IPA Action Group Application 2025

Title of proposed Action Group:

Integrated ground ICE data initiative (InICE)

Action Group Principal Investigator (PI):

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Objectives and scope of the Action Group:

Ground ice is a fundamental component of the permafrost system, playing a critical role in regulating thermal energy storage, eco-hydrological processes, ground stability, freshwater security, and climate feedback mechanisms. Despite its significance, the spatial distribution of underground ice remains poorly understood due to limitations in measurement technologies, data availability, and predictive modeling. This gap in knowledge poses challenges to advancing permafrost research and understanding its dynamics in a changing climate. The current scarcity of comprehensive ground ice datasets underscores the urgent need for harmonized regional and global-scale data compilation and mapping efforts.

The InICE Action group aims to address these challenges by: (i) Collecting and integrating ground ice measurement data. (ii) Mapping the spatial distribution of near surface ground ice to enhance understanding of its variability. (iii) Establishing a collaborative networking platform to promote cross-regional and international cooperation. Through these efforts, InICE seeks to support the goals of the IPA by producing scientifically valuable datasets and fostering collaboration among researchers from diverse disciplines and regions.

Building on prior data compilation and mapping efforts (e.g., Zwieback & Meyer, 2021; Saito et al., 2021; Karjalainen et al., 2022; Fu et al., 2022; Zou et al., 2024; Aga et al., 2023; Zwieback et al., 2024), InICE will further extensive data collection and compilation, then incorporate cutting-edge comprehensive approach that integrates data, mechanistic, and knowledge to mapping near-surface ground ice map (O'Neill et al., 2019; Ran et al., 2021, 2022; Liu et al., 2023). We will identify ground ice data and potential contributors through existing synthesis efforts, surveys, data repositories, industrial sector, and new literature searches. To reach our goals, we will (i) promote the Action Group's activities at key conferences and within the IPA communication network, (ii) team up with existing databases and data collections (like GTN-P

and APGC) and create a centralized platform/add-on to facilitate ground ice data submission, management and dissemination, (iii) Organize online mini-workshops and establish mailing lists to facilitate communication and knowledge sharing. Two dedicated PhD students, Bingquan Wang and Yibo Liu, from the Northwest Institute of Eco-Environment and Resources (NIEER), Chinese Academy of Sciences, will work full-time to integrate datasets, produce a ground ice distribution map, and deliver other project outputs. The students will be supported by the Action Group team, leveraging collective expertise and resources to ensure success.

Timeline:

The timeline of operation of this action group will be for two years (2025 to 2026). The division of work according to the timeline undertaken by the action group is as follows:

03/2025: Action Group started, design data sheets.

04/2025: Advertising the data call at the EGU conference and IPA network (**Milestone 1**)

10/2025: Establish a mailing list for InICE communication.

12/2025: Ground ice survey data collection and compilation, develop a data platform to facilitate data archiving, management and dissemination (**Milestone 2**)

03/2026: Generating a near-surface ground ice content map (**Milestone 3**)

12/2026: Analyze the spatial distribution characteristics of near-surface ground ice content in the Northern Hemisphere and release the datasets (**Milestone 4**)

Deliverables:

The InICE initiative will deliver:

(i) Harmonized ground ice survey datasets and distribution maps.

(ii) Strengthened international collaboration on permafrost ground ice survey and modelling.

By addressing critical data gaps, InICE will not only advance permafrost science but also provide actionable insights for policymakers, researchers, and communities working to mitigate the impacts of permafrost degradation.

Other Action Group Members:

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International dimension:

This project's scientific team comprises internationally dynamic early-career and mid-career experts in geocryology, many of whom have established long-standing collaborative relationships both within the team and with their respective institutions. These active scientists bring innovative approaches and perspectives, as well as a deep commitment to advancing permafrost science. Their collective expertise spans a wide range of disciplines within geocryology, ensuring a comprehensive and interdisciplinary approach to the project's objectives. By combining the energy and creativity of emerging scholars with a solid foundation of experience, the team is well-positioned to make significant contributions to the field. The Action Group is committed to fostering active collaboration with other permafrost data organizations, such as the Global Terrestrial Network for Permafrost (GTN-P) and the National Tibetan Plateau Data Center (TPDC) in China. These efforts aim to improve permafrost data integration, refine monitoring strategies and mapping paradigms, and share datasets and findings to address critical scientific questions.

Budget:

A total budget of €6,000 (€3,000 per year) is allocated primarily to support Action Group members' participation in international conferences and to cover the publication of the database, maps, and summary documents. In Year 1, €3,000 from the IPA will be used to fund the travel

of one Action Group member to attend the EGU conference in Vienna in April 2025. In Year 2, another €3,000 from the IPA will support the travel of one Action Group member to the AGU conference in 2025. Furthermore, we will actively pursue additional funding opportunities to enhance the Action Group's activities and ensure the successful delivery of project outcomes.

Secretarial support:

The Action Group would need administrative support from the IPA Secretariat, including disseminating data initiatives through the IPA network, organizing small online workshops, and hosting side events at EGU. Additionally, we request assistance in preparing and compiling progress reports at the end of the project and for quarterly updates.

References:

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20 November 2024

Attn: Reference letter for Prof Youhua Ran's application for the Action Group of IPA

Dear Executive Committee members,

I am writing to staunchly support Professor Youhua Ran to apply for the 2025–2026 Action Group. Having had the privilege of working alongside Dr. Ran as a colleague at the Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences, and knowing him personally as a close friend, I can confidently attest to his exceptional expertise, dedication, and innovative contributions to permafrost mapping and data integration, and leadership.

Dr. Ran is an accomplished early-career scientist specializing in permafrost mapping studies. Over the years, he has developed extensive expertise, particularly in understanding the spatial distribution of permafrost thermal state, analyzing observational datasets, and advancing mapping methodologies. He has led or participated in numerous projects that utilize field observations, data modeling, and spatial analyses to explore the permafrost distribution and their responses to global change. This work has revealed critical insights into the vulnerability of permafrost to climate change and its interactions with ecosystems. Dr. Ran has published over 100 peer-reviewed papers, and his work has been cited more than 5,500 times. His datasets have been downloaded over 25,000 times, reflecting their widespread use and impact. Recently, his work has focused on integrating multidisciplinary datasets, particularly those concerning ground ice distribution. These efforts serve as a critical foundation for developing high-resolution ground ice mapping, model validation, and advancing our understanding of permafrost dynamics.

The proposed IPA Action Group's focus on collecting, integrating ground ice data, and mapping ground ice distribution aligns seamlessly with Dr. Ran's academic background and professional expertise. His long-term research into permafrost spatiotemporal patterns has equipped him with a deep appreciation for the importance of data synthesis. Ground ice plays a critical role in permafrost landscapes, influencing water resources, ground stability, and infrastructure safety. Yet, the current availability of ground ice data remains limited, and there is an urgent need for regional and global-scale data harmonization and mapping efforts. The Action Group's mission to address these gaps will not only advance our scientific understanding but also provide invaluable resources for assessing the impacts of climate change on permafrost systems globally.

In my view, Dr. Ran possesses the vision, expertise, and dedication necessary to lead the 2025–2026 Action Group on underground ice mapping. His proven track record of scientific excellence and his ability to address urgent challenges in the field make him an ideal candidate for this role. I am confident that Dr. Ran will make invaluable contributions to this initiative, and I wholeheartedly support his application. I am ready to provide support for his IPA Action Group once granted. Please do not hesitate to contact me if additional information is required.

Sincerely,

Huijun Jin, Geocryologist, Hydrogeologist & Geotech Engr

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8, December, 2024

Reference letter for the IPA Action Group

I support Professor Youhua Ran for his exceptional contributions to the permafrost mapping.

Dear committee members,

It is my great pleasure to support Professor Youhua Ran's application for the 2025–2026 Action Groups on ground ice data integration and mapping. This is an extremely challenging yet urgent task, and he has already made significant progress in preparing the necessary data to support this endeavor.

Dr. Ran is a distinguished professor at Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences. His specific contributions include but are not limited to the compilation and reconstruction of permafrost ground measurement data, encompassing a substantial amount of underground ice data, the development of innovative permafrost mapping methods, and the creation of a next-generation series of permafrost maps. These high-quality datasets, maps, and analyses have significantly enhanced our understanding of permafrost across the Qinghai-Tibet Plateau and the Northern Hemisphere, and has been widely applied in the fields of geocryology and geography.

Dr. Ran has summarized the research on permafrost mapping in China and proposed a new framework for permafrost mapping that integrates multi-source data and information, such as ground-based measurements, remote sensing observations, and domain-specific knowledge. He has pioneered methods for permafrost mapping and simulation through physically constrained machine learning. On the Qinghai-Tibet Plateau, Dr. Ran developed a high-accuracy thermal stability distribution map for permafrost. He also projected future permafrost changes and assessed the potential economic impacts of permafrost degradation on regional infrastructure, addressing a critical knowledge gap concerning the economic consequences of permafrost degradation in this region.

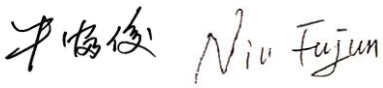
On a hemispheric scale, Dr. Ran created high-accuracy datasets for mean annual ground temperature and active layer thickness with 1 km resolution. He also created the next-generation biophysical permafrost map, which classifies

permafrost based on formation conditions and vulnerability. This innovative map highlights the sensitivity of permafrost to climate change and its intricate interactions with ecosystems across the Northern Hemisphere.

Dr. Ran has published over 100 journal papers, including eight ESI Highly Cited Papers, and his work has been cited more than 5,500 times. All of his datasets are publicly available through the National Tibetan Plateau Data Center (TPDC) and have been downloaded more than 25,000 times.

I am confident that Professor Youhua Ran is the most deserving candidate for this Action Group.

Yours sincerely,



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