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Latitude-dependent sensitivity of ^{10}Be records to variations in geomagnetic field intensity

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The atmospheric production rate of cosmogenic ^{10}Be is inversely related to the geomagnetic field strength. This leads to variable deposition rates of ^{10}Be in environmental archives, such as ice or sediment cores. ^{10}Be records from these archives can, therefore, be used to reconstruct past intensities of the geomagnetic field. Recent ^{10}Be production and atmospheric mixing models, however, suggest that the sensitivity of ^{10}Be records to changes in the geomagnetic field intensity depends on the latitude. This impacts the use of single-site ^{10}Be records for reconstructing global ^{10}Be production rates and, therefore, geomagnetic field intensities.
Here, we quantitatively assess the latitudinal sensitivity of ^{10}Be deposition to geomagnetic field changes. We present new authigenic ^{10}Be/^{9}Be data from a sediment core from the Bay of Bengal (IODP U1446) and compile additional ^{10}Be data from ice and sediment cores. Our analysis focuses on ^{10}Be deposition changes during the Laschamps geomagnetic field intensity minimum at different latitudes. We compare ^{10}Be deposition changes with changes in modeled ^{10}Be production from geomagnetic field reconstructions (LSMOD.2, GGFSS70, Black Sea, GLOPIS-75) and the GEOS-Chem atmospheric mixing model.

Our findings reveal that ^{10}Be deposition changes are larger in the tropics (tropical enhancement) and diminish at higher latitudes (polar bias), indicating incomplete mixing of cosmogenic beryllium, consistent with atmospheric mixing models. This latitudinal sensitivity needs to be taken into account when reconstructing variations in global geomagnetic field intensity from ^{10}Be.