

Tracking an Ice-ochrone

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Regional and continent-scale estimates of mass balance changes occurring on the ice sheets in Antarctica and Greenland have improved in recent years, but even the most advanced studies have not addressed the issue of accumulation variability. Both repeat laser altimeter measurements of surface elevation and mass flux calculations covering large regions can provide reliable results of short-term changes in mass balance if they incorporate accumulation data that are highly accurate, highly resolved, and spatially continuous. By tracking continuous radar reflections dated with ice cores, we show that undulations on the surface of ice sheets cause accumulation rates to be highly variable over short distances. As a result, current accumulation estimates for Antarctica and Greenland are inadequate for estimating ice sheet mass balance, because they are based on measurements that are too widely spaced to capture the full range of variability present on ice sheets. In order for either of these methods to produce reliable results, they must be coupled with accumulation data that are at least as accurate and continuous as those produced by shallow radar profiling.