Looking into ice shelf rifts with GLAS

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Since the launch of ICESat in January 2003, Geoscience Laser Altimeter System (GLAS) has provided glaciologists with unprecedented topographic information for Antarctica, delivering elevation profiles containing exquisite detail. The small footprint of GLAS (65m) has the ability to measure sub-kilometer scale features on the surface of the ice shelves, such as ice shelf rifts, which were previously not resolved by the large-footprint satellite radar altimeters. This makes it an ideal instrument for studying ice shelf rifts. Often when GLAS encounters a rift, there is a double peak in the return waveform, the first corresponding to the ice shelf surface and the second to the rift base. The GLAS processing scheme assigns the peak with the largest amplitude to be the surface. However, over rifts this is often not the case, as the peak from the rift base can have low amplitude, especially if the rift is filled with ice mélange (which has a rough surface and scatters GLAS photons). We have retracked GLAS data over ice shelves to always pick the last return. In this manner we can for the first time measure the thickness of ice mélange within ice shelf rifts, and how this thickness changes over time. This is significant because of the important role that ice mélange can play in rift propagation.