



Seasonal Variability of Greenland Ice Sheet Mass Balance

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The mass balance of the Greenland Ice Sheet (GrIS) is a substantial contributor to current and future sea level changes. Numerous studies have investigated annual to decadal changes in GrIS mass using observations and models, but have not focused on seasonal changes. We have evaluated the spatiotemporal variability of the GrIS mass balance at intra-annual timescales using mass changes derived from the Gravity Recovery and Climate Experiment (GRACE), surface mass balance from the Modèle Atmosphérique Régionale (MAR) regional climate model, and dynamic mass changes simulated by the Ice Sheet System Model (ISSM). Results from GRACE indicate a seasonal cycle of mass change that varies spatially across the ice sheet. Although net mass loss generally occurs during summer months and mass gain occurs during winter months, the timing of seasonal changes is spatially variable. In contrast, model results predict a seasonal cycle that is relatively consistent across time and space. Discrepancies between model predictions and GRACE results suggest that processes not captured by either MAR or ISSM (such as cycles of water storage and release, and seasonal variability of ice flow) play an important role in seasonal fluctuations of GrIS mass. Incorporating such processes into ice sheet models and/or climate models may be important for predicting future mass loss, and for understanding the spatiotemporal variability of discharge into the surrounding oceans.