Report: Working Group – Ecosystem Response to Changes in Climate in Cold Regimes
21 Sept, 2006 @ 2:15-3:30p

Organizers: Lyons (MCM), Bowden (ARC), Ducklow (PAL), Williams (NWT)
Attendees: 56 signed in and I would guess another ~5 who did not sign in, so ~60

I asked each of the six sites with the most direct interest in "cold" climates to make brief presentations. Bill Frazier (PAL), Mark Williams (NWT), John Magnuson (NTL), Roger Ruess (BNZ), Breck Bowden, John Hobbie and Gus Shaver (ARC), and Peter Doran (MCM), all presented data from their sites demonstrating the impact of climate change and variation affecting changes in the state of H_2O (i.e. snowpack, lake ice, permafrost, glacier ice, sea ice) on the ecosystem structure and function. Frazier showed that climatic warming (6°C in the past decade), especially in the winter, at PAL has decreased sea ice and this has led to changes in biodiversity throughout the ecosystem, but it is extremely dramatic in the sea bird populations. Paleo data indicate there has been nothing like this biodiversity change in the past 700 years. Williams demonstrated how the earlier season snowpack melt at NWT has affected both the timing and quantity of aquatic nutrient fluxes and decreased microbial activity in sub-snowpack soils. Magnuson spoke about the timing of ice on and ice off of lakes throughout the world, especially at NTL sites. The changes of ice off closely follow the timing at the end of the Little Ice Age and the more recent "hockey stick" changes in ~1976. He also emphasized that these historic records are globally important and serve as a time series that correlates to many important decadal scales or less climatic variations such as ENSO, NAO and PO. There are strong coherences between these records and temperature. Ruess (BNZ) talked about the loss of permafrost in central Alaska where permafrost temps are now -2°C but have been increasing at a rate of 0.7°C per decade. He demonstrated the impact of permafrost warming and loss on soil gas fluxes, groundwater flow and chemistry, and changes in vegetation. Bowden, Hobbie and Shaver (ARC) also spoke about the rapid temperature rise in the Arctic and the projections that these increases (0.7°C per decade over the past 3 decades) will continue. This increase should have important impacts on how both nutrients and water are transferred through the ecosystem: as thermokarst develops, increasing ground water-surface water occurs and chemical weathering increases. Doran (MCM) demonstrated that since the late 1980s the temps at MCM have decreased at a

rate of 0.7°C per decade, with the most significant decreases in the austral summer. A warmer summer in '01-02 "pulsed" the hydrologic system and the lake levels, which had been decreasing, refilled to pre 1990s levels. The model predictions at MCM suggest warming over the next 50 years. Glenn Juday (BNZ) also mentioned that warming in central Alaska had led to increased insect damage to trees and fires.

There was only a few minutes left in the workshop after these presentations (due to the delayed start), but a number of potential follow-up activities were mentioned by the group. These include the following:

1. Development of a 40m bore hole installations at these sites in order to monitor soil temperature changes (inter-site monitoring)
2. Development of a synthesis paper on the following:
    A. Site climate responses to ENSO, NAO, PO and/or SAM
    B. Climatic tipping points – radical ecological change brought about by pressed or pulsed climatic change
    C. A more sophisticated documentation of warming and how it has impacted ecosystems at each site
    D. Compiling the ecological impacts driven by the change of state of H_2O at these sites
    E. How has climate affected the migration of eco-types/biodiversity at each site
    F. Document the timing of the response of different snow/ice types (i.e. sea ice, permafrost, glacier ice, snowpack, lake ice) at the sites.

Submitted by
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