



## **Retreat of Pine Island Glacier controlled by marine ice-sheet instability**

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Over the last 40 years Pine Island Glacier in West Antarctica has thinned at an accelerating rate, so that it is currently the largest single contributor to sea-level rise in Antarctica. In recent years, the grounding line, which separates the grounded ice sheet from the floating ice shelf, has retreated by tens of kilometres. At present, the grounding line is crossing a retrograde bedrock slope that lies well below sea level, raising the possibility that the glacier is susceptible to the marine ice sheet instability mechanism. Here, using three state-of-the-art ice flow models, we show that Pine Island Glacier's grounding line is likely engaged in an unstable 40 kilometre retreat. The associated mass loss increases substantially over the course of our simulations from the average value of  $20 \text{ Gt a}^{-1}$  observed for the 1992-2011 period, up to and above  $100 \text{ Gt a}^{-1}$  equivalent to 3.5–10 mm eustatic sea-level rise over the following 20 years. Mass loss remains elevated from then on, ranging from 60 to  $120 \text{ Gt a}^{-1}$ .