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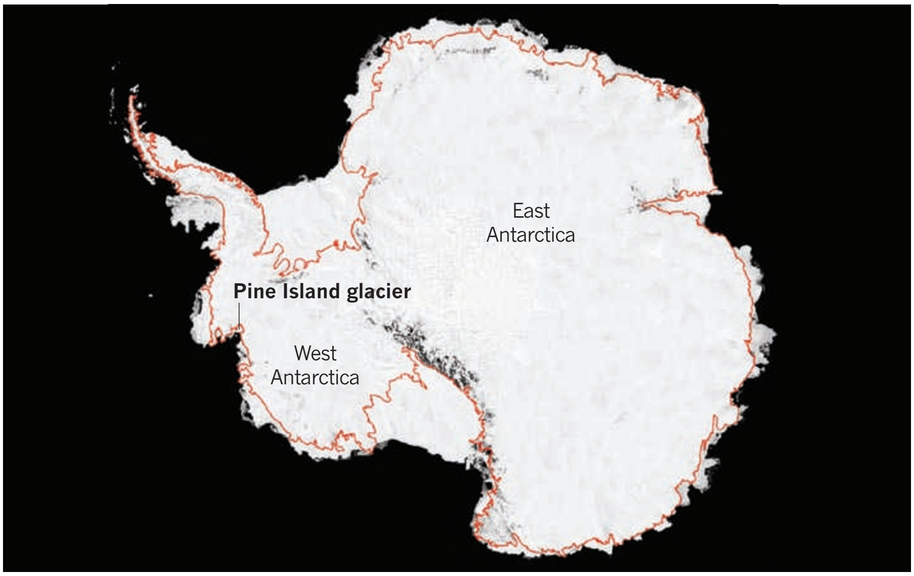

Figure 1 | The Antarctic grounding line. The grounding line is the transition point of a glacier from flow on bedrock to floating ice shelf, and is a crucial location for estimating ice loss to the ocean. Morlighem and colleagues' numerical treatment[2], as applied to the Pine Island glacier, will improve modelling of ice flow in this zone. Identifying the location of the grounding line around Antarctica is another task, and the red line on this map, generated from satellite data, shows just such a depiction. The map was presented earlier this year by a team led by researchers at NASA's Goddard Space Flight Center (see ref. 12).

models, then, only partly represent current ice-sheet geometry and flow.

Help is now at hand through the application of inverse methods. Such methods involve extracting model parameters from available data, and have shown their worth in improving model forecasts in meteorology and oceanography. Although they were introduced in glaciology almost 20 years ago[6], they have remained largely unexploited. But new initiatives have recently emerged[7,8], among which the work of Morlighem *et al.*[2] offers the most accomplished attempt to tackle the weaknesses in existing ice-sheet models.

First, using the finite-element method, Morlighem *et al.* solved the full set of flow equations (the Stokes equations) and two approximations of those equations commonly used in ice-sheet models. Second, they generalized a particular inverse method, namely the control method[9], to plausibly infer the basal drag, exerted by the bedrock on the overlying glacier, from measured surface velocities. Finally, they applied their methodology over the Pine Island drainage basin, successfully reducing the gap between surface observations and model results. The comparison of the basal-drag patterns, obtained by the inverse method for each flow approximation, confirms the need for careful flow resolution in the vicinity of the grounding line.

Challenges remain, however, in terms of both method and computation. Robust simulations will require computation of grounding-line motion, which is at the heart of a 40-year debate. Recent progress has been made in this respect, from both theoretical[10] and numerical perspectives[11], showing that a significant grid refinement (to the subkilometre scale) is required in this transition zone between grounded and floating ice. Such a refinement, together with the extension of Morlighem and colleagues' methodology from a drainage basin to a whole ice sheet, will require massive parallel computation facilities. Nonetheless, we have reached the stage at which more robust numerical tools will soon allow model simulations to be run forward in time, and proposal of prognostic simulations of the behaviour of polar glaciers. ■

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NATURE

50 YEARS AGO

In a recent address given in the University of Nottingham, Sir William Slater, secretary of the Agricultural Research Council, made a strong plea that universities should lead rather than follow contemporary thought, and in particular that they should be sufficiently independent financially to be able to allocate sufficient funds for research on lines of work entirely of their own choosing. Sir William was discussing the relative values of such research and of sponsored research, undertaken with the assistance of outside bodies ... The problem of course arises out of the extent to which the universities are now dependent on public funds, and how far, even with the University Grants Committee, it is possible for their independence from outside pressure to be fully maintained.
From *Nature* 15 October 1960.

100 YEARS AGO

The second congress on radiology and electricity was held at Brussels on September 13–15 ... [The] president called upon Madame Curie to give an account of the recent experiments made in Paris to isolate metallic radium. It will be remembered that this metal has hitherto not been separated from its salts, although a radium amalgam was obtained some years ago by Coehn. The beautiful experiments described by Madame Curie, resulting in the isolation of metallic radium, must be regarded as a triumph in chemical manipulation when it is remembered that ... the operations had to be carried out with minute quantities of material in such a way as to avoid loss of the precious substance during the process. These experiments should remove all possible doubt that radium is, in fact, an element belonging to the same group of metals as barium.
From *Nature* 13 October 1910.