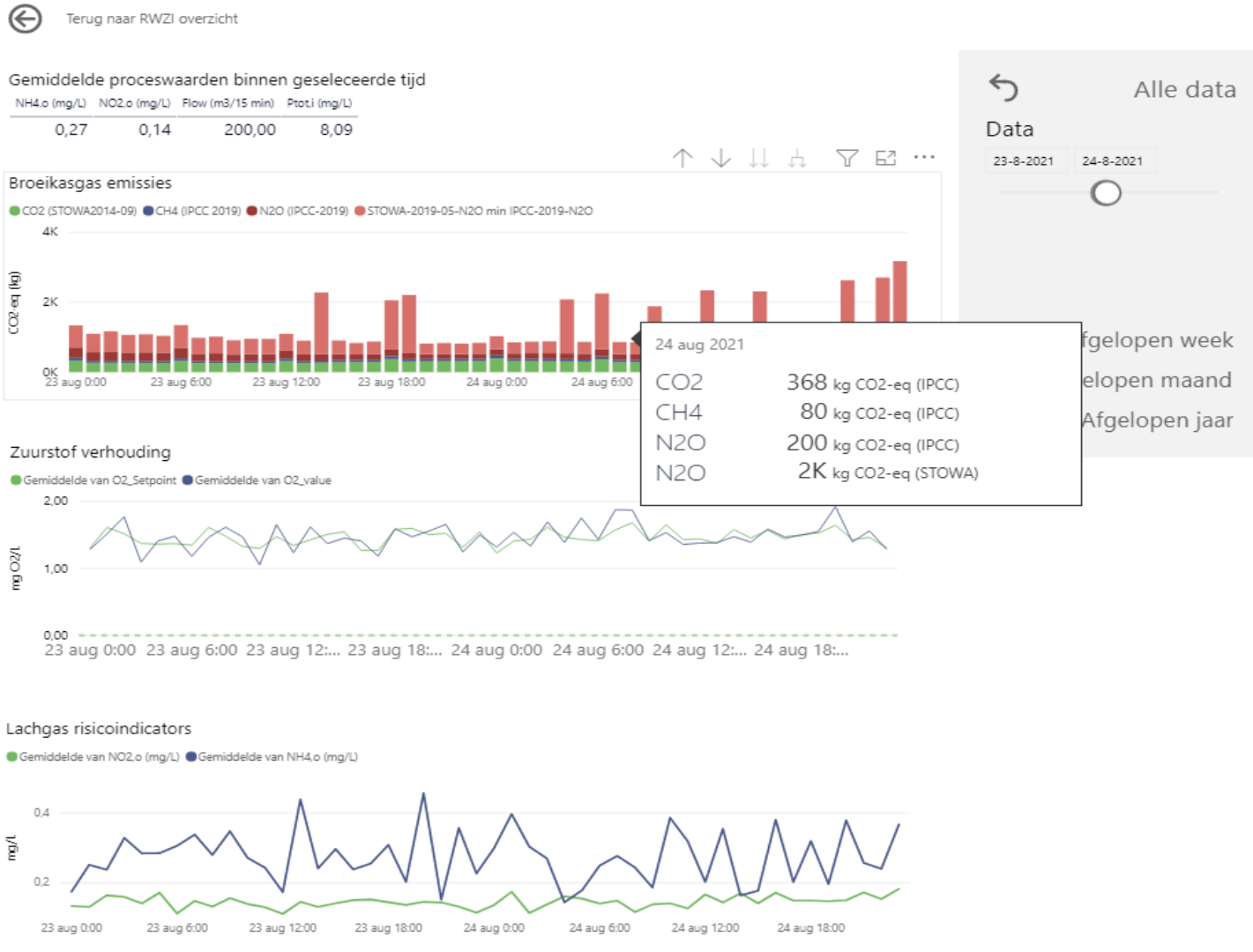


Witteveen + Bos

+EIC

Dashboard

op dag- of uurbasis



Dank u wel

arjen.van.nieuwenhuijzen@Witteveenbos.com

jose.porro@cobaltwater-global.com