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C62A-0913

Growing and Advancing Calving Glaciers in Alaska

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In stark contrast with the majority of glaciers in Alaska that are losing volume and retreating in response to climate forcing, about 10 large glaciers are increasing in volume and advancing. All of these are calving glaciers that are advancing into seawater. Hubbard Glacier, at the head of Disenchantment Bay near Yakutat, Alaska, is one of the advancing glaciers and is the largest calving glacier on the North American Continent. Hubbard Glacier's current advance began shortly before 1895 and has recently been newsworthy because its advance blocked the entrance to Russell Fiord between June and August 2002. Other prominent examples are Meares Glacier, at the head of Unakwik Inlet in Prince William Sound, which is advancing into old-growth forest, and Harvard Glacier, at the head of College Fiord, which has a well-documented history of advance beginning between 1905 and 1911. Calving glaciers that are currently growing and advancing have at least four things in common. All of them (1) are at the heads of long fiords, (2) have undergone massive retreats during the last thousand or more years, (3) presently calve over relatively shallow moraine shoals, and (4) have strongly positive mass balances that are a consequence of a surface-area distributions that have unusually small ablation areas compared to the accumulation areas. For example, Hubbard Glacier retreated about 61 kilometers between 1000 A.D. and late in the 19th century. The depth of seawater at the calving terminus averages between 60 and 80 meters in a fiord that reaches 230 meters below sea level in front of the glacier and 400

meters below sea level under the ice. The accumulation area of Hubbard Glacier is 95 percent of the entire glacier area and, like the other advancing glaciers, is far from being in equilibrium with climate on the positive mass balance side. Glaciologists often point out that glaciers are sensitive indicators of climate. This paradigm should not be applied to calving glaciers. During most of the calving glacier cycle, the slow advances and relatively rapid retreats are not very sensitive to climate. For example, the calving glaciers that are currently growing and advancing in the face of global warming, were retreating throughout the little ice age. Calving glaciers become sensitive to climate only late in the advancing phase, when the mass flux out of the accumulation area approaches the mass lost by melting in the ablation area and losses due to calving can no longer be replaced. No reasonable change in climate will change this imbalance and stop the advances of these few glaciers.

<http://ak.water.usgs.gov/glaciology/hubbard/>

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