

The Losers Next Door: Mass loss from Thwaites, Pope and Smith glaciers

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Headlines about mass loss from the Amundsen Sea sector are often dominated by the antics of Pine Island glacier. But just next door, three large glaciers have each made their own contributions to sea level. A synthesis of laser-altimetry and photogrammetry from ICESat, IceBridge, and Worldview, shows that Thwaites, Pope and Smith have together lost more mass since 2009 than PIG, and while the near-grounding-line thinning on PIG appears to be thinning, it has held steady over the last year on Smith Glacier. The cause of the large ice losses in these glaciers is probably ongoing changes near the grounding line. Visible-light and radar imagery reveals changes in crevassing patterns and in the configuration of ice rises near the fronts of all of these glaciers, suggesting that thinning ice shelves have lost some support from submarine peaks that once helped buttress them against ice flowing from upstream, while combined altimetry and ice-sounding measurement reveal changes in the extent of grounded ice.

At the same time, melt near the grounding lines has eroded contact between ice and rock. In some cases, the changes have been subtle, as in the Thwaites Ice Shelf, where the freeboard of nearly-floating ice has decreased, leading to patchy flotation; in the case of Pope Glacier, the change is not subtle at all: beneath the fastest-flowing part of the glacier, the ice has thinned by nearly 30 m/yr since early measurements in 2002, creating a dramatic new embayed area upstream of the grounding line. The extent to which these changes can continue will depend greatly on the future rate and pattern of marine melt, the specifics of which will be discussed in a companion presentation by Ian Joughin.