

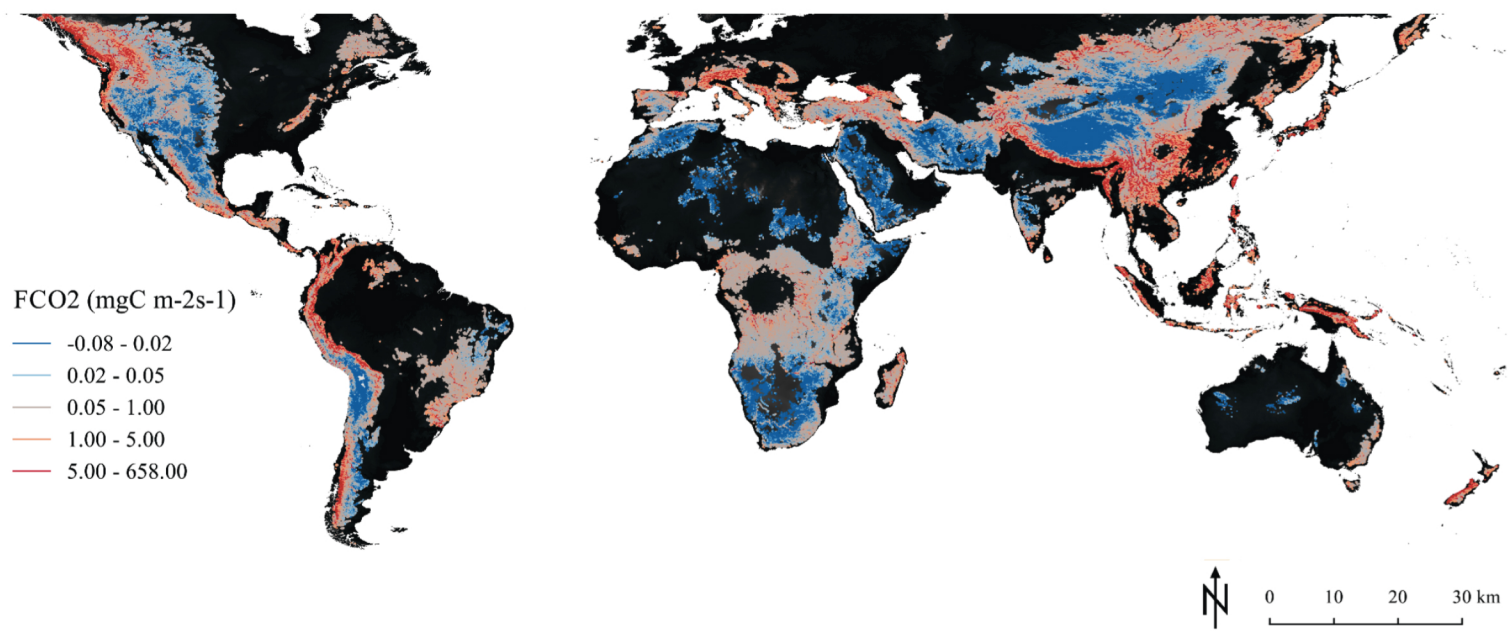
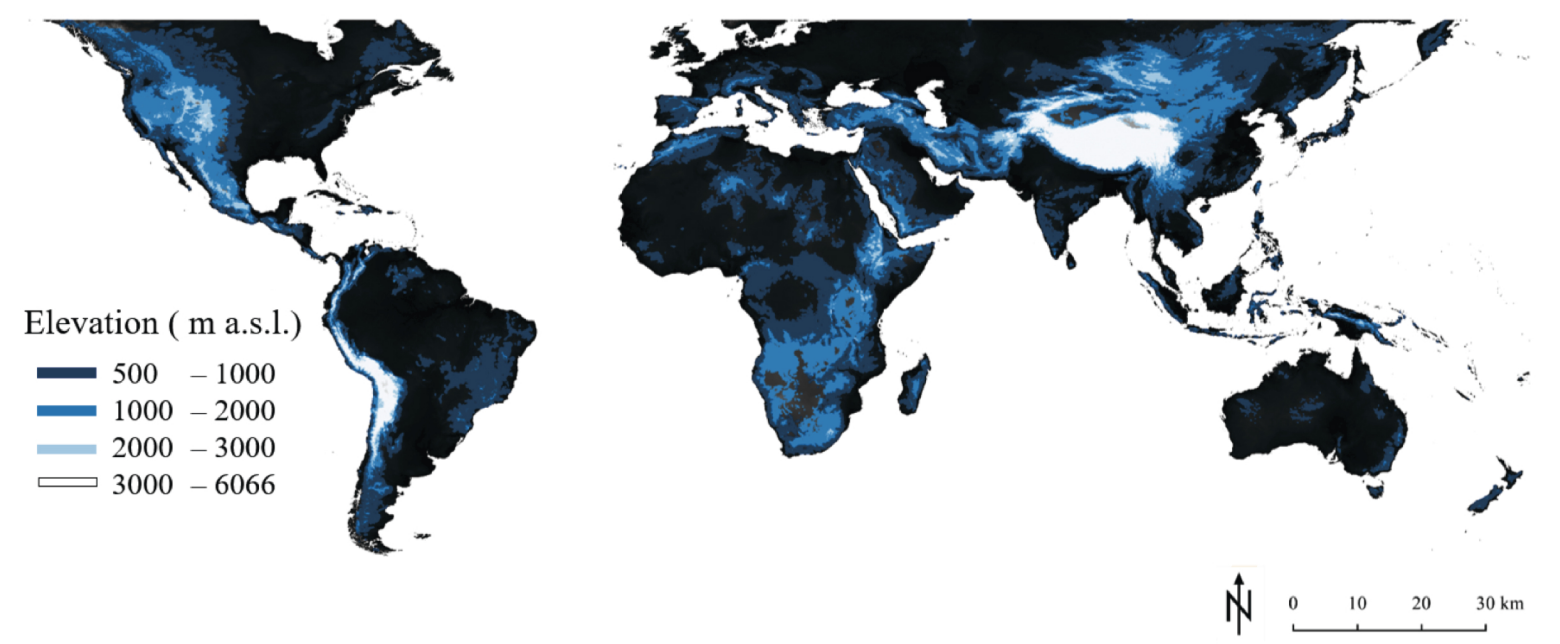
SBER

Stream Biofilm and Ecosystem
Research Laboratory

EPFL

BACKGROUND AND AIMS

Mountains contribute 25% to the global land surface and more than 30% to the global runoff. Despite this, the potential role of mountain streams for the global carbon cycle has not yet been considered. This is because they typically drain catchments devoid of terrestrial primary production and major soil build up, and because of low residence times within the stream channels. Here we scale up for the first time CO_2 evasion fluxes from streams that drain the major mountain ranges worldwide.



IMPLICATIONS

For the first time we have a tool at hand to quantify the contributions of mountain streams to the global CO_2 fluxes. Preliminary figures are very high and further stress the relevance of streams for global biogeochemistry. This work sheds new light on mountain streams as connector between the geological and biological carbon cycle.

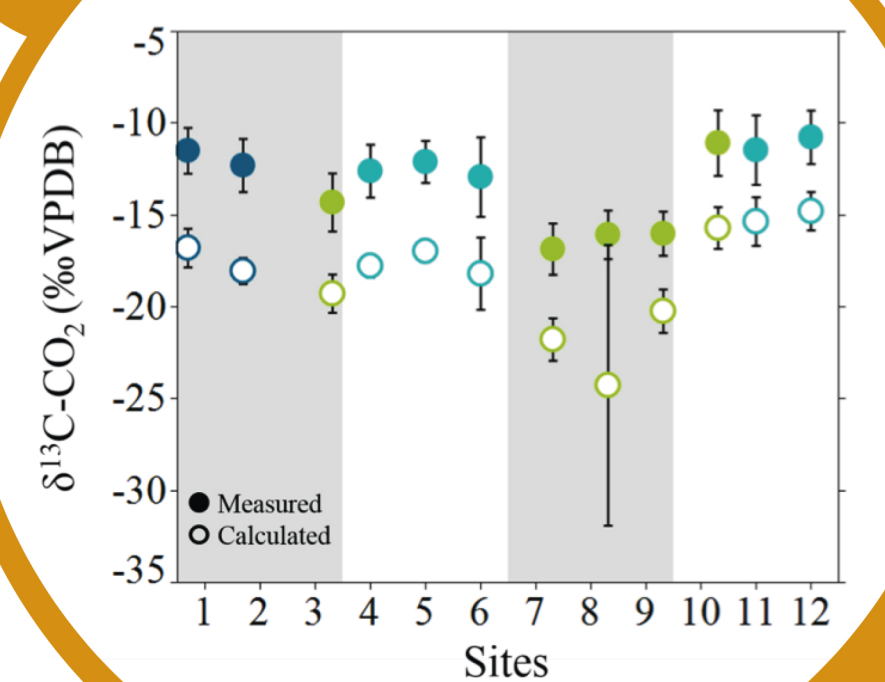
Do mountain streams matter for the global carbon cycle?

METHODS

We use novel scaling relationships based on a few geopredictors (e.g., altitude, slope) to predict pCO_2 and gas exchange in mountain streams. In combination with extensive GIS work, we estimate these geopredictors, discharge and surface area of the mountain streams worldwide. We train our models based on spatially highly-resolved information from Switzerland, which we then transfer to the other mountain ranges. Stable isotope analyses on CO_2 and dissolved inorganic carbon from Swiss streams allow us to assess the sources of the CO_2 evolving from these streams.

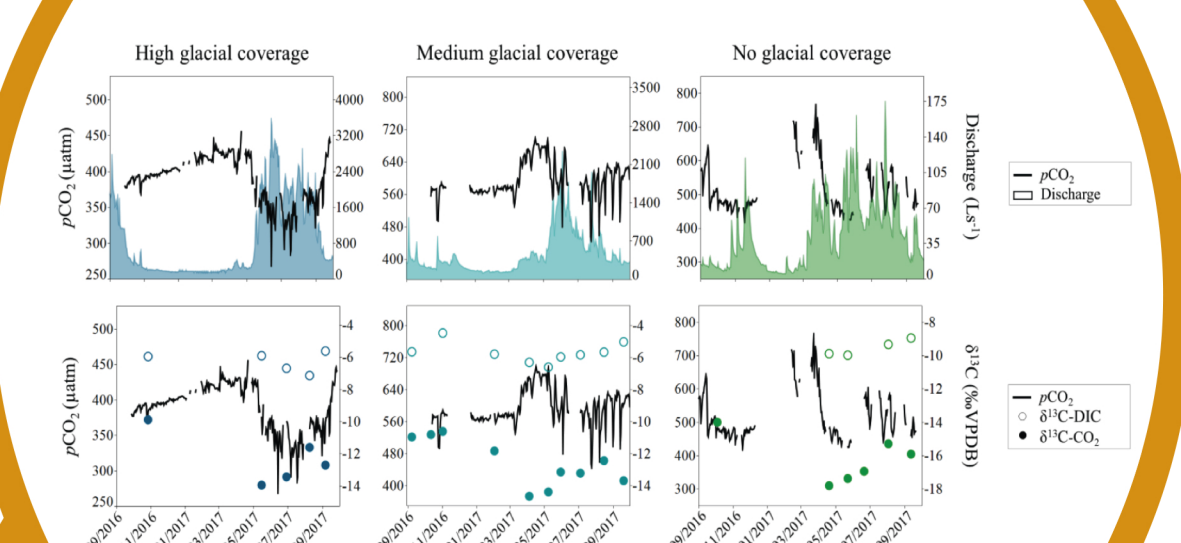
RESULTS

Stable isotope analyses indicate that most CO_2 in the Swiss mountain streams (Valais) originate from rock weathering and soil respiration, while in stream metabolism seem to be a minor contributor.



RESULTS

The partial pressure of CO_2 in these Swiss mountain streams is typically very low owing to high gas exchange through the turbulent stream interface to the atmosphere and to low replenishment from the external sources.



RESULTS

Mountain streams in Switzerland evade approximately $0.3 \text{ Tg C year}^{-1}$ into the atmosphere, clearly with hotspots around the highest peaks. At the scale of Europe, mountain stream outgas $7.3 \text{ Tg C year}^{-1}$, which is half of previous estimates for all the fluvial ecosystems in Europe.