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The firn air content of Larsen Ice Shelf

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A novel method is presented that uses sounding measurements to decompose the total thickness of an ice shelf into solid-ice thickness and firn-air thickness (or water thickness). The method is applied to a 1997/98 airborne radar survey of Larsen Ice Shelf, revealing large spatial gradients in air thickness that are consistent with existing measurements and local meteorology. Meltwater-enhanced firn densification appears to best explain the gradients. There is sufficient air in Larsen C Ice Shelf that densification could account for its observed lowering, and the pattern of lowering superficially agrees with trends in melting. Repeating the method with a modern survey would conclusively distinguish atmospheric-led changes in Larsen Ice Shelf from changes in oceanic basal melting. The technique also holds promise for the calibration of firn models, derivation of ice thickness from elevation measurements, and conversion of observed volume changes to mass.