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Observing Changes in Land Ice from GRACE and Future Spaceborne Multi-Beam Laser Altimeter Missions

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Recent changes in the cryosphere highlight the importance of methods that directly observe the complex spatial and temporal variation of land ice. Since its launch in March of 2002, the NASA/DLR Gravity Recovery and Climate Experiment (GRACE) mission has been acquiring ultra-precise inter-satellite K-band range and range-rate (KBRR) measurements providing new observations of the Earth's land ice. Employing a surface mass concentration (mascon) solution technique, we have computed multi-year time series of surface mass for the Greenland and Antarctica ice sheets as well as the Gulf of Alaska mountain glaciers. These mascon solutions provide important observations of the Earth's land ice with seasonal, annual and inter-annual net balance quantified at $\sim$240km spatial resolution. In this talk we present the latest GRACE derived ice mass solutions for the Gulf of Alaska glaciers, Greenland and Antarctica. We compare the solutions derived from various solution techniques including those that estimate the mass flux directly from the GRACE observations (regional high-resolution mascon and global mascon solutions), as well as regional averaging kernel techniques applied to spherical harmonic solutions estimated from the GRACE data. We also explore the impact of parameterization and forward modeling on the final solutions. In addition, we take a look forward and investigate the capabilities of future spaceborne multi-beam laser altimeter missions (e.g. DESDynI-Lidar). The results of pre-launch simulations are presented, quantifying the expected performance (spatial and temporal resolution, and accuracy) of these missions in recovering ice sheet surface elevation change.