RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

FRANCE 2030 — PROGRAMME DE RECHERCHE CARBONE ET ÉCOSYSTÈMES CONTINENTAUX

Carbon sink or methane source - local to global scale assesment of lentic waters' role in the climate system (DEEP-C)

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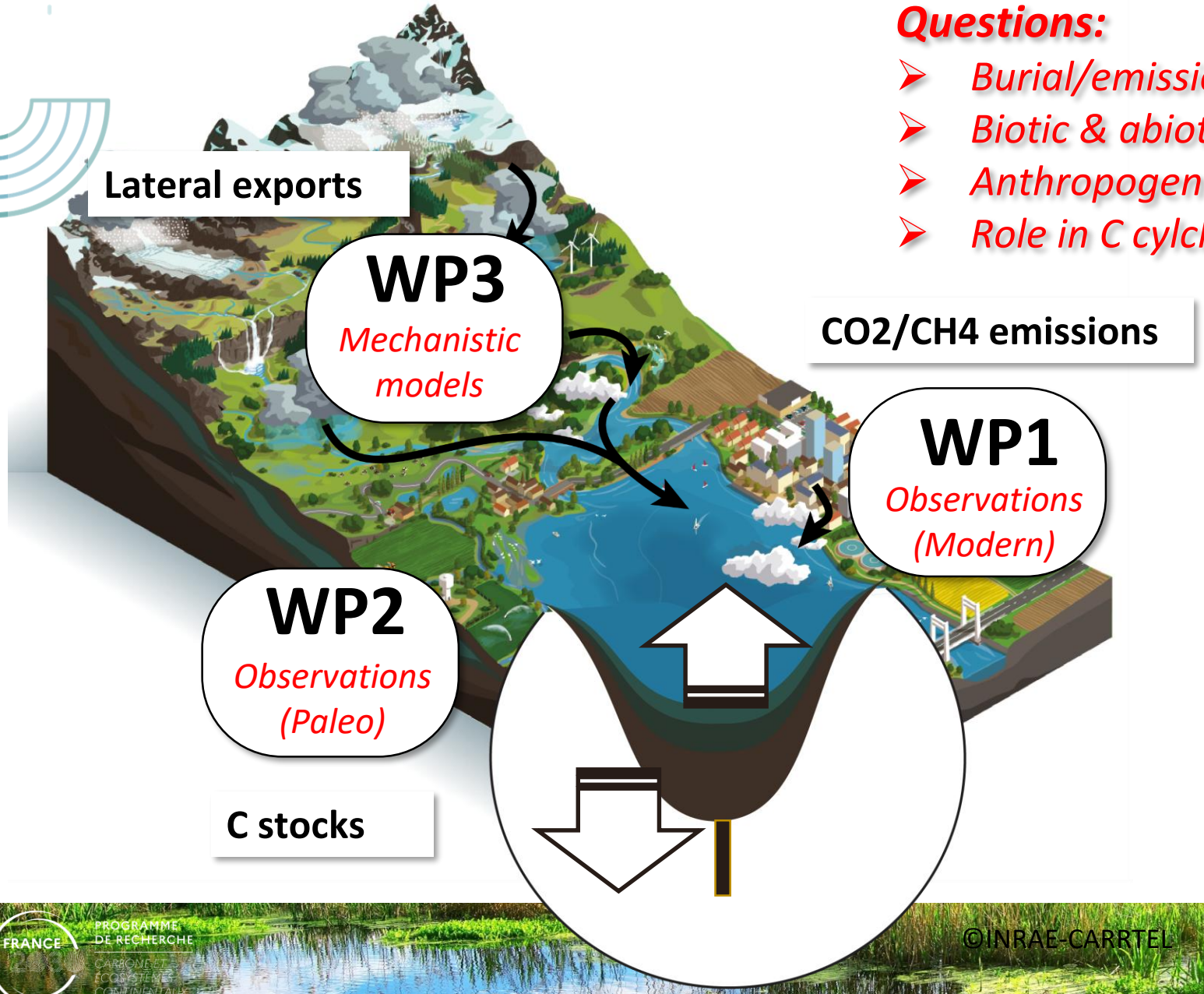
Main objectives in DEEP-C



Questions:

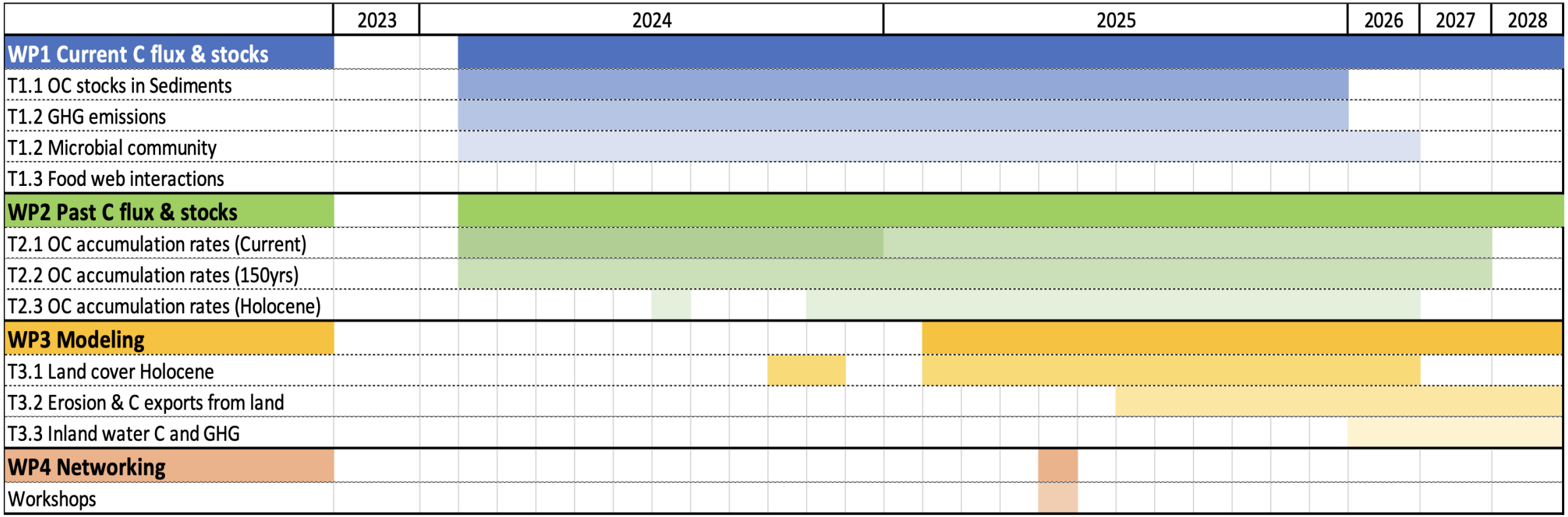
- *Burial/emissions balance?*
- *Biotic & abiotic controls?*
- *Anthropogenic alteration?*
- *Role in C cylcle & climate?*

WP4
Network International

- **Objective**: Understanding and modeling the role of lentic water in the C cycle and climate system
- Budget : 1,5M€
- 8 Laboratories, 40 people
- National inventories, global assessments

Key facts

- 2024-2025 Data collection
- 2025-2028 Data analysis & modeling (+data consolidation)



Key facts

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	2023	2024	2025	2026	2027	2028
WP1 Current C flux & stocks		**Data collection**	**Data Analysis**			
T1.1 OC stocks in Sediments		**1. Synthesis**	**1. Targeted initiatives (question)**			
T1.2 GHG emissions		**2. New collection**	**2. Papers & valorisation**			
T1.2 Microbial community		○ GHG pilote sites	**3. Data collection (consolidation)**			
T1.3 Food web interactions		○ C stocks	○ GHG national			
WP2 Past C flux & stocks		○ Methods (proxys)	○ C stocks national & broader			
T2.1 OC accumulation rates (Current)						
T2.2 OC accumulation rates (150yrs)						
T2.3 OC accumulation rates (Holocene)						
WP3 Modeling			**Modelling & data integration**			
T3.1 Land cover Holocene			**1. Check data compatibility (WP1-2)**			
T3.2 Erosion & C exports from land			**2. Interact with WP1-2**			
T3.3 Inland water C and GHG			**3. Pilote sites & upscaling**			
WP4 Networking						
Workshops						

WP4 Stimulate international synthesis & concept charing

Advancement on data collection

Consolidation of National Data Collection

- 50 lakes – Carbon (C) stocks: synthesis of existing radiogenic and carbon data
- 50 new sediment cores – Carbon stocks: sediment coring completed; laboratory analyses in progress
- 4 new pilot sites – Monitoring of C fate in lentic waters: monthly field measurements over one year
- 4 new sites – Monthly GHG monitoring: integrated within the OLA lake observatory
- 40 sites – One-time GHG measurements

Highlight

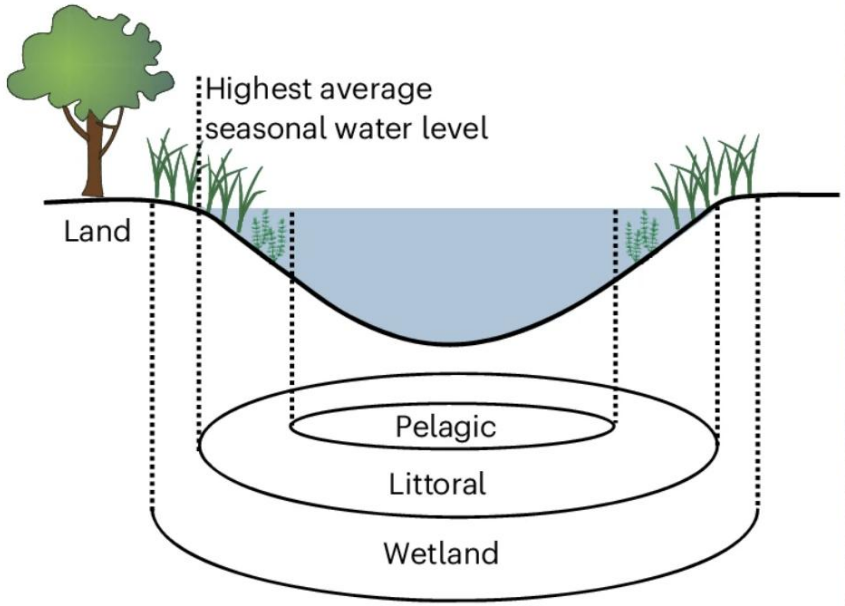
Results from Itier-Desgué et. al (in prep)

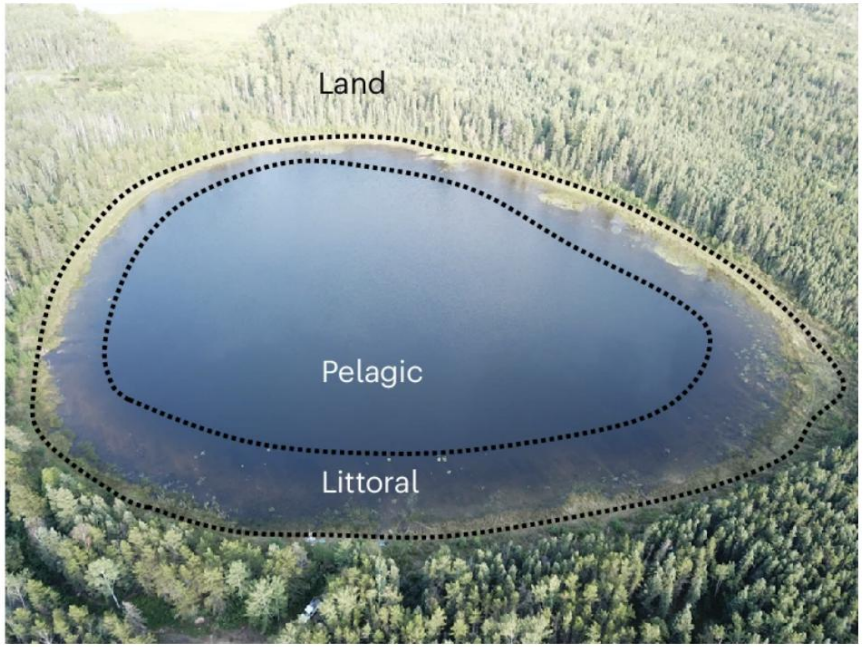
— *Transversal work in DEEP-C* —

Contribution of lake littoral zones to the continental carbon budget

Grasset et al. (2025) show that the global C balance of lakes may reverse from a net C source to a net C sink when including littoral zones (due to aquatic vegetation)

Illustrations of littoral zones



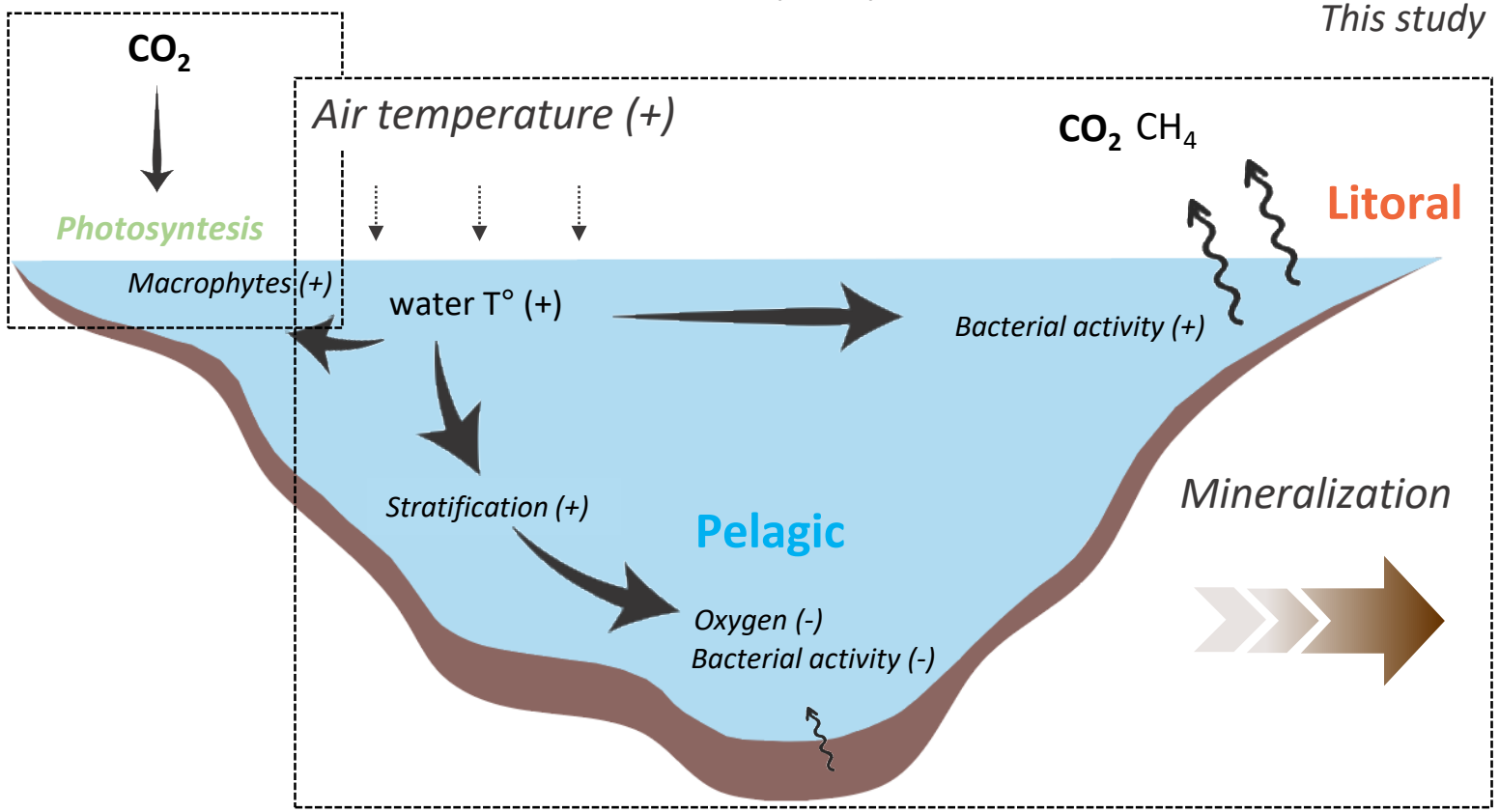


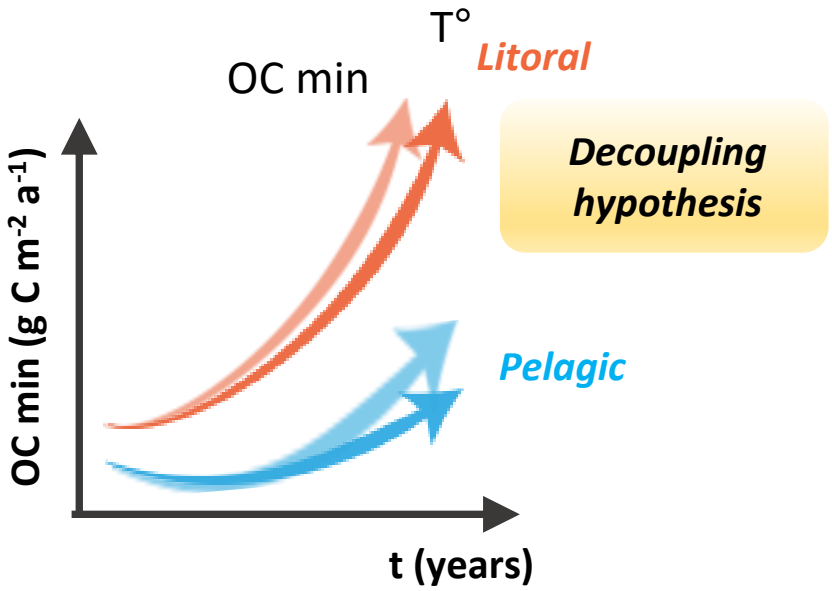
Grasset et al. Nat. Geos. (2025)

Decoupling of littoral and pelagic carbon dynamics under climate change

Grasset et al. Nat. Geos. (2025)

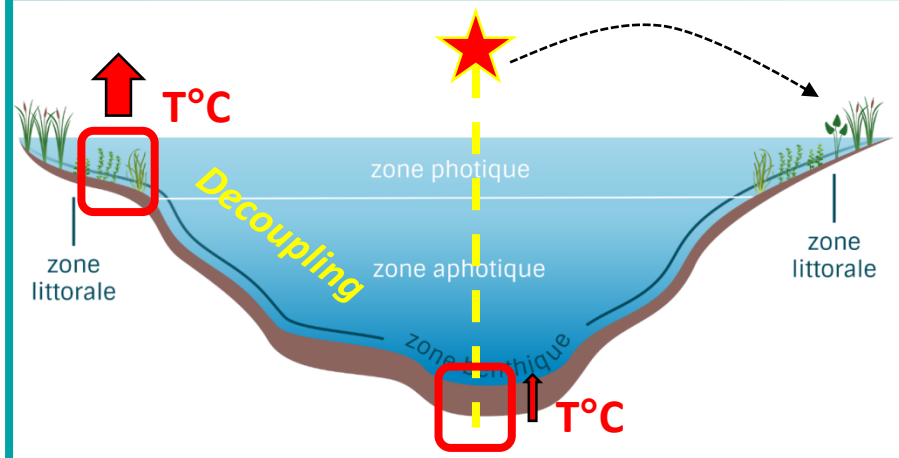
This study





Decoupling of littoral and pelagic C cycles

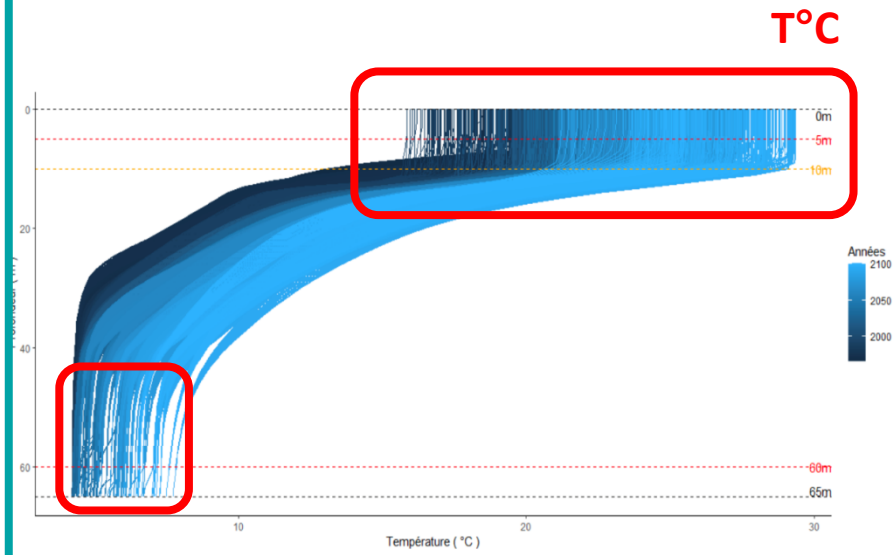
Hyp 1: surface T°C = littoral T°C



Surface T° in pelagic zone as proxy of littoral T°

- limitations, but coherent

Hyp 2: rates benthic littoral T°C >> benthic pelagic



Vertical T° profiles (central lake location)

Decoupling of littoral and pelagic C cycles

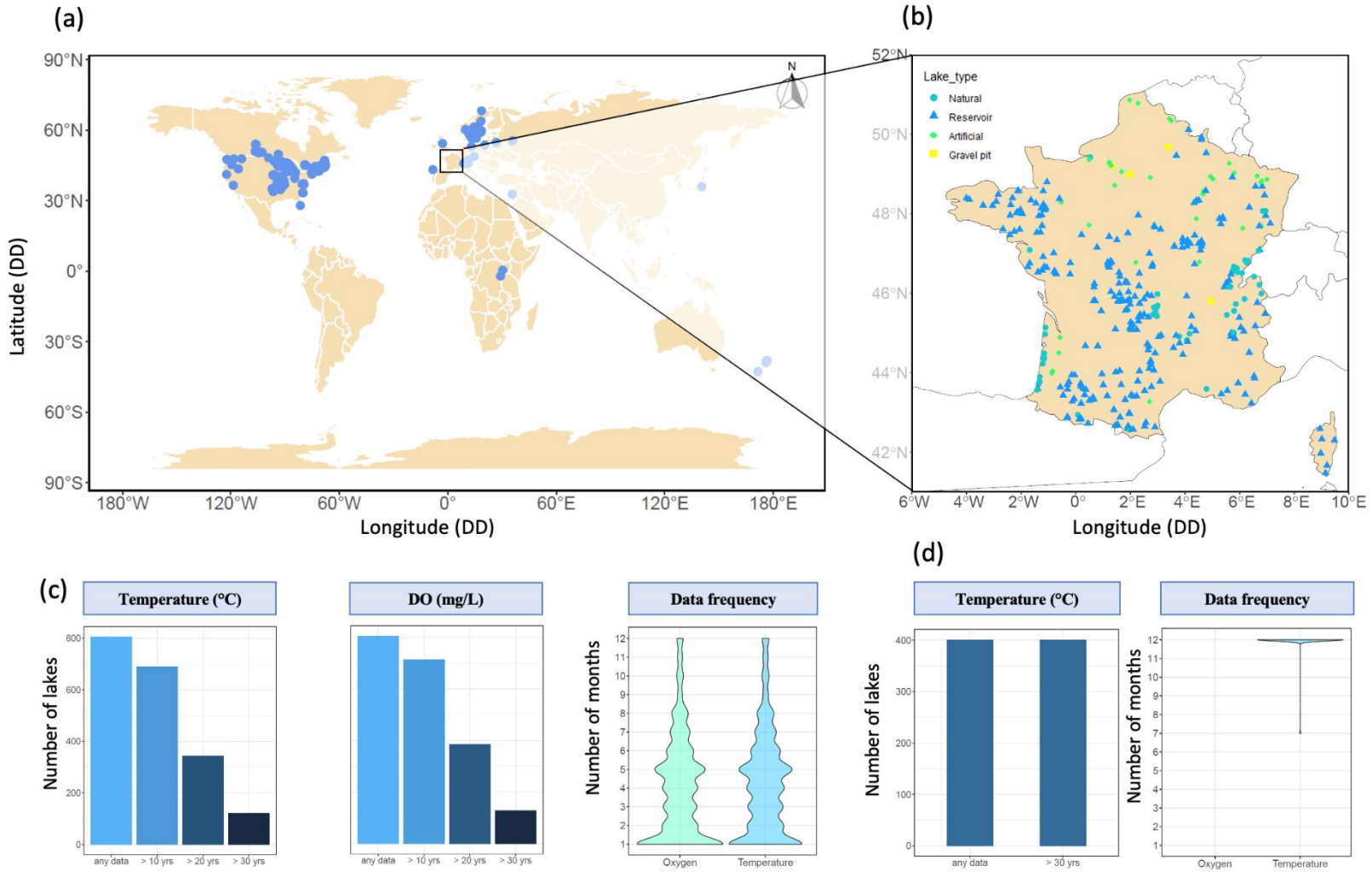
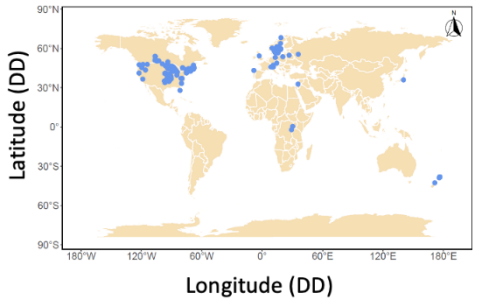


Figure 1. Overview of the databases used. (a) Global distribution of 822 lakes with 40 years in situ temperature and oxygen measurements (GLEON database). (b) Location of new data : from the French lakes monitored under the Water Framework Directive (WDF), with modeled epilimnion and hypolimnion data (OKPLM model). (c) Coverage and data density by variable for global lakes and (d) Lake count and data coverage in the French dataset.

Decoupling of littoral and pelagic C cycles



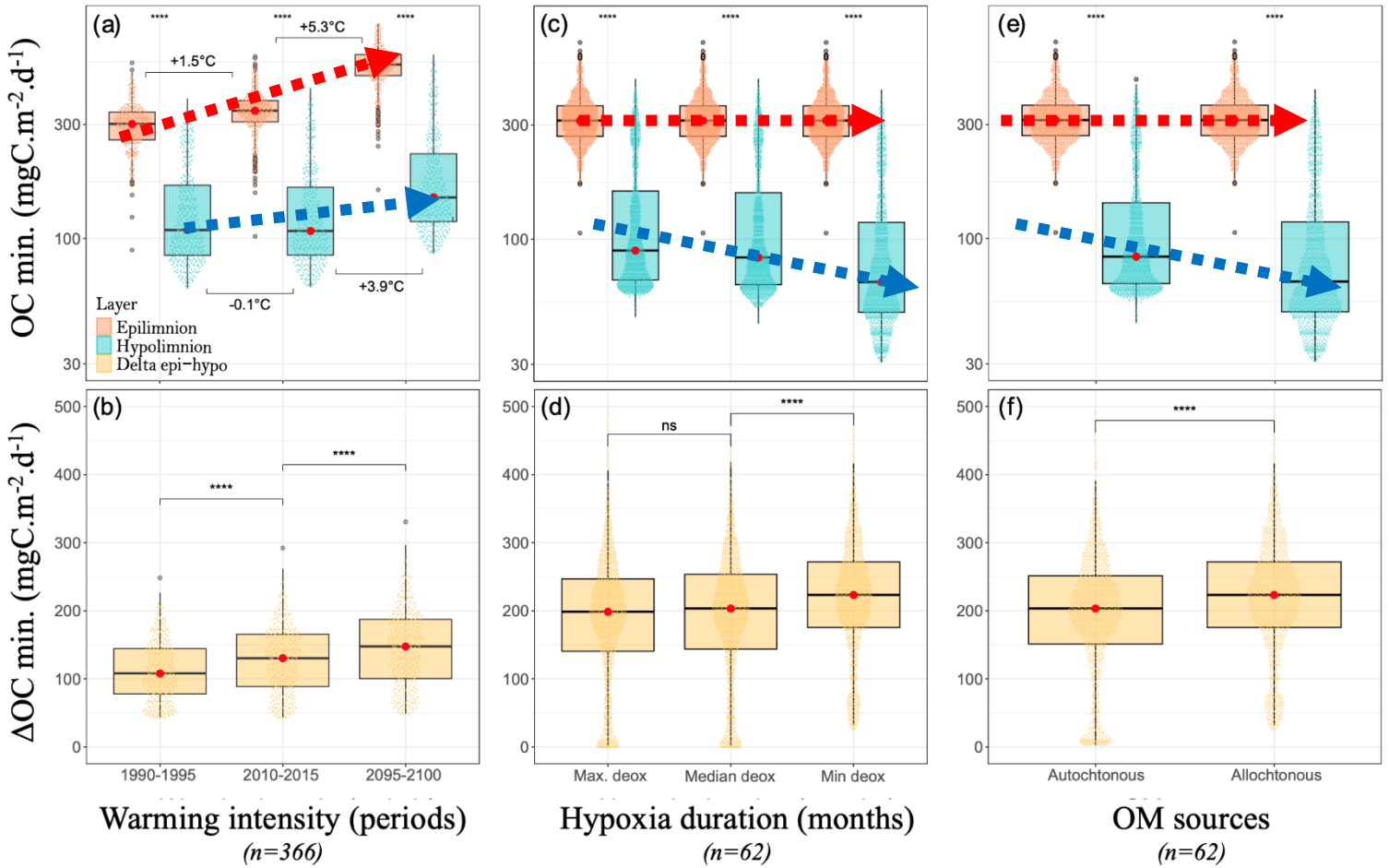


Figure 2. Effect of temperature increase (°C) (a,b) oxygen conditions (c,d) and organic matter sources (e,f) on OC mineralization ($mgC.m^{-2}.month^{-1}$) in littoral vs. pelagic zones from global database (n=366 lakes for temperature analysis and n=62 lakes for oxygen and allochtony effects). Panels (a), (c) and (e) show absolute OC mineralization (log scale), while panels (b), (d) and (f) show the increasing delta between the two layers.

Thanks for your attention

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