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Long-term low latitude and high elevation cosmogenic ^{3}He production rate inferred from a new calibration site in hyperarid Northern Chile

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The rates at which the cosmogenic nuclides are produced at the surface of the Earth are usually inferred from independently dated geological calibration sites. Despite available calibration sites for cosmogenic ^{3}He are relatively abundant, they are clustered both in space (mid to high latitudes) and time (ca. 5-20 ka), which prevents qualitative assessments and further developments of production models used to convert cosmogenic ^{3}He concentrations into exposure ages and/or denudation rates. Accordingly, more low latitude calibration sites with exposure durations significantly longer than 20 ka are required.

Here we present the results from a new geological calibration site located in northern Chile were several samples have been collected on the surface of a well-preserved lava flow for both ^{40}Ar/^{39}Ar dating and cosmogenic ^{3}He analyzes. Cosmogenic ^{3}He concentrations were converted to a sea level high latitude (SLHL) reference position using the eruption age determined for the lava flow from the Ar measurements, together with scaling frameworks that include varying combinations of geographic spatialization schemes, atmosphere models and geomagnetic field reconstructions. The inferred SLHL cosmogenic ^{3}He production rates are consistent with the most recent estimates available from the literature and thus attest to the robustness of both the most widely used and recently developed scaling models. Finally, we use the same scaling frameworks to re-evaluate the mean global-scale cosmogenic ^{3}He production rate in olivine and pyroxene minerals using an updated compilation of previously published calibration datasets.