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The CoNTESTA Project: Impacts of geomagnetic field changes on cosmogenic nuclide production-rate variability and implications for surface-exposure dating

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Determining the geographic footprint of past climate events is a fundamental step in identifying the mechanisms that drive and propagate these changes around the globe. Glacial deposits are a particularly robust source of such data; glaciers are sensitive indicators of climate that leave records of their past fluctuations on the landscape. Given precise chronologic control, glacial deposits can be used to reconstruct past climate variability. Recent advances in cosmogenic nuclide surface-exposure dating have established past glacial fluctuations as a key climate proxy. However, uncertainties in the application of cosmogenic nuclide production-rate-scaling frameworks hinder efforts to compare past glacial fluctuations with other records of past climate conditions. Production-rate scaling is particularly uncertain in the tropics, where the theorized impacts of changing magnetic field strength on the incoming cosmic ray flux are greatest. Here we present results in-progress from the CoNTESTA [Cosmogenic Nuclide Temporal and Elevation Scaling: Testing and Application] Project, which seeks to establish multiple nuclide production-rate calibration sites of varying age from the low latitudes in order to assess directly the impacts of changing magnetic field strength on nuclide production over time. We also report new data that address empirically the impacts of elevation on nuclide production. The results of this project will strengthen our understanding of cosmogenic nuclide production globally and will improve surface-exposure age calculations from all regions. This in turn will enable more robust assessment of the global phasing of glacial fluctuations and will forward our understanding of landscape dynamics and Earth surface history.