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Dynamics and Change of the Devon Island Ice Cap, Nunavut

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Introduction: This report summarizes field measurements collected by the glaciology group from the University of Alberta on the Devon Island ice cap in April/May 2010 as part of our ongoing study of the dynamics and change of the ice cap. The work is focused along a north-south transect from near the ice cap summit to its southern margin, and on the Belcher Glacier, a major tidewater outlet glacier in the northeast of the ice cap. The 2010 field campaign was a continuation of activities that commenced in 2004.

Summary of Activities: On the southern transect, we repeated measurements (begun in 2004) of the surface elevation of the ice cap using GPS, and of snow properties using ground penetrating radar (GPR), snowpits and shallow ice cores. We also maintained velocity stakes, and serviced and downloaded data from 3 weather stations that were set up in 2004. We also surveyed GPS/GPR profiles along the length of Belcher Glacier (first measured in 2009). These measurements allow us to track changes in the thickness of the ice cap from year-to-year, and to monitor changes in the extent of summer melting. Comparison with measurements from previous years clearly shows the buildup of ice formed by refreezing of meltwater in surface layers of the ice cap – a result of five unusually warm summers since 2005, during which melting has extended to even the highest elevations on the ice cap. Such conditions have probably not occurred on the ice cap since the late 1950s.

On the Belcher Glacier, we resurveyed our network of 37 velocity stakes using GPS methods, serviced our 3 weather stations and 6 continuously recording GPS sensors, which provide information about changes in the rate of flow of the glacier in the summer melt season. These have now been running for three years and show us clearly how the glacier speeds up when summer melting begins. 3 time lapse cameras were set up overlooking the glacier terminus to monitor the glacier's flow, breakoff of icebergs, and the breakup and removal of sea ice in the fjord beyond the glacier terminus. They also show how the extent and location of the meltwater plume that emerges from beneath the glacier changes as the melt season progresses. A clear picture is emerging of how iceberg calving occurs at Belcher Glacier. Small icebergs calve regularly along the whole glacier terminus but calving of large tabular bergs is confined to the southern part of the terminus. Here, the glacier seems to be floating and the meltwater plume emerges. The glacier's flow speed seems to vary quite a lot in response to changes in how much water drains into the glacier and how big the meltwater plume is. The biggest iceberg calving and terminus retreat events are also linked to periods of high runoff and fast glacier flow, suggesting that meltwater draining into the glacier can float the terminus and trigger tabular iceberg production.

NRI -ᑯᓐᓄᑦ ᐊᕐᕌᒍᑕᒫᖅᓯᐅᑎ ᐅᓂᒃᑳᖅ (ᑎᓯᐱᕆ 2010-ᒧᑦ)
ᖃᐅᔨᓴᕈᓐᓇᐅᑎ ᓚᐃᓴ ᓇᒪ 02 067 10N-M

ᐱᖁᓯᖏᑦ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖏᓪᓗ ᑕᓪᓗᕈᑎᐅᑉ ᕿᑭᖅᑕᖓᓂ ᓯᕿᒥᑦ, ᓄᓇᕗᒥ

ᒫᑎᓐ ᓭᑉ, ᓄᓇᓕᕆᔩᑦ ᓯᓚᓐᓂᐊᖅᐱᓪᓗ, ᐃᐊᓪᔫᑕᒥᐅᑦ ᓯᓚᑦᑐᒃᓴᕐᐱᔪᐊᖓᓂ

ᓄᓇᒥ ᖃᐅᔨᓴᕆᐊᓚᐅᖅᑐᑦ 2010-ᒥ: ᒫᑎᓐ ᓭᑉ, ᒋᐳᕆᐊᓕ ᒐᔅᑳᓐ, ᐳᕌᑦ ᑖᓄᓪᓴᓐ, Hᐊᓇ ᒥᓪᓐ (ᐃᐊᓪᔫᑕᒥᐅᑦ ᓯᓚᑦᑐᒃᓴᕐᐱᔪᐊᖓᓂᑦ); ᐆᓪᓗᐃ ᓄᓇᒦᑎᓪᓗᒋᑦ: 26 ᐃᐳᓗ - 26 ᒪᐃ, 2010-ᒥ.

ᐱᒋᐊᖓᓚᐅᕈᓯᖓᓂᑦ: ᑖᓐᓇ ᐅᓂᒃᑳᓕᐊᕗᑦ ᖃᓄᐃᑦᑑᓂᖓᓂᒃ ᓄᓇᒥ ᐆᒃᑐᕋᕆᐊᖅᑐᖅᓯᒪᓪᓗᑕ ᑲᑎᓯᒪᑎᓪᓗᒋᑦ ᓯᕐᒥᓂᒃ ᖃᐅᔨᓴᖅᐲᑦ ᐃᐊᓪᔫᑕᒥᐅᑦ ᓯᓚᑦᑐᒃᓴᕐᐱᔪᐊᖓᓂᑦ ᑕᓪᓗᕈᑎᐅᑉ ᕿᑭᖅᑕᖓᓂ ᖁᑦᑎᒃᑐᒥᐅᓂ ᐃᐳᓗ/ᒪᐃᒥᓗ 2010-ᒥ ᐃᓚᐅᖃᑕᐅᓪᓗᑕ ᐊᖏᓂᖅᓴᒥ ᖃᐅᔨᓴᕈᑕᐅᔪᒥ ᐱᖁᓯᖏᓐᓂᒃ ᓯᕿᒥᑦ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖏᓐᓂᓗ. ᐱᓕᕆᕝᕕᒋᓚᐅᖅᑕᕗᑦ ᑕᒫᓂ ᐆᒃᑐᕋᐃᓪᓗᑕ ᐅᐸᖃᑦᑕᓚᐅᖅᑕᕗᑦ ᓯᕿᒥᐊᓘᑉ ᖄᖓᓂ ᑕᓪᓗᕈᑎᐅᑉ ᕿᑭᖅᑕᖓᑕ ᑕᕐᕋᖕᖏᓐᓂᑦ ᓯᕿᓂᖕᖏᓄᑦ ᐊᒻᒪᓗ ᖄᖓᓂᑦ ᑕᐅᓄᖓ ᓯᒡᔪᒧᑦ ᓯᕿᓂᖕᖏᓂ, ᐊᒻᒪᓗ ᐱᐊᓪᓯ ᓯᕿᖓᓂ ᑖᓐᓇ ᑕᐅᓄᖓ ᐅᓕᓐᓂᕐᒧᑦ ᑎᑭᓯᒪᖕᒪᑦ (ᓯᕗᓪᓕᖅᐹᒥ ᐆᒃᑐᕋᖅᑕᐅᓯᒋᐊᓚᐅᖅᑐᖅ 2009-ᒥ). ᐆᒃᑐᕋᖅᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᖅ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖓ ᐊᕐᕌᒍᑕᒫᑦ, ᐅᔾᔨᖅᓱᕋᓱᐊᕐᓗᑎᒃ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖓᓂᒃ ᐊᐅᔭᒃᑯᑦ ᐊᐅᓐᓂᕆᕙᖅᑕᖏᑦ. ᐃᒡᓗᐊᓄᖕᖑᕐᓗ ᐆᒃᑐᕋᐃᖃᑦᑕᓚᖕᖑᔪᑦ ᐅᑭᐅᖑᓚᐅᖅᑐᒥ ᓱᕞᓪᓕᖅᐸᓪᓕᐊᓂᖓ ᓇᓗᓇᖏᒻᒪᑦ ᐊᕐᕌᓂᓂᑕᐃᑦ ᖁᐊᖅᐸᓪᓕᐊᖏᓐᓇᕐᒪᑕ ᖄᖓᓂ - ᑕᓪᓕᒪᓂ ᐅᑭᐅᓂ ᐅᖅᑰᓂᖅᓴᐅᓂᖓᓂ 2005-ᒥᑦ, ᐊᐅᓐᓂᖃᓕᕐᒪᑦ ᖁᑦᑎᓐᓂᖅᓴᒧᑦ. ᑕᐃᒫᑎᒋ ᐊᐅᓐᓂᑰᓯᒪᔪᖅ ᑕᐃᓱᒪᓂᑐᖄ ᐃᓱᓕᓕᖅᑎᓪᓗᒍ 1950ᑦ.

ᐱᐊᓪᓯ ᓯᕐᒥᐊᓗᐊᓂᓕ, ᕿᒥᕈᒋᐊᖅᑐᒃᑲᓐᓂᓚᐅᖅᑕᕗᑦ ᐆᒃᑐᕋᐅᑎᓕᕝᕕᐅᓯᒪᔪᑦ 37 ᓱᒃᑲᓕᓂᖓᓂᒃ ᐃᖏᕋᓂᖓᑕ ᑕᐅᓄᖓ ᓯᓚᒧᑦ ᖁᑉᐸᖅᑎᑕᐅᓯᒪᔪᒧᑦ ĠPS-ᑯᑦ ᐅᒃᑐᕋᖅᑕᐅᖏᓐᓇᖅᓱᓂ. ᐋᕿᒃᓱᐃᒋᐊᖃᓚᐅᖅᑐᒍᑦ ᐱᖓᓱᓂᒃ ᓯᓚᓐᓂᐊᖅᑎᒃᑯᑦ ᐆᒃᑐᕋᐅᑎᖏᓐᓂᒃ ᐊᒻᒪᓗ ᐱᖓᓲᔪᖅᑐᑦ ᑕᐃᒪᖓᓂᑦ ᓂᐱᓕᐅᖅᐸᓪᓕᐊᖏᓐᓇᖅᑐᑦ GPS-ᑯᑦᑕᐅᖅ, ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖓᓂ ᑰᒃᐸᓪᓕᐊᓂᖓᓂᓗ ᐆᒃᑐᕋᐃᖏᓐᓇᖅᑐᑦ ᐊᐅᔭᒃᑯᑦ ᐊᐅᓐᓂᕆᕙᒃᑕᖓᓂᒃ. ᐃᓕᐅᖅᑲᖅᑕᐅᓯᒪᓕᑦᑐᑦ ᐅᑭᐅᓂᒃ ᐱᖓᓱᓂᒃ ᑕᒫᓂ ᓇᓗᓇᐃᖅᓯᔪᑕᐅᔪᑦ ᐊᐅᔭᒃᑯᑦ ᓱᒃᑲᓕᓂᖅᓴᐅᓕᖅᑲᑦᑕᕐᒪᑕ ᓯᕐᒥᐊᓗᒃ ᐊᐅᒃᐸᓪᓕᐊᓂᖓᓂ ᐱᖓᓱᓂᒃ ᐃᓕᓯᓯᒪᓪᒪᑕ ᐊᔾᔨᓕᐅᕈᑎᓂᒃ ᐃᓱᓕᕝᕕᐊᓂ ᓯᕐᒥᐅᓘᑉ ᑲᑕᖃᑦᑕᖅᑐᓂᒃ ᓯᑯᓂᒃ ᐱᖃᓗᔭᓂᓗ. ᓯᒡᔭᖓᓂᓗ ᐃᕗᐊᑦ ᐊᐅᒃᐸᓐᓂᖏᑦ ᑕᒪᐅᖓ ᑲᖏᖅᓱᖓᓄᑦ ᓯᕐᒥᐊᓘᑉ ᐊᑯᐊᖓᓂ. ᓇᓗᓇᐃᔭᐃᒋᓪᓗᑎᒃ ᑕᕆᐅᖑᖏᑦᑐᑉ ᐃᒪᐅᑉ ᐊᒃᑎᒋᓂᖓᓂᒃ ᐃᖅᑲᖓᓂᓗ ᐅᑭᐅᓕᒫᒥ. ᓇᓗᓇᐃᔭᐃᓪᓗᑎᒃ ᓯᕐᒥᐊᓗᖏᒥᑦ ᖃᓄᖅ ᐱᖃᓗᔭᐃᑦ ᑲᑕᖃᑦᑕᕐᒪᖔᑕ ᐱᐊᓪᓯ ᓯᕐᒥᐊᓗᐊᓂᑦ. ᒥᑭᔫᑎᓂᒃ ᐱᖃᓗᔭᓂᒃ ᑲᑕᐃᖃᑦᑕᖅᑐᑦ ᑭᓯᐊᓂᓕ ᐊᖏᔫᑎᐊᓗᐃᑦ ᐱᖃᓗᔭᐃᑦ ᐲᔭᖃᑦᑕᖅᑐᑦ ᓯᑭᓂᖕᖏᓐᓂᑦ ᐃᓱᓕᕝᕕᐊᓂᑦ. ᑕᑉᐸᓂ ᓯᕐᒥᐊᓘᑉ ᐃᓱᐊᓂ ᐳᒃᑕᓕᖃᑦᑕᕐᒪᑕ ᑕᒪᓐᓇᓗ ᐃᒪᖓ ᑕᕆᐅᖑᖏᓐᓂᖅᓴᐅᓪᓗᓂ ᐆᒃᑐᕋᑕᓚᐅᕐᒥᔪᖅ ᖃᓄᑎᒋ ᐅᖓᓯᒃᑎᒋᔪᒧᑦ ᑕᕆᐅᖑᖏᓐᓂᖓ. ᐊᖏᓂᖅᐹᓂᒃ ᐱᖃᓗᔭᓕᐅᖃᑦᑕᖅᑐᑦ ᐃᓱᐊᓂᑦ ᓱᒃᑲᓕᓂᖅᐹᒥ ᐊᐅᒃᐸᓪᓕᐊᓂᖓᓂ, ᑕᐃᒪᓐᓇ ᖃᐅᔨᓚᐅᖅᑐᑦ ᓯᕐᒥᐊᓗᒃ ᐊᐅᒃᐸᓪᓕᐊᓕᕋᖓᑦ ᐅᓄᕐᓂᖅᓴᓂᒃ ᐱᖃᓗᔭᐃᔭᖅᑲᑦᑕᕐᒪᑕ.