

Methodologies to determine the nutrients standards in French freshwater rivers and lakes

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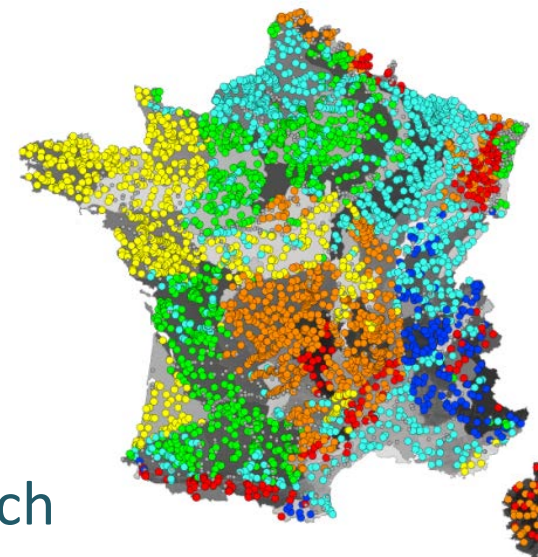
Statisticians of the Onema-Irstea consortium



Methodology in rivers



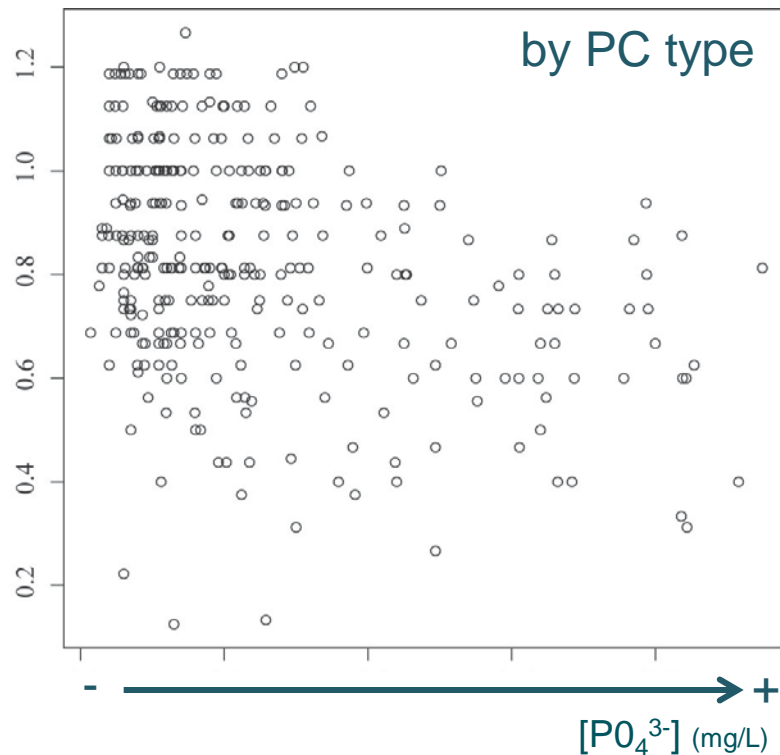
- A median values from monthly samples, 2003-2008
 - Inter-site variability \gg annual & seasonal variability
- A physicochemical typology
 - 6 homogeneous PC types
- Statistical analysis (per PC types)
 - Conditional Probability Analysis approach
 - Physicochemical thresholds



Hypothesis : PC = limiting factors on biological communities

Example : macro-invertebrates \sim PO_4^{3-}

IBGN-EQR

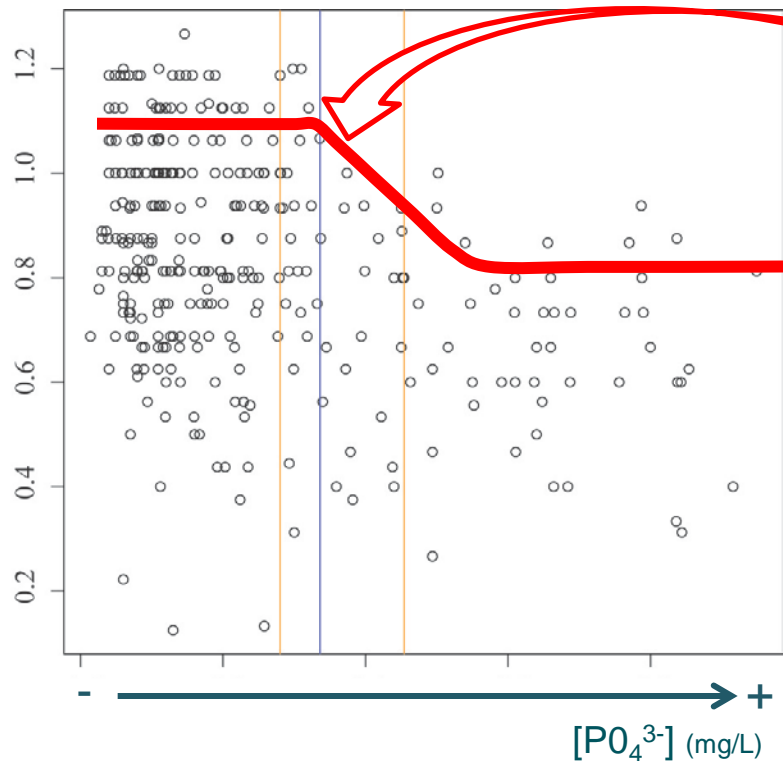


Conditional Probability Analysis

Hypothesis : PC = limiting factors on biological communities

Example : macro-invertebrate communities $\sim \text{PO}_4^{3-}$

IBGN-EQR



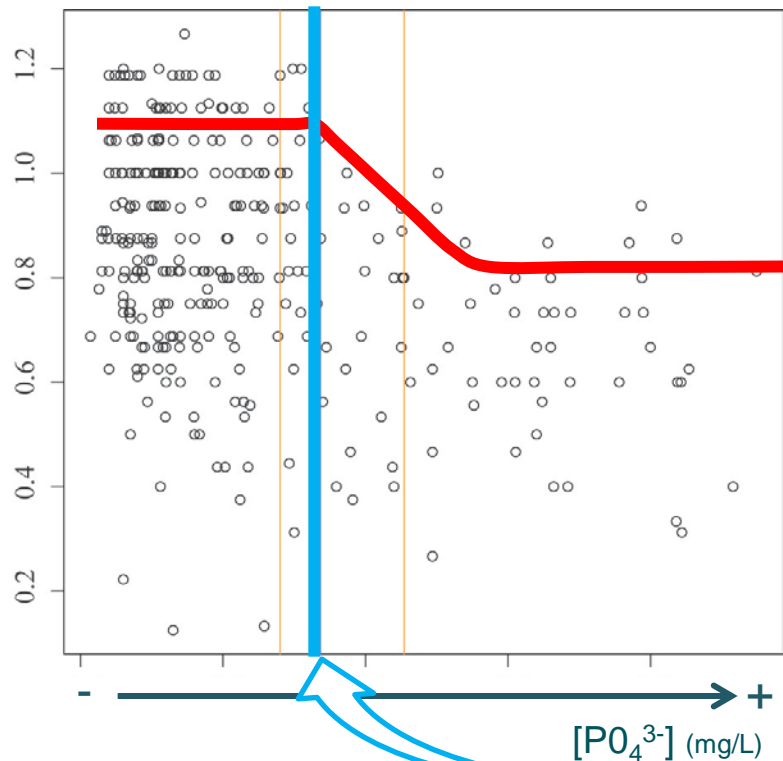
Limiting effect of the PC on the biological community

Conditional Probability Analysis

Hypothesis : PC = limiting factors on biological communities

Example : macro-invertebrate communities $\sim \text{PO}_4^{3-}$

IBGN-EQR



Limiting effect of the PC on the biological community

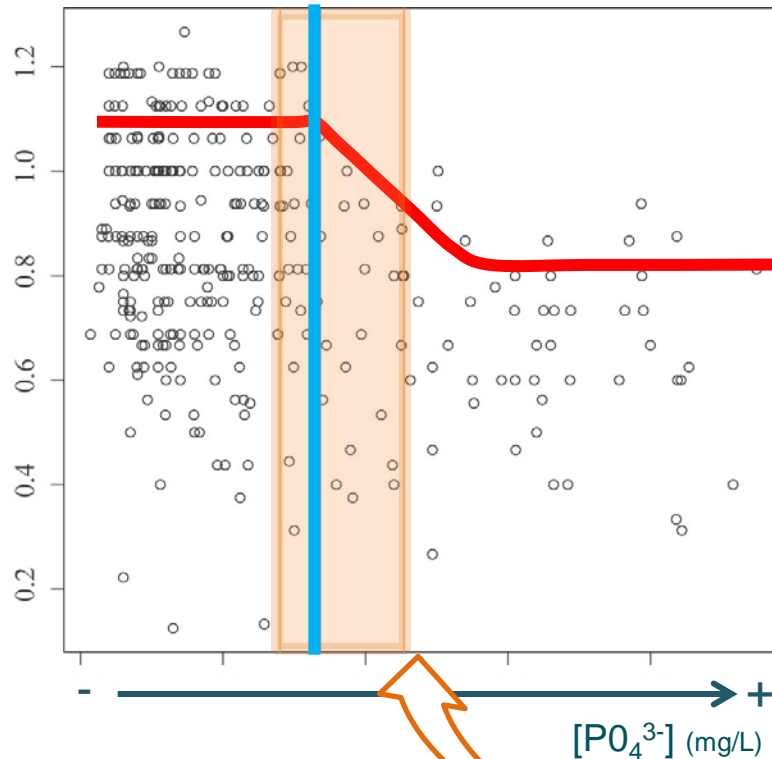
PC threshold for the good ecological status

Conditional Probability Analysis

Hypothesis : PC = limiting factors on biological communities

Example : macro-invertebrate communities $\sim \text{PO}_4^{3-}$

IBGN-EQR



Limiting effect of the PC on the biological community

PC threshold for the good ecological status

Estimated errors by bootstrapping analysis



Methodology in rivers



- The good/moderate threshold

Biological communities	Already used biological indexes	Future biological indexes
Diatoms	IBD2007	IBD2007 improved
Macro-invertebrate	IBGN	I2M2
Fishes	IPR	IPR+
Macrophytes		IBMR

- Others thresholds

→ in progress

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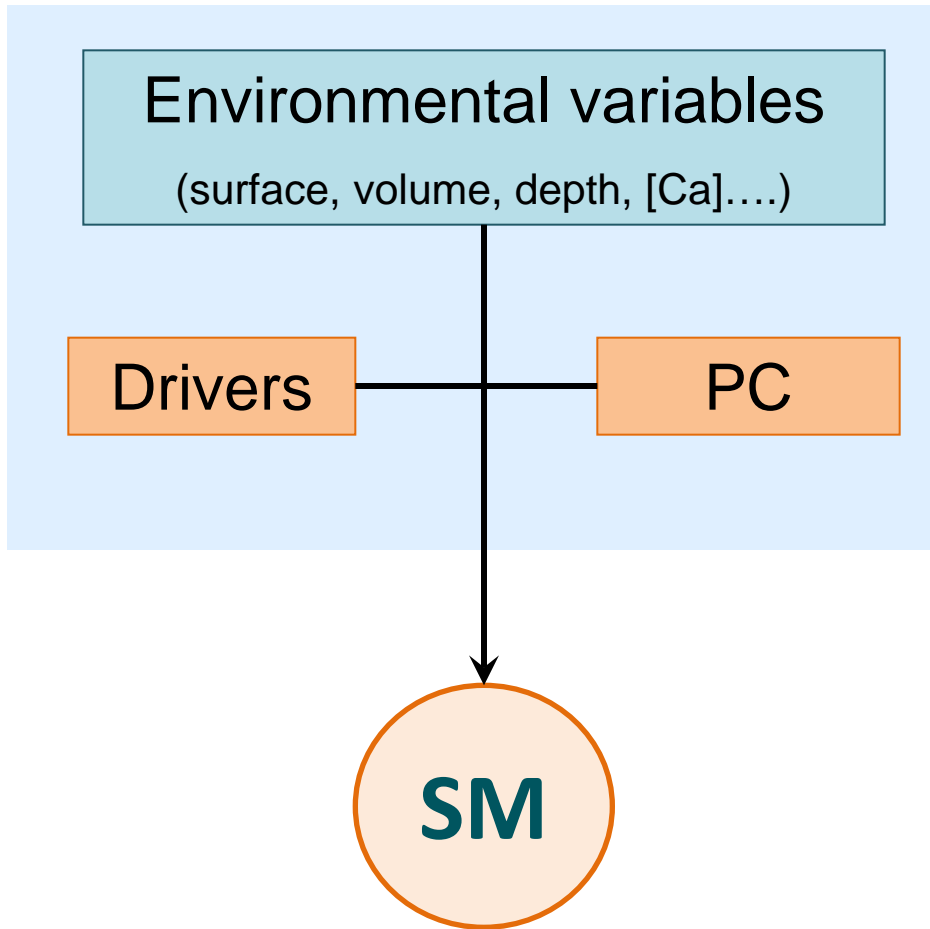
Methodology in lakes



- Mean values from 4 annual samples (2004-2011)
 - Inter-site variability >> annual & seasonal variability
 - Inter-site variability >> spatial variability in each lake
- A typology
 - Thermal behaviour typology (STR/POLY)
 - Modelling approach considering natural chemistry
- Statistical modelling analysis
 - Hindcasting approach

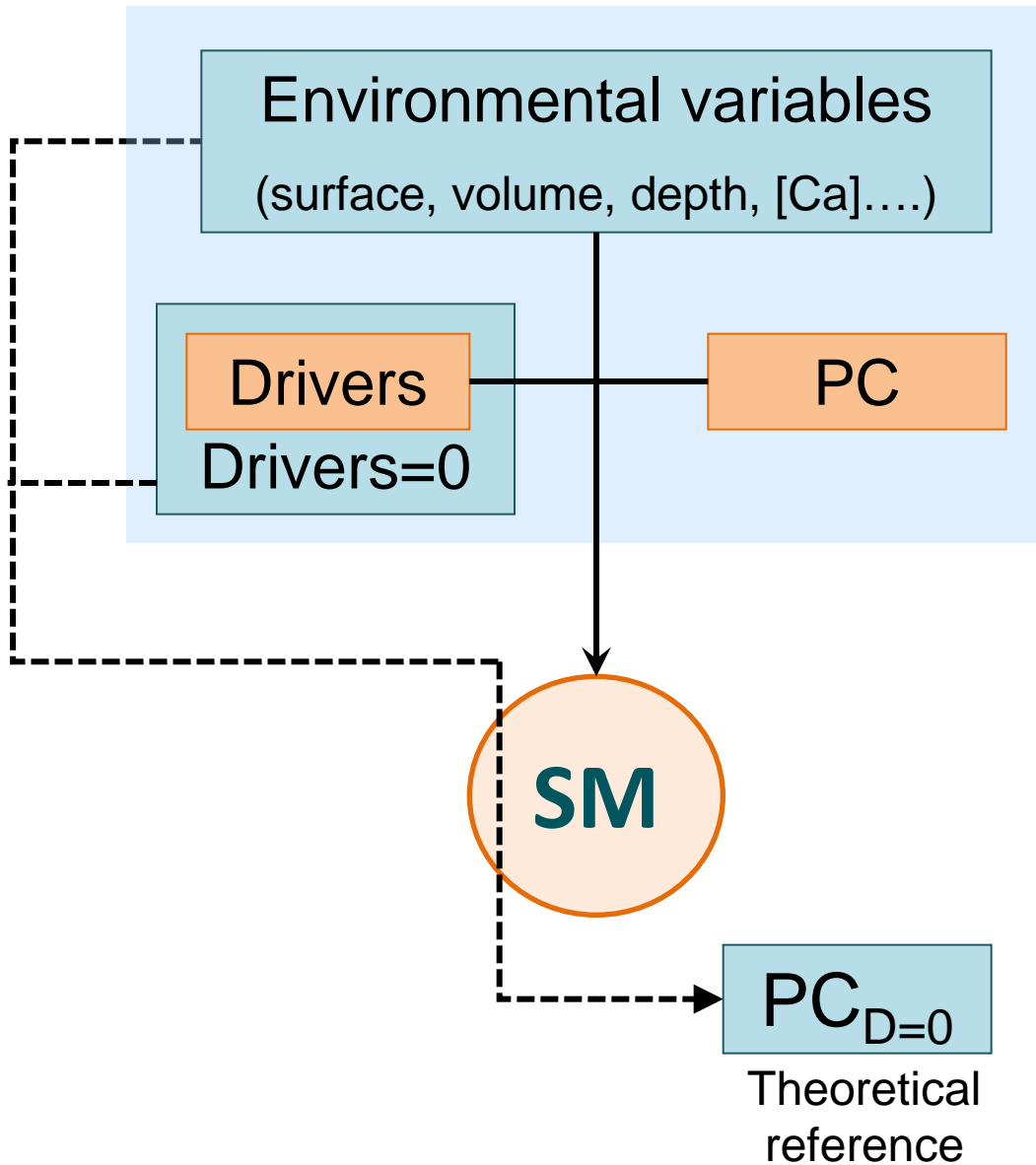


Hindcasting modelling



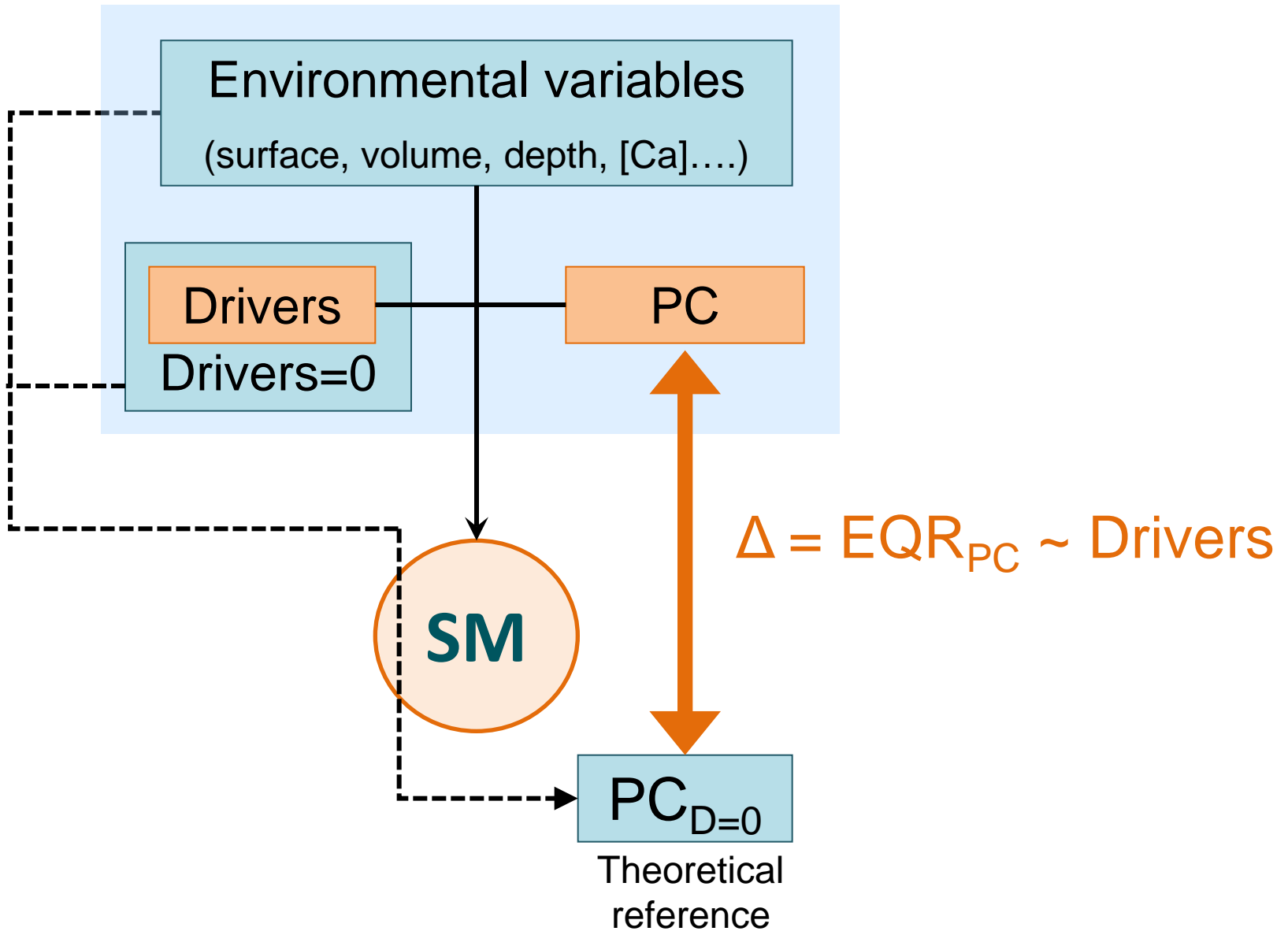


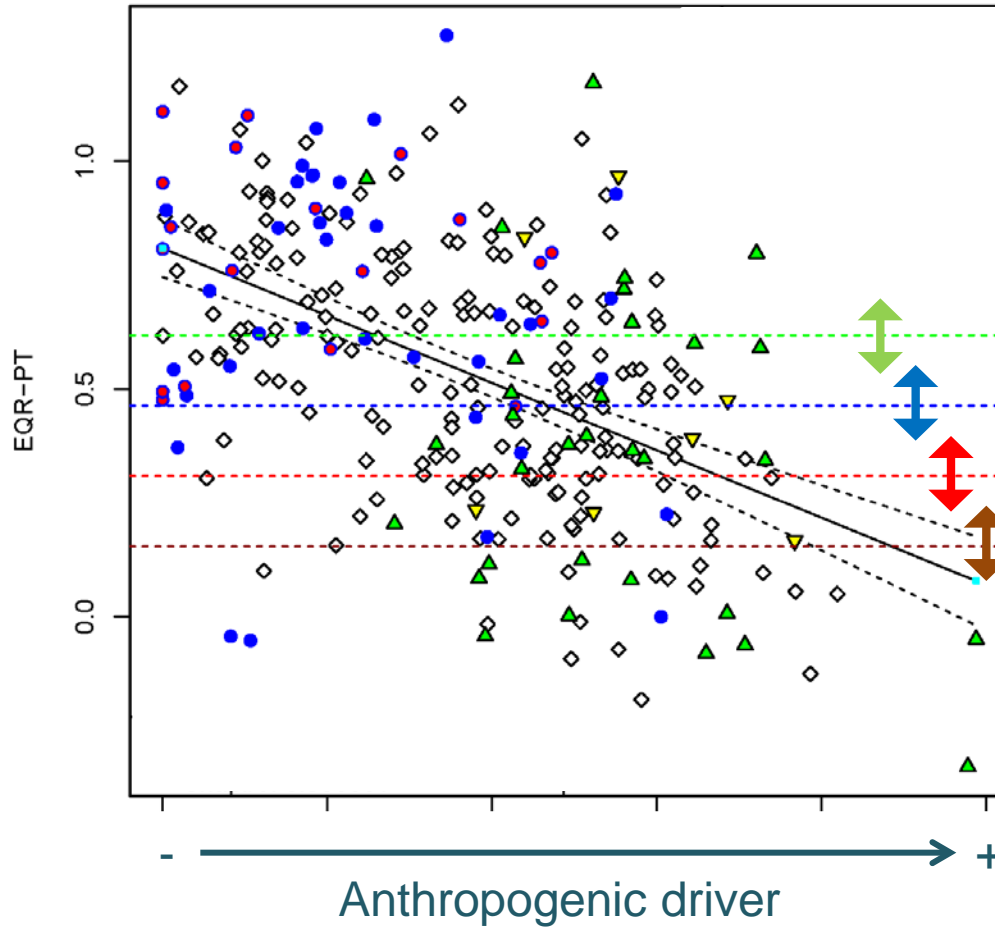
Hindcasting modelling





Hindcasting modelling





- Methods to fix the thresholds have to be tested
- Thresholds are lake-dependant



In the future but soon...



- Validate the hindcasting models for each physicochemical elements
- Estimate thresholds by a comparison with biological indexes (= rivers)
- Consider the uncertainties

... for all the supporting physicochemical quality elements.

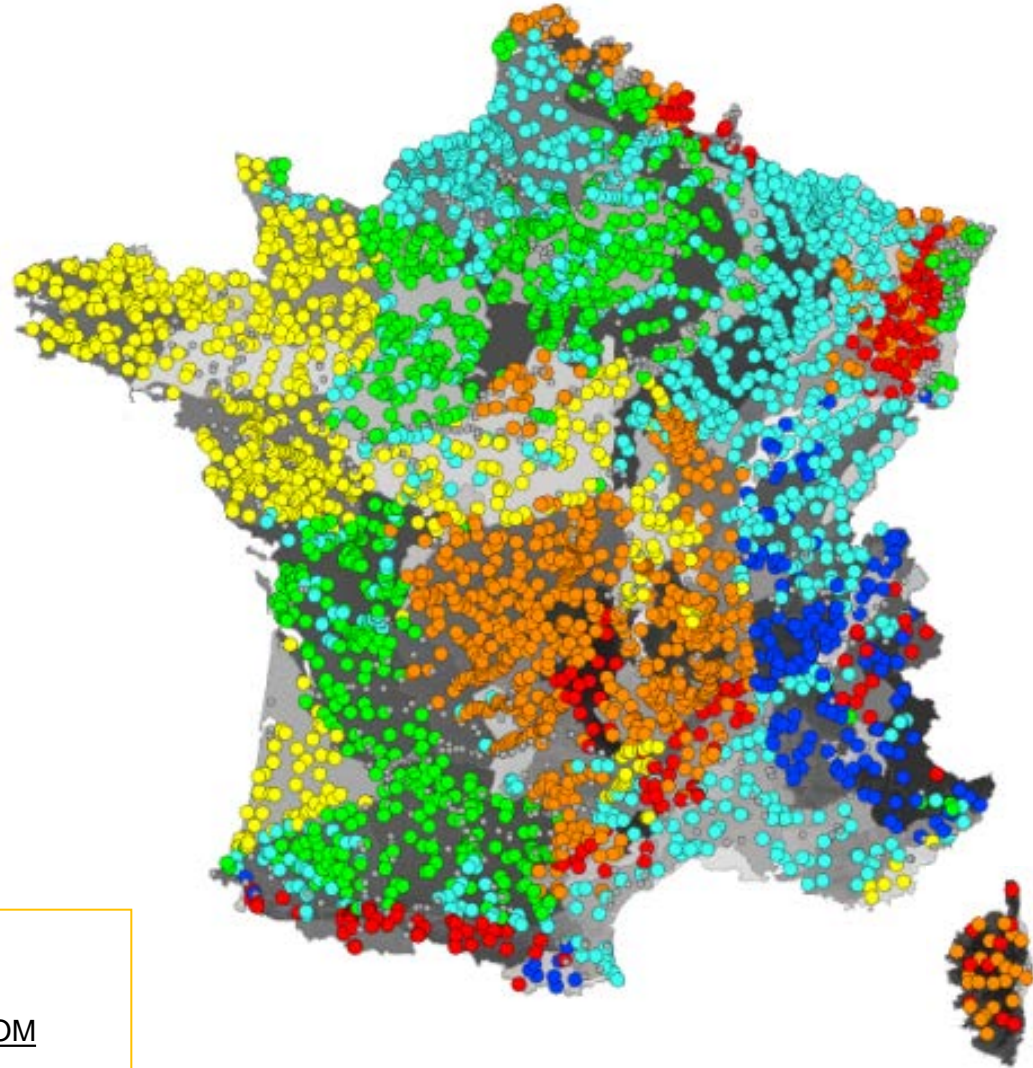
Thank you



A natural heterogeneity



And a recent
typology for
rivers ...



Water hardness

Hard

Soft



Low altitude / high nutrients & SOM



medium altitude & concentration



High altitude / low nutrients & SOM



Physicochemical elements



Monitoring network in lakes (minima):

+ 4 campaigns per year, 1 year per cycle of 6 years

+ in-situ measurements each meter (◆)

+ 8 water samples: euphotic zone (■) and bottom water (■)

+ 1 sediment sample at the end of the summer (◆)

