

Time of day matters: Diurnal changes of CO₂ fluxes across European streams



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SEFS 2017, Olomouc

04.07.2017



- 1st Collaborative European Freshwater Science Project for Young Researchers ("FreshProject")
- A call initiated by the European Federation of Freshwater Sciences (EFFS) board, the European Fresh and Young Researchers (EFYR) and representatives of the Fresh Blood for Fresh Water (FBFW)
- Financially supported by national limnological societies from Austria, France, Germany, Italy, Spain/Portugal, Switzerland and United Kingdom

*"Encourage young freshwater researchers across **Europe** to create synergistic interactions that lead to new knowledge, promote **networking** among young European Limnologists and offer experience in generating research ideas, acquiring funding, planning and carrying out a collaborative international **scientific project**."*



Europe

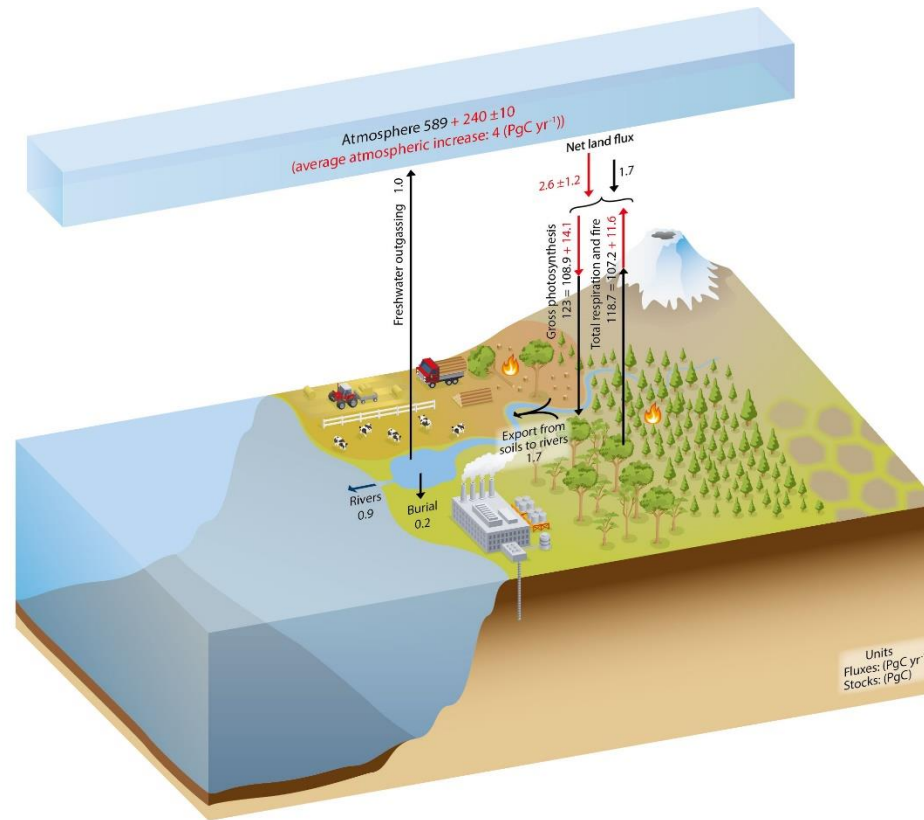
Assessing CO₂ Fluxes from **European Running Waters**

<https://freshproject-eurorun.jimdo.com/eurorun/project-eurorun/>



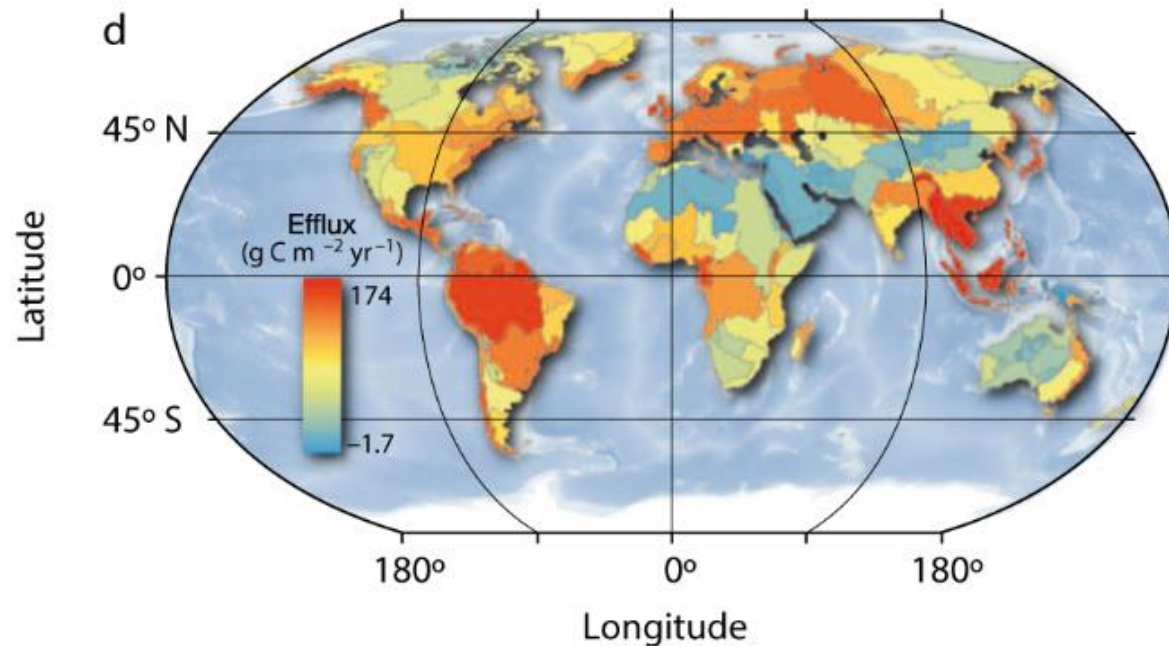
Scientific project

Networking



- Inland waters can emit carbon that was fixed on land
- Better understanding of fluxes and their mechanisms/dynamics needed

Global CO₂ fluxes from running waters (Raymond et al. 2013)



- 3 Pg C yr⁻¹ is emitted as CO₂ from global inland waters
- up to 70% of the global CO₂ flux is assigned to running waters



Europe

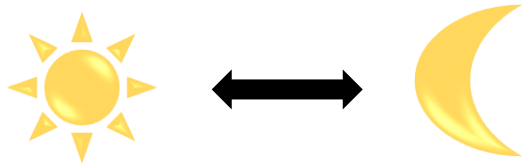
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Scientific project

Diurnal patterns

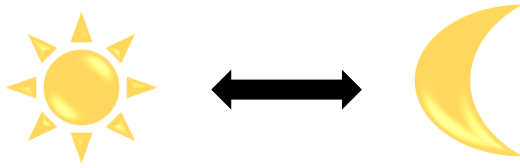


Seasonal patterns



Networking

Diurnal patterns



Seasonal patterns

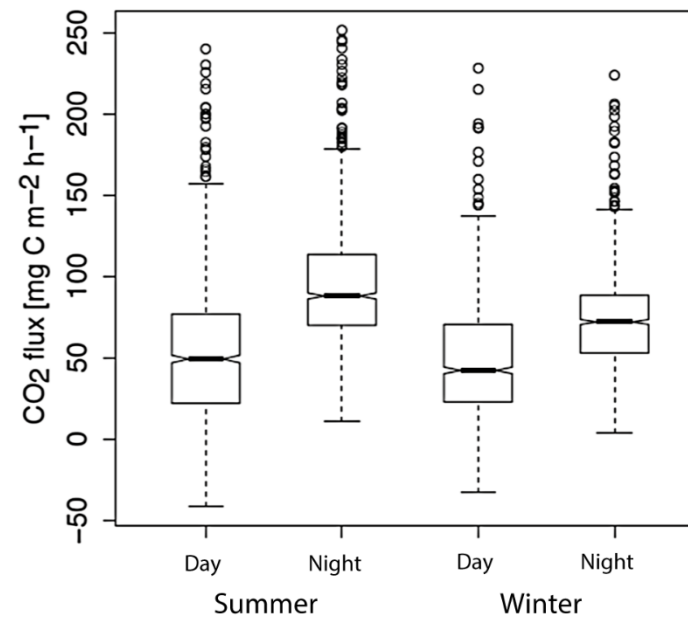


Figure 7. Seasonal and day-night differences in CO₂ evasion flux from Oberer Seebach stream water to the atmosphere. Shown are the medians and quartiles (box) and the whiskers indicating the minima and maxima accounted for outliers with more than 1.5× of the interquartile variation.



Europe

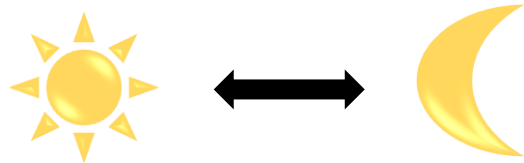
Assessing CO₂ Fluxes from **European Running Waters**

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Scientific project

Diurnal patterns



Seasonal patterns



Networking

Workshop for teaching construction of the chamber,
the handling and the data analysis



Introduction

The teams



16 teams in
11 European countries



Introduction

Workshop – September 2016



Introduction

Workshop – September 2016



Field survey



Seasonal campaigns at fixed time periods:

- CO₂ fluxes with floating chamber
- pCO₂ in the water with equilibration method (if possible)
- Physico-chemical parameters with multiprobe



Field survey



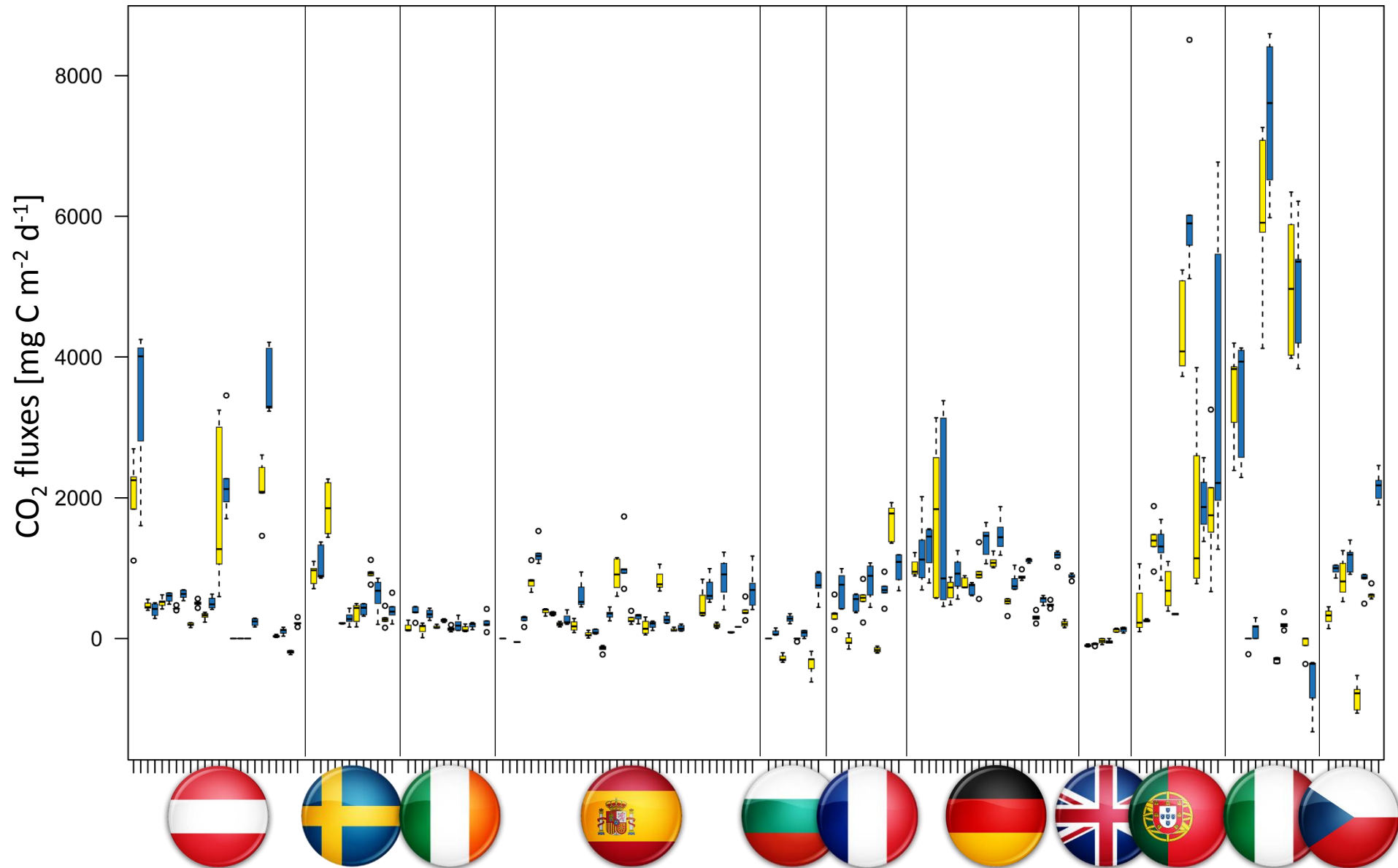
Seasonal campaigns at fixed time periods:

- CO₂ fluxes with floating chamber (11 am and 11 pm GMT)
- pCO₂ in the water with equilibration method (if possible)
- Physico-chemical parameters with multiprobe



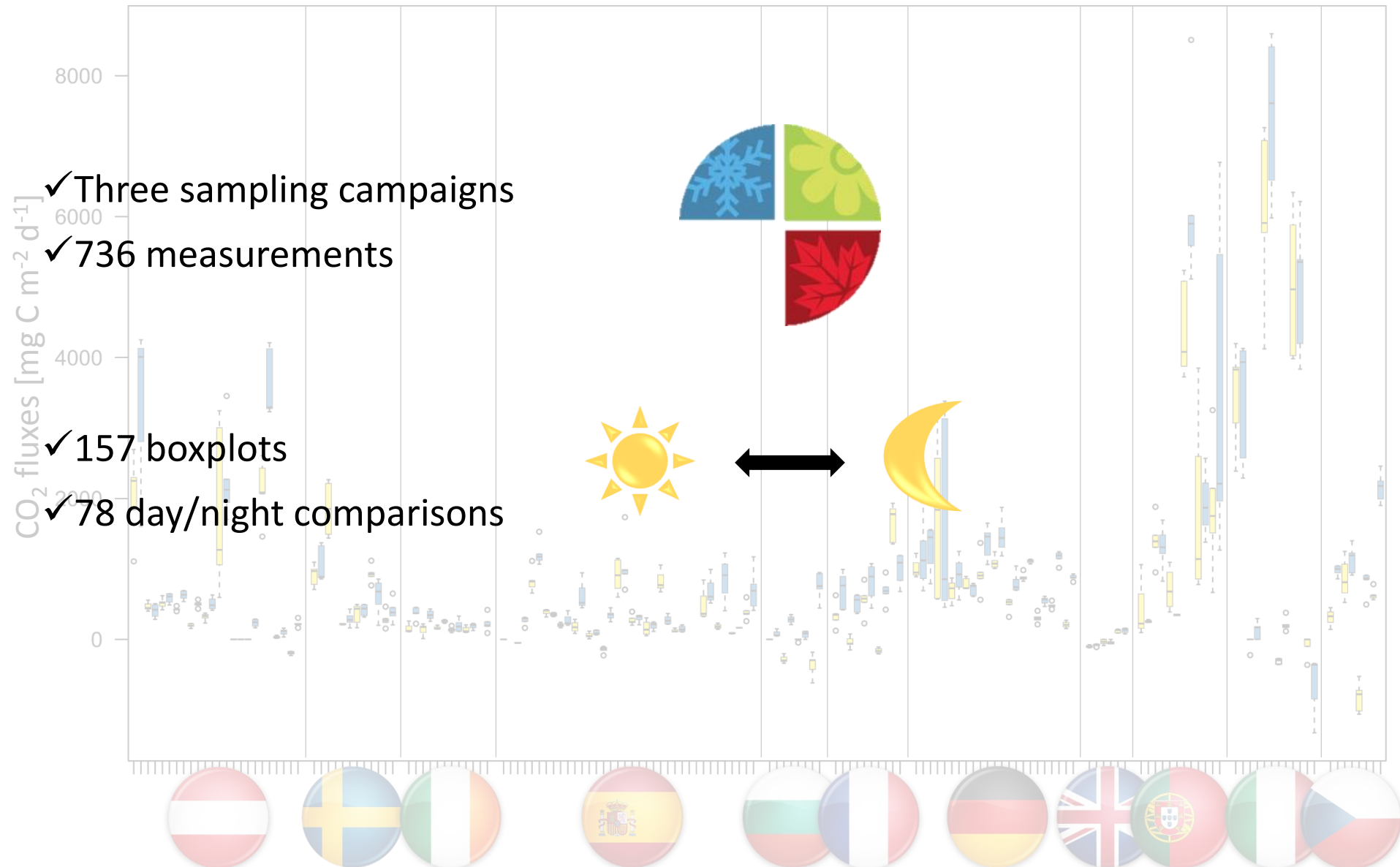
Results

Overview CO₂ fluxes – all teams/all seasons



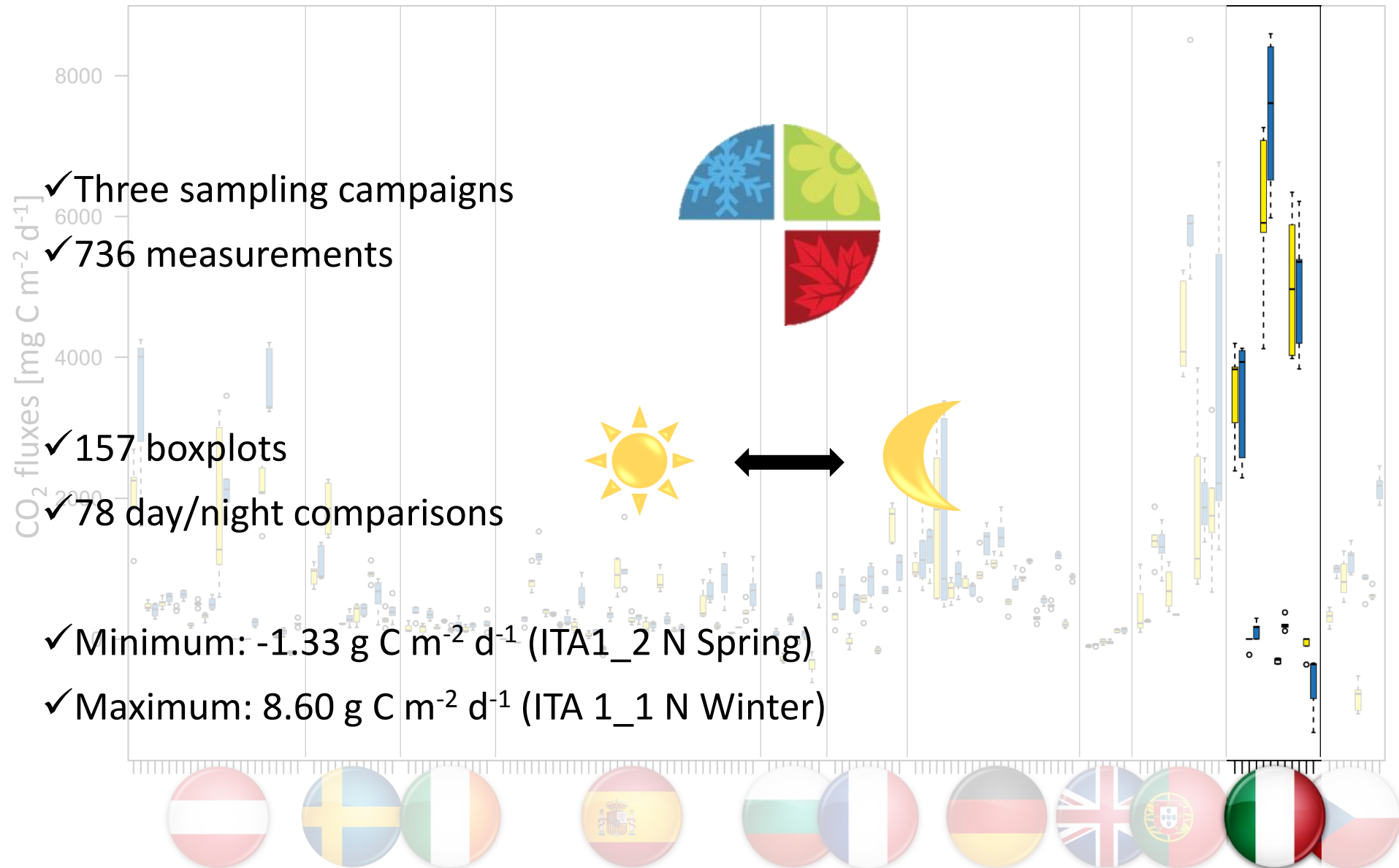
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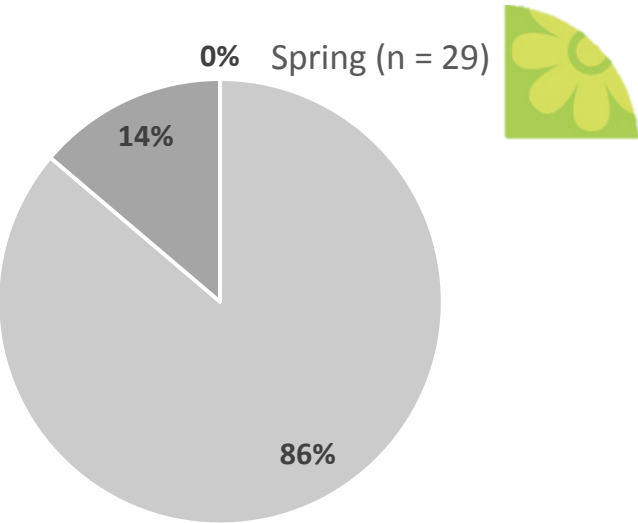
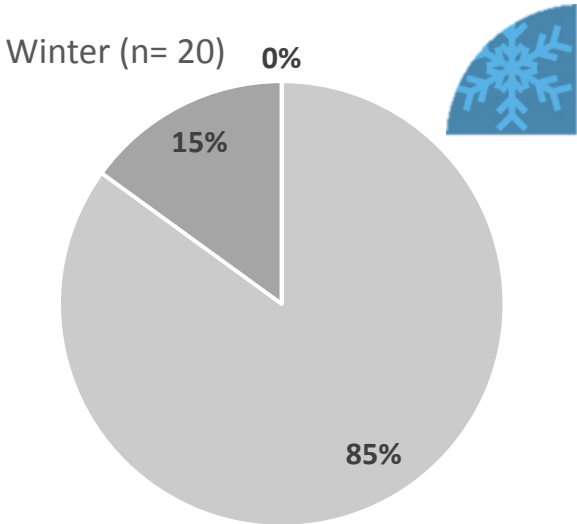
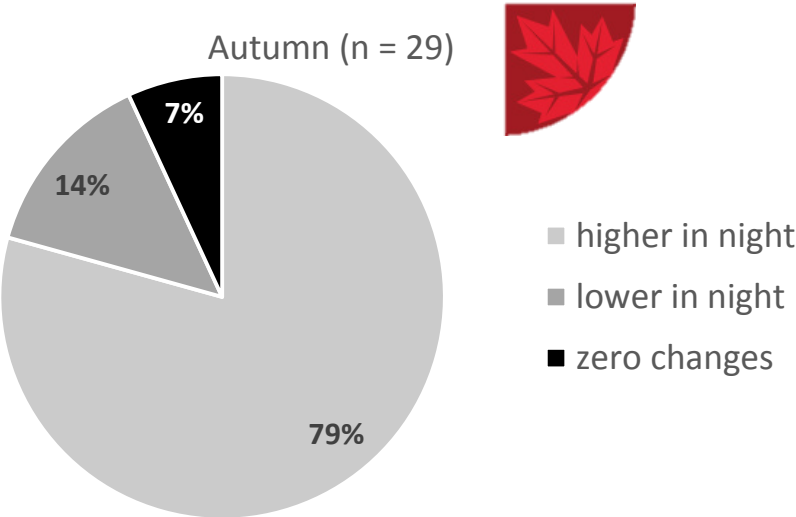
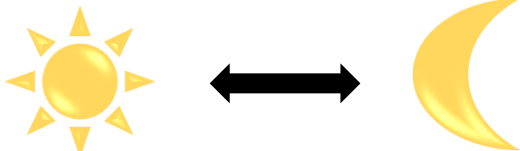
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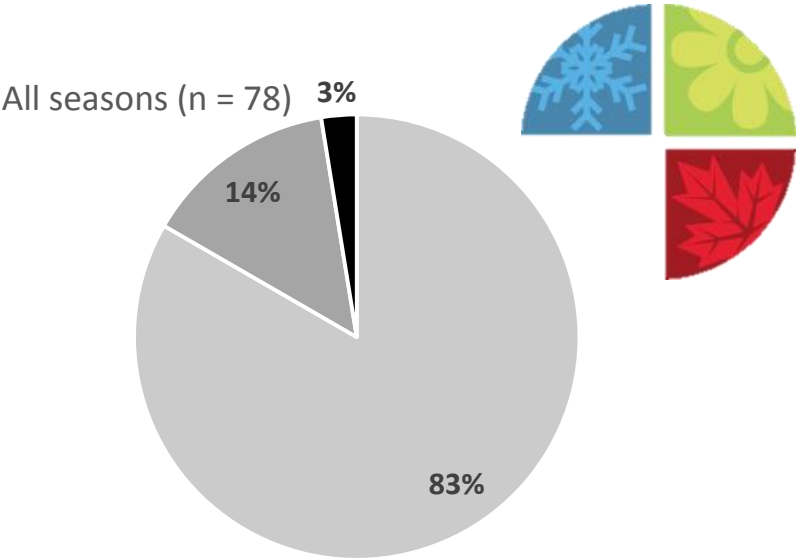
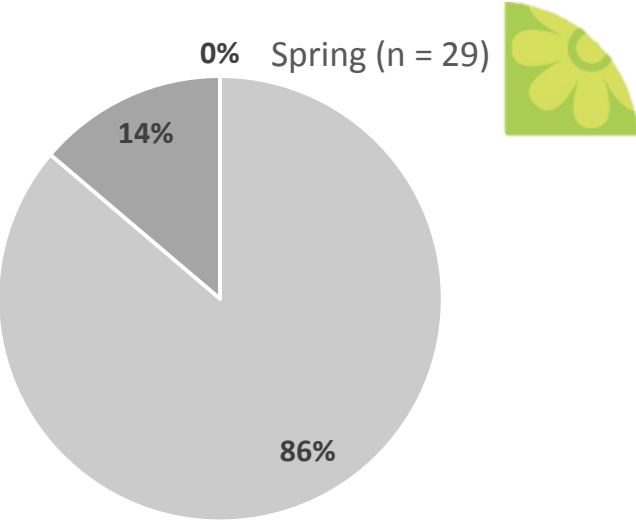
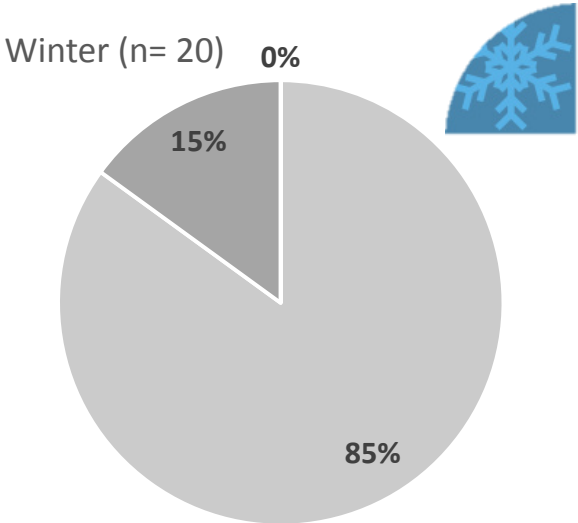
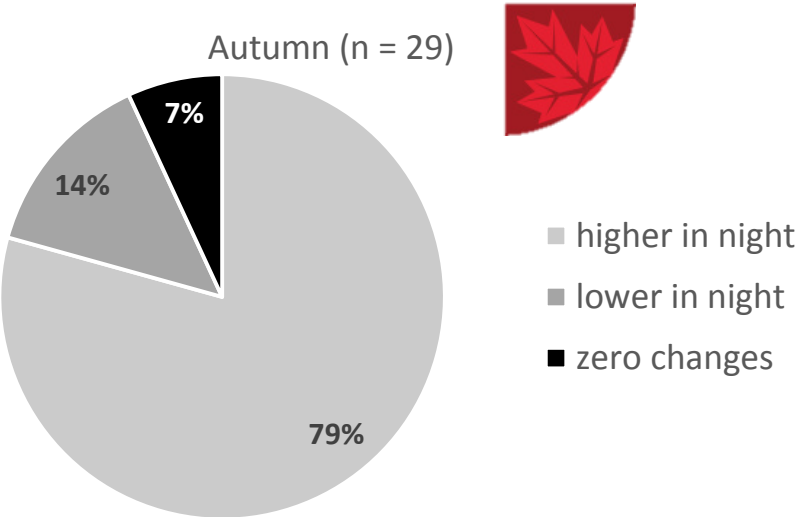


Results

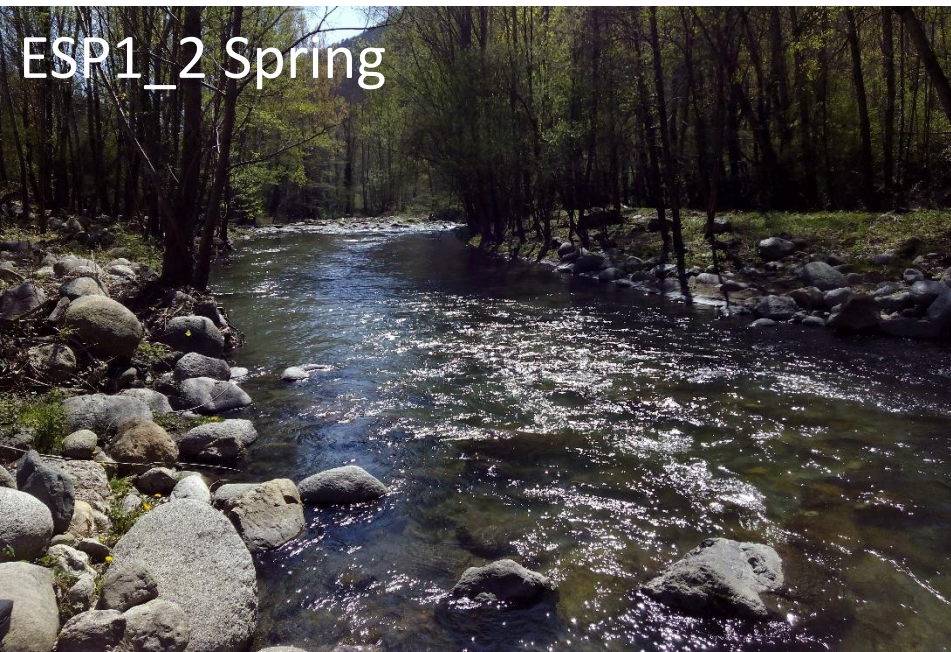
Differences



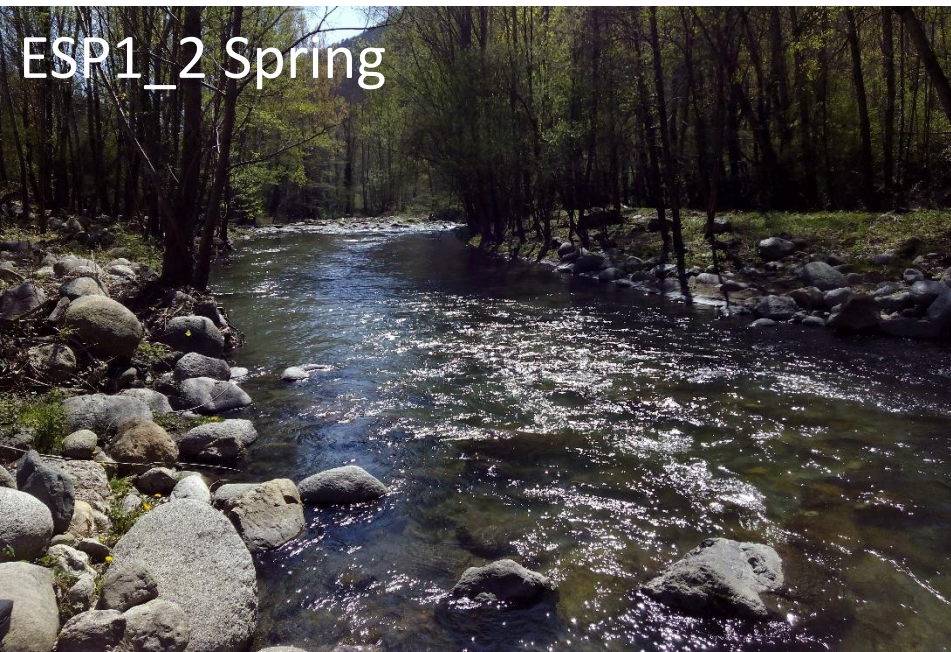
Results



$$F_{CO_2} = k (CO_{2\ water} - CO_{2\ atm})$$



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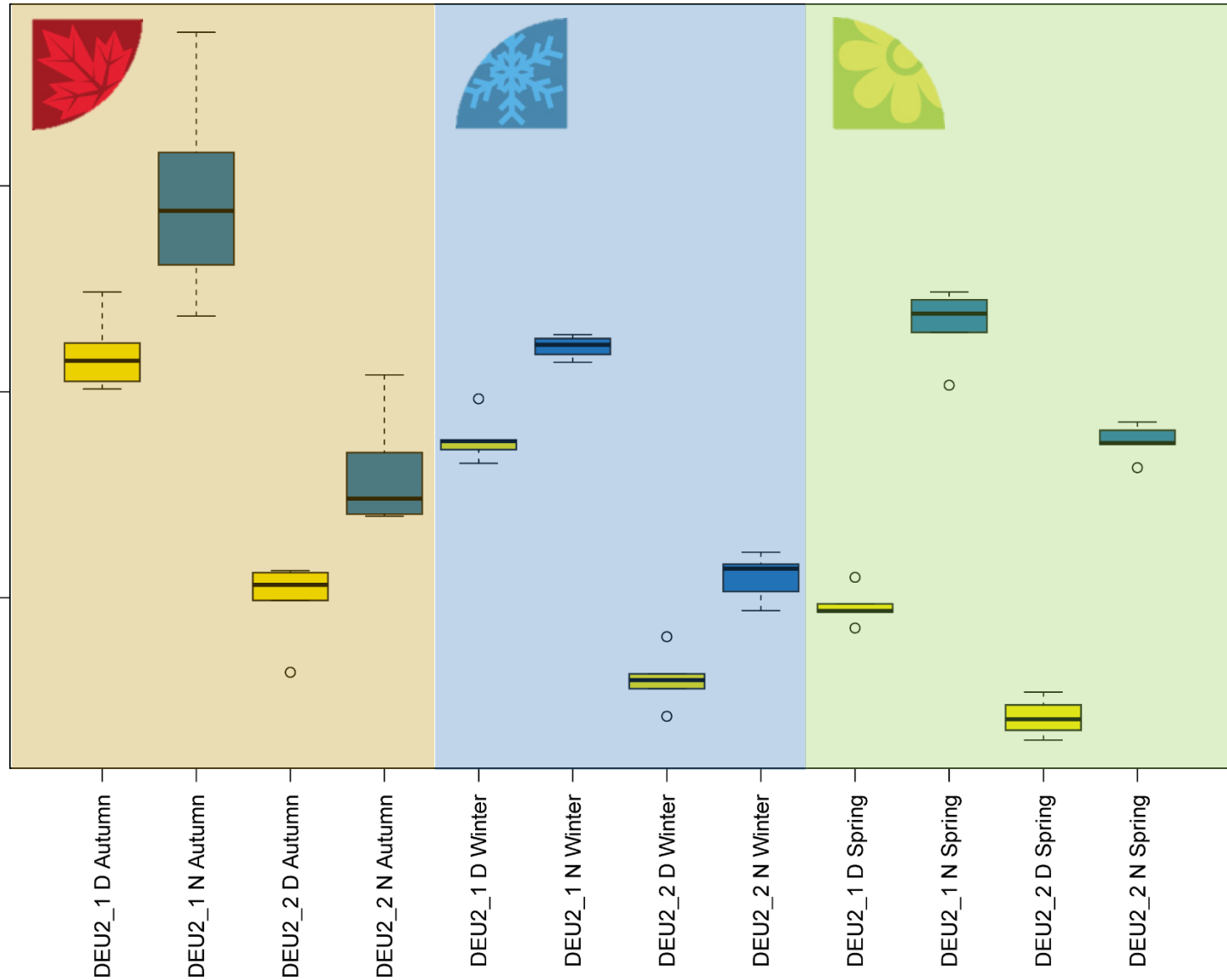


Results

CO₂ fluxes in German forested streams

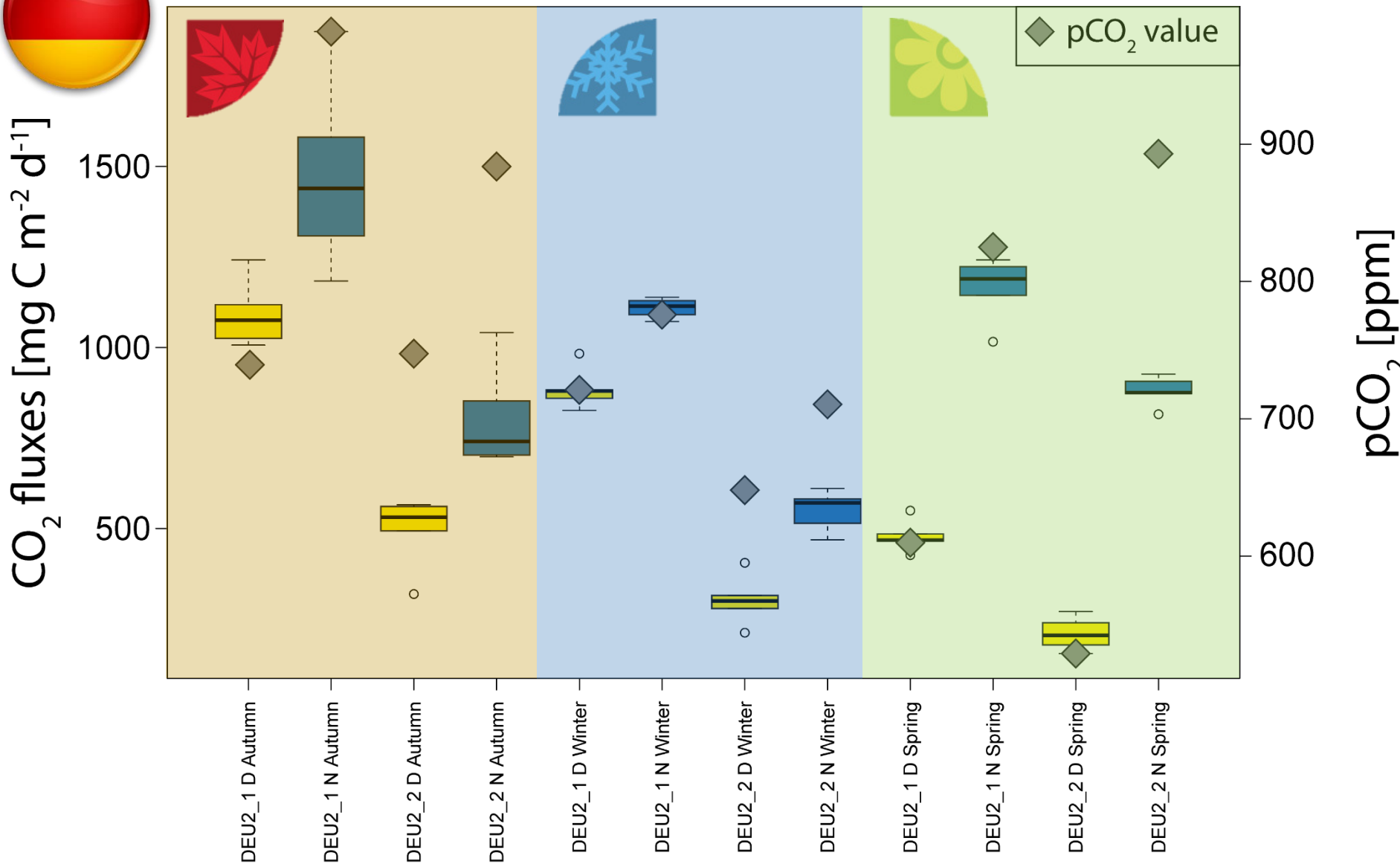


CO₂ fluxes [mg C m⁻² d⁻¹]



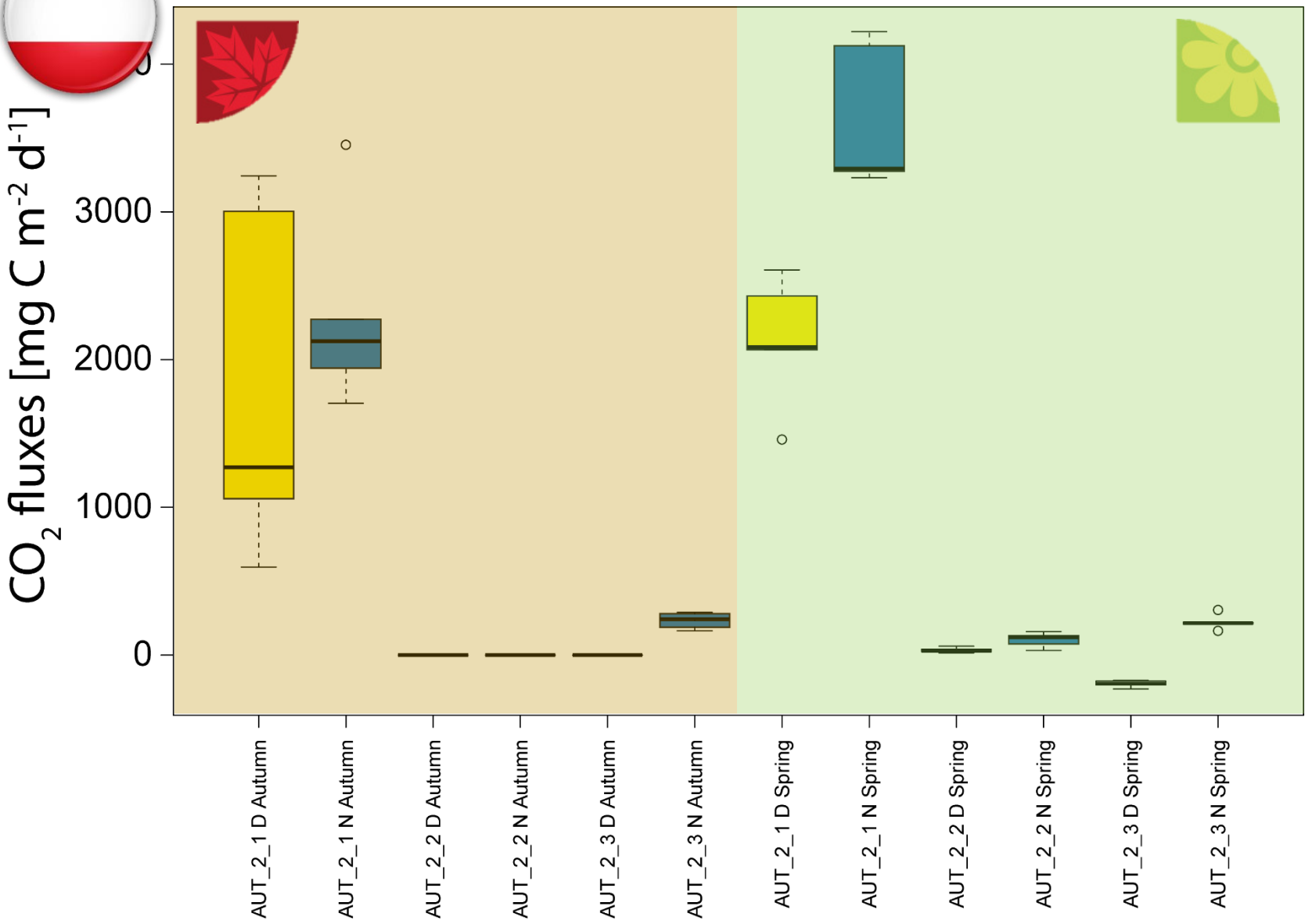
Results

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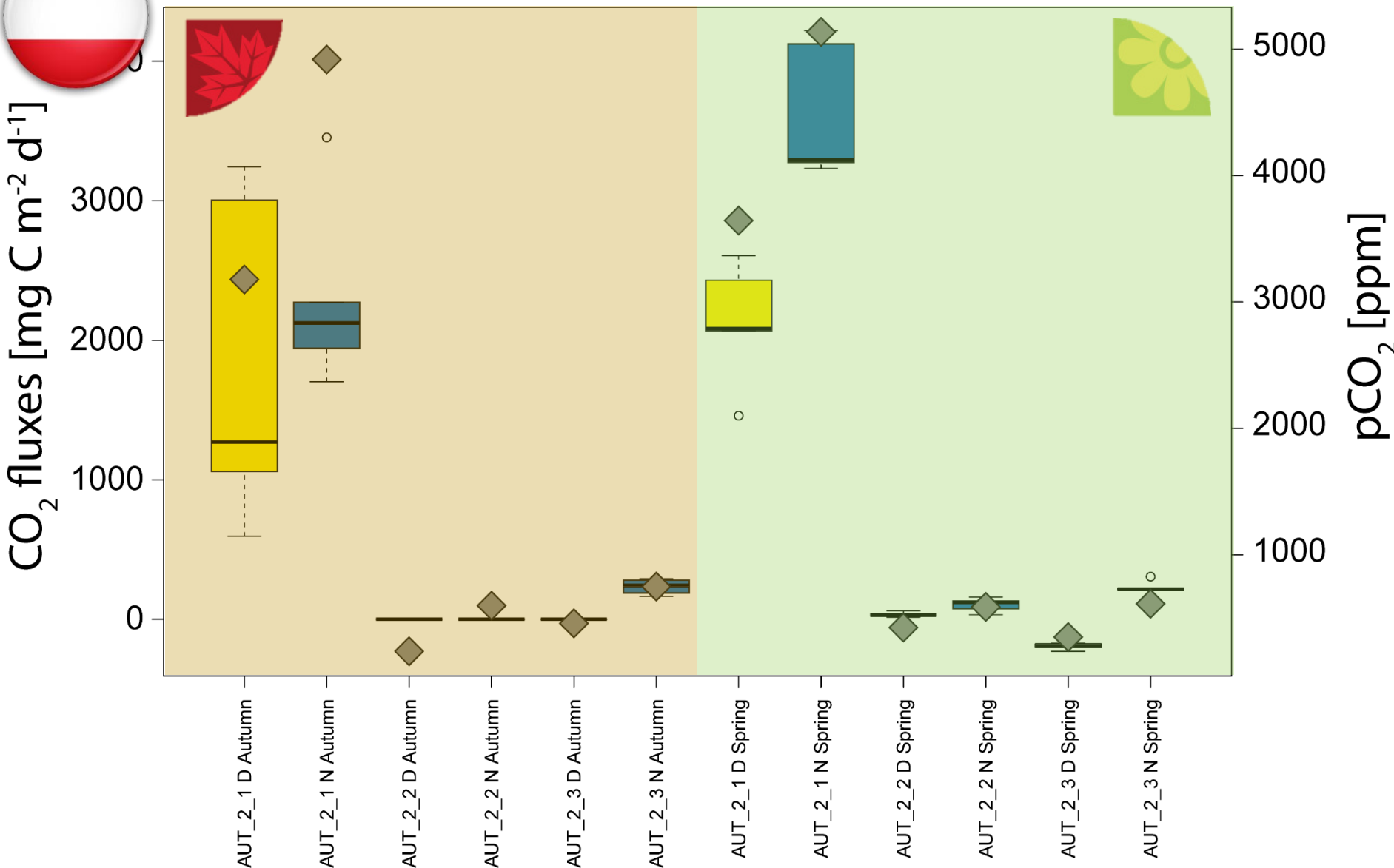
Results

CO₂ fluxes in Austrian alpine streams



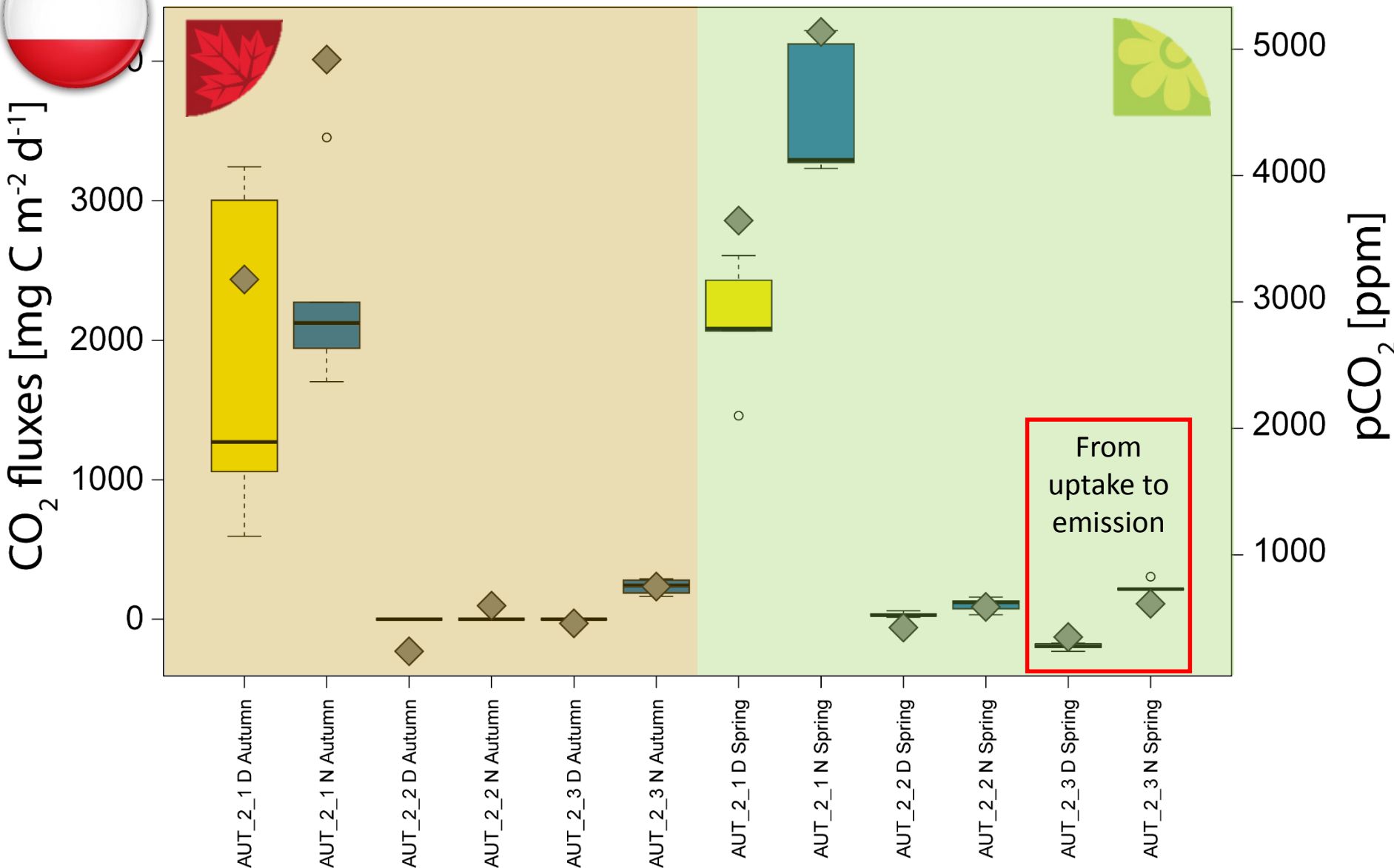
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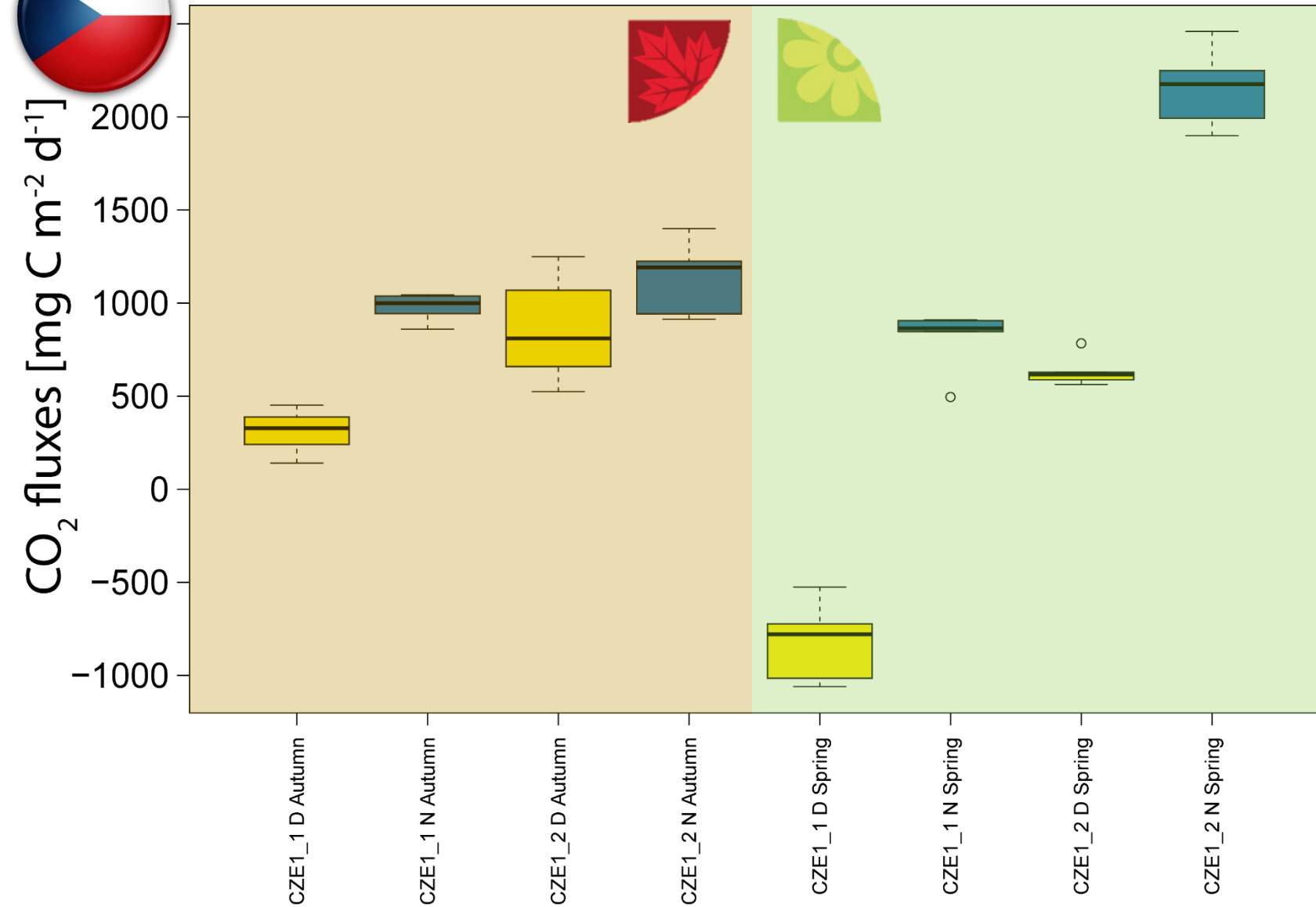
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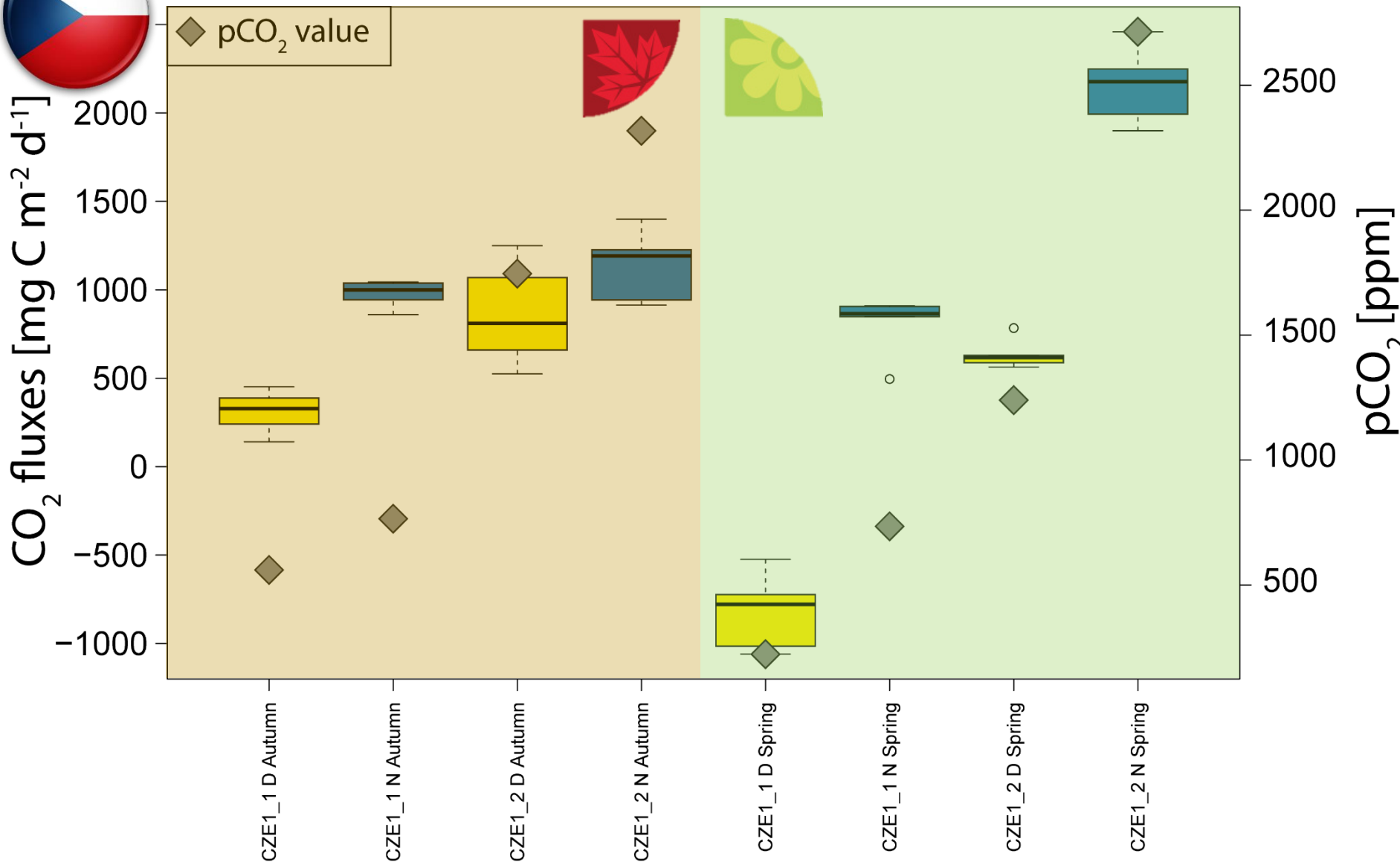
Results

CO₂ fluxes in Czech agricultural streams



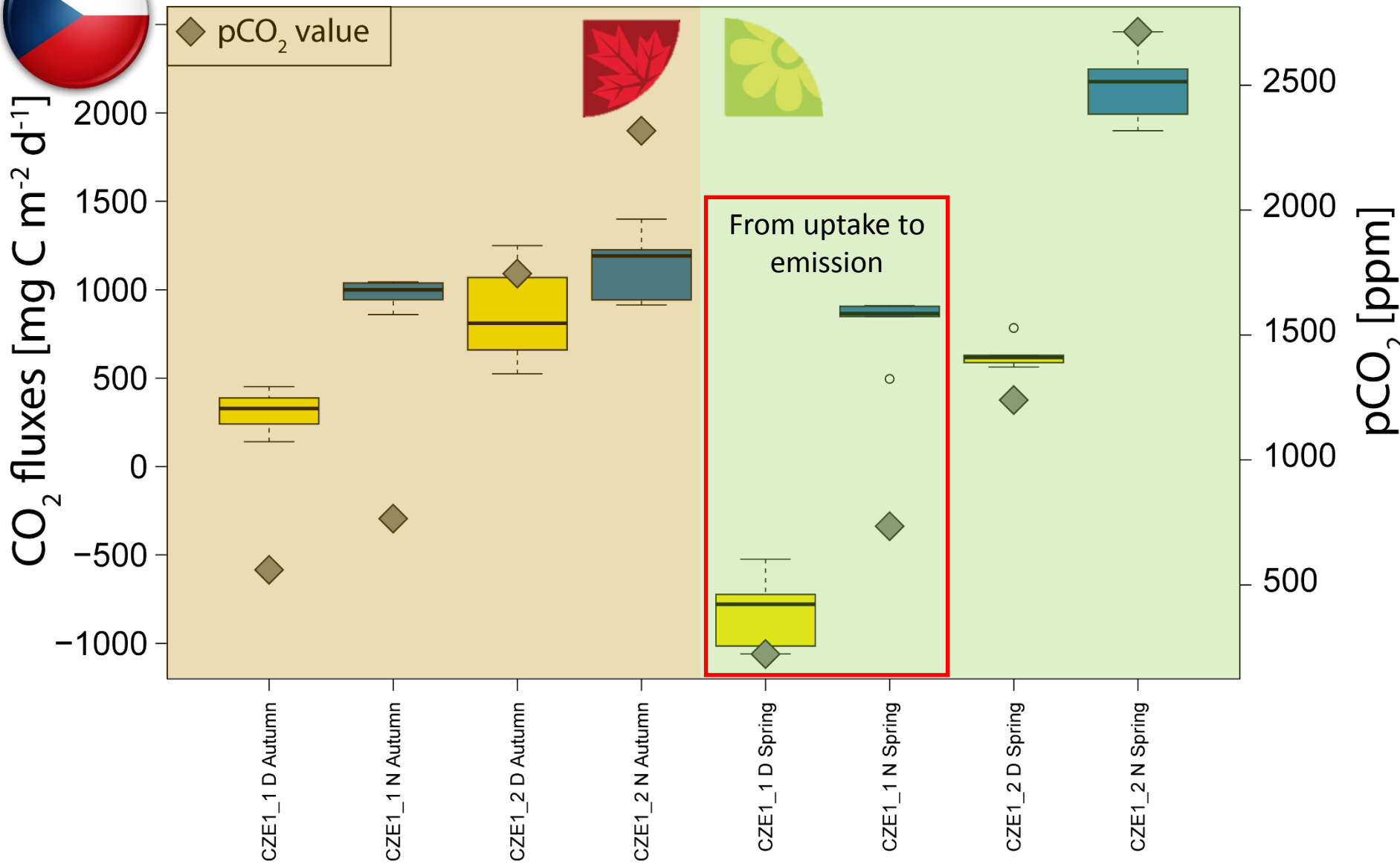
Results

CO₂ fluxes in Czech agricultural streams

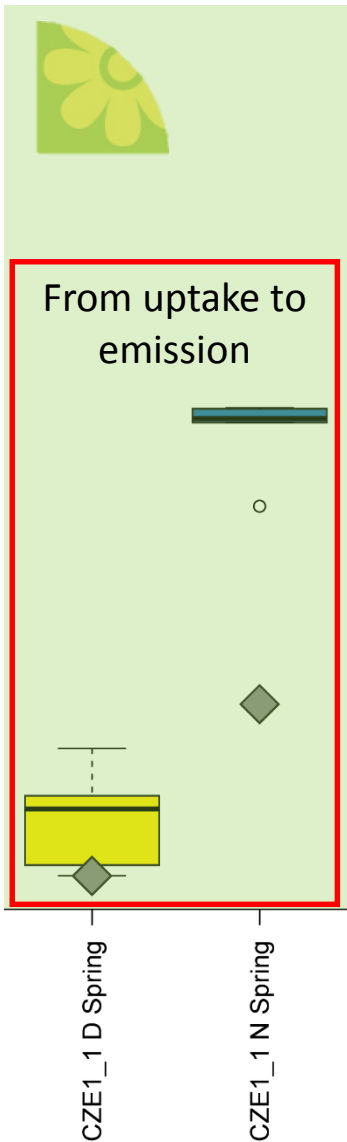


Results

CO₂ fluxes in Czech agricultural streams



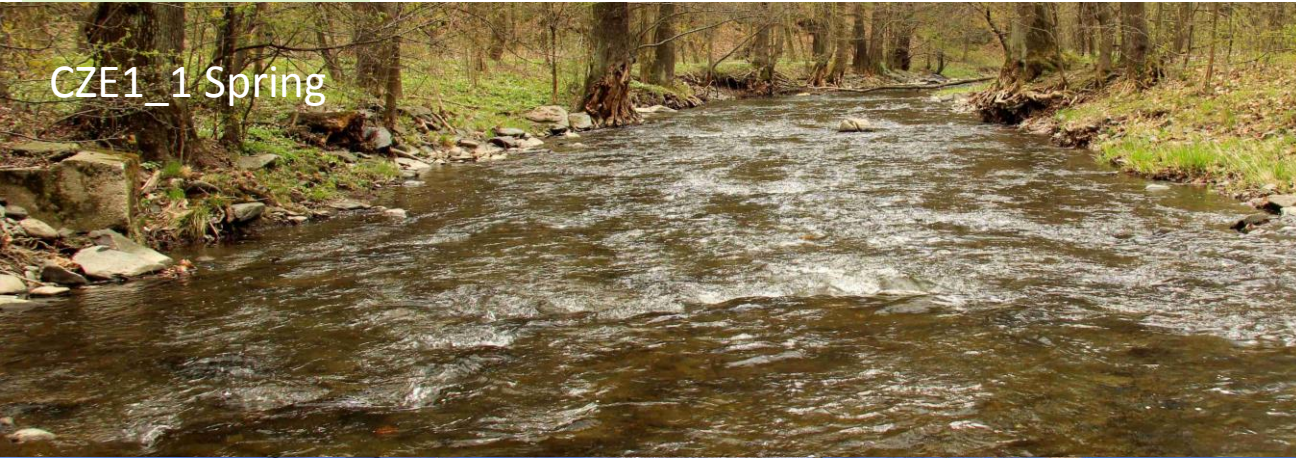
- 9 of 65 increases in CO₂ fluxes change from uptake to emission (14%)





- 9 of 65 increases in CO₂ fluxes change from uptake to emission (14%)
- Predominantly biofilm

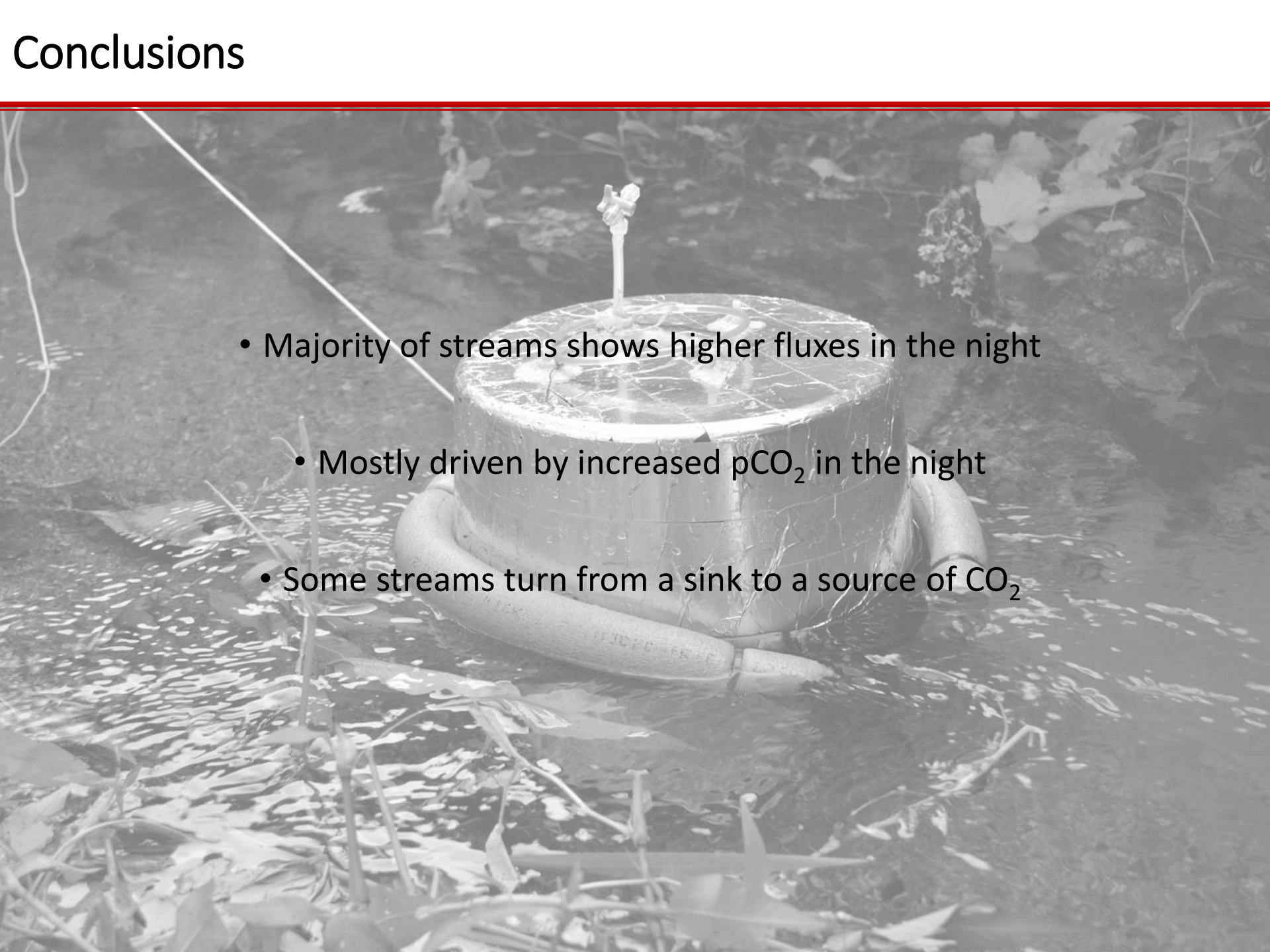
CZE1_1 Spring



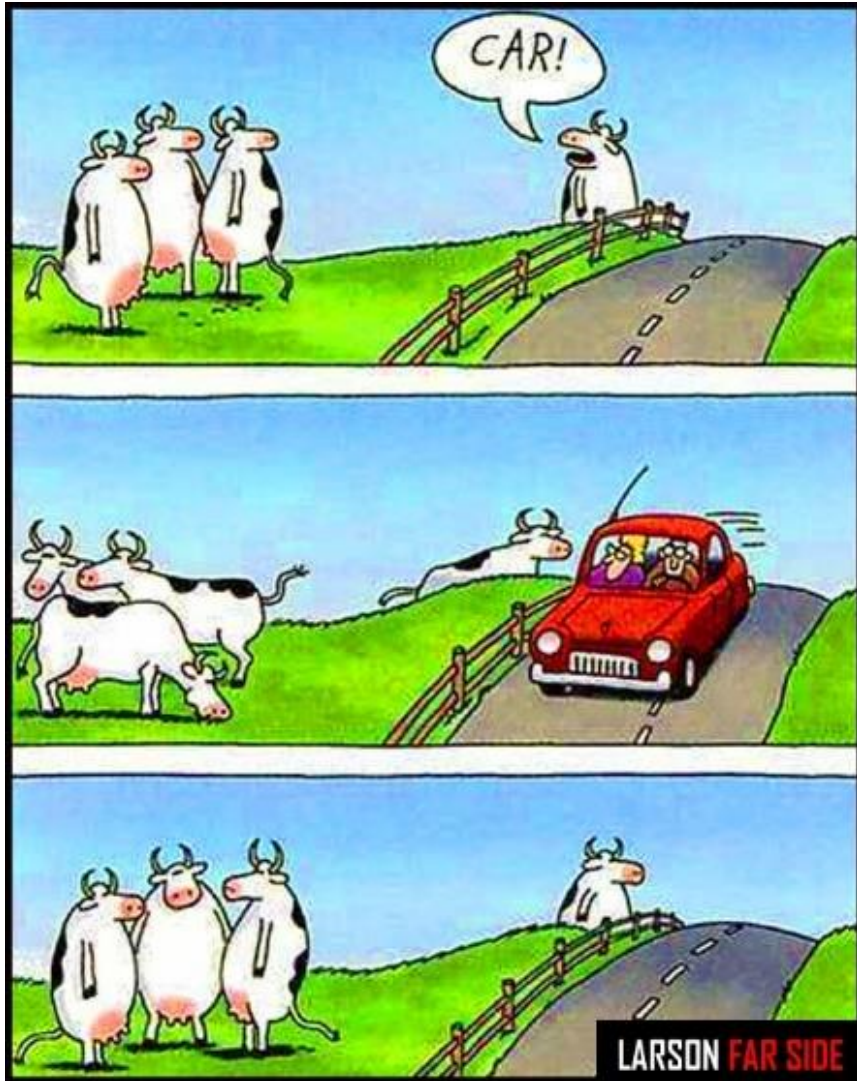
ITA1_2 Winter



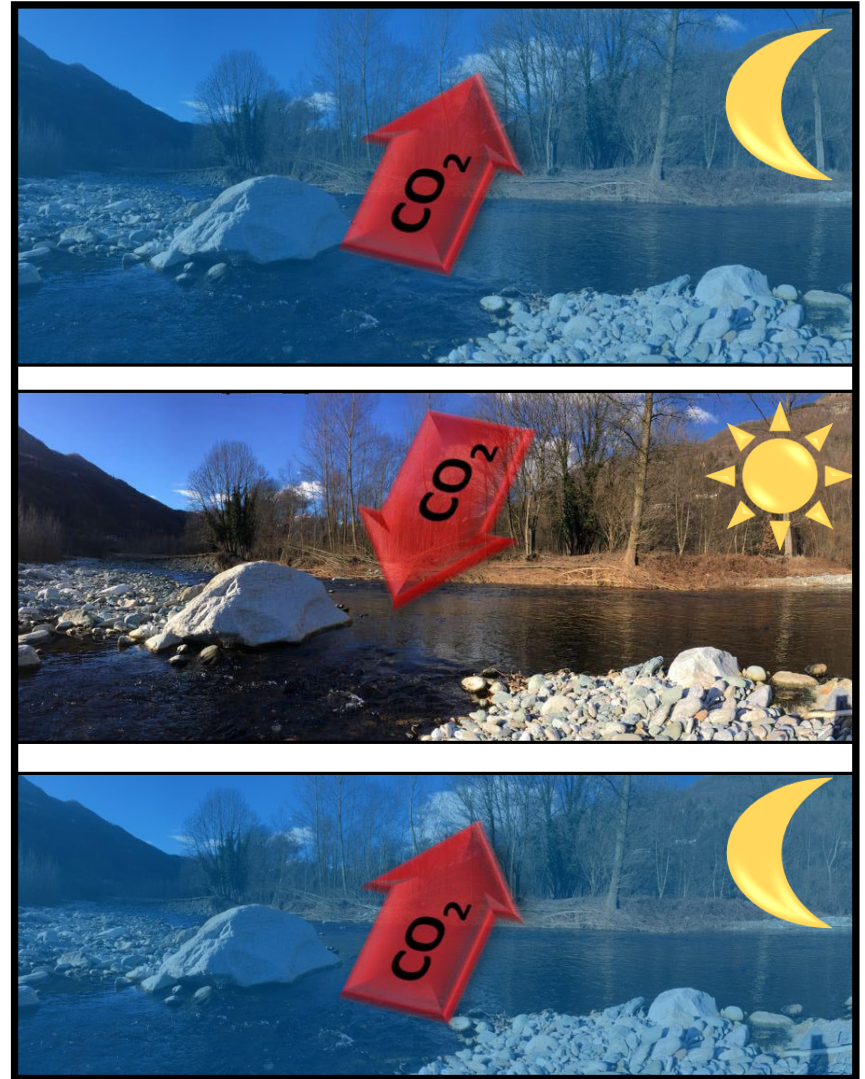
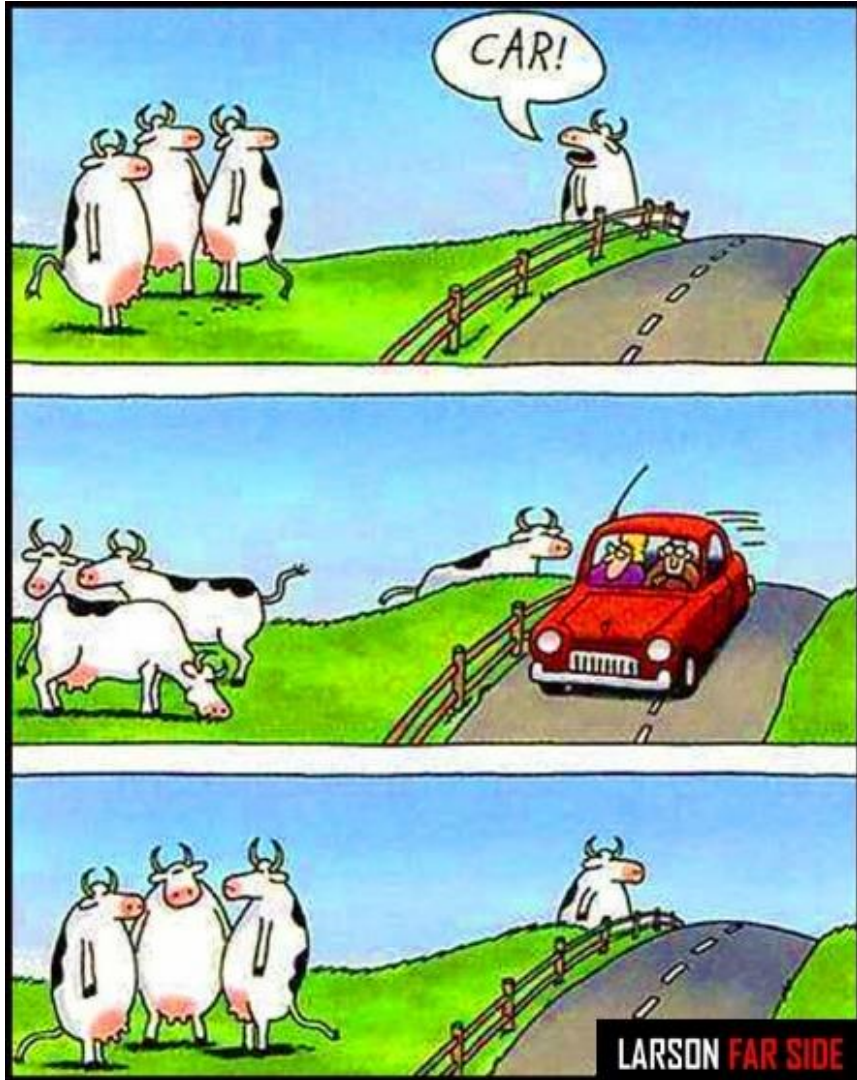
Conclusions

- 
- Majority of streams shows higher fluxes in the night
 - Mostly driven by increased $p\text{CO}_2$ in the night
 - Some streams turn from a sink to a source of CO_2

Conclusions

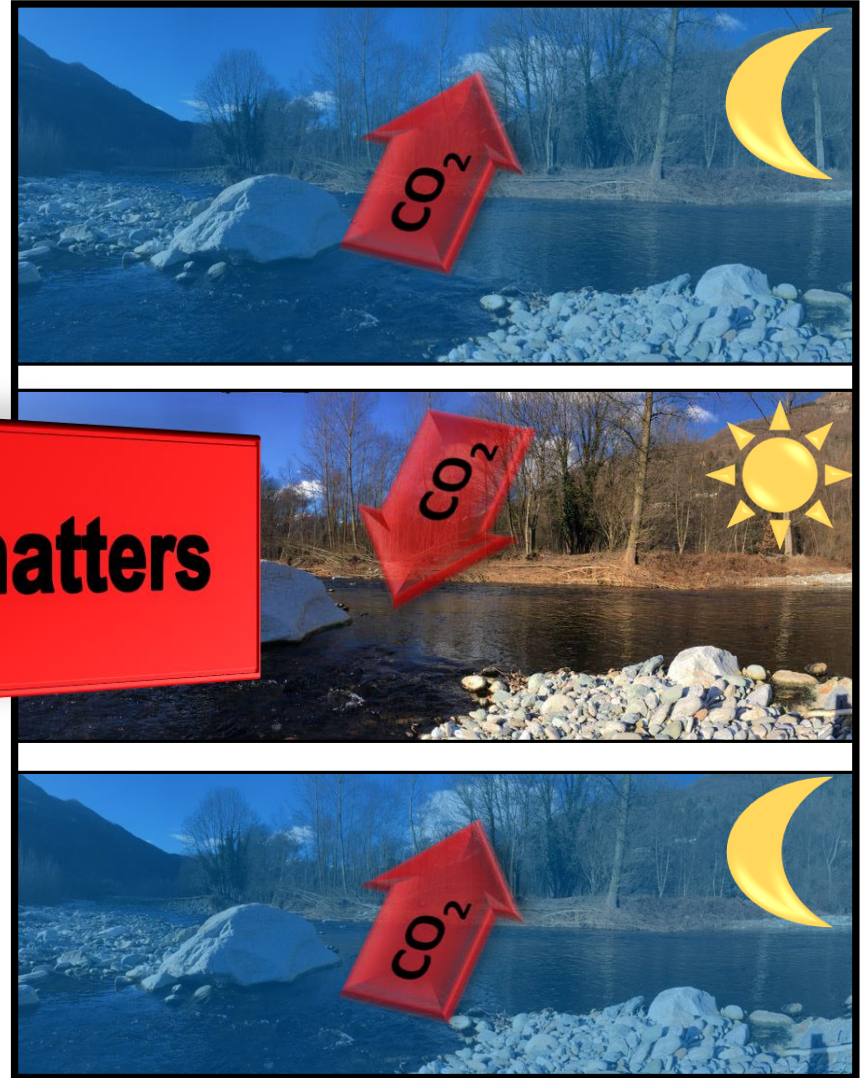


Conclusions



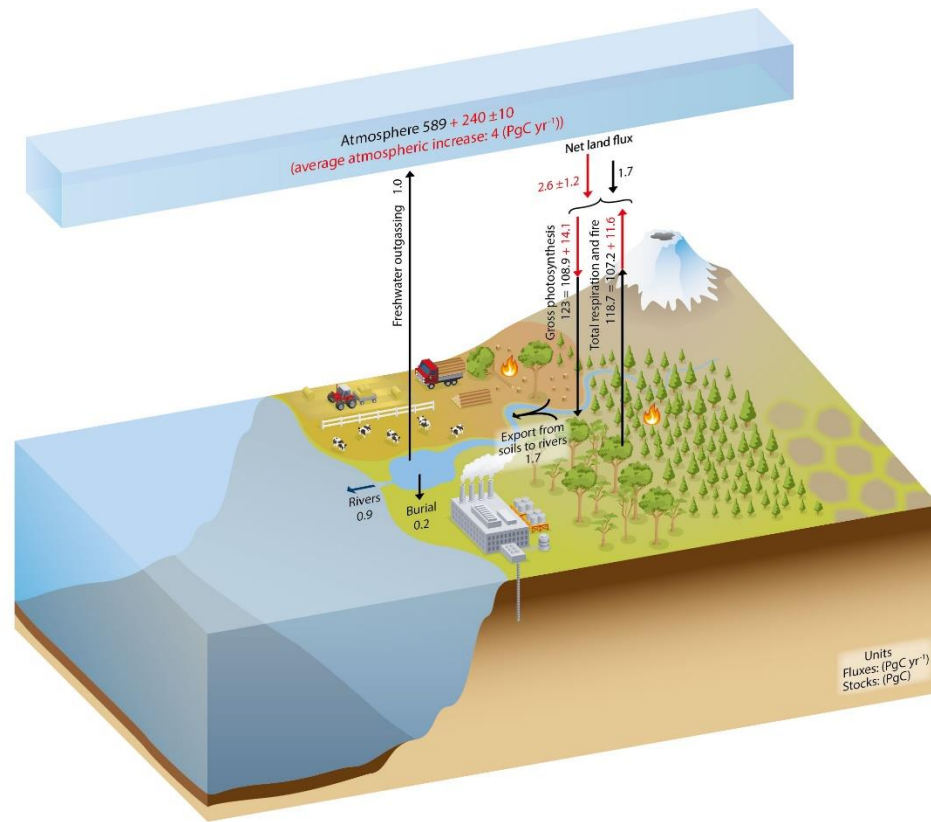
Conclusions

Time of day matters



Conclusions

Time



Acknowledgement

THANKS

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Associação
Ibérica de
Limnologia

AIL



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Societad svizra d'idrologia e da limnologia



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