GTN-P Monitoring Network: Detection of a 3°C Permafrost Warming in Northern Alaska During the 1990s

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The Global Climate Observing System's permafrost-monitoring called the Global Terrestrial Network for Permafrost (GTN-P) is designed to monitor: (1) changes in the permafrost's seasonal active-layer, and (2) the thermal response of deeper permafrost to climate change. Active-layer monitoring is generally accomplished using automated surface instrumentation, while the thermal state of deeper permafrost is determined through periodic temperature measurements in boreholes. The U.S. Department of the Interior has been contributing to GTN-P with a 21-element deep borehole array in northern Alaska. This is the largest array of deep boreholes in the world currently available for monitoring the thermal state of deep permafrost. Periodic temperature measurements in the DOI/GTN-P boreholes began in the late 1970s, soon after the array was drilled. Near-surface temperature fluctuations across the array were generally small during the 1980s, except for a short cold period during 1983-1984. The situation changed dramatically during the 1990s. Beginning in 1989 (Figure 1), coincident with a large change in the Northern Hemisphere Annular Mode-NAM, temperatures began warming across the array. By 2002 near-surface permafrost temperatures had warmed an average of 3°C (mean-annual) across the array relative to 1989 (Figure 1). During this period permafrost temperatures along the coast warmed 1-2°C while those at some interior sites had warmed 4-5°C. The detected permafrost warming is a response to both air temperature changes and changes in the thickness and duration of the seasonal snowpack.

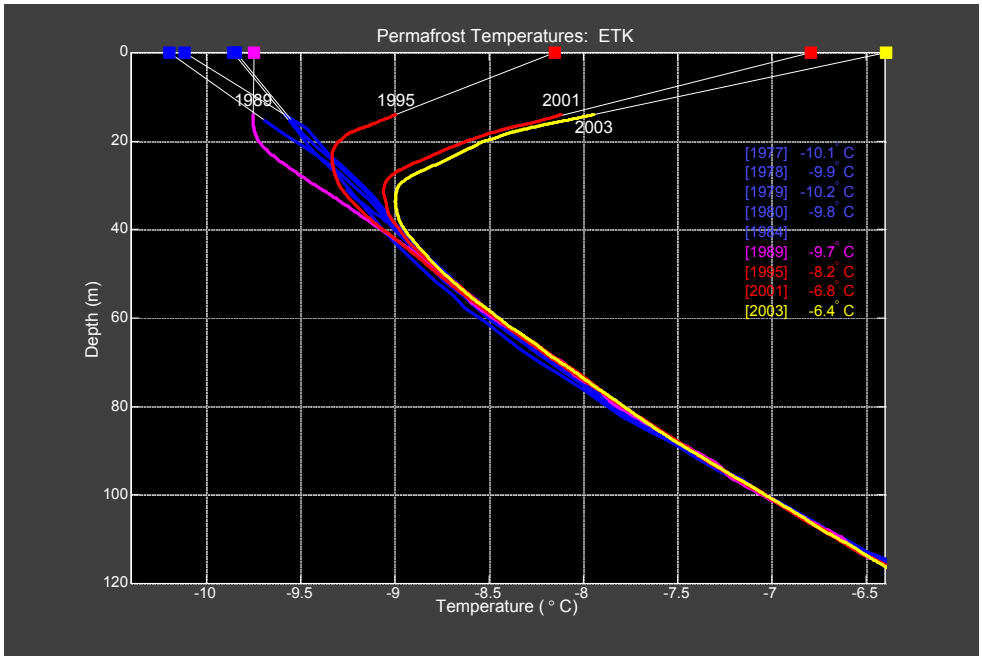

Figure 1. Permafrost temperatures recorded in one of the DOI/GTN-P boreholes (ETK) on the Arctic Coastal Plain since 1977.