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Tidal evolution of the northwest European shelf seas from the Last Glacial Maximum to the present

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Two-dimensional palaeotidal simulations have been undertaken to investigate tidal and tide-dependent changes (tidal amplitudes, tidal current velocities, peak bed stress vectors, seasonal stratification) that have occurred in the NW European shelf seas during the last 20 ka. The simulations test the effect of shelf-wide isostatic changes of sea-level by incorporating results from two different crustal rebound models, and the effect of the ocean-tide variability by setting open boundary values either fixed to the present state or variable according to the results of a global palaeotidal model. The use of the different crustal rebound models does not affect the overall changes in tidal patterns, but the timing of the changes is sensitive to the local isostatic effects that differ between the models. The incorporation of ocean-tide changes greatly augments the amplitude of tides and tidal currents in the Celtic and Malin seas before 10 ka BP, and has a large impact on the distribution of seasonally stratified conditions, magnitude of peak bed stress vectors and tidal dissipation in the shelf seas. The predictions on seasonal stratification are supported by well-dated evidence on tidal mixing front migration in the Celtic Sea. Additional experiments using the global model suggest that the variability of offshore tides has been caused mainly by changes in eustatic

sea-level and ice-sheet extent. In particular, a large decrease observed at 10-8 ka BP is attributed to the opening of Hudson Strait accompanied by the retreat of the Laurentide Ice Sheet.