The effects of climate change on the coastal geomorphology of southwestern Banks Island, NWT

Karissa Belliveau[1], Norm Catto[2], Evan Edinger[2], and Donald Forbes[3]
1. Environmental Science Program, Memorial University of Newfoundland, St. John's, NL, A1B 3X9 <karissa@mun.ca> ¶ 2. Department of Geography, Memorial University of Newfoundland, St. John's, NL, A1B 3X9 ¶ 3. Geological Survey of Canada (Atlantic), 1 Challenger Dr. (PO Box 1006), Dartmouth, NS, B2Y 4A2

Well-publicized community concern about changing coastal conditions led to Sachs Harbour being chosen as one of the first coastal sites for detailed study along the E-W gradient as part of ArcticNet Project 1.2. Fieldwork, including RTK coastal profiling, and analyses of aerial photography and QuickBird images were used to assess coastal processes, rates of coastal retreat, and long-term decadal changes in coastal erosion rates near the community of Sachs Harbour, NWT.

The southwestern coastline of Banks Island is dominated by low bluffs composed of frozen unlithified glacially derived sediments containing segregated ice lenses and ice-rich silty

sand horizons. Rising sea level and decreasing sea ice extent, coupled with regional submergence due to crustal flexure, has rendered this coastline vulnerable to erosion. Increasing effectiveness of storm events in eroding these bluffs could lead to increasing sedimentation on the shoreface and the nearshore. High sedimentation rates may have negative consequences on the marine biotic community in this region, with rapid burial of organisms hampering biological productivity.

Fieldwork in 2005 identified the dominant geomorphic processes and measured current rates of coastal erosion. Coastal surveys included 31 transects, distributed from north of Cape Kellett to southeast of Sachs Harbour. Sediment samples were taken from the shore-zone and nearshore environments to delineate longshore transport cells. Suspended particulate matter was measured in the nearshore zone and resampled during and after a small rain/wind/wave event. These results were used to determine the effectiveness of overland flow to increase sedimentation and resuspension of material in the nearshore.

The coastal bluffs are undergoing retreat, particularly west of Sachs Harbour. Bluffs in the eastern section of Sachs Harbour appear to be actively eroding. However, much of the community is sheltered from wave action by the spit to the south. West of the community where the bluffs are exposed to higher energy conditions, the sediments are finer grained, and there is increased wave erosion during storm events. Thermal erosion plays a major role in coastal retreat. Melting ground ice causes retrogressive thaw flow failures and slumping and creep of material to the base of slopes. Disturbed sediment is subject to removal during storm events. The results of a small rain/wind/wave event on August 9–10 indicate that although there was minor increase in overland flow and intensity of wave action, a much larger event would be necessary to actively transport disturbed material offshore.

Ongoing research will determine longer-term changes and quantitative rates of coastal retreat. Prediction of the future evolution of this coastline in response to changing climate conditions will allow Sachs Harbour to assess impacts and develop any adaptations necessary.