Does the Rhône River fertilise Lake Geneva ?

in the context of its re-oligotrophisation

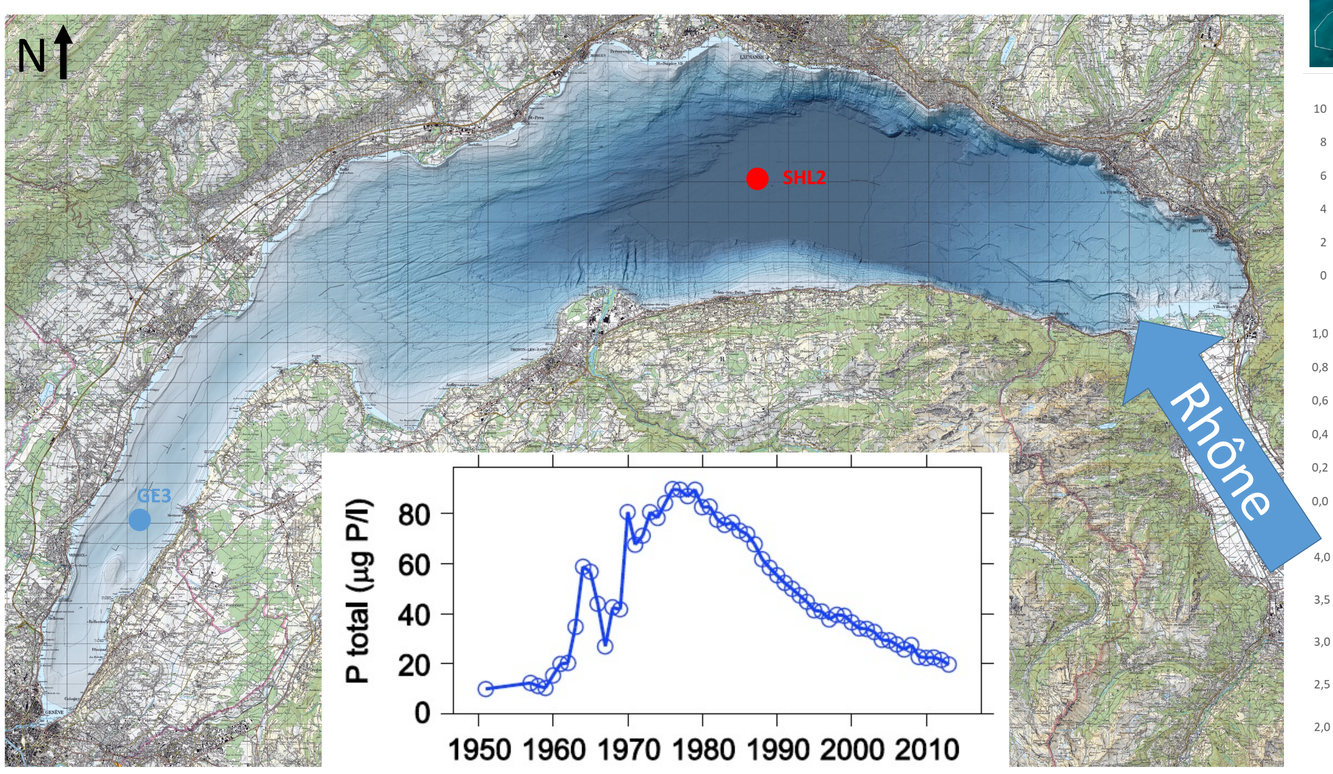
UNIL | Université de Lausanne

Gabriel Cotte, Torsten Vennemann

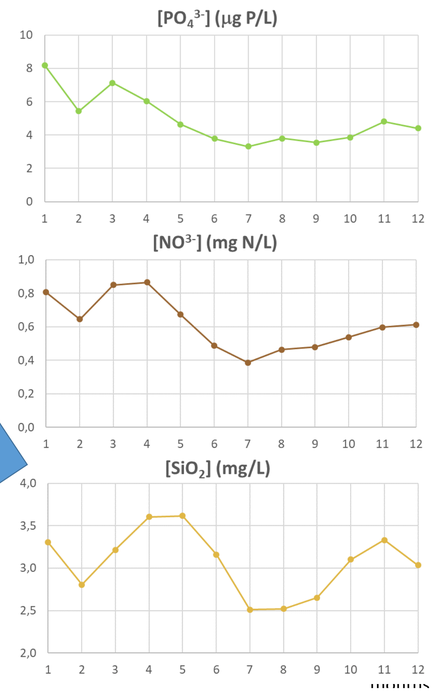
Contexte

After a period of eutrophication during the 60's and 70's with annual average of total phosphorus reaching 90 µg P/L, Lake Geneva has been on the way of re-oligotrophisation. Since the 80's, after Swiss and French measures were taken to limit the phosphorus input into the lake, the concentration decreased to 10 µg P/L. Despite this important reduction, the amount of biomass measured every year does not decline. Nowadays, because the phosphorus becomes a limiting factor earlier and earlier during the season, it is important to evaluate (i) which nutrients are coming from the river inputs, (ii) where it is transported and (iii) how it is metabolized.

This study focuses on the Rhône River, the principal tributary to Lake Geneva, both in terms of discharge of water and sediment load.



Averaged concentration in the lake *(CIPEL 2016)*



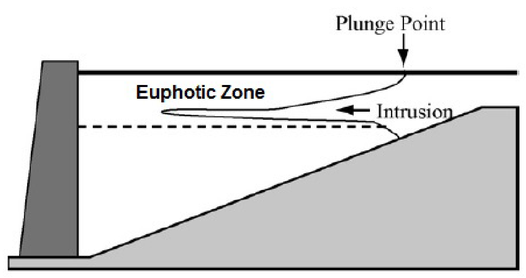
Averaged Rhône concentration *(BAFU 2010-2016)*

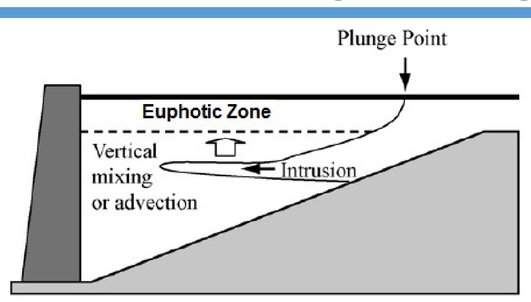
Questions

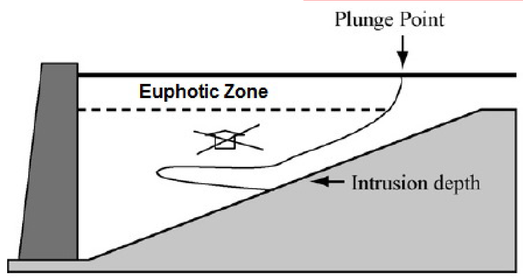
Are the Rhône nutrients available for the primary production ?

WHAT ?

WHERE ?







WHEN ?

During the stratification period (from spring to early fall)

During fall

During winter and flooding events (indirect fertilisation via winter mixing)

Rueda et al., 2007

The "river-lake transition" project

Partnership : UNIL | Université de Lausanne, EPFL, Université de Genève

Are there **hydrodynamic processes** at the river mouth that are creating optimal conditions for phytoplankton growth ?

Is there a **chemical gradient** related to the Rhône water dispersion ?

Is there an optimal zone for phytoplankton growth in the river-lake transition zone through an **ecocline** ?

Material & Method

Frédéric Soulignac (EPFL – ECOL)

- ADCP transects
- Suspended particles analysis

Gabriel Cotte and Matthieu Fallet (UNIL – IDYST)

- $\delta^{18}O$ and δD of water
- DIC and $\delta^{13}DIC$
- POC and $\delta^{13}POC$
- Nutrients: P, N, Ca and Si

Fabio dos Santos Correia (UNIGE - ISE)

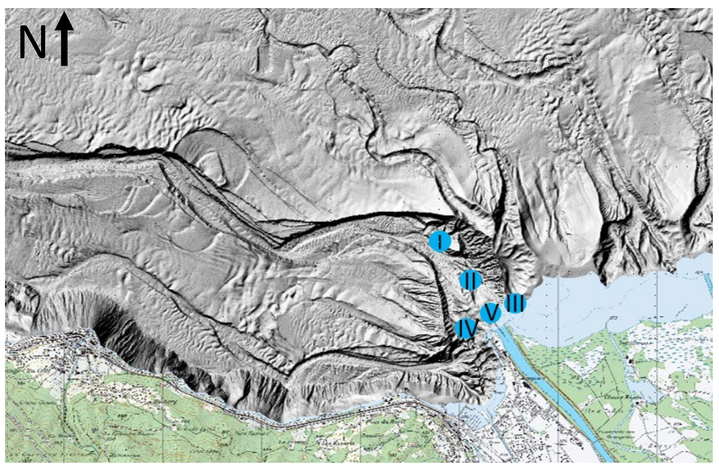
- Chl a profiles
- Cells analysis (Cytobuoy)
- Pigments analysis (HPLC)

$\delta^{18}O$ = water tracer

Sampling calendar :

- *April 2019*
- *September 2019*

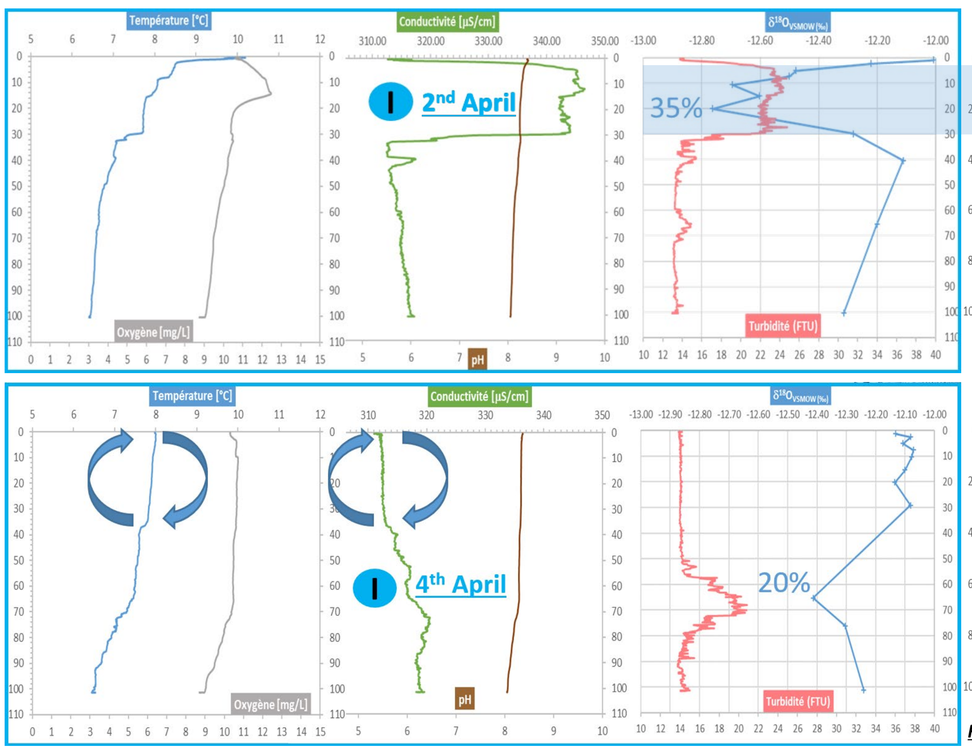
First Results

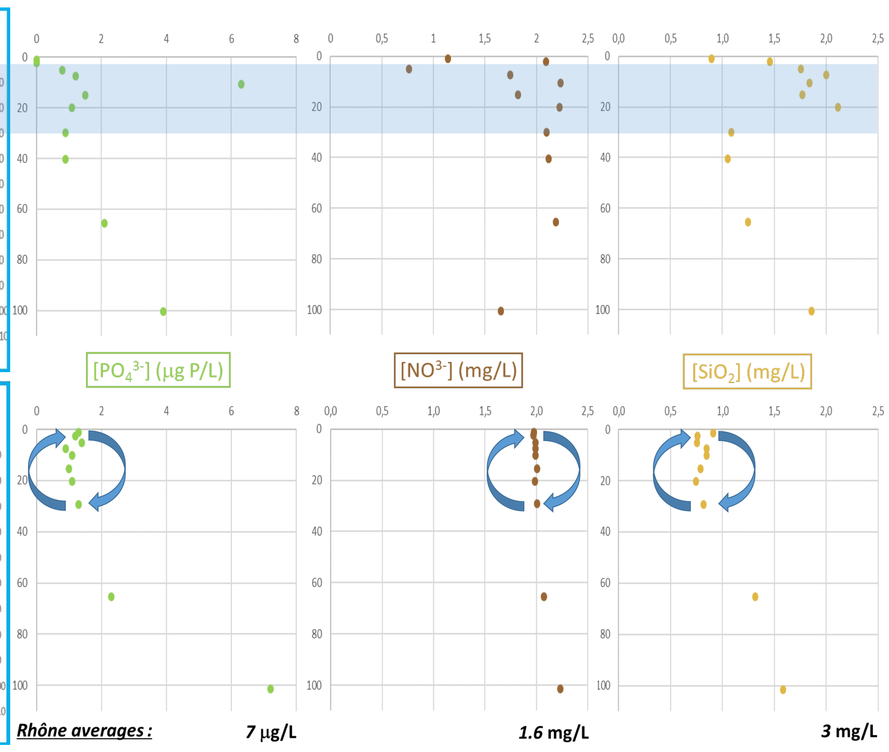


2nd April : Intrusion between 3 and 30 m depth

3rd April : Westerly 50 km/h

4th April : Intrusion between 55 and 80 m depth





Conclusion

- The example of this wind event shows the link between the **meteorological conditions** and the **nutrient dispersion**.
- The impact of the Rhône River intrusion on the Primary Production of the lake will depend on the **intrusion depth**, the **hydrodynamic** of the lake and the amount of **nutrient** transported by the Rhône.
- The **biological data** coupled to the **chemical data** will allow to explain the phytoplankton dynamic in the river mouth area.