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Observation of the annual mass variations of the glacier complexes near the Gulf of Alaska using GRACE data

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Recent melting from glaciers near the Gulf of Alaska may contribute more to ongoing global sea level rise than melting from the Greenland icesheet. Unfortunately, the geographic and temporal sampling intrinsic to standard glaciological and aerial altimetric methods adds to the large uncertainties in estimates of the total annual and secular contribution from the large glacier complexes. We use the GRACE monthly fields to examine the annual component and to better constrain the annual mass balance for the glacier complexes near the Gulf of Alaska. This data set allows for more regular temporal sampling of the mass change and is an integrated measure of the mass balance across all of the glacier complexes in the region. From the monthly data sets, we calculate monthly averages over a long narrow region along the coast that encompasses the major glacier complexes. Because the mass change occurs over this narrow region, the estimates of the total mass variation derived from the resulting time series scale inversely with the level of smoothing of the GRACE data. Results from forward models of melting from glaciers also scale in the same manner, and we use this scaling to obtain preliminary estimates of 118 ± 10 km^3 (water equivalent) for the the annual amplitude and 114 ± 15 km^3/yr for the total annual mass balance in the region. The errors reported are formal, and we investigate their robustness using regional models.