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Ice sheet sensitivity to the timing of outlet glacier terminus positions

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Higher-order numerical ice-sheet models are being relied upon to provide sea-level rise projections, such as the ones published in the IPCC Assessment Reports. Observed Greenland Ice Sheet mass loss over the last ∼15 years have been partitioned roughly equally into surface mass balance change and dynamic change, driven by marine-terminating outlet glacier retreat. Ice-sheet model capabilities have rapidly evolved recently and, to simulate evolving ice sheet dynamics over the next century, some models are now able to implement a moving boundary at outlet glacier termini. However, an open question remains: at what frequency must models be able to reproduce outlet glacier terminus positions in order to simulate sea-level rise accurately? In other words, do models need to simulate individual calving events or are yearly averages of terminus position enough? Using the Ice Sheet System Model (ISSM), we perform a ∼30-year hindcast of ice sheet dynamic mass change from 1985 to present in West Greenland in response to observed terminus retreat. By forcing outlet glacier terminus positions at various frequencies (monthly, yearly, etc.), we quantify the sensitivity to the timing with which terminus positions are specified for the 15 marine-terminating outlet glaciers in the region. Our findings will help guide the implementation of terminus position dynamics in ice sheet models and the interpretation of sea-level rise projections.