



ICMGP 2024
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Exploring the concept of climate penalty in the context of Hg contamination

Hélène Angot, Davide Mattio, Yann Bertrand, Nicolas Bonfanti, David Gateuille, Elsa Gautier, Stéphane Guédron, Pierre Sabatier



Context: The Minamata Convention and its Effectiveness Evaluation



Articles 8 and 9

These Articles concern **controlling and, where feasible, reducing emissions and releases of Hg** to the atmosphere and to land and water.

Article 12

The Conference of the Parties shall **evaluate the effectiveness of this Convention, beginning no later than six years after the date of entry into force of the Convention** and periodically thereafter at intervals to be decided by it.



Context: The Minamata Convention and its Effectiveness Evaluation

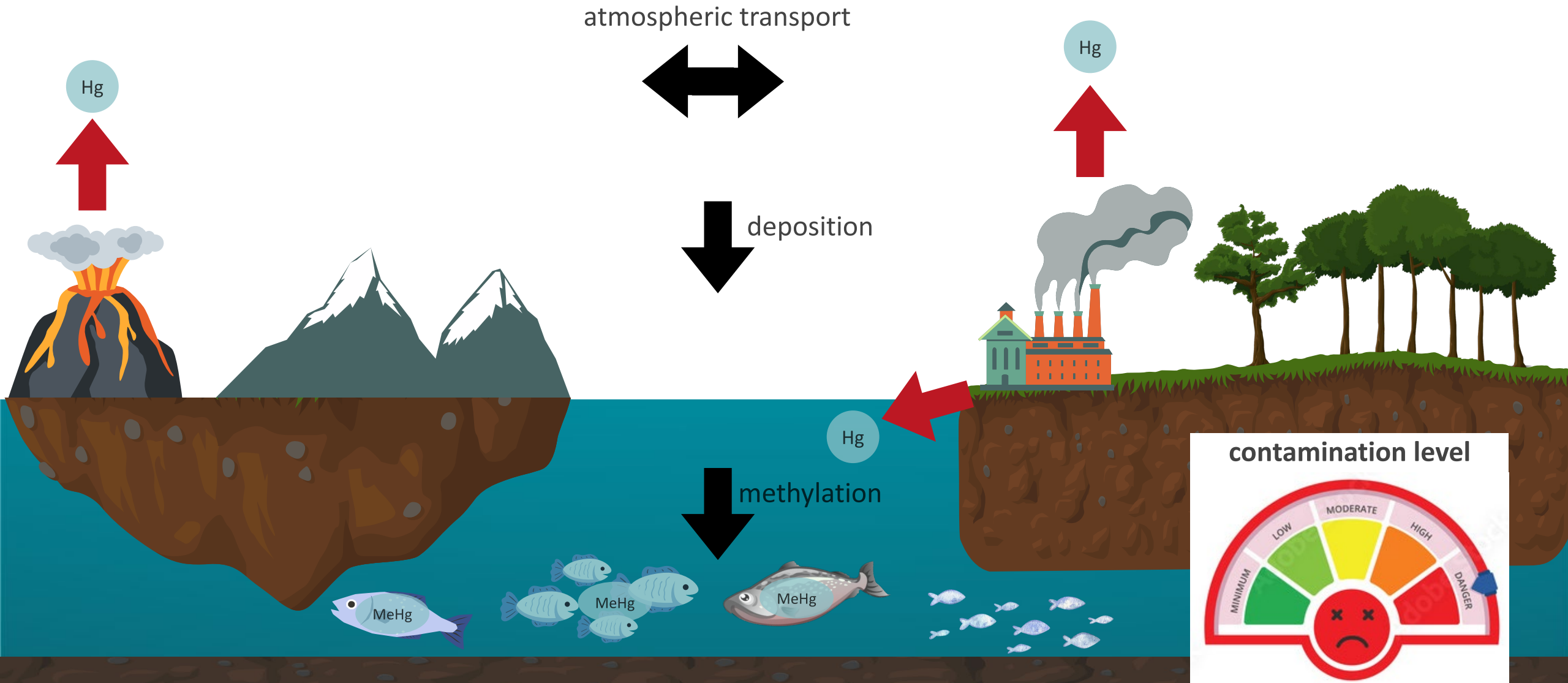


Overarching policy questions

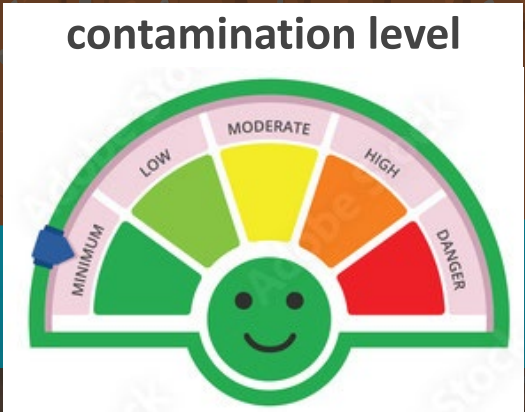
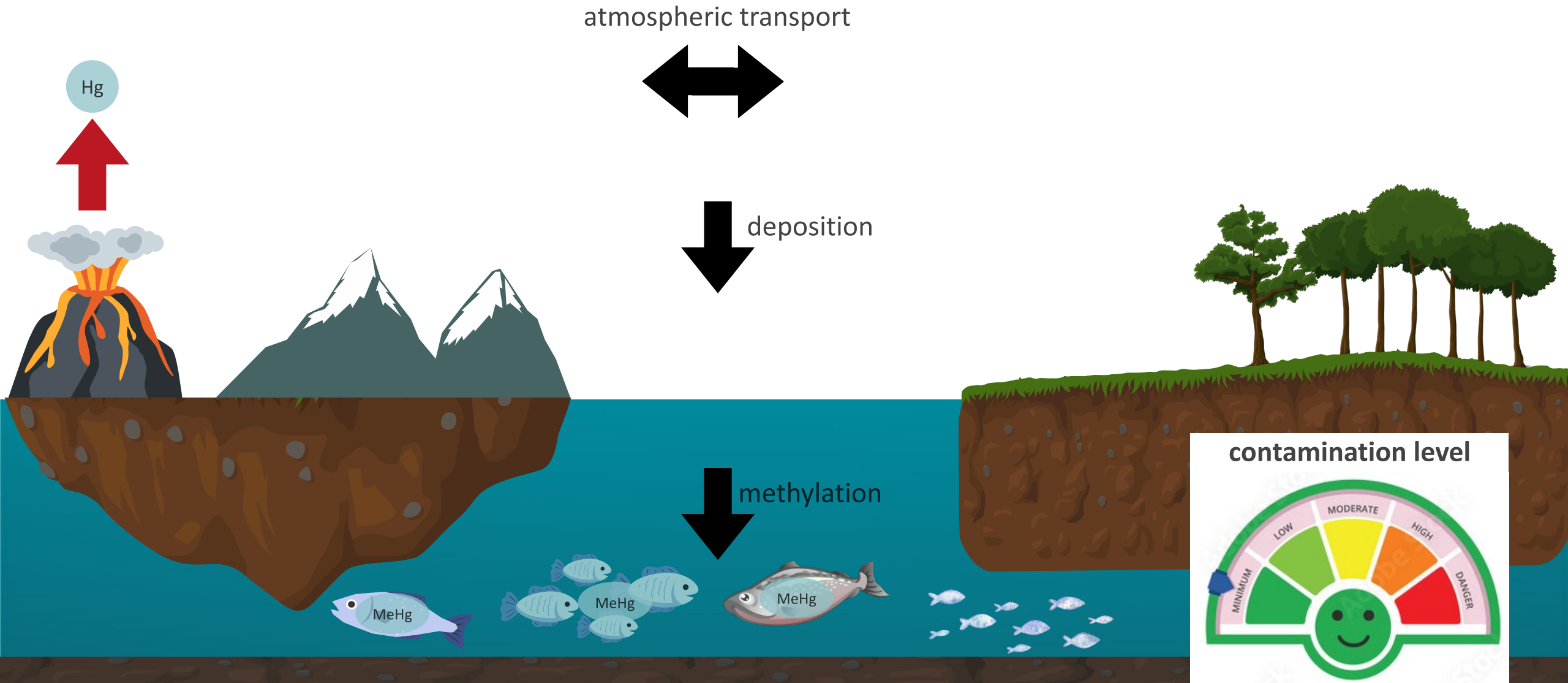
1. Have the Parties taken actions to implement the Minamata Convention?
2. Have the actions taken resulted in changes in Hg supply, use, emissions, and releases into the environment?
- 3. Have those changes in emissions and releases resulted in changes in levels of Hg in the environment, biotic media, and vulnerable populations that can be attributed to the Minamata Convention?**
4. To what extent are existing measures under the Minamata Convention meeting the objective of protecting human health and the environment from Hg?



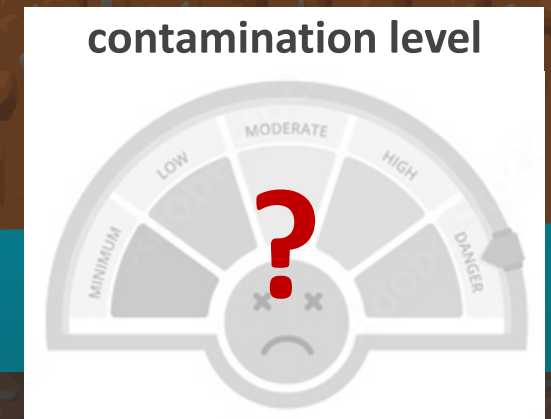
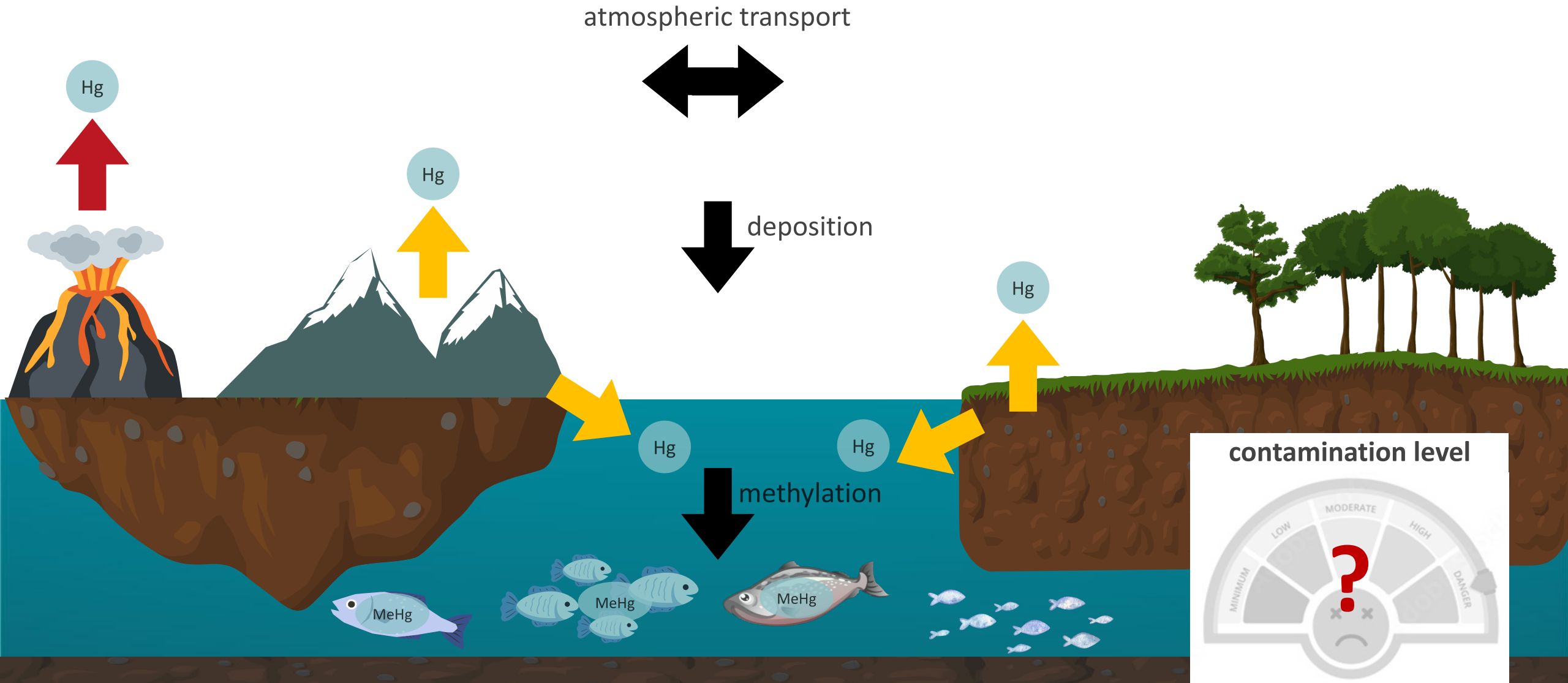
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The critical unknown: the impact of changing secondary emissions and releases



Overarching policy questions

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- Impact of changing secondary emissions and releases on environmental trends?
- Role of climate change on environmental trends?



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- Role of climate change on environmental trends?
- Differentiate anthropogenic and climate-driven contributions to observed environmental trends



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- Models

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• Models

<https://doi.org/10.5194/gmd-2024-65>
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Geoscientific
Model Development
Discussions



The Multi-Compartment Hg Modeling and Analysis Project (MCHgMAP): Mercury modeling to support international environmental policy

Ashu Dastoor¹, H el ene Angot², Johannes Bieser³, Flora Brocza^{4,5}, Brock Edwards⁶, Aryeh Feinberg^{7,8}, Xinbin Feng^{9,10}, Benjamin Geyman¹¹, Charikleia Gournia¹², Yipeng He¹³, Ian M. Hedgecock¹⁴, Ilia Ilyin¹⁵, Terry Keating¹⁶, Jane Kirk¹⁷, Che-Jen Lin^{18,19}, Igor Lehnher²⁰, Robert Mason²¹, David McLagan^{22,23}, Marilena Muntean²⁴, Peter Rafaj⁴, Eric M. Roy²⁵, Andrei Ryjkov¹, Noelle E. Selin^{25,26}, Francesco De Simone¹⁴, Anne L. Soerensen²⁷, Frits Steenhuisen²⁸, Oleg Travnikov²⁹, Shuxiao Wang^{30,31}, Xun Wang⁹, Simon Wilson³², Rosa Wu³³, Qingru Wu^{30,31}, Yanxu Zhang³⁴, Jun Zhou³⁵, Wei Zhu³⁶, Scott Zolkos³⁷

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- Models
- Environmental archives

HOW?



The twin lake experiment



The twin lake experiment

French Alps – Ecrins National Park



The twin lake experiment

French Alps – Ecrins National Park



LAKE 1

- High-altitude alpine lake (2300 m asl)
- Rain gauge type lake
- Influenced by atmospheric deposition



The twin lake experiment

French Alps – Ecrins National Park



LAKE 1

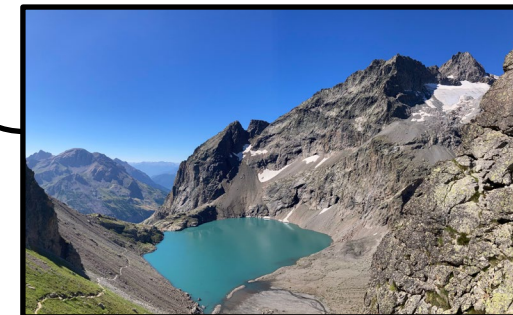


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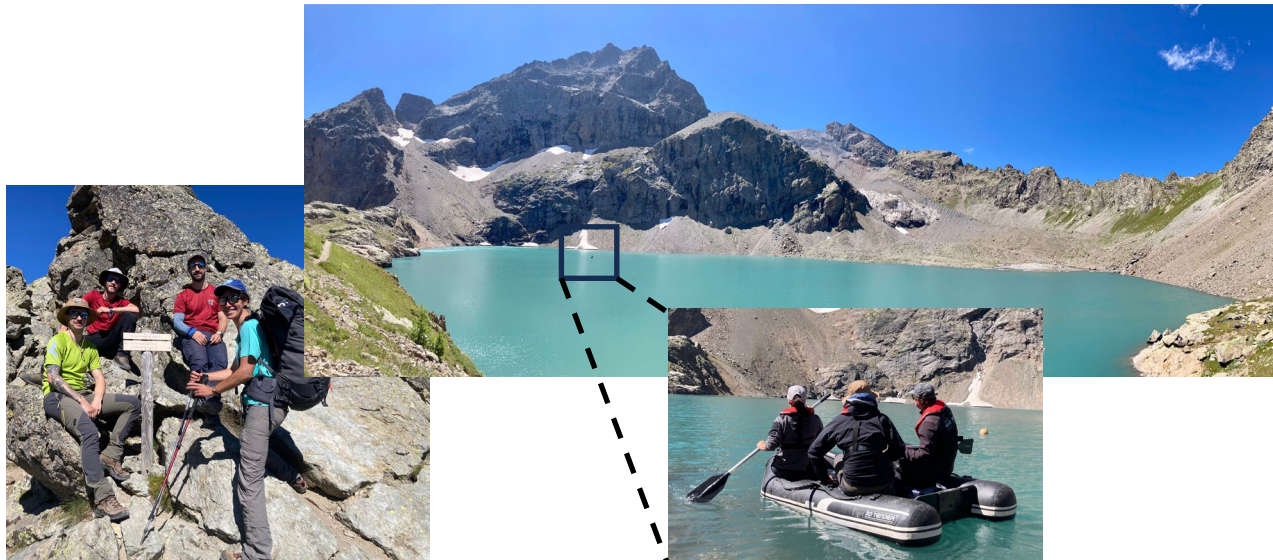
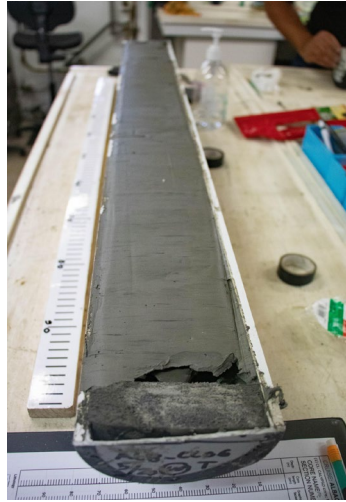
LAKE 2

- High-altitude alpine lake (2500 m asl)
- Proglacial lake
- Influenced by atmospheric deposition and **glacial melt input**



The twin lake experiment

Collection of sediment cores (July 2023)



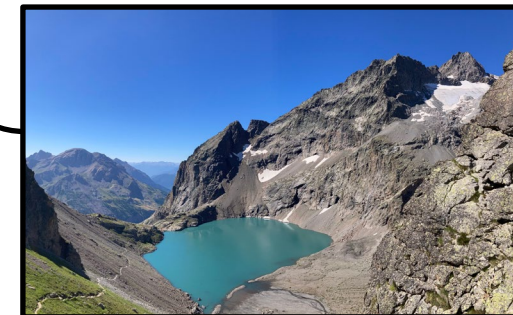
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The twin lake experiment

Analytical work

- Cores cut into slices of 0.5 cm
- Core dating (^{210}Pb and ^{137}Cs)
- Characterization
 - Water content
 - Organic matter content
 - Elemental composition (XRF core scanning)
 - Hg concentration (DMA)

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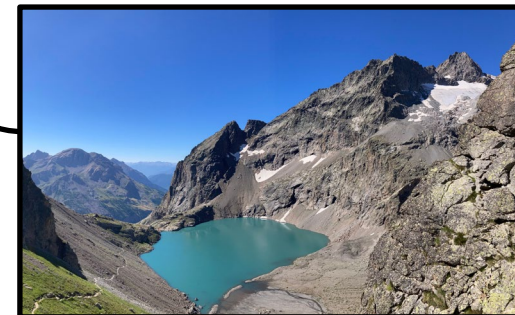


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Davide Mattio

Master's student

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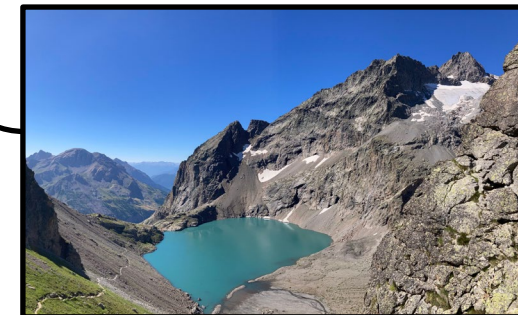


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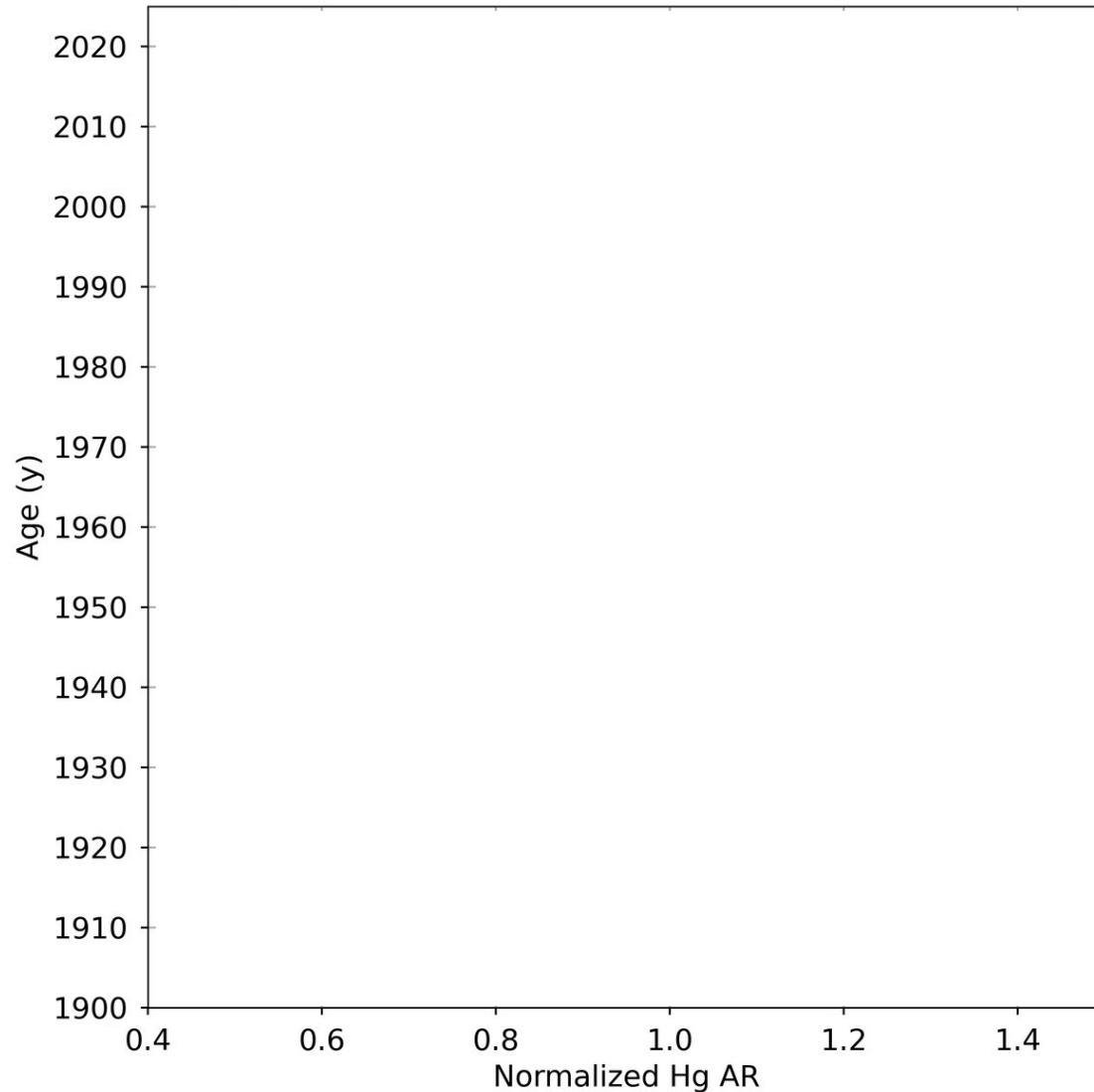
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The twin lake experiment

Preliminary results



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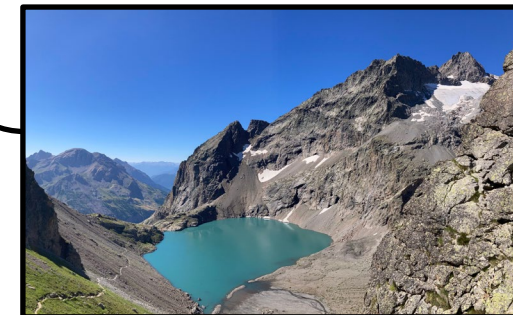


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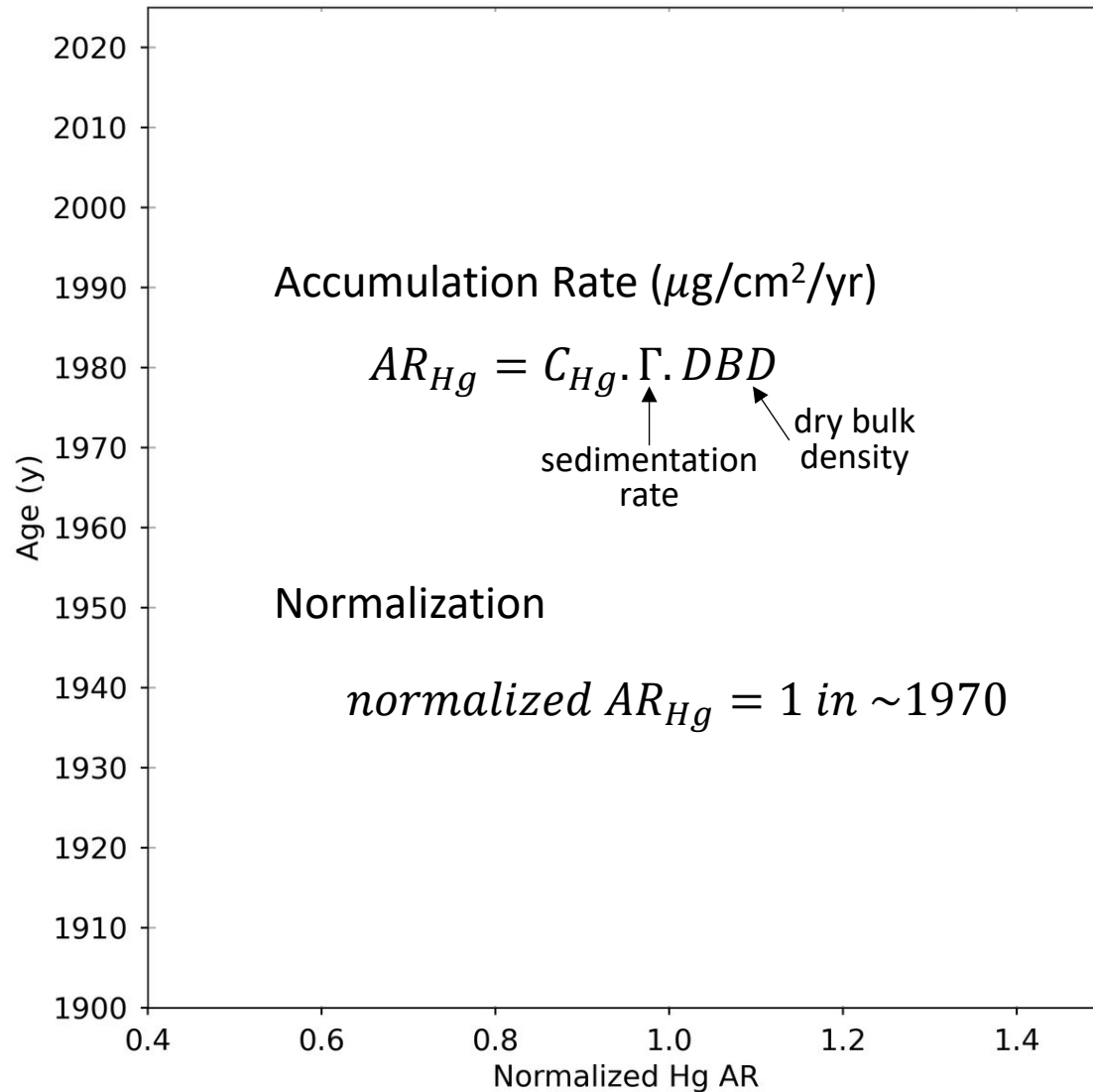
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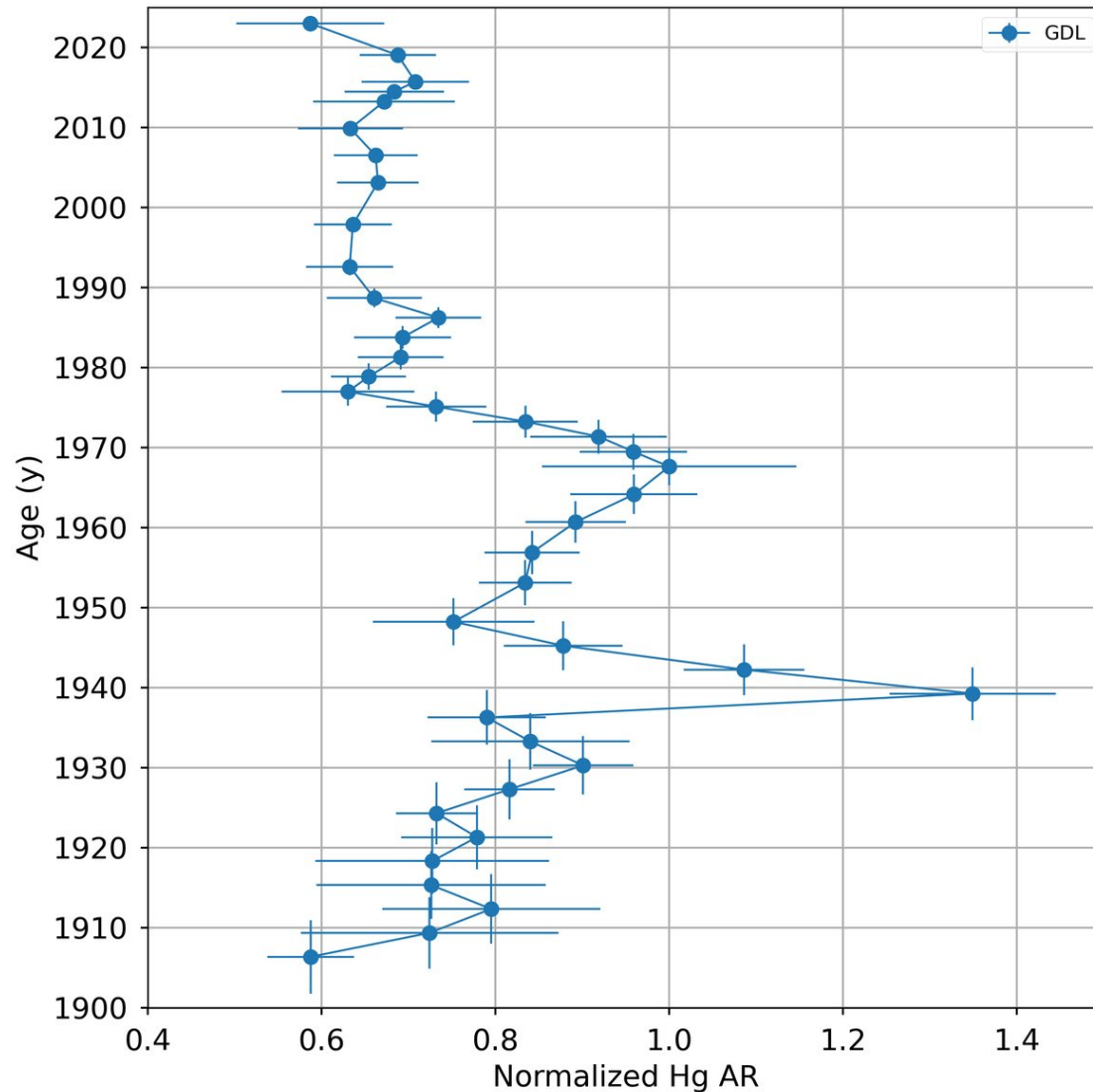
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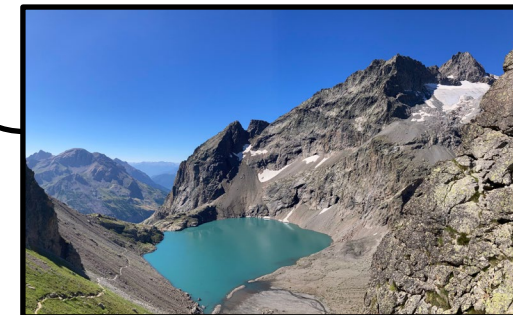


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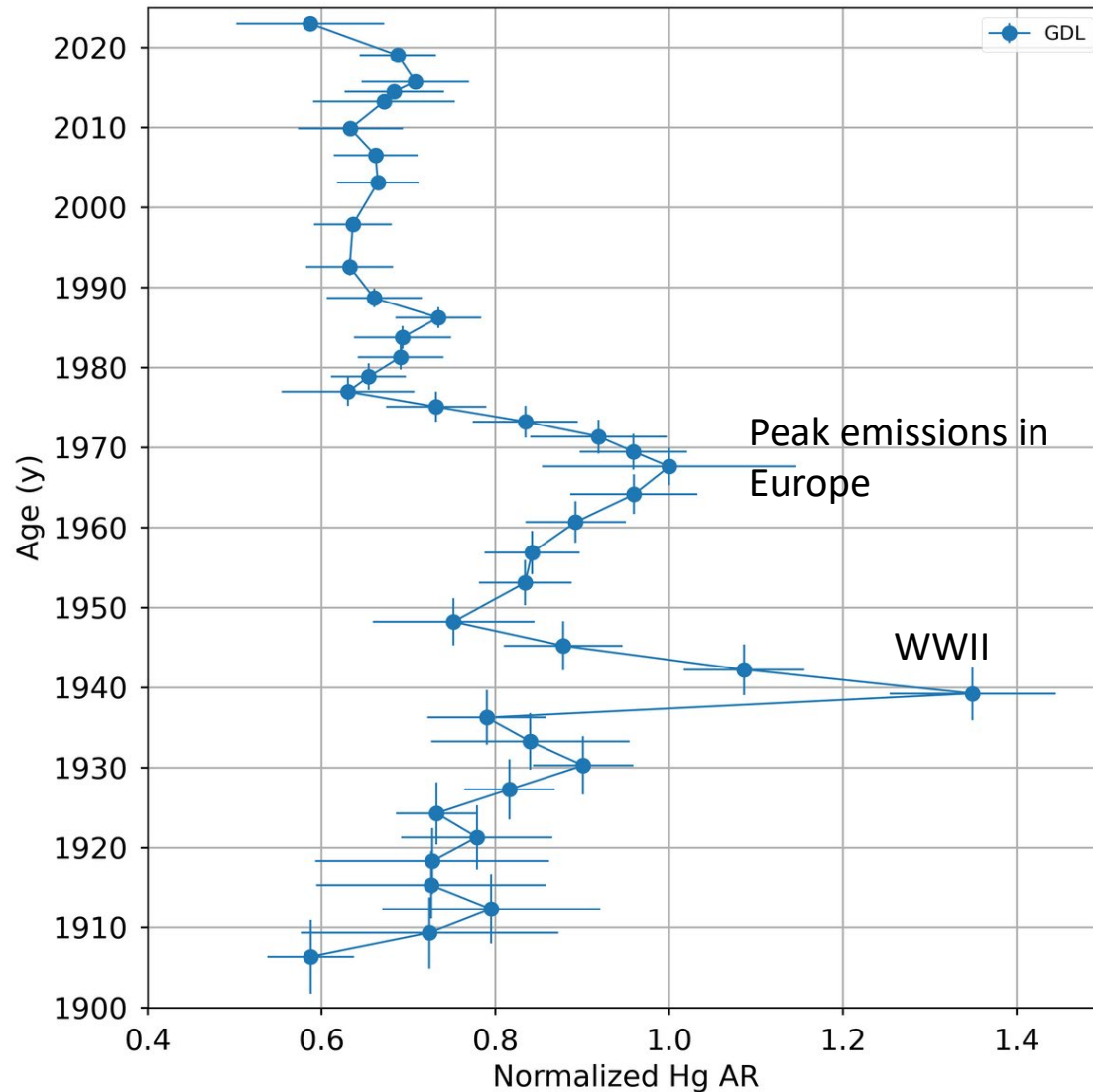
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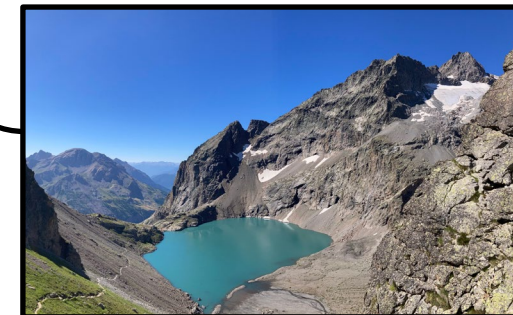


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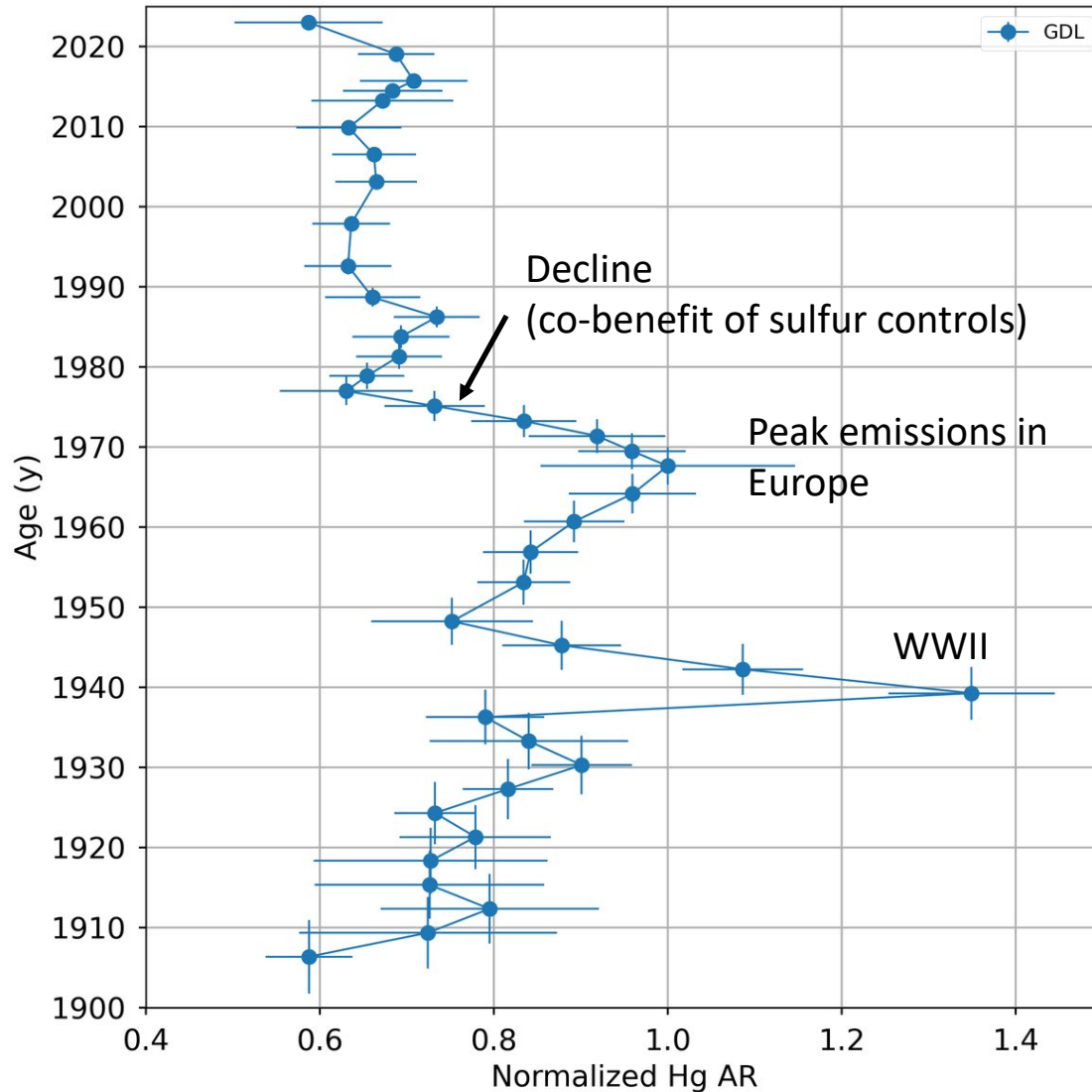
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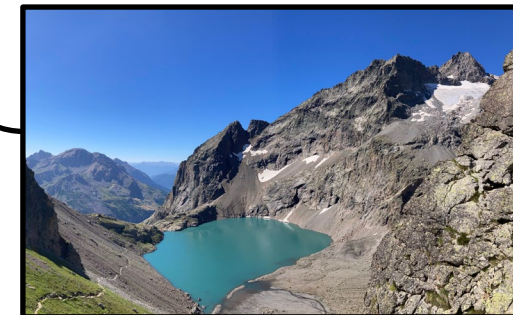


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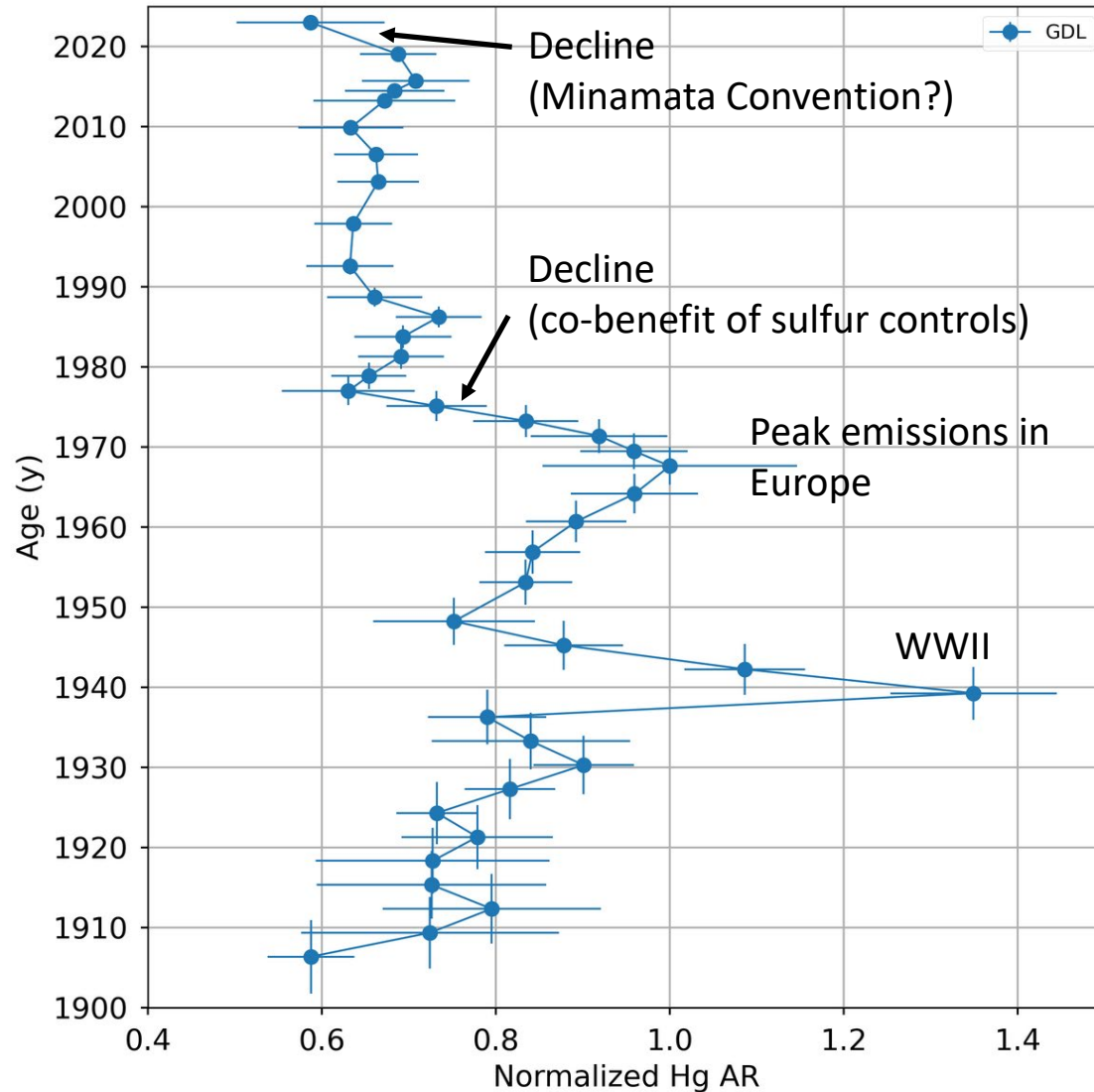
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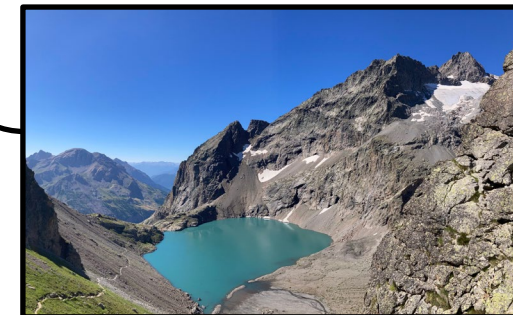


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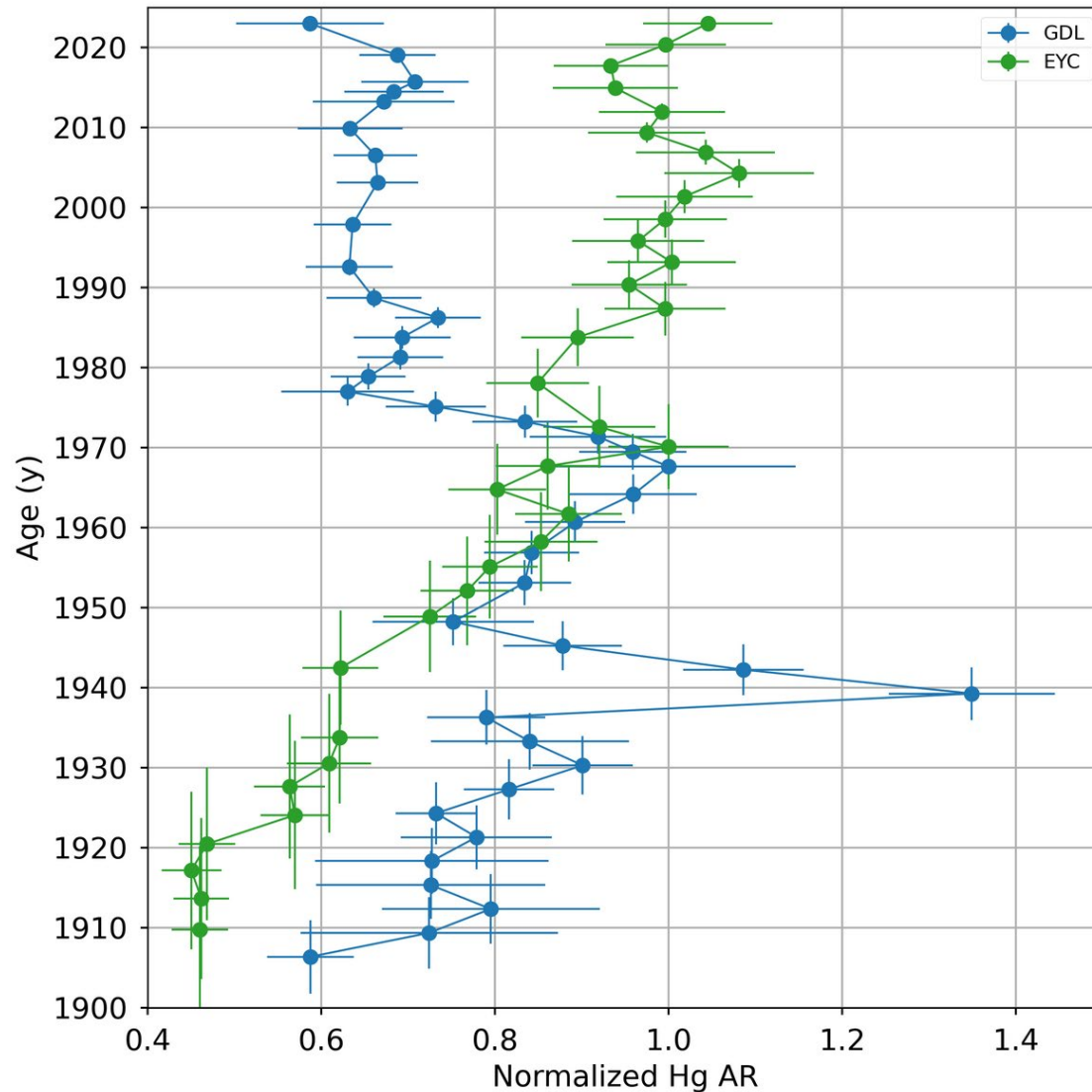
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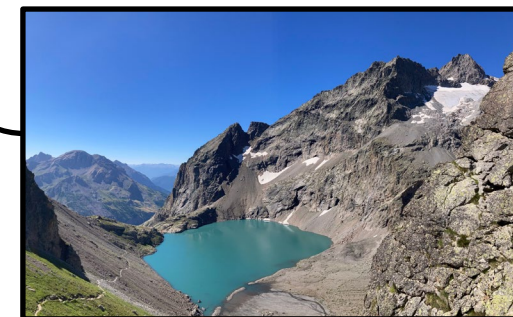


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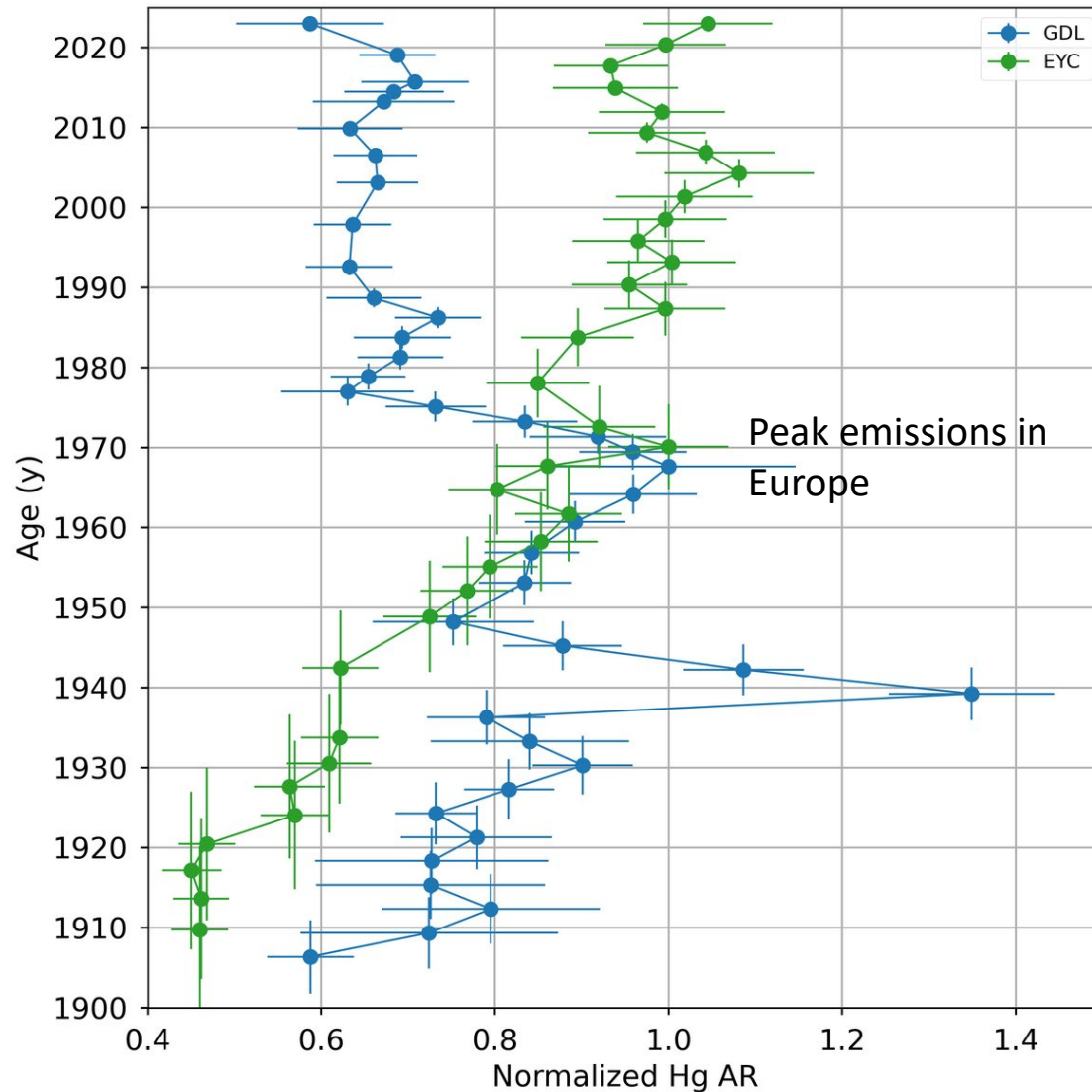
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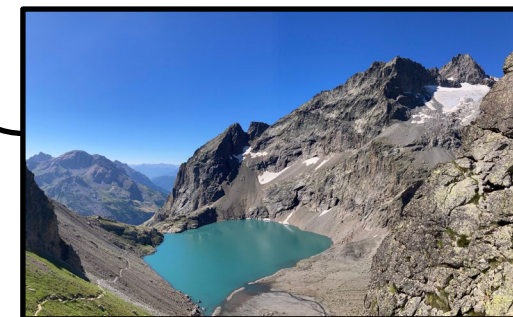


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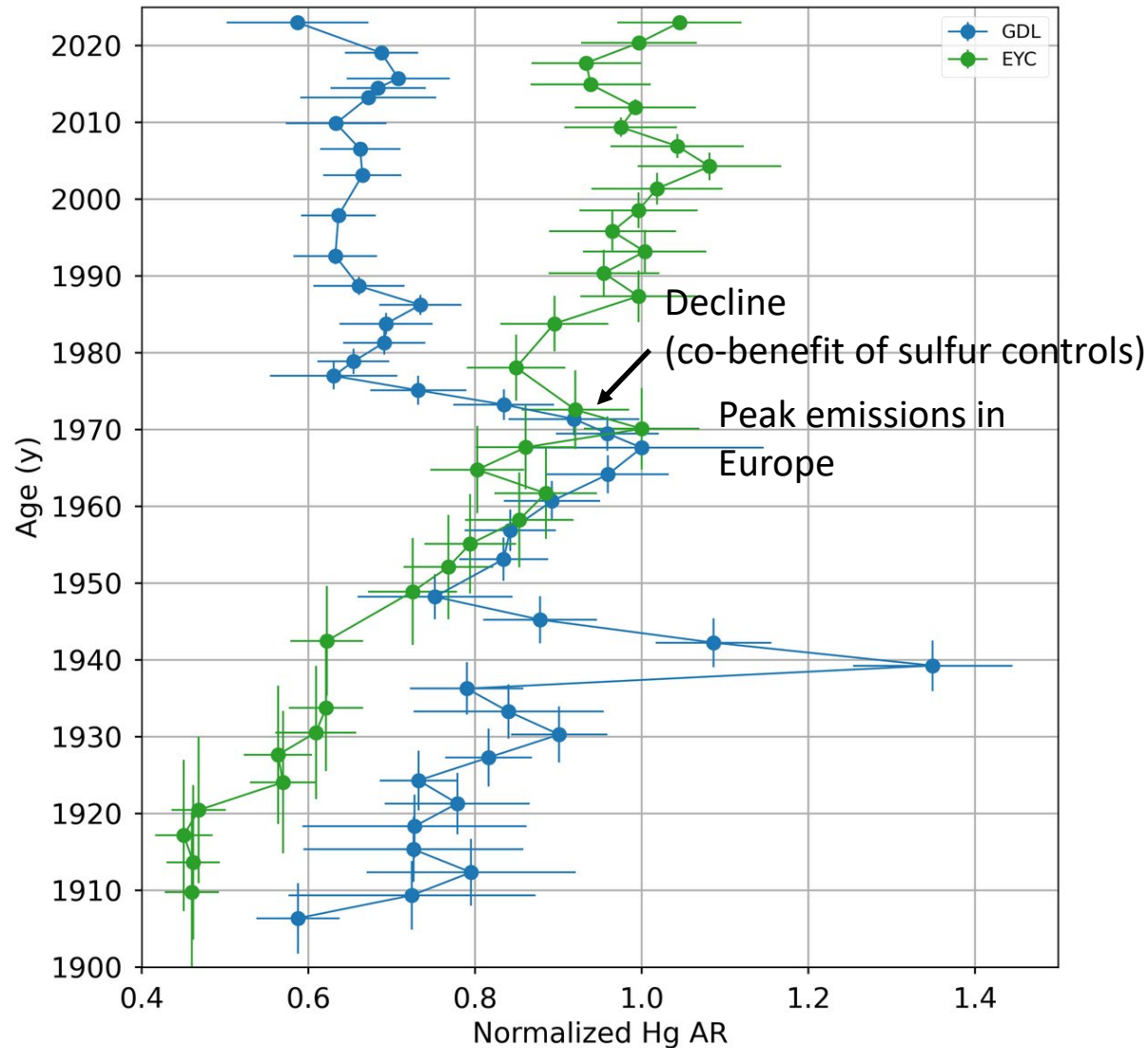
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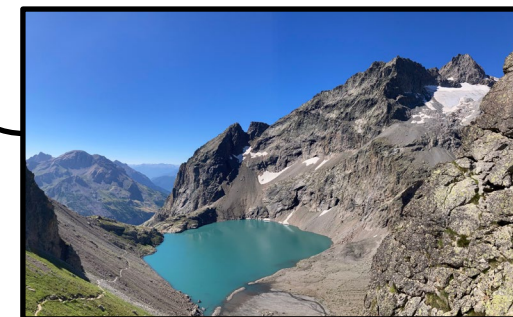
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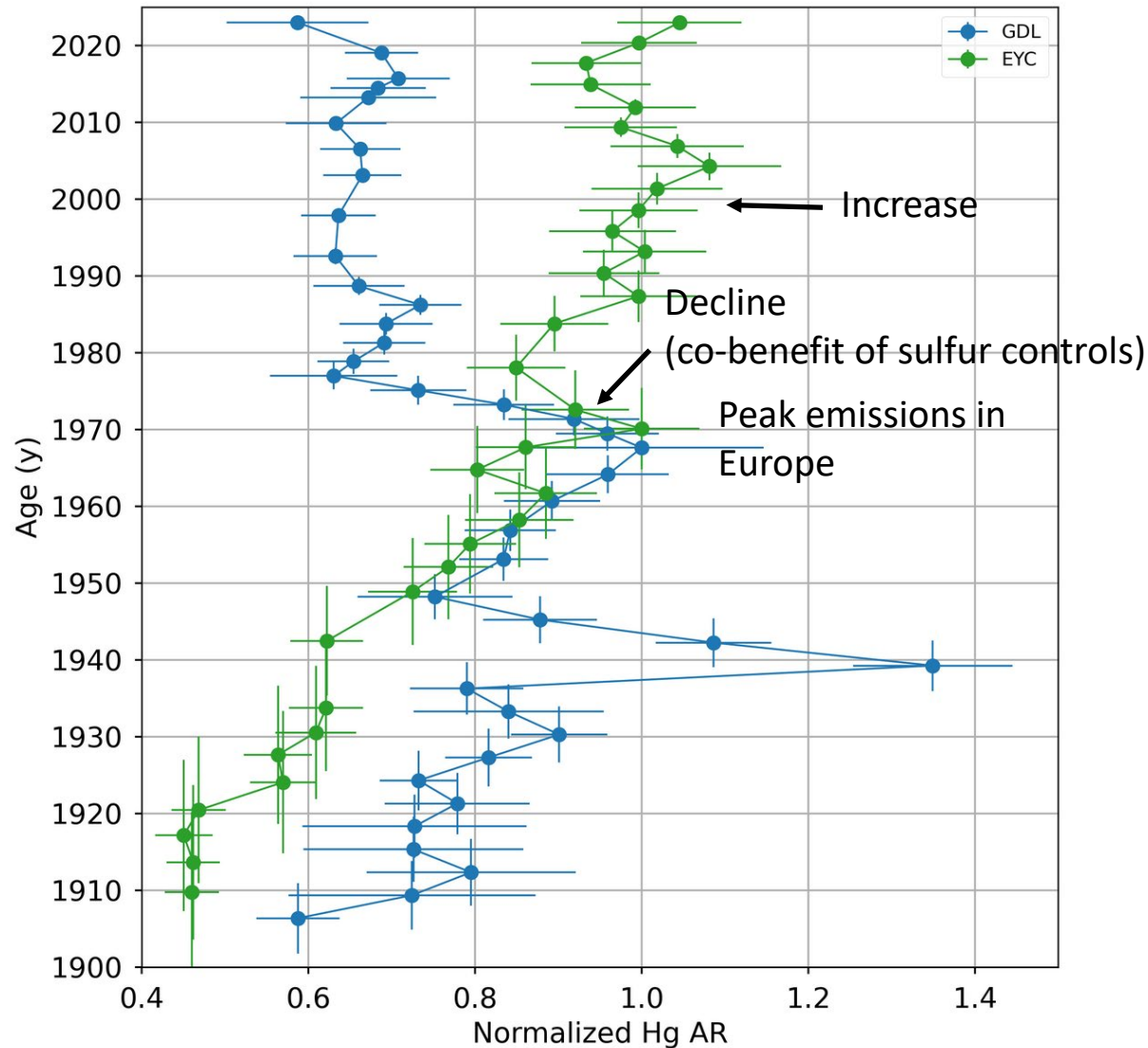


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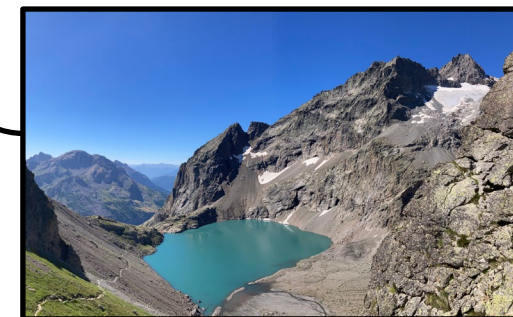


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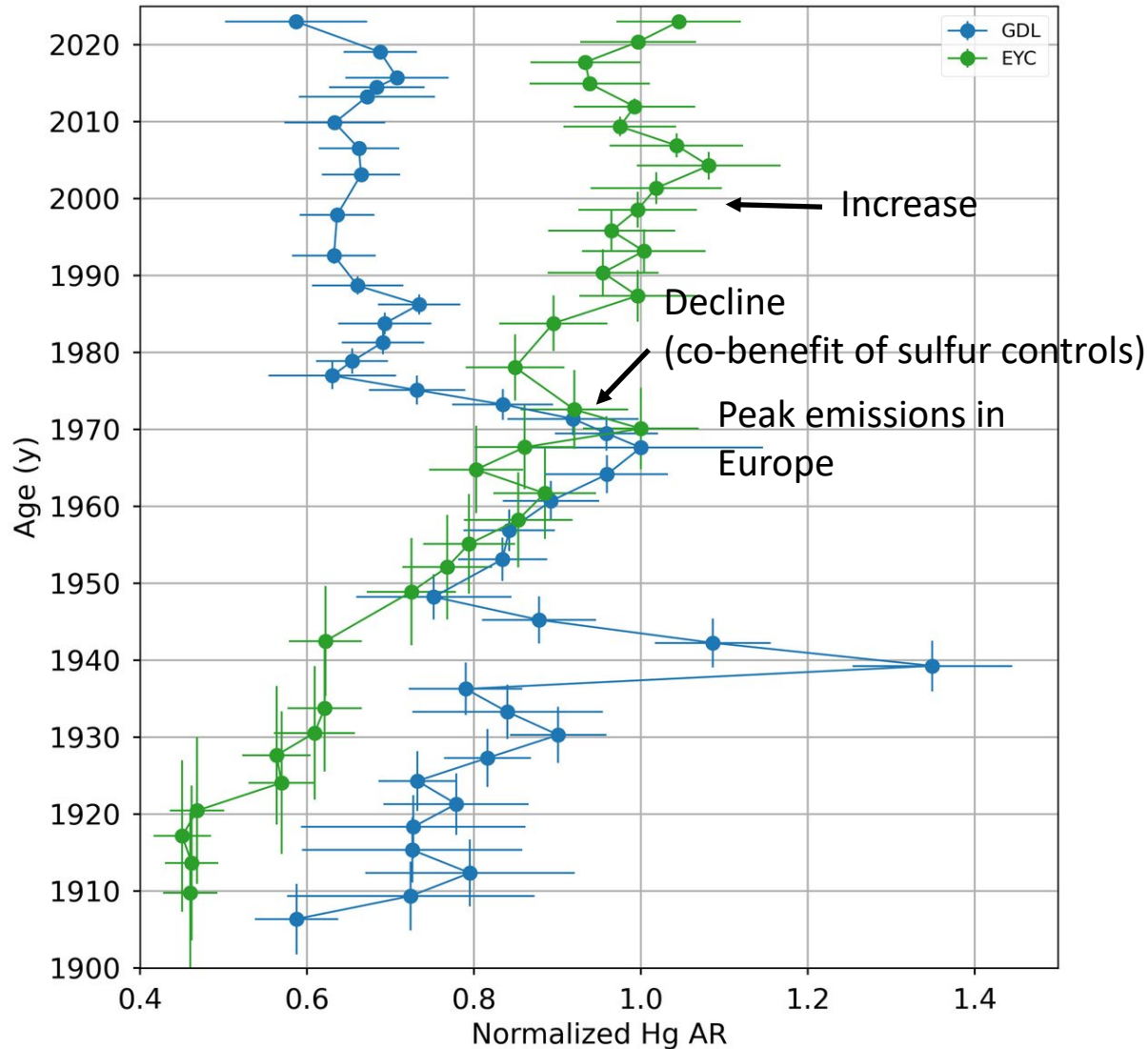
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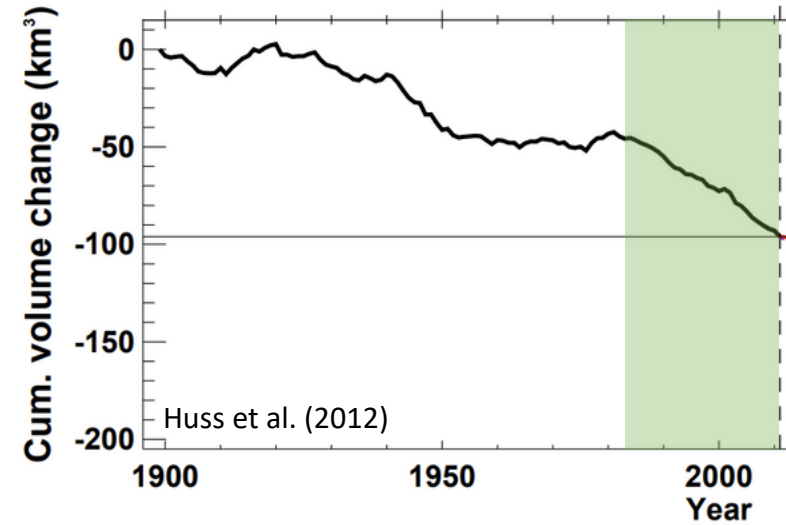


The twin lake experiment

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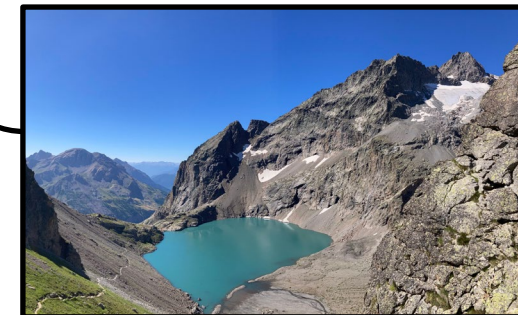


Glacier mass balance in the European Alps



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The twin lake experiment

Next step

- Organic matter content
- Elemental composition (XRF core scanning)



Mixing model

Relative contribution of:

- Watershed erosion
- Glacial melt
- Primary productivity

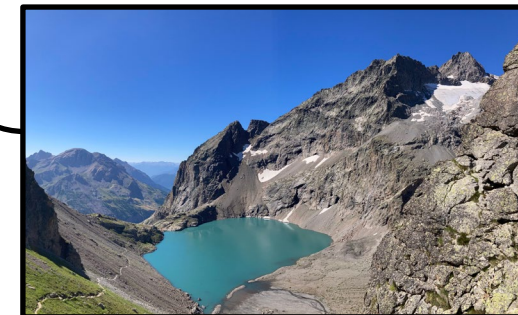
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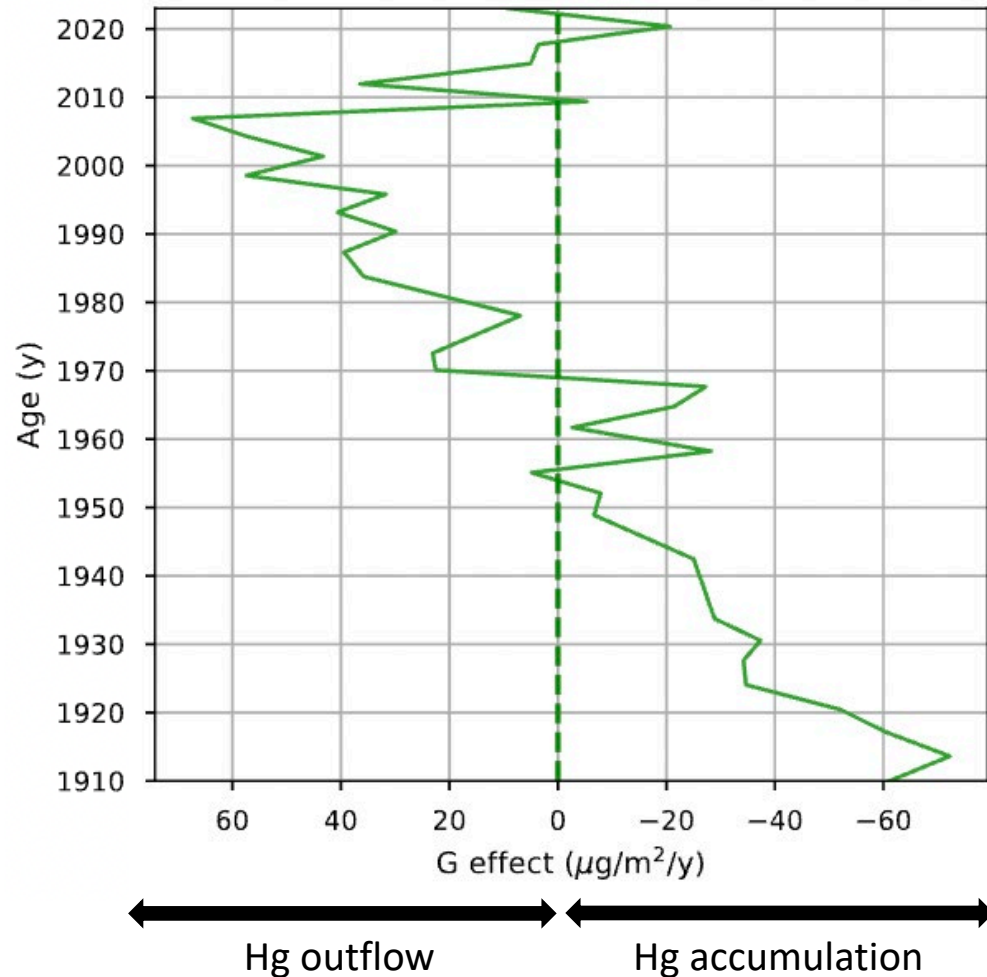


The twin lake experiment

Mixing model – “Glacier Effect”



Highly preliminary



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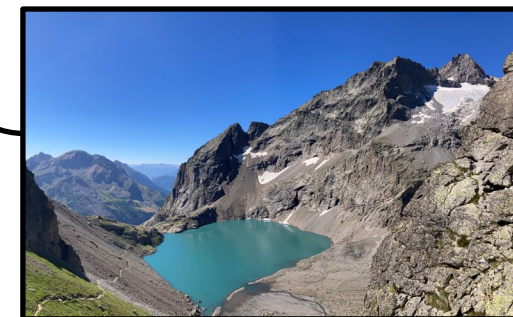


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Take-home message

- Proof of concept
- Climate change affects environmental trends



Incorporate climate change impacts into policy-making and Effectiveness Evaluation



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