

River delta's rise puts Arctic's future in flux
Climate change in Arctic seas is driving summer water levels at the Mackenzie's mouth to three times normal, B.C. researchers find

April 4, 2008 at 4:12 AM EDT

VANCOUVER — In the Mackenzie River Delta, where there are about 45,000 lakes separated by thin arms of land, researchers have found that global warming is causing water-level increases three times greater than expected.

When Lance Lesack a Simon Fraser University geographer, and Philip Marsh, an Environment Canada scientist, began to study the myriad lakes of the delta, they thought they would find more evidence of the impact of global warming.

They were surprised by just how rapid and extensive those changes are, Dr. Lesack said yesterday.

"In the case of the Mackenzie Delta, it's three times what we thought it would be ... and that's quite dramatic," said Dr. Lesack, who found a 30-centimetre rise in summer water levels of low-elevation lakes over the past 30 years.

"This is not something that's just of pertinence to the Mackenzie Delta. I think what this work indicates is that receding sea ice is going to have a huge effect around the entire circumpolar region," he said.

Dr. Lesack and Dr. Marsh studied a sample of lakes spread across the 13,000 square kilometres of the delta, near the Arctic communities of Inuvik and Tuktoyaktuk, where Canada's longest river, the 4,421-kilometre Mackenzie, flows into the Beaufort Sea.

The lakes there were formed when water pooled on the frozen landscape. Most of the lakes are isolated from the Mackenzie for most of the year, but are "recharged" each spring when the river overflows its banks.

But with Arctic temperatures rising and sea-ice retreating earlier each year, the river ice jams that caused the massive spring floods have begun to diminish.

Despite the reduction in ice-jam floods, however, the researchers found water levels rising in the lower-lying lakes, which were being swamped by river waters for longer periods each year. The flooding of Lake 80, for example, has increased to 138 days from 101 days since 1973. In the same period, Lake 129 has gone from 145 days of flooding to 169 days.

Dr. Lesack said while this has been happening, higher elevation lakes have been experiencing shorter periods of flooding because the Mackenzie hasn't been experiencing as many huge ice-jam floods.

So if the Mackenzie isn't having as many big floods, where is all the extra water in the lakes coming from? Dr. Lesack said the explanation is that ocean storm surges are increasingly backing up water into the Mackenzie, leading to more flooding in the lower lakes. And those storm surges, he said, are increasing as sea ice melts all around the circumpolar region.

Ice acts as a buffer against wind. But with the sea ice melting faster, the increased amount of open ocean has led to more ocean surges into low-elevation areas such as the Mackenzie Delta. "This would have an effect on any low-lying area around the

whole circumpolar coast," said Dr. Lesack, whose research appears to be the first in the world to look at how global warming is affecting water levels in Arctic deltas.

He said the new findings suggest that coastal communities in the North may experience more flooding, sooner than anticipated, that widespread environmental changes could occur in the biologically rich delta, and that oil and gas exploration could be affected because gas extraction causes land to subside, creating a greater flooding threat.

"What is happening in the Mackenzie Delta is of world importance. It is a harbinger of what is likely happening in other circumpolar Arctic deltas, where little is known about the impact of global warming," Dr. Lesack said.

The study, Effects of Global Change on Canada's Mackenzie River Delta, is part of an International Polar Year investigation into changes in Arctic freshwater systems. The paper was featured in a recent issue of Geophysical Research Letters, an international Earth science publication.

SEA CHANGE: A GLIMPSE INTO THE FUTURE OF THE CIRCUMPOLAR ARCTIC

The circumpolar Arctic region is expected to experience massive changes over the next 50 years, driven by two major factors:

Sea-level rise

Ocean warming and glacier melting have contributed to a net rise in sea level around the Arctic. So far, that increase has been small, but any future increases in sea level will likely affect the major river deltas around the circumpolar region first, because they are in low-elevation areas.

River-ice breakup and ice jamming

Peak annual water levels in the major deltas in the circumpolar region are controlled by the effects of ice breakup and jamming. Some researchers have argued that if the Arctic region warms, river ice jamming will be reduced, the flood peaks in rivers will also be reduced and higher-elevation lakes in the deltas may dry up. At the same time, diminished sea ice is causing more storm surges, leading to increased flooding in low areas, such as the Mackenzie Delta.

A significant cause for concern is development plans to extract natural gas and oil from substantial areas of the outer Mackenzie Delta and Beaufort shelf over the next 30 years. ... Risk of coastal flooding in the town of Tuktoyaktuk and other areas affected by oil and gas extraction should be reassessed in light of our new information.