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Quantifying Holocene Accumulation Rates from Ice-Core Dated Internal Layers from Ice-Penetrating Radar Data over the West Antarctic Ice Sheet

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Modelling the past and future evolution of the West Antarctic Ice Sheet (WAIS) to climate and ocean forcing is challenged by the availability and quality of observed palaeo boundary conditions. Aside from point-based geochronological measurements, the only available proxy to query past ice-sheet processes on large spatial scales is Internal Reflecting Horizons (IRHs) as sounded by ice-penetrating radar. When isochronal, IRHs can be used to determine palaeo-accumulation rates and patterns, as previously demonstrated using shallow, centennially dated layers. Whilst similar efforts using deeper IRHs have previously been conducted over the East Antarctic Plateau where ice-flow is slow and ice thickness has been stable through time, much less is known of millennial-scale accumulation rates over the West Antarctic plateau due to challenging ice dynamical conditions in the downstream section of the ice sheet. Using deep and spatially extensive ice-core dated IRHs over Pine Island and Thwaites glaciers and a local layer approximation model, we quantify Holocene accumulation rates over the slow-flowing parts of these sensitive catchments. The results from the one-dimensional model are also compared with modern accumulation rates from observational and modelled datasets to investigate changes in accumulation rates and patterns between the Holocene and the present. The outcome of this work is that together with present and centennial-scale accumulation rates, our results can help determine whether a trend in accumulation rates exists between the Holocene and the present and thus test to what extent these glaciers are controlled by ice dynamics rather than changes in accumulation rates.