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Release of Polychlorinated biphenyls (PCB) from melting alpine glaciers to downstream ecosystems in a warming climate

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Alpine glaciers have served as cold traps and long-term reservoirs for Polychlorinated biphenyls (PCBs) and can act as secondary source as they melt. PCBs were widely used since the 1940s and, due to their persistent, bioaccumulative, and toxic properties were banned internationally in 2004.
Recent climate warming accelerates glacier melting, releasing these stored PCBs into downstream ecosystems. Understanding the magnitude and processes of storage, redistribution, and release of PCBs is crucial for assessing risks to high-mountain ecosystems, water quality, and human health.
Ice core segments of the Fiescherhorn glacier and sediment of the lake Oberaar were analysed by GC/EI-HRMS. PCB concentrations in ice layers peaked in the 1970s and returned to 1940s levels by 2002. Seasonal variations reflected temperature-dependent air mass transport and relocation of PCBs due to surface melting and refreezing processes. Although environmental emissions have decreased, input fluxes to Lake Oberaar remained nearly constant from the 1970s to the mid-1990s, suggesting substantial pollutant release from glacial reservoirs. High-mountain lakes can be vulnerable to PCB accumulation and biomagnification along food chains, particularly in fish.
Melting glaciers as a secondary source of PCBs represent an important and ongoing environmental concern. Further studies and continuous monitoring are needed to evaluate the ecological impacts of these pollutants on sensitive high-mountain ecosystems.

Author: FREUDLING, Carina

Presenter: FREUDLING, Carina

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