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Zones Ateliers
LTSER FRANCE BASSIN DE LA MOSELLE

Effect of clear-cutting on the dissolved organic matter in the Wüstebach catchment

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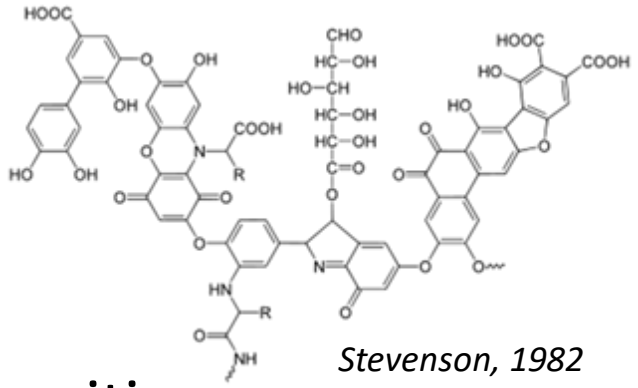
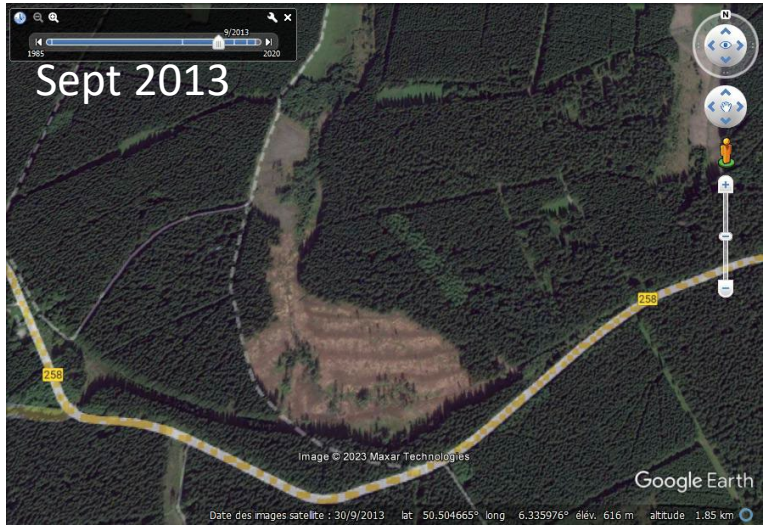
Background



Stevenson, 1982

- Aquatic dissolved organic matter (DOM)
- Part of the carbon cycle
- Decomposition of plant, bacteria and algae
- Complex soluble organic compounds, without a clear composition
- Fulvic acids, humic acids, protein-like substances
- Protects aquatic organisms from UV radiation ☺
- Toxic by-products during drinking water production ☹
- Allochthonous or autochthonous DOM
- Land use and land management
- Forested areas: lumbering, cleart-cuts (pest-infection, unwanted species)

The Wüstebach catchment



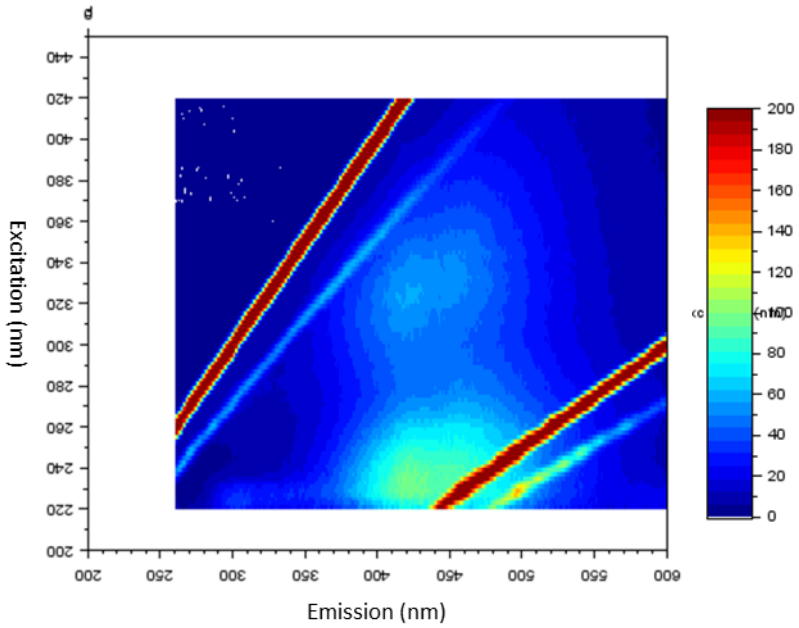
The Wüstebach catchment

Natural regeneration

Question: How the change of vegetation, sun irradiation, temperature, etc. may affect the dissolved organic matter, in terms of quantity and « quality » ?

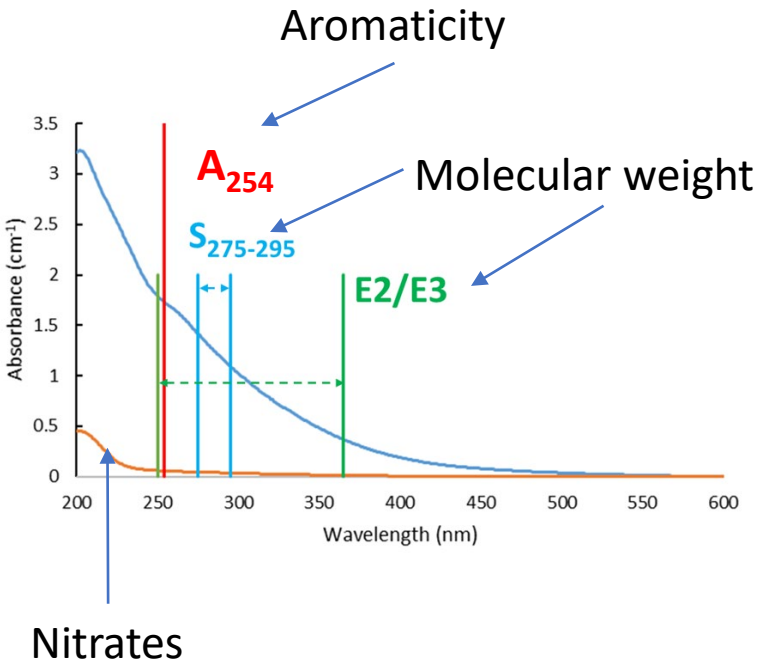
How to characterize the dissolved organic matter ?

- Sophisticated and lab-intensive methods
  - NMR, HPLC-HRMS
- Optical methods
  - UV-visible spectroscopy, fluorescence
  - Lab as well as in-situ
  - Can be easily used in routine
- Wüstebach catchment
  - Sampling on a weekly basis
  - UV-vis spectra and excitation-emission matrices since 2011
  - It is possible to extract spectral descriptors to track the « quality » of DOM

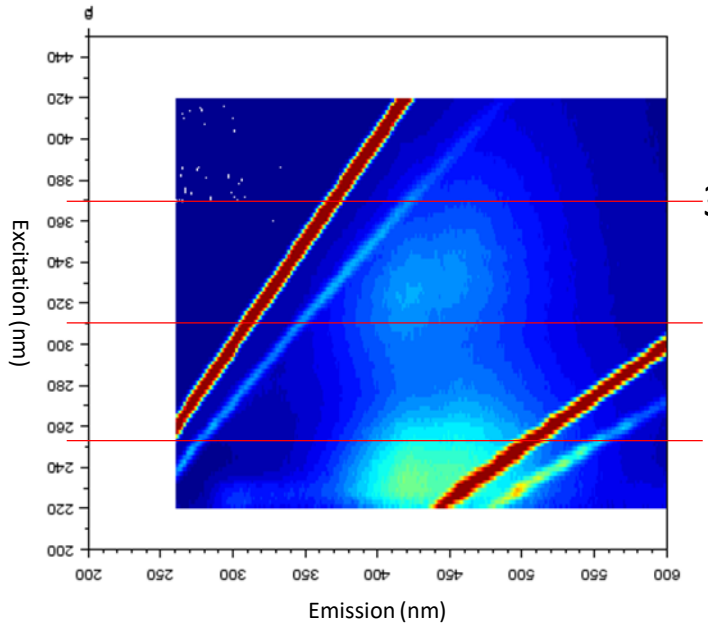


Spectral descriptors

- For more info: poster 93601
- Inner-filter effect: dilution before acquiring fluorescence data
- A_{254} final < 0.1 cm^{-1}



Three emission spectra of interest



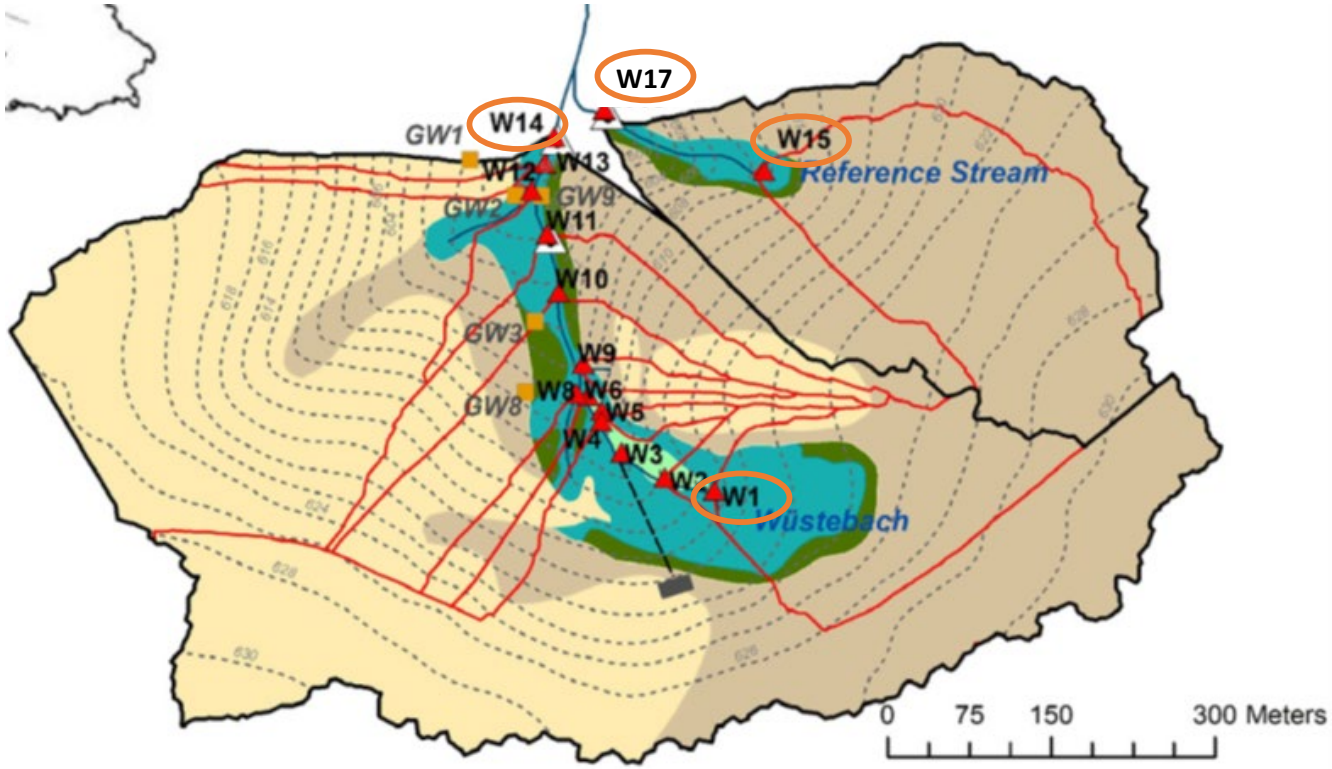
370 nm — FI (Mc Knight et al. 2001)
Origin of fulvic acids

310 nm — BIX (Huguet et al., 2009)
Recent DOM, mostly autochthonous

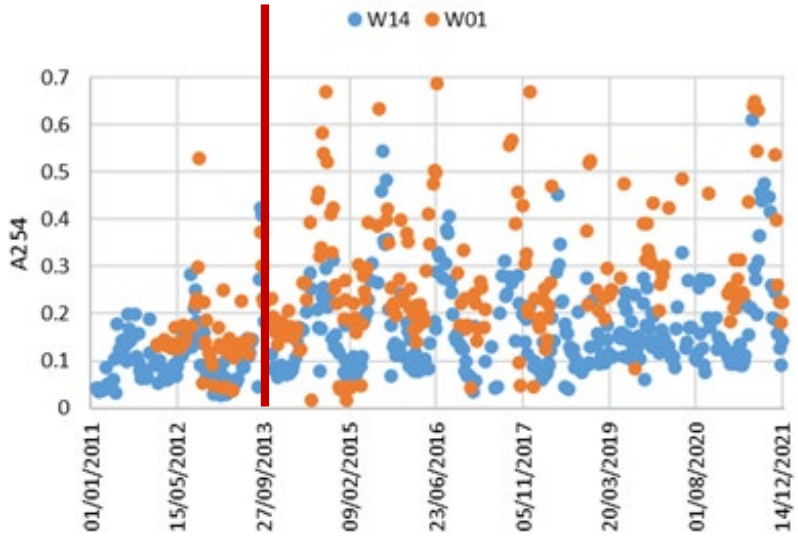
254 nm — Humification index HIX
(Ohno, 2002; Zolnay, 2003)

Results: 2011 – 2013 – 2021

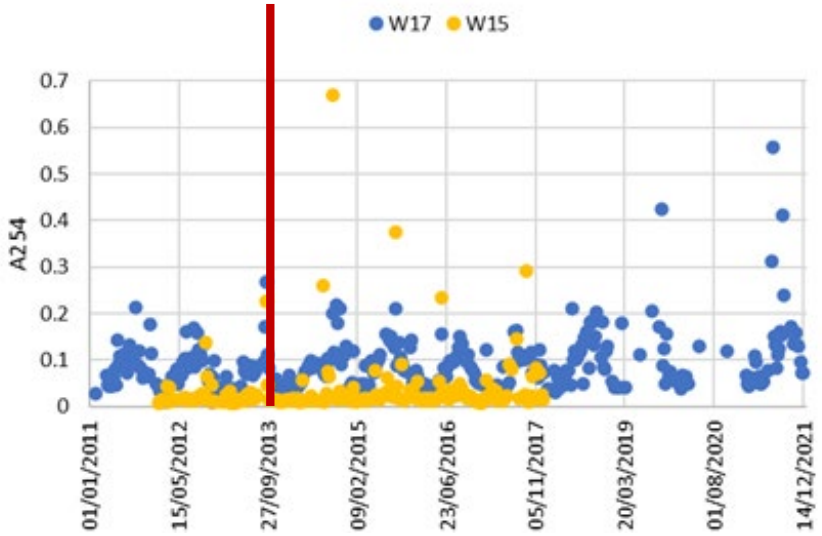
- Clear-cut: september 2013
- Comparison of W01 (source) and W14 (outlet) of the Wüstebach
- With the reference stream: W15 (source) and W17 (outlet)

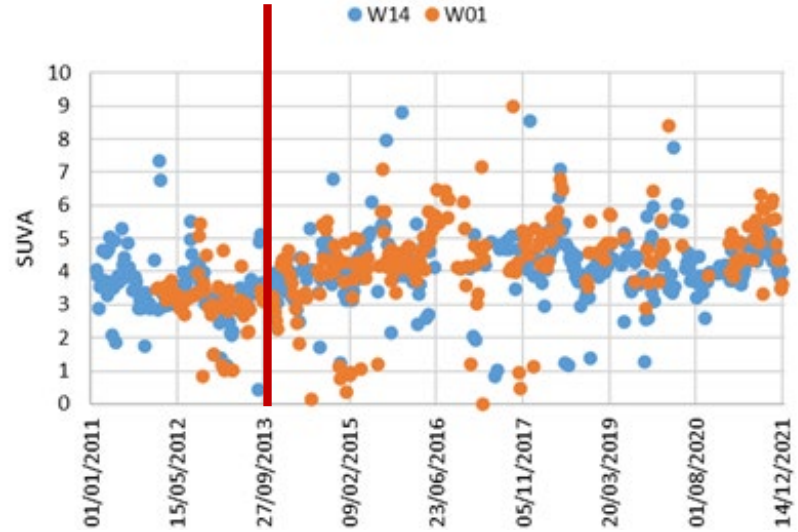


Results: 2011 – 2013 – 2021

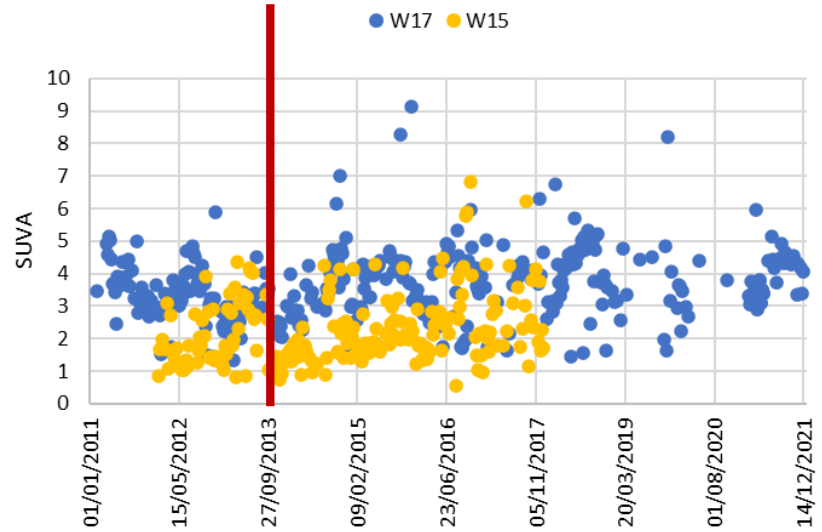


Increase of A_{254} variations



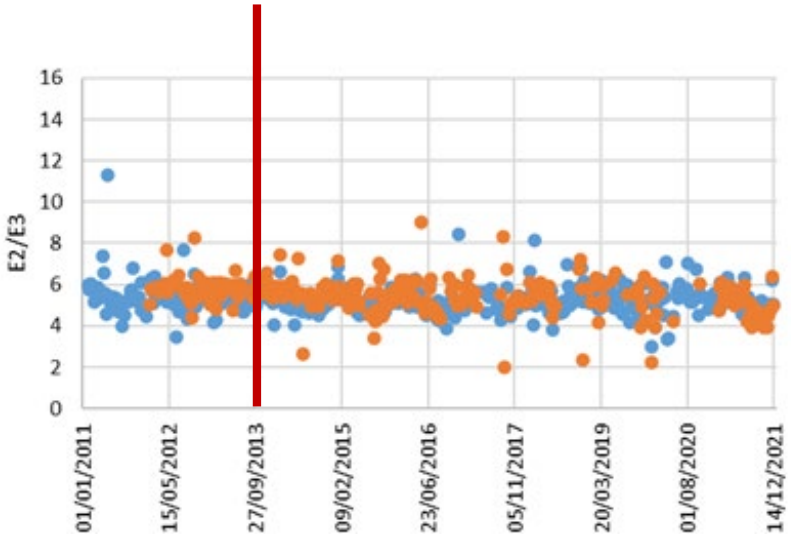


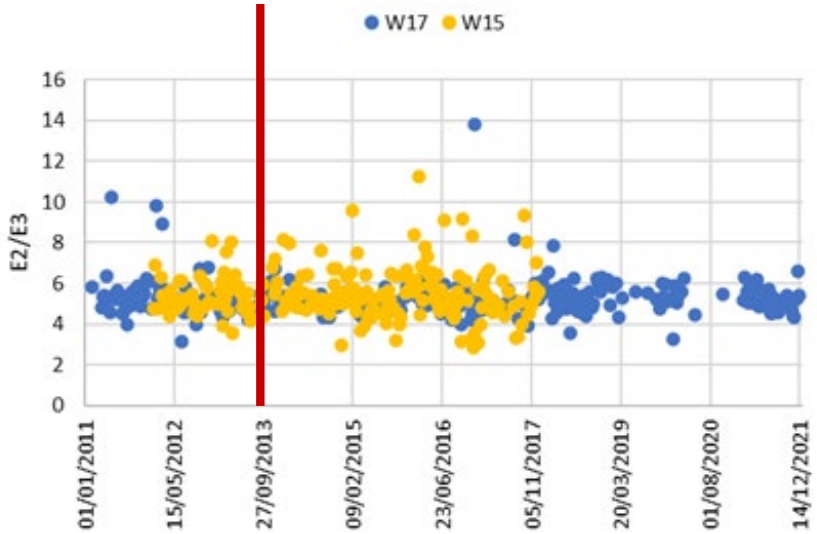
Increase of SUVA



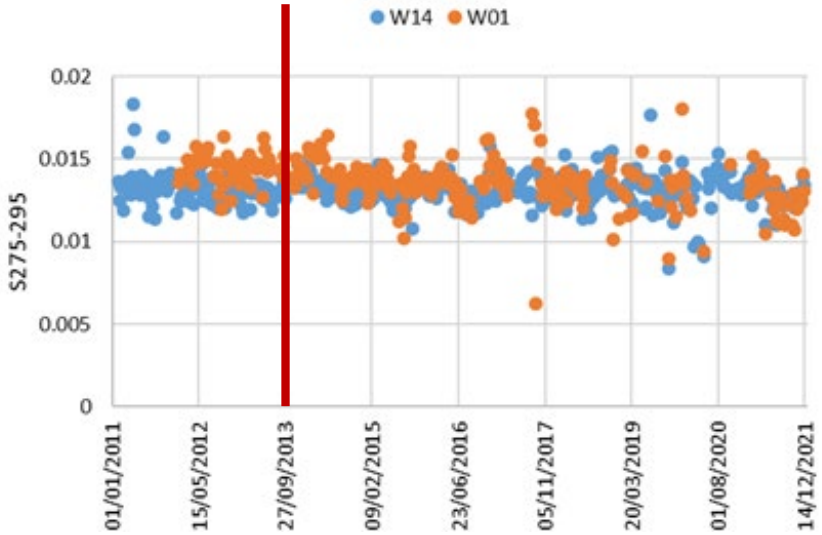
$SUVA = A_{254}/DOC$

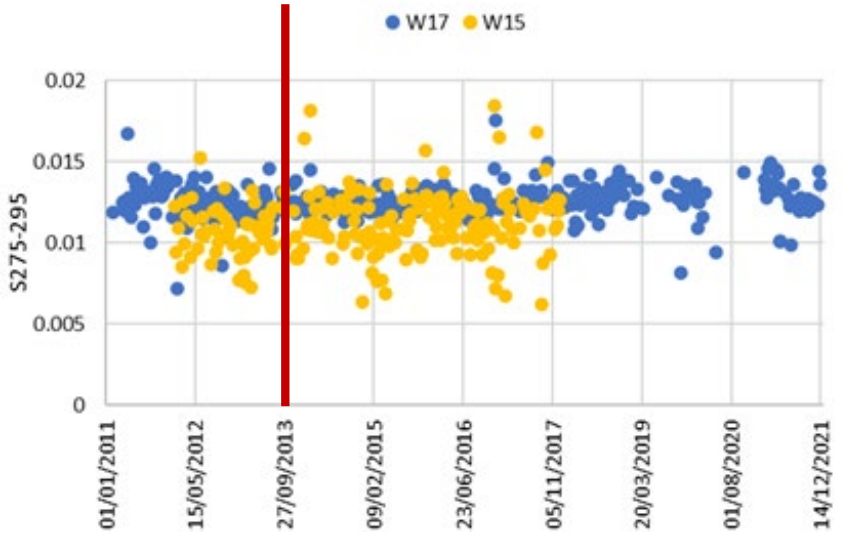
Results: 2011 – 2013 – 2021





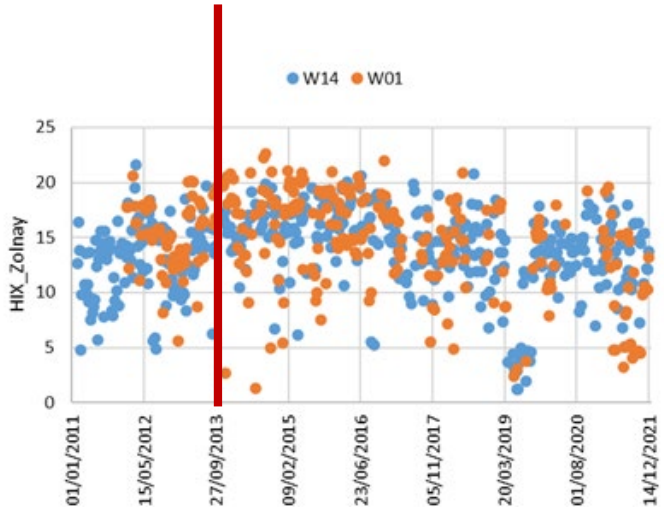
A slight increase of the DOM molecular weight is possible

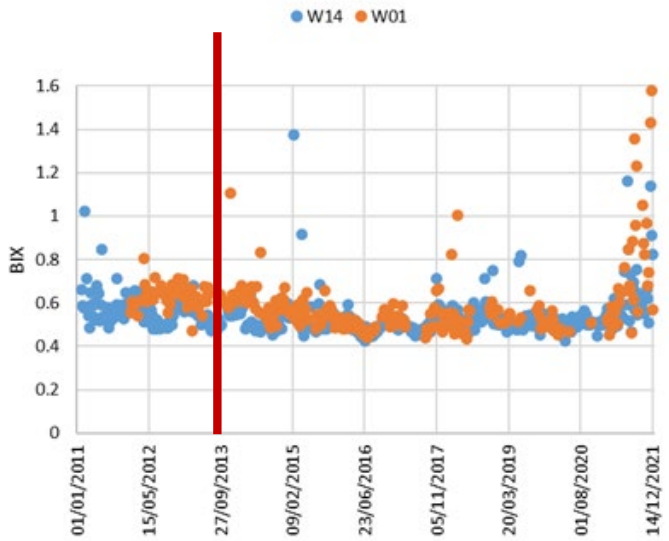


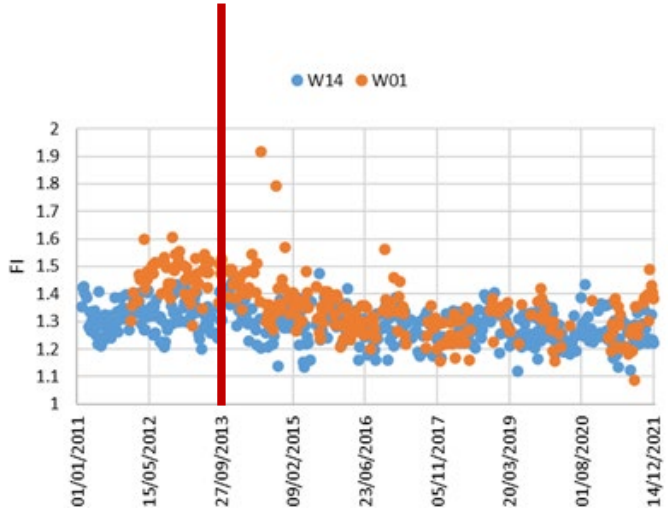


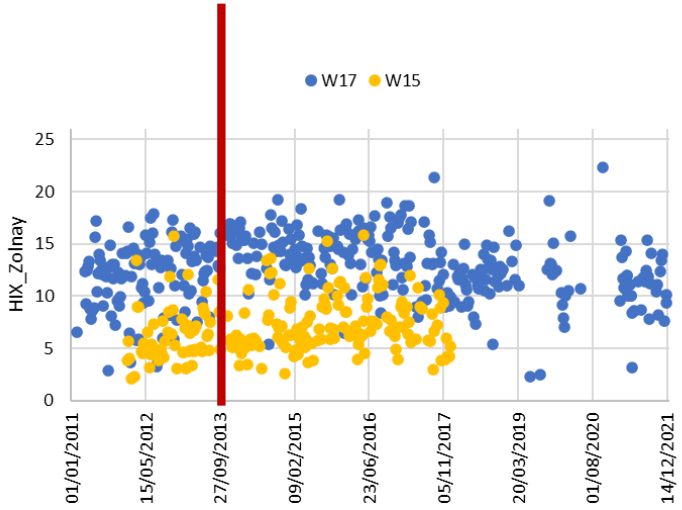
Both descriptors decrease when MW increases

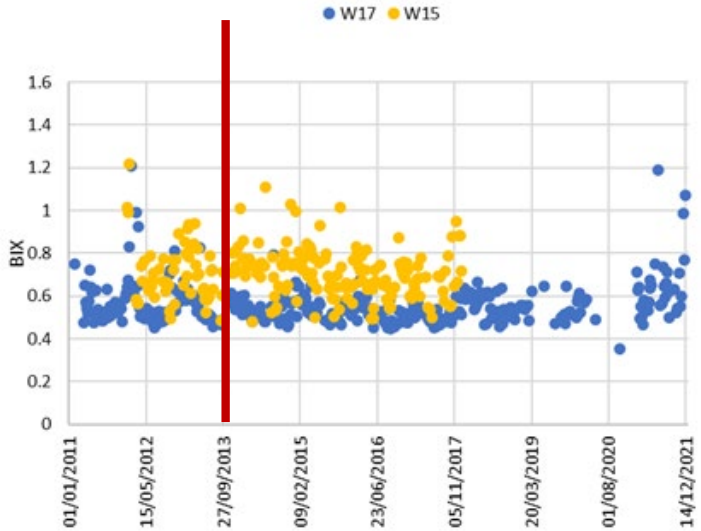
Results: 2011 – 2013 – 2021

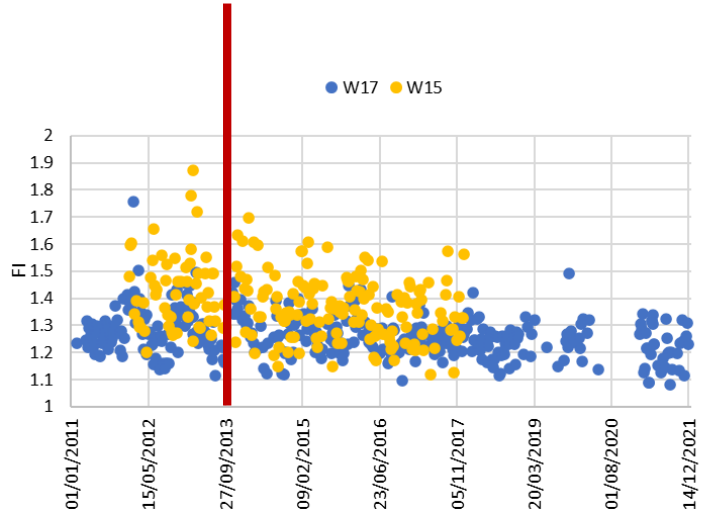












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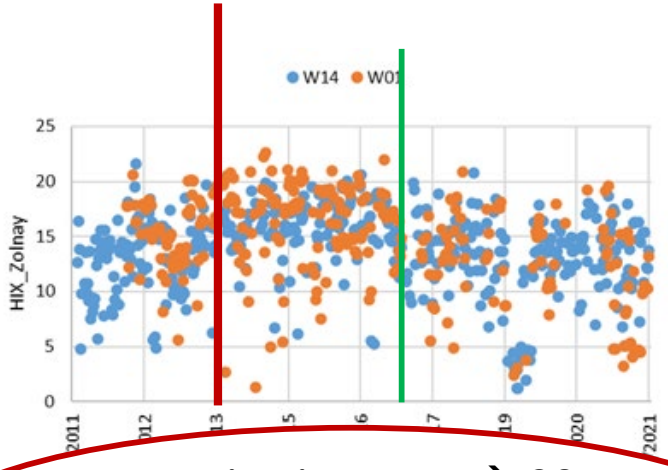
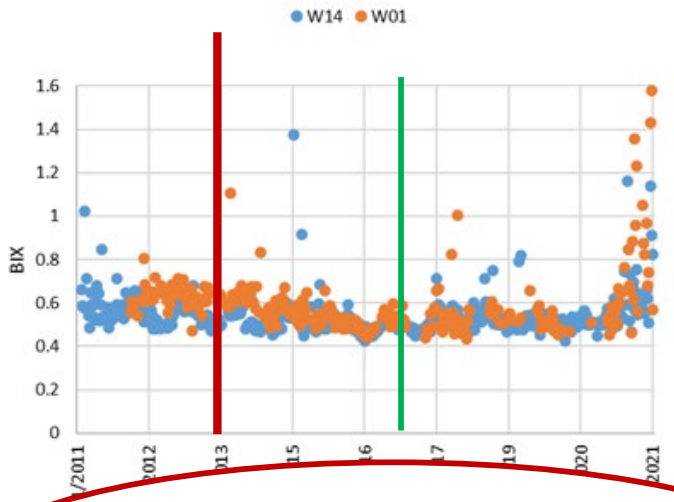
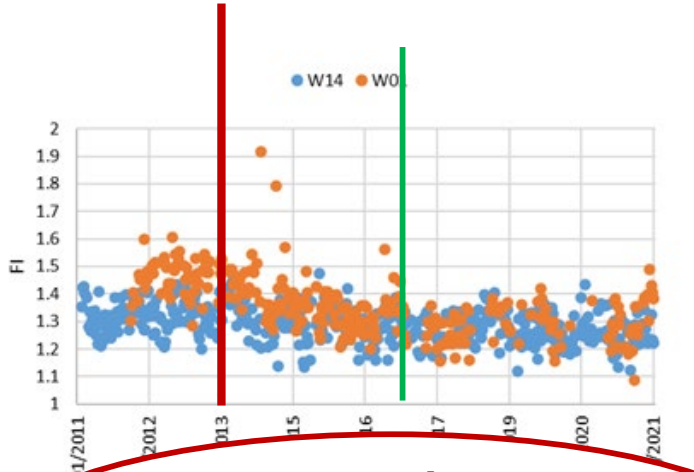


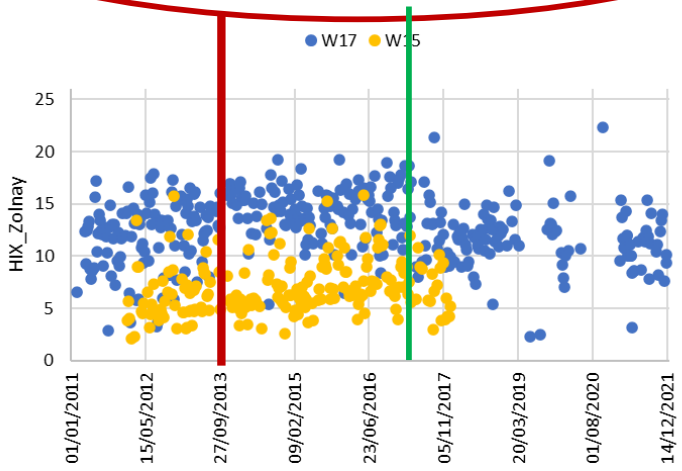


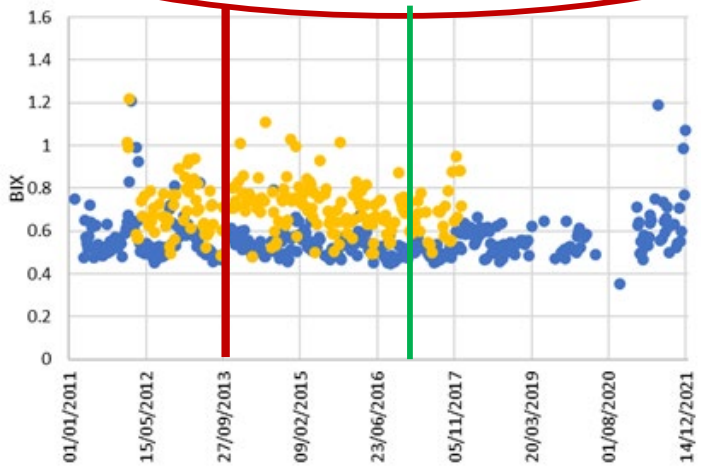


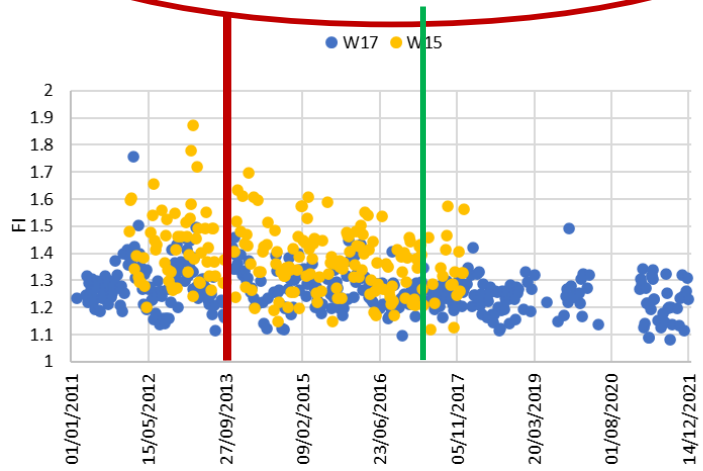
Very noisy, increase → 2017
?
Increase also for W15 !

Decrease → 2017
Then stabilization

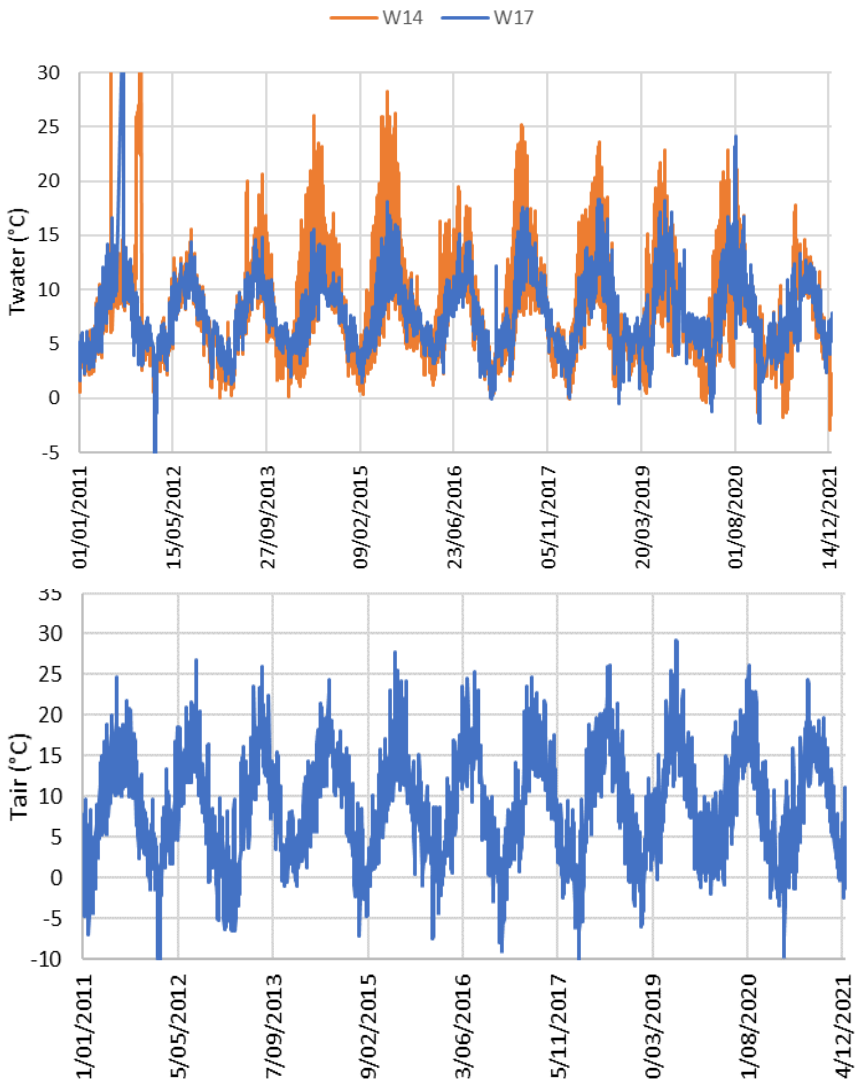
Decrease → 2017
… for both streams
(terrestrial)







What other factors can influence DOM ?

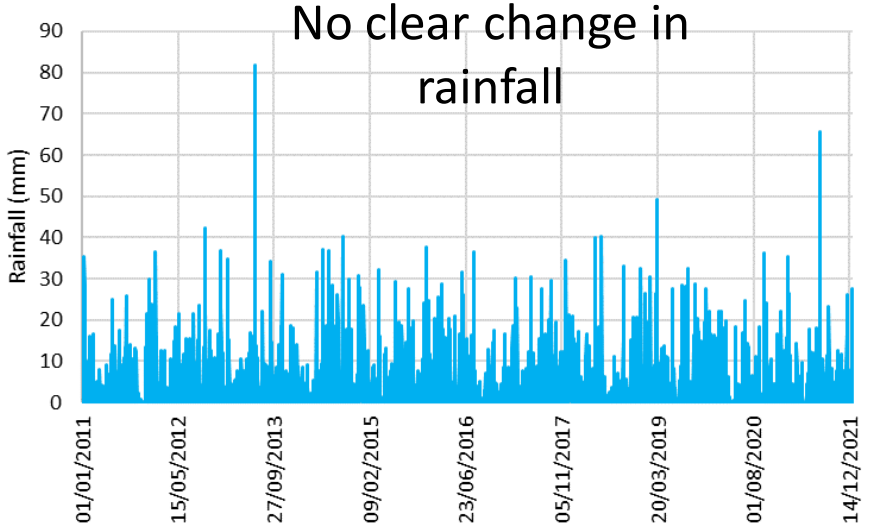


Kall_Sistig

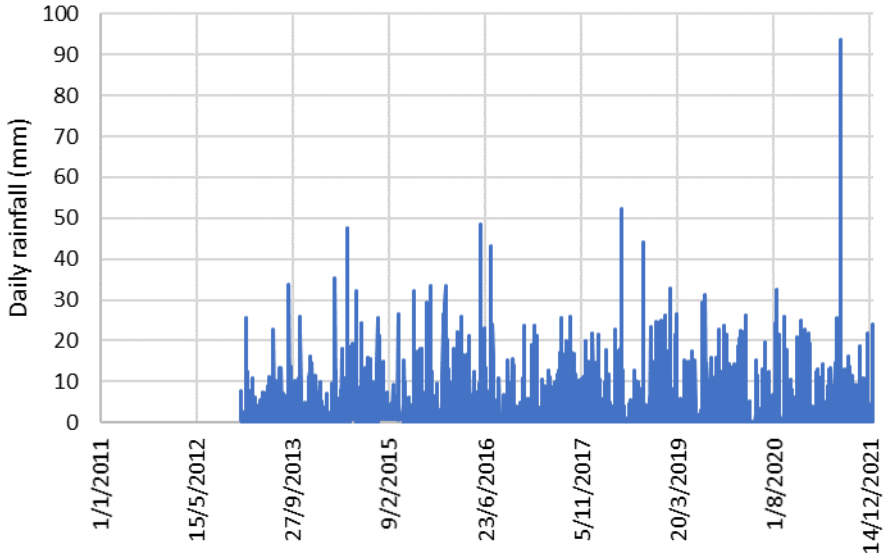
Higher temperature due to solar irradiation for W17
Stabilization in 2016 due to lowland vegetation ? (ferns, …)

Also for reference stream (less shade at forest edge ?)

No variation of T_{air} at a larger scale



Monschau



Wüstebach

Take-home message

- Effect of the clear-cut on DOM quality was noticed shortly after the clear-cut
- Stabilization in 2017 (about 3 years after the clear-cut)
  - Change in type of vegetation, sun irradiation, temperature
- Some effect on the reference stream
  - Difficult to explain so far, maybe shading effect
- Data analysis not finished: some additionnal descriptors are examined

Acknowledgement: TA-RA access program of eLTER

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