EGU21-2480
https://doi.org/10.5194/egusphere-egu21-2480
EGU General Assembly 2021

Changes in Northwest Greenland Ice Sheet Elevation and Mass

Inès Otosaka[1], Andrew Shepherd[1], and Andreas Groh[2]
[1]Centre for Polar Observation and Modelling, University of Leeds, Leeds, UK
[2]Institut für Planetare Geodäsie, Technische Universität Dresden, Dresden, Germany

About a third of Greenland's total ice losses come from the Northwest sector, a sector that includes a large number of marine-terminating outlet glaciers, which have all experienced widespread retreat triggered by ocean-induced melting. Here, we derive changes in surface elevation, volume and mass in the Northwest sector of the Greenland Ice Sheet using a decade of CryoSat-2 observations. We find an average elevation change rate of 18.7 ± 0.4 cm/yr, with rapid thinning at the ice sheet margins at a rate of 42.7 ± 0.9 cm/yr. We compare our CryoSat-2 rates of elevation change to airborne laser altimetry data from Operation IceBridge. Overall, there is a good agreement between the two datasets with a mean difference of 6.5 ± 0.5 cm/yr and standard deviation of 31.1 cm/yr. We further compute volume change, which we convert to mass change by testing three alternate density models and we find that the northwest sector has lost 386 ± 3.7 Gt of ice between July 2010 and July 2019. We compare our mass balance estimate to independent estimates from gravimetry and the mass budget method across different spatial scales. First, we compare the different estimates by splitting the sector into two and four regions. While our altimetry estimate is the least negative across all regions, the gravimetry and mass budget estimates alternate in recording the largest ice losses. We further compare mass changes derived from altimetry and the mass budget method in each of the 74 individual glacier basins of the Northwest sector. We find a high correlation of 0.81 between rates of mass change from altimetry and the mass budget method, with the highest differences recorded in Steenstrup-Dietrichson and Kjer Gletscher basins. Our comparisons show that the spatial pattern of the differences between mass balance estimates is complex, suggesting that discrepancies between techniques do not solely originate from one single region or technique. Finally, we explore several factors that could potentially bias our altimetry mass balance estimation, by investigating differences between satellite radar and airborne laser altimetry, the dependency on grid spatial resolution and the impact of using different density models.