A scenic view of a lake with a forest in the background and a close-up of water ripples in the foreground. The sky is blue with light clouds. The water in the foreground is dark and shows detailed ripples and reflections. The background features a dense line of green trees under a clear sky.

**Niclas Hjerdt**

# **Modelling tools**

**SMHI**

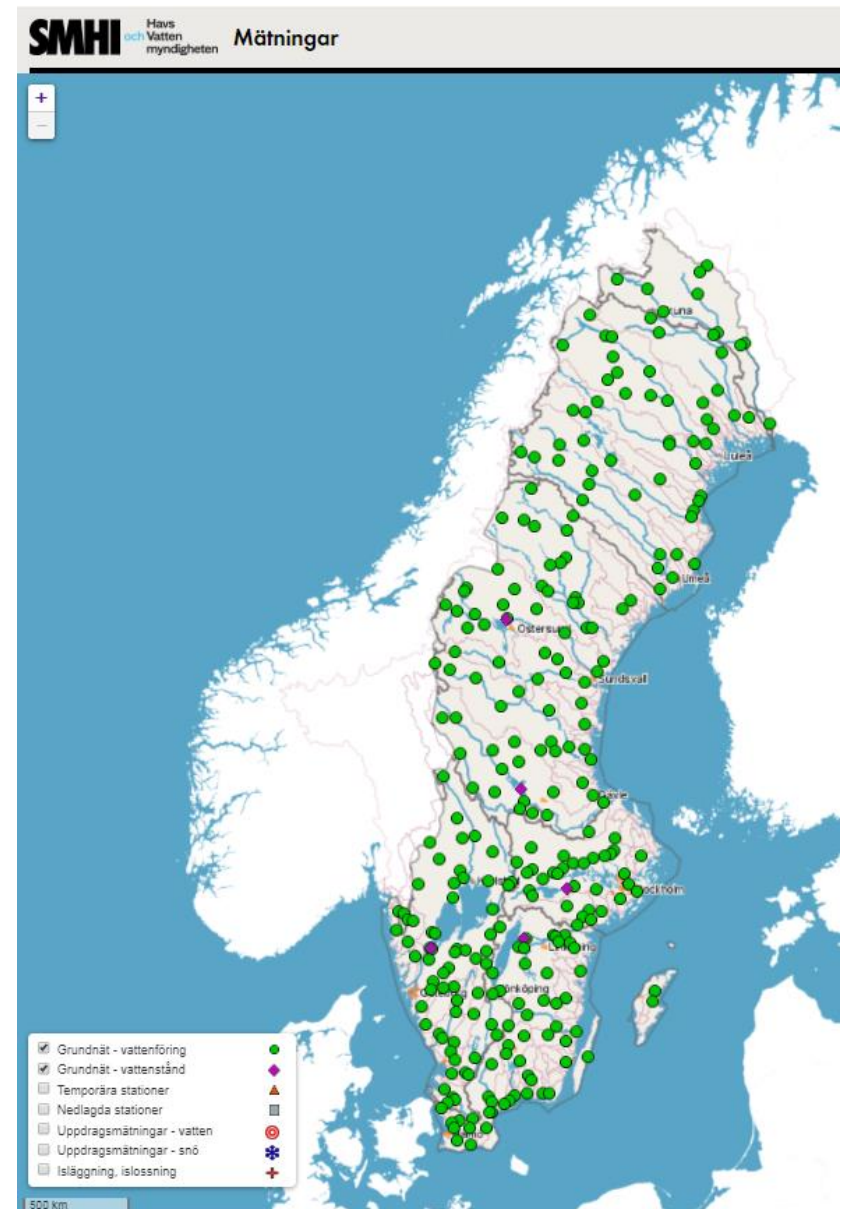
# Why models?

~330 hydrological stations

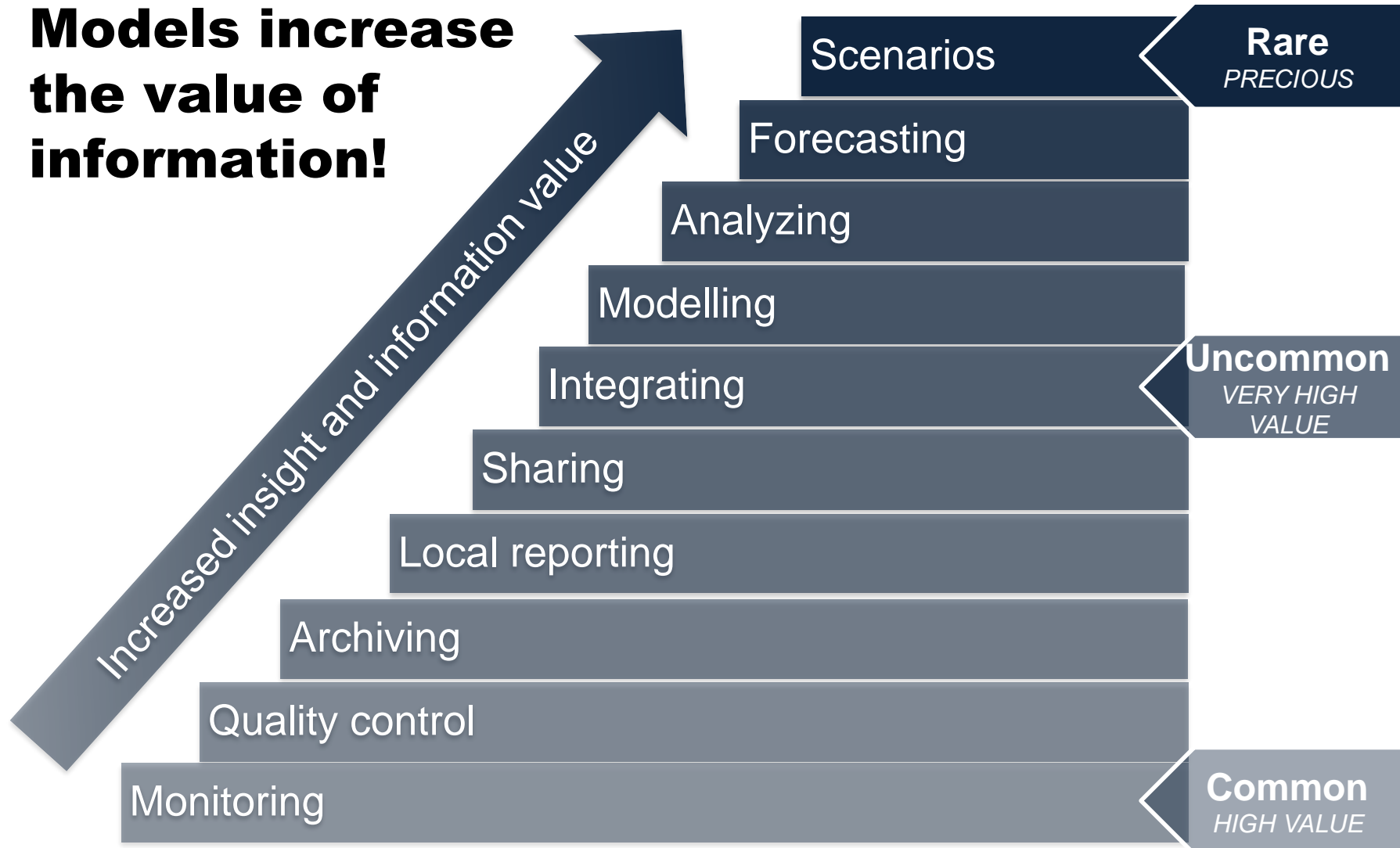
~27,000 water bodies

How to characterize water bodies without observations?

→ Modelling tools!



**Models increase  
the value of  
information!**

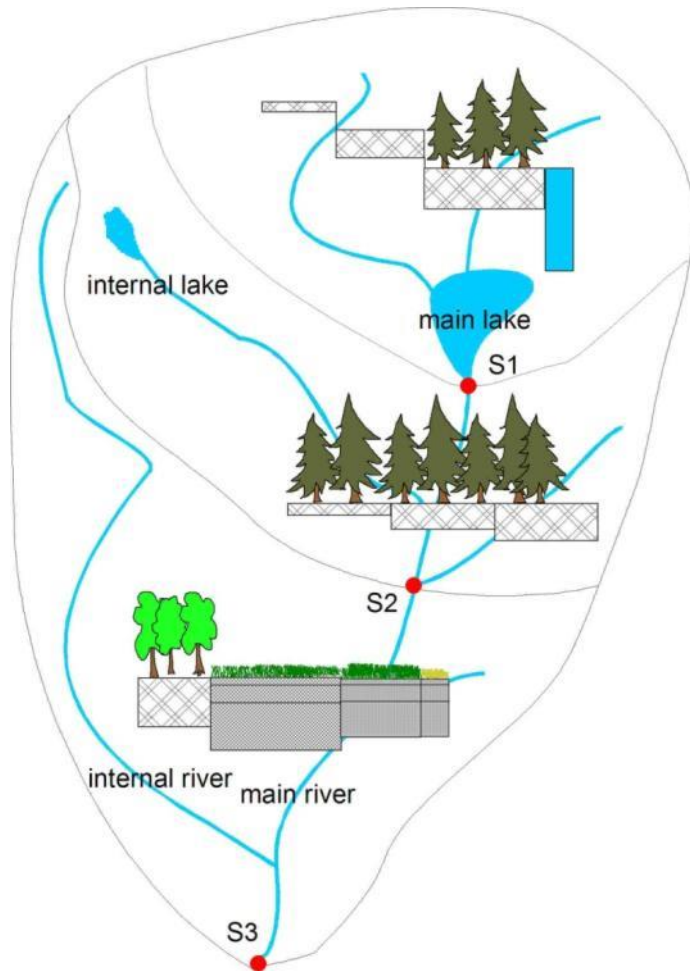




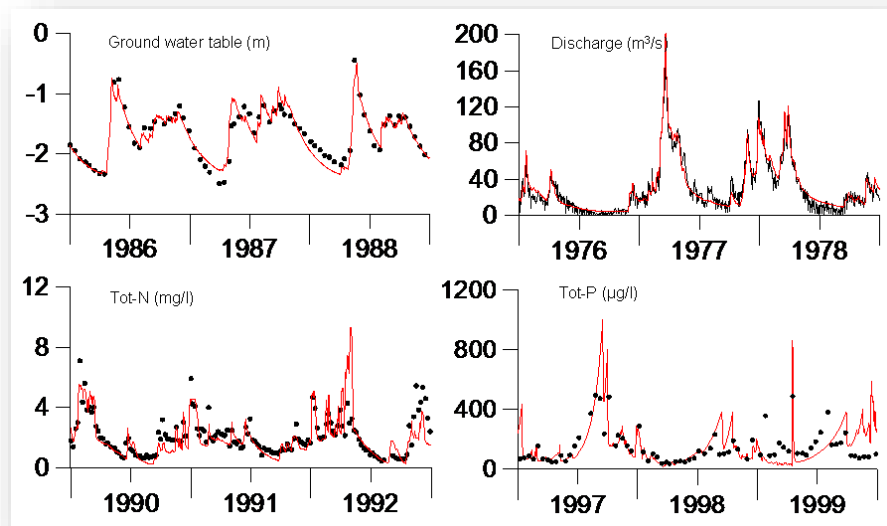
# Model complexity: Which model can fly?



# HYPE: HYdrological Predictions for the Environment

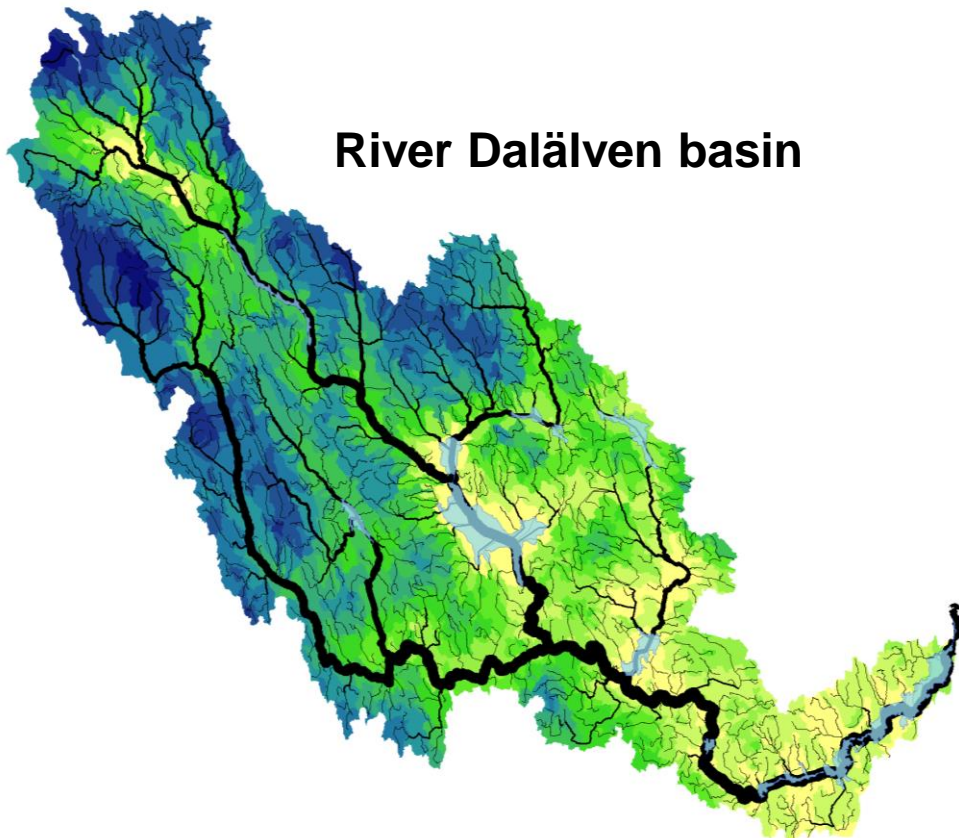


- Conceptual model with flow path description.
- Simulates water *and* solute transport.
- Model parameters are linked to land use and soil type instead of area.
- An OpenSource model (2011)

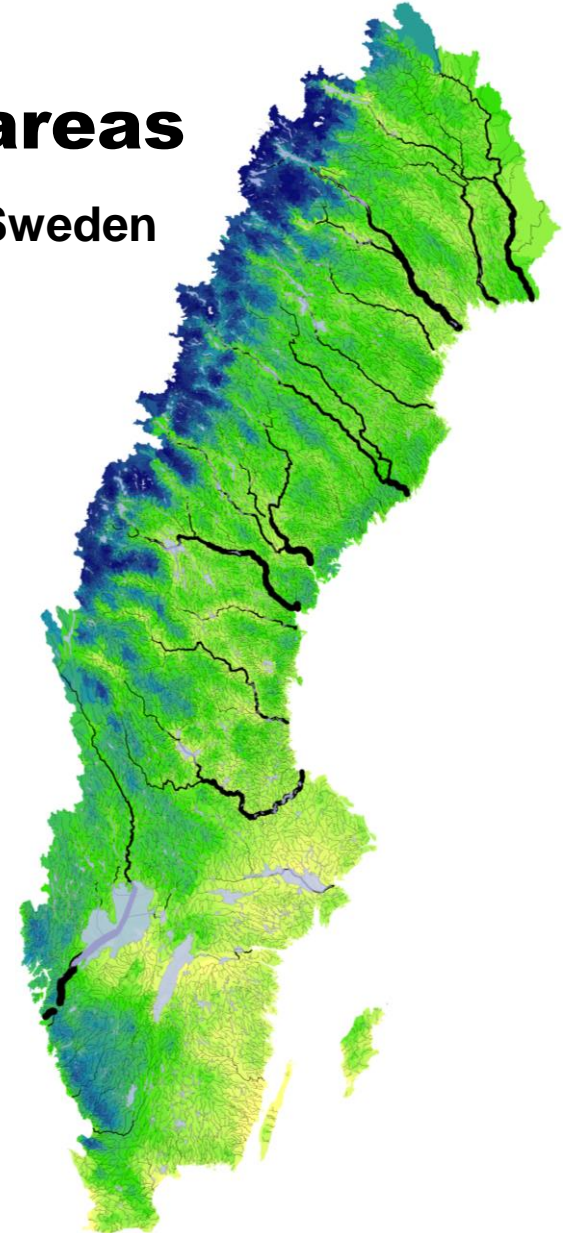


## S-HYPE produces detailed water information over large areas

- Specific runoff 1981-2010 (colour)
- Total discharge 1981-2010 (black)

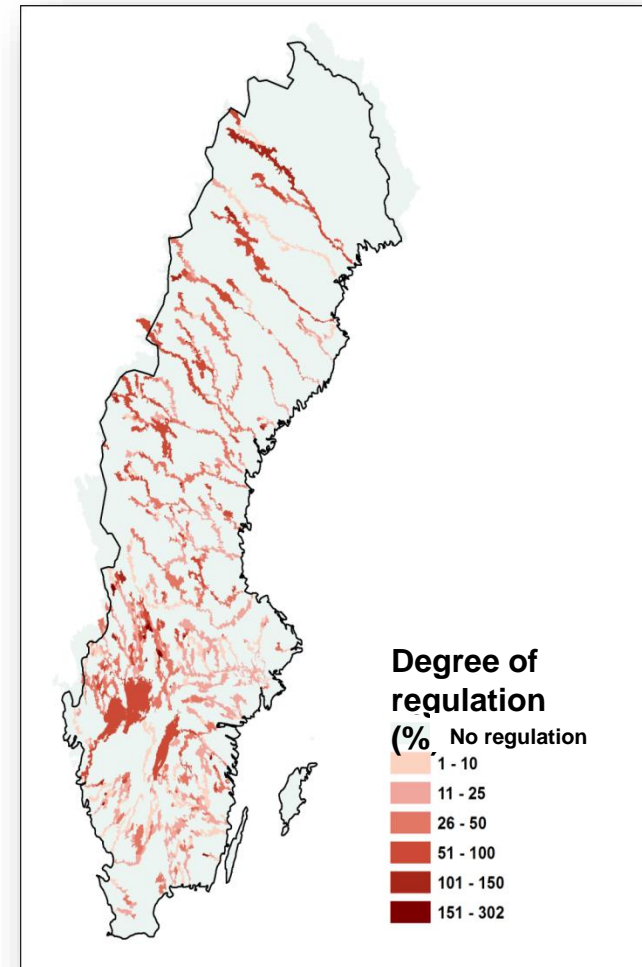


Sweden

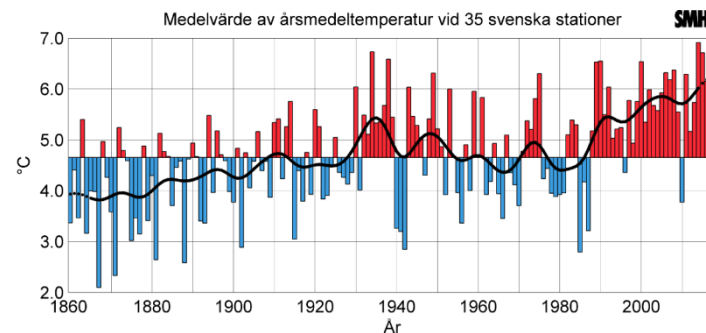
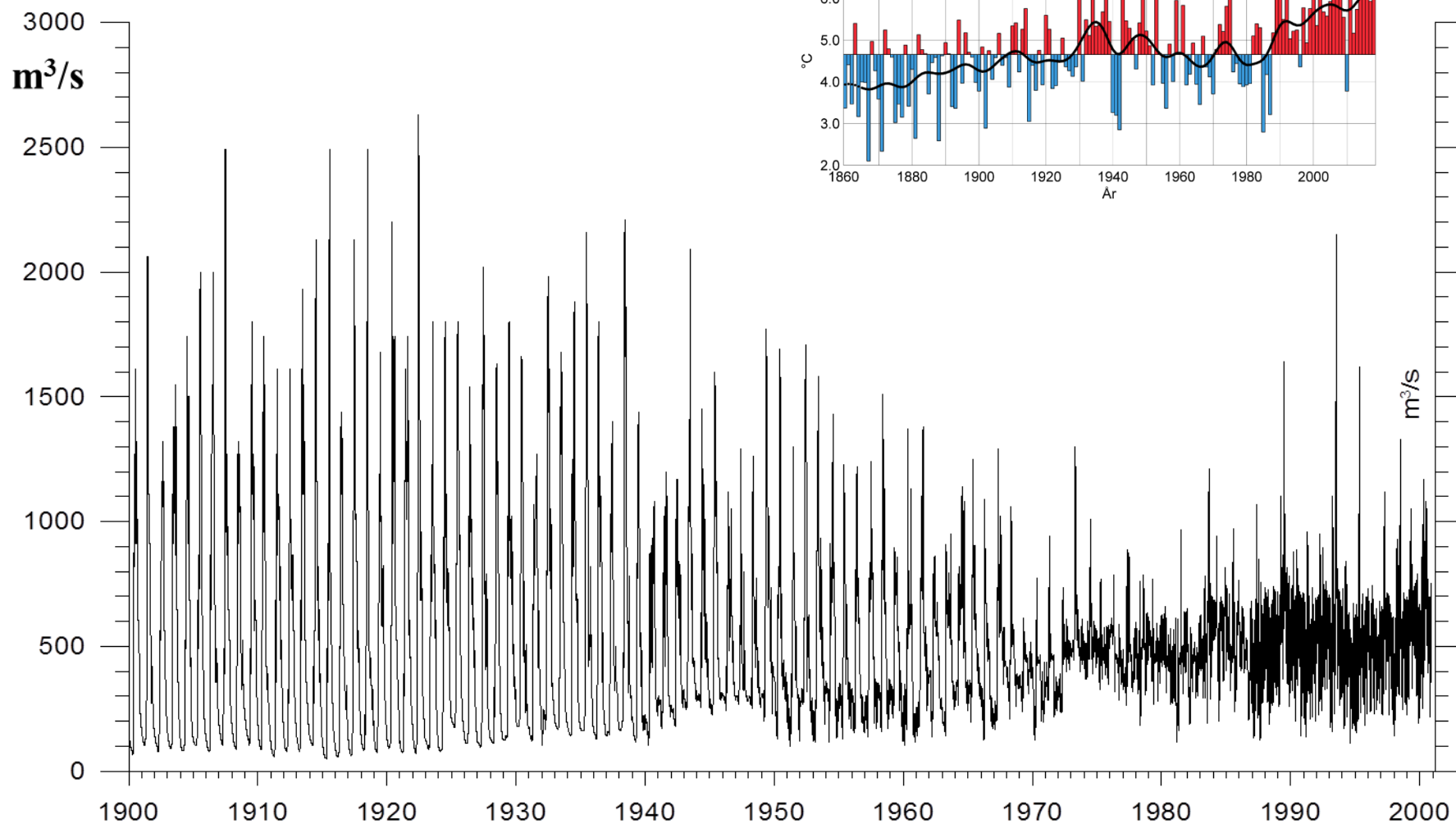


## Example: Modelling reference conditions in regulated rivers

- S-HYPE is used to simulate both regulated and unregulated river flow.
- The time series are compared to classify hydrological regime of regulated rivers.

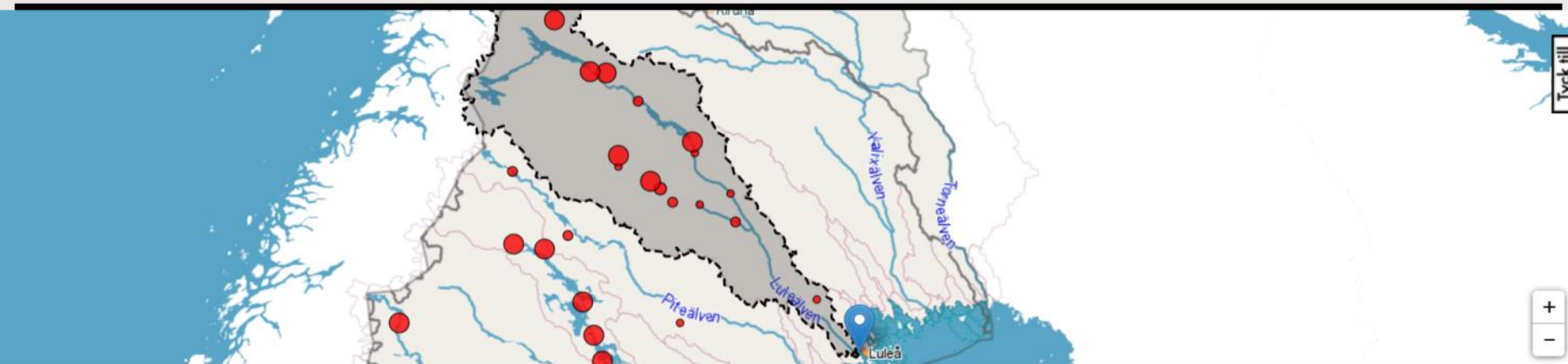


# Luleälven river flow 1900-2000



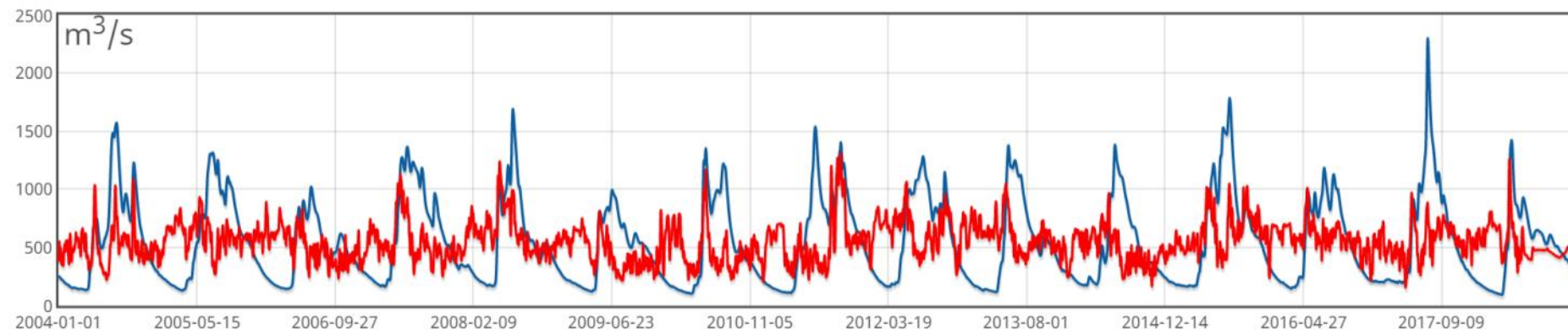


## Luleälven: Regulated vs unregulated flow

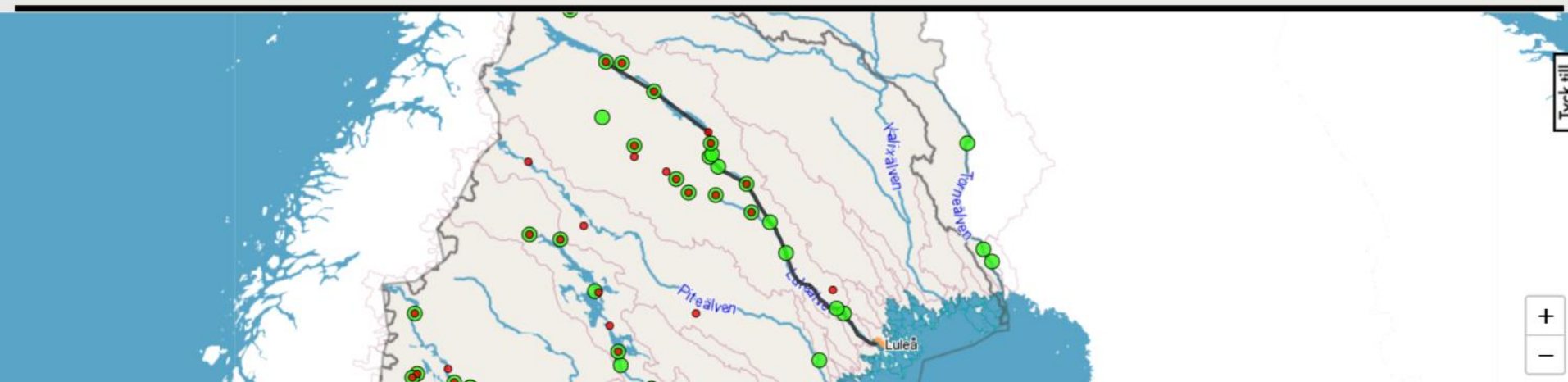


729032-178765 Luleälven (9) 25244 km<sup>2</sup>

Tidsserie  Q<sub>N</sub>  Q<sub>R</sub>  Q<sub>RK</sub>



# Luleälven: Hymo status classification



Tyck till

+  
-

750815-157670 Akkajaure SUBID: 36264

Volymsavvikelse, timme

Logaritmisk Y-axel

Nedtonad bakgrund

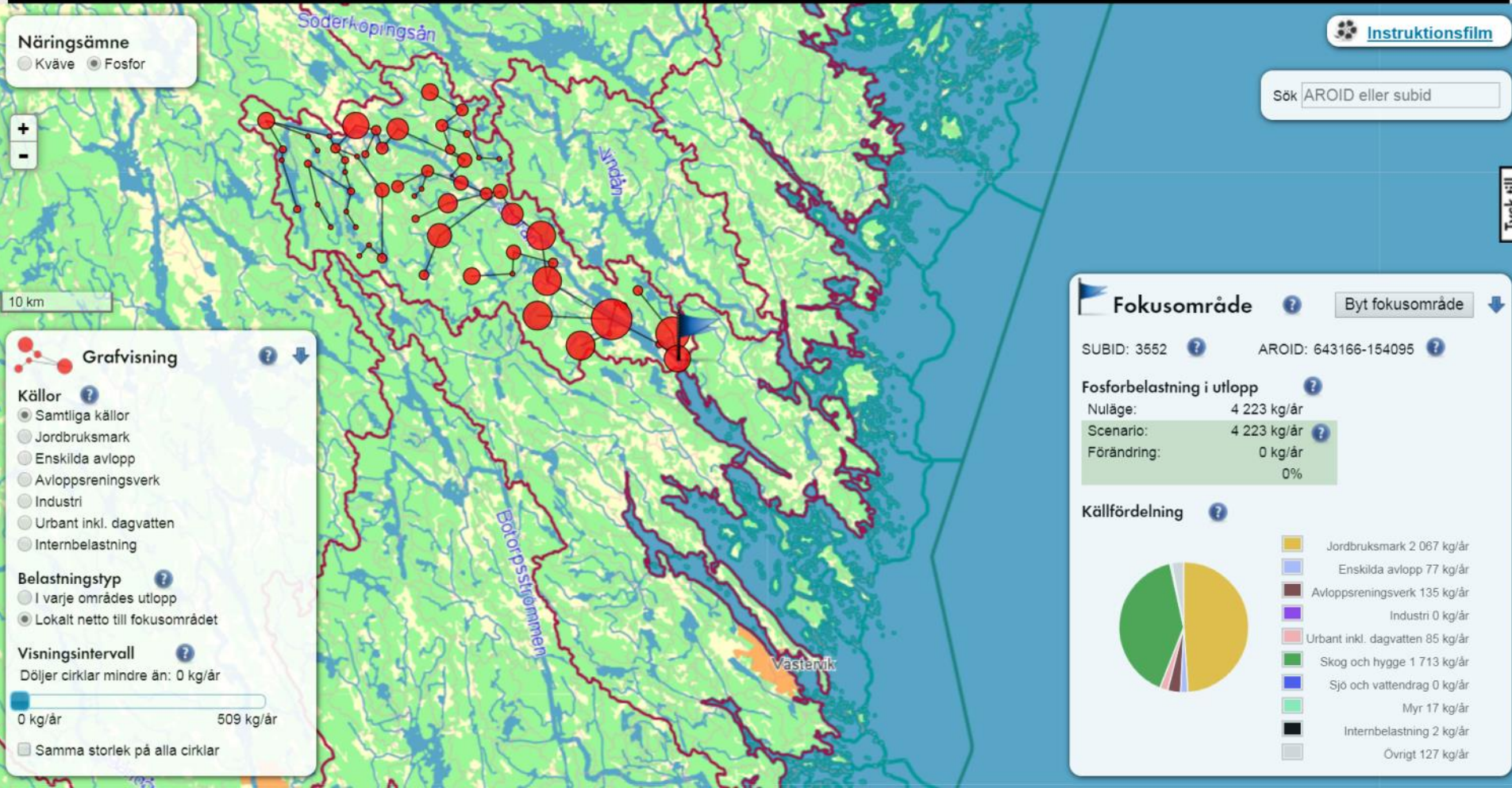
Cirkelpositioner

Ladda ner diagramdata



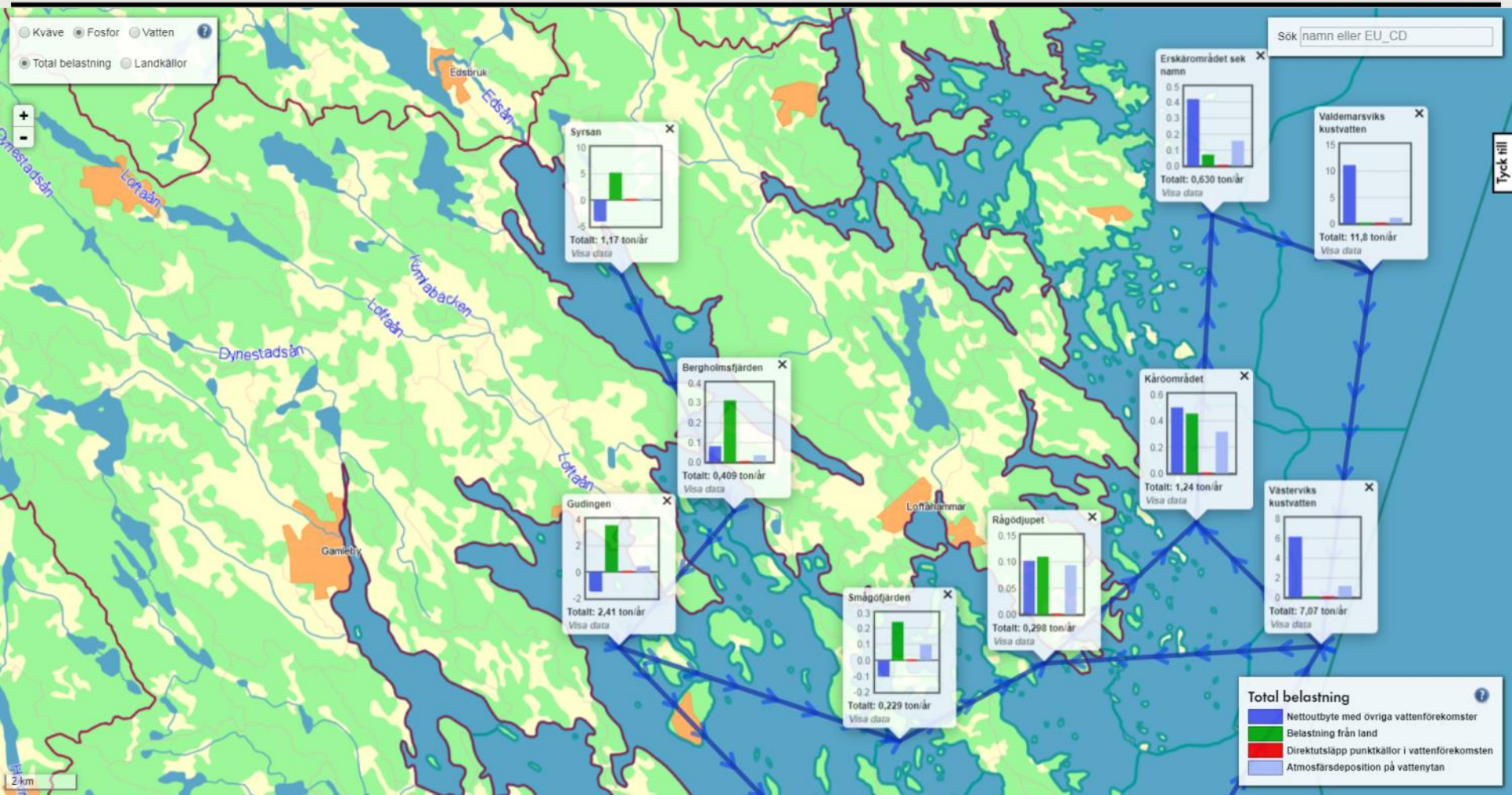


# Example: Source apportionment of nutrients in inland waters...



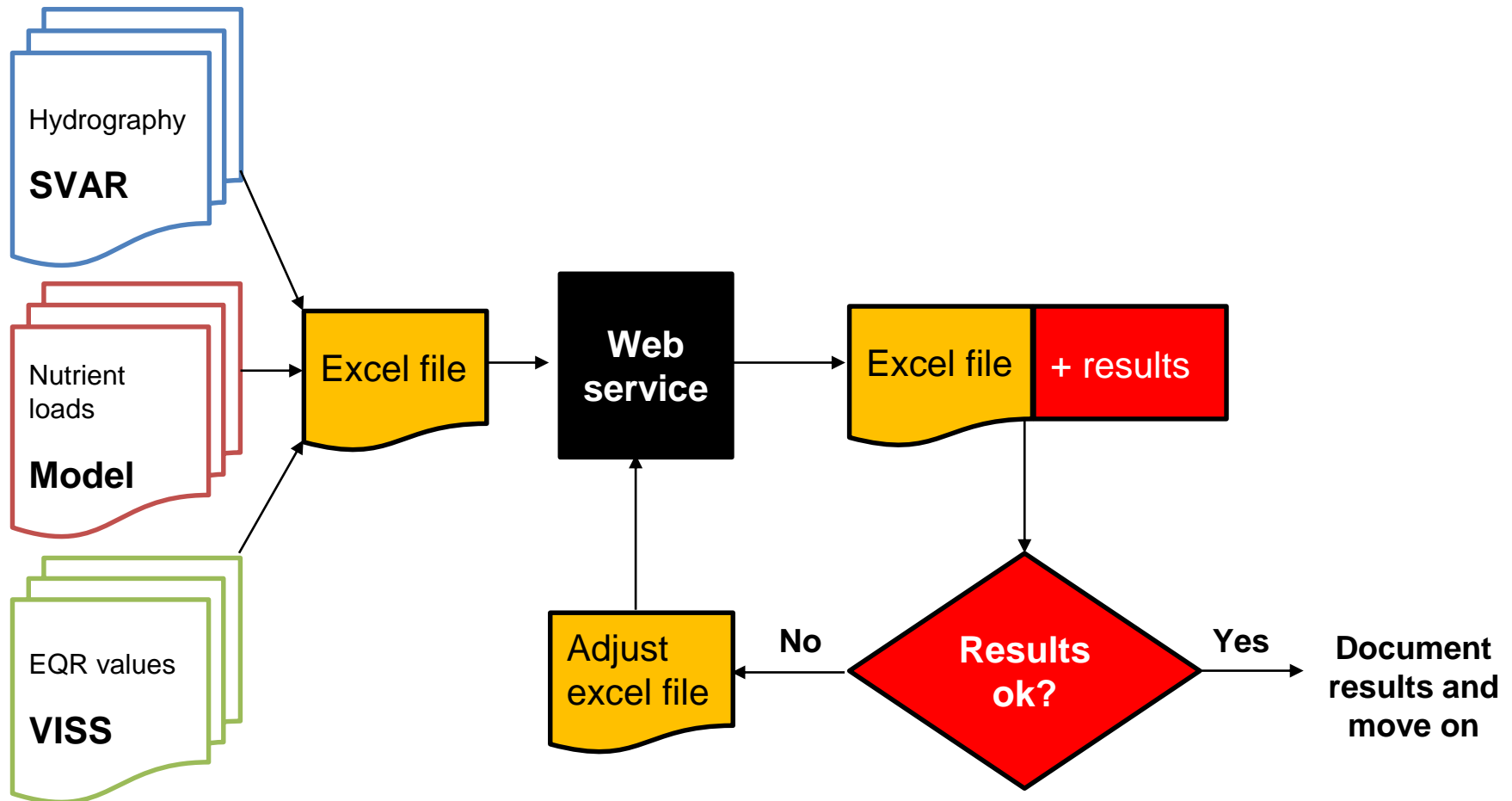


## ...and the transport, mixing, dilution and retention of nutrients in coastal areas



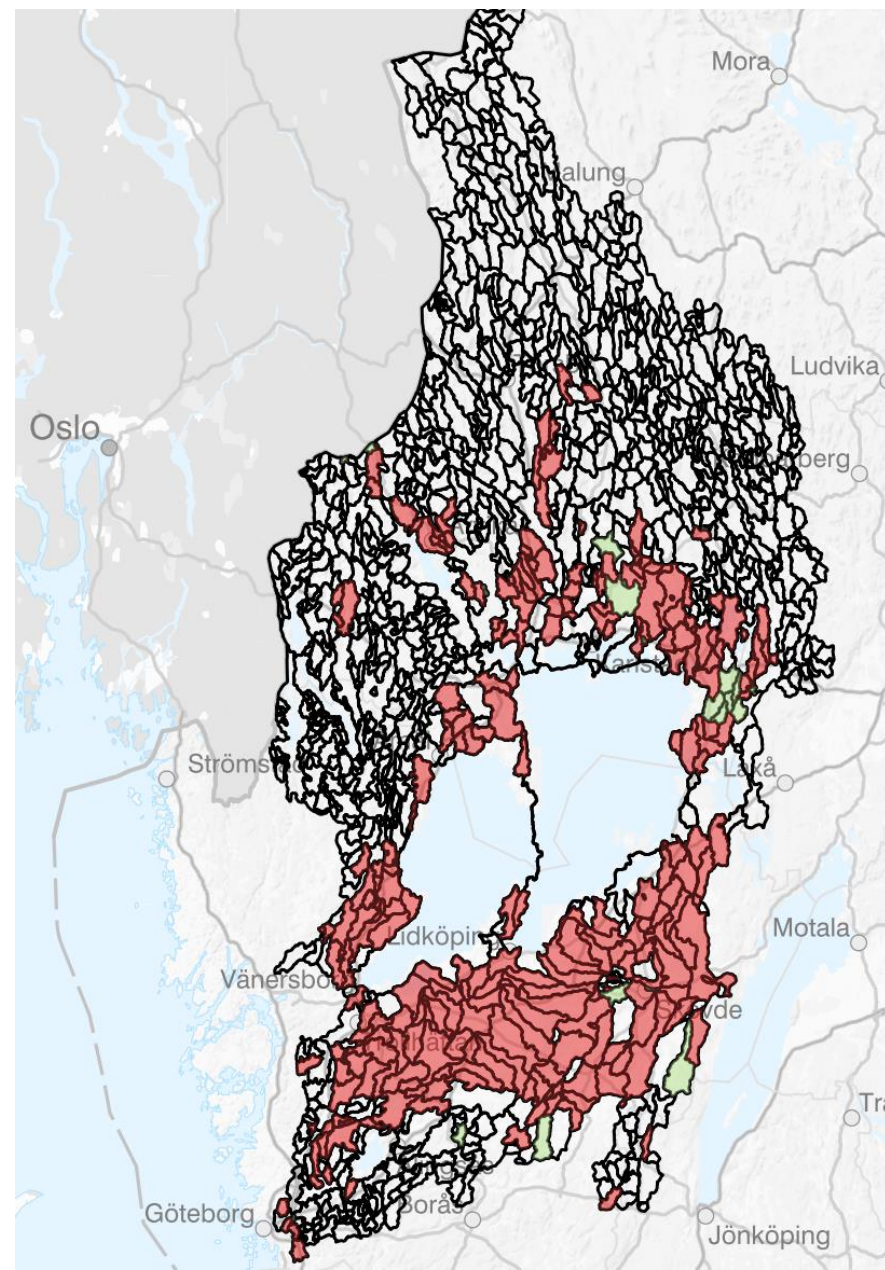


# Example: Allocating phosphorous load reductions



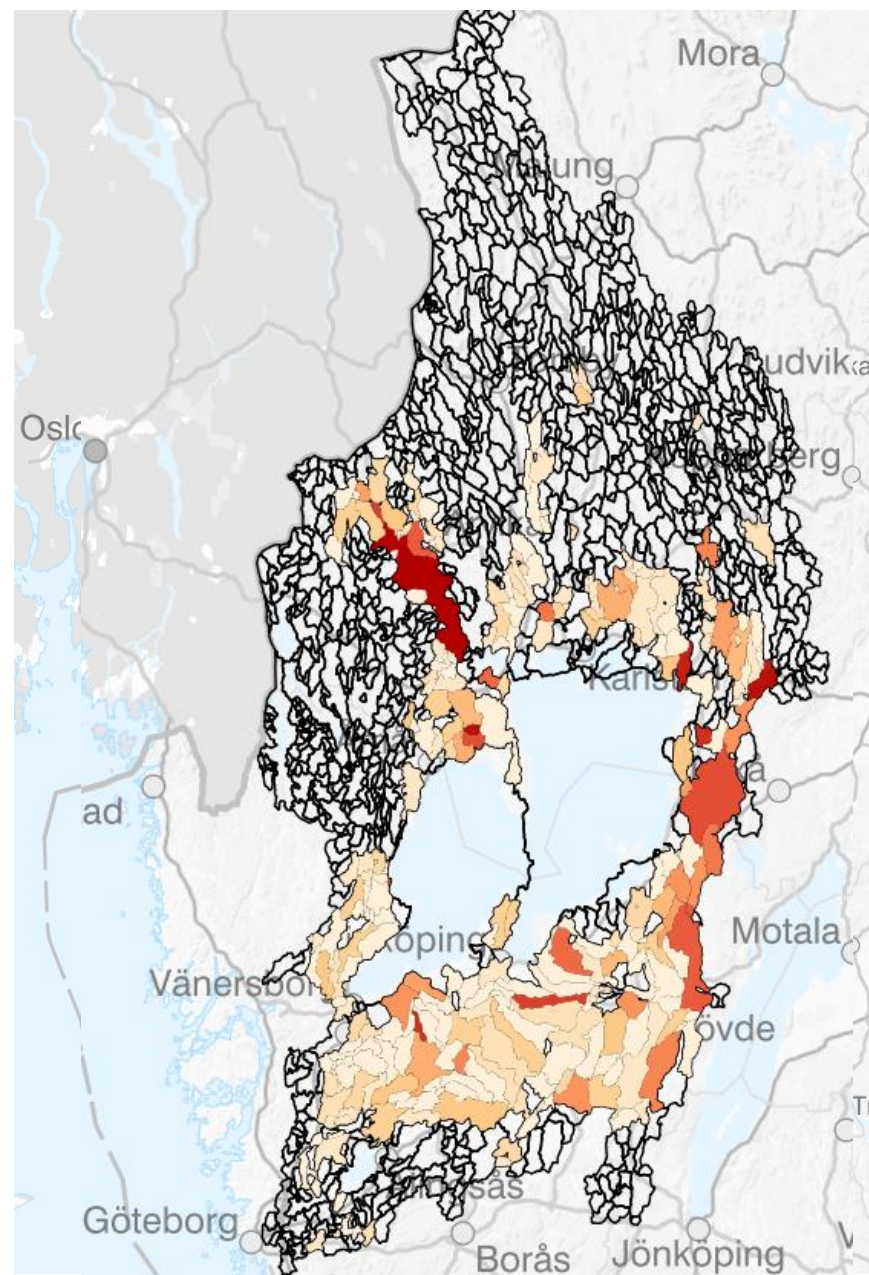
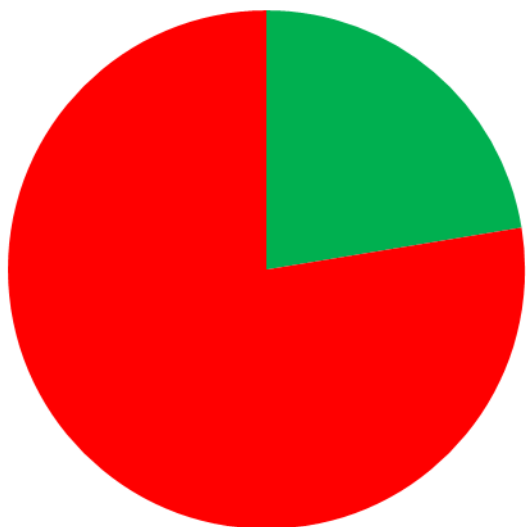
## Allocating P reductions in Göta älv

- 1623 surface water bodies
- 299 water bodies with EQR for phosphorous.
- 21 water bodies with good or better status (EQR  $\geq 0,5$ )



## After first iteration...

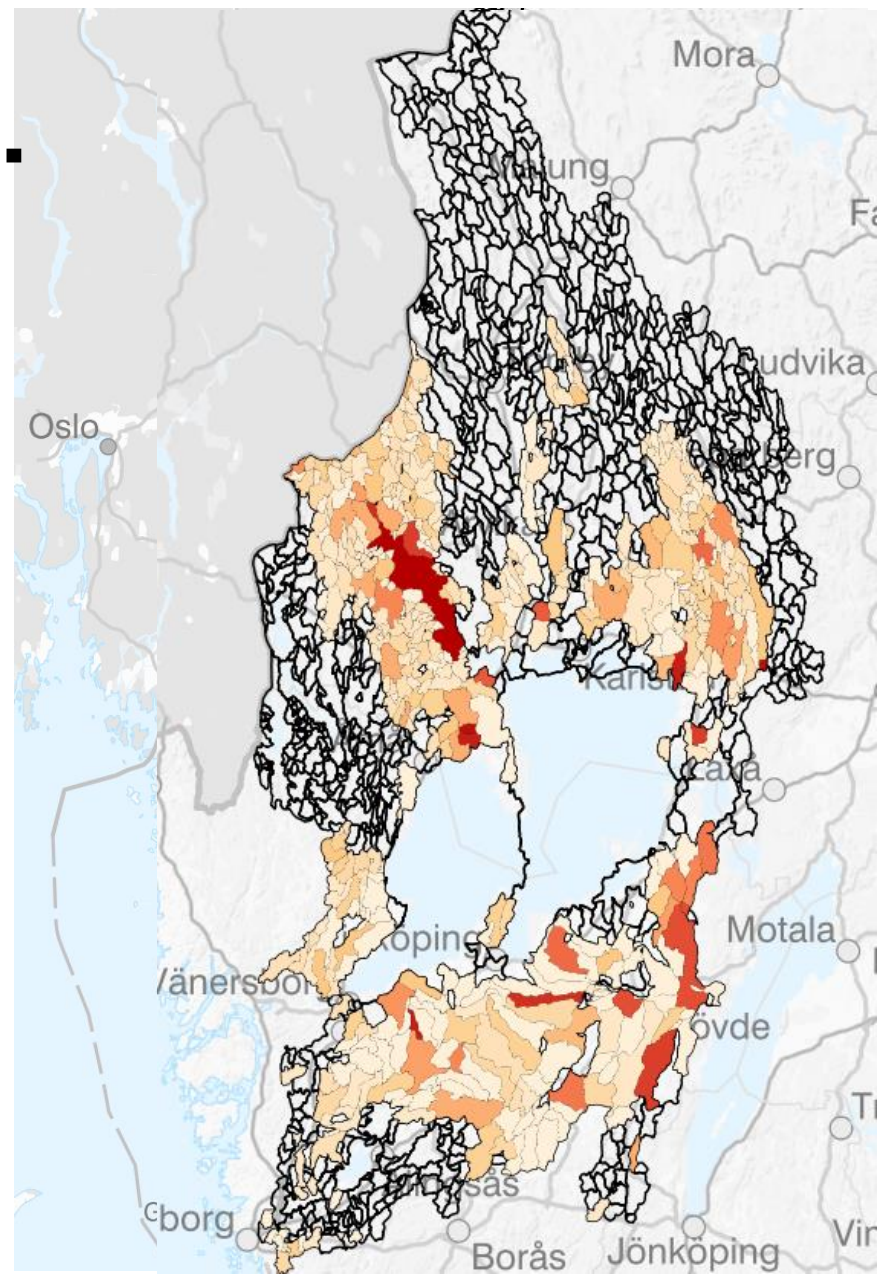
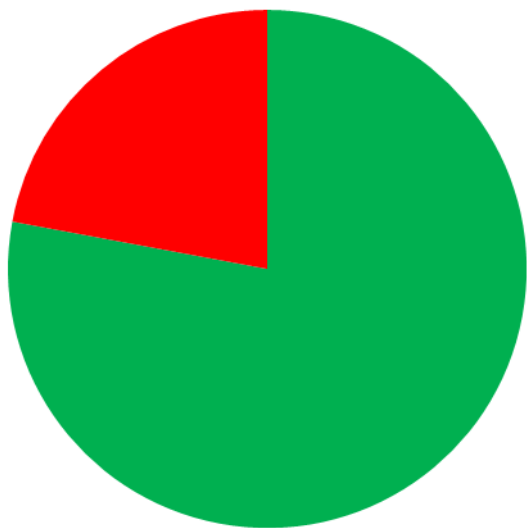
- **67** water bodies with good or better status (EQR  $\geq 0,5$ )
- **327** water bodies with allocated phosphorous reductions





## After second iteration...

- **233** water bodies with good or better status (EQR  $\geq 0,5$ )
- **582** water bodies with allocated phosphorous reductions





## **Models already offer ways to**

- ✓ Fill gaps in space and time,
- ✓ Identify faulty measurements,
- ✓ Characterize reference conditions,
- ✓ Calculate source apportionment of emissions,
- ✓ Allocate nutrient load reductions,
- ✓ Quantify effects of climate change,

## **...but why not use models to**

- **Group water bodies** according to hydrological similarity (climate, soils, land use, pressures, etc.)

A photograph of a brown frog sitting in a pond, surrounded by reeds. The frog is the central focus, with its head and front legs visible. The water is dark, and the reeds are light brown and green. The text "Thanks for your attention!" is overlaid on the left side of the image.

**Thanks for  
your attention!**

**SMHI**

[niclas.hjerdt@smhi.se](mailto:niclas.hjerdt@smhi.se)