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Extracting geomagnetic and solar signals from globally distributed ^{10}Be records on multi-millennial time scales

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The production rate of cosmogenic nuclides such as ^{10}Be varies as a function of changes in primary cosmic ray flux, shielding by the Earth's magnetic field and solar activity. Primary cosmic ray flux is generally assumed to be constant on short to million year time scales. The solar effect is generally smaller than the geomagnetic one on centennial and longer time scales. Higher frequencies solar modulation can be filtered out in order to minimize the solar influence. Another approach involves eigenanalysis techniques for separating the patterns of the geomagnetic field, the solar component and other inherent sources.

The progress in global geomagnetic field reconstruction on long time scales provides estimates of dipole moment and regional intensity variations for any location on Earth. The new global, time-dependent, 100 ka geomagnetic field model (GGF100k) moreover offers the possibility to estimate the geomagnetic shielding against the incoming flux of cosmic rays in terms of the time evolution of the vertical cutoff rigidity, which is the minimum rigidity a vertically incoming particle must have in order to penetrate the geomagnetic field.

We compiled more than 40 globally distributed records of ^{10}Be from sediments, loess and ice cores. As a first step, a global stack record of ^{10}Be production rates is built and compared with geomagnetic field intensity variations. The agreement is significantly better when only high resolution ^{10}Be records are included in the stack. Some sediment locations that provide both types of signals are first used to check for any delays in recordings of the signal in the two records. We particularly focus on investigating the Laschamp excursion ($\sim$41 ka), when the lowest dipole moment is observed in the GGF100k model. We ultimately aim to utilize the ^{10}Be records to better constrain the minimum field intensity during the excursion.