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Improving volume loss estimate of the Greenland Ice Sheet between 2002-2012

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Ice loss from the Greenland Ice Sheet is dominated by loss in the marginal areas. Dynamic induced ice loss and its associated ice surface lowering is often largest close to the glacier calving front and may vary from rates of tens of meters per years to a few meters per year over relatively short distances. Hence, high spatial resolution data are required to accurately estimate volume changes. We estimate ice volume change rate of the Greenland ice sheet during 2003-2009 using Ice, Cloud and land Elevation Satellite (ICESat) laser altimeter data (Zwally et al., 2011). To improve the volume change estimate we supplement ICESat data with altimeter surveys from NASA's Airborne Topographic Mapper (ATM) during 2002-2010 (Krabill et al., 2011) and NASA's Land, Vegetation and Ice Sensor (LVIS) during 2007-2010 (Blair and Hofton, 2010). The Airborne data are mainly concentrated along the ice margin and therefore significantly improve the estimate of the total volume change. Our results show that adding ATM and LVIS data to the ICESat data increases the estimate of catchment-wide ice volume loss in northeast and southeast Greenland by 10-20 percent. This is mainly due to increased volume loss near the margin of the GrIS. Furthermore, we provide volume loss estimates during 2002-2009 and 2009-2012. Our 2009-2012 estimate suggest enhanced volume loss at the entire southern half of the GrIS.