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Investigating the grounding zone of the southern Ronne Ice Shelf with ICESat

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Since its launch in January 2003, the ICESat mission has mapped the Antarctic ice sheet to 86°S, completely covering the ice shelves. ICESat track spacing is dense in the southern parts of the Ross and Filchner-Ronne ice shelves, where no altimeter data have previously been acquired. We show that analysis of repeat-track ICESat data across the ice shelf grounding zone (GZ) can be used to identify the location of the GZ from tidally-induced bending or flexure of the ice shelf. ICESat samples every 172 m along-track with a footprint of 65 m diameter, thus easily resolving the GZ which is typically several km wide. Time variability of measured ice elevation along tracks can be used to precisely identify the landward and seaward limits of flexure due to tides, thus providing GZ position and width. Here we present results for the southern part of the Ronne Ice Shelf, including Institute Ice Stream, which provide important new information about the GZ in this region. We compare the ICESat-derived GZ locations with those inferred from the new MODIS Mosaic of Antarctica, showing that the GZ is often not detectable in satellite imagery. By analyzing data around the perimeters of the RIS and FRIS, we can significantly improve the GZ definition relative to existing estimates and also locate regions of partial grounding. By defining the flexure characteristics of the GZ, including width and curvature, it will be possible for the first time to apply tidal corrections within the GZ, which is frequently a region of intense basal melt and thus a significant focus of shelf-ice mass balance studies.