

## Monitoring the hotspots and hot moments of nutrient losses in agricultural catchments to support catchment modeling and region-specific selection of mitigation options

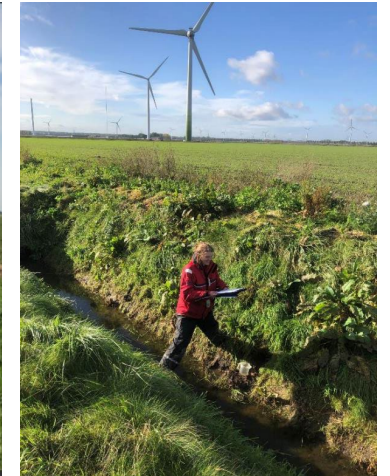
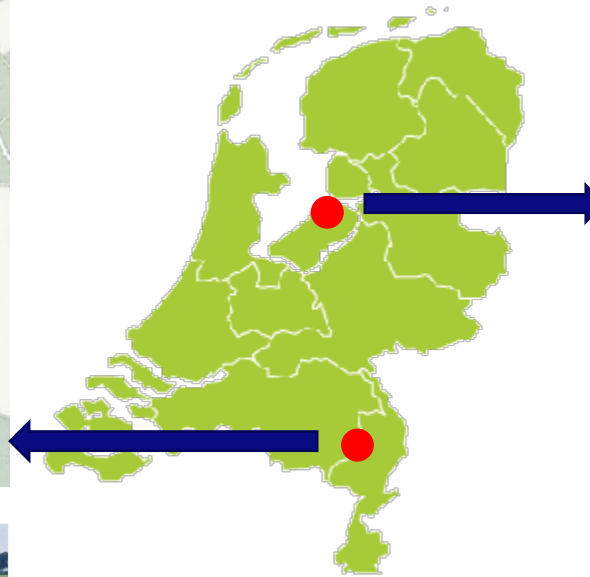
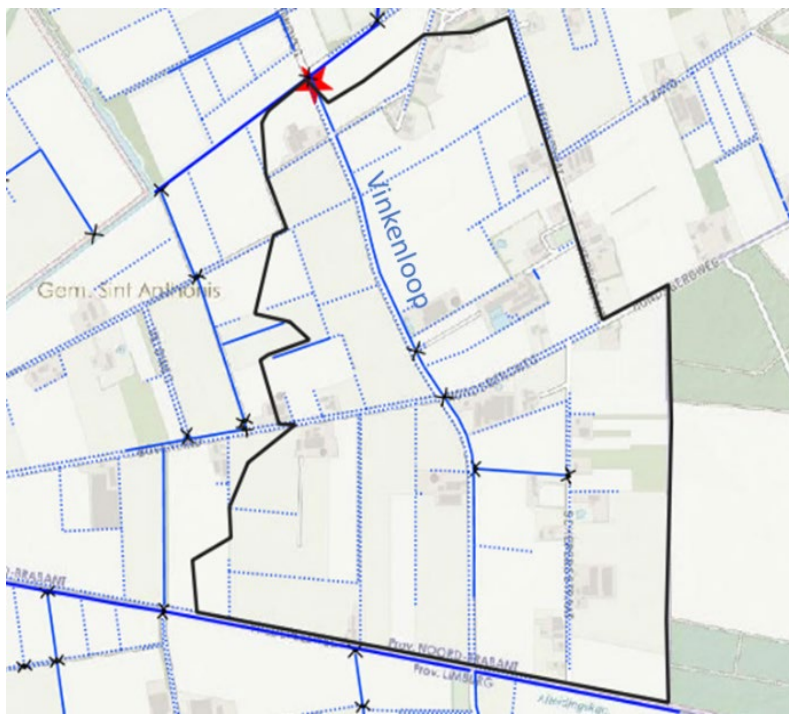
Joachim Rozemeijer  
Kevin Ouwerkerk  
Simon Buijs  
Vince Kaandorp

# Introduction

- Clean water is essential for a healthy environment
- Improvement in Dutch water quality is stagnating
- Extra effort needed to reach the WFD goals in 2027
- Area specific approach: The right actions at the right place
- Area specific monitoring and modeling



# Pilots

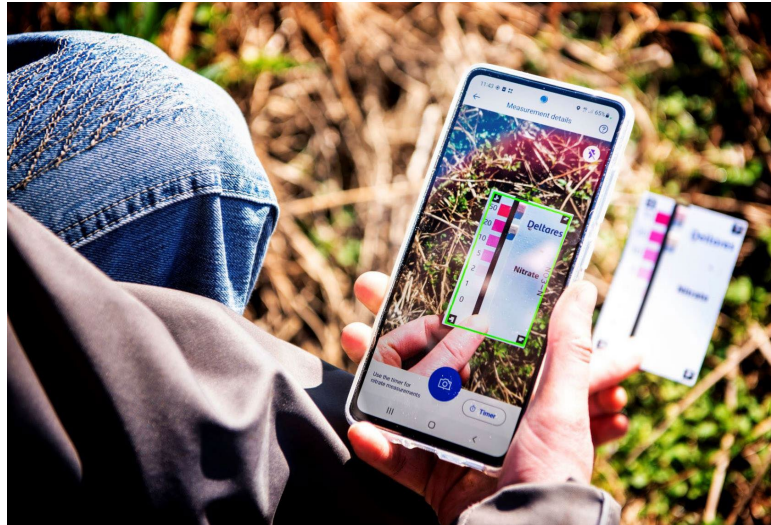


**Deltares**

- Vinkenloop (7 km<sup>2</sup>)
- Freely draining sand area
- Land use: 92% agriculture

- Vuursteentocht (13 km<sup>2</sup>)
- Regulated clay polder
- Land use: 99% agriculture

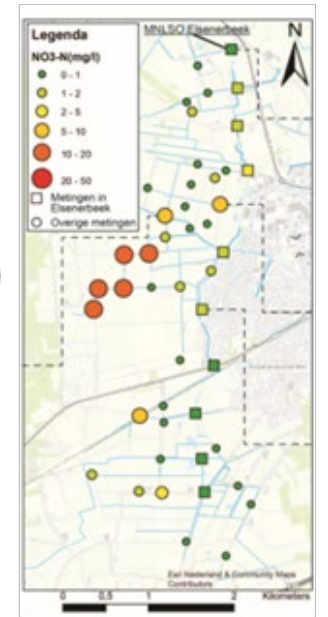
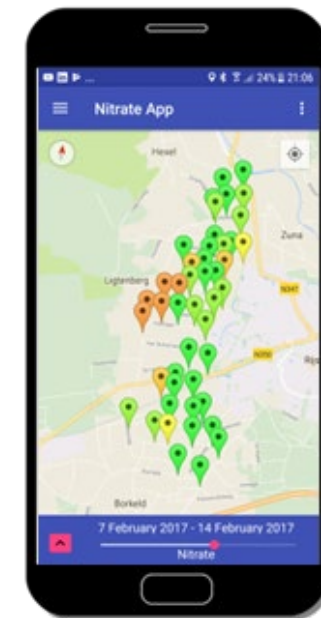
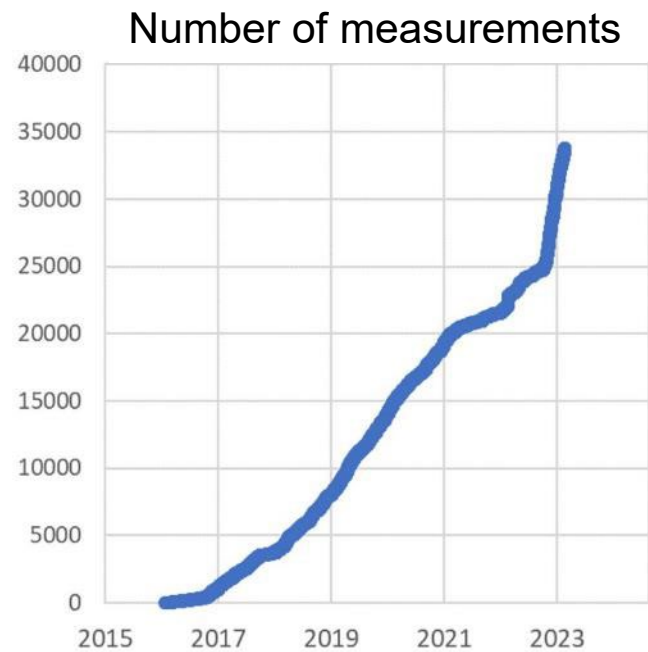
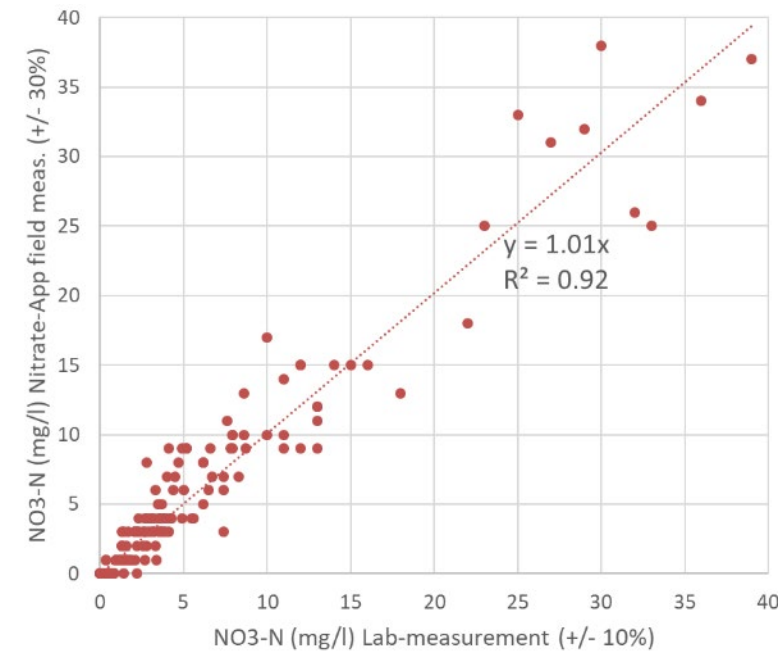
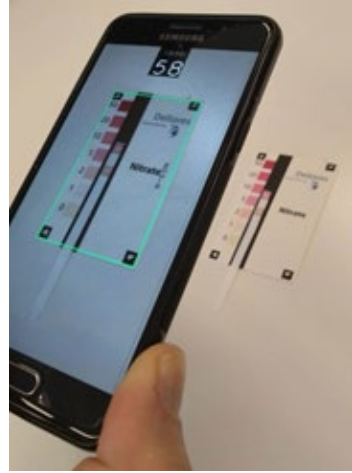
# Routings (hot spots)



# Sensors (hot moments)

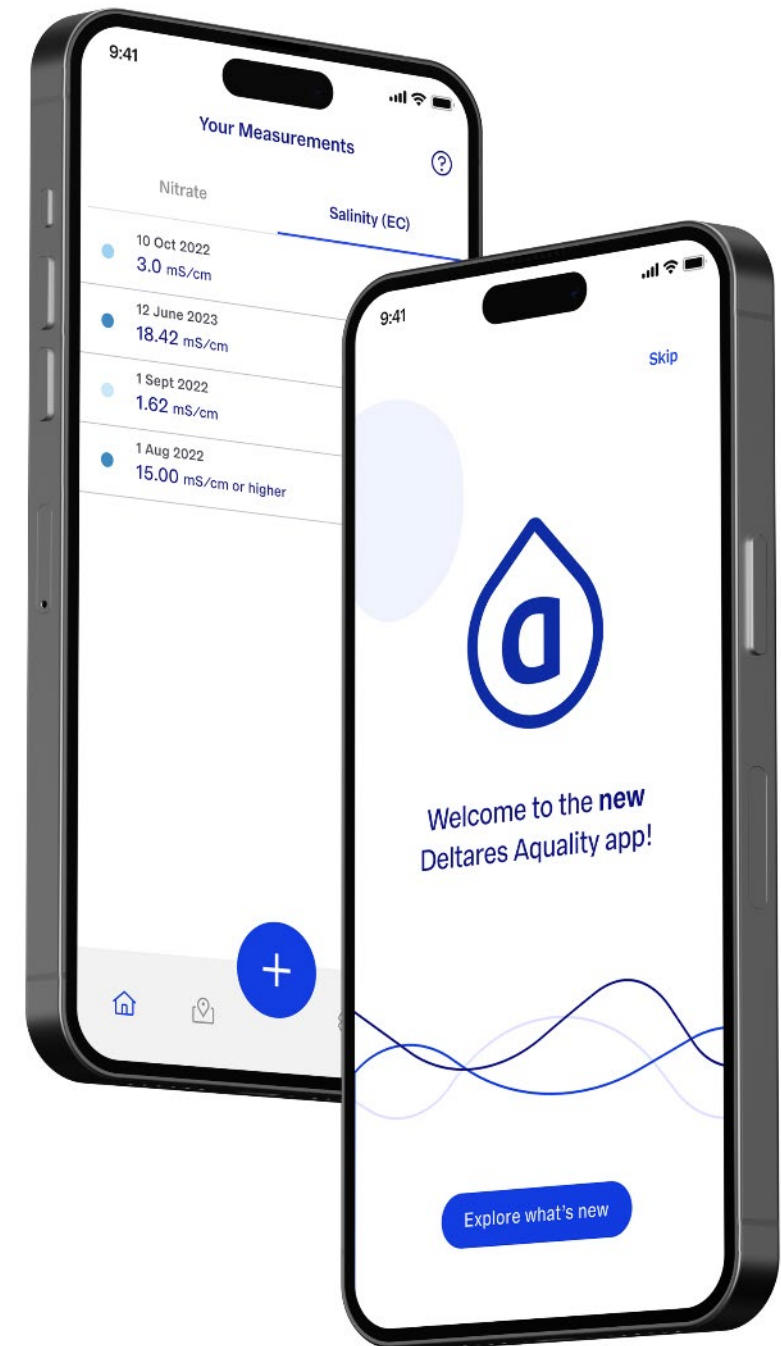


# Nitrate App Overview



# Big upgrade with IBM

- New name: **Deltares Aquality app**
- Fresh new look and feel
- Manual input for measurements
- And more!



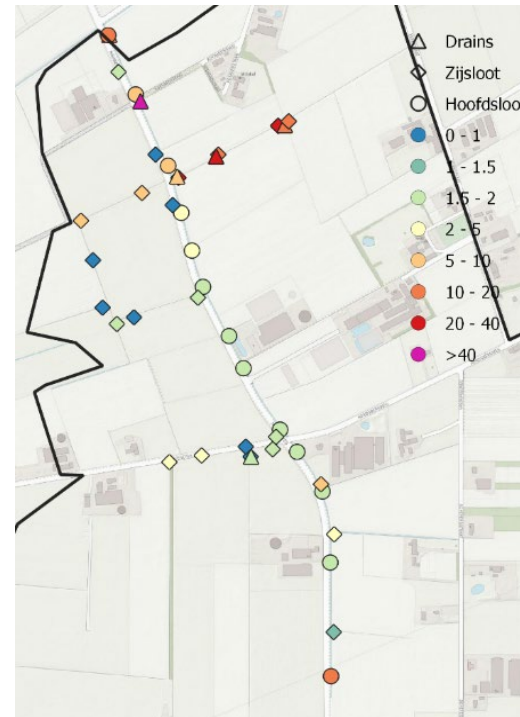
# Routings: Finding hotspots (Vinkenloop, Feb. 2022)



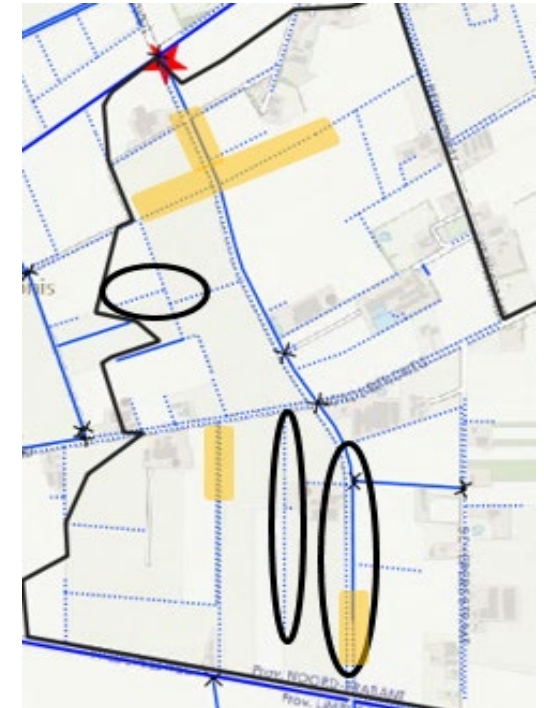
EC [mS/cm]



Temp (difference compared to reference) [°C]



NO3-N [mg/l]



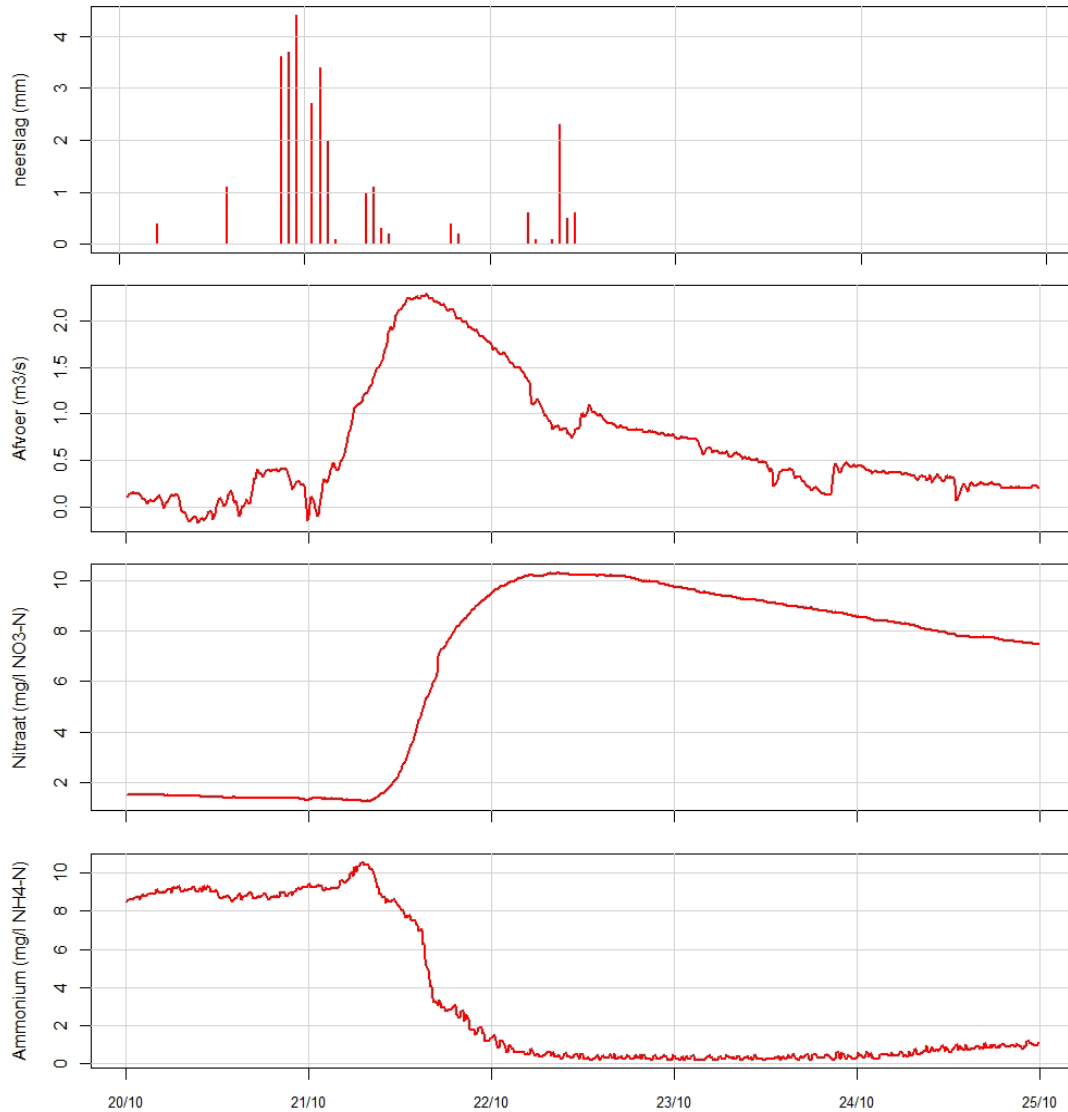
Overview (NO3 sources & seepage)

# Vinkenloop routings





# Nutrient dynamics rain event (e.g. 29-04-2021)



Rain [mm]

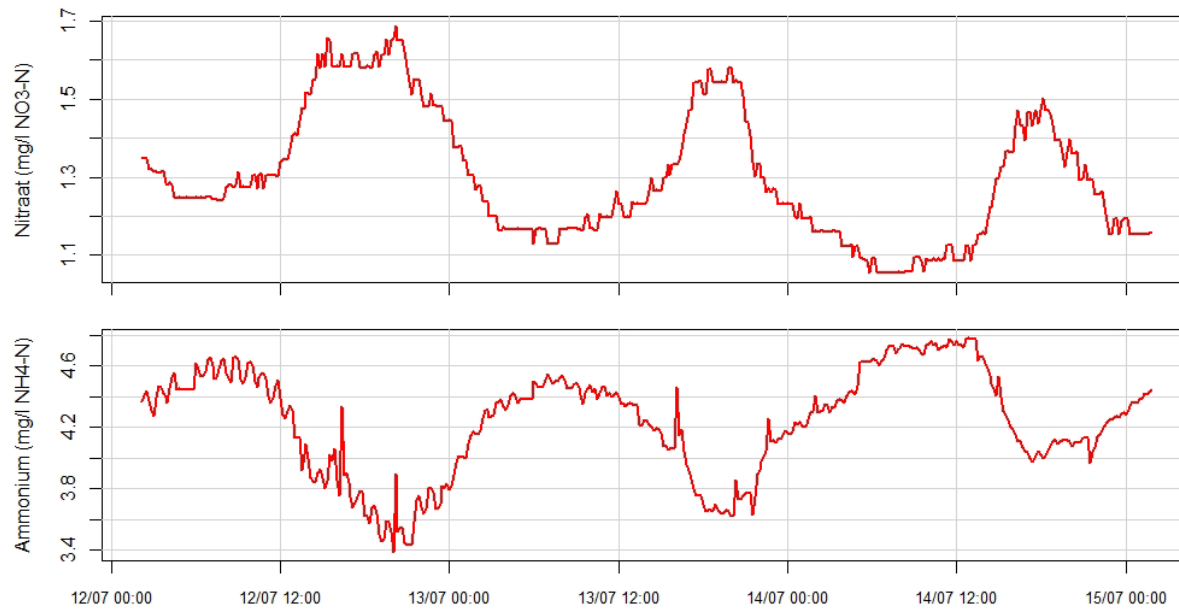
Discharge [m<sup>3</sup>/s]

NO<sub>3</sub>-N [mg/l]

NH<sub>4</sub>-N [mg/l]



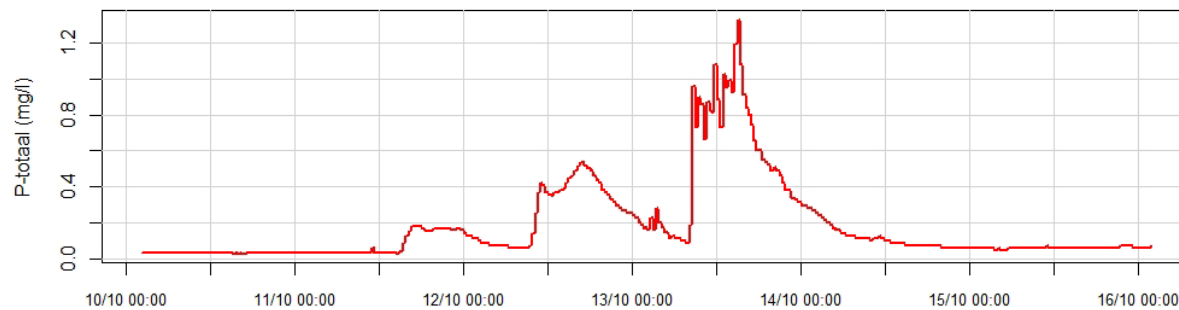
# Retention/uptake & events



NO<sub>3</sub>-N [mg/l]

NH<sub>4</sub>-N [mg/l]

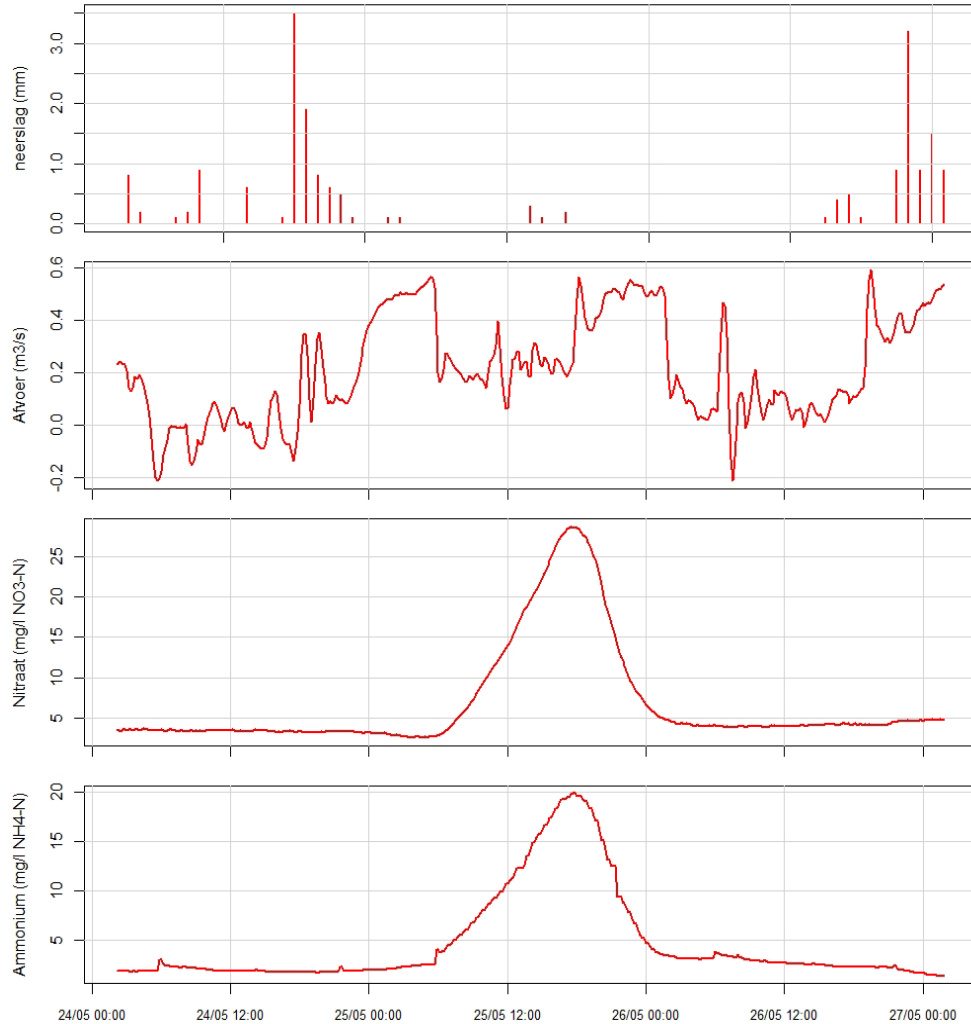
Retention/  
uptake



Total-P [mg/l]

Mow work

# Unknown event (25,26-05-2021)



Rain [mm]

Discharge [m<sup>3</sup>/s]

NO<sub>3</sub>-N [mg/l]

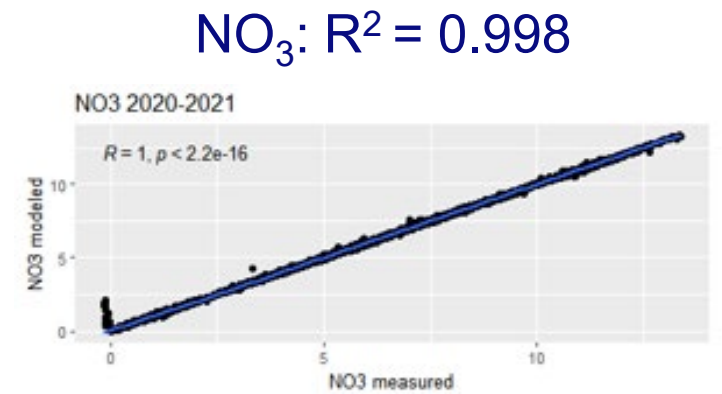
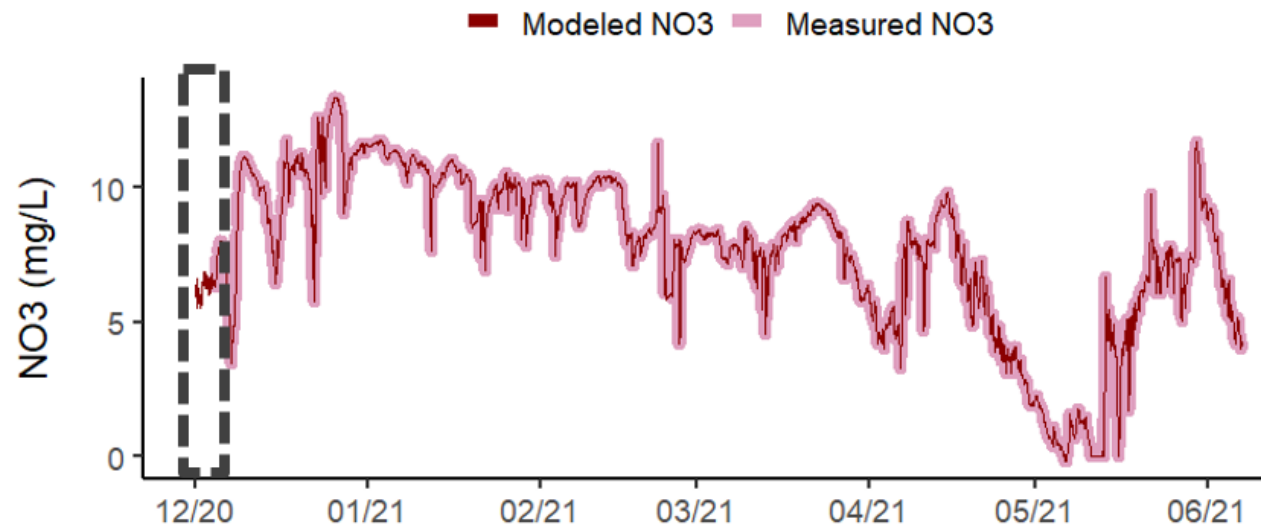
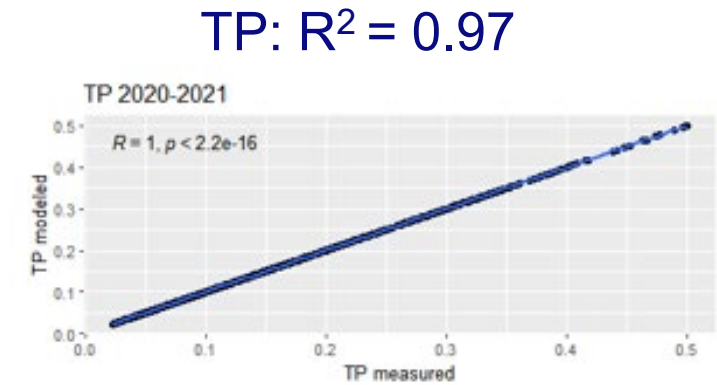
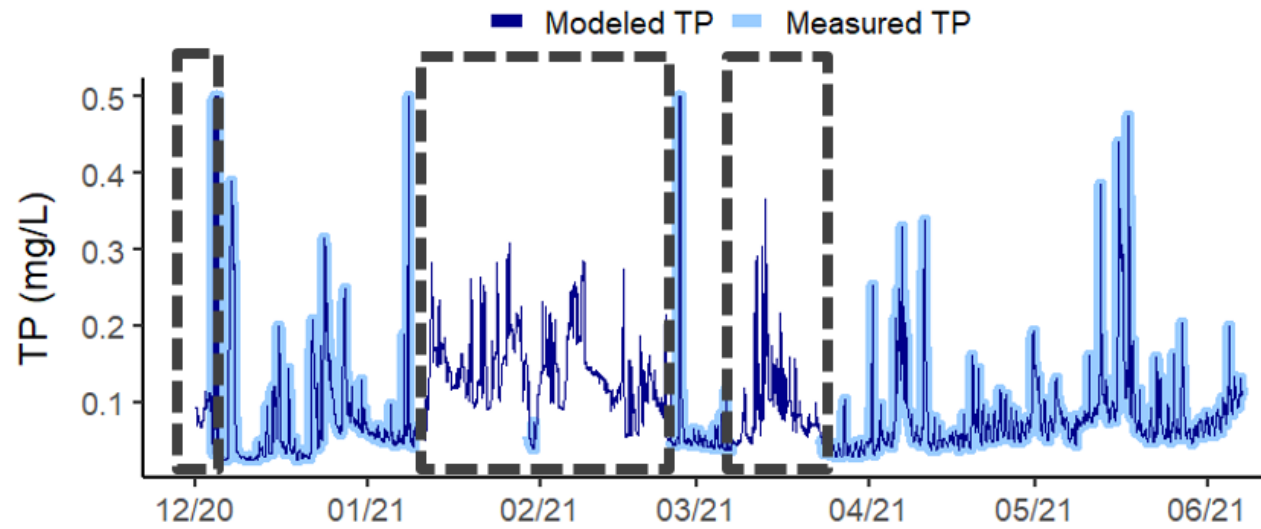
NH<sub>4</sub>-N [mg/l]

- Symmetrical shape
- Dispersion from short point discharge

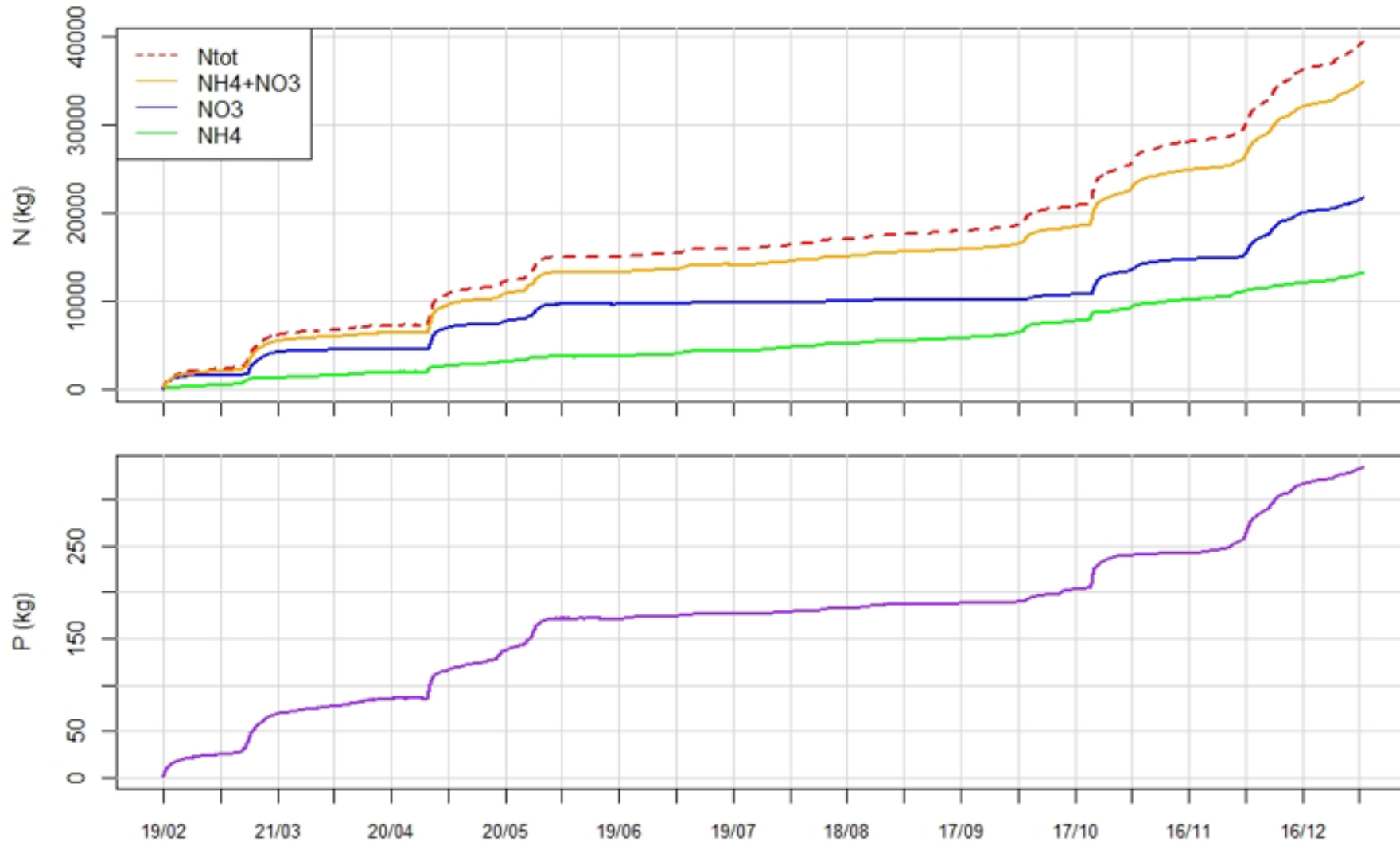
Manure dump?



# Gap filling using Random Forest



# Nutrient Loads



Ntot: 39 t (125 kg/d)

NO3+NH4: 35 t (125 kg/d)

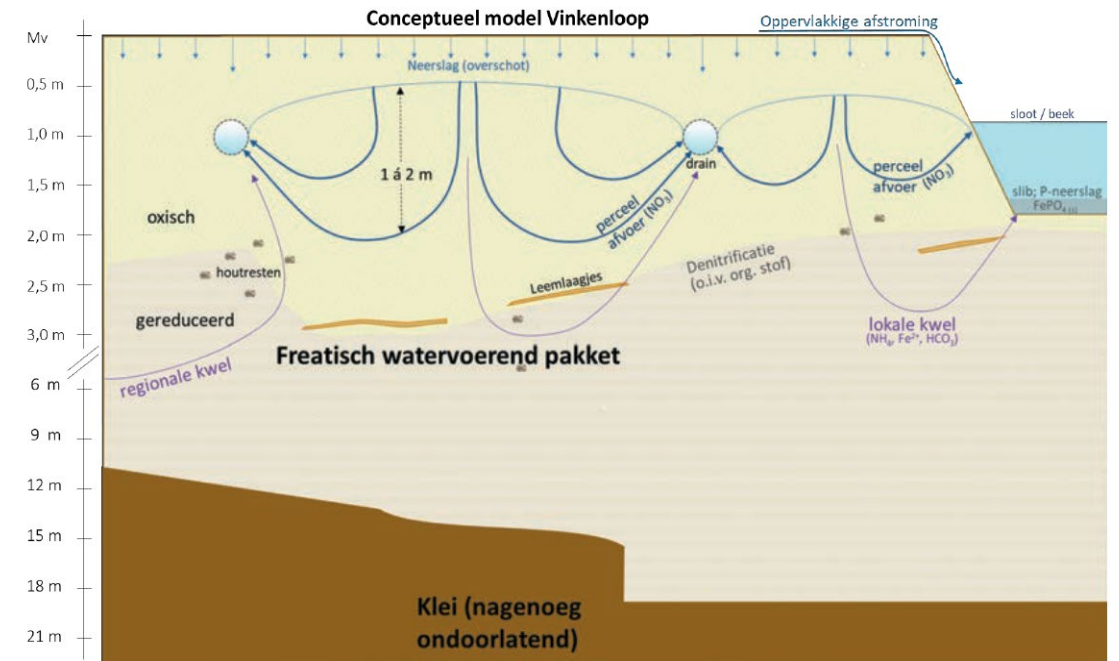
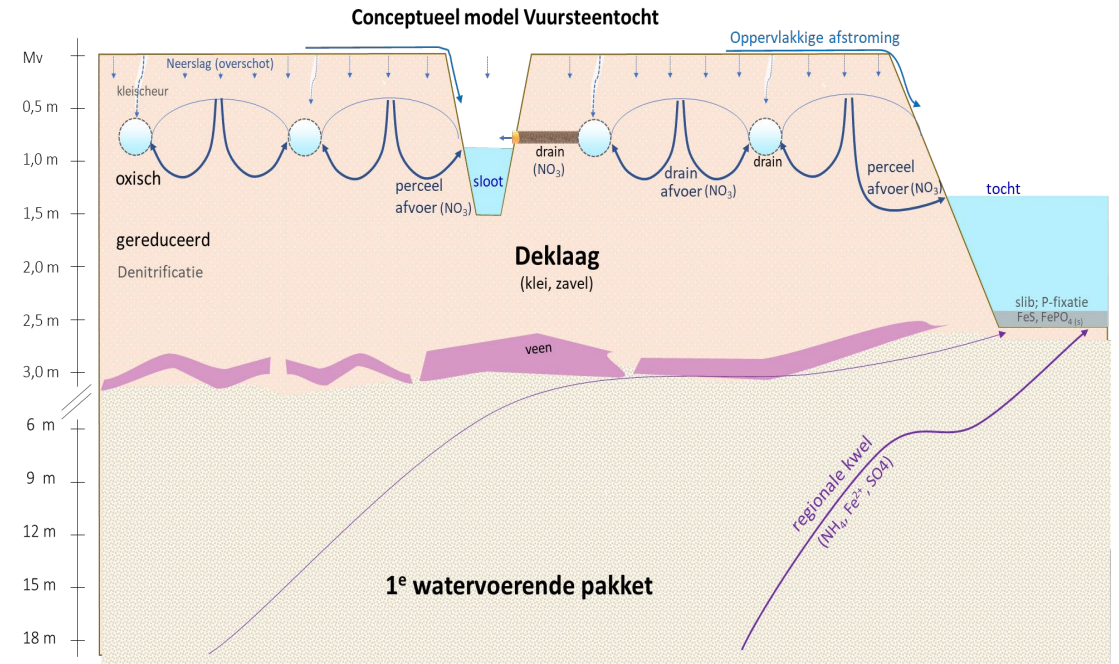
NO3: 22 t (69 kg/d)

NH4: 13 t (42 kg/d)

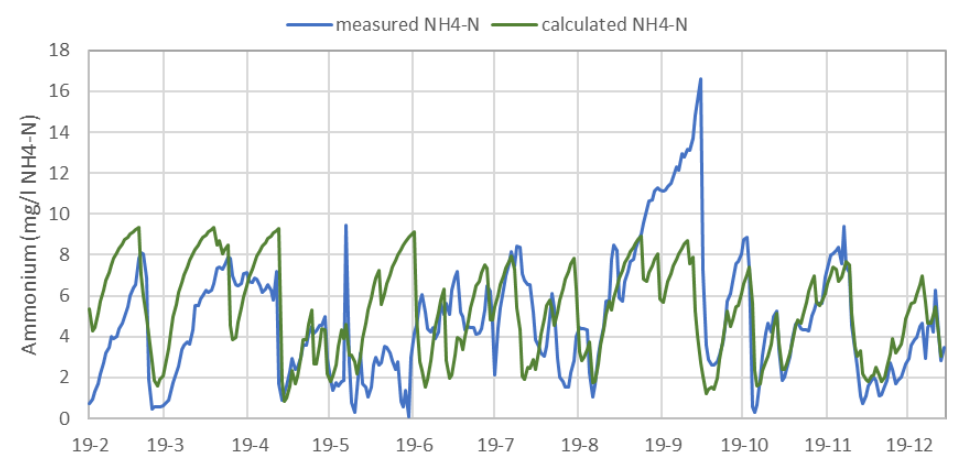
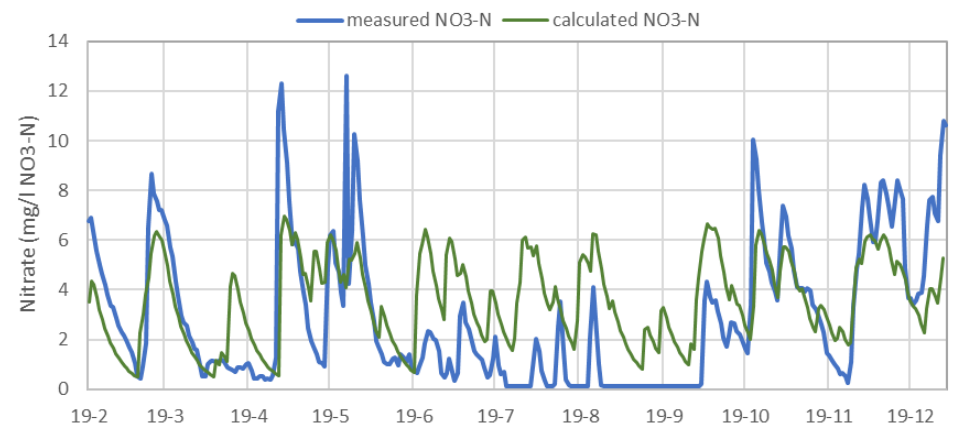
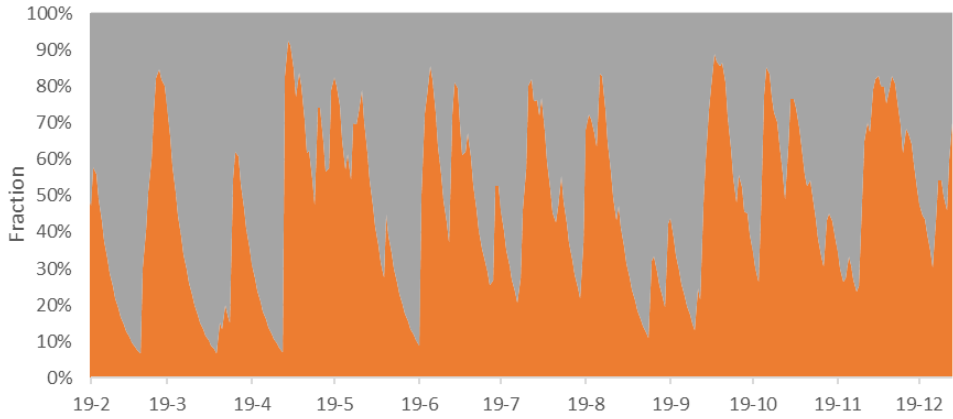
P: 335 kg (1,07 kg/d)

# Area specific modeling

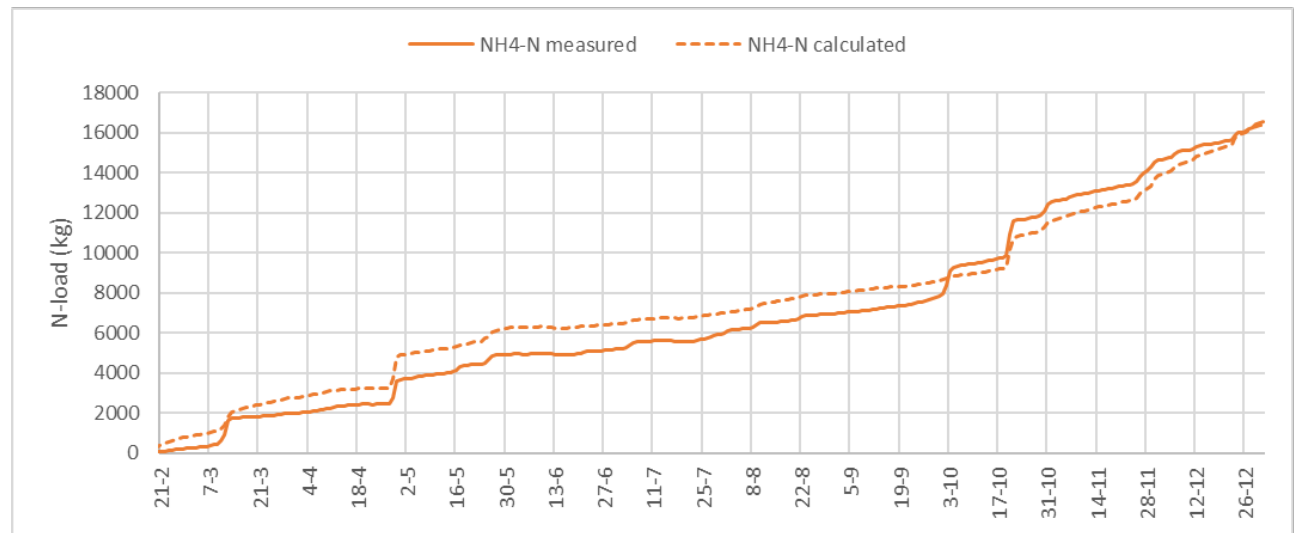
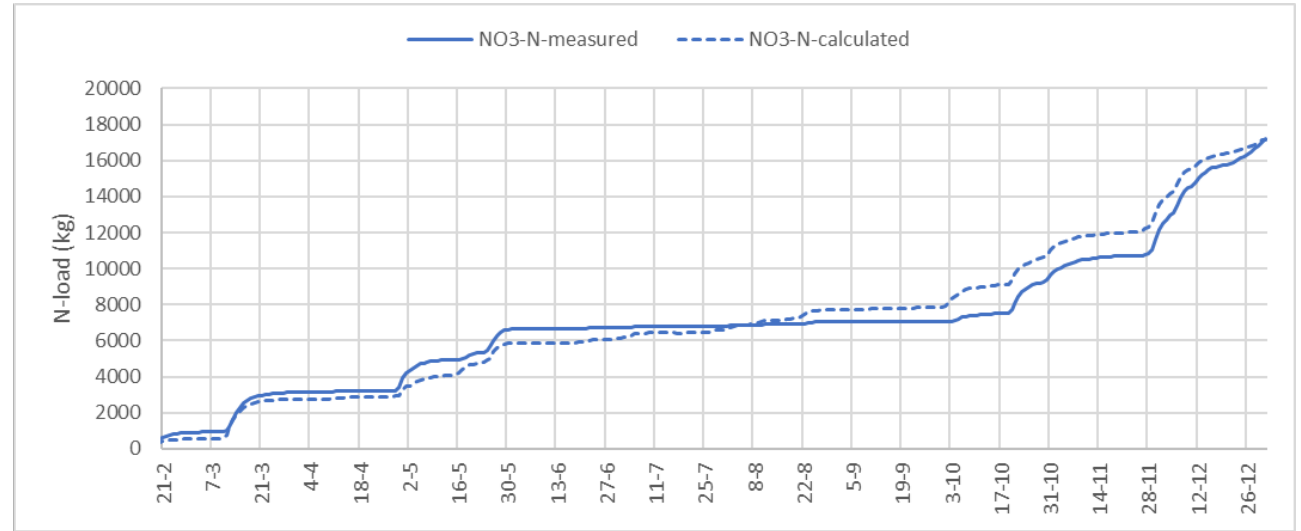
- Conceptual model
- Dynamic water- and nutrient balance (data driven model)
- SWAP-ANIMO (1D water and nutrient transport model)



■ fraction leaching water ■ fraction seepage water



# Dynamic water- and nutrient balance



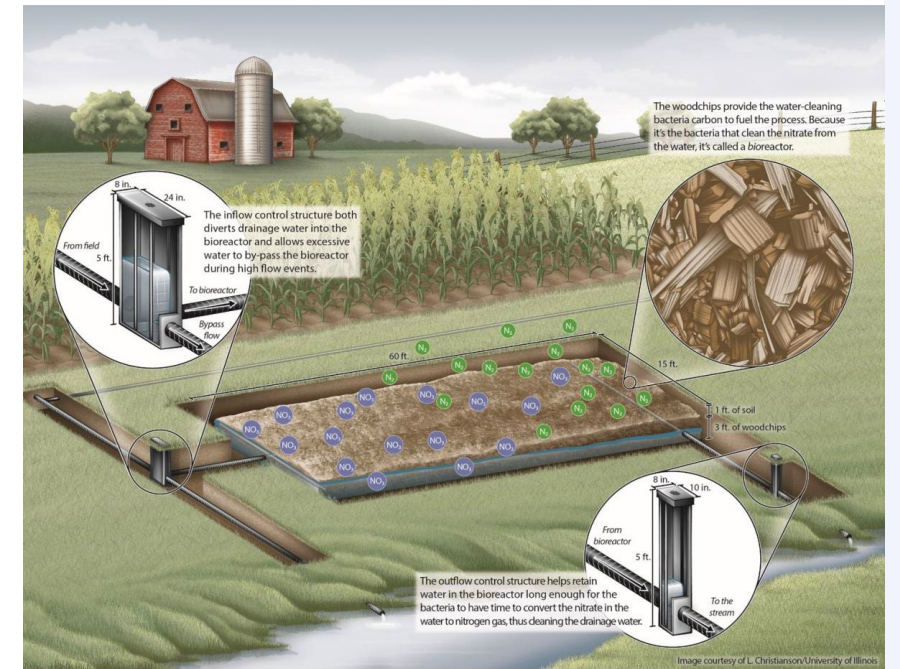
# Proces based modeling (SWAP ANIMO)





# Region-specific mitigation

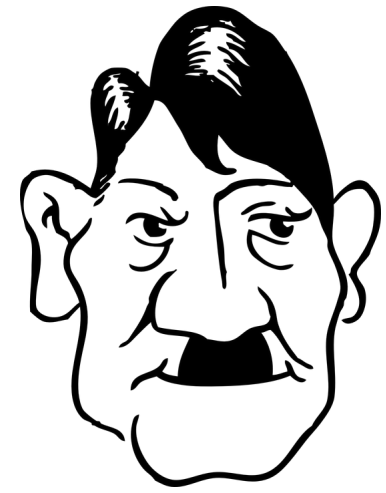
- Vinkenloop (permanent hotspots)
  - Filtering of drainage water with woodchip bioreactor:  $\text{NO}_3$
  - Capture P-rich sediments
- Vuursteentocht
  - Stop fertilizing after harvest
  - Adjustable outlet weir to increase water and nutrient retention



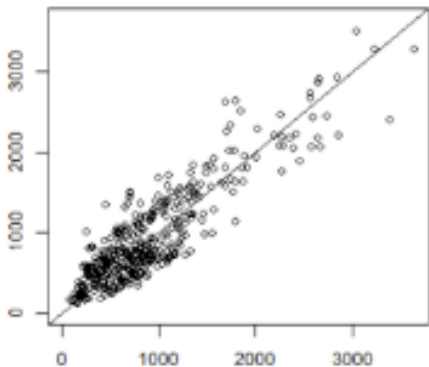
L. Christianson, Univ. of Illinois



- “I think Hitler was bad!”
- “Why?”
- “Because he has a strange moustache.”



Monitoring data reduce the risk of ***being right for the wrong reason***



- “My water quality model is ready to predict!”
- “Why?”
- “Because it reproduces field measurements.”

# Thank you for your attention!

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