CURRENT GLACIER MASS BALANCE
SIGNATURES IN THE TIME-VARIABLE GEOID

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The global reservoir of small (or mountain) glaciers may be experiencing an accelerated phase of net melting. Estimates of the recent mass balance of large systems of such glaciers, using point measurements of accumulation and discharge rates or changes in ice sheet height along profiles obtained from altimetry, are subject to biases associated with incomplete sampling. Integrated measurements, such as changes in sea level and the geoid (or sea surface), are more robust in this specific sense. However, these variations may be contaminated by signals from Late Holocene glacial fluctuations. As an example, in regions with low asthenospheric viscosity, such as Alaska and Patagonia, predictions of radial crustal motion (and thus sea level) are known to be highly sensitive to the local glacier history over the last few thousand years [e.g., Ivins and James, 1999, Larsen et al., 2003; Tamisiea et al., 2003]. In contrast, the predicted geoid (sea surface) variation in the same regions is insensitive (to within 10%) to this aspect of the loading history. In addition, the geoid variation caused by Pleistocene and Early Holocene ice loads above these regions would have relaxed by present time and is negligible. In this talk we demonstrate that measurements of geoid variations in the vicinity of small glacier systems provide a remarkably robust (i.e., uncontaminated) measure of the ongoing mass balance of these systems. Thus, we conclude that such measurements should be a key target of satellite gravity missions.