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Thinning Glaciers, Sea Level and Changing Climate in Northwestern North America

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Measurement of glaciers in Alaska, Yukon, and NW British Columbia with small-aircraft laser altimetry has shown that these rapidly-thinning ice masses contributed 52 +/- 15 km^3/yr (water equivalent) to rising mean sea level during the mid-1950's to the mid-1990's, and 96 +/- 35 km^3/yr (w.e.) during the mid-1990's to 2000/2001. This represents approximately 6 to 12% of global mean sea-level rise during those time periods (Arendt et al., 2002); it is the largest glaciological contribution during recent decades to rising sea level yet measured, from a single source region. We will present additional and new altimetry data, particularly for glaciers in the St. Elias and Chugach Mountains acquired in 2003 and 2004.

Extrapolation suggests that between 1900 and 2005, the glaciers of NW North America may have contributed roughly 5,900 km^3 (w.e.) or 16 mm in total to rising mean sea level at a rate that accelerated during the 1990's (i.e., 52 kmˆ3/yr 1900 to 1995; 96 kmˆ3/yr 1995 to 2005). Raised beach, tree-coring, and differential GPS analyses have shown that since the Little Ice Age maximum (about 1760), isostatic uplift driven by this thinning and retreating ice load has caused relative sea-levels to *fall* throughout coastal southern Alaska at 3 to 26 mm/yr (maximum in Glacier Bay), with current uplift rates up to 34 mm/yr farther NW near the coastal community of Yakutat (Larsen et al., 2004).

Work is in progress to estimate the contribution to rising mean sea level during the next century from thinning glaciers in NW North America, employing an arctic regional model (MM5) with boundary conditions from a global climate model, in conjunction with glacier mass balance modeling. Hindcast MM5 simulations of temperature and

precipitation (T and P) data at meteorological stations over a 1-year time period, and comparison to measured T and P at those stations, suggest that dynamical downscaling will be a reasonable method for estimating T and P needed for simulation of glacier mass balances during the coming century.

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