These shapefiles accompany the manuscript entitled ‘The configuration of Northern Hemisphere ice sheets through the Quaternary’, which is published in Nature Communications.

The citation for this work is:

Batchelor, C.L., Margold, M.M., Krapp, M., Murton, D.K., Dalton, A.S., Gibbard, P.L., Stokes, C.R., Murton, J.B., Manica, A. The configuration of Northern Hemisphere ice sheets through the Quaternary. Nature Communications. In Press.

The shapefiles in this online repository are arranged by time-slice. There are 18 time-slices, which are: the Last Glacial Maximum (LGM), 30 ka, 35 ka, 40 ka, 45 ka, MIS 4 (58–72 ka), MIS 5a (72–86 ka), MIS 5b (86–92 ka), MIS 5c (92–108 ka), MIS 5d (108–117 ka), MIS 6 (132–190 ka), MIS 8 (243–279 ka), MIS 10 (337–365 ka), MIS 12 (429–477 ka), MIS 16 (622–677 ka), MIS 20–24 (790–928 ka), the early Matuyama palaeo-magnetic Chron (1.78–2.6 Ma), and the late Gauss palaeo-magnetic Chron (2.6–3.59 Ma). We have produced maximum, minimum and best-estimate hypotheses of Northern Hemisphere (NH) ice-sheet extent for 17 separate time-slices prior to the LGM, and a best-estimate for the comparatively well-constrained LGM.

The shapefiles have the following projection information:

Projected coordinate system: North\_Pole\_Lambert\_Azimuth\_Equal\_Area

Projection: Lambert\_Azimuth\_Equal\_Area

False easting: 0.00

False northing: 0.00

Central meridian: 0.00

Latitude of origin: 90.00

Linear unit: Meter

Two sub-folders are listed for each time-slice: data, and hypothesised ice-sheet reconstructions.

DATA

In the data sub-folder for each time-slice, we include shapefiles of the empirical and modelled data that were used to draw the ice-sheet reconstructions.

These data were compiled through a literature search of published evidence for the spatial extent of NH Quaternary glaciation. Details of the source publication, methodology and age of glaciation are provided in Supplementary Information in our Nature Communications article. The data were digitised and georeferenced from their source publication using Esri’s ArcGIS software.

Three types of data were digitised:

(1) empirical outlines of ice-sheet extent

(2) modelled outlines of ice-sheet extent

(3) point-source empirical data that show the former occupation of a site by ice

Notes about literature search:

- Empirically derived ice-sheet outlines were the main target of our literature search.

- In cases where the same author(s) have published multiple reconstructions for the same area, we used the most recent hypothesised ice-sheet extent.

- We did not include data points that are located well inside a suggested ice margin.

- When using ice-sheet outlines that are derived from a synthesis of previously published empirical evidence, we did not include all of the data points that informed the synthesised reconstruction.

- It is beyond the scope of this study to review all marine-sedimentological evidence for ice sheets (i.e. ice-rafted debris). Sedimentological and stratigraphic data (including marine seismic data) were particularly targeted for the oldest time-slices, for which published ice-sheet outlines are scarce.

- We do not include evidence for floating ice shelves or sea ice.

- For modelling results in which many reconstructions are available for each time-slice, we used the least extensive reconstruction (i.e. peak climatic warmth) for the relative warm intervals (e.g. MIS 5a and 5c), and the largest reconstruction (i.e. peak climatic coldness) for all other time-slices.

- Except for noting the error bounds for the reported age of glaciation derived from each publication, we do not assess the validity for each data source.

- We did not compile data for the ice extent at the relatively well-defined LGM, around 26.5 ka. Rather, a best-estimate reconstruction was derived mainly from the compilation of Ehlers *et al*. (2011), with modification of the ice-sheet limits in some areas (Supplementary Information).

Notes about outline digitisation:

- Some empirical outlines and data points are included in more than one time-slice; for example, where the error bounds of an age estimate span multiple time-slices or where an age estimate lies on the boundary between two time-slices.

- Ice-marginal positions that are inferred from studies of ice-rafted debris in sediment cores were included as point-source data. In these cases, the data point was placed at the position that the core was taken and an arrow shows where the ice is inferred to have reached.

- Some of our shapefiles include more than one data point for each previously published study. Where multiple dates have been acquired within a relatively small spatial area, we show a single data point in a representative location.

Use of these data:

- The shapefiles show the amount and distribution of published evidence for the general extent of the NH ice sheets at 17 time-slices through the Quaternary: they should not be used for local-scale studies or as a substitute for consulting the original source data.

- Inaccuracies may have been inherited from the original data source and/or may originate from the digitising and georeferencing process.

- Further information about these data is available in the Methods and Supplementary Information sections of our Nature Communications article.

ICE-SHEET RECONSTRUCTIONS

In the ice-sheet reconstructions sub-folder for each time-slice, we include shapefiles of our hypothesised maximum, minimum and best-estimate ice-sheet reconstructions. See the Supplementary Information of our Nature Communications article for explanatory text that details the decisions made in reconstructing the maximum, minimum and best-estimate ice-sheet extents.

Notes about ice-sheet reconstructions:

- Although mountain glaciers, ice fields and ice caps developed in many high-relief areas of the NH during the Quaternary, our maximum, minimum and best-estimate reconstructions were only performed for areas that have been suggested to have been covered by ice masses >50,000 km² (i.e. ice sheets).

- To avoid unnecessary complexity, several ice-sheet templates were used for the ice extent in the North American Cordillera, Greenland, Iceland and north-east (NE) Asia (see Methods).

- For regions and/or time-slices where empirical and modelled data are not available, a feasible ice-sheet extent was derived using the ice-sheet configuration from another time-slice that has a similar value in the global δ18O record (see Methods and Supplementary Information).

- Our reconstructions aim to capture the maximum extent of each ice sheet within each time-slice, with the exception of the comparatively warm periods of 45 ka, MIS 5a and 5c for which we attempt to capture the ice extent during peak warmth. The maximum extent of glaciation may have occurred at any time(s) within a time-slice.

- Our ice-sheet reconstructions do not capture the time-transgressive nature of the ice-sheet limit between different regions of the NH prior to the last glacial cycle (MIS 2–5d).

Use of these data:

- Because of a lack of empirical data, some of our best-estimate ice-sheet extents (e.g. for MIS 8 and 10) are highly uncertain. As a result, they should not be used to indicate the position of the ice-sheet margin, only as an indication of the likely amount of ice present in the NH during this time

- The use of maximum, minimum and best-estimate reconstructions in our study provides a visual indictor of uncertainty and identifies regions and time-slices where future work should be directed.

- Our maximum, minimum and best-estimate reconstructions are necessarily subjective, but they provide systematic and consistent approximations of generalised NH ice-sheet extents through the Quaternary.

POWERPOINT DOCUMENT

This online repository includes a PowerPoint document that contains high-resolution images of our data maps and ice-sheet reconstructions.

Notes about maps:

- Our maps of ice-sheet extent through the Quaternary show the sea level and topography of the present day. This is because of the uncertainty involved in calculating isostatic adjustments and rates of sediment erosion during the Quaternary. We recognise, though, that NH topography has changed significantly during this time.

- To aid interpretation of our maps, each best-estimate ice-sheet reconstruction has been allocated an overall robustness score (from 0 to 5) that reflects the amount and reliability of the source data from which the ice-sheet extent was constructed (see Methods). This score represents an average of the individual scores (black numbers) for each of the four main ice-sheet regions during that time-slice.

- Background is ETOPO1 1 arc-minute global relief model of Earth's surface. The citation for these data is: Amante, C. & Eakins, B. W. ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis. NOAA Technical Memorandum NESDIS NGDC-24. National Geophysical Data Center, NOAA (2009).

- The maps should not be used for local-scale studies or as a substitute for consulting the original source data.