A global database of greenhouse gas fluxes from (sub)tropical inland waters

FRESHWATER SCIENCES
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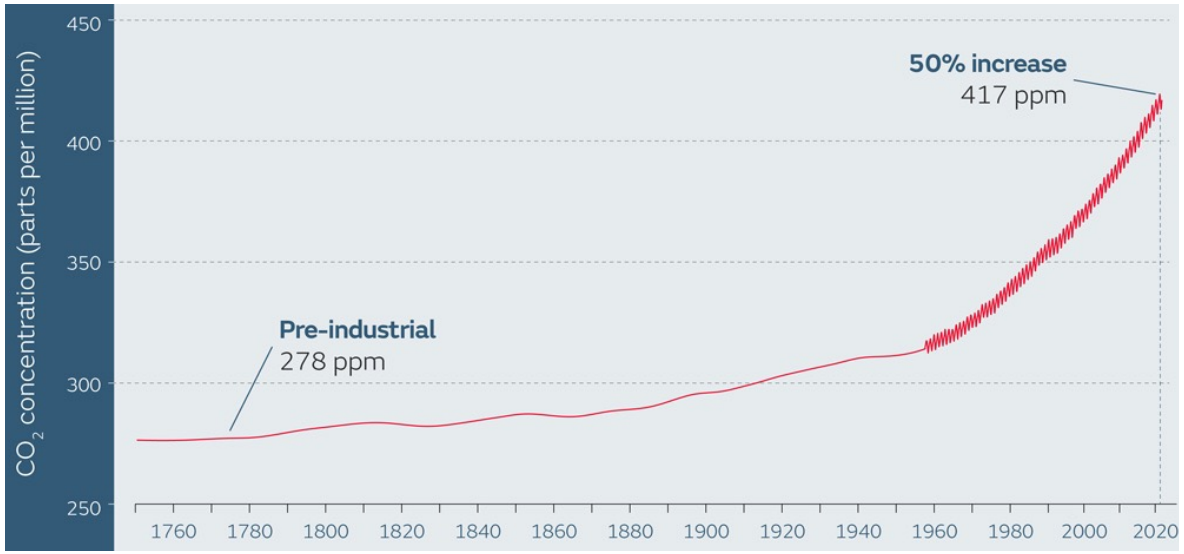
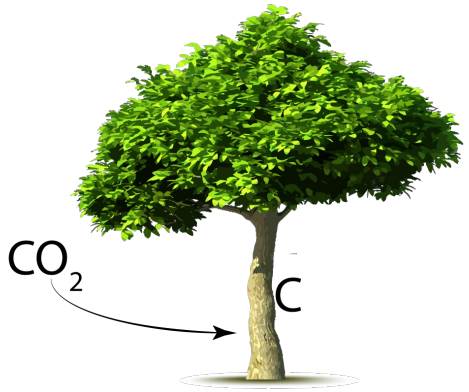
GLOBAL FRESHWATER SCIENCE

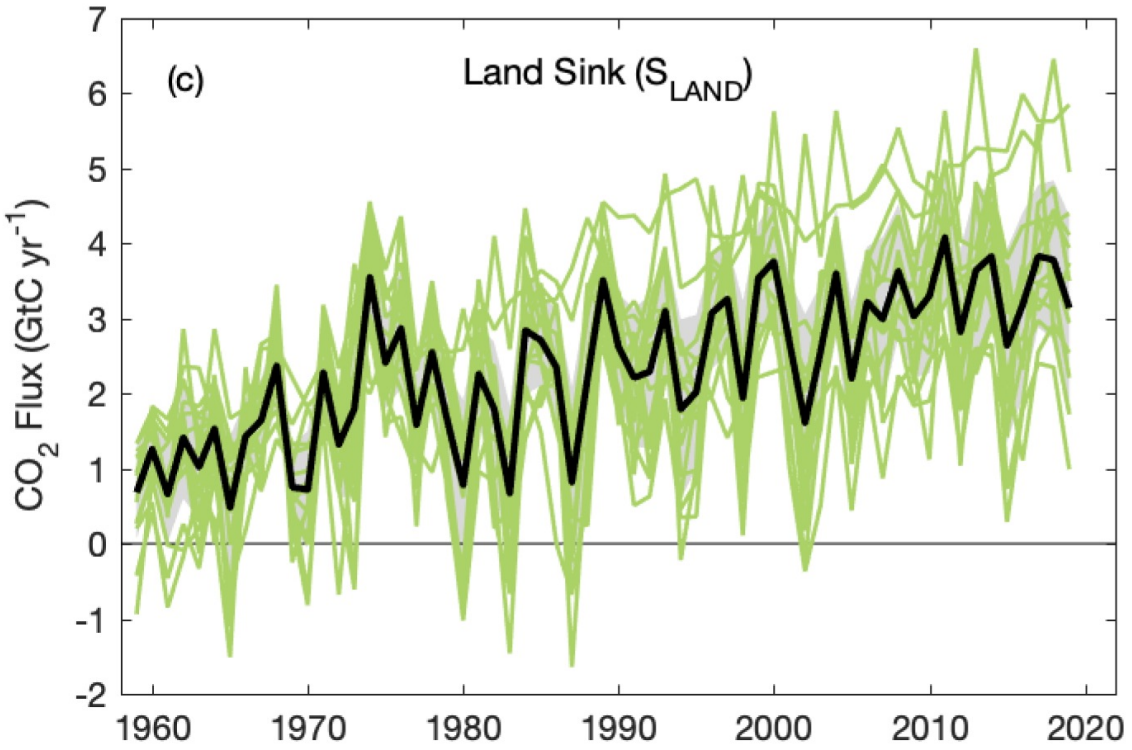
C. Duvert, N.S. Marzolf, A. Linkhorst, K. Attermeyer, E. Calamita, T. DelSontro, L. Deirmendjian, A. Dixon, C. Grasset, A.M. Herreid, L.C. Jeffrey, S. Liu, C. López-Lloreda, M.N. Macedo, L. Marcon, D. Oviedo-Vargas, J. Paranaíba, L. Ran, A. Rexroade, D.A. Riveros-Iregui, G. Rocher-Ros, J. Rosentreter, V. Solano, P. Taillardat, J. Wang, K.M. Whitmore, L. Zhang, A.V. Borges

Terrestrial ecosystems: a growing sink for atmospheric CO_2



Met Office 2021





Friedlingstein et al. 2020 **ESSD**

The terrestrial C sink is “leaking”

The terrestrial C sink is “leaking”

Smithsonian MAGAZINE

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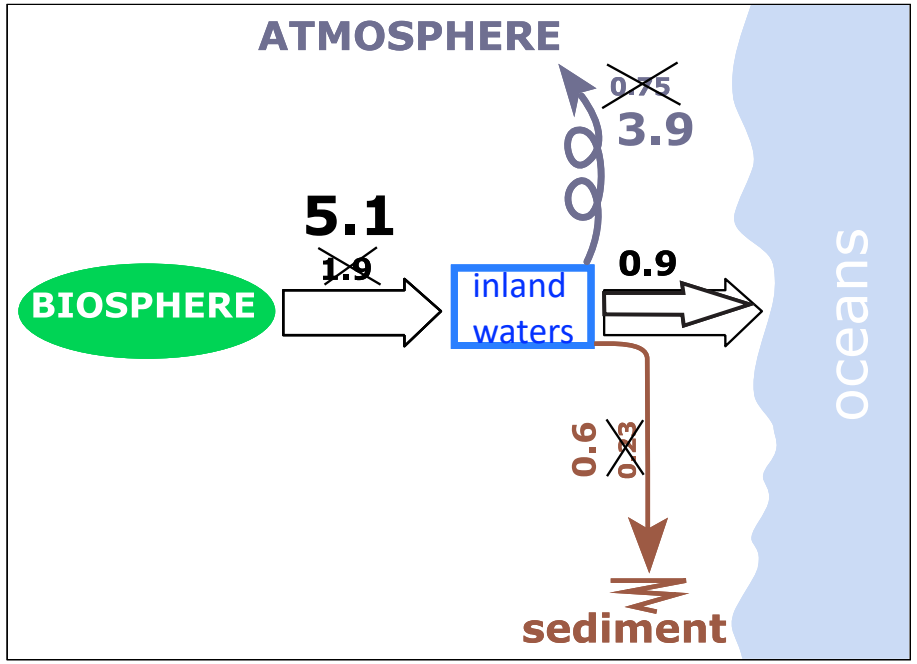
World’s Rivers and Streams Leak a Lot of Carbon Dioxide

Inland waters as major exporters of C

“passive pipe” ➡ “reactor”



Cole et al. (2007), **Ecosystems**

Sawakuchi et al. (2017), **Frontiers**

Drake et al. (2018), **L&O Letters**

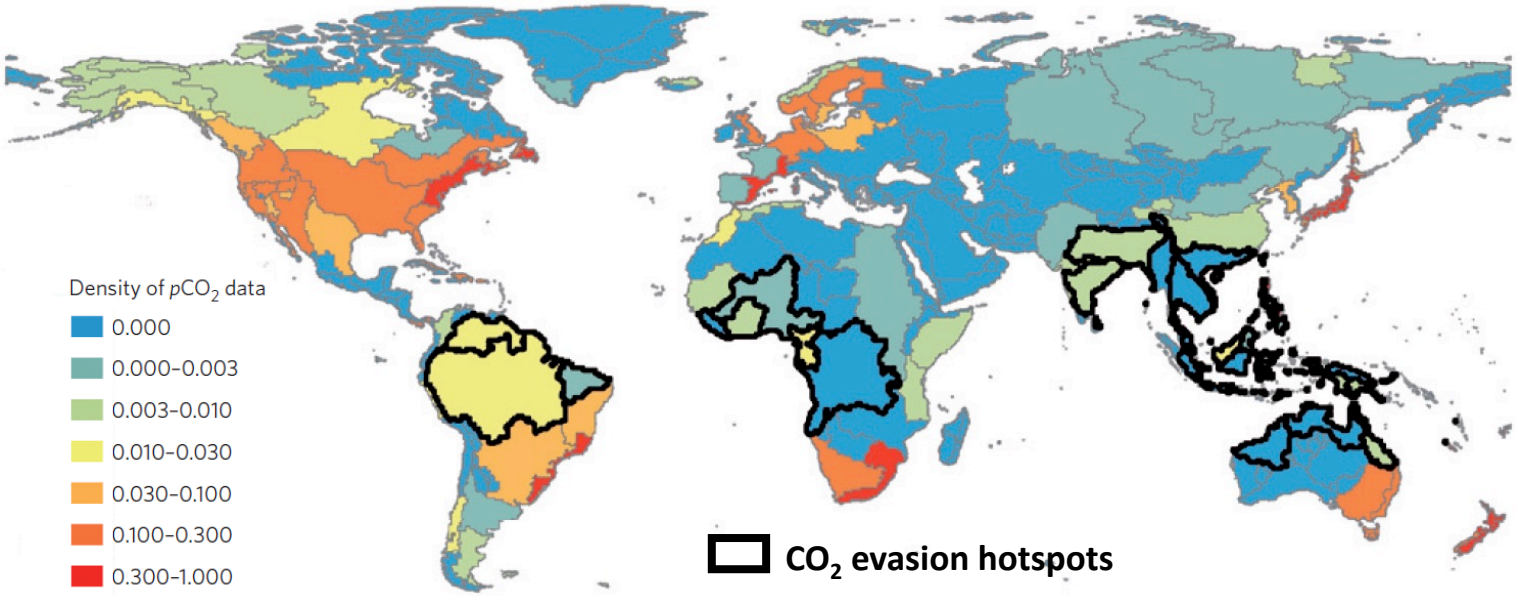
Ecosystems (2007) 10: 171–184
DOI: 10.1007/s10021-006-9013-8

ECOSYSTEMS

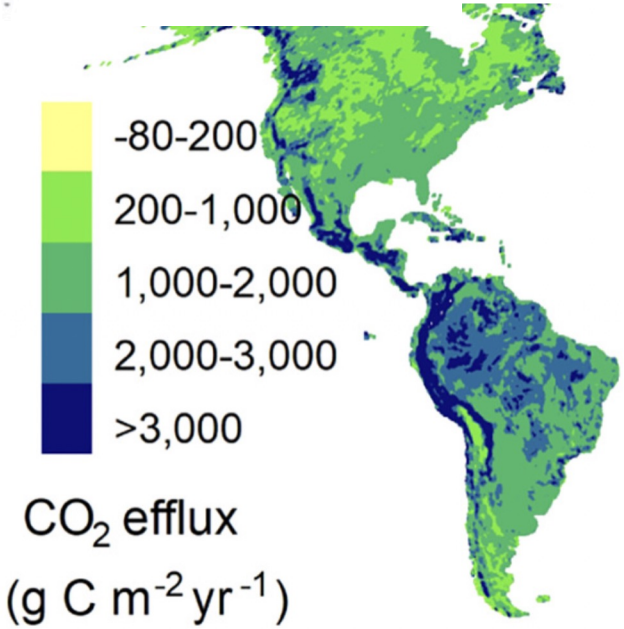
Plumbing the Global Carbon Cycle: Integrating Inland Waters into the Terrestrial Carbon Budget

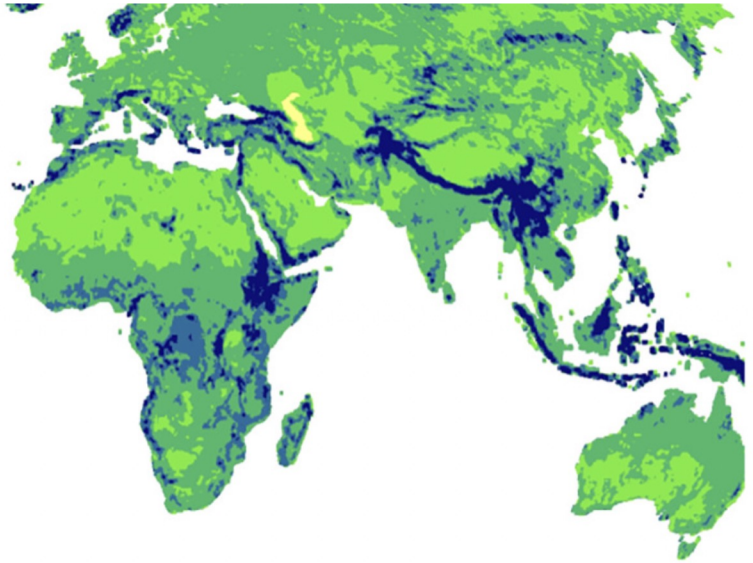
J. J. Cole,[1] Y. T. Prairie,[2,*] N. F. Caraco,[1] W. H. McDowell,[3] L. J. Tranvik,[4] R. G. Striegl,[5] C. M. Duarte,[6] P. Kortelainen,[7] J. A. Downing,[8] J. J. Middelburg,[9] and J. Melack,[10]

GHG emissions from inland waters: big in the tropics?



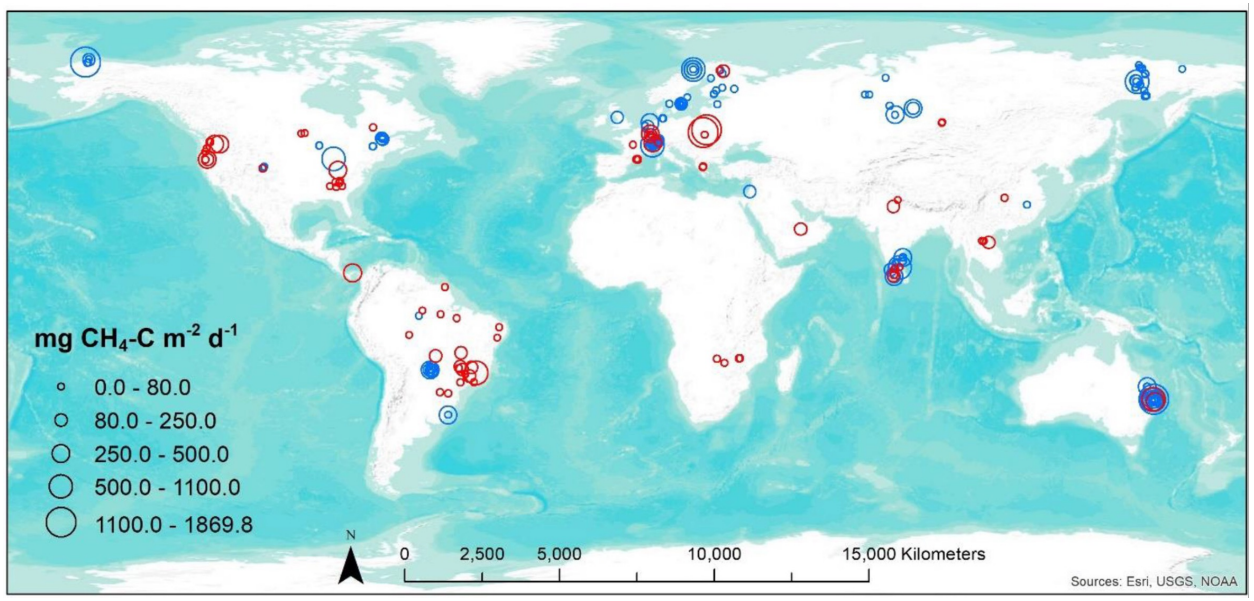
Regnier et al. (2013), Nat. Geosci.





Liu et al. (2022), PNAS

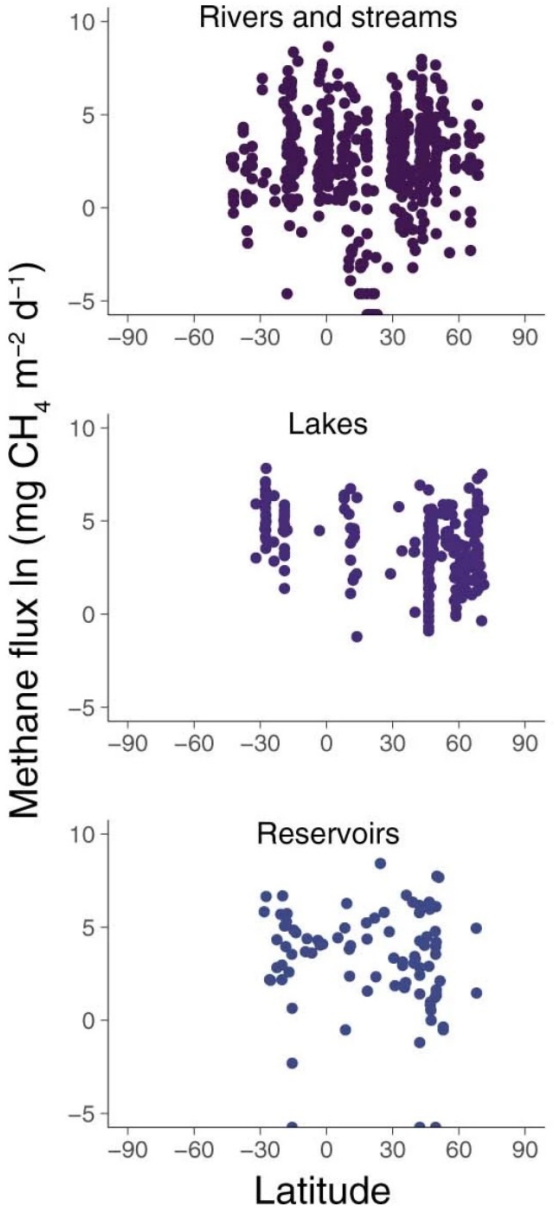
GHG emissions from inland waters: big in the tropics?



Deemer and Holgerson (2021), **JGR B.**

	FCO_2	Diffusive FCH_4	Ebullitive FCH_4	FN_2O
	TgC $year^{-1}$	TgCH_4 $year^{-1}$	TgCH_4 $year^{-1}$	GgN_2O-N $year^{-1}$
African tropical lakes				
This study (*)	**6.3 ± 1.9**	**1.3 ± 0.3**	**2.3 (0.8–5.5)**	**0.3 ± 0.2**
This study (**)	**3.3 ± 1.0**	**0.4 ± 0.1**	**1.8 (0.6–4.1)**	**−0.1 ± 0.1**
Previous studies	35.6	n.a.	n.a.	3.7

Borges et al. (2022), **Sci. Adv.**



Rosentreter et al. (2021), **Nat. Geosci.**

Need for a comprehensive GHG database for the (sub)tropics

Build a curated and openly accessible data repository for new observations to:

- update the tropical inland water GHG flux
- explore the drivers of variations in GHG fluxes and conc

***SS11**: Greenhouse gases in tropical streams, rivers, lakes and wetlands: current work and future research needs*

Greenhouse Gas Emissions from Reservoir Water Surfaces: A New Global Synthesis FREE

Bridget R. Deemer, John A. Harrison, Siyue Li, Jake J. Beaulieu, Tonya DelSontro, Nathan Barros, José F. Bezerra-Neto, Stephen M. Powers, Marco A. dos Santos, J. Arie Vonk

BioScience, Volume 66, Issue 11, 1 November 2016, Pages 949–964, https://doi.org/10.1093/biosci/biw117

Published: 05 October 2016

-2022-346
19 October 2022
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Open Access Earth System Science Data Discussions

GRiMeDB: The global river database of methane concentrations and fluxes

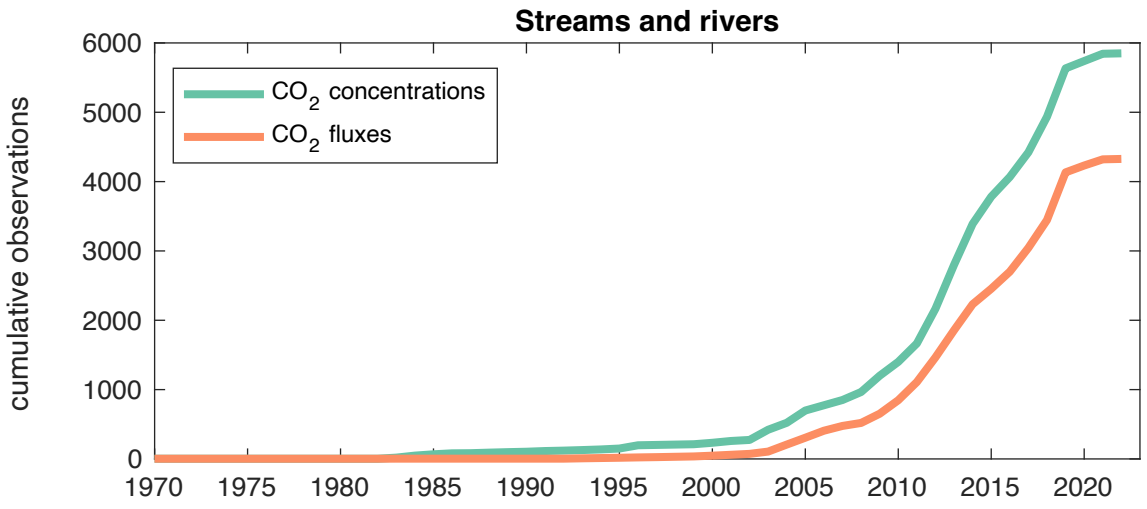
Emily H. Stanley[1], Luke C. Loken[2], Nora J. Casson[3], Samantha K. Oliver[2], Ryan A. Sponseller[4] Marcus B. Wallin[5] Liwei Zhang[6] Gerard Rocher-Ros[7,8]

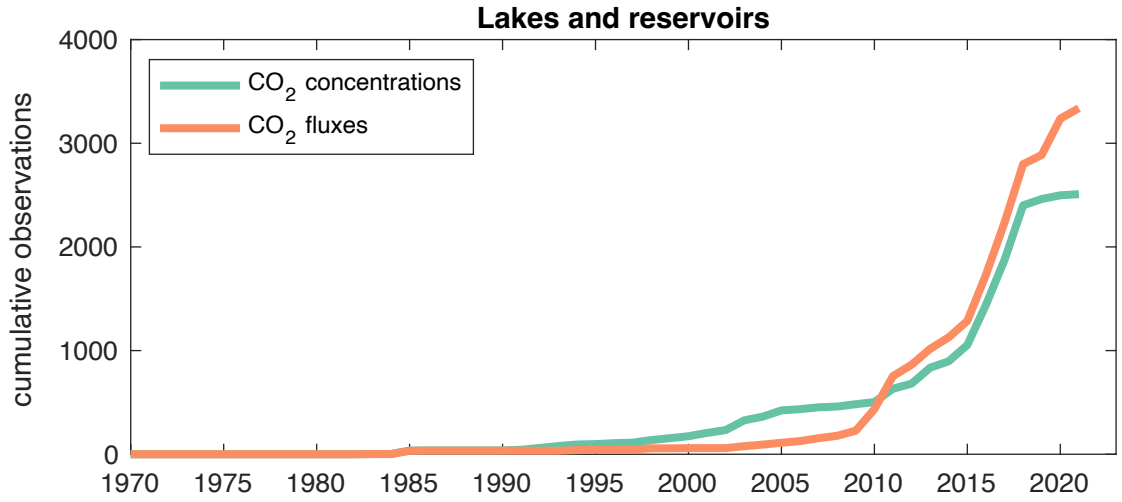
Database overview

- Concentrations and fluxes of CO_2, CH_4, and N_2O
- Streams/rivers, lakes/reservoirs, and wetlands
- ~520 publications between 1975 and 2023
- 14,000+ concentration and 12,000+ flux measurements
- Measurement methods (e.g. direct/indirect CO_2 estimates) + auxiliary data
- Includes subtropics (up to|34|° latitudes) to reflect global “tropicalisation”

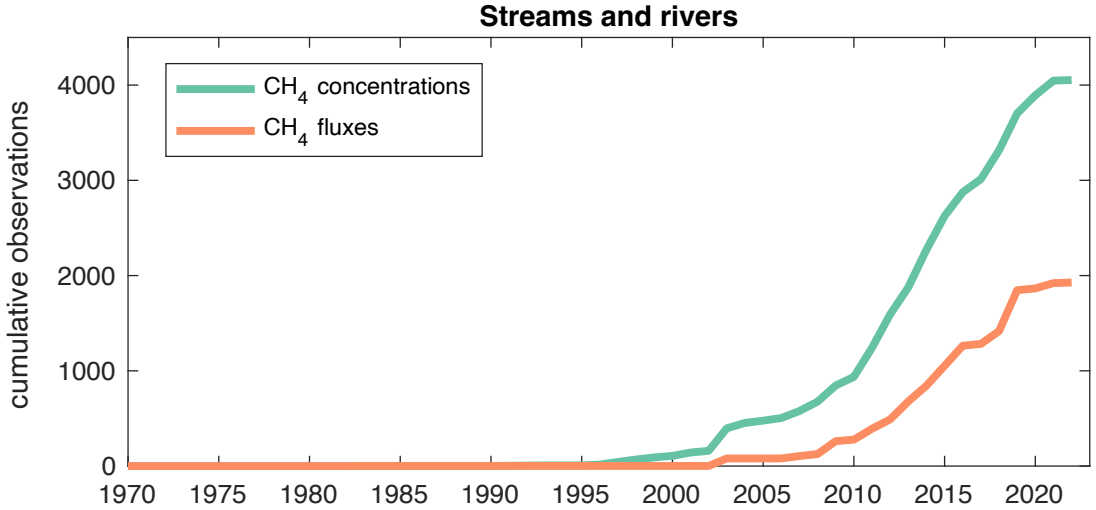
Increase in data collection from the 2010s

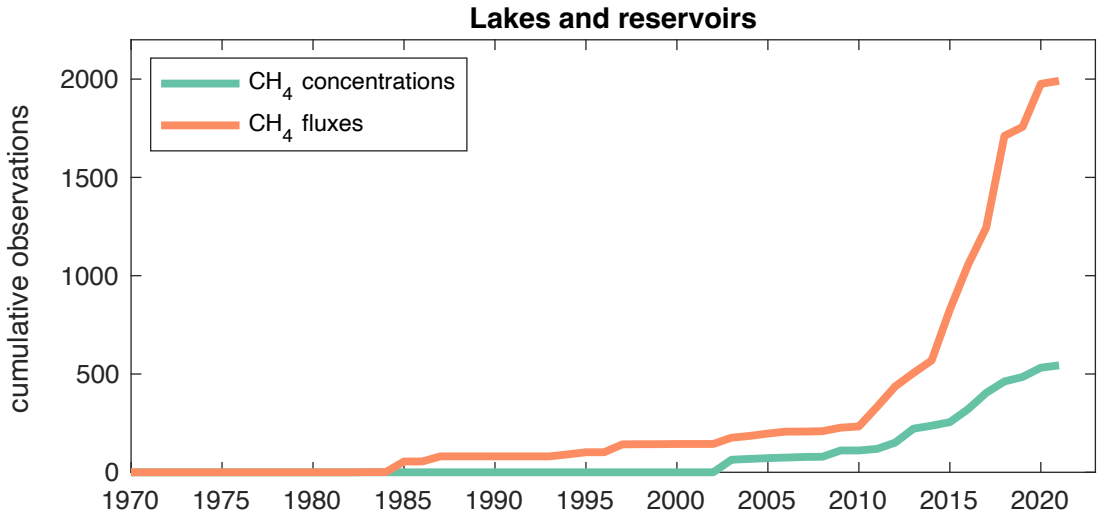
CO_2





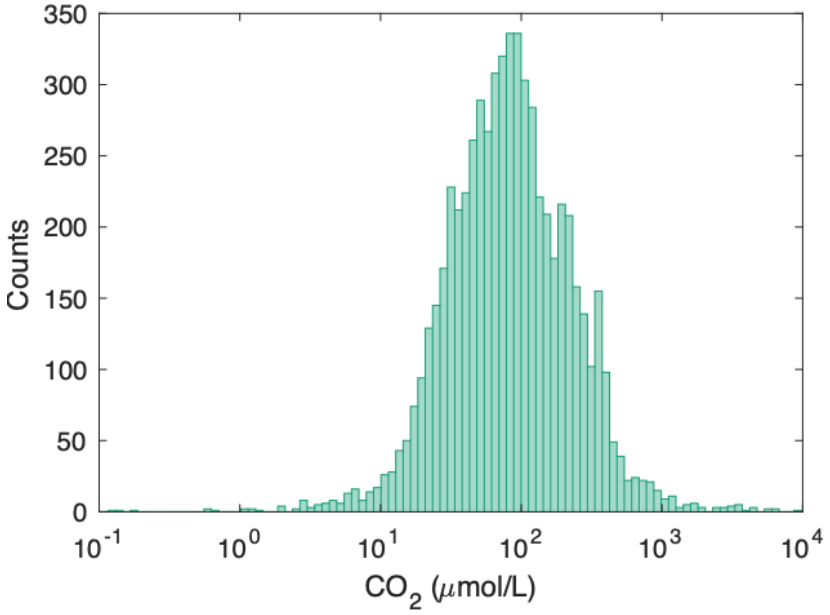
CH_4

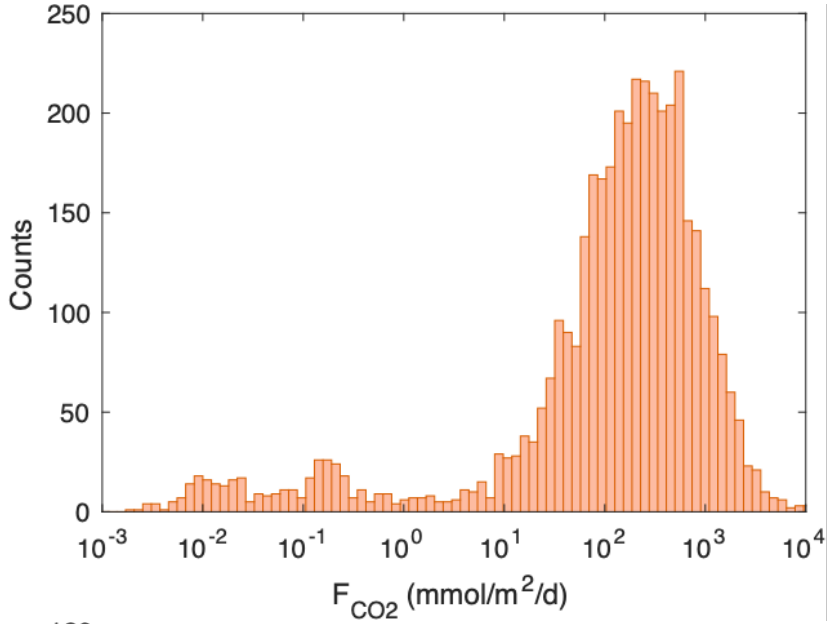




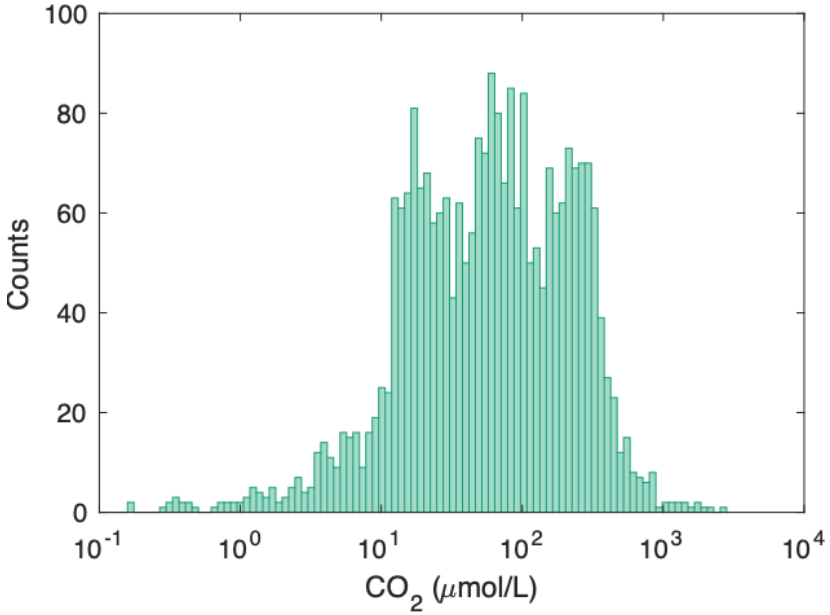
Distribution of CO_2 concentrations and fluxes

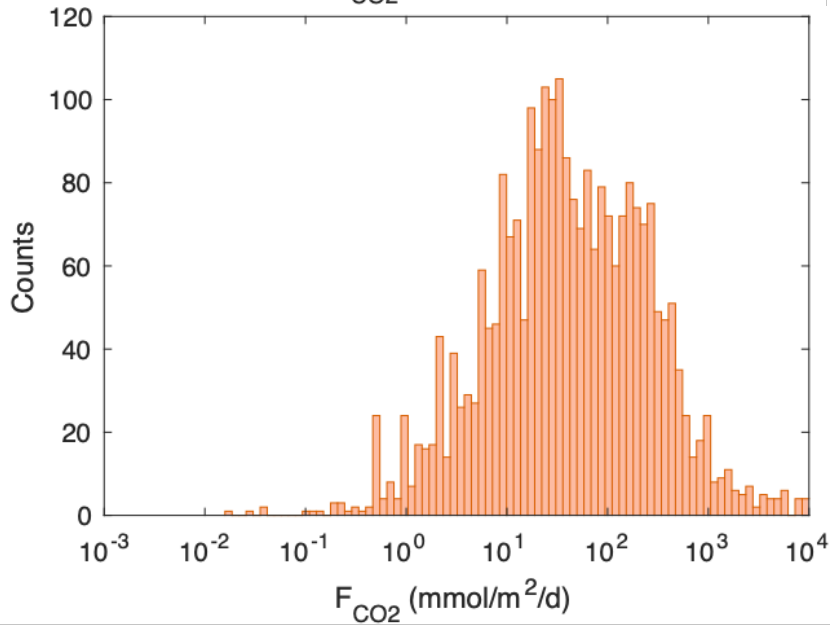
Streams and rivers





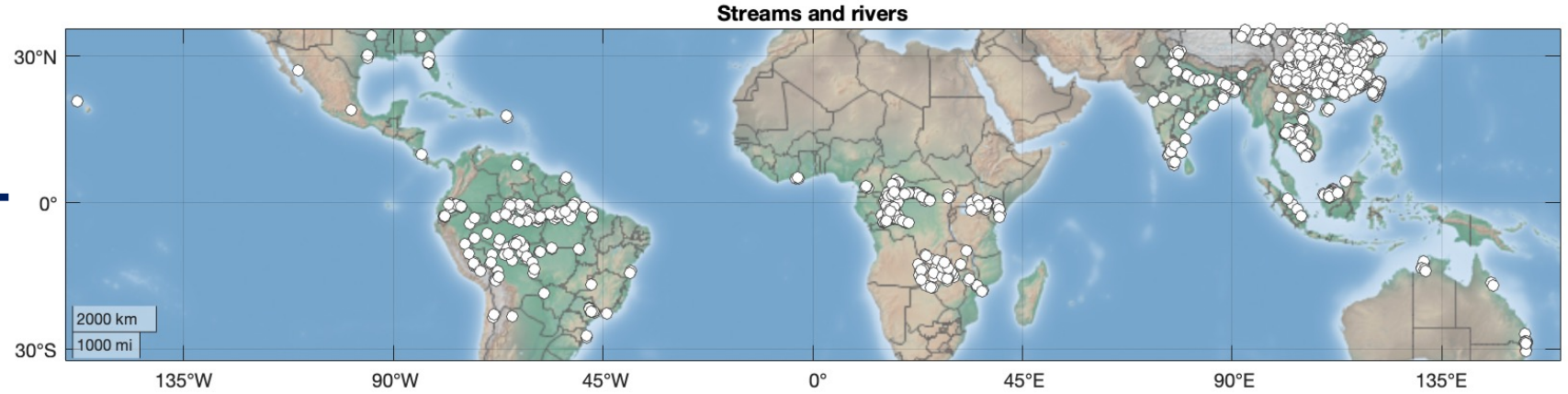
Lakes and reservoirs



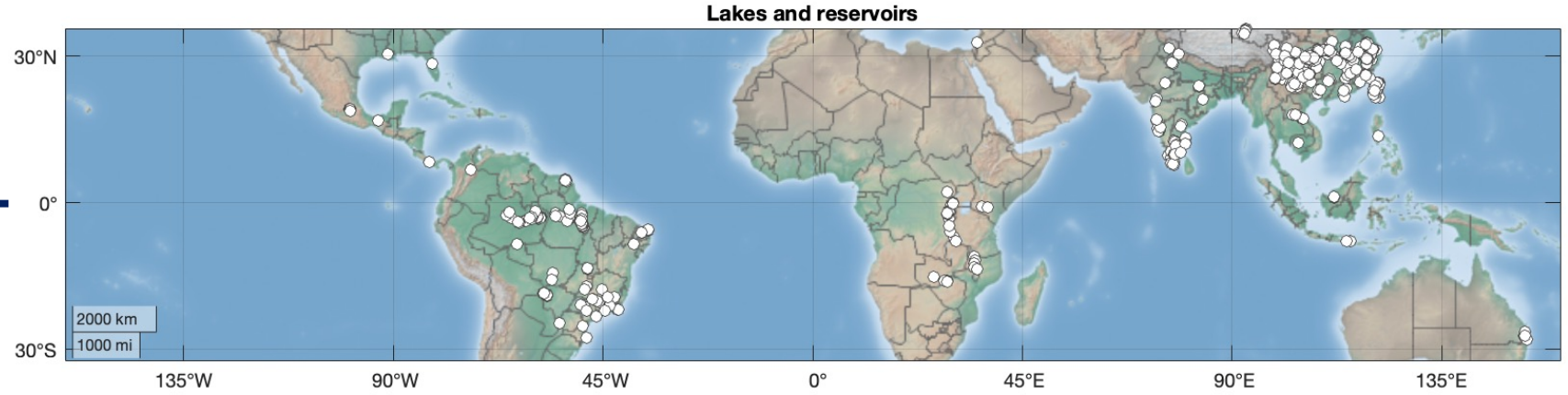


Spatial patterns

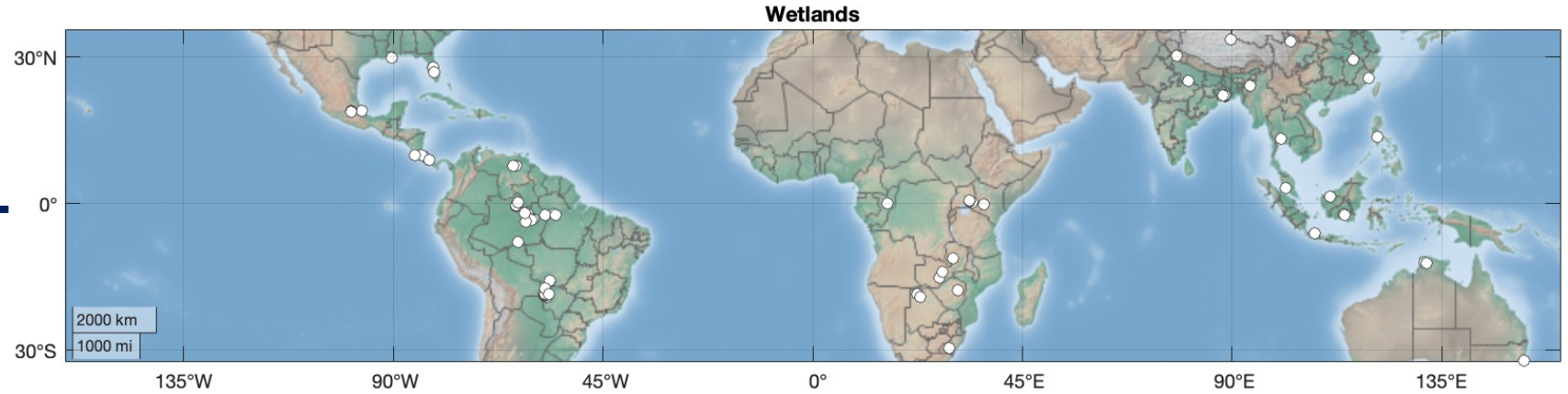
> 16,000 data points



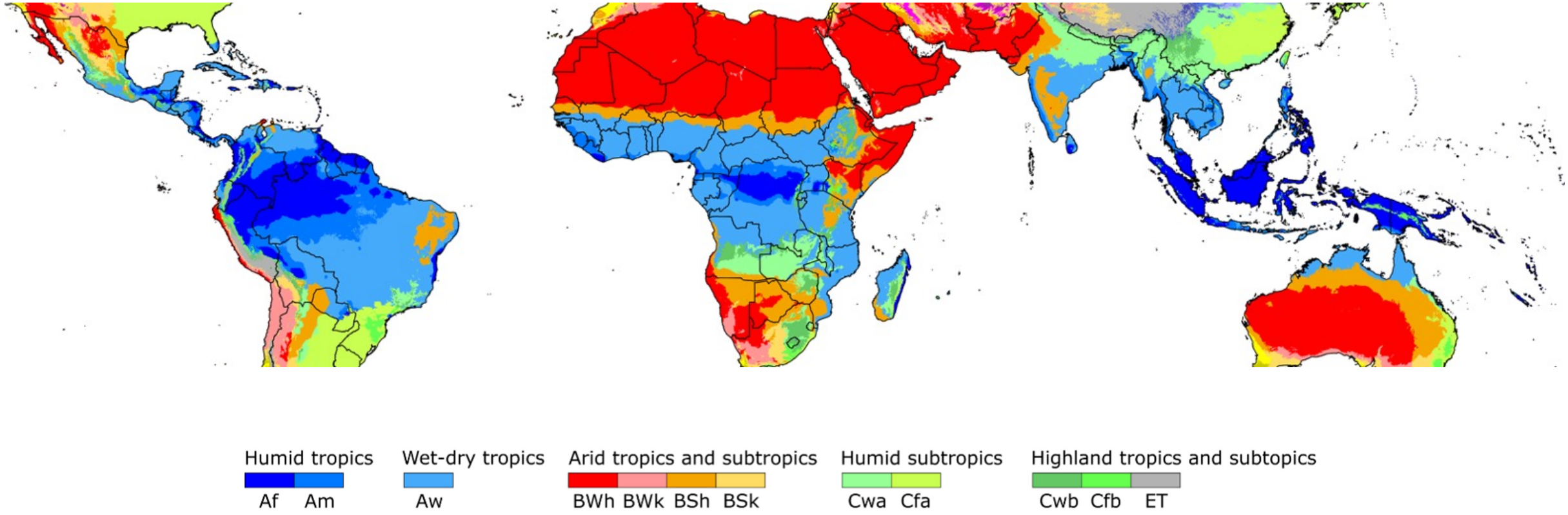
> 8,000 data points



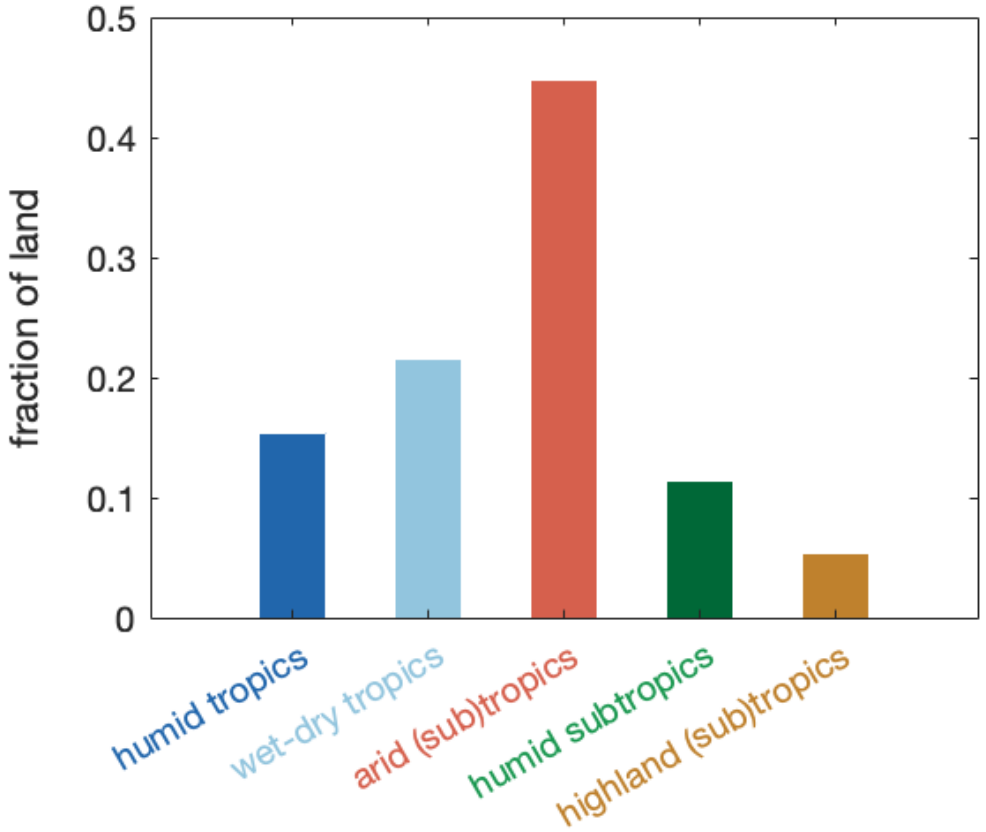
> 1,000 data points

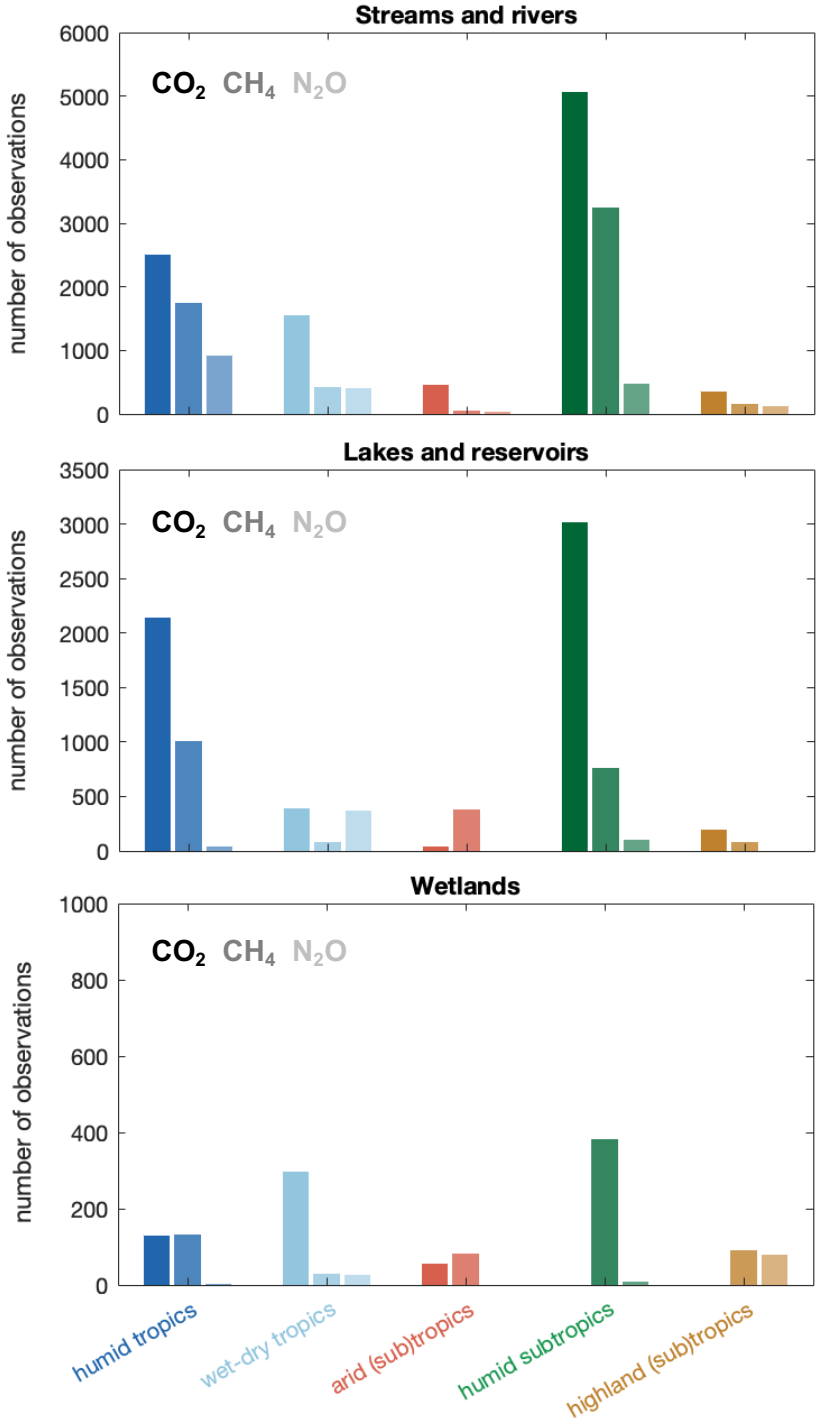


Köppen-Geiger climate classes



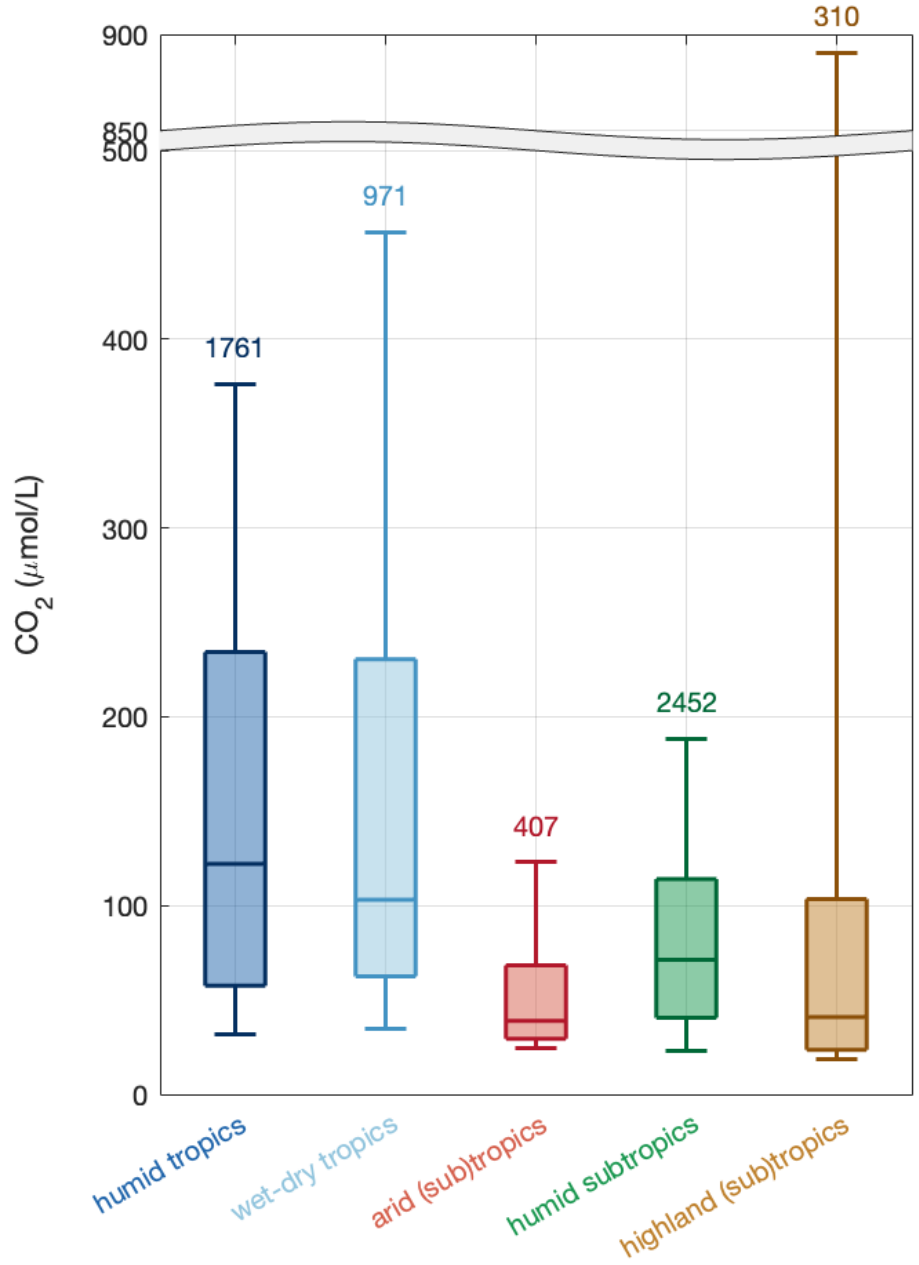
An uneven spatial coverage?

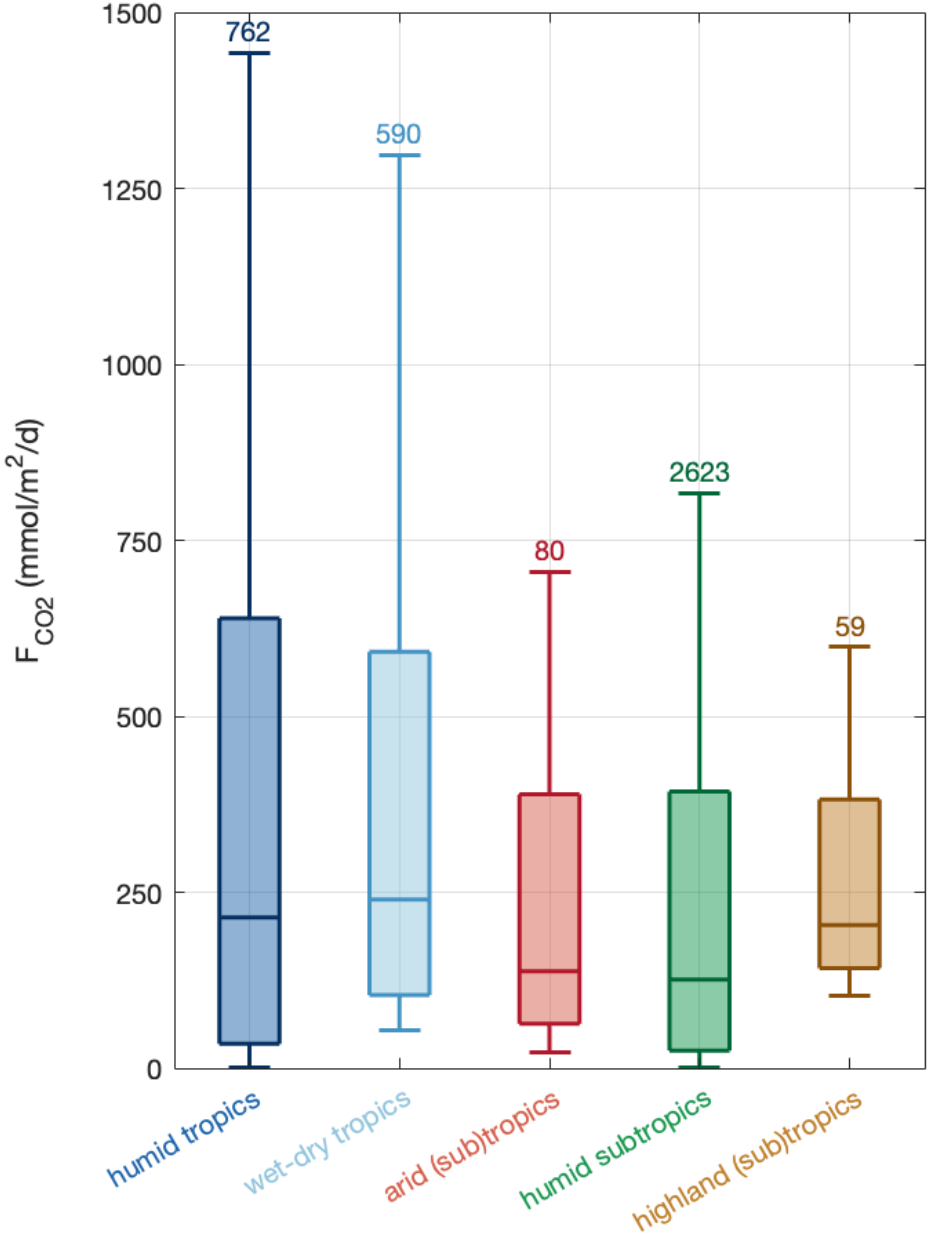




Large variations across climate types

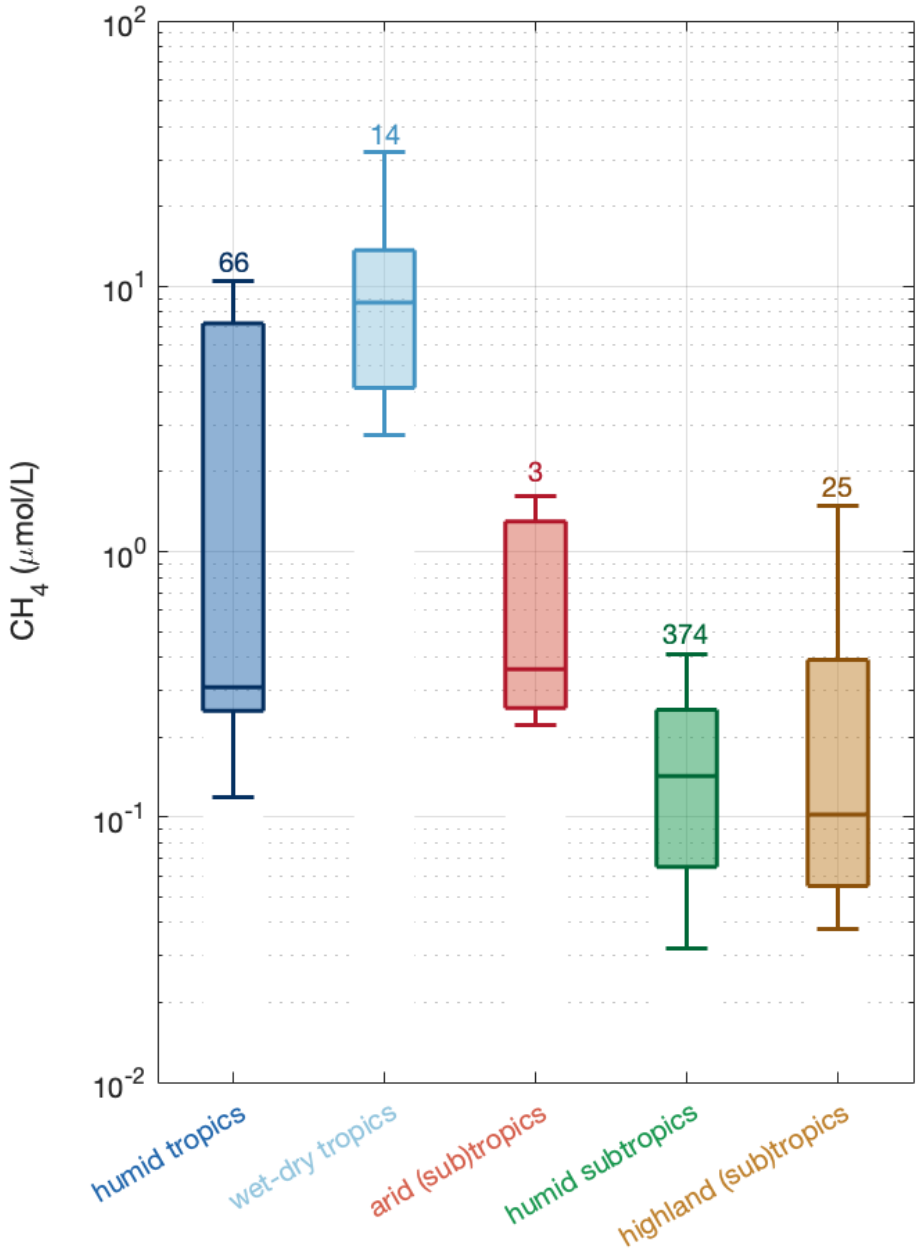
Example 1:
Stream and river data (CO_2)

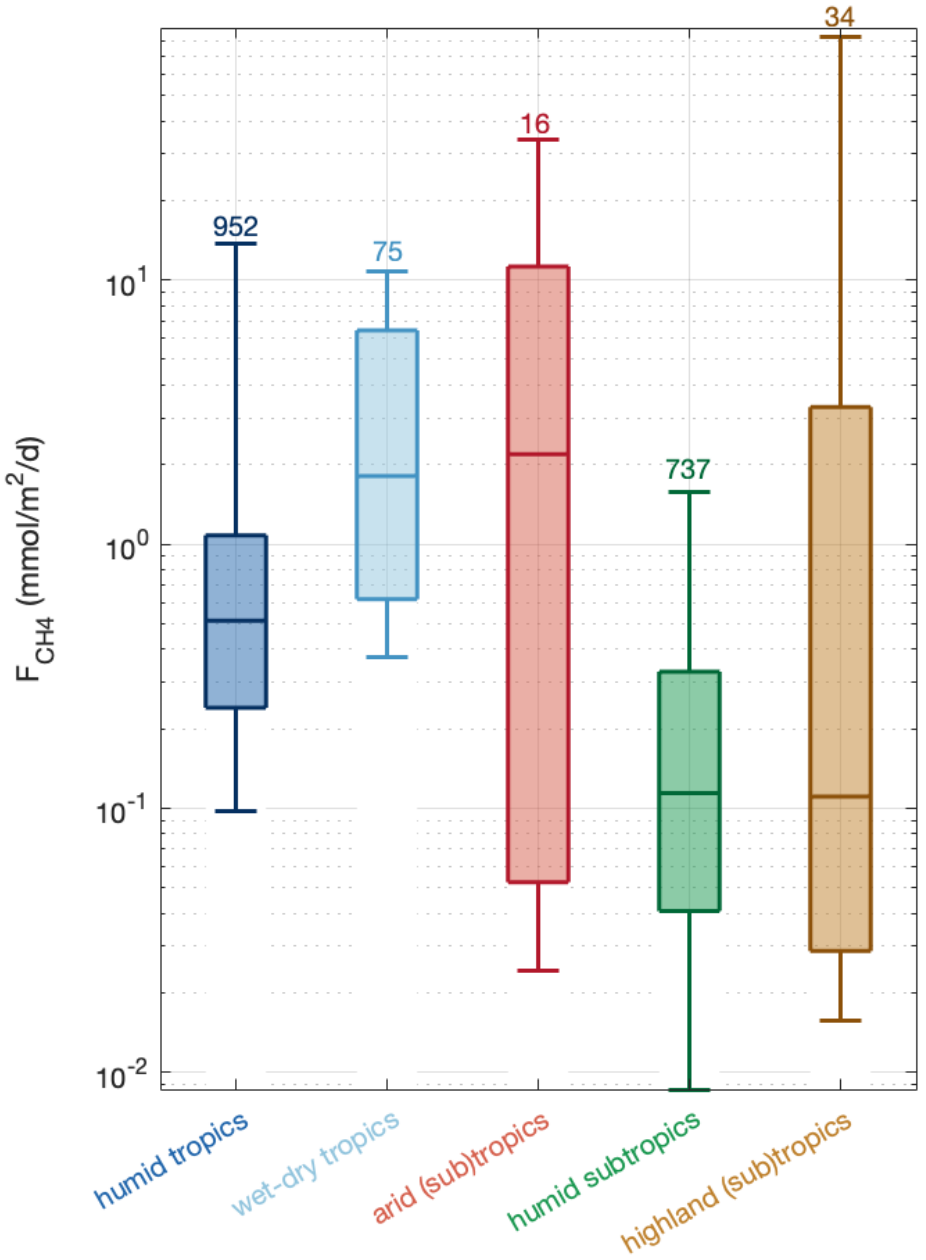




Large variations across climate types

Example 2:
Lake and reservoir data (CH_4)





Priority research areas for tropical GHG research

- Use our DB to assess the role of landscape attributes on GHG concentrations and fluxes
- Bring more nuance to our understanding of the tropics
- Address the observational gap in the wet-dry and highland tropics
- Develop approaches that cross boundaries between ecosystem types
- Share and publish data more systematically!

CHARLES DARWIN UNIVERSITY AUSTRALIA

Do you have data to share? Are you interested in contributing?

Come join us!

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