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230Th normalization: New insights on an essential tool for quantifying sedimentary fluxes in the modern and Quaternary ocean

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^{230}Th-normalization is a valuable paleoceanographic tool for reconstructing high-resolution sediment fluxes during the late Pleistocene (last ~500,000 years). As its application has expanded to ever more complex marine environments, the nuances of ^{230}Th systematics, with regards to particle type, particle size, lateral advective/diffusive redistribution, and other processes, have emerged. We synthesized over 1000 sedimentary records of ^{230}Th from across the global ocean at two time slices, the Late Holocene (0-5000 years ago, or 0-5 ka) and the Last Glacial Maximum (18.5-23.5 ka), and investigated the spatial structure of ^{230}Th-normalized mass fluxes. On a global scale, sedimentary mass fluxes were significantly higher during the Last Glacial Maximum (1.79-2.17 g/cm^{2}kyr, 95% confidence) relative to the Holocene (1.48-1.68 g/cm^{2}kyr, 95% confidence). We then examined the potential confounding influences of boundary scavenging, nepheloid layers, hydrothermal scavenging, size dependent sediment fractionation, and carbonate dissolution on the efficacy of ^{230}Th as a constant flux proxy. Anomalous ^{230}Th behavior is sometimes observed proximal to hydrothermal ridges and in continental margins where high particle fluxes and steep continental slopes can lead to the combined effects of boundary scavenging and nepheloid interference. Notwithstanding these limitations, we found that ^{230}Th-normalization is a robust tool for determining sediment mass accumulation rates in the majority of pelagic (> 1000 m) marine settings.

GEOTRACES Working Group 3: Particle Fluxes: Costa, Kassandra M.; Hayes, Christopher M.; Anderson, Robert F.; Pavia, Frank J.; Bausch, Alexandra; Deng, Feifei; Dutay, Jean-Claude; Geibert, Walter; Heinze, Christoph; Henderson, Gideon; Hillaire-Marcel, Claude; Hoffmann, Sharon; Jaccard, Samuel L.; Jacobel, Allison W.; Kienast, Stephanie S.; Kipp, Lauren; Lerner, Paul; Lippold, Jörg; Lund, David; Marcantonio, Franco; McGee, David; McManus, Jerry F.; Mekik, Figen; Middleton, Jennifer L.; Missiaen, Lise; Not, Christelle; Pichat, Sylvain; Robinson, Laura F.; Rowland, George H.; Roy-Barman, Matthieu; Tagliabue, Alessandro; Torfstein, Adi; Winckler, Gisela; Zhou, Yuxin