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On stability of marine-based glaciers; sensitivity of modelled grounding-line migration to calving criteria

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Studying the evolution of the Antarctic ice sheet requires understanding of the ice sheet grounding-line migration. Previous studies suggest that stable steady state ice sheets have their grounding-lines only in a region of downward-sloping bed. These studies have a water-depth dependent criterion to define the calving flux or terminus position. In this study we examine the role of calving laws on the prediction of grounding-line migration. We present the result of MISMIP-type (Marine ice sheet model intercomparison) experiments by using different calving criteria; a commonly used calving law (height above buoyancy criterion) and our new calving law which relates the occurrence of calving events to downward penetration of surface crevasses and upward propagation of basal crevasses. This new calving law eliminates the dependence of calving rate or terminus position on local water depth. Our modelling-comparison results emphasize the importance of using a realistic calving criterion.