Abstract Submitted
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Ice sheets on plastically-yielding beds[1] IAN HEWITT, University of Oxford — Many fast flowing regions of ice sheets are underlain by a layer of water-saturated sediments, or till. The rheology of the till has been the subject of some controversy, with laboratory tests suggesting almost perfectly plastic behaviour (stress independent of strain rate), but many models adopting a pseudo-viscous description. In this work, we consider the behaviour of glaciers underlain by a plastic bed. The ice is treated as a viscous gravity current, on a bed that allows unconstrained slip above a critical yield stress. This simplified description allows rapid sliding, and aims to investigate 'worst-case' scenarios of possible ice-sheet disintegration. The plastic bed results in an approximate ice-sheet geometry that is primarily controlled by force balance, whilst ice velocity is determined from mass conservation (rather than the other way around, as standard models would hold). The stability of various states is considered, and particular attention is given to the pace at which transitions between unstable states can occur. Finally, we observe that the strength of basal tills depends strongly on pore pressure, and combine the model with a description of subglacial hydrology. Implications for the present-day ice sheets in Greenland and Antarctica will be discussed.

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Ian Hewitt
University of Oxford

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