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Just the right age: well-clustered exposure ages from a global glacial ^{10}Be compilation

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Cosmogenic exposure dating has been used extensively for defining glacial chronologies, both in ice sheet and alpine settings, and the global set of published ages today reaches well beyond 10,000 samples. Over the last few years, a number of important developments have improved the measurements (with well-defined AMS standards) and exposure age calculations (with updated data and methods for calculating production rates), in the best case enabling high precision dating of past glacial events. A remaining problem, however, is the fact that a large portion of all dated samples have been affected by prior and/or incomplete exposure, yielding erroneous exposure ages under the standard assumptions. One way to address this issue is to only use exposure ages that can be confidently considered as unaffected by prior/incomplete exposure, such as groups of samples with statistically identical ages.

Here we use objective statistical criteria to identify groups of well-clustered exposure ages from the global glacial "expage" ^{10}Be compilation. Out of ∼1700 groups with at least 3 individual samples ∼30% are well-clustered, increasing to ∼45% if allowing outlier rejection of a maximum of 1/3 of the samples (still requiring a minimum of 3 well-clustered ages). The dataset of well-clustered ages is heavily dominated by ages <30 ka, showing that well-defined cosmogenic chronologies primarily exist for the last glaciation. We observe a large-scale global synchronicity in the timing of the last deglaciation from ∼20 to 10 ka. There is also a general correlation between the timing of deglaciation and latitude (or size of the individual ice mass), with earlier deglaciation in lower latitudes and later deglaciation towards the poles. Grouping the data into regions and comparing with available paleoclimate data we can start to untangle regional differences in the last deglaciation and the climate events controlling the ice mass loss. The extensive dataset and the statistical analysis enables an unprecedented global view on the last deglaciation.