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Monitoring ice and snow volume variations in Greenland with ICESat and GRACE data

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For the first time, integrated variations of ice and snow volume in Greenland are separately derived from satellite data. The observations used are from two complementary satellite missions, the ICESat laser altimetry mission and the GRACE gravity mission. At first, the data from each satellite mission are processed separately. ICESat data from the GLA12 Antarctic and Greenland Ice Sheet Altimetry Data product have been exploited to identify height changes at approximately 1 000 000 geometrically overlapping footprints within the time interval from 2003 to 2007. On the basis of this information, parameters describing the total (snow + ice) volume change could be derived. GRACE data (a time series of monthly gravity field models for the same time interval) were used to obtain the total mass variations in Greenland. Both results have been corrected for the isostatic adjustment. Assuming that the density of ice and snow are known, we have combined estimations of mass and volume changes and extracted information on variations of snow and ice volume separately. In particular, our first results show that snow volume in Greenland keeps increasing, although the total (snow + ice) volume and total mass change clearly show negative trends.