

DTU

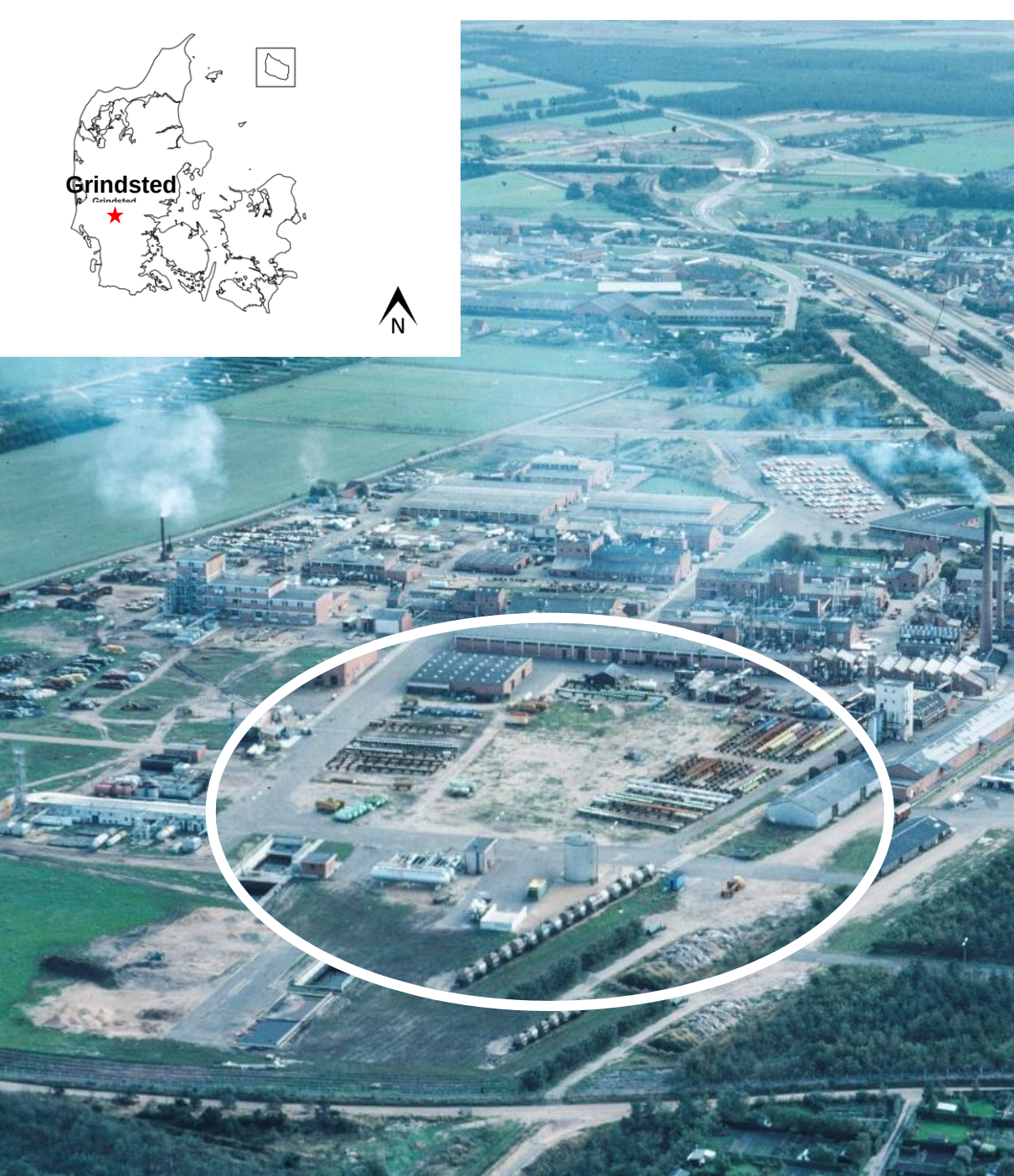


ATV vintermøde 2022

G. Lemaire¹, C. Andreassen¹, C. Lade¹, H. Draborg¹,
M. M. Broholm¹, P.L. Bjerg¹, L. Dissing ², J. K. Pedersen ²

¹DTU Miljø og ² Region Syddanmark

Udsivning af pharmaceutiske stoffer til Grindsted å



Grindstedværket (1924-2013)

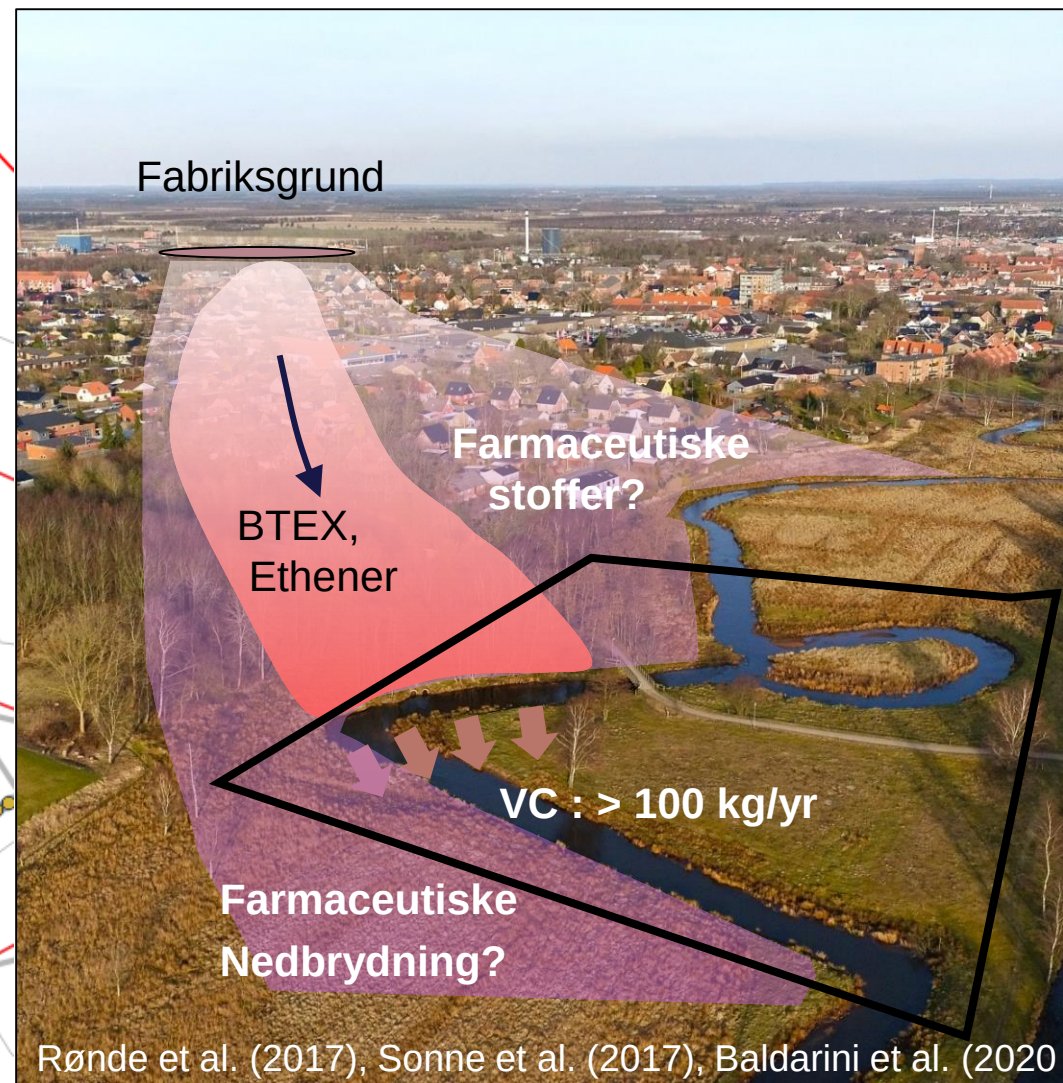
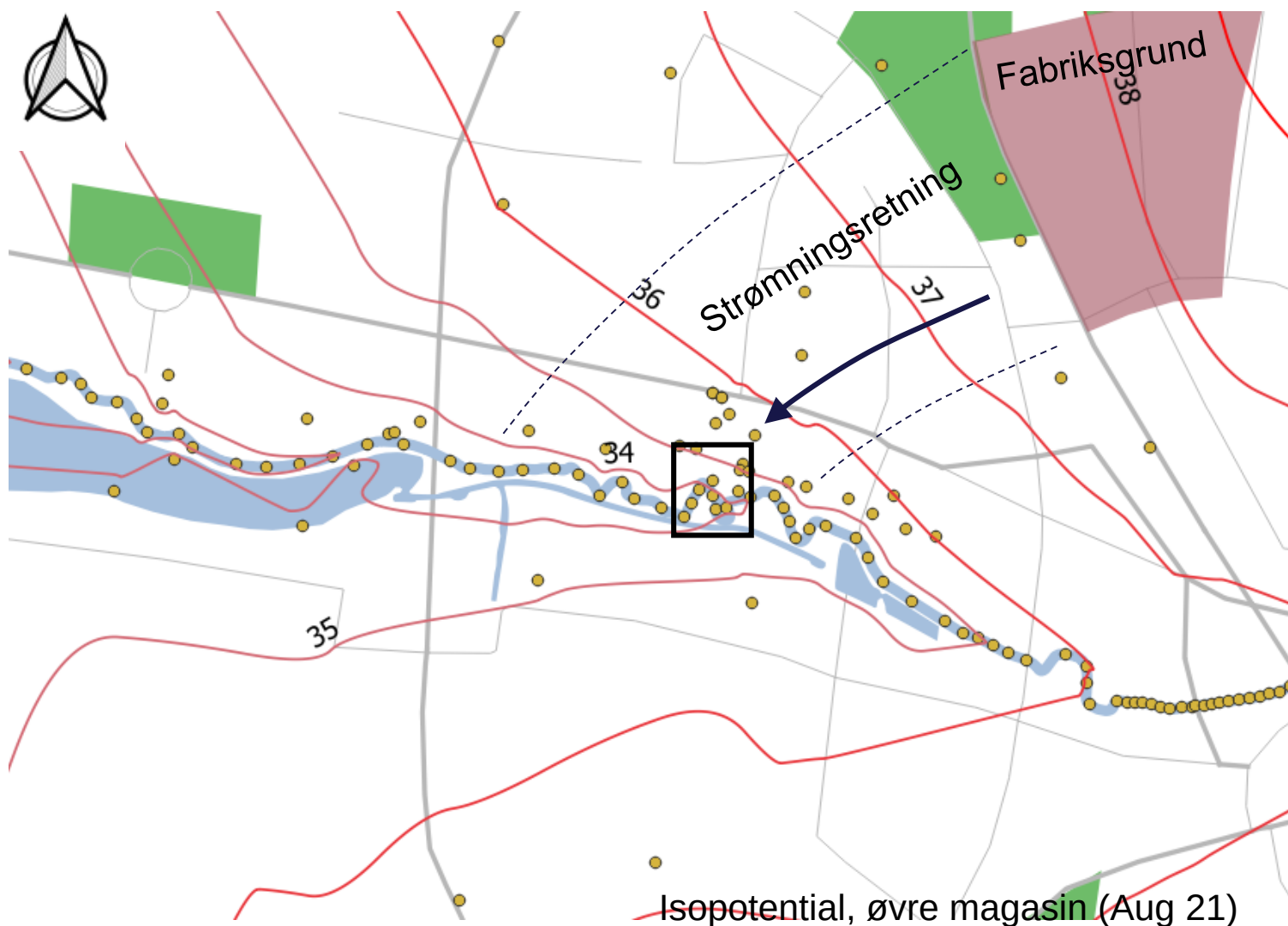
Generationsforurening

Produktion af farmaceutiske stoffer

- Sulfonamider
- Barbiturater
- BTEX
- Chlorerede ethener

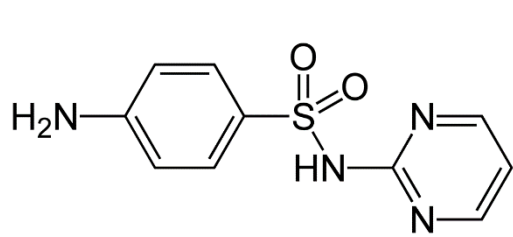
Forslag til afværgemuligheder
(slutning af 2023)

Transport af forurening

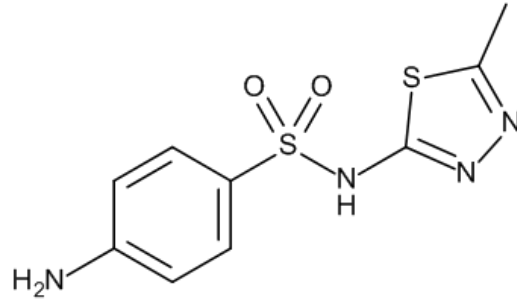


Rørde et al. (2017), Sonne et al. (2017), Baldarini et al. (2020)

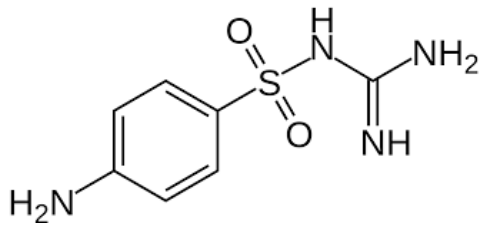
Sulfonamider



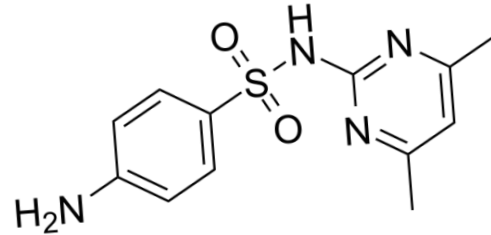
Sulfadiazine



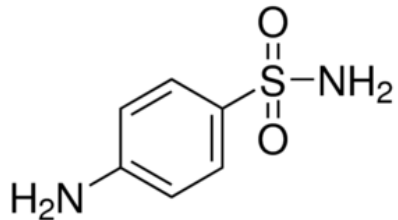
Sulfamethizole



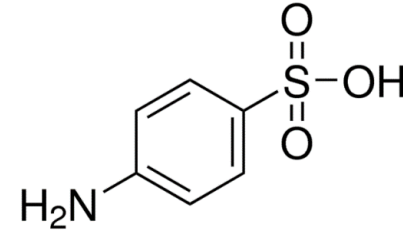
Sulfaguanidine



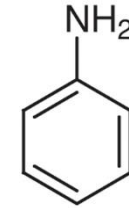
Sulfamethazine



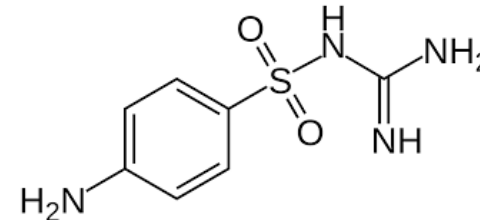
Sulfanilamide



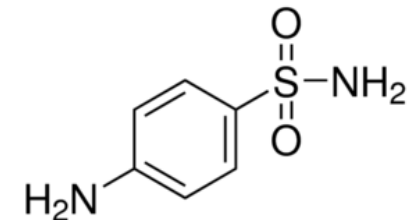
Sulfanilsyre



Aniline



Sulfaguanidine



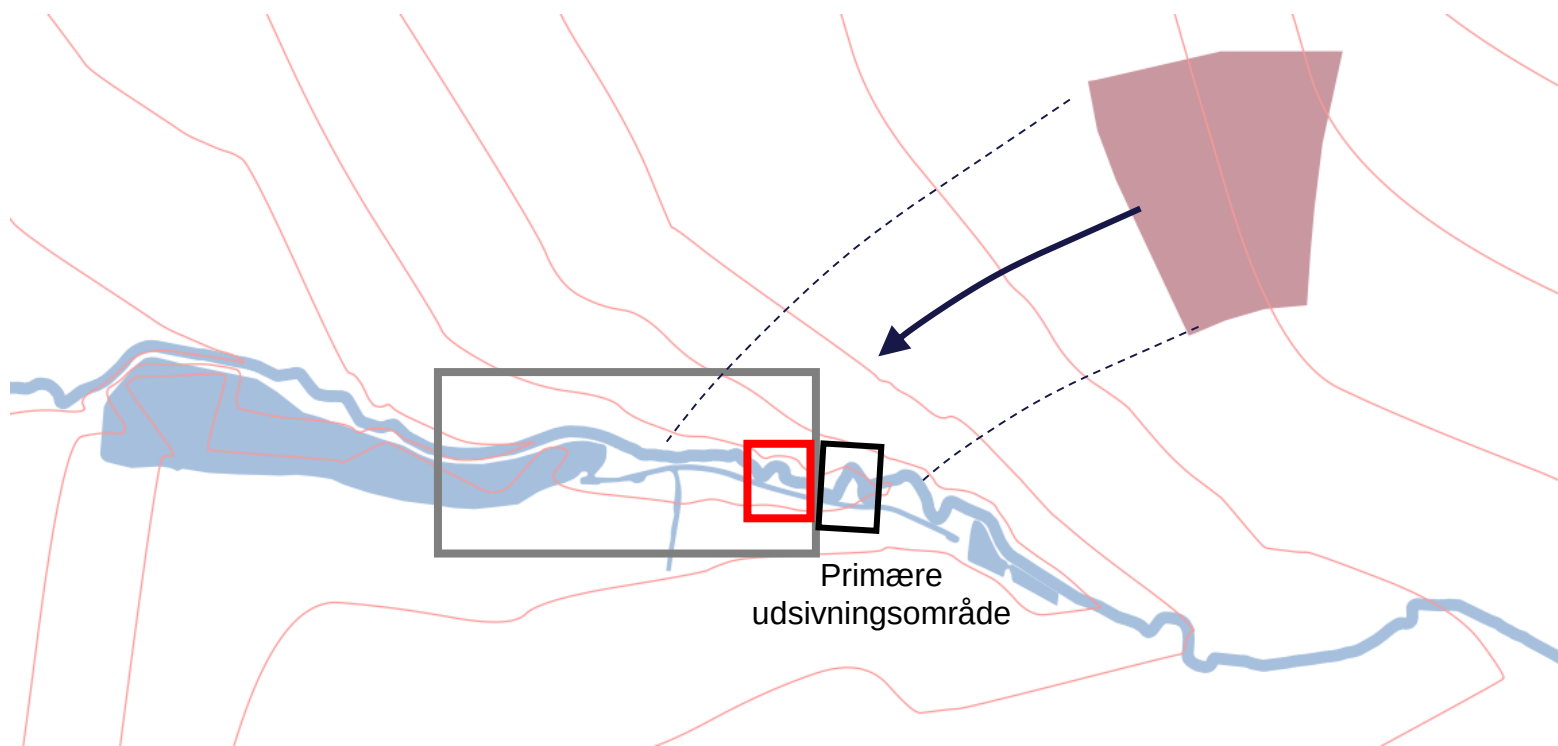
Sulfanilamide

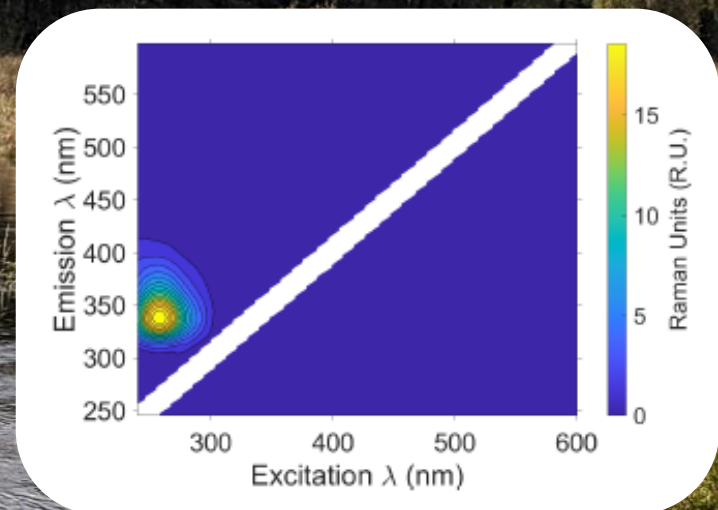
Nedbrydning

Høj vandopløselighed, høj mobilitet, ikke flygtige
Nedbrydningsveje ikke godt dokumenteret

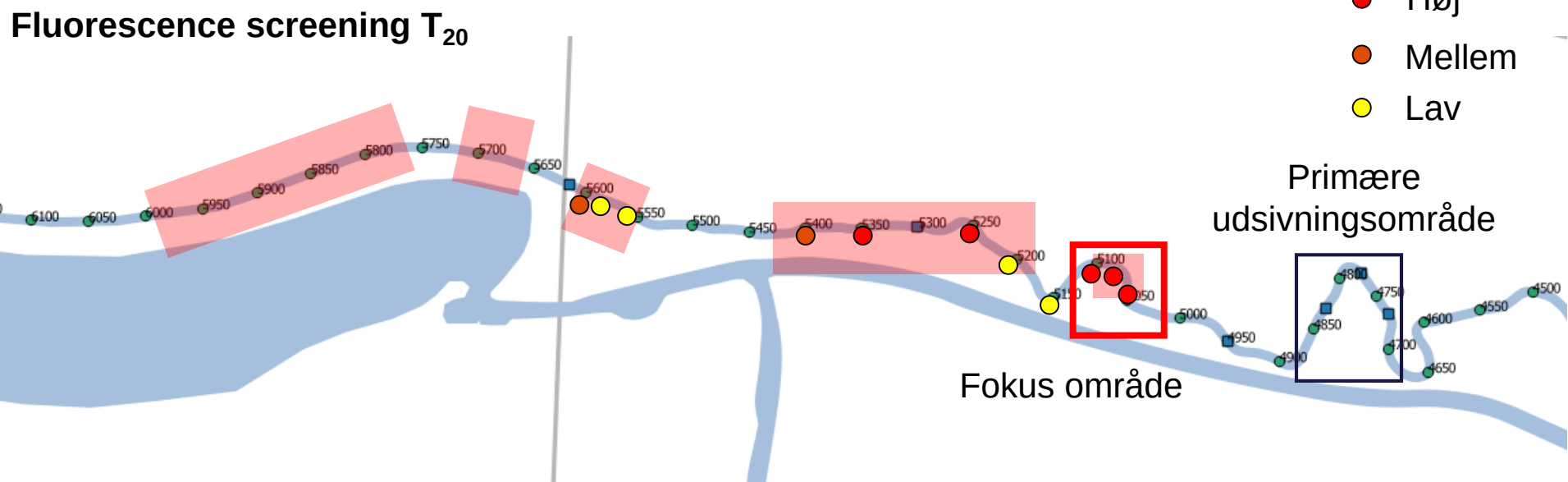
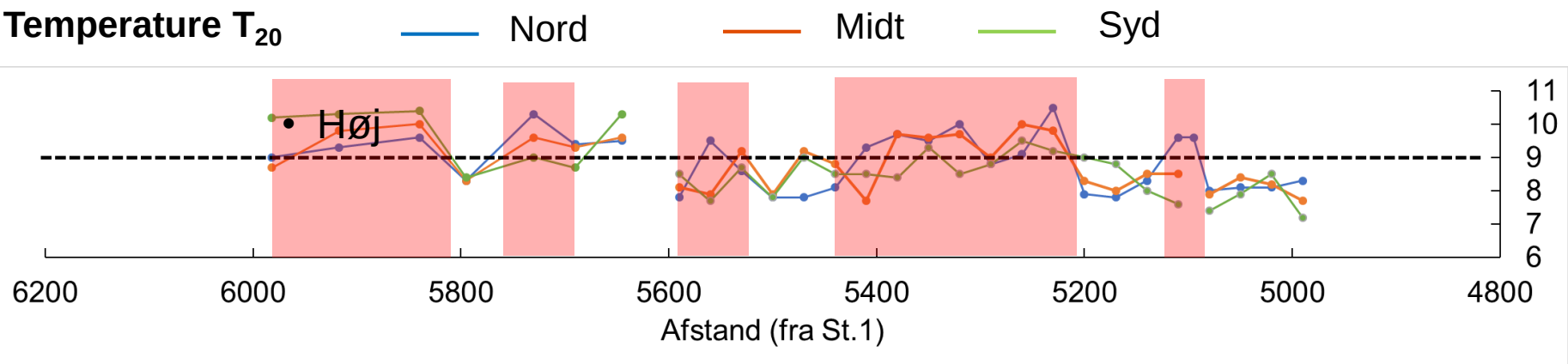
Formål

- At identificere udstrømningsforholdene i et mindre undersøgt område ved Grindsted Å
- At undersøge et område med udsivning af farmaceutiske stoffer
- At kvantificere mængden af forurening fra dette område (forureningsflux – in stream CMD)





Grundvandsudsivning til åen



Fokusområde i ydre meander

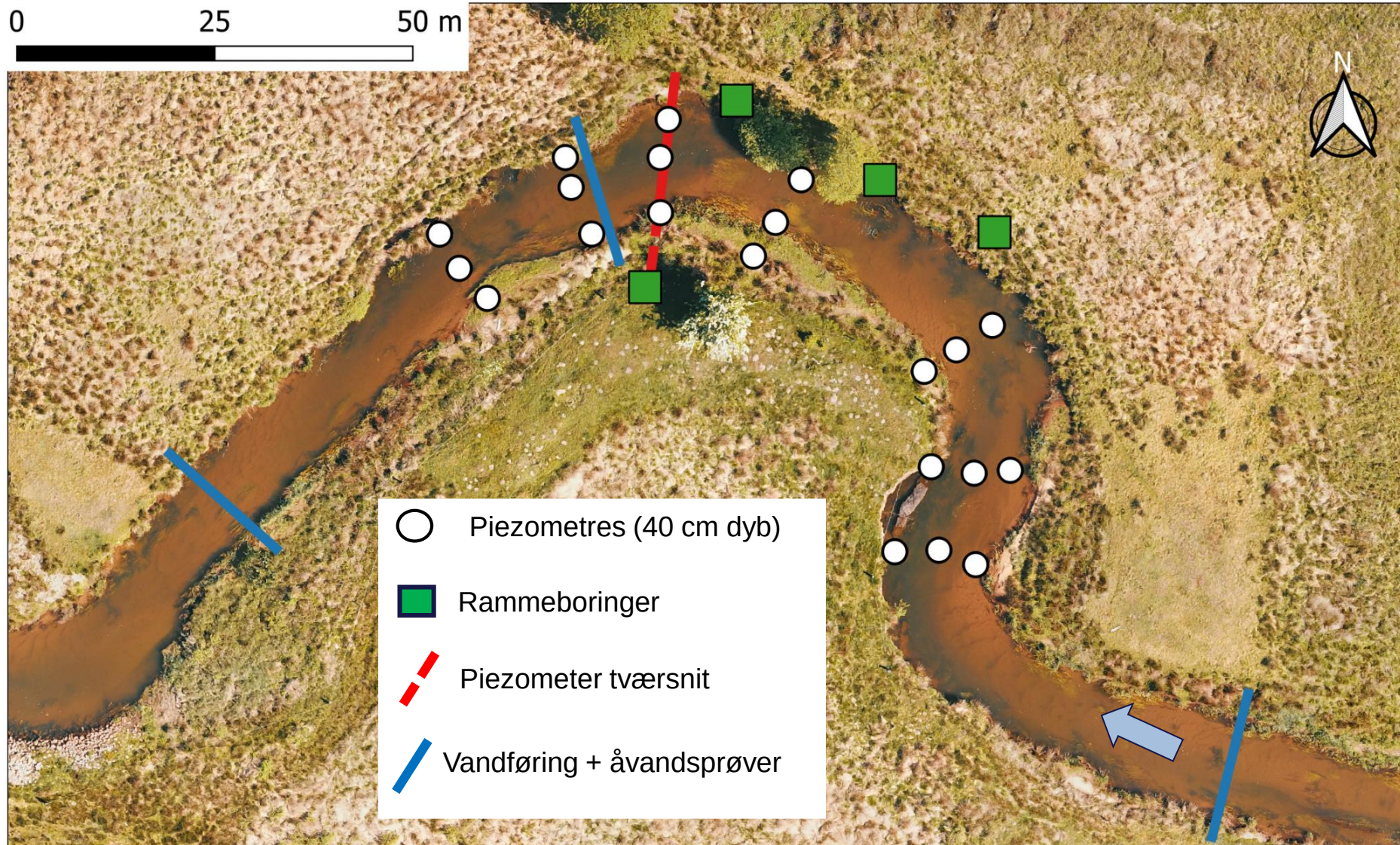
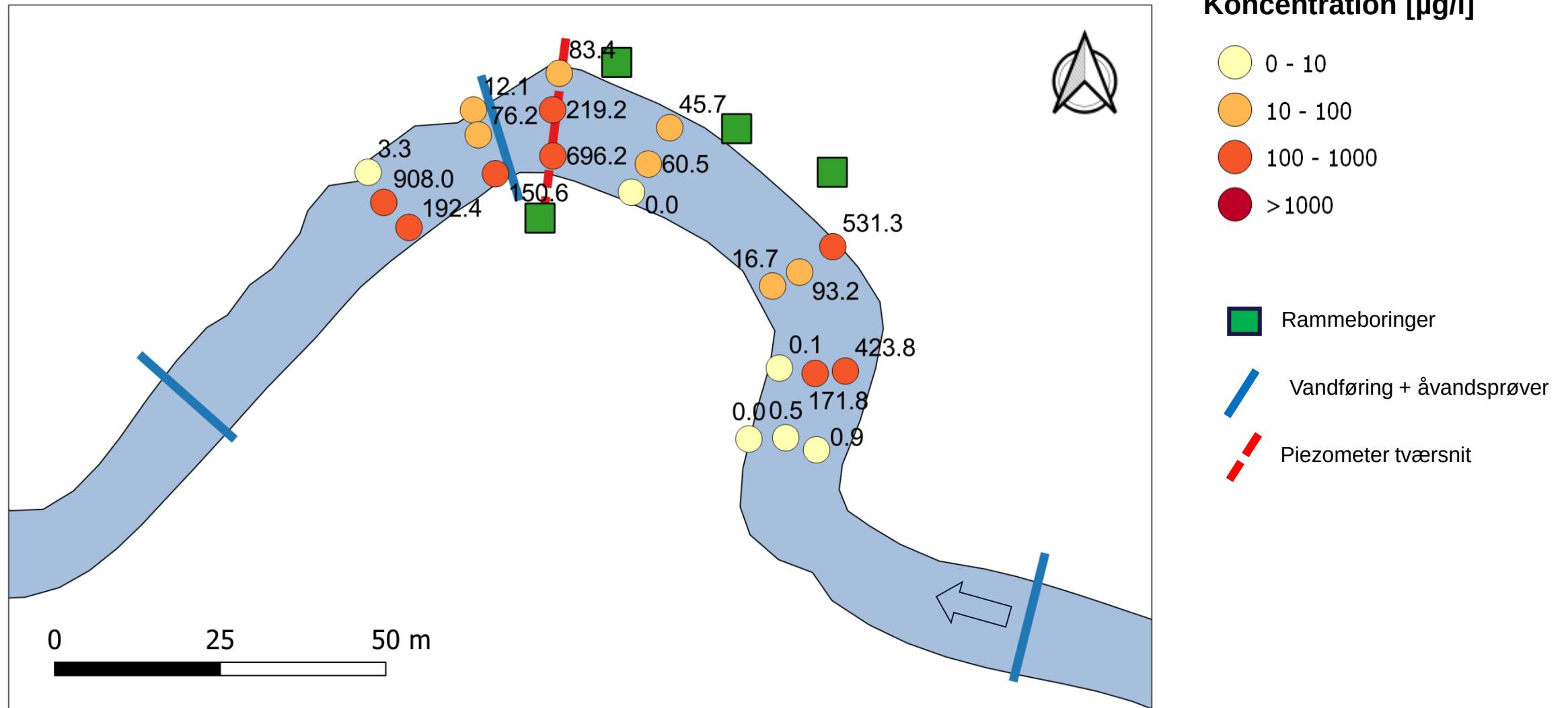
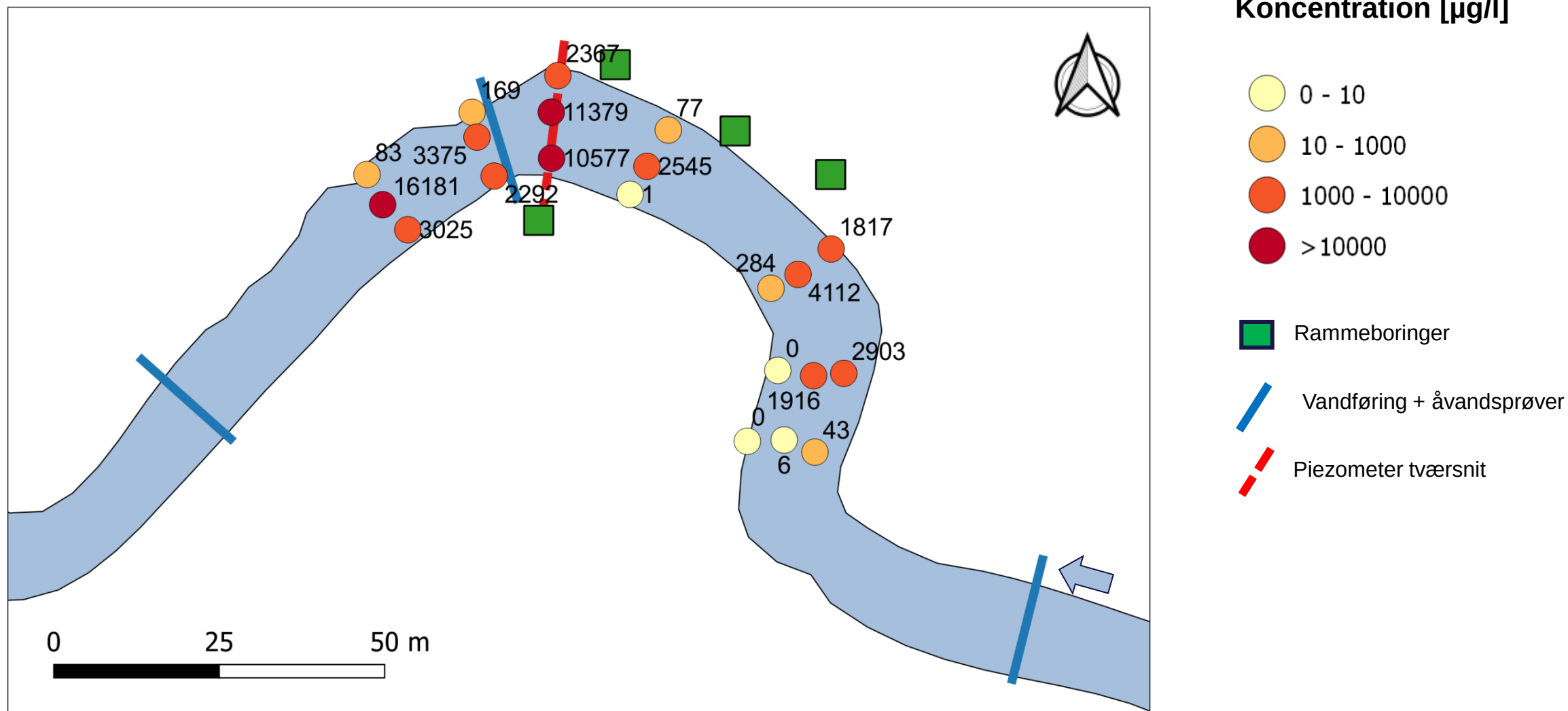


Photo courtesy: Riverscapes

Sum sulfonamider (40 cm u. b.)

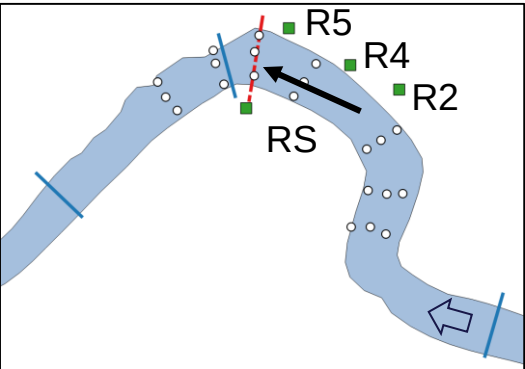
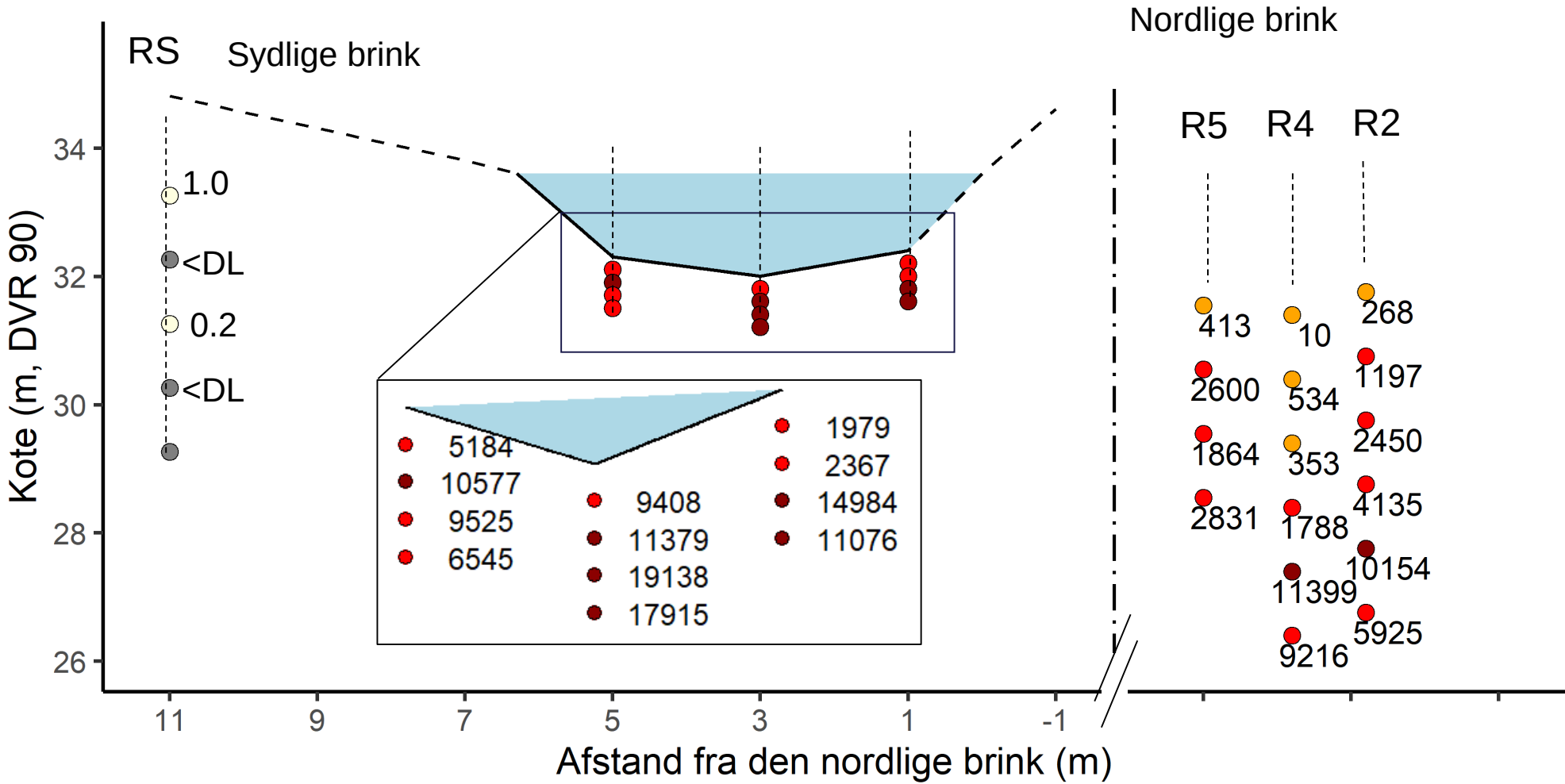
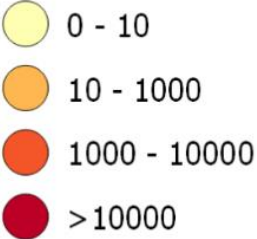


Sulfanilsyre (40 cm u. b.)

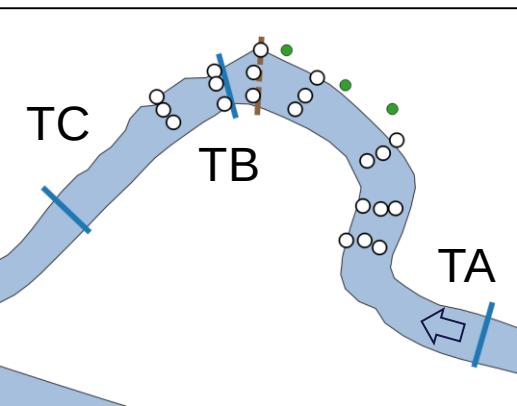
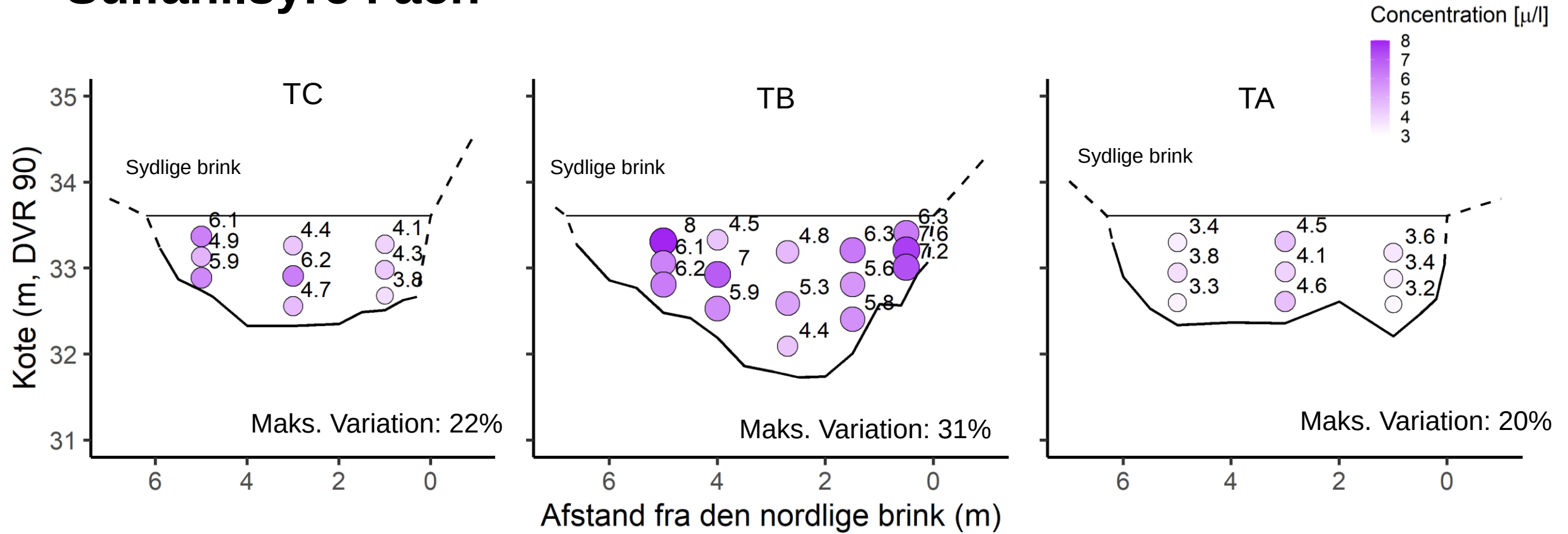


Sulfanilsyre: tværsnit visualisering

Koncentration [$\mu\text{g/l}$]



Sulfanilsyre i åen

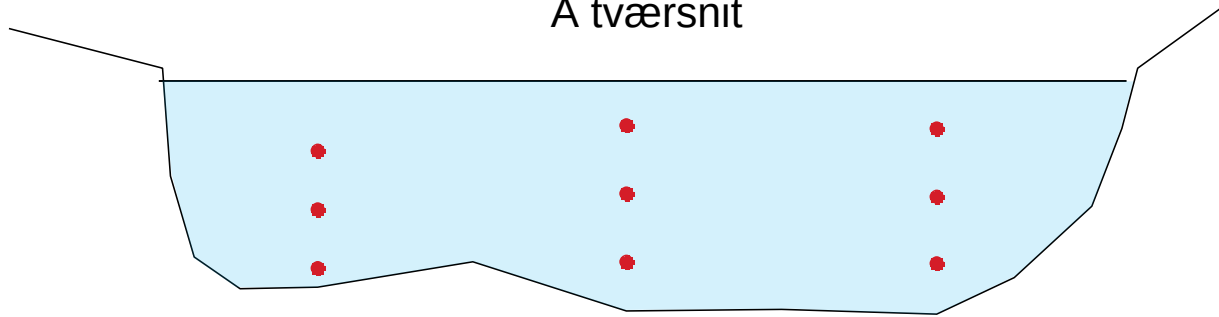


**Betydelige rumlige variationer af koncentrationer:
Ikke fuld opblanding**

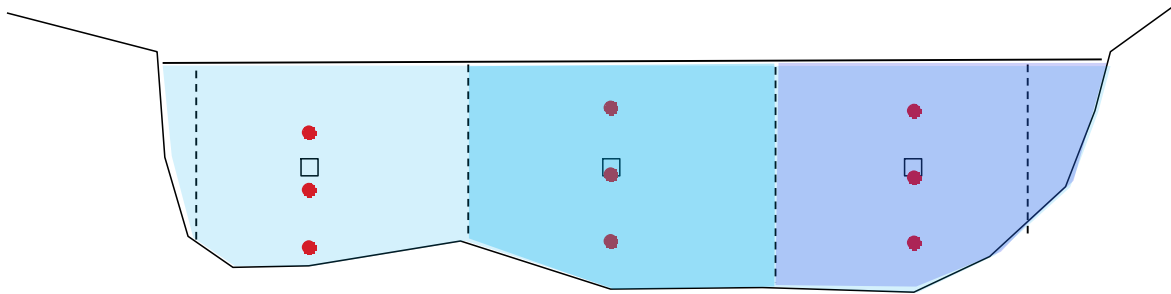
Forureningsflux vurdering (åvand)

● Målinger

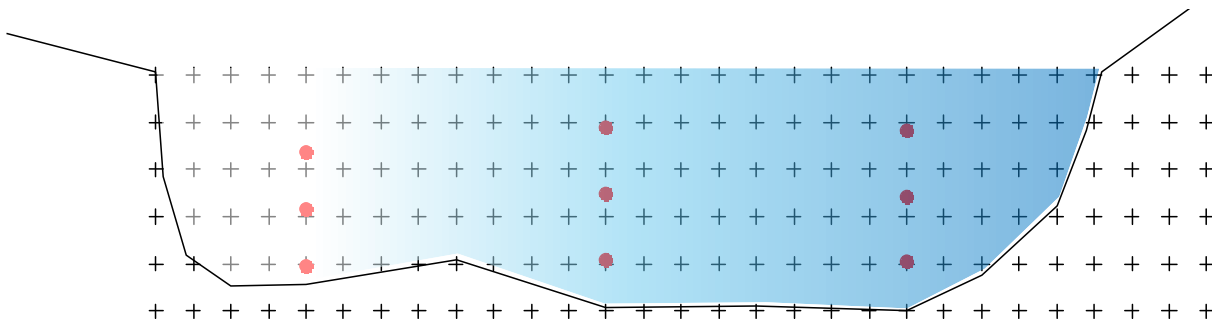
Å tværsnit



□ Gennemsnitsværdi



+ interpolationspunkt



Fuld opblanding

$$J = C_{mix} * Q$$

Midt-sektion metode

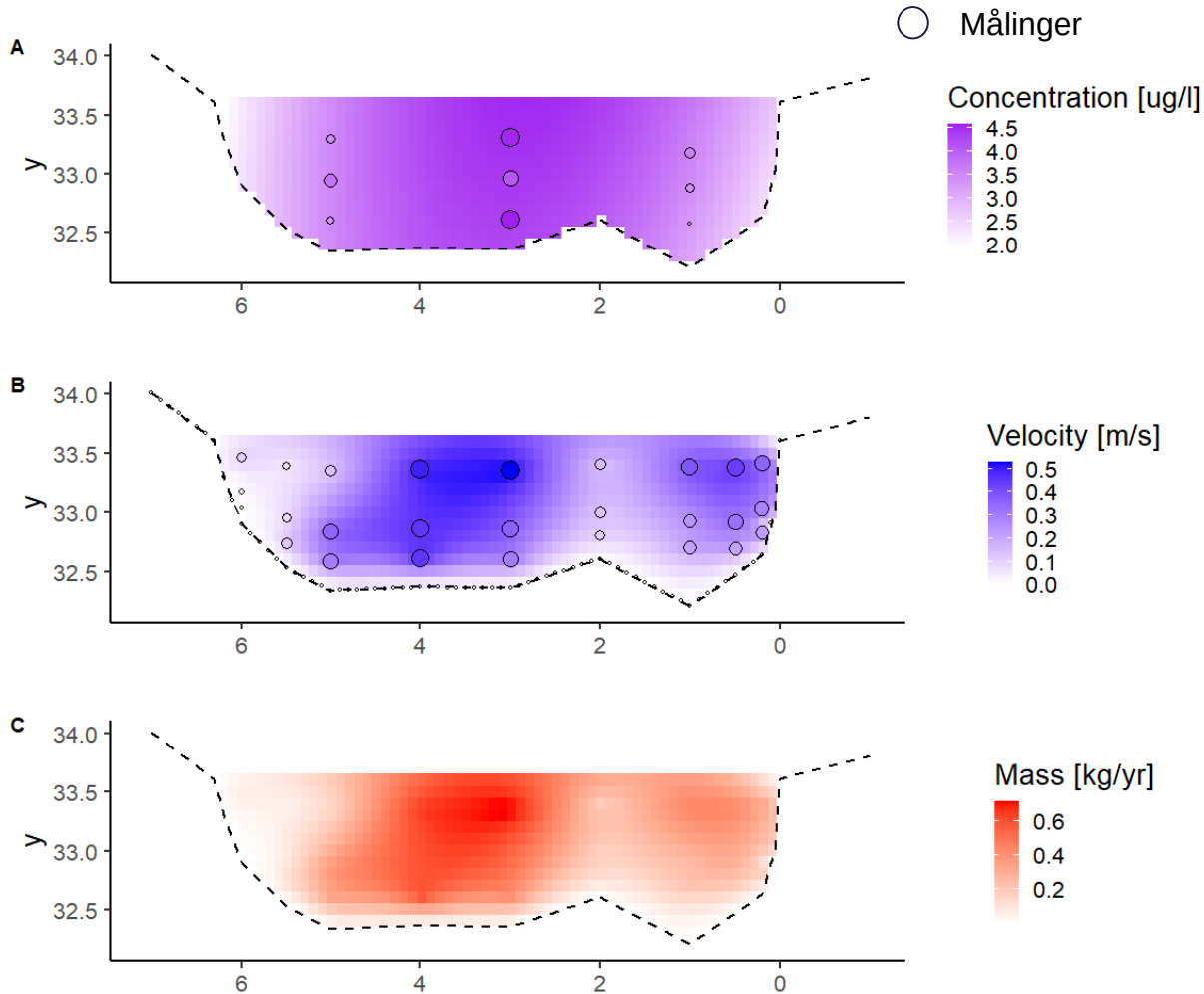
$$J = \sum_i \bar{C}_i * \bar{v}_i * A_i$$

Interpolation

$$J = \sum_i \tilde{C}_i * \tilde{v}_i * A_i$$

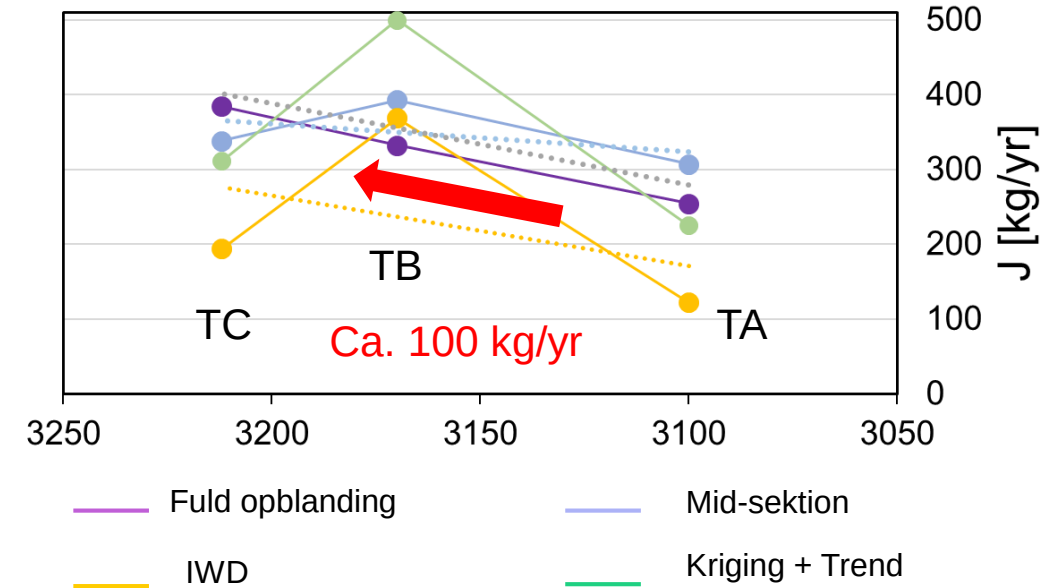
(Bivariate, Inverse Weight, Kriging, etc)

Sulfonamider fluxvurdering

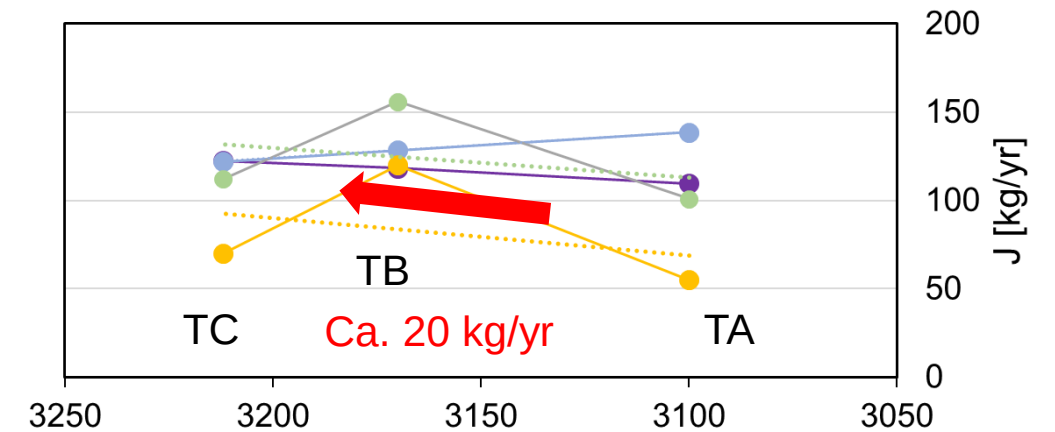


Eksempel : sulfanilsyre interpolation (tværsnit TA)

Sulfanilsyre

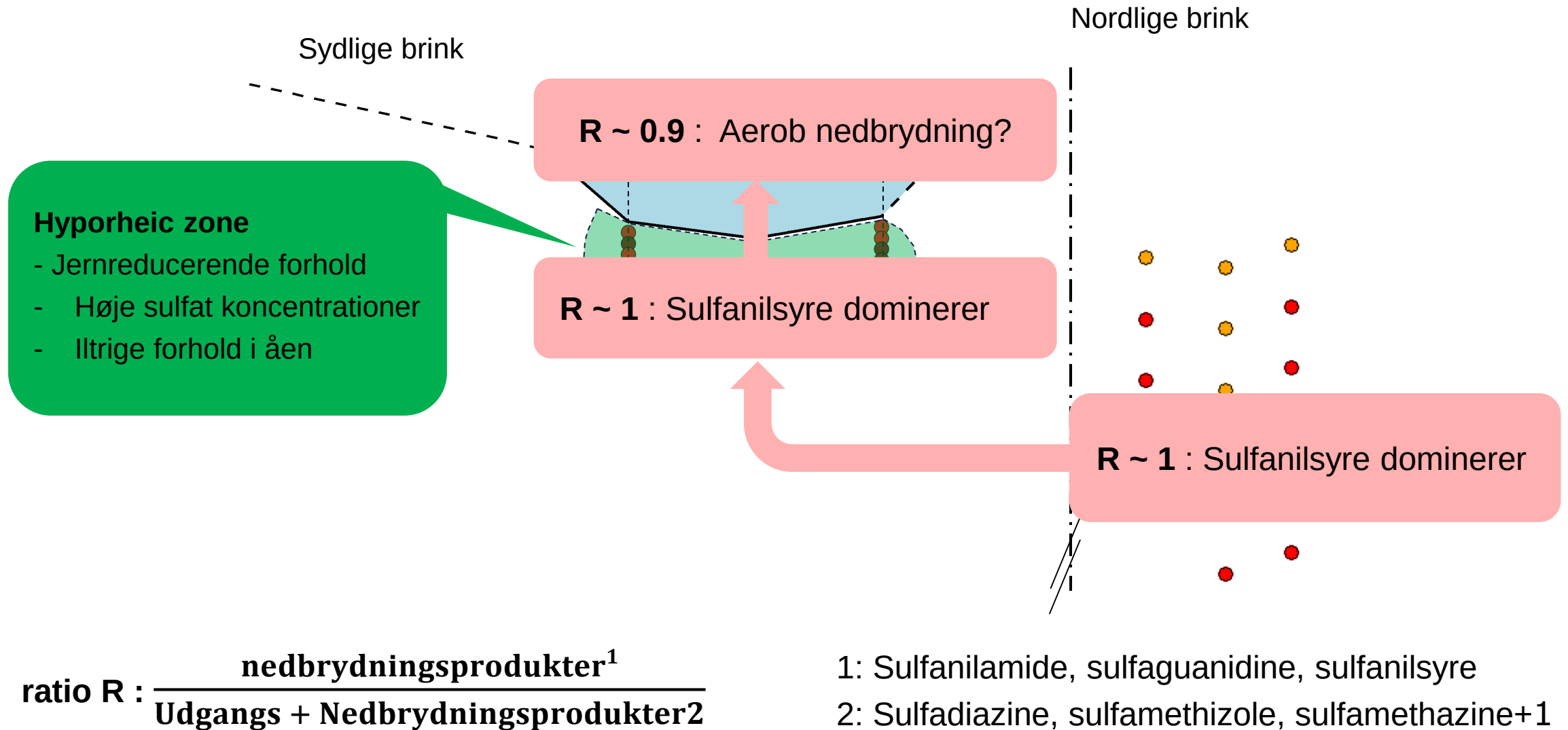


Sum (sulfonamider), uden sulfanilsyre

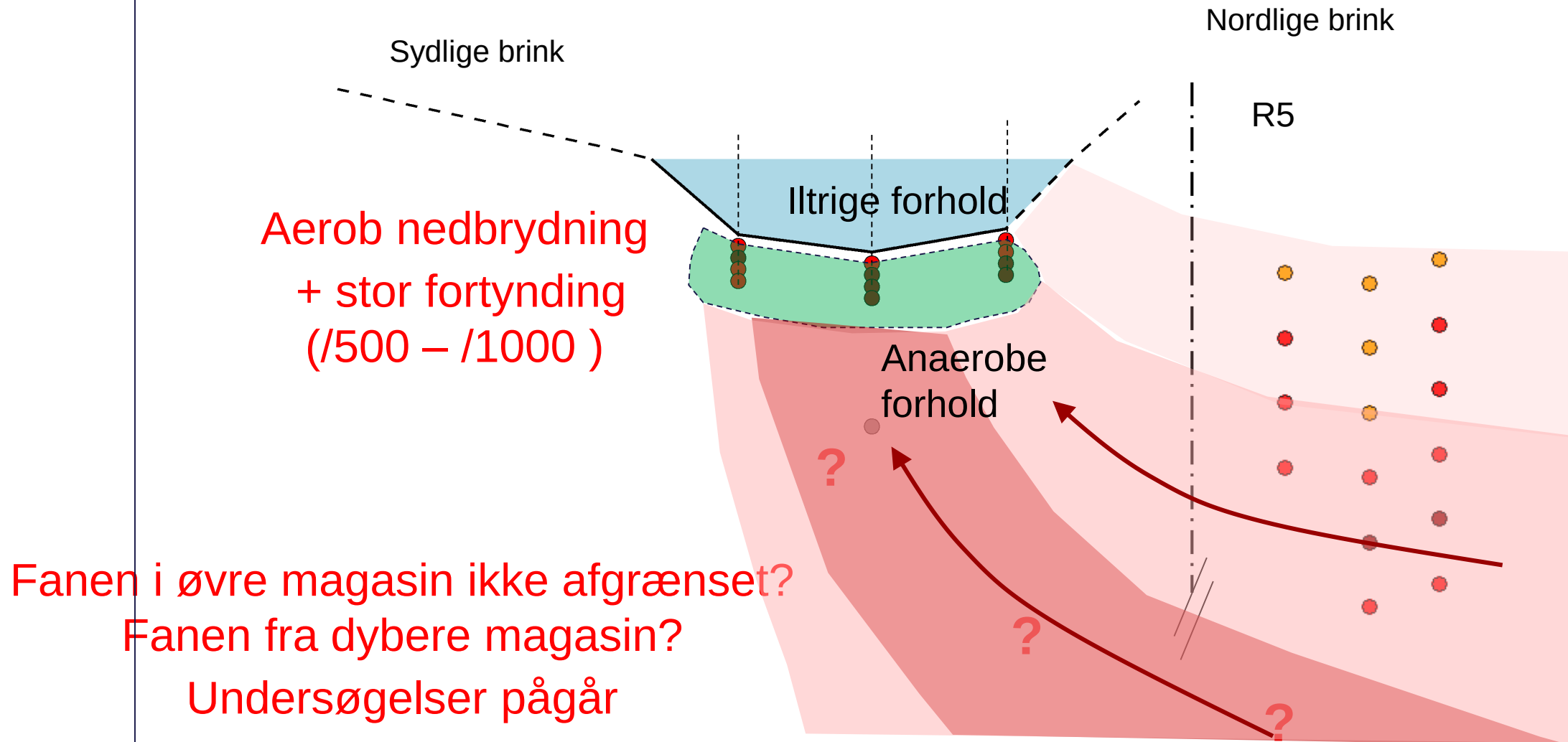


Området bidrager til sulfonamider flux men usikkerhed i vurdering ("near-field" effekt)

Konceptuel forståelse



Konceptuel forståelse

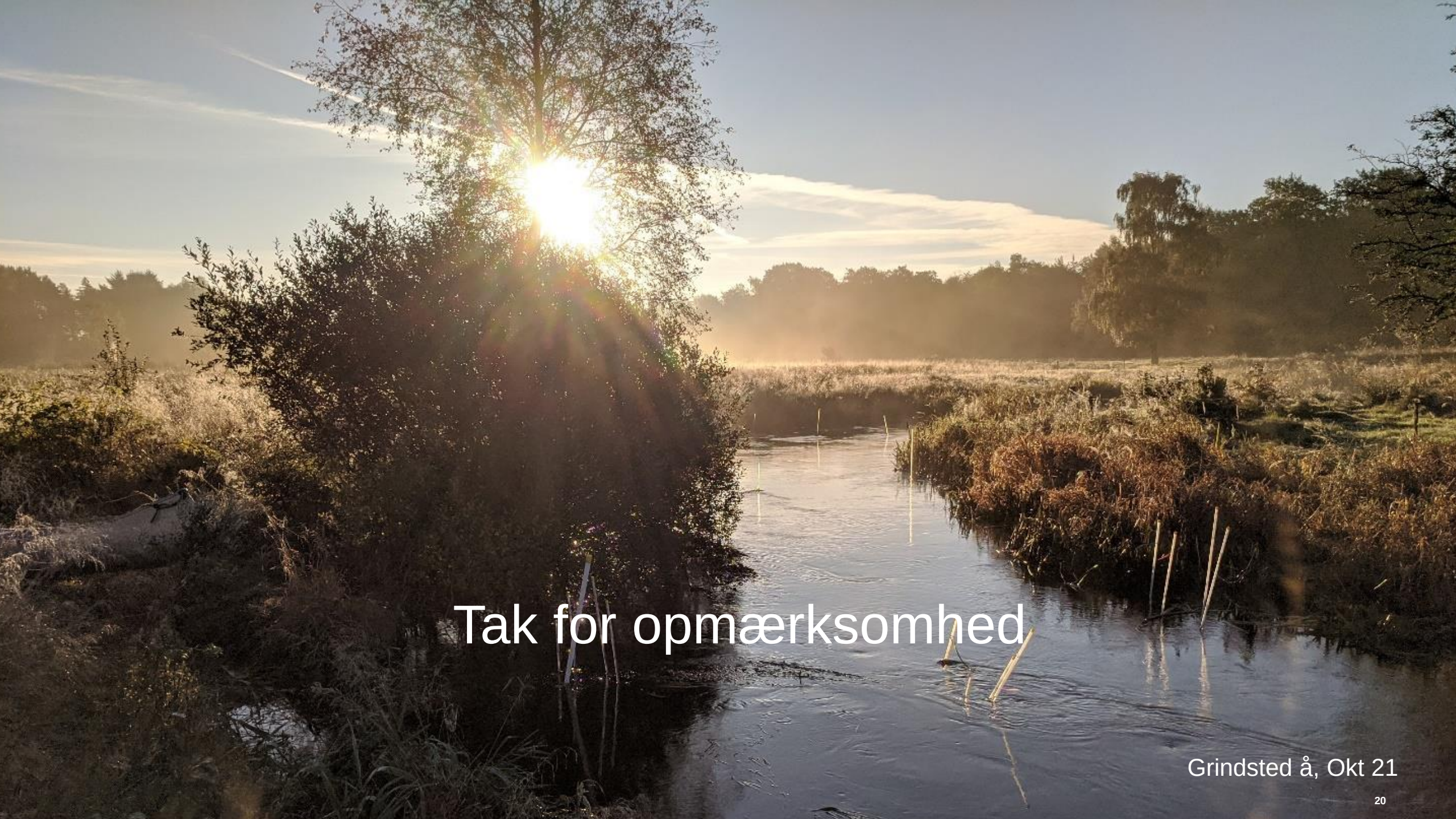


Konklusion

- Farmaceutiske stoffer (sulfonamider) kan **udsive** til Grindsted Å **fra andre områder** nedstrøms det primære udsivningsområde (chlorerede ethener)
- **Flux af sulfonamider påvist i et “nyt” område** i en ydre meander over en kort strækning
- **Høje koncentrationer** (sulfanilsyre og sulfonamider) **under åbund**, sandsynligvis **transport** nordfra fra **dybere lag** med potential nedbrydning i den hyporheiske zone.
- Størrelsen af fluxen i åen er usikker mht. bidrag pga. “near-field” interpolations effekt
- **Yderligere undersøgelser pågår** for at afklare indsivning fra dybere lag og beregne fluxen af farmaceutiske stoffer og chlorerede opløsningsmidler langs hele åen

Tak





Tak for opmærksomhed

Grindsted å, Okt 21

DTU

