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Age uncertainty in marine palaeoclimate records of the last Millennium

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Reconstructing the climate of the last Millennium from non-annually laminated marine sediments poses a suite of dating challenges for which the resultant age uncertainties are poorly defined. We review the known uncertainties associated with the most commonly applied dating methods and provide best-estimates for some of the key processes which may contribute to the unknown uncertainties associated with sediment age-depth models and resultant marine palaeoclimate series. Recent progress in estimating both spatial and temporal changes in marine radiocarbon reservoir ages are reviewed, suggesting that reservoir ages north of Iceland varied rapidly, by more than 200 years, over the last millennium. We highlight the potential of using novel, regionally calibrated, annually-resolved records of the radiocarbon "bomb-pulse" from the marine bivalve Arctica islandica to test radiocarbon-based sediment age-depth models post-1950. Despite potential age uncertainties of up to 400 years in some radiocarbon-based age models, tephra isochrons of Icelandic origin provide the potential to test the phasing of climatic events between distant marine, terrestrial and ice core records throughout the last millennium at sub-decadal timescales. Multiple dating methods, when applied to the same sediment record, can significantly reduce age uncertainty, notably in the post-industrial era when the integration and calibration of sediment proxies with instrumental records are critical.