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Permafrost Conferences and Observing Networks: Contributions to International Co-Operation and Monitoring

by Jerry Brown

INTRODUCTION

PRIOR TO 1963, FORMAL MULTINATIONAL CO-OPERATION related to permafrost research and engineering was extremely limited, particularly with the former Soviet Union. Access to Soviet institutions and literature relied predominantly on publications documented by the U.S. Library of Congress in its Bibliography on Cold Regions Science and Technology (Yerg, 1951). Permafrost-related citations continue to be added to the COLD bibliographic database at the American Geosciences Institute (<https://www.coldregions.org>).

Multinational communications were greatly facilitated with the First International Conference on Permafrost (ICOP), which was held in November 1963 at Purdue University, West Lafayette, Indiana. The conference was the first formal international gathering of scientists and engineers working on permafrost and had representation from 12 countries. There were three Soviet participants and 17 published Soviet papers in the proceedings. The conference was the formal start of multinational permafrost co-operation and exchange of information.

Another permafrost-related international activity in the 1960s was led by the International Geographical Union Commission on the significance of periglacial phenomena: in summer 1969. This commission held a conference in Yakutsk, Siberia, that was attended by 50 foreign participants. The conference included a memorable field excursion on the Lena and Aldan Rivers and a viewing of the expansive ice-rich and loess-like Yedoma deposits. The conference was facilitated by academician P.I. Melnikov and was a de facto dress-rehearsal or dry run for the more complex Second ICOP, which took place in Yakutsk in 1973.

This paper describes activities and accomplishments of past ICOPs and the implementation of long-term monitoring programs. It is anticipated that these continuing activities and accomplishments will contribute to the planning of and contributions to International Polar Year 2032–33.

PERMAFROST CONFERENCES

International conferences on permafrost provide opportunities to report recent research results. They are also a forum for coordinating and reporting long-term observations of key permafrost indicators and their changes as part of the Global Terrestrial Network Permafrost (GTN-P). These conferences bring together international scientists and engineers and, more recently, an increasing number of early-career researchers.

Twelve ICOPs have been held between 1963 and 2024: three each in Canada and the United States, two in Russia, and one each in China, Germany, Norway, and Switzerland. A total of 4153 individuals from 45 countries have participated. Starting in 2001, there have also been regional conferences in nine countries.

Following the first conference in 1963 at Purdue University, the second conference was convened in Yakutsk in 1973, organized by P.I. Melnikov, director of the Melnikov Permafrost Institute of the Russian Academy of Sciences in Yakutsk, Siberia. That conference had 400 participants from 16 countries. Two volumes of its proceedings were published by the U.S. National Research Council.

The Third ICOP was convened in 1978 in Edmonton, Alberta, and included a Chinese delegation. Translations of Russian and Chinese papers were published by the National Research Council of Canada.

The International Permafrost Association (IPA) was formally organized in 1983 during the Fourth ICOP held in Fairbanks, Alaska. Since then, both the ICOPs and regional permafrost conferences have been organized under the auspices of the IPA. A summary of the first eight conferences was published by Brown and Walker (2007), followed by reports of the 2008, 2012, and 2016 conferences (Brown et al., 2008; May et al., 2012; Brown and Stanilovskaya, 2014; Schollaen et al., 2017). A 50-year history of international co-operation with Soviet and Russian permafrost colleagues was presented at the Tenth ICOP in 2012 in Salekhard, Russia (Brown, 2012).

The recent four-year cycle of international conferences was interrupted by the COVID-19 pandemic, which caused the cancellation of the proposed 2020 ICOP in China. Instead, a virtual regional conference was convened by the IPA in 2021, organized by the University of Colorado, Boulder. The Twelfth ICOP was held in Whitehorse, Yukon, in June 2024. Because of the Russian invasion of Ukraine and related sanctions, Russian participation was limited to several virtual participants and some graduate students working in Western countries. Few Chinese delegates attended because of difficulties in obtaining visas.

The focus of this report is international co-operation, including the three most recent international conferences, regional conferences, and the status of related international monitoring programs. These programs include measurements of permafrost temperature, active layer thickness, and rock glacier velocity. I also talk about related programs on coastal processes and carbon fluxes.

Starting in 2001, regional permafrost conferences have been held in nine countries. The regional permafrost conferences provide additional opportunities for both local and international participation and coordination. These are generally convened at two-year intervals between the international conferences. Starting in 1992, conferences on soils and permafrost were held in Pushchino, Russia; they provided an added venue for international participation and co-operation. The May 2025 conference restarts the series after the pandemic.

Several IPA-related activities contributed to the 2007–08 International Polar Year and were reported at the 33rd International Geological Conference in Oslo, Norway, and at follow-up venues (Brown et al., 2008; Brown, 2010). The IPA coordinated an assessment of worldwide thermal state of permafrost that was reported in a special issue of *Permafrost and Periglacial Processes* (Romanovsky et al., 2010).

As further historical background, a poster presented at the Twelfth ICOP documented attendance since the 1963 conference and identified known participants who had since died (Brown et al., 2024). A recent paper co-authored by 30 permafrost specialists from 11 countries provides an update on permafrost science and engineering developments in response to climate warming for the period 2019–24 (Burn et al., 2024). The article covers 20 thematic areas of geocryology that are increasing our understanding of the substantial consequences of a warming climate on permafrost environments ranging from circumpolar lowlands to high mountains around the world.

ICOP VENUES AND PARTICIPATION

Table 1 provides information on the content and attendance at all 12 ICOPs. Conference proceedings containing refereed papers or abstract volumes of all ICOP and regional conferences can be viewed and downloaded from the IPA website (The International Permafrost

Association, n.d.). Starting in 1989, the IPA newsletter *Frozen Ground* published additional conference details, including summaries of both the IPA council and executive committee meetings. All issues of *Frozen Ground* are also archived on the IPA website.

Depending on location, attendance numbers and the composition of nationalities at ICOPs have varied significantly. The largest participation was at the Fourth ICOP in Fairbanks in 1983, which was a time of great interest in northern industrial development. A very strong attendance was also registered in 2016 for the Eleventh ICOP in Potsdam, Germany, in part because of its accessibility. Additionally, the largest number of countries (36) were represented at that ICOP, which generated a correspondingly large number of posters and abstracts. As an indication of the sustained international interest in permafrost, the Twelfth ICOP continued the outstanding attendance numbers (over 600 people) from a relatively large number of countries (28).

The content and format of each international conference is the responsibility of the organizing country, and publications have varied from abstracts only to volumes with both state-of-the-art review papers and individual peer-reviewed papers. Poster presentations provide opportunities to present current and in-progress research. Field trips, both local and extended, are an integral part of the conferences and offer visiting participants the opportunity to observe characteristic regional permafrost, periglacial, and engineering conditions, as well as take part in cultural activities. Field-trip guidebooks provide a lasting record of regional permafrost conditions.

In recent years, conference content has increased awareness of the impacts of climate change. The following section highlights content from the past three international conferences.

RECENT ICOPS

The Tenth ICOP was held in Salekhard in the Yamal-Nenets autonomous district, West Siberia, 25–29 June 2012 (May et al., 2012). This ICOP recognized and marked the evolution of the previous 50 years of co-operation between Russian and other international researchers and institutions by making that the topic of the opening plenary session (Brown, 2012). Of the 522 conference participants, 287 were Russians, and 150 participants represented the Permafrost Young Researchers Network (PYRN). The two-volume proceedings were the results of a collaborative effort between the organizing committees from the United States and Russia. Volume one contained 82 English-language papers from 13 countries (Hinkel, 2012). Volume two contained 106 Russian papers that were reviewed and translated in Russia and subsequently edited in North America (Melnikov, 2012). Final edited, camera-ready copies of both volumes were prepared at the University of Alaska, Fairbanks. Three companion volumes of extended

TABLE 1. Summary of the first 12 International Conferences on Permafrost.

Conference	First	Second	Third	Fourth	Fifth	Sixth
Year	1963	1973	1978	1983	1988	1993
Location	United States	USSR	Canada	United States	Norway	China
Chair	K.B. Woods	P.I. Melnikov	R.J.E. Brown	T.L. Péwé	K. Flaate	C. Guodong
Participants	285	400	452	851	305	275
Countries present	9	16	13	24	19	21
Plenary sessions	All	All	10	8	5	6
No. of contributors	100	258	139	158	289	127
Posters	0	0	15	109	37	57
Local field trips	0	3	0	7	1	1
Extended field trips	0	6	3	5	5	2
Number of volumes	1	2	3	2	3	2
Number of pages	563	1,649	1,110	1,937	1,620	1,360
Number of papers	104	277	147	276	287	189
Abstract volumes	0	1	1	1	0	1
Field-trip guidebooks	0	6	6	6	2	2
Conference	Seventh	Eighth	Ninth	Tenth	Eleventh	Twelfth
Year	1998	2003	2008	2012	2016	2024
Location	Canada	Switzerland	United States	Russia	Germany	Canada
Chair	D. Hayley	W. Haeberli	D. Kane	V.P. Melnikov	H-W. Hubberten	L. Arenson
Participants	268	296	685	552	753	605 (133 virtual)
Countries present	25	24	31	24	36	28
Plenary sessions	4	6	7	7	9	4
Numbers of contributors	188	230	358	260	306	232
Posters	59	88	187	350	532	263
Local field trips	1	1	21	5	12	8
Extended field trips	5	3	5	4	3	3
Number of volumes	1	1	2	3	0	2
Number of pages	1276	1322	2100	1728	1276	507
Number of papers	188	230	358	189	846	64
Abstract volumes	1	1	2	2	1	1
Field-trip guidebooks	0	4	4	4	0	3

abstracts and four field-trip guidebooks were prepared by the Russian organizers. All publications were printed by the Northern Publisher, Salekhard, Russia.

The Eleventh ICOP was convened in Potsdam, Germany, 20–24 June 2016 (Schollaen et al., 2017). A total of 753 participants from 36 countries attended the conference, including 92 Russians, many of whom were involved in bilateral programs with Germany (Hubberten et al., 2018), the United States, and other countries. More than 150 members of PYRN attended a pre-conference workshop. The formal sessions included nine plenary speakers, 67 technical sessions, and 30 poster sessions. The proceedings volume (1276 pages long) contained 532 extended abstracts. Twelve local field trips and three post-conference trips were included in the conference activities. A database of participants in prior conferences was presented, and copies were made available (Brown et al., 2016).

The most recent international conference, the Twelfth ICOP, was held in Whitehorse, Yukon, Canada, 16–20 June 2024. It was attended by 605 people, including 133 online participants representing 28 countries. Over the four days, there were four keynote presentations, nine concurrent sessions, five poster sessions (including two virtual poster sessions), eight local field trips, and three pre- and post-conference extended field trips. Two volumes of proceedings, one with 64 reviewed papers and the other with 429 extended abstracts, were published online. Three field-trip guidebooks covered excursions in the Yukon and the western Canadian Arctic. Some informal field guides were also prepared for the local field trips. Russian attendance was limited to four virtual participants, with Russian publications including seven first-authored papers and 12 co-authored papers. The modest participation by Russian scientists and engineers was a direct response to restrictions resulting from the Russian invasion of Ukraine.

Attendance restrictions stemmed from a 2023 IPA council motion resolving that relations between the IPA and the Russian adhering body be paused until the International Union of Geological Sciences or other agencies have re-established their professional engagement with Russia, at which point the IPA council may consider similar restoration of relations with the Russian adhering body.

During the 2024 ICOP, a poster listing ICOP participants by country was displayed in a prominent location (Brown et al., 2024; IPA, n.d.). For an example of attendance prior to 2024, six participants attended nine conferences, six others attended eight conferences, and six more attended seven conferences. The poster also included the names of the known deceased. Of the approximate 3684 participants at all prior conferences, at least 283 from 19 countries were known to have died. Canada, the United States, and Russia had the most participants known to have died between 2016 and 2024: 23, 23, and 26, respectively.

REGIONAL CONFERENCES

Regional IPA-supported permafrost conferences began in 2001 and have since taken place at two-year intervals between the ICOPs. The first European Conference on Permafrost (EUCOP) was convened in Rome and had more than 120 attendees from Europe, Russia, North America, South America, Japan, China, and South Africa. Its major emphases were on the initial results of the Permafrost and Climate Change in Europe program and mountain permafrost. Of the ten regional conferences, six have been EUCOPs; they were convened in Germany, France, Norway, Portugal, Spain, and Svalbard. Additional venues included locations in China, Japan, New Zealand, and the virtual conference hosted from the United States during the COVID-19 epidemic.

Venues and attendance statistics for recent regional and international permafrost conferences are presented in Table 2. Details of these conferences are reported in *Frozen Ground* and their abstract volumes are available on the IPA web site (IPA, n.d.). The 2018 EUCOP5, held in Chamonix, France, provided opportunities for robust attendance by

Russians. The 2021 virtual conference was convened by the University of Colorado, Boulder, and included the publication of 34 refereed papers by the American Society of Civil Engineers under the title *Merging Permafrost Science and Cold Regions Engineering* (Zufelt, 2021).

As noted, Russian participation in European-based conferences generally has been more robust because travel arrangements are more convenient and cost-effective than travel to North America, Asia, or the Southern Hemisphere.

The Third Asian Conference on Permafrost, scheduled for Mongolia in June 2026, presents a promising opportunity for dialogue among all members of the permafrost communities.

PERMAFROST-RELATED OBSERVING NETWORKS

Several circumpolar international observing networks provide long-term observations of key permafrost parameters. The records for active layer thickness and permafrost temperature have been recorded for the longest period of time.

The GTN-P is an international program focused on the monitoring of permafrost parameters. GTN-P was developed in the 1990s by the IPA under the Global Climate Observing System (GCOS) and the Global Terrestrial Observing System programs. The original long-term goal was to obtain a comprehensive view of the spatial structure, trends, and variability of changes in active layer thickness and permafrost temperatures (GTN-P, 2025).

The GTN-P consists of three contributing databases: the thermal state of permafrost (TSP), the Circumpolar Active Layer Monitoring (CALM, 2025), and rock glacier velocity (RGV). These observations are defined as essential climate variables.

TSP measures and reports annual permafrost temperature from an extensive international borehole network that in 2024 included 23 participating countries and Antarctica.

CALM measures the annual thaw thickness over the underlying permafrost (Nelson et al., 2021). The CALM network includes observation sites throughout the

TABLE 2. Attendance at international and regional permafrost conferences since 2012.

IPA Conference	Location	Year	Total	Russians
Tenth ICOP	Salekhard, Russia	2012	522	286
Fourth RCOP	Évora, Portugal	2014	450	18
Eleventh ICOP	Potsdam, Germany	2016	753 (739)	91
Second Asian	Sapporo, Japan	2017	178	23
EUCOP5	Chamonix, France	2018	460	84
SouthCop	Queenstown, NZ	2019	115	3
Virtual RCOP	Boulder, USA	2021	416	7
EUCOP6	Puigcerdà, Spain	2023	450	18
Twelfth ICOP	Whitehorse, Canada	2024	605	4 virtual

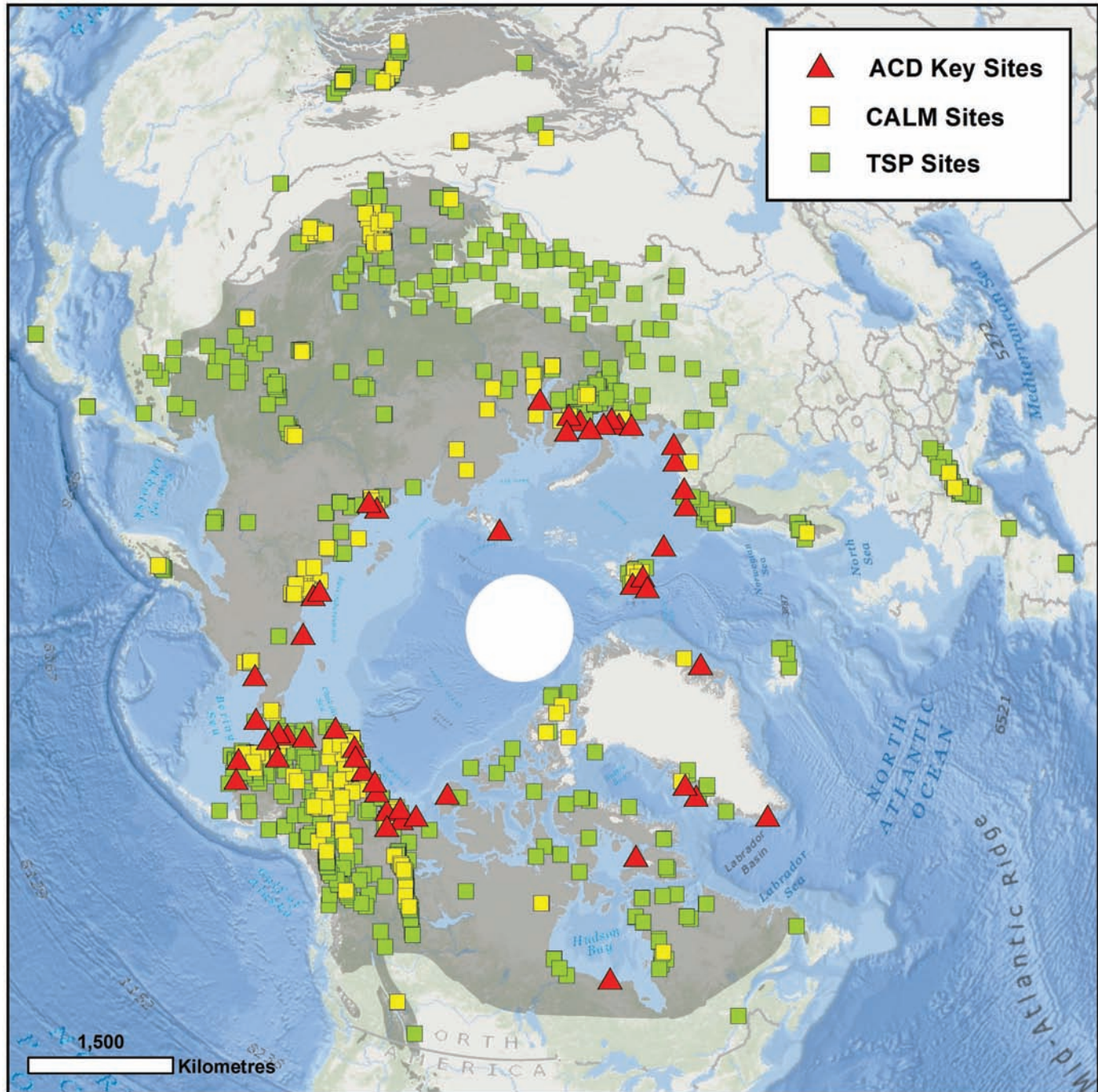


FIG. 1. Locations of existing international sites for CALM, TSP, and former Arctic Coastal Dynamics program. Credit: Ben Jones.

circum-Arctic region plus a substantial number of sites in Antarctica. Up to 2024, data from 65 sites from five countries and Antarctica have been reported.

RGV measures the movement of permafrost terrain in mountains as a time series of surface velocity values and depends on shifts in ground temperatures (Hu et al., 2025).

Participating GTN-P countries provide annual data submissions. Annual summaries for the thermal state of permafrost and active layer thickness have been reported in *State of the Climate in 2023: The Arctic* (Druckenmiller et al., 2024; Smith et al., 2024). International GTN-P coordination is

facilitated by the secretariat at the Alfred Wegener Institute, Potsdam, Germany, which conducts annual meetings and maintains an updated website providing access to data (Streletskiy et al., 2021). At the annual GTN-P meeting in November 2024, data were reported by 15 countries. In the United States, CALM and TSP were supported by grants from the U.S. National Science Foundation. Figure 1 shows the locations of existing international sites for CALM and TSP and sites of the former Arctic Coastal Dynamics program (Rachold et al., 2003).

The Permafrost Carbon Network, launched in 2011, includes a series of meetings and working groups designed to synthesize results of ongoing permafrost carbon research. These activities are quantifying the role of permafrost carbon in driving climate change in the 21st century and beyond. There are more than 500 members from 130 research institutions located in 21 countries. Annual workshops are held prior to the American Geophysical Union Annual Meetings (Permafrost Carbon Network, 2025). The most recent status of Arctic terrestrial carbon cycling, including Alaskan permafrost temperatures, was reported in the 2024 Arctic Report Card (Natali et al., 2024).

An international network with a focus on coastal erosion was initiated in the early 2000s under the Arctic Coastal Dynamics program and based on a 1999 workshop (Brown and Solomon, 2000). Publication of a series of annual workshops provided documentation and rates of erosion at multiple Russian, Canadian, and U.S. sites (Rachold et al., 2003). The Permafrost Coastal Systems Network is a more recent international activity concerned with erosion and other changes on permafrost coasts (Permafrost Carbon Network, 2025).

CLOSING COMMENTS

The international and regional conferences on permafrost provide continuing opportunities for presenting

research results and developing further in-person coordination. Compilations of GTN-P observations will remain the primary source of data that measure the response of permafrost to climate change on the global scale. These data will include results to be presented at the Thirteenth ICOP (2028) in Florence, Italy, and future regional conferences. It is hoped that international collaboration with Russian colleagues will resume once international tensions are eased, and that relevant long-term monitoring results and field observations will be included in updated international inventories. Both TSP and CALM were important programs of the Fourth International Polar Year (Brown et al., 2008) and should be included in planning for the Fifth IPY in 2032–33.

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