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Grounding lines, coastal stress-boundaries, and the inside-out ice sheet.

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Recent theories of the coastal flow of ice sheets have proposed that there is a boundary region where the stress within the ice makes a transition from extending flow, characteristic of ice shelves, to shearing flow, characteristic of the grounded ice sheet. The details of this transition have recently been illuminated by three new theories, each corresponding to a distinct limiting case (Schoof, 2007; http://www.eos.ubc.ca/˜cschoof/groundingline.pdf). To predict the Antarctic contribution to sea level we need to know which theory most closely resembles the real world. Another complication is that, in plan view, grounding lines are curves, not straight lines, so we also need to extend the theory from two dimensions to three. We describe some progress towards extending the theory to 3D, beginning with an axisymmetric ice sheet. The axysymmetric model can describe laterally diverging flow (with ice flowing radially outwards towards an ocean) or laterally converging flow (where the ice flows radially inwards towards a small central ocean). The latter case provides an analogue for inwardly curved embayments, such as Pine Island Bay. The problem of computing temperatures within the ice is also considered, and consequences for the large-scale prediction of the Antarctic ice sheet are discussed.