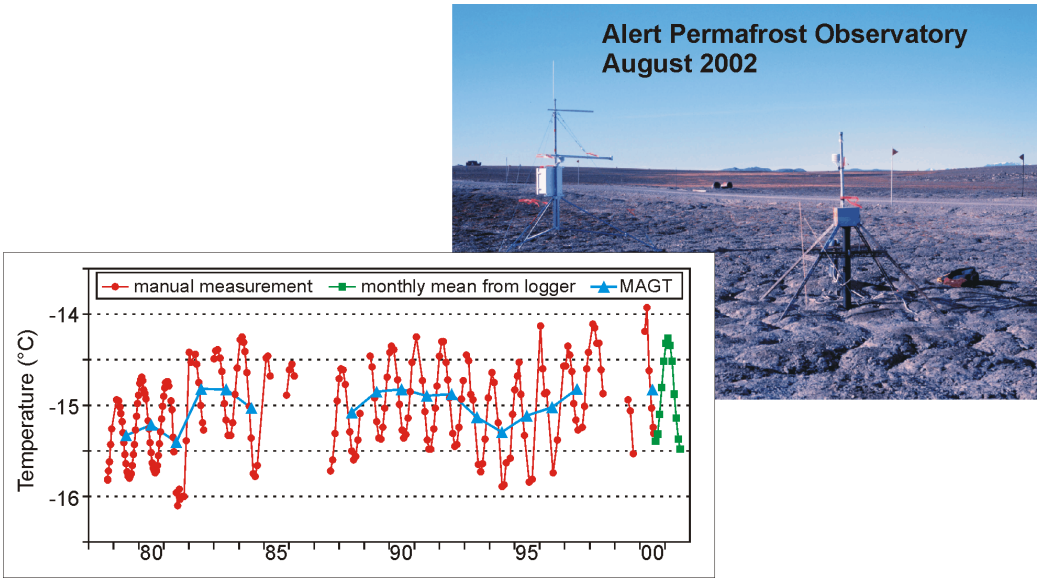
The Global Terrestrial Network for Permafrost (GTN-P)
Status Report - Thermal Monitoring Component



Submitted by

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Introduction

The Global Terrestrial Network for Permafrost (GTN-P) was established in 1999 by the International Permafrost Association (IPA) to provide long-term field observations of active layer and permafrost thermal state that are required to characterize and detect changes in permafrost conditions. The data supplied by the network will enhance our ability to predict the consequences of permafrost degradation and to develop adaptation measures to respond to these changes. The GTN-P contributes to the World Meteorological Organization's Global Climate Observing System and Global Terrestrial Observing System. An overview of the GTN-P is given by Burgess et al. (2000).

Since 1999, the IPA's ad hoc GTN-P committee has made considerable progress in organizing and implementing the GTN-P. This is in large part the result of voluntary efforts as there is no formal over arching funding for the GTN-P implementation. A status report submitted to the IPA Executive Committee in March 2001 at the 1st European Permafrost Conference, reviewed progress in the implementation of the thermal monitoring program of the GTN-P (see Burgess et al. 2001). A brief update on GTN-P status was also presented at Pushchino in May 2002. This report reviews the progress made in the organization of the GTN-P since 2001 and provides additional material to the summaries provided in Frozen Ground 2001 and 2002. This report will focus on the thermal monitoring component. The activities of the active layer component which is represented by the CALM program are not covered here.

Status of the Thermal Monitoring Component

Borehole inventory, site maps and metadata/data compilation

The permafrost thermal monitoring program consists of a globally comprehensive network of boreholes for ground temperature measurements. Many of these boreholes were drilled for research, geotechnical, or resource exploration purposes in the last two decades and have been maintained as thermal monitoring sites. An initial survey identified about 370 boreholes from 16 countries which could contribute to the thermal monitoring system of the GTN-P. Regional networks include those of the Geological Survey of Canada (GSC) in the Mackenzie region, the University of Alaska's Alaskan transect, the United States Geological Survey's deep boreholes in northern Alaska and the European Community's Permafrost and climate in Europe (PACE) program of boreholes largely in alpine permafrost. In addition to these boreholes in the Northern Hemisphere, there are a few sites located in Antarctica and Argentina. An inventory of candidate boreholes and background material on the GTN-P is provided on the web site developed by GSC (www.gtnp.org).

Over the last two years, efforts have focussed on compilation of metadata (site descriptions) for the candidate boreholes. This process has been slower than anticipated, and metadata have been compiled for approximately 70% of the boreholes that were initially identified as candidate sites. Locations of sites in the Northern Hemisphere for which site descriptions are available are shown

in Figure 1. This information has been compiled into a digital database in MS Access format. All site metadata is accessible through the GTN-P web site and will be released as a digital GSC open file report. This information will also be available on the CAPS2 CD.

Sites for which metadata are available are located throughout the permafrost zone of the Northern Hemisphere (Table 1 and Figure 1) with the exception of China for which no borehole information has been received. Six sites are also located in the southern hemisphere in Argentina and Antarctica. The majority of these boreholes are between 10 and 125 metres deep (Figure 2). Boreholes are distributed throughout the continuous, discontinuous and sporadic permafrost zones with the sporadic zone being the least represented. Sites in alpine permafrost are located in Europe, Canada and Argentina.

Table 1. Summary table of boreholes for which site descriptions have been submitted

Location	**Surface <10 m**	**Shallow 10-25 m**	**Intermediate 25-125 m**	**Deep > 125 m**	**Total**
Alaska	2	2	18	15	37
Antarctica	4				4
Argentina	2				2
Canada	5	33	13	5	56
Greenland				1	1
Italy			1		1
Kazakstan		2	1	1	4
Kyrgyzstan				2	2
Mongolia	4	6	3		13
Norway		1		1	2
Russia	1	44	35	47	127
Spain		3	1		4
Svalbard		2	1		3
Sweden			2		2
Switzerland		1	4		5
Total	18	94	79	72	263

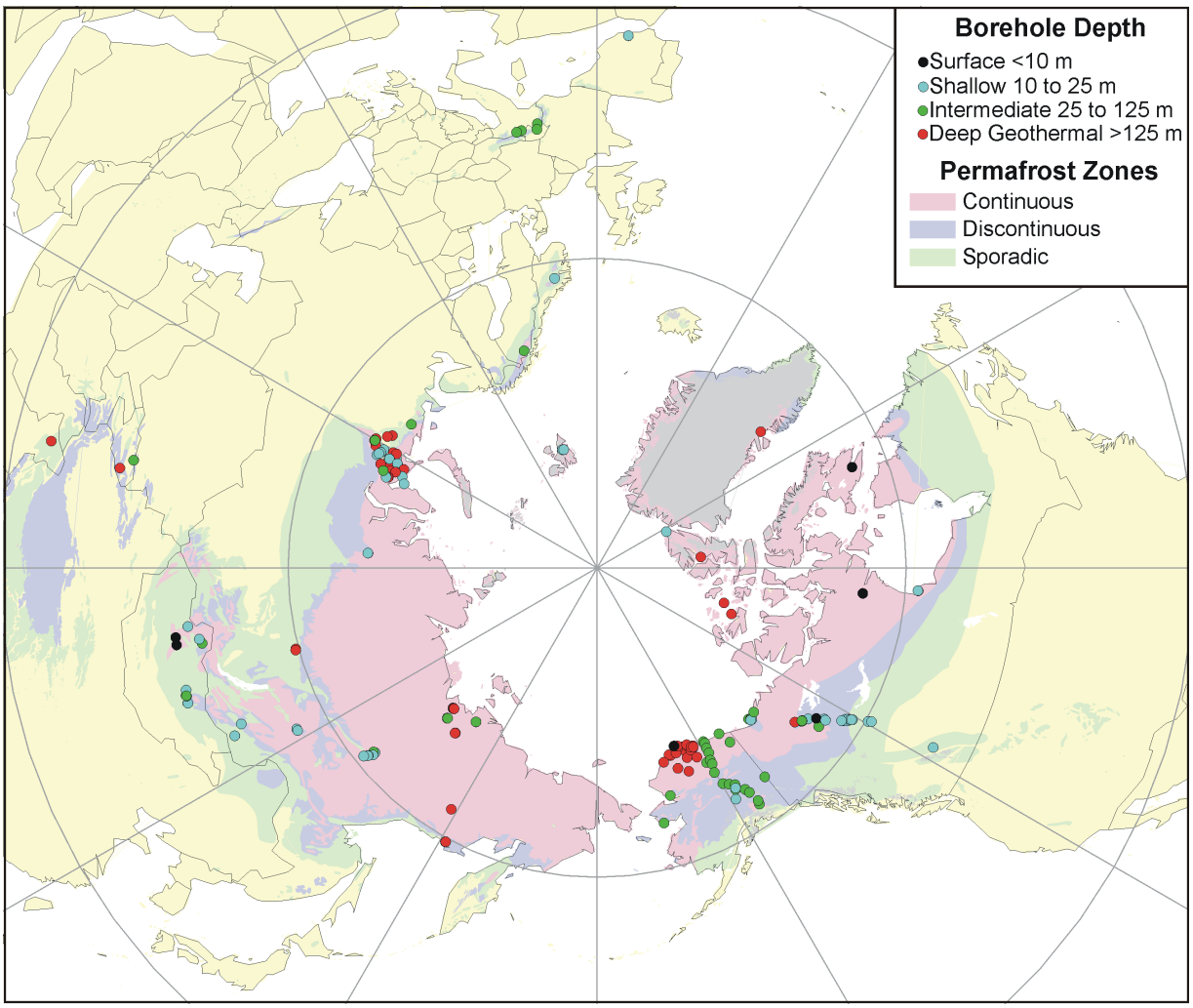

Figure 2. Location of boreholes for which site descriptions (metadata) have been submitted (compiled by S. Smith, Geological Survey of Canada, July 2003).

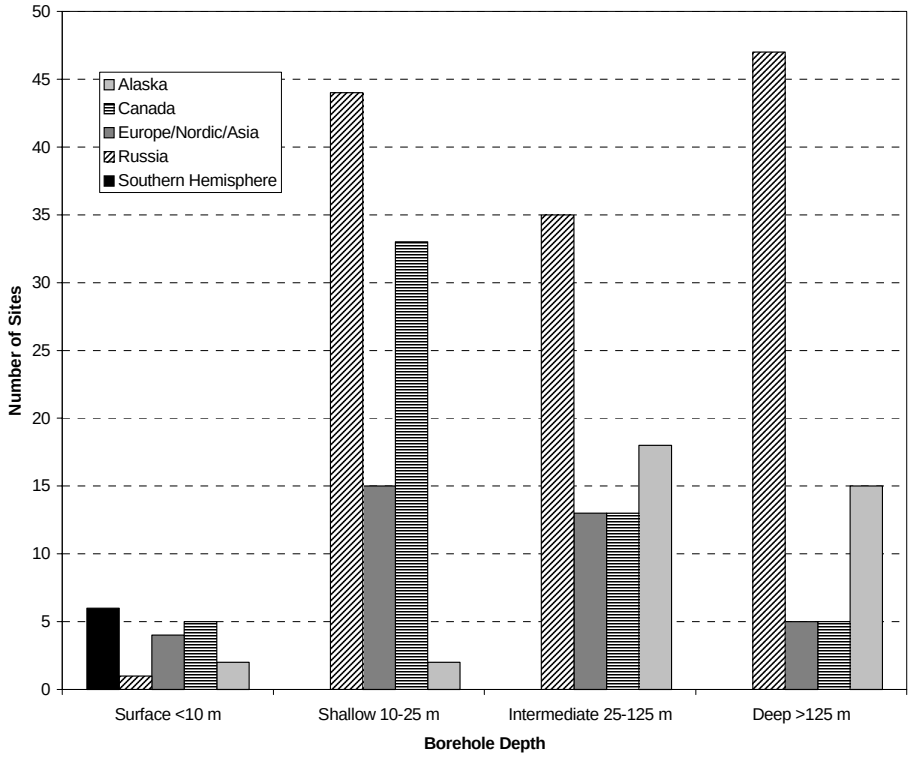

Figure 3. Distribution of boreholes for which site descriptions have been submitted.

Development of the database structure has been initiated with the site description component completed in draft form. Historical data from Canadian monitoring sites are being compiled into this relational database format to test the structure and manipulation routines. Data from other sites have also been submitted and historical database compilation for all sites will take place over the next year. Continued submission of data on an annual basis where possible from network sites will take place similar to that for the CALM network to build up a long-term database of permafrost thermal data. Summary data will be available through the GTN-P web site. The data submission/dissemination component is currently under development.

It is proposed that investigators submit monthly data for sites (especially shallow sites) which have higher frequency data collection. This will facilitate the calculation of maximum, minimum and mean temperature and definition of the temperature envelope. Available temperature logs will be submitted for those sites with recording intervals at frequencies less than monthly. All processing and quality control will be done by the investigators.

The GTN-P organizing committee met a number of times over the last two years. This included meetings in Rome (March 2001), during the European Permafrost Conference, in Boulder (January 2002 and February 2003) and Delaware (November 2002) at the CALM workshop. The

next meeting will occur at the 8th International Conference on Permafrost. Plans and time lines for summary reports and regional assessments will be developed.

Related Recent Activities

Second Adequacy Report of the Global Climate Observing System

The significance of cryospheric observations was emphasized in the preparations for the Second Adequacy Report of the Global Climate Observing System (GCOS) Committee to the United Nations Framework Convention on Climate Change. These contributions were organized under GCOS/GTOS and its Terrestrial Observations Panel for Climate (TOPC). W. Haeberli presented revisions to the permafrost variables at the TOPC meeting in June 2002. S. Smith, J. Brown and M. Burgess provided the permafrost contribution to the report on 'Glaciers and ice caps, Snow cover, and Permafrost' to be included in Annex 1 to the second Adequacy Report on atmospheric, oceanic and terrestrial observing networks.

Initial results from GTN-P published in EOS

In December 2002, a paper was published in EOS (Romanovsky et al. 2002) that provided an overview of the GTN-P and a summary of observed recent changes in permafrost temperature throughout the permafrost zone of the northern hemisphere. Initial results from the refurbished permafrost observatory at Barrow Alaska were also highlighted. In addition, the paper discussed the applications of the data provided by the GTN-P including the provision of crucial information to politicians and decision makers for the evaluation of climate change impacts and the development of adaptation measures.

Canadian Permafrost Monitoring Network

In 2001, the Geological Survey of Canada (Smith and Burgess PIs) received funding for four years from the Government of Canada's Action Plan 2000 to develop and implement the framework and infrastructure for a national permafrost monitoring network. This initiative will allow Canada to meet its obligations to provide systematic cryospheric observations under GCOS and to contribute to the GTN-P. A data management system is currently under development for the Canadian network which will also serve as the model for the GTN-P and is expected to be operational within the next year.

The GSC is collaborating with Environment Canada to integrate snow and permafrost monitoring sites. Automated weather stations with acoustic snow sensors were installed at five boreholes in summer 2002 and an additional five will be installed in summer 2003.

Joint Canada-Denmark DFAIT funded project

In March 2001, Margo Burgess and Sharon Smith of GSC and Hanne Christansen of Institute of Geography, University of Oslo and the IPA Secretariat, received funding from the Canadian Department of Foreign Affairs and International Trade for a Canada-EU Northern Science and Technology Project: "Compilation and documentation of variations in permafrost conditions in Greenland and the adjacent Canadian Arctic, a contribution to the Global Terrestrial Network for Permafrost". This initiative allowed the compilation of historical permafrost thermal data for Greenland which contributes to the Global Geocryological Database and the GTN-P. Data were compiled for boreholes at Paaktisoq, Illulissat, Kangerlussuaq and Sisimiut. In addition, boreholes were identified that could contribute to the GTN-P. A borehole at Paakitsoq was determined to be the best candidate and the Greenland Geological Survey in Nuuk has agreed to include this borehole and its data in the GTN-P. This borehole is 250 m deep and was in operation between 1985 and 1992 and reactivation is planned for summer 2003.

Analysis of permafrost temperatures along with climatic data from Canadian Arctic (includes sites at Alert and Iqaluit) and Greenlandic sites is in progress which will allow documentation of the spatial variation in temporal trends in permafrost conditions in this region. A scientific paper documenting these trends is planned and this synthesis will also contribute to a summary report planned for the GTN-P in 2004.

Barrow Permafrost Observatory

In April 2002, Vlad Rominovsky and Kenji Yoshikawa of the University of Alaska Fairbanks and Jerry Brown, added two 45 m boreholes to the Barrow permafrost observatory. This observatory was established to compare present permafrost temperatures with those obtained at the same site during the 1950s and early 1960s by Max Brewer. Initial results from this site appeared in EOS (see above).

European Permafrost Monitoring Network and PACE

The European Permafrost Monitoring Network established under the EU 4th Framework PACE project continues Under PACE21 (Permafrost and Climate in the 21st Century) to provide permafrost thermal data for a transect extending from Svalbard through Scandinavia, to the Alps and Sierra Nevada. Results from the first phase of this project were presented at the 1st European Permafrost Conference and in a special issue of Permafrost and Periglacial Processes. Metadata and permafrost temperature data for these sites has been submitted to the GTN-P.

Contributors and Acknowledgements

V. Romanovsky (University of Alaska, Fairbanks) and J. Brown (IPA) are members of the organizing committee of the GTN-P with S. Smith and M. Burgess. Assistance with metadata compilation, database development and web site development has been provide by D. Riseborough and J. Chartrand.

References

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GTN-P Web site: www.gtnp.org
CALM Web site: http://k2.gissa.uc.edu/~kenhinke/CALM/