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Implications of Cosmogenic Isotope Linkage for Integration of Terrestrial, Ice and Marine Records and for IntCal Curve Construction

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Cosmogenic isotopes provide a basis for linking the timescales of different records on the assumption that the production rates for different isotopes share a common signal. This has been shown to be very effective in linking the Greenland GICC05 timescale to the tree-ring based radiocarbon timescale with decadal precision through the Holocene and into the Late Glacial. Muscheler et al (this meeting) report that using lower frequency components of the signal allows linkage over the full range of the radiocarbon timescale. Here we consider some of the wider implications of linking cosmogenic isotopes between different records.

Alignment of ^{10}Be and ^{14}C have implications for the integration of environmental records generally, enabling many of the key environmental archives (terrestrial, ice and marine) to be compared on timescales with centennial precision, allowing researchers to re-evaluate assumed synchronisms and potential leads and lags. By using a combination of age-depth modelling and wiggle-matching methodologies it is possible to generate a relationship between different timescales with quantified errors. This approach has consequences for the generation and use of the IntCal calibration curves. Linkage by cosmogenic isotope signal provides an alternative method to climate tuning for generating timescales for inclusion in the calibration curve. The relationship between the ice core timescales and the IntCal timescale is also one which is of critical importance for robustly comparing radiocarbon dated samples and records into an environmental context. In addition, the relationships derived between different record-timescales can be used to assess the synchrony between the climate signals in, for example, Greenland, the Hulu speleothems, and the Cariaco basin: using the linkages and their quantified uncertainties it is possible to plot different climate-proxy data on any of the related age or depth scales. Finally, the linkages seen between different cosmogenic signals also provides a way to distinguish between signal and noise in radiocarbon calibration datasets in the time range 25-50ka cal BP, with implications for the statistical algorithms used in radiocarbon calibration curve generation.