Maximum extent and readvance dynamics of the Irish Sea Ice Stream since the Last Glacial Maximum

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The Irish Sea Ice Stream (ISIS) has one of the best documented retreat histories of the British-Irish Ice Sheet (BIIS) and was the first ice stream to be constrained by Bayesian analysis of geochronological data. These attributes made it a model system for the BRITICE-CHRONO research project, which aimed to produce the best constrained ice retreat record of any palaeo-ice sheet contributing key observational constraint for ice sheet modelling. The project has generated a suite of new radiocarbon ages from deglacial sequences offshore in the Celtic and Irish seas and terrestrial cosmogenic nuclide and optically-stimulated luminescence ages from ice-marginal sites in the Isles of Scilly, Ireland, Wales and NW England. Here we assess the retreat dynamics across the entirety of the ISIS integrating the new chronology in a revised Bayesian analysis that constrains the pattern and timing ice marginal fluctuations. ISIS differs from much of the former BIIS, in that it was a compound ice stream with two outlets, one marine terminating flowing through the Irish Sea Basin into the Celtic Sea, and a terrestrial terminus flowing southwards through Cheshire-Shropshire lowlands into the English Midlands. ISIS extended as far as the continental shelf break to the SW of Britain and Ireland at 25.5 ka; independently-dated ice-rafted detritus is registered from ISIS in adjacent deep-sea cores synchronous with this advance. The western ISIS then retreated rapidly northwards through the Celtic Sea, with evidence for readvance phases, reaching St Georges Channel by 24.3 ka and the Llŷn Peninsula by 23.9 ka. The complex readvance sequences identified on the Llŷn (24-20ka) and in eastern Ireland have now been tightly constrained to register centennial-scale oscillations of the ice front driven by internal ice dynamics over topographic pinning points and constrictions of the ice-stream. The eastern axis of the Irish Sea ice displayed differing dynamics with little evidence of streaming but reached a coeval maximum at ∼25ka, and confining topography and the interaction with fronting lake basins contributing to regulate the retreat dynamics, eventually pulling back offshore by ∼21 ka. Retreat northwards into the northern Irish Sea then accelerated evacuating the deeper water of the western Irish Sea first, developing pronounced ice margins across the northern Isle of Man by 19.1 ka. The final retreat phase, with ice margins pulling back onto terrestrial settings in the north of Ireland and SW Scotland around 17 ka, was a deglaciation accomplished in a fully marine context evidenced by the preservation on the seabed of subglacial landforms and by increasing influence of local ice sources with flow realignment during drawn-down and retreat.