

# Antarctic ice mass change from ICESat and GRACE data

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Increasing evidence from satellite missions shows that Antarctica is losing enough ice to contribute to about 10-20% of the observed global sea-level rise. In particular, the recent disintegration of large ice shelves around the Antarctic Peninsula (AP) and the observed acceleration of the rate of mass loss from the Amundsen Sea Embayment (ASE) are of major concern, considering the potential instability of the West Antarctic Ice Sheet. However, measurements obtained with different techniques are still providing a wide range of estimates, with uncertainties that are often as large as 50% of the total signal. Here we discuss surface mass change estimates based on five years of ICESat and GRACE satellite data, from 2003 to 2008. Both missions are particularly suited for the observation of Polar Regions, due to their orbital configuration, and provide mutually independent measurements that allow to assess surface mass change. The two datasets have also different characteristics: ICESat provides a high spatial resolution (a few tens of kilometers), but with discontinuous temporal coverage (2-3 campaigns per year), while GRACE provides a continuous temporal coverage (generally represented by monthly solutions), but characterized by a lower spatial resolution (about 300 km). In addition, surface mass balance estimates from ICESat are dependent on the assumed firn density profile, while for GRACE they are dependent on the applied correction for Glacial Isostatic Adjustment (GIA). The different properties of those two satellite missions can be exploited through a combination strategy that allows to simultaneously constrain both surface mass balance and GIA. This approach has the advantage of being independent from GIA modeling results, which especially for Antarctica carry large uncertainties. Our results show how most of the ongoing mass loss is originating from the AP and the ASE, while the East Antarctic Ice Sheet appears to be close to equilibrium, though with significant regional variations.